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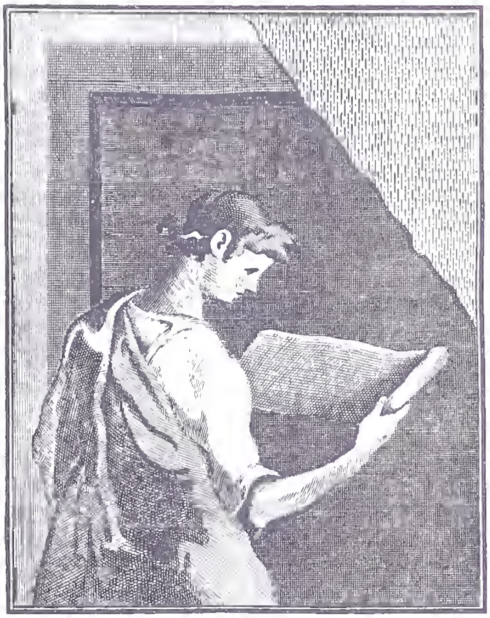

WORK

An Illustrated Magazine of Practice and Theory

FOR

ALL WORKMEN, PROFESSIONAL AND AMATEUR.

EDITED BY

FRANCIS YOUNG,

AUTHOR OF "EVERY MAN HIS OWN MECHANIC."

FROM MARCH 23, 1889, TO MARCH 15, 1890.

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 1.] SATURDAY, MARCH 23, 1889. [Price One Penny.

A CABINET IN FRET-CUTTING.

An Art-Work for Skilful Workers.

BY J. W. GLEESON-WHITE.

There are, it is sad to remember, some amateurs in fret-cutting whose method (or lack of it) is to trace their pattern within one-sixteenth of an inch of its outline or thereabouts, and then paste the design upon a rough piece of wood from a cigar-box, cut it vaguely within another one-sixteenth of an inch of the tracing (this only gives an eighth of an inch away from the line, really a very fair result, as they take it sometimes in excess, sometimes less, so it comes all right in the end), then, having pulled off the tracing with the help of a moist finger and a blunt pocket-knife, proceed to make it up, with one white tin tack, one blue one, and a good big crack across the fretwork itself, and stand enraptured at the result—a bracket, say, that only cost one shilling for pattern, saws, and wood, and is worth less than the least valuable thing in the universe.

To such as these I speak not, nor even to the patient schoolboy who spends untold energy and turns out most creditable fretwork, yet contents himself with such rudimentary joinery that, however excellent the actual sawing of his design when his work is done, it is merely "fretwork." This design must be finished by a good joiner, whether by the amateur himself or passed over to a professional matters not, so long as it is well done, for this cabinet is distinctly *not* worth doing badly—few things are for the matter of that; and unless the would-be maker is willing to devote skill and care beyond the usual run, he had better select another of the many patterns available, and, saying, "That thing! why, it is not worth cutting; look at all the small holes the idiot has put in it!" or some such graceful word, bid it depart from his sight, for he will have none of it.

Yet, though the work involved is not to be rapidly done, the gossip about it may be short. It is intended that the fretwork be worked in duplicate in very thin ebony, or in wood stained black after cutting, and mounted afterwards on holly or other white wood; both being polished before being glued together, of course. The fretwork may be cut two pieces at a time; this reduces the sawing by half, and yields facsimile replicas of the pattern. The rest of the framework to be of ebonised wood polished, with appropriate mouldings of fine, neat design. If the four smaller panels can be worked to drawer fronts it will be much better; but, in lieu of that, cupboards will suffice.

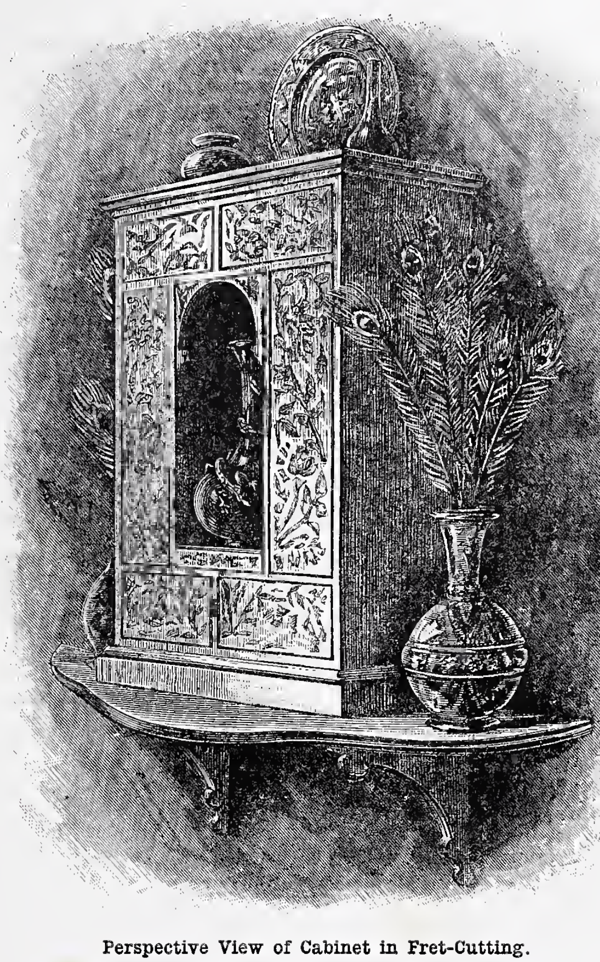
For inlay—and by that I mean the usual plan of replacing the cut pieces of wood in the holes from which they came—an alternative half of the design is shown much modified in its details. For since in this case the necessary perforations drilled in each cut-out piece to admit the saw can hardly be arranged so deftly—always at the point of an angle—that when each piece is replaced they are no blemish to the work, it will be better to reverse this arrangement of the wood. That is, to work as usual the whole design in white wood, staining the cut-out pieces with Stephens' ebony stain. These should be carefully replaced, and the holes stopped with a mixture of sawdust and glue before polishing, the whole surface being glued to a thin backing of hard wood. If the one who suggests it may say so, I do not think this plan would be so effective, although more genuine in some respects.

As a practical hint, I would suggest lining the wood with newspaper and replacing the pieces from the back, when the puzzle—for such it is—will be greatly simplified by the clue afforded in the printed matter. For the first method, knowing how easily white wood darkens with age, whether polished or plain, it may be that a coat of fine white enamel paint would be better for the under part. It is possible that if the cut and polished wood were laid over the varnish paint when wet, and left under a heavy pressure, that the junction would be as firm as glue. It would certainly avoid the danger of the glue oozing beyond its place and staining the visible parts of the design.

The framework of the cabinet being pure joinery, I need not speak of it here; more skilful cooks attend to the joints in our *menu*; my business is to provide the *entrées* and sweets only, and, as too many of the former is a proverbial danger, it is safest to leave the others to explain the serious part of the programme, as they are so well able to do.

It may be best to repeat the advice of absolutely perfect finish, so far as in this imperfect life such a thing is obtainable. For very many ornamental objects, whether carved or painted, a certain roughness and irregularity of handling gives a real artistic value, lost in merely "niggling" precision and absolute accuracy of detail. But for a cabinet on so small a scale, and in the style of symmetrical design chosen, an almost mechanical rigidity of correctness and unstinted labour to attain the very best result practicable must be exacted; then the amateur may put his work beside that of the skilled artisan with no fear of the contrast, since, in an art so mechanical as fretwork, the individual temperament of the artist that tells so largely in wood carving is practically unfelt.

In the illustration given in this page is shown a perspective view of the cabinet when completed and placed on a moulded shelf specially prepared for its reception.



Perspective View of Cabinet in Fret-Cutting.

(For Full-Size Working Drawing of Front, see Pattern Sheet presented with this Number.)

WORK.

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

TO OUR READERS.

"Read you, and let us to our WORK."
2 King Henry VI., i. 4.

ALTHOUGH no apology may be needed for the appearance of WORK, an explanation of its Why and its Wherefore—its *raison d'être*, as our friends across the Channel would put it—is certainly desirable, and a little space in this, its first Number, may be usefully taken up in showing the causes that have led up to its introduction; the persons to whom it chiefly appeals; the objects at which it aims; the special features by which it will be marked; and the field of operation that it seeks to cover.

First, then, let it be shown *why* and *wherefore* WORK has been called, and has come, into existence. What, let us inquire, is the great demand of the time; for what are most men chiefly asking and seeking in the present day? To this question the right reply is by no means difficult to find. It is, and must be—"Better and fuller means of Technical and Practical Education."

Never, indeed, it may be said, was the demand for technical education greater than it is at the present time! Never was it heard more loudly than it is now among workmen of British nationality! And why? Simply and solely because of late years it has become painfully apparent that by means of increased facilities for obtaining technical knowledge the foreign workmen have been stealing a march upon them. Never, forsooth, at any time has the necessity for sound technical education for the workman been so thoroughly impressed upon the minds of men as now; and never has it been so eagerly desired and demanded by all grades and classes of the people. At the present moment there lies in the pigeon-holes of the British Government a Bill for the Promotion, Extension, and Elaboration of Technical Education in the United Kingdom, which will be discussed and moulded into law at the earliest opportunity. Our Universities and great Public Schools are awakening to the necessity of teaching the hands to work as well as the brain to think. In every large town, and in London itself—the head as well as heart of the Empire—a craving is springing up for the establishment of technical institutes and workshops, in which any and every man, whatever may be his social station in life, may obtain improved knowledge of the leading handicrafts that are practised by men, or even to learn their very rudiments, if he so require. In these amateur workmen are already assembling, that they may better know through practice under trained teachers how to carry out the work they may have adopted as a hobby; and professional workmen that they may become better conversant with the theory that underlies the work they do; and by this, and a quickening of their taste and perception of the beautiful in form and perfection in execution, gain greatly in skill, and capacity for carrying out the work by which they have to live. And all grades of workmen are alike led to seek self-improvement, because they have realised the truth of the grand old saying —*Knowledge is Power*.

To meet, then, at a most critical period of our national existence, the needs of workmen belonging to each and both of the two great classes into which workmen are naturally divided—professionals on the one hand, and amateurs on the other—WORK has been brought into being. That WORK will prove the most useful and most complete serial of its class that has yet been given to the world, there is every reason to believe; and, without doubt, it will be eagerly sought after, read, and followed by those for whose benefit it has been produced, as the first, the best, the most helpful, and the most reliable practical instructor of the times in which we live. Nay, more than this, it may be regarded as being verily unique in itself through the comprehensiveness of its scope, for, although efforts may have been made, prior to this, to help and instruct the amateur, never yet has any attempt been made to regard all workmen, whether workers for gain and daily bread or workers for amusement and recreation, as one great family possessed of common aims and actuated by common interests, who enter the lists of competition in friendly rivalry alone, to provoke one another to the execution of work of greater excellence than either the one or the other has as yet produced. Each class has much to learn of the other; each class can teach the other much. Time it is to be up and doing, and, with regard to those who write in the pages of WORK, it is to lead and help their fellow-men to better things that they are banded together. They, verily, are first afield to guide where guidance may be needed, and to give assistance and lend a helping hand wherever aid may be sought. And this they will ever do in the spirit of Solomon's mingled counsel and command—"*Whatsoever thy hand findeth to do, do it with thy might.*"

Mention has been made, well nigh in the same breath, of the amateur and the professional workman; but are they not more closely akin than superficial thinkers are disposed to allow? Are not all men amateurs alike? Are not all professionals? Verily, yes; each and every man in his own order. What, indeed, is the difference between workmen, amateur and professional, save that the latter practises his craft or calling for gain, and the former loves and cultivates an art for his amusement. The distinction is very much like that which has been drawn from time immemorial between those who live to eat and those who eat to live; and the comparison runs far more closely in parallel lines than may appear at first sight, for if the professional works to live, does not the amateur in an equal degree live to work? Even a professional workman is an amateur in everything else except the one particular handicraft by which he lives; so that, speaking fractionally, every man, if he be one-fourth professional, is very likely three-fourths amateur, and so may be regarded as being in point of fact more of an amateur after all than he is of the professional. Said a working man to the writer one day, "I look upon myself as an amateur in every man's trade except my own, and as I like to know something about all trades besides my own, I hail with pleasure every source from which I can derive some knowledge of them." Every man, indeed, has, or ought to have, his hobby whether he be professional or not, and therefore, in seeking to administer to the improvement of one class and to build up and augment the knowledge of its members, precisely the same thing is done in the interests of the other.

This has been said to show that the pages of WORK are intended for both groups of workmen alike, and to point out, on the good old principle that what is sauce for the goose is sauce for the gander, that that which is desirable and useful for one group to know is equally useful and desirable for the other. If there be any difference at all, it will be found to consist chiefly in this—that the professional workman requires and desires to gain in comprehension of theory, and the amateur, conversely, in practice, and thus each will be brought on *pari passu* to the same goal—perfection in execution.

We must now pass on to consider briefly the objects of WORK, and the subjects that are to receive treatment in its pages. On this it is only necessary to say that in the papers which will appear from week to week will be found a clear and practical exposition of the *modus operandi* to be followed in every art, craft, or science that bears, either directly or indirectly, on handiwork of a constructive or decorative character, the directions being supplied and comments made, either in short single papers, or in series of articles tersely and comprehensively written. If the reader presses for a more accurate definition of the nature of the articles that will be treated in WORK, let him attempt to sum up in his mind for a moment the handicraft trades that are most familiar to himself, and endeavour to realise that instruction will be given on, or notice taken of, every one of them sooner or later. To catalogue them would be simply to make a list of every kind of constructive and decorative work that is practised by man. Let us take this as done, and so avoid the waste of time, space, and power that would be involved in its preparation. Number 1 and Part 1 will sufficiently serve as samples of the whole. It is impossible, manifestly, to touch on everything at once, but everything, nevertheless, will be touched on in time.

In general character, WORK will be purely technical and instructive. Nothing that comes within the region of polemics will be touched on in its pages, and discussion will be permitted on such subjects only as are possessed of common interest for all readers.

With reference to the special features by which WORK will be marked, it may be said that every paper that requires it will be fully illustrated with sketches, diagrams, or working drawings to scale, as may be necessary, of the articles and processes described. This alone will tend to render WORK invaluable both to the workman himself and those at whose bidding and for whose benefit he may work.

New machinery, new tools, new appliances, new arts, new processes, new modes of treatment will always find exposition in its pages, and a special feature will be made of

OUR GUIDE TO GOOD THINGS,

in which notice will be taken of tools, machinery, technical works, etc., and all things useful and novel that manufacturers and inventors may produce in the interest of those who labour with the hands. Manufacturers and others are requested to send the Editor timely notice of any new tool, machine, or appliance that they are about to introduce as a new claimant for public favour.

It is open to question if there exists a single workman, professional or amateur, who has not, at some time or other, desired to seek information on points connected with his trade or hobby. For the satisfaction of these in subsequent numbers—when time and opportunity have been given to readers to mention subjects on which they need advice—a portion of each weekly issue will be set apart for replies to queries under the title of

SHOP: A CORNER FOR THOSE WHO WANT TO TALK IT.

Questions, however, must be strictly confined to matters connected with trades and handicrafts. Replies will be given in every case by practical men who know what they are about, and who thoroughly understand the subject on which they undertake to write. It will not be possible, however—and readers must ever bear this in mind—to give answers immediately to questions asked. It is commonly thought that a question asked one week can be easily answered in the next week's issue. This is impracticable, as those who give the replies reside in every part of the United Kingdom, far and near, and with magazines of a large circulation, it is necessary *to go to press*, as it is termed, or, in other words, to finish them, some days in advance of the date of publication.

Readers and contributors who are possessed of reliable recipes that they themselves have tried and tested are requested to forward them to the Editor for insertion in

MEANS, MODES, AND METHODS,

a department which, in time, will constitute a most valuable collection of formulas and processes. Senders of recipes will be held responsible for their accuracy and utility, and must give names and addresses—but not necessarily for publication. In all cases when recipes are copied from contemporary publications, their source should be indicated. Recipes copied from old books will be declined, as it would be easy to fill whole pages of the magazine from such sources without any possible benefit to the readers.

At intervals, large sheets will be issued, containing full-size Working Drawings to Scale, of Art Furniture, Decorative Work, Machinery, etc., that may be made and mounted in the workshop at home, and other subjects of general and special interest. The Cabinet in Fretwork, presented with Number 1 and Part 1, will serve as an example of these sheets.

The articles and papers that appear in WORK will be supplied by capable writers of experience and marked ability, who will spare no pains to render the Magazine, not only unrivalled, but beyond all rivalry as

THE LEADING TECHNICAL INSTRUCTOR OF THE AGE.

It only remains now to indicate the field of operation that it seeks to cover. It appeals to the interests of all workmen, professional and amateur, who are to be found in the United Kingdom, the Colonies, and Dependencies of the British Crown, the United States of America, and, in short, throughout the world wherever workmen who speak and read the English language are to be found. It is a wide area, it is true, but WORK will be known all over it and throughout it before 1889 is numbered among the years that are past and gone.

THE EDITOR.

THE BUNSEN BATTERY.

How to Make, Work, and Maintain It.

BY GEORGE EDWINSON BONNEY.

I.—INTRODUCTION—CHIEF CHARACTERISTIC OF BATTERY—CLASSIFICATION—INNER OR POROUS CELL—POROUS POTS—POSITIVE ELEMENT OF BATTERY—ANOTHER ARRANGEMENT—DAMPER—AMALGAMATION OF CYLINDERS—CARBON ROD—BINDING SCREWS AND CLAMPS—WIRES.

IF I were writing for any other paper except WORK, I should feel myself bound to apologise to its readers for introducing a subject on which so much has been written in other and older magazines. The youth of WORK, however, in relation to its contemporaries, together with the fact that it will appeal largely to young workmen—more largely, I expect, than any existing publication, whether in the Old World or in the New—has led me to select a Bunsen battery for treatment in this my first article. Some of us older workmen are apt to think that because we know all that can be said or written on any given subject, everybody else must have an equally good acquaintance with it. We are apt to forget the troubles of our younger days, when we picked up our stock of knowledge bit by bit and crumb by crumb from every source within our reach. So, when we take up our weekly newspaper, we hastily scan the titles of the articles, and as quickly run our eyes down the columns in search of a novelty. If we find something new, something that adds to our stock of knowledge, we read the article carefully; but if we fail to meet with some new thing, we turn aside contemptuously and condemn it as a thing of little worth. Perhaps this estimation is a good one as regards its value to ourselves, but a little consideration will lead us to the conclusion that we are but units among many thousands, and of these there may be many only too glad to have what we despise.

We stand as lights to the younger workmen around us. The future of this nation depends upon those young men. If they learn to despise knowledge now, they will live to find themselves common labourers to the skilled workmen of other nations. Much good or harm may be wrought in the mind of a young man by the example of older men, and therefore it behoves us to be careful in our manner towards the inquiries of our young men. The best of them will not stand still because we happen to be tired with the day's work. The time has passed, and is gone never to return again, when lads were silenced by a peremptory order such as "You do as I tell you, and ask no questions." Youths *will* ask questions, and will *expect* answers, and if we do not answer them truly they rightly lose confidence in us and seek their answer elsewhere.

Therefore I take the risk of being told by my older brethren that I am writing on a stale subject, because I know that what I have to say will be acceptable to others, and I shall always be pleased to answer their questions.

The Bunsen battery receives its name from Professor Bunsen, its inventor. As generally used in England, it may be regarded as a cheaper and modified form of a battery previously invented by Mr. Grove, and now known as the Grove battery. In the Bunsen battery a plate of carbon, or a block of this substance, replaces a thin plate of platinum used in the Grove battery. This is the only difference between them. The result of this difference in cost is that between the prices of carbon and platinum, amounting generally from 4s. to 5s. per cell in favour of carbon. The result in power obtained may be put down as ·08 volt. in favour of the platinum.

The Bunsen is classed as a double fluid cell because two fluids are used to excite its action. Each cell of a battery is composed of an outer or containing cell or pot, and an inner or porous pot or diaphragm. One such composite cell may be named a battery, whilst this may be composed of any number of cells connected together. The outer containing cell in general use is a cylindrical jar of stoneware, 6½ inches by 3¾ inches, or 6 inches by 4 inches, holding (when the porous cell is left out) about one quart of liquid. This is named a quart Bunsen, and costs 9d. each cell; smaller cells holding a pint of liquid are used sometimes, and larger cells, holding respectively half a gallon and a gallon of liquid, are used for large operations such as in electroplating. When the battery is required to fit in a box or similar rectangular-shaped space, the cells are made either square or rectangular to suit. Cells are also made in glass and in porcelain, in all sizes and shapes demanded.

The inner or porous cell is made of porous earthenware, and is intended to act as a partition between the two liquids employed in charging the cell, to keep them from mixing freely together. The pores allow the two liquids to just touch each other through the pores, and thus form a conducting path for the electricity generated in the cell. These porous cells are made in a cylindrical form for round pots, or in flat, rectangular forms for the square or rectangular pots. They are made in sizes to suit the outer containing pots, the size of which should always be given when ordering porous pots. As a general rule, the rim of the porous pot should stand from ½ an inch to ¾ of an inch above the rim of the containing pot, and there should be ¾ of an inch space around the porous pot between its sides and the inner sides of the containing pot. Too much space between the two cells tends to increase the internal resistance of the battery.

Porous pots are made in two kinds of ware—one red, the other white. The red ware is sometimes glazed around the rim to keep the salts formed in one cell from creeping into the other; but this does not present any advantage, for the salts creep up under the glaze and eventually peel it off, leaving an unsightly ragged rim. The white ware is most compact and more uniform in texture, so to speak, than the red ware. Cells differ a great deal in their degrees of porosity, and should be chosen as nearly alike as possible. The appearance of hardness serves as one guide to a choice, and this may be verified by filling all the chosen cells with clean water and setting them aside on a dry bench or table. Very porous cells will allow the water to come freely through their pores, and their porosity may be determined by the quantity of water coming through the pores in a given time. If cells are too porous they allow the nitric acid to pass into the other cell, and so spoil the solution contained therein; while, on the other hand, if they are not sufficiently porous, or too hard, they increase the internal resistance of the battery, and thus reduce the force available for work.

The positive element of this battery is made of zinc. This is the wearing part of the battery; it is the fuel intended to be consumed to furnish electric force. As in the furnace of a steam boiler we oxidise or burn coal to supply steam force, so in a battery we oxidise zinc to generate electric force. The zinc element of a Bunsen battery is generally made of $\frac{1}{8}$ inch best rolled Belgium zinc plate, bent in the form of a cylinder when intended for use in a round cell, or in the form of flat plates when used in square or rectangular cells. When very thin porous cells of the flat form are employed, the zinc plates are sometimes bent in the form of the letter **U**, and thus made to surround the cell, going down one side, under the bottom, and up the other side. By this arrangement a powerful cell can be got into a small space.

Another arrangement possessing similar advantages consists in coupling two zinc plates together at their tops, and immersing their lower edges in a layer of mercury at the bottom of the outer cell. The zinc cylinder used in the round cells should be just small enough to slip easily into the cells without leaving any appreciable space between their sides and the sides of the cells, as only the inner surface is acted upon with advantage. The upper rim of the cylinders should come just $\frac{1}{2}$ an inch above the rims of the cells, for convenience in attaching the binding screws to which the connecting wires are fastened.

If we immerse clean zinc in dilute sulphuric acid (the solution employed in charging the outer cells of this battery), it will rapidly oxidise and be converted by the free acid into zinc sulphate, whilst a quantity of hydrogen gas is sent from the solution into the air. Under such conditions as these, a large part of the energy so generated would be wasted in heating the solution and ejecting hydrogen from it, and only a small part be available in the form of electricity. We have, therefore, to check this rapid combustion and put a damper on, to ensure a more slow and useful oxidation of the zinc. The damper employed is mercury, known under the common name of quicksilver. Mercury possesses the property of being able to take to itself a portion of some other metals with which it is brought into contact, and form an alloy which is named an amalgam of mercury. It readily attaches itself to clean zinc, and forms with it an amalgam of zinc and mercury. This amalgam is not so readily attacked by dilute sulphuric acid as is pure zinc, and it possesses the merit of being only dissoluble in the acid when the circuit of the battery is closed, or, in other words, when it is set to work. We therefore cause the cylinders, or the plates of zinc (to be used in this battery), to receive a coat of mercury, when they become amalgamated with it, and protected from the attacks of the acid.

Some makers send out their zinc cylinders amalgamated ready for use. If they are not thus prepared, they must be amalgamated before they are used. Our first care is to clean the zinc. If this is greasy, the cylinders should be soaked in hot alkali—soda or potash water—and then rinsed in hot water. Meanwhile get a shallow dish, such as an earthenware baking dish; pour into it enough water to cover the lower side of a cylinder when placed in it sideways; then add one-third of this quantity of commercial sulphuric acid (oil of vitriol) slowly and carefully. When this is done, pour into the dish enough mercury to cover the bottom of it, or to be easily scooped into the interior of one of the zinc cylinders. The acid solution will be scalding hot, and into this place the cylinders one at a time, rolling each cylinder over and over in the mercury, passing this through the interior and well brushing the mercury over every part, inside and out, with an old plate brush, a mop of hemp, or a hare's foot, until every part has been covered. If some fine copper wires can be placed among the hemp, or in the brush, they will facilitate the spread of the mercury. As each cylinder is amalgamated, set it to drain in a stoneware pot to catch any mercury that may come off. If parts of the cylinders are left uncovered with mercury, the acid will attack the bare parts and pit the zinc.

The negative element of the Bunsen battery is a bar or rod of carbon, of square section, or a plate of carbon to suit the porous pot in which it is to be placed. The carbon bars used in this battery are made from fine coal and coke compressed in a mould with some binding medium, such as gas tar, and heated to give it the needed hardness. A substitute may be improvised out of the scurf from the roof of a gas retort, obtainable from gasworks. This is procurable in rough misshapen lumps, which have to be sawn to the required shape before they can be used in the battery. This is done by means of an old saw, or a piece of sheet iron notched like a saw, using plenty of water as a lubricant. It is a hard and dirty job, and not worth the candle, when we consider the low price of carbon blocks (one penny per square inch), obtainable from all vendors of electrical articles. Common gas coke, or even best oven coke, is not hard or compact enough in itself to form a substitute. Well moulded and baked carbon blocks are indestructible by nitric acid, and will last an indefinite time.

Connection is made between the carbon block of one complete cell and the zinc cylinder of another by means of copper wires, or strips of sheet copper, attached temporarily to the elements by brass binding screws and clamps. The wire is secured to the zinc cylinder by means of a binding screw. The cheapest forms of these are usually very defective, and after a little use they either spring apart and crack at the shoulders, or the very fine threads of the screws wear out, and so fail to hold. When buying these, see to it that the screws are properly cut with deep threads, the females with long bearings, and the shoulders strong. The wires are secured to the carbons by a kind of binding screw named a clamp. There are some two or three patterns of these clamps in use. One has a slot only to receive a strip of copper as a connector. This is inconvenient for wire connectors. The other patterns have holes pierced in a lug, either at one side or on top and in the centre of the clamp. The last form is preferable in actual use. In buying clamps, see to it that the jaws are wide enough to clasp the ends of the carbon blocks, that the screws are long enough, and the threads well cut. The heads of the screws should be flat, not milled, as the milling cuts one's fingers when connecting or disconnecting the screws. It is also best to have all the screws and clamps lacquered before they are used, as the lacquer protects the brass from the attacks of acid fumes. If binding screws and clamps are not lacquered they should be made as hot as can be borne to the hand, then dipped in hot melted paraffin; allow all the surplus paraffin to drain off whilst still hot, then clean all points of contact with emery cloth. The holes are best cleaned with a pointed stick dipped in flour emery.

The wires for connections should be slightly larger than the line wires employed; that is to say, if we employ a line of No. 16 B.W.G. copper wire from the battery to the work, we should have connecting wires of No. 14 B.W.G. copper well annealed.

(*To be continued.*)

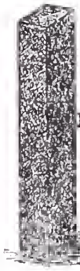


Fig. 1.

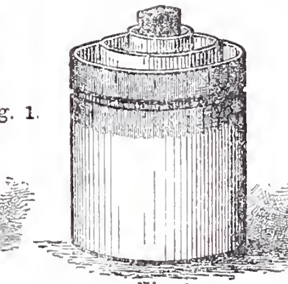
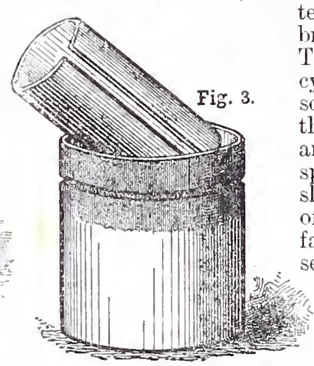


Fig. 2.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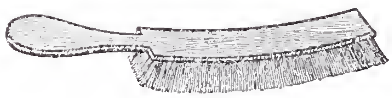


Fig. 4.

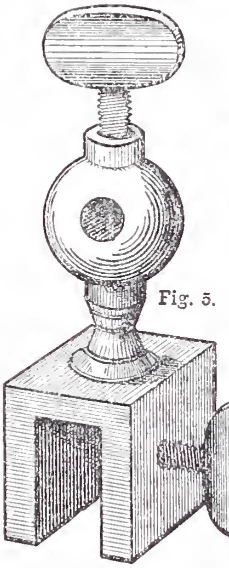


Fig. 5.

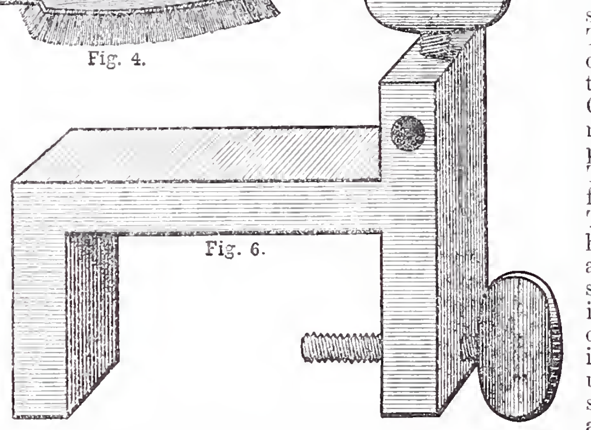


Fig. 6.

Fig. 1.—Carbon Block for Bunsen Battery. Fig. 2.—Complete Cell. Fig. 3.—How to Set Zinc Cylinder on Outer Cell to Drain after Amalgamation. Fig. 4.—Brush for Cleaning Zinc Cylinders. Fig. 5.—Binding Screw for Zinc Cylinder (full size). Fig. 6.—Ditto for Carbon Block (full size).

A CHAT ABOUT FURNITURE.

Text—Two Fancy Tables.

BY D. ADAMSON.

The Old Loo Table—Chippendale's Designs—Quasi Art Critics—Requirements in Designing Furniture—Curved Outlines in Furniture—Change of Tops: its Utility—Suitable Sizes for Small Tables—Materials—Tops—Legs—Framing—Blocks—Fixing—Alternative Form of Table.

The old-fashioned centre or loo table is seldom seen in use nowadays. The style in furniture, not only as regards the articles themselves, but in decorative details, has rapidly changed during the past twenty years—is, indeed, now changing. The place of the massive-looking loo table, with its frequent over-elaboration of carving, its ponderous claws, in all its glory of burr walnut top, a glory of marking which, as a little bit of decoration planned and executed by the Great Architect of the universe, could not be utterly ignored even amid the uncouth and inartistic work of the middle of this century, is now occupied by the small, light occasional table—or say, rather, several of them. Old-fashioned things, are they? The old style coming up again? Indeed! Yes, I have heard all that before often and often, but reiteration of a mistaken notion does not prove the truth of an assertion.

It is a popular mistake to suppose that our modern furniture designers do nothing but copy old models, and that the beautiful productions of the artistic cabinet maker are nothing more than facsimiles of—Chippendale, you suggest. Well, well, let the poor old man rest. You may safely do so without scruple, for not from him, nor yet from his contemporaries, does the modern designer draw inspiration. Occasionally a piece of Chippendale may be reproduced, but not often, and then it is generally one of his quieter and simpler designs.

In all its horrible eccentricity of nondescript Gothic, worse Chinese, and inane rococo, combined though they be with the most exquisite workmanship and occasionally a quaint gracefulness, Chippendale's style is not in favour with those whose training enables them to discriminate between the true and the false in design.

In designing furniture—and I daresay anything else—one must first have some acquaintance with mechanical work. Without this it is impossible to decide how the material—in this case principally wood—can be used to the best advantage, without cumbersomeness on the one hand or fragility on the other. After this, convenience must be studied. Is the design suitable for its intended purpose? To take an extreme case for the sake of illustration, in designing a chair for ordinary use, would any one raise the seat three or four feet from the ground? To do so, of course, would be absurd, for such a height would, except for special purposes, not be pleasant. One could not sit at an ordinary table in such a chair nor put it to the intended use of a chair. Fashion, further, has much to do with design, for it must not be forgotten that those who cater for the public must do so according to popular demand. If one asks who creates fashion, what can the answer be? It is a species of evolution, but in its origin is so intangible that it cannot be grasped. It is like the fog—very undefined, but with a very unmistakable reality. Is, then, the fashion in furniture not influenced by the designer or the manufacturer? To a great extent it is, but he does little more than apply his skill in such a direction as may, in his opinion, best supply the demand. For the rest the designer must rely on his own resources and his general ideas of what constitutes a beautiful object. At the present time fashion seems to require that everything must be cheap as well as pretty, the latter being an unknown quantity.

My ideas may be that the two little tables illustrated are pretty; the reader's may be that they are the reverse. I hope not; but they are certainly inexpensive, which means that there is neither a superfluity of wood nor that the construction is complicated. For this reason, if for no other, they will commend themselves to the inexperienced maker, and if he is influenced by a desire to have fashionably designed furniture, let it be said that they, or others of similar character, may be seen by the dozen in our leading furniture shops.

Those who observe these will notice that a reaction seems to have set in against the severe, straight lines of the so-called Early English style, and that curves are introduced where a few years ago it would have been considered heresy to do so. These curves are generally supposed to distinguish the Queen Anne style, so those who wish may call these tables so. The fact is that curves, more or less graceful, are not confined to any particular style, and it is by recognising and applying whatever is beautiful in form and colour that the art renaissance of the present age is nourished.

Another thing which must be regarded in designing furniture, or, if you will, in adapting old designs to modern tastes, is this:

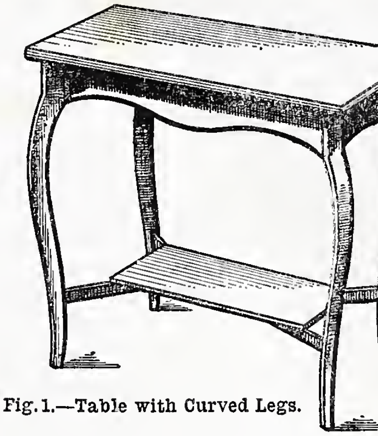


Fig. 1.—Table with Curved Legs.

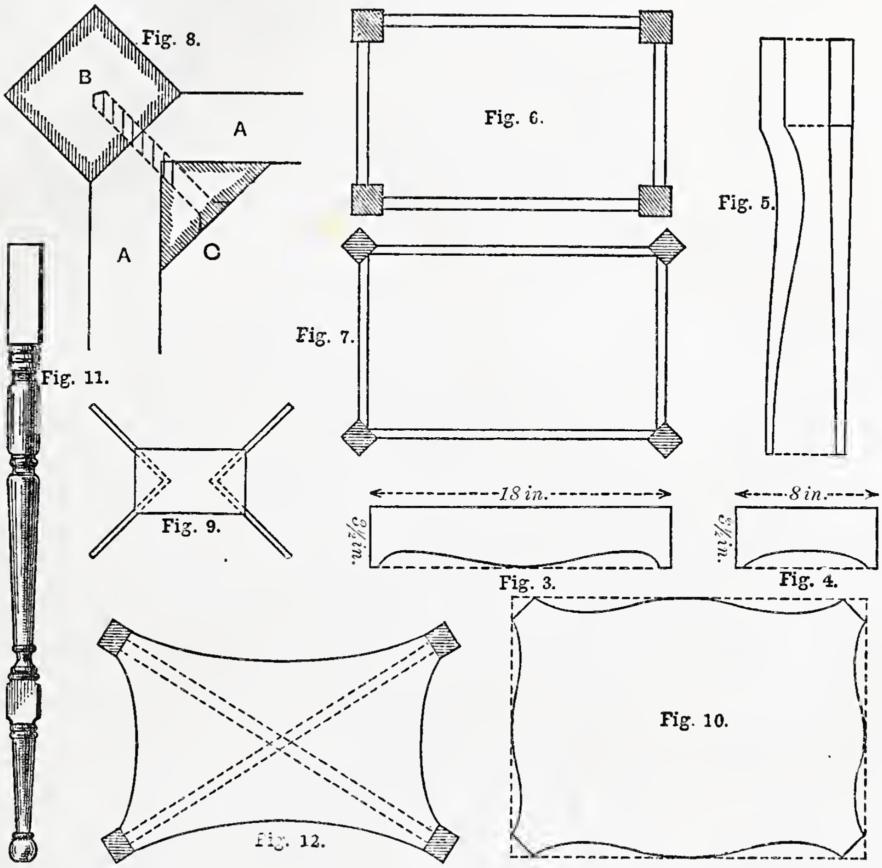


Fig. 3.—Long Rail of Framing. Fig. 4.—Short Ditto. Fig. 5.—Leg. Fig. 6.—Ordinary Framing. Fig. 7.—Alternative Ditto. Fig. 8.—Connection of Rails and Leg. Fig. 9.—Stretcher Board and Rails. Fig. 10.—Shaped Top. Fig. 11.—Turned Leg. Fig. 12.—Bottom Board and Stretcher for Fig. 2.

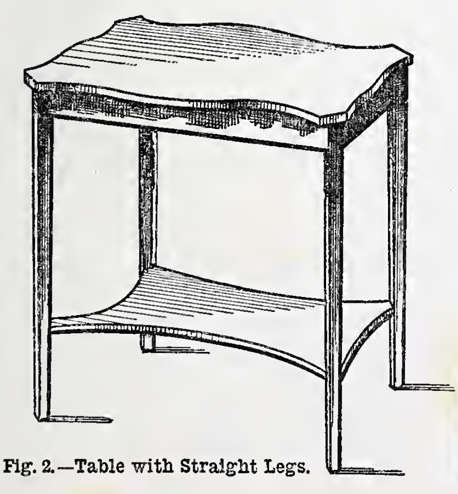


Fig. 2.—Table with Straight Legs.

as habits change, so does our furniture. In its way, the massive Elizabethan table with its bulbous legs is good—may have been best adapted to the period when it was supreme. Now, in our ordinary living-rooms it is out of harmony with the surroundings. We do not require such ponderous structures, in our drawing-rooms at any rate. Lighter things are more convenient, and if they are not so strong they are strong enough. We do not expect a small table to be knocked about in a reckless manner, nor yet that any great weight should be laid on it; hence, whatever some may say about the necessity for everything being made as strong as possible, let us qualify their dicta by saying as strong as service and utility demand. Now, for fancy drawing-room tables these are substantial enough, fragile though they may look and wrong in theory though the curved legs of one of them may be according to some people. For their comfort it may be admitted that were strength the only consideration, these curved legs are undoubtedly not the best form; but for the present let us adopt the Hogarthian idea and eschew straight lines.

Whether the "line of beauty" or the "Eastlake" style be the better need not be discussed. We want two tables with curves, and we will have them.

As a rule, curved outlines entail more work than straight, and it may almost be said that some forms of shaped construction are beyond the range of the amateur worker. These tables, however, are so simple that no one who can use a bow saw or a good fret machine need be afraid to tackle them. The general construction of both being the same, it will be unnecessary to give instructions separately for each. The drawings of the various parts will show sufficiently what is required to enable any one to make either, or, if he wish to exercise his ingenuity, to construct from the elements given tables which to a casual observer might seem new designs. Possibly this may be a new notion to some, and as all design is, broadly speaking, merely a new combination of forms or outlines already known and rendered with more or less ease and grace, let me just suggest as a very elementary lesson in furniture designing a few ideas that may be got from these tables.

Perhaps the first which will occur to most is merely the change of tops, and a very practicable one too. By transposing the tops we get already four different tables. Then there are the bottom boards; they may be changed in the same manner. The shaped rails may be substituted for the straight framing, or *vice versâ*. The tops, instead of being oblong, may be square. Alterations in outline will also occur to the student, and by-and-by he will find himself able to prepare his own designs instead of being, as is too frequently the case with amateur cabinet makers, compelled to merely copy a piece of furniture, whether in existence or only a drawing. When he is to some extent able to work alone, more pleasure, not to say utility, will be gained. There is a desire to see the ideas set forth in pencil embodied in solid form. The drawing but feebly represents the finished thing, in which the interest grows as the work proceeds. We have the ideal completed article in our mind's eye, and we are naturally wishful to see whether the actual approaches it. It never does; at least, I, for one, am always disappointed in some detail or other, and I imagine that is the experience of most of us, whatever our work may be.

But why should this be mentioned? Not needlessly, I hope, for it may save the novice, at any rate, some vexation to be aware beforehand that success is only comparative. If his work surpasses his ideal, possibly his work may be superlative, but—and a very big "but" it is—the chances are that the ideal has been a very poor one.

Is it an exception to find that as a man progresses in any art, so to himself does his ideal seem more and more difficult of attainment? Perhaps he gets more critical as increasing knowledge shows hitherto unsuspected weaknesses—just little, tiny, insignificant details which might be improved on. Ay, the ideal in furniture work is not more easily reached than it is in actual life; but shall we on that account sit down and not attempt anything? No; rather let us do the best we can, our motto being "Excelsior!"

The last few sentences are to me a strong confirmation of the ideal not approaching the reality. I would that I could have expressed myself in the glowing language of a Ruskin, but that is impossible; and I can but hope that the suggestions offered may be of some service to those for whom they are intended—viz., beginners—not so much in actual manipulation as in design. Of course, it cannot be expected that the novice, however well up in theory he may be, will be able to design furniture without practice and knowledge of facts, but there are many little things he might manage not only to make but to devise, without being dependent on any one for design. Having indicated the principles which may assist him, let us now leave the designer, or, rather, merge him in the artisan.

The size of such small tables is not bounded by any fixed rules, but suitable dimensions may be given as follows:—Top, 1 ft. 10 in. × 1 ft. 4 in., at a height of about 26 in. from the ground. For the tops $\frac{3}{4}$ in. stuff will do very well, and for the legs $1\frac{1}{4}$ in. The framing may be only $\frac{1}{2}$ in., but the same substance as the top will be better. In fact, with a supply of $1\frac{1}{4}$ in. and $\frac{3}{4}$ in. wood the tables may be made; and in speaking of these thicknesses it will be understood that they are those of the stuff in the plank, and consequently planing and cleaning up will reduce them. To begin with, they usually measure less than the nominal thickness, and by the time they are finished they will probably be little if any more than 1 in. and $\frac{1}{2}$ in. respectively. Those who prefer to use thicker stuff may of course do so, but with good sound timber the substance named is all that is necessary. In any wood the thickness for the top will be sufficient, but with a soft, weak wood—such as sequoia—it stands to reason that the curved legs may advantageously be thicker than if they are made of a strong, tough wood like ash. Ordinary baywood, walnut, pine, etc., will do if of the thickness stated.

The tops will have to be jointed, *i.e.*, the necessary width will have to be got by joining two pieces of board. Glue alone will be sufficient to join them, the edges in contact being planed as true as possible, and well worked together. The jointing should be done while the boards are in the rough, and before anything else is done full-sized drawings of the various parts should be made. For the shaped pieces, in order to ensure uniformity of outline, it will be better to form templates or moulds of thin cardboard or wood cut to shape. These can then be used as rules to set out the actual work by.

For the shaped leg table, besides the top, which is straight, and may be simply cut to size (22 in. × 16 in.), four pieces will be required for the framing. Two of them will be of the size and shape indicated by Fig. 3, and the others by Fig. 4. The legs must also be got out, as shown in Fig. 5, where it will be more clearly seen than in the illustration, Fig. 1, that they taper to the lower end, and that they are rectangular in section. They may be of the same thickness throughout, but they will not look so well, and the tapering, so far as the thickness is concerned, can easily be managed with the plane. The taper in width will of course be provided for when cutting the legs from the plank. We may suppose that the thickness of the leg at the top straight part is 1 in., or a little over, and at the bottom from $\frac{5}{8}$ in. to $\frac{3}{4}$ in. To ensure the right amount being taken off each side, the bottom end should be marked, and if this is done it will be unnecessary to take the trouble which would be involved by marking off the taper on the face of the wood. It will be observed that where the curve in the leg is most pronounced the wood is wider than lower down. The reason for this is to give extra strength where the bearing is across the grain, for a moment's reflection will show the veriest tyro that the wood can be more easily split or broken at this part than elsewhere.

It is now necessary for the reader to refer to Figs. 6 and 7, showing the plan of frame and legs fastened together. Fig. 6 shows the ordinary construction of framing, where the rails and legs are either fastened together by mortise and tenon or by dowels. Fig. 7 shows a construction which is very much simpler, and equally serviceable for light things. It will be observed that the legs are on the "cant," as it is often called, *i.e.*, not parallel with the framing as they generally are when the ordinary construction is followed. Now, understanding this, refer to Fig. 8, which shows, still in plan, the connection of the framing and the legs. A, A, represent the framing, B, the leg, and C, a block glued to A, A, which it connects, and by means of screws is fastened to the leg. To form and fit these connections proceed as follows:—Get four blocks of the section shown, and not longer than the width of the framing. See that two of the sides form a perfect right angle, easily ascertainable with the square, for if they do not it stands to reason that the framing will be "out." Fasten them into the corners of the framing with glue, and if there should be any doubt about the gluing being sufficiently well done to ensure durability, a small screw or two may be used through each block into the rail. No harm can result from the addition of screws, and if there is anything amiss either with the glue or its application they will prevent a collapse.

At this stage it is apparent that the framing will have square corners, which must be cut off so that the leg may be fitted. First of all get the thickness of the leg, and set it off on the top of the frame. Then with the gauge run lines down to the bottom of the frame. The lines give a reliable guide to cut off the corner to, and if they are accurately followed the square part of the leg must fit perpendicularly. To fasten the framing to the leg a couple of good stout screws are driven through the block into the leg, which may also be glued up, but, as it is next to end grain, too much reliance must not be placed on glue alone.

The top is fixed to the framing by blocks like those in the corners, glued both to the top and to the rails. Two or three blocks of, say, 3 in. long along each side, and one or two at each end, will be sufficient. They are of course fixed within the framing, not outside it under the overhang of the top, where they would show and be unsightly. In addition to the blocks, it will also be advisable to use screws, say one through each rail into the top. They should be driven in on the slant, and care be taken that they do not come through to the surface of the top.

The stretcher and bottom board shown in the illustration are not absolutely essential, but as they give rigidity it will be as well not to grudge the extra time required for them. For convenience of description they have been left till now, but in actual work it will of course be seen that they should be prepared before the table has progressed so far as described. The board, or shelf, may be taken as measuring about 13 in. × 8 in., but the size is really of no consequence; whatever it is, the construction will be the same. Four pieces, say, $\frac{3}{4}$ in. square, support it. The outer ends of these are to be cut to fit the legs, and the others screwed to the shelf from below, taking care that its corners are evenly placed above each rail. It will perhaps simplify matters for the beginner if these are fixed at right angles to each other, *i.e.*, the pair at each end of the table, as in the diagram Fig. 9. Were the legs stouter it would be better to sink the ends of the stretchers in them; and this might be done even as they are, but not to any great extent—not more than just sufficient to let the ends in, say, $\frac{1}{16}$ in. or so. In either case a screw ring or eye should be driven into each leg. The stretchers will rest on the eye, and a screw driven through it will hold firm enough.

Now for the other table, which is made in a precisely similar manner, the differences being that the top is shaped as shown in Fig. 10. The framing is straight (3 in. wide), the legs either straight tapered, or, as they may be, turned, and the bottom board larger, extending from leg to leg. As a suggestion for the turner, Fig. 11 is given. The square block allows plenty of substance for the shelf to be well sunk in it. The cut may be most easily made by sawing across and removing the surplus wood with a chisel, and the stretcher rails may be dispensed with altogether. It will, however, be better to have them, and in this case one can be carried right across to the opposite leg, the other being cut in the middle, as in Fig. 13. They will be screwed both to the shelf and the legs, as in the other table.

The maker's work is now brought to an end, and it only remains to finish the table by polishing, or, what is now very fashionable, painting them with one or other of the enamel preparations. Nothing need, however, be said at present about either of these processes, as our chat about furniture seems already to be rather lengthy, though I sincerely trust not unprofitable to any one. It has been my aim first to describe the form and construction of a good type of small table that will be found useful in any house in many places for a variety of purposes; and, secondly, by the designs that have been given by way of illustration, to enable any carpenter, whether professional or amateur, to make such tables either for his own use or for sale.

CIRCULAR-SAW RIGS FOR THE LATHE.

BY A FOREMAN PATTERN MAKER.

Circular Saw a desirable Adjunct to Lathe—Saw Spindles in Brass, Wood, and Steel—Iron Table to fit Headstock—Rough-and-ready Wood Attachment—Alternative Wood Attachment—Fences—Cutting Bevels, etc.—Bevel Sawing—Cutting Rebates, Tenons, Grooves, etc. — Canting Fence for Long Bevel Sawing.

Those who possess a lathe of not less than four-inch or five-inch centres might often save a good deal of the time spent in light sawing by attaching a circular saw thereto. A good deal of power is required to drive it, hence no heavy work of this kind can be done in a lathe. I should place the limit to the thickness which can be freely cut at from five-eighths of an inch to three-quarters of an inch. But workmen, and especially amateurs, often want to saw large quantities of *thin* stuff into strips alike, or nearly alike; and it is in such work as this that the saving is effected by the use of such a saw. When making small drawers, cabinets, boxes, etc., it is simply invaluable. There are several different ways of making the attachment, none of them very difficult, and the cost but slight. I propose, therefore, to show sundry ways in which it can be effected.

The saw itself is mounted on a spindle, shown in Fig. 1. If the headstock mandrel of the lathe has a good thread on the nose, and the spindle is screwed to make a good fit therewith, no other support will be necessary. But should the fit be imperfect, then the poppet centre must be run up, and centred in the free end to steady it while cutting. The spindle is preferably made of brass, cast from a pattern. After being screwed to the mandrel nose, it should be turned up in its place, care being particularly taken to have both the pin, and the shoulder against which the saw abuts, perfectly true. The dimensions are taken from a spindle of my own. I have found the friction of the washer, when pinched up by the nut, quite sufficient to keep the saw from slipping on its mandrel. But probably if a saw larger than five inches or six inches were used it might be necessary to make a projection, or steady pin, on the spindle to fit a corresponding notch in the saw, as is the practice with circulars of ordinary dimensions. But probably, in such a case, the interposition of a leather washer between the metal washer and saw plate would effectually prevent slipping under the heaviest cutting which could be done in a lathe.

Spindles of this kind can be made in hard wood, and will answer nearly, or quite, as well as metal ones. Fig. 2 gives an illustration of one of this character. A block of straight-grained hard wood, A, turned parallel, bonded with ferrules, and tapped like a wooden chuck to fit the mandrel nose, has a hole bored right through its body to take a half-inch bolt, B, whose square head is sunk in at C to prevent it from turning, a nut and washer at D tightening the saw in place.

Again, instead of designing the spindle to embrace the mandrel nose, it can be made, as in Fig. 3, of a piece of steel, being countersunk at both ends for the point centres of the lathe, and driven through a carrier. Or the left-hand end could be driven from a jaw chuck, or drill chuck; or, if filed square, could be driven from a square hole chuck.

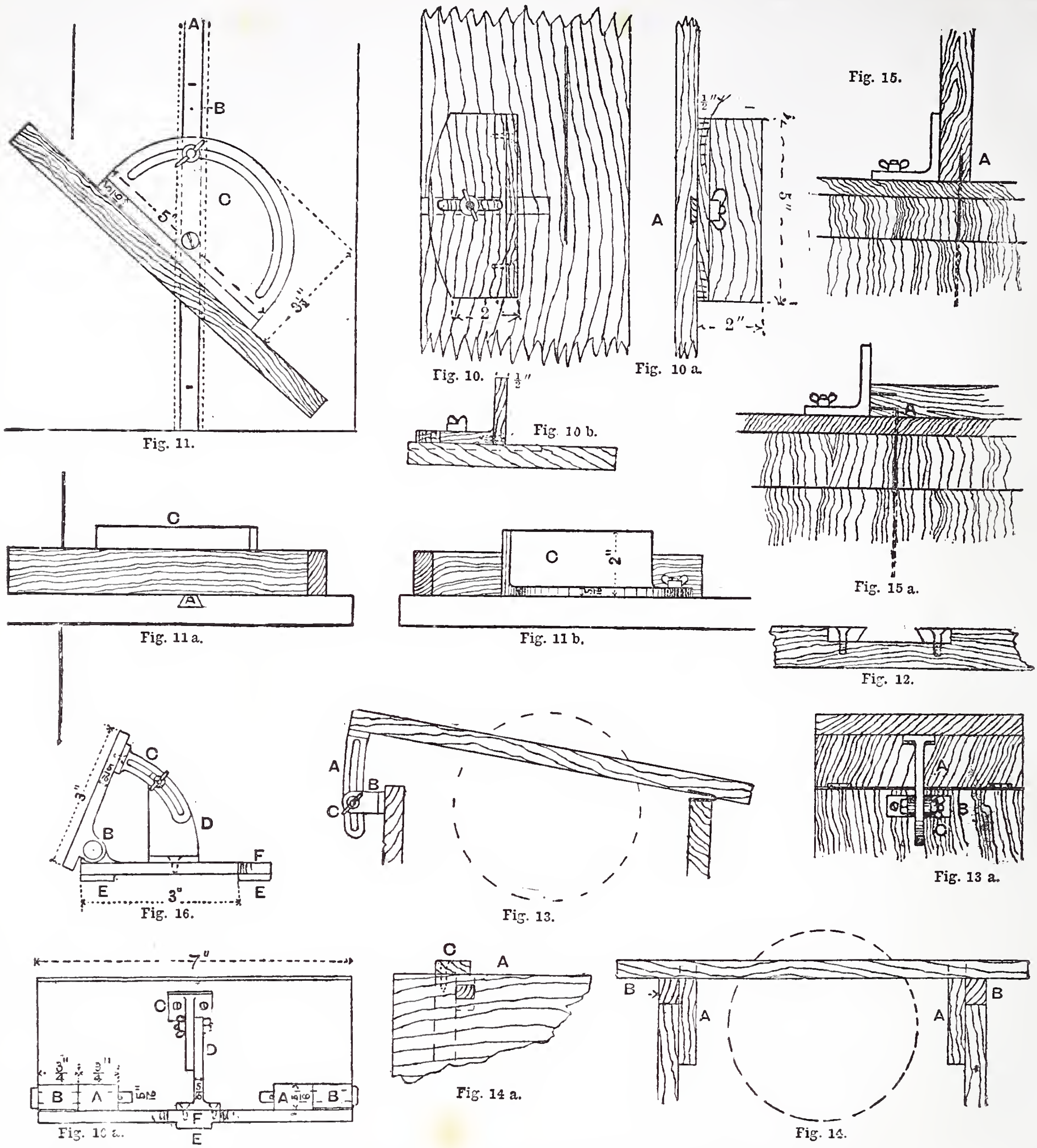
We have the choice of various tables. I will describe three. Fig. 4 represents one which I made for my own lathe, and which is a good and convenient type for headstocks having parallel edges on the front portion. It is made to fit the headstock by means of the grooves, A, A, sliding down the edges of the front upright. Two quarter-inch holes are drilled and tapped in the sides of the uprights, corresponding in position with the holes, B, in Fig. 4, and a couple of thumb screws passing through these hold the table at the correct height in relation to the saw, whose spindle passes close underneath the table without actually touching it.

The table is made of cast iron, for which a pattern is required. It is very light, only three-sixteenths of an inch thick in the plate, and stiffened with a flange running all round the bottom edge. At C is shown a small fence, also of cast iron, which is provided with a slot and bolt, so that it is traversed across the table. The strip seen at its front edge, by sliding along the front edge of the table, preserves the parallelism of the fence with the saw.

The top of the table may either be planed or simply filed, the latter answering sufficiently well. The slit for the saw should properly be cut, owing to the difficulty of casting it so narrow. A key-hole saw will, if sharpened with short triangular teeth of equilateral form, like those of a hack saw, cut through soft cast iron without much difficulty. A common hack saw will, of course, do the same, but it is not thick enough in the blade to cut a slot which would take the circular saw, since the latter must have a little clearance in order to avoid noise, and grinding of the teeth, when running. To start the cut, it is necessary to drill a couple of holes at the ends where the slit is to terminate, then remove the narrow separating film of metal with the point of a thin file and so gain an entry for the narrow end of the saw, which, once entered, will cut the slit with comparative ease. It will probably be a little irregular, and perhaps not quite wide enough. If so, widen and smooth the cut sides with a thin warding file. The holes drilled to start the cut answer the very useful purpose of giving clearance around the saw teeth, preventing risk of injurious rubbing of the same.

I have given the sizes of my own table, but these are not necessarily hard and fast dimensions. The measurement between the cheeks, A, A, is omitted, since this must be accommodated to individual lathes. In a large number of lathes, in which the front upright of the headstock is not parallel but curved in outline, the fitting and making of a table of this kind would be troublesome, hence I should in such cases adopt one of the forms to follow.

Fig. 5 shows a rough-and-ready table attachment, which, though handy for occasional use, is not so substantial as the other forms figured. It may be of wood, in which case a plate of metal must be let into the shank, to take the pinch of the set screw in the socket of the T rest. But preferably it should be of metal, in which case the plate and shank could be cast in one from a pattern, though a better method would be to get a piece of sheet iron or brass, about one-eighth of an inch thick, and screw it down on the top of a bit of iron bar, forming the shank. Fig. 6 shows an enlarged view of the union. A bit of solder may be run round the angle as shown, to stiffen the joint. Whether made in wood or metal, fences of some of the forms shown in the various figures can be fitted on the table with little trouble. Even where the most substantial tables are already fitted to a lathe, it is worth one's while to have one

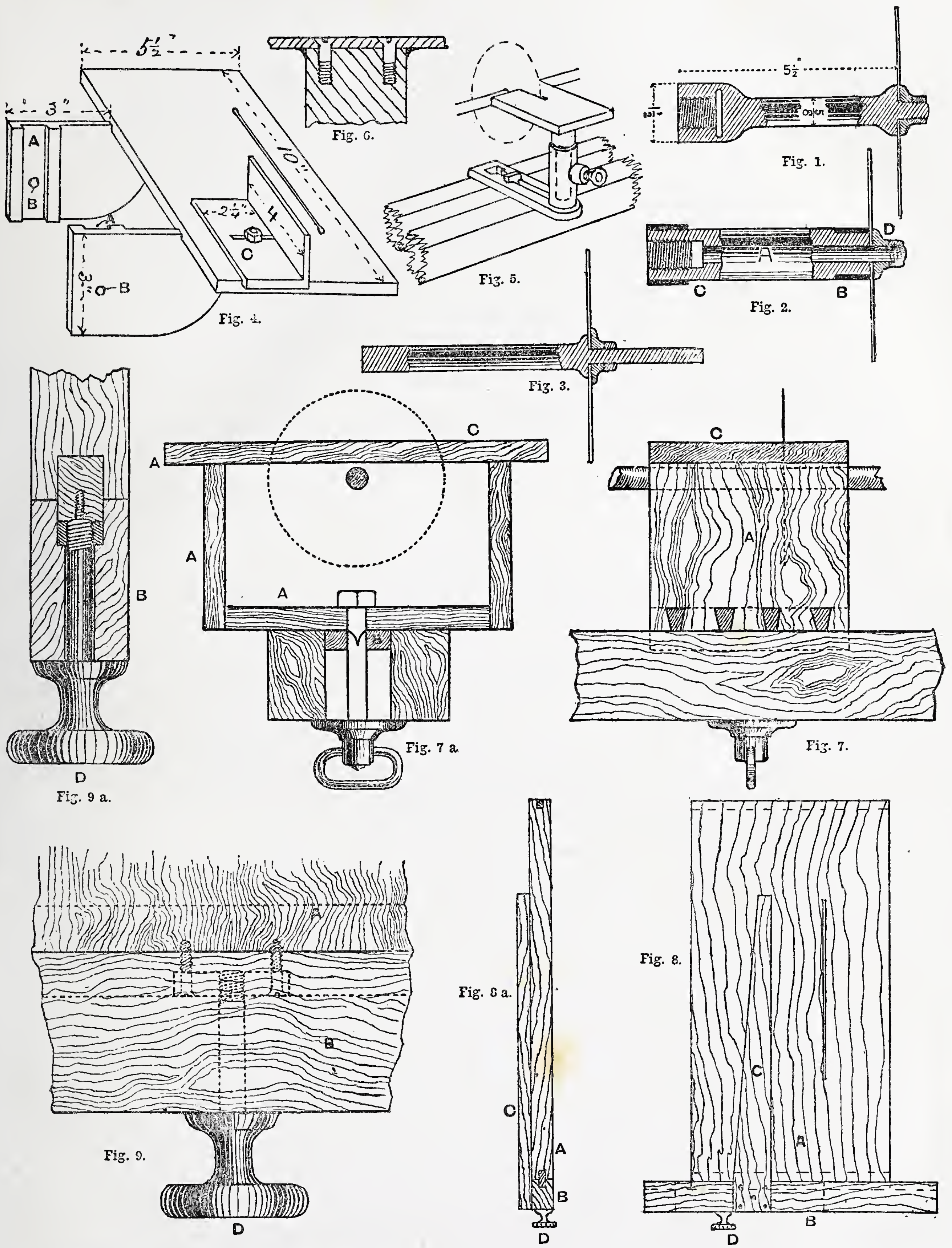


Circular-Saw Rigs for the Lathe. Fig. 10.—Plain Wooden Fence in Plan. Fig. 10 a.—Side View of Ditto. Fig. 10 b.—End View of Ditto. Fig. 11.—Fence for Bevel Sawing in Plan. Fig. 11 a.—Ditto: Front View. Fig. 11 b.—Ditto: Hind View. Fig. 12.—V Groove for Table. Fig. 13.—Hinged Table: Front View. Fig. 13 a.—Ditto: End View. Fig. 14.—Method of Elevating Table without Hinges: Side View. Fig. 14 a.—Ditto: Plan of One Corner. Fig. 15.—Sawing Rebates. Fig. 15 a.—Sawing Tenons. Fig. 16.—Canting Fence for Long Bevel Sawing in Plan. Fig. 16 a.—Ditto: Side View.

like Fig. 5 for quick attachment and temporary use. Its slit is at once readily adjusted to the saw, and the T rest is then clamped to the bed in the position corresponding therewith.

Fig. 7 shows a very good and old-fashioned rig for a circular saw, and one which almost anybody who may not perhaps care to tackle iron work can construct with little difficulty, most of the work being in wood. A is a frame of hard or of soft wood, having a tongued piece, B, screwed to its under face to fit between the lathe bearers. C is the actual table hinged to the back of A, the throwing back of the table being necessary in order to bring the frame underneath the saw. Being thrown back, and the frame slid underneath, the table is then brought down over the saw, the latter passing up through its slit—the slit having been cut by the saw itself at the time of making the table. The tongue always fitting closely between the bearers, there can be no trouble due to want of adjustment. In this case no dimensions are given, but the diagram affords an idea of relative and suitable proportions, the sizes being properly adapted to a five-inch lathe.

The full advantage of these tables is to be obtained only by the addition of various fences for the guidance of stuff which is being sawn. Some of these attachments I will now describe. Fig. 8 shows a plain guide for parallel sawing, adapted to a



Circular-Saw Rigs for the Lathe. Fig. 1.—Brass Spindle for Circular Saw. Fig. 2.—Wooden Spindle for ditto. Fig. 3.—Steel Spindle for ditto for Point Centres. Fig. 4.—Iron Table and Fence. Fig. 5.—Plain Table for T Rest. Fig. 6.—Attachment of Table to Shank. Fig. 7.—Wooden Table for Lathe Saw, Hinged: Front View. Fig. 7 a.—Ditto: Side View. Fig. 8.—Wooden Fence in Plan.—Fig. 8 a.—Ditto: Side View. Fig. 9.—Pinching Screw shown in Fig. 8 on Enlarged Scale. Fig. 9 a.—Ditto in Section.

wooden table like Fig. 7. The table, A, is grooved along the front edge to receive the tongue of the sliding bar, B, to which the guide, C, is attached. This is clamped in any position by means of the set screw, D, which is tapped into a brass plate sunk and screwed into the tongue piece on A, a slot in the bar, B, allowing the latter to traverse freely over the screw. The screw attachment is shown enlarged in Fig. 9. This, if well fitted, forms an efficient guide.

Another fence is shown in Fig. 10, which may be fitted either to a wooden or to an iron bench, and which can very well be made of two pieces of any hard wood screwed together. The gluing and screwing of the dovetail slip, A, on the under side of the fence stiffens the base, which would otherwise be much weakened by the cutting through of the slot for the thumb screw. The dimensions given are proportionate and approximate only.

Perhaps the greatest advantage of the application of small circular saws to the lathe lies in their adaptability to the cutting of bevelled and polygonal faces. The lathe saw is essentially an amateur's tool, and the more it can be utilised the better. By devising suitable arrangements, much work which would otherwise have to be done with chisel and plane can be saved. Mitred and bevelled joints, rebates, grooving, tenons, and much beside, can be cut with rapidity and accuracy; and the very fine teeth of saws from three to seven inches in diameter will, if kept in order, leave the surfaces clean and smooth.

To do bevel sawing at right angles with the table, it is clear that the piece of wood being cut must not, when set at the angle required, be slid along the face of the fence, but that the fence and the wood must move together parallel with the saw. Hence the purpose of the arrangement in Fig. 11, where A is a V groove cut in the saw table, parallel with the slit, to receive the sliding piece, B, on which is pivoted the quadrant fence, C, capable of being slewed to any angle, and pinched with the thumb screw. The sliding strip may be of hard wood or of metal; but it must be very neatly fitted in either case. A metal strip is to be preferred, sliding between metal guides. If the table is made of wood, these can be fitted as shown in Fig. 12; and wrought iron or brass would be more suitable than cast iron. The quadrant, owing to the weakening effect of the slot, should be of metal; but it is quite easy to make, the pattern being simple, and the filing and fitting slight in amount. The slot can be cut out nearly to the size in the pattern, and finished in the casting by filing. It would not be a very troublesome task to divide out the circular edge of the quadrant into degrees, and, by bringing any division into correspondence with a centre line on the slide, to cut to any required angle without the trouble of tentative adjustment.

In order to cut rebates, tenons, grooves, and shouldered work generally, it is necessary either to use saws of various diameters, which is troublesome, costly, and not precise; or to place blocking, or thickness pieces, on the table, which, if deep, interfere with the fences; or to raise the table itself. The latter is the proper way, and it may be effected as follows :—Suppose the table is hinged, as in Fig. 7, it may be fitted with an attachment on the underside at the front of metal, Fig. 13, A being a slotted quadrant screwed to the table, and B, a piece screwed to the face of the box, into which the set screw, C, is tapped. This is a neat and exact mode of adjustment.

A rougher method is shown in Fig. 14. Here the table, instead of being hinged, is dropped in place simply by means of four pieces, A, fitting between the frame, the strips, C, being added to keep the table from shifting sideways. The pieces, A, are tenoned into the table, and by making them sufficiently long, there is room to permit of the parallel thickness pieces, B, B, being laid upon the top of the frame. A supply of strips of various thicknesses can be kept in readiness for use. The pieces, C, keep the table sideways.

To cut tenons and rebates it is only necessary to adjust the height of the table until the saw stands above it to the same distance as the depth of rebate required—to adjust the fence, and run the stuff along. (Fig. 15.) Then readjust the fence and table, and run the second cut along to meet the first, so removing the piece, A, at once. For doing work of this kind in quantity, the lathe saw is invaluable.

Lastly, the bevel sawing of long stuff is done by means of a canting fence. Fig. 16 shows a plain form made in metal, the construction of which is so easy that no amateur need be without it. In the absence of such a fence, blocks of wood cut to various definite angles would have to be made and placed against the rigid fence. In Fig. 16, two lugs, A, A, are cast on the base, and two, B, B, on the fence. These are united freely with pins. The quadrant piece, C, screwed to the fence, furnishes, with the set screw and the upright attachment, D, the means of adjustment for bevel. The guide strips, E, E, fit in the groove in the table, and a set or pinching screw (not shown) passing through the lug, F, holds the table down in any position.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

I.—INTRODUCTORY.

THERE can be no doubt but that the use of "signs," as a means of advertising, is of the most ancient origin; in fact, it is known that in old Rome the taverns had signs, and that the Greeks also made use of them, as is proved by the frequent allusions made by the old Greek writers on the subject.

In mediæval England, when most people could neither read nor write, a "sign," or "sign-board," was an absolute necessity to the tradesman, and in the reign of Henry VIII. almost every house in street, lane, and alley exposed a sign of some description. These signs were generally indicative of the trade carried on within. With the spread of education, however, these "signs" gradually fell into disuse, although many are in existence to the present day, as the three golden balls of the pawnbroker, and the gaily painted pole of the barber.

It is not, however, the historical side of the subject on which I intend to treat in the present paper, but on the practice of the modern art of lettering on signs, shop-fronts, walls, vehicles, etc. Therefore, *sign painting*, in the proper acceptance of the term, as an almost obsolete art will be left untouched, exception to this rule being made only in the case of the royal arms, arms of public companies, shields, and a few of the most general of hotel sign-boards. It is for this reason I have headed my articles "Sign Writing and Lettering" in contradistinction to "Sign Painting," which title, to say the least, is somewhat misleading. Indeed, the naming of this art—for art it is, although perhaps partly mechanical—has invariably been a sore point with all previous writers on the subject, but, for my own part, I unhesitatingly say that the correct description of the work, as practised at the present day, is to be found in the title of these articles.

There are very few men at the present day who undertake this class of work who could paint a subject on a sign-board; and this can hardly be wondered at, as the man who does such work must of necessity be a first-class artist. This reminds me that some of our most celebrated artists have, on occasions, not thought it beneath their dignity to paint a sign. A specimen of Hogarth's work is, I believe, still to be seen inside "The Mischief" in Oxford Street, near to Soho Square, and an engraving of it used to be exhibited in the window not very long ago, if not at the present day. This, the old sign of the house, is said to be Hogarth's handiwork, and is specified as such in the lease of the house. Catton, one of the original members of the Royal Academy, and Wade, its first professor of perspective, worked occasionally for the London innkeepers. The latter painted a full-length portrait of Shakespeare, five feet high, for a publican, whose house was at the north-west corner of Little Russell Street, Drury Lane. George Morland, I believe, painted more tavern signs than any other artist of note. David Cox, it will be remembered, painted a sign for "The Royal Oak Inn" at Bettws-y-Coed in Wales, which has since been the cause of litigation in the Law Courts, and only lately decided. At Wargrave-on-Thames, midway between Henley and Twyford, and hard by Sir Morell Mackenzie's country seat, is a quaint, old-fashioned inn, the "St. George and the Dragon," the sign of which was painted by two great artists; in fact, to be correct, that side of the sign-board on which St. George is charging the dragon was painted by Leslie, and the reverse side was painted not by Watts, as has been sometimes asserted, but by Hodgson.

By what I have said, therefore, it will be seen that there are three distinct classes of work and workers, viz., sign painters, sign writers, and the common letterers. The first is an artist pure and simple, capable also, as a rule, of doing any class of letter painting. The second is a clever man in his profession, capable of doing any class of writing and lettering, from church work to the outside of a West-end tradesman's shop, but stopping short at actual pictorial work. The last is the intelligent mechanic, who, in nine cases out of ten, accidentally discovers that he is gifted with being able to make exact formations of letters and figures, and which by a little practice he acquires to a nicety. These men are to be found in large wheelwrights' and carriage-builders' yards, and in the railway carriage and waggon works throughout the country. As a rule, they generally use block letters, with a simple shading, such as one sees on railway waggons and coal trucks. This work is simply "letter painting," and those who execute it seldom get beyond it. It has much sameness about it, and holds out no field for improvement in the way of spacing, style, and display. I have personally known many of these men on railways, and whenever they have made any attempt at sign writing it has proved a most signal failure; whereas had they received a little training from a practical man they would probably have soon been enabled to execute their work with credit. But I have knowledge also of two cases where men have possessed a remarkable "gift" for this work—one in general sign writing, the other in "lettering" waggons. The sign writer, a homeless, shoeless, drunken vagabond, is still alive. He cannot read nor write, yet he can paint a sign with ornamental borders and letter it in any style, without mis-spelling a word or making the slightest mistake. His charges are absurdly low; he is generally in a half-drunken condition, and his couch at night time is more often than not the floor of some out-house. This is one of the worst cases of a mis-spent and ill-directed life it has ever been my lot to witness. In the other man the aspect of the case was just reversed; he was a mechanic of the roughest order, a waggon repairer, but honest, frugal, and sober. Whenever occasion called for it, he would employ the sign writer just alluded to to re-letter a truck or waggon. Cheapness was no doubt his reason for getting his work done by such a man, who, moreover, frequently disappointed him. One day the waggon repairer—whom I had noticed frequently standing for hours watching me at work on a waggon—came up to me and asked, politely enough, how I had learnt the art of forming letters, or, as he put it, "Painting them 'ere letters on waggons?" I told him that I was self-taught, my only guide being a half-crown handbook on the subject. "Could I tell him where he could get the book?" "Oh, yes," was the reply, and I entered the office and gave him the publisher's address. It may scarcely be believed, but within a fortnight I saw that man lettering a railway waggon, and forming letters to such a degree of nicety as to put even myself and the drunken professional writer "in the shade."

These cases may help to illustrate the way in which a great majority of men drift into becoming sign writers. As in all other trades and professions, it is often a matter of chance. But these men can hardly ever hope to become clever and proficient in their chosen walks of life; they have not studied the rudimentary principles of the work, have not started at the bottom rung of the ladder, and do most of their work without knowing the why and the wherefore of each individual process.

It is not, however, this class of workman which we want in the coming generation—we must endeavour to make him something better; and now that he has found a fitting tutor and guide in WORK, he will have only himself to blame if he sinks in striking out for fame in the struggle of life.

In the succeeding chapters on Sign Writing it will be my earnest endeavour to take the student through each successive course in the easiest possible stages, commencing at the very root of the subject. It must not be inferred from what I have already said that it requires a gifted nature to properly acquire this art; on the other hand, with proper and methodical training it is within the reach of all. Indeed, towards the close of my subject I hope to show how the more simple styles of plain lettering may be carried out by almost mechanical means. These instructions, however, are principally intended for those who follow some trade in which a little lettering is sometimes required, but which the workman has not a chance to learn except by properly following up the course of instruction as laid down in these pages.

Having briefly surveyed the general aspect of the subject, I will, in my next, commence the practical part of our work.

(*To be continued.*)

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

I.—THE SIMPLE KALEIDOSCOPE.

THE "tube of ten thousand flames." Such was the title applied by the Chinese to the instrument which forms the subject of this paper; and certainly the title appears to be most appropriate and suggestive when we take into consideration the myriads of pictorial views it is capable of producing. The peculiar name bestowed upon it by its distinguished inventor, Sir David Brewster, is derived from three Greek words, signifying "beautiful," "a form," and "to see." When first introduced to the public, about the year 1818, it is recorded that the effects produced by its wonderful qualities created such an extraordinary sensation both in this country and abroad that immense numbers were hastily constructed, and cargoes of them sent to foreign and distant lands, copies having been met with in the most remote districts of Switzerland.

It is not my present purpose to enter into a disquisition on the principles of the kaleidoscope, but merely offer a short explanation to assist the reader in comprehending the nature of the various parts of the instrument, and then pass on to consider its construction in its simplest form and after a fashion which may be reasonably supposed to lie within the province of any intelligent amateur capable of using a soldering bit or wood-working tools, and wishful to provide a source of amusement for the younger, and, for the matter of that, the older portion of the family circle during the long winter evenings.

The kaleidoscope consists essentially of two pieces of glass, which may be oblong or tapering in form to suit the fancy of the maker. These are secured and supported at any angle which forms an *even*, aliquot part of a circle, in a suitable tube, at one end of which is a cell termed the object box, formed of two circles of glass, the inner one being clear, and the outer one of ground glass; these are kept apart about $\frac{1}{8}$ of an inch by means of a ring of brass or other suitable material so as to enclose between them a number of coloured and clear pieces of glass, etc. The opposite end of the tube is closed with a cap in which is a small aperture at which the eye is placed in order to view the pictures presented by the several reflections of the fragments of glass in the object box.

As wood workers undoubtedly predominate amongst the readers of WORK, I propose to treat the subject first from this standpoint as shown in Fig. 1. On inspecting the Fig., it is obvious that access to a lathe will materially assist the worker, or, if this is not possible, the cap and the flanged collar at the back of the object box may be obtained for a trifle from any turner.

To proceed, first turn or otherwise prepare a mandrel or cylinder of wood about a foot long and 2 inches diameter, on which to prepare a tube of paper; rub a little grease over 10 inches of its length as a precaution against the paper being glued to the wood. Cut out a strip of stout cartridge or brown paper, say 3 feet long and 9 inches wide, up to 3 inches from one end, where it should have a projection of an inch at each side, making 11 inches wide for the last 3 inches; set off 6 inches from this wide end, give the remaining portion of the strip a coat of thin, hot glue, fasten the projecting edges of the clean end square along the mandrel, and fold the strip tightly round it, pressing out with a cloth any excess of glue, so as to finish with a smooth surface. After standing aside for a day to dry, it will now require the ends cut true, and the best way to do this will be to fold a half sheet of note paper round the tube about $\frac{1}{2}$ an inch from the end and run a sharp knife neatly round close to the edge of the note paper; then treat the other end in the same manner, so as to leave the tube 8 inches long, and slip it off the mandrel.

We next require two circular pieces of mahogany $\frac{1}{4}$ of an inch thick to fit each end of the tube, having a portion removed as indicated in Figs. 2 and 3 to an angle of 60 degrees, which angle may be easily obtained by dividing the circumference of a circle into six equal parts.

The reflectors measure 8 inches in length, and are $1\frac{1}{2}$ inches wide at one end, and $1\frac{3}{16}$ inches at the other. They may be cut from mirror glass or from plain clear window glass, moderately thin, say 16 oz., and the backs prepared by giving them a coat of drop black mixed with varnish, and a little terebine to accelerate its drying, or even black varnish will do for the purpose. When dry, the reflectors are now ready to be placed in the tube and secured in position by a piece of stout card cut to fit round the curve and meet at the edges of the reflectors. Before placing the card in position, it should have a piece of dead black paper pasted on the inside or by giving it a wash with Indian ink.

The next step is to provide a cap for the eye, and this may be achieved in the lathe by hollowing one side to a depth of $\frac{3}{8}$ of an inch to fit outside the tube, with a clean cut aperture in the centre $\frac{3}{8}$ of an inch diameter, then to reverse the work by turning down a piece of wood on a chuck to fit the recess, and finish off the outside as shown in section, full size, in Fig. 4.

The object box may also be constructed of wood in the manner shown in section and elevation, Figs. 5 and 6. A piece of hard wood, preferably of mahogany, 4 inches square is trued up to $\frac{3}{16}$ of an inch thick, and an opening cut or bored in the centre $2\frac{1}{2}$ inches diameter; a recess $2\frac{3}{4}$ inches diameter and $\frac{1}{16}$ of an inch deep is further produced on one side in which to insert a circle of thin, clear glass; a cap is next turned with a flange and bored to fit outside the tube at the object end. Fix the glass in the recess by means of a red-hot wire applied to a few tiny pieces of marine glue laid round the edge, and secure the flanged cap centrally to this square piece with 4 screws, being careful not to split either in so doing. On the opposite face are also screwed two narrow strips $\frac{1}{2}$ an inch wide and $\frac{1}{4}$ of an inch thick, one piece along each edge and across the grain to prevent warping; between these two strips another piece 4 inches by 3 inches and $\frac{1}{4}$ of an inch thick is hinged, and provided with clips to keep it in position; this is also fitted with a piece of ground glass, as shown, on the inside, with the ground face of the glass outwards. The foregoing method of constructing the object box admits of the easy removal and change of the fragments of glass, etc.

To those who may prefer to take the alternative course, I may remark that the taper form is usually adopted when the tube is of tin plate. Still keeping to the same length and the same diameter at the object end, I propose to taper the tube to $1\frac{1}{2}$ inches at the eye end. The plate requires to be cut to the form seen in Fig. 7. First secure the plate by the corners with tacks to the bench or floor, and make a trammel to draw the large circles by driving a couple of wire nails through a lath 18 inches apart. Make the centre nail secure, and scribe a circle, A, B, on the plate as shown; now shift the outer nail 8 inches inwards and scribe a second circle, C, D. With a pair of compasses set to 1 inch mark six divisions along the line, A, B, and scribe lines through the first and last points towards the centre. Outside the figure thus formed, a space about $\frac{1}{4}$ of an inch wide must be set off to allow for the joint. Having cut the plate neatly to the lines, bend about $\frac{1}{8}$ of an inch along each edge slightly downwards over the edge of a block of hard wood, both edges one way; the underside will then form the inside of the tube, and the plate must now

Fig. 2.—Plan of Tube at Eye End, with Cap Removed (full size).

be gently bent or beaten with a smooth-faced wood mallet, round a mandrel having the same dimensions as the inside of the proposed tube. It now only remains to secure the plate on to the mandrel with a piece of wire twisted round in two or three places, solder the joint, and the tube is complete.

The reflectors for this form are $1\frac{1}{2}$ inches at the object end, and taper to $\frac{3}{4}$ of an inch at the eye end; for the third side I should still advocate the use of cardboard as in the cylindrical form, but it may consist of a similar piece of glass or a piece of thin wood blackened on the inner side. In order to bring the aperture in the cap at the eye end into a central position as regards the tube, it will still be necessary to raise the narrow end of the reflectors into the most suitable position for the eye, in its relation to the reflectors. This support is shown in elevation in Fig. 8, and may be formed of tin plate with the edges turned back where they come in contact with the glass. The same course must be taken with the object end, as in Fig. 3, securing each support with a drop or two of solder. It will be best to form the cap in wood, and perhaps the

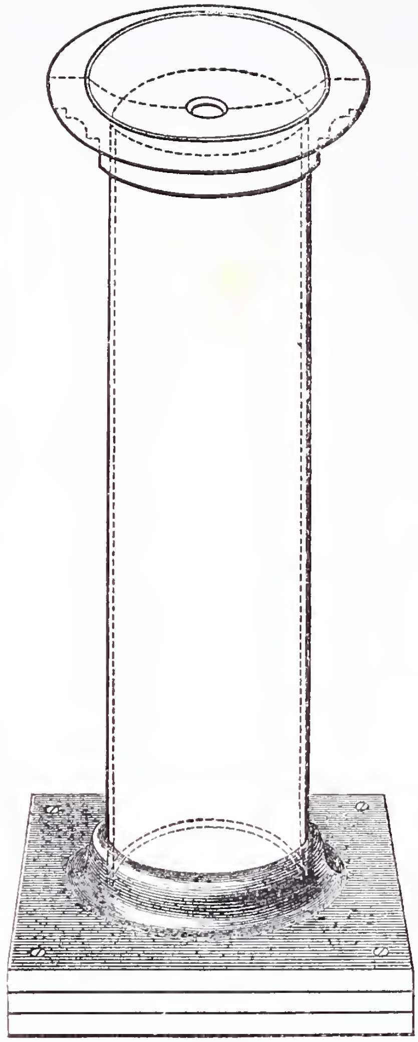


Fig. 1.—View of Simple Kaleidoscope, with Parallel Paper Tube (half full size).

same may be said of the object box; but if this is not desirable it may be made of a strip of tin plate $\frac{3}{4}$ of an inch wide, formed into a collar to fit outside the tube, and one edge turned over about $\frac{1}{16}$ of an inch all round to support a circle of ground glass cut to fit the interior; over this glass is placed a brass ring $\frac{1}{8}$ of an inch thick, neatly curved to the circle, and made to spring in somewhat tightly. The objects chosen are now introduced, and a circle of clear glass resting on the ring is laid over them; the box with its contents is then slipped on to its place, and by way of embellishing the tube and attaching the box to the same, a piece of wall paper of a small, neat pattern is selected and pasted over the whole length of the tube, the object box included. Now glue the cap to the paper cover and the instrument is complete.

Respecting the choice of colours, blue, green, and yellow will be found most suit-

Fig. 3.—Plan of Tube at Object End, with Object Box Removed (full size).

able, always selecting pale tints in preference to opaque objects. Colourless fragments may also be introduced, together with the coloured glass, with effect.

The symmetry and beauty of the picture or patterns produced, and consequently the pleasure derived from the contemplation of them, will depend principally on the degree of accuracy attained in adjusting the reflectors to the correct angle, which may be tested by having but one piece in the object box, large enough to occupy a considerable portion of the field, say one-third, when the observer will notice there are six views ranged round the angular point formed by the junction of the reflectors. Each section should then be apparently of the same size, and their adjacent edges coincide with each other. The images being reflected from the posterior surfaces of the reflectors, this interferes very considerably with the perfect form of the patterns, but this defect will be obviated in the instrument to be described in future chapters. This instrument, it may be said, is the invention of the writer, and will tend, it is hoped, to render the kaleidoscope of greater practical utility than heretofore.

(*To be continued.*)

Fig. 8.—Section of Eye End of Taperform Tube, with Cap Removed (full size).

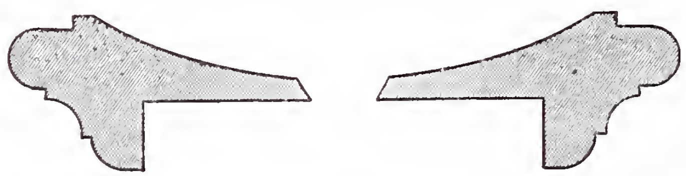


Fig. 4.—Section of Cap for Eye End (full size).

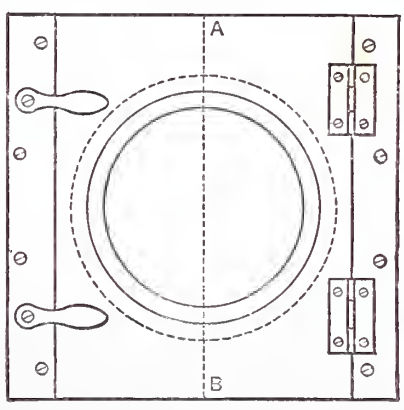


Fig. 6.—Plan of Object Box, with Glass Removed, showing Construction of Top (half full size).

Fig. 5.—Section of Object Box on Line, A, B, Fig. 6 (half full size).

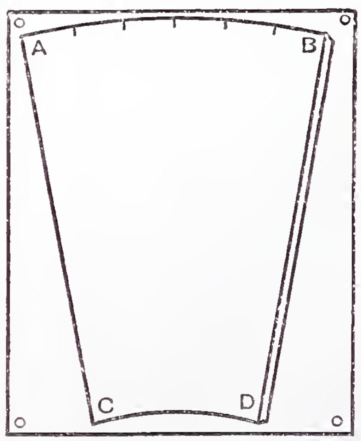


Fig. 7.—Mode of Setting out Plate for Taper Tube (one-fourth full size).

OUR GUIDE TO GOOD THINGS.

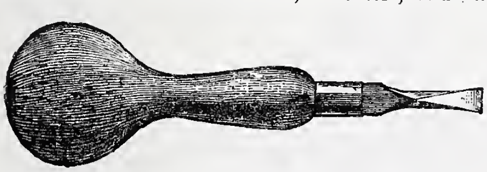
Introductory.

Many a workman, unfortunately, misses the chance of obtaining some special tool, machine, or appliance that may be of the utmost use to him in his particular calling, because he may not have seen it, or even heard of it, in the locality in which he lives. Show a man a new tool with which you have recently provided yourself, and it often happens that he will say, "Why, where did you get hold of this? It is the very thing I want, and just what I have been looking for I don't know how long!" And having learnt where the article on view may be had, off he goes, congratulating himself on his good fortune, and buys one at the earliest opportunity.

Now, it is in the spirit, and with the hope, of giving such useful and desirable information, week to week, to the readers of Work that "Our Guide to Good Things" has been set on foot—to make them acquainted, in fact, with the existence of new tools, machinery, appliances, technical works, etc., of which they might otherwise be still in ignorance: and, as it has been said elsewhere, to give timely notice of "all things useful and novel that manufacturers and inventors may produce in the interest of those who labour with the hands." That such notice may be beneficial to those whose productions and goods may be mentioned is obvious to all, but it must not be supposed for a moment that whatever may be advanced here is done in the interest of manufacturer or seller, with the view of directly recommending any particular article, and thus, perhaps, indirectly depreciating another. The names of makers, and of sellers too, must of necessity be mentioned, but in the case of the latter it will be rather to show who has been the first to give information respecting the tool or appliance described, than with any intention of bringing them prominently into notice as sellers of the goods described.

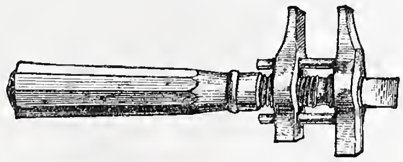
Further, in all notices of articles described in this part of the magazine, it will be sought rather to give a clear and accurate description of the tool, machine, or appliance under consideration, and to point out the purpose it is intended to serve, than to express any authoritative opinion respecting it, leaving it to each reader of Work to determine for himself whether or not it is the thing he needs, and if it be likely to prove of value to him.

Having thus cleared the way, as appears desirable, in order to avoid any misapprehension, let me ask all manufacturers, inventors, and



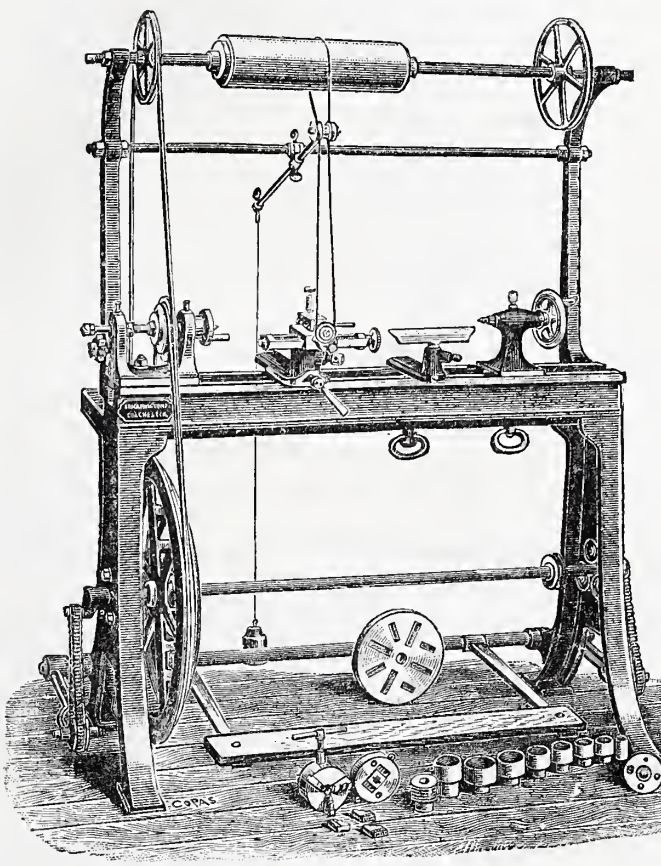
Handy Short Screwdriver.

patentees, under whose notice Work may come, to supply information with respect to their specialities, that they may receive early mention in these pages; and for the same end let me also ask all dealers, and readers of Work as well, to send information of any good thing with which they may become acquainted. In the case of small articles, which can be transmitted by parcel post, it is desirable that a specimen should be sent for inspection, as it is impossible to describe any tool clearly and accurately without seeing and handling it. With regard to machinery, lathes, etc., it is requisite that a full and complete description should be sent, or that arrangements should be made with the Editor for



Small Parallel-jawed Wrench.

its inspection, either by himself or by some competent person. In all cases it is of the utmost importance that an illustration of the article under notice should accompany the description.



The Britannia Company's New "Lukin" Lathe.

1.—The "Lukin" Lathe.

The first piece of machinery that offers itself for description in Work is the "Lukin" Lathe, a new and useful appliance for plain and ornamental turning, made from the design of the Rev. James Lukin, B.A., a gentleman who has long been known in the mechanical and engineering world as a reliable authority on lathes and everything connected with them. It is manufactured by the Britannia Company, Colchester, Essex, who will promptly answer any inquiries that may be made respecting it. The illustration given herewith affords a good representation of it, and from an inspection of this the reader may obtain a fair idea of its construction and general appearance. It is preferably made, however, either with crank and steel centres, or with improved roller bearings, so as to be readily accessible for cleaning and oiling.

It should also be noted that the lathe may be had constructed with inside cranks and hooks, with the axle upon hardened centres. These details, however, are altogether optional, and will be suited to the wishes of the purchaser.

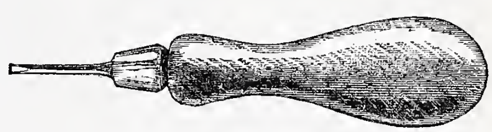
The lathe, as shown in the illustration, is said to be satisfactory in every respect. The beds are 4, $4\frac{1}{2}$, or 5 feet long, the length of bed being a variable quantity, so to speak; the centres are 5 inches high. The mandrel headstock is fitted with oil cups; the faces and edges are bright, and the rest japanned black. The mandrel is traversing, with the front neck 1 inch and the other $\frac{5}{8}$ inch, both working in collars of hard steel, or of phosphor bronze if preferred. Other dimensions are:—Width across face of bed, $4\frac{3}{8}$ inches; depth of bed, $4\frac{1}{2}$ inches; diameter of nose of mandrel, 1 inch; pitch of screw, 8 per inch; diameter of driving wheel, 27 inches. It will be understood from that which has been said above respecting the bed, that the lathe can be had in three sizes in this respect. It is also supplied with gap-bed if desired.

There are six formers, or guide screws, of steel, of the following pitches:—8, to fit the mandrel nose, 10, 12, 16, 24, and 30. These are fitted on in the usual manner, and work in a segment plate. By means of the traversing mandrel with the guide screws, threads may be cut upon telescope, microscope, and other similar fittings, in wood or metal, not exceeding the length of the guides.

The overhead is of the usual kind, with tension rod and pulleys, there being a hollow mahogany roller and a pair of cast-iron pulleys, that on the right being intended to gear with the small one on the crank axle, whereby a very slow motion may be obtained, which is sometimes desirable. The slide rest represented is of a very simple character, and, though good of its kind, is not intended to be taken as the best possible for the "Lukin" lathe, which can be fitted to order in this respect, according to the desire or the requirements of the purchaser.

The lathe was originally designed to meet the general purposes of amateurs who are fond of lathe work, and is therefore made of sufficient strength and substance to admit of rougher usage than usually falls to the lot of an "ornamental" lathe, properly so-called. Thus it will carry a 6 lb. jaw chuck or heavy 10 inch face plate, with large metal turning rest, and, at the same time, will execute fine eccentric work with the utmost accuracy. The range of its capabilities depends, of course, upon the chucks and fittings; but with a drill, eccentric, and vertical and horizontal cutter, an immense amount of beautiful work may be done.

For example, all kinds of plain turning in soft and hard wood can be done, such as boxes with or without screwed covers, tool handles, vases, egg cups, bread platters, butter dishes, needle cases,



Patent Brass-capped Bradawl.

spill pots, spice boxes, string boxes, ring stands, napkin rings, curtain rings, chair and table legs, pillars, plain or twisted, spindles for overmantels, brackets, etc., watch stands, chains cut out of the solid, metal spinning, etc. etc. All fittings can be screwed by aid of the traversing mandrel instead of being glued together, which is an advantage in many ways.

In ornamental turning, with an eccentric cutter alone, used with the division plate, all simple patterns of interlacing circles may be executed. With the vertical and horizontal cutter, basket and fluted work can be done. With the eccentric cutter alone, flat faces can be cut, as, for example, the flat sides of a hexagon or a cube, and also a perfect ball or sphere. With the drill, various perforated work of a highly decorative character can be cut, besides fluted work. By the addition of a spiral chuck and dome chuck to the lathe—appliances already mentioned—Elizabethan twist, spherical work, and such-like, may be included in the list of ornamental work done by means of this lathe.

In addition, any brass work, with screwed joints or otherwise, may be turned out, such as microscopes, telescopes, electric bells, the parts of model engines; and a variety of light work in iron and steel may be done, such as screws, nuts, and small bolts, and if castings are obtained the lathe will suffice for fitting up many pieces of mechanical apparatus, chucks, etc.

So much for the capabilities of the lathe, which it will be allowed are numerous and comprehensive. It only remains to afford a few particulars with regard to construction. The fittings of the fast headstock for ornamental turning have been already mentioned. A plain sleeve is provided, to be used in place of the screw former, when plain turning is to be done, or when screw cutting is only temporarily interrupted, a simple device being provided to avoid taking off and putting on screw guide and sleeve.

The cone pulley is made of gun metal with three or four speeds, and its front fitted with a division plate having three or more circles of holes of any selected numbers and a spring index point. A driver chuck and face plate are fitted.

The loose head or poppet is fitted with a steel tubular mandrel, coned at front end for centres and screwed at back end, and fitted with a left-hand square thread traversing screw, and bright turned hand wheel, and secured to the bed by a through bolt-and-bow nut and plate beneath. A plain hand rest, with T's for wood and metal, is fitted. The bed is of cast iron of strong section, without cross ribs to impede the free passage of poppet and rest from end to end, and with double flat face truly planed. It is mounted on strong cast-iron standards. The treadle is fitted with bright turned rocking shaft and cast-iron arms. The bright turned wheel shaft runs on friction rollers, and is coupled to the rocking shaft by chain and roller gearing. The heavy-rimmed driving wheel has three quick speeds and two smaller speeds for slow motion.

The lathe is fitted with a polished mahogany tool board at back. The ornamental overhead is constructed with strong rigid cast-iron vertical supports as shown, carrying the bright turned horizontal shafts. It has, as it has been said, a turned and polished mahogany drum or cylinder to slide along the upper grooved shaft, and driving wheels with tension rod and pulleys for adjusting the driving gut.

The price of the lathe alone, for plain turning, is £22 10s.; with ornamental overhead motion, £30. A plain slide rest in addition raises the price to £35, and an ornamental slide rest to £40 10s. These quotations are for the lathe with 4-feet bed; for longer beds or gap-bed a small additional charge is made.

2.—New Wire-thread Fret Saw.

I think the readers of WORK will be the first to hear anything about this New Wire-thread Fret Saw, which was shown me a few days ago by Messrs. Richard Melhuish & Sons, 85 and 87, Fetter Lane, London, E.C., and to which, for want of a specific title from the maker, we ventured to assign the above name. Literally this new fret saw is nothing more nor less than a piece of strong steel wire toothed on all sides at wide intervals between the teeth, and presenting the appearance of a piece of wire of extremely small diameter, barbed with small but exceedingly sharp points in every direction. Now the advantage of this peculiarity of construction is that the saw will cut in any direction, backwards, forwards, upwards, downwards, sideways, just as you will, *without any need of turning* the saw handle. Make a single hole with a drill, in the usual way, and insert the saw, and you may cut out the most intricate forms, going into as many points or curves as you will and back again without any palpable change of direction of the saw blade. It is a veritable novelty in fret-saw blades, and cannot fail, I think, to come speedily into favour with fret cutters. It is not possible to do more than make early mention of it here. The saw will, of course, be made in sizes like the generality of fret saws; but with regard to price, about which I particularly inquired, nothing definite is yet settled. Further notice will be given of this at the earliest opportunity.

3.—Small Parallel-jawed Wrench.

There must be few nowadays, it is fair to suppose, to whom a handy pocket wrench has not become a daily requirement, and especially for bicyclists and tricyclists. The Small Parallel-jawed Wrench figured in the preceding page is useful for a variety of purposes, and presents good points in its construction which are not to be found in others of its kind. In the first place, it is a composite tool, capable of acting as wrench, hammer, or screwdriver, as may be required, the projection at the upper end, above the wrench, serving as the last-named, and the upper jaw of the wrench, which, it will be noticed, projects slightly beyond the lower jaw, as the second. The jaws of the wrench are strengthened and kept in their relative positions by two stout bars fastened into the upper jaw, and passing through holes drilled in the lower jaw for their reception. The screw, which proceeds from the handle and passes through the jaws, is threaded in opposite directions, so that when turned one way it has the effect of drawing the jaws apart, and of bringing them together again when turned the other way. The jaws open to the extent of one inch when brought asunder to the utmost. The handle is of wood, and therefore more pleasant to handle on a cold day. The price of the wrench is 3s.

4.—Handy Short Screwdriver.

Without doubt many a workman has found the ordinary screwdriver very much in the way when he has been engaged in putting a lock on to the inside of the front of a drawer, and *vice versâ*—more particularly when doing the *vice versâ*, or taking the lock off, because this is generally done with the drawer in position—that is to say, in the table. The short screwdriver illustrated in the preceding page is well adapted for work of this description, and indeed for any kind of work in which it is necessary to insert screws with the blade of the screwdriver turned towards the workman. The handle being broad and flat is convenient to hold in the hand, and the blade is short and strong, and securely fixed in the handle by being deeply notched into the brass ferrule that is shown in the engraving, between the handle and the blade. This screwdriver is not mentioned as being absolutely new, for it has been in the market a year or more, but I do not think it is widely known, and possibly a knowledge of its existence may be useful to many.

5.—Patent Brass-capped Bradawl.

This is an improvement on the old form of bradawl, which only requires to be known to ensure its general adoption. In the old bradawl the tang of the blade was driven into the handle, and a semblance of strength was given to the tool by the ferrule, whether of brass or iron, with which the upper end of the handle was encircled; and frequently after a little use, when the bradawl has been thrust into a piece of wood somewhat harder than usual, handle and blade have parted company in a most aggravating way when it has been sought to draw it out again, the handle remaining in the operator's hand and the blade in the wood, from which it has been removed by other than the legitimate means. Such a catastrophe, however, may be averted by the use of the Patent Brass-capped Bradawl, in which the upper end of the handle is worked in such a manner into the brass cap that takes the place of the ferrule that the blade is secured in the handle so firmly that there is not the slightest possibility of any separation between the one and the other in the manner described above. Having used these bradawls myself, and found them far superior to the ordinary bradawl, I can recommend them.

THE EDITOR.

Trade Notes and Memoranda.

SOME TOPICS OF THE HOUR.—Street Buildings and Architecture—Architectural Brickwork—Jerry Building Convictions—Ventilation through Walls—Electricity in Raising Water—Liquid Fuel—"Pyrodene," a non-inflammable protection — Tendering for Work in America—Rustless Iron.

LOVERS of cathedral architecture are warned that Rochester's west front is just now underpinned and subject to excavation.—There is to be a new promenade at Morecambe, at a cost of £10,000.—An Architectural and Building Trades' Exhibition opens at the Agricultural Hall, London, from April 1st to the 13th.—New lighthouses and screw piles are shortly to be erected in the Belfast Lough.—The cutting of the Nicaragua Canal is to be commenced at once.—A Manchester designer has just been entrusted with the statue of Godefroi de Bouillon for a niche on the south side of Lichfield Cathedral.—Important additions are about to be made to the Cambridge Natural Science School.—The Lake Scenery District Railway Scheme is coming to the front again.—New patents have lately been taken out for: a painter's stencil holder; a steam press for brick making; a wall embossing method; safety bolts and locks; improvements in balcony windows; a new sash fastener; chimney cowls; and a patent has also been granted for tie bricks for cavity walls.

THE Society of Arts are offering prizes to Art workmen in the following classes:—I. POTTERY (INCLUDING PORCELAIN AND EARTHENWARE). 1. The Body, any material: *a.* Thrown, not shaved, first prize, £5; second prize, £2; *b.* Shaved or turned, first prize, £5; second prize, £2. 2. Decoration: *a.* Modelled and glazed, first prize, £10; second prize, £5; third prize, £3; *b.* Painted under glaze, first prize, £10; second prize, £5; third prize, £3; *c.* Enamel on the glaze, first prize, £10; second prize, £5; third prize, £3. 3. Stone salt-glazed ware: *a.* Plain; incised and glazed, first prize, £10; second prize, £3; third prize, £3; *b.* Coloured or otherwise decorated, first prize, £10; second prize, £3; third prize, £3. The Art workman must have designed the body of the pot as well as have executed the decoration. All the specimens of pottery sent in for competition must be dated on the clay. II. STONE CARVING. First prize, £25; second prize, £15; third prize, £10; fourth prize, £5. The capital of a column, with square, circular, or octagonal abacus, not to exceed twelve inches in width. III. WROUGHT-IRON GRILLES. First prize, £25; second prize, £15; third prize, £5. A grille measuring not less than three feet superficial, nor more than five feet superficial. The object for which the grille is intended must be stated—whether for a protective purpose, for the outside of a window, for a street-door panel, or for indoor use as a window screen, coil case, ventilator, etc. IV. GOLDSMITHS' AND SILVERSMITHS' WORK. [Prizes presented by the Goldsmiths' Company.] A cup or sugar basin of beaten silver, chased or otherwise, made within the year 1888, first prize, £20; second prize, £5. A pendant or brooch, or locket of gold without gems, first prize, £20; second prize, £5. All articles for competition must be sent in to the Society's House, John Street, Adelphi, on or before Tuesday, April 23rd, 1889. The conditions under which these prizes are offered can be obtained on application to the Secretary.

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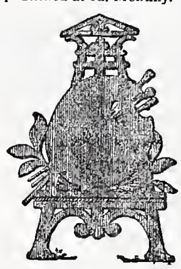

Mr. H. HOWES, Forest Gate, E., received a Bronze Medal at the Finsbury Polytechnic for a Picture Frame, published with *The Amateur* for 1888. Mr. EMIL LEDER, in Kukus, received a Silver Medal at the Agricultural Exhibition, held in 1887 in Német Palanka, Hungary. This is the second distinction conferred on our old friend and subscriber, having previously received a Gold Medal at an exhibition held at Kaaden, Bohemia, for articles made from pattern sheets published with *Der Dilettant*. Nos, 817 and 818, Easel, Photo-holder, Overmantel, and Handkerchief Box Fretwork designs, at 6d., post free. Catalogue 37 to 31, of Artistic Fretwork, Carving, Inlaying, and Wood-painting designs, Mouldings, Cabinet Fittings, Fancy Woods, Tools, Varnishes, Stains, Polishes, Machines, Clockworks, and every other requisite, with 900 engravings, 6d., free.

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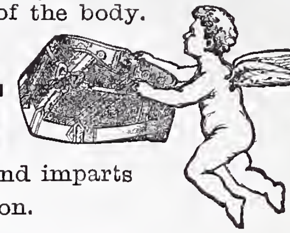

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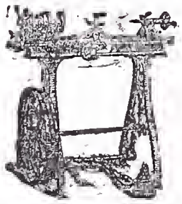

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 2.] SATURDAY, MARCH 30, 1889. [Price One Penny.

A HOME-MADE DOG CHUCK.

BY OLLA PODRIDA.

Utility of Chuck—Materials—Cost—Proportionate Dimensions of Body—Mode of Making Chuck—Construction of Dogs.

The chuck about to be described will be found useful for almost every variety of work, and, as far as the needs of an average amateur go, it will compete successfully and compare favourably with its expensive descendant—the four-jawed expanding chuck. It is, in the form given herein, easily made—no patterns or special process being necessary—at home, and with a little practice will give entire satisfaction to the user.

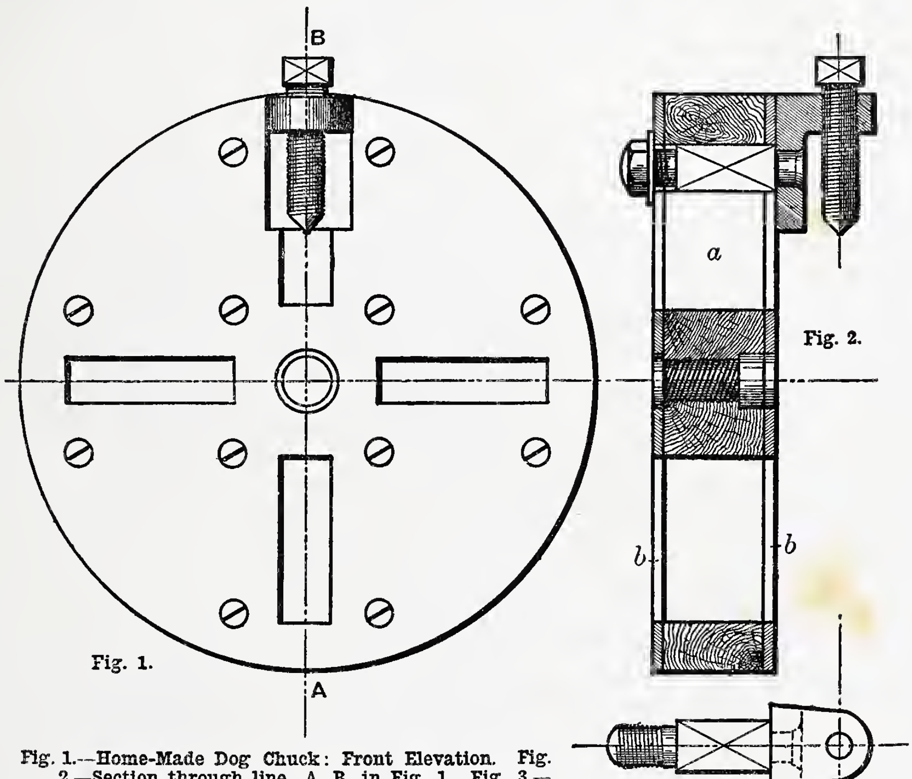


Fig. 1.—Home-Made Dog Chuck: Front Elevation. Fig. 2.—Section through line, A, B, in Fig. 1. Fig. 3.—Plan of Dog.

The materials required are within easy reach of every one, comprising a disc of hard wood for the body, some sheet iron for facing the front and back, and a few inches of square bar iron for the shanks of the dogs. The dogs may be made of angle iron or bent out of flat bar iron. The cost will, of course, depend on the size. For one about 8 or 9 inches in diameter the cost of materials would be about a shilling or eighteenpence.

Referring to the illustrations:—Fig. 1 is a front elevation showing the arrangement of the slots for receiving the dogs, which are four in number, one only being shown. Fig. 2 is a vertical section of the chuck through A, B, showing the construction more clearly. The thickness of this wooden part should not be less than $\frac{1}{6}$th of the diameter of the chuck; for example, a 9-in. chuck should have a body of wood at least $1\frac{1}{2}$ in. thick. The body or middle part, *a*, is of wood—box, beech, hornbeam, oak, mahogany, pitch pine, or other hard wood. This wooden part is faced on both sides with sheet iron, *b*, *b*, about $\frac{1}{16}$th or $\frac{1}{8}$th of an inch thick, secured by countersunk wood screws, as shown in Fig. 1. A plan of the dog is given in Fig. 3, but the construction will be better comprehended from Fig. 2, where it is also shown in section.

In making the chuck, first get a piece of wood of suitable size for the body, plane one side, and strike out the size with the compasses and rough out slightly larger to allow for turning. Bore and tap the centre to suit nose of mandrel; the thread, with care, can be formed by the mandrel nose itself if no suitable tap is at hand. By the way, every amateur lathesman should have a set of taps corresponding with the mandrel of his machine. Returning to the subject, the next thing is to prepare the sheet iron facing for the back by striking out a circular piece to the right size and marking out the slots, which must be cut before fixing on the wood. These slots must be drilled and filed out to suit the dog shanks; they must not be cut straight out with a chisel; by so doing the plate would be buckled beyond recognition. A hole must be drilled in the centre to clear nose of mandrel. The holes for screws must also be drilled and countersunk for stout screws; these screws to be rather less than half the thickness of chuck in length, so as to avoid fouling the others in front. The plate having been fixed, the chuck at this stage must be screwed on the mandrel and turned and faced truly. This done it must be removed and the slots cut through the wood by first boring holes through with a centre-bit, and shaping out the remainder with chisel, and rasp, or coarse file, care being taken that the slots, when finished, are square to the face. The plate may now be prepared for the front of chuck by cutting a piece to the size and marking the positions of the slots from the chuck by laying the latter upon the plate and tracing the outlines of the slots with a scriber, noting the position in which this is done so that the plate may readily be replaced in the position from which it was marked. The screw holes being drilled and countersunk the plate can be finally fixed, and in doing so the slots must be kept fair with each other. Trifling inequalities in these slots can be removed with a file after the whole has been put together. The periphery of the chuck can be turned up, and the clearing hole in centre of front plate bored in place. If convenient, a slight cut may be run over the face, but if the iron plate on the front has been well bedded this should be unnecessary. The chuck is now ready for the dogs.

These dogs are made of wrought iron. The shanks are formed out of bar iron $\frac{1}{2}$ in. square, rounded down to $\frac{3}{8}$ in. diameter at the back ends and screwed for nuts. The front ends are rounded to $\frac{7}{16}$ in. diameter, and the dog riveted on as shown in Fig. 2. Cold riveting will do, but hot is best, and a notch should be cut in one side of the hole so that when riveted on there shall be no tendency on the part of the dog to turn and become loose on the shank. In riveting, the shank must be held in a vice by the square part. The dog screws may be made from $\frac{7}{16}$ in. square bar iron, rounded down and screwed with conical points slightly flattened and case hardened, but the best job would be to make them of steel and lightly temper the points. The screws must be arranged so that they or the dogs may be reversed if required, and they must fit well in the holes. The dogs may be made by bending suitable pieces of flat iron, or they may be cut out of angle iron if the latter is obtainable. To avoid injury to work from the points of the screws, small pieces of iron, slightly curved for round work, and provided with a countersink on the convex side for the conical points of the dog screws, should be interposed. The dog screws should always be kept short, or project as little as possible between the dogs and the work, so as to avoid injury to them by bending.

Other uses might be suggested for this form of chuck, such as providing it with a few extra holes between the slots so that work might be bolted on to it or otherwise attached than by the dogs, which, of course, can at any time be removed; but, as space is limited, I leave such to the ingenuity of the worker, which, especially if sharpened on the grindstone of necessity, will readily adapt the circumstances to his needs.

LATHES AND TURNING APPLIANCES.

BY F. A. M.

I.—Introductory.—How to Choose a Lathe.

Man has been described as "a tool-making animal." He is probably the only animal with brains enough to enable him to see the value of tools, and with dexterity enough to make and apply them. If any one doubts the value of tools let him for a moment imagine what would be our condition without them, and he will very quickly be convinced that were we confined to our teeth and nails, and allowed to use no other implements than these, we should have to return to the existence of the most degraded savages. Gold, jewels, and rich robes, etc., may be precious, but far more precious still are tools. Look with respect, then, gentles, at the carpenter's bench and basket of tools, at the blacksmith's anvil and vice, for you could more easily dispense with your carriages and horses, your houses and parks, than you could do without these.

All work but the most mechanical is done with tools, therefore Work will be constantly occupied with them. A man may turn a crank without a tool, but this sort of work employs his muscles alone, his animal nature; and it is more and more left to animals and to the forces of nature.

Now of all tools the lathe is the king. Much as the steam engine has done for humanity, the lathe has done far more, and without it both the steam engine, and almost every other machine, would be impossible. Parents, do your boys trouble you in the holidays by knocking nails into the doors and carving their names on the gate? Perhaps you never considered they have an instinctive desire to use tools. Send them for an hour a day to a carpenter, get them some tools other than the pocket-knife, and set apart an outhouse, or a dressing-room, as a workshop for them; if they take to it, and work with perseverance, buy them a lathe.

I will here stop to confess that I am something of an enthusiast on the subject of the lathe, and I had better say so, lest my readers should fail to discover it. My own dear father gave me a lathe when I was fourteen years old; I climbed a high tree that looked along the road, and stayed there about three hours, watching for the cart which was to bring it from the station. It was a very suitable boy's lathe, costing £5; all iron, 3½ in. centres, and 3 ft. long. I have it now; it has been a great pleasure to me, and is so still; never were £5 better spent!

Before going into the general question of "How to Choose a Lathe," I may say here that, for a boy of fourteen, I do not advise an expensive lathe, lest the desire to turn should not prove permanent; besides this, a boy's small lathe will always be useful in after years, even when the turner has a more expensive one, a second and smaller lathe being a great convenience. As I intend to mention the names of several manufacturers in connection with the work in which I think they excel, I may say here that for a boy's lathe of the size here mentioned I should go to Charles Taylor, of Edmund Street, Birmingham, whose price is £4 15s. He supplies a small slide rest to suit for £2 18s., and a complete turning outfit, comprising 3½ in. centre lathe, slide rest, chucks, tools, and drills, for £11. With this outfit a boy might set to work at once upon small nicknacks, boxes, chess-men, etc. etc., in wood; and if in addition be added a 10s. 6d. parallel vice, and some files, taps and dies, rhymers, etc., he could fit up a model engine.

Let us now approach the question, "How to Choose a Lathe," from the grown-up amateur's, or mechanic's, point of view. It is a wide question, since the *kind* of lathe depends on the *kind* of work to be done with it, and the *quality*, or perfection of the lathe, on the depth of the purse. I can only hope, then, to offer such remarks as may enable my readers to choose for themselves according to their own requirements. Remembering, then, that we are dealing with foot lathes exclusively, we may say they can be broadly divided into two kinds, viz., those for turning wood, and those for turning metal; also some desire to combine the two.

Wood Lathes.—Suppose a carpenter, or cabinet maker, wishes to take up turning, he should look to three things—first, he will want high centres and a long bed, say 7 in. or 8 in. centres, and a bed that will take in work 4 ft. or 5 ft. long; second, he will want an easy-running lathe, therefore the mandrel must be of small diameter in the neck and run on a back-centre screw behind; third, he should have a mandrel of a good length, say 8 in. to 12 in. long, from collar to hinder end. A wood-turner's lathe must run fast, and if the bearing surfaces of the mandrel are large it will drive hard. You cannot tell whether a lathe runs easily by simply putting the foot on and driving it round, unless at the same time you notice how many times the mandrel turns to each turn of the crank, or, in other words, what is the speed ratio of the pulleys. A proper speed ratio for wood turning is 8 to 1, and at this speed the lathe should run easily or it is not fit for wood turning. This it will not do if the collar of the mandrel is more than 1¼ in. in diameter and ¾ in. long, or it may be 1 in. long by 1 in. diameter. The mandrel neck and collar should be perfectly hard so that no file will scratch them. I once bought such a lathe, for a workman friend, for £2; it was second-hand, and rough to look at, but very useful and light to turn; it is, no doubt, a bargain, but such lathes are to be met with for £3 or £4. A carpenter could make the frame of the lathe himself, and buy the headstocks, rest, wheel, and crank axle. This sort of lathe would be a workman's tool—for use, not for show. A wood turner may very likely wish to put his work together with screws, and to produce screws in the lathe he will probably require a traversing mandrel. Writing from Tunbridge Wells, where such things are used, I may say the turners here pay a high price for a traversing mandrel and collar, and these they mount themselves in a wooden headstock. The makers of ornamental turning apparatus make very beautiful lathes with traversing mandrels—quite works of art—but they are very expensive. I do not know that a good traversing mandrel can be obtained at a moderate price, but the Britannia Company have lately brought out a lathe with traversing mandrel and overhead motion, called the "Lukin Lathe," a notice of which, with an illustration, will be found in page 13 (No. 1) of this Magazine.

A good lathe for wood can be obtained from J. Buck, of 56, Holborn Viaduct: 5 in. centre, £11 15s. This would have no traversing mandrel; it would be of iron, and would not have the capacity of the wood lathe first described, but it would be better-looking. Buck's next quality "best lathe," with divided pulley and very well finished, costs £19 5s.; but if one requires a traversing mandrel and overhead motion the price rises to £65, and you get a fine tool, fit for ornamental turning when the requisite apparatus is added. These lathes could have slide rests fitted and be used for *small* metal work, though, as they are intended for wood, they have no back gear, and therefore could not well deal with iron of over one inch in diameter.

Metal-turning Lathes.—We will now turn to those lathes which are intended for turning metals. Now, metals require a much slower speed; also a slide rest (of no use for wood) becomes almost a necessity. These lathes, then, are fitted with back gear and slide rest. They will turn wood, but not conveniently, because they are made for slower speeds than wood requires. Metal-turning lathes are made in great quantities, and the price has been reduced, by competition and improved methods of manufacture, to what would have been deemed incredible some time ago. Moreover, in this direction our English manufacturers appear to hold their own. Supposing, as before, that a workman wished for an iron-turning lathe of about 5 in. centre with slide rest and back gear, he would find a great number of makers ready to supply him. Perhaps the first thing he had better do would be to obtain "The Metal-Turner's Handbook," by P. N. Hasluck; because there he will have in a small compass illustrations of the work of some of the best known English makers, with short descriptions and prices. If the lathe is to be a slide lathe with saddle and leading screw, then, if a *small* lathe be required of 3½ in. centre for model engine making, or electrical work, etc., there is nothing to beat the Britannia's Company's No. 14 lathe at £18 18s. For larger sizes, perhaps Milnes of Bradford may be preferred; his 5 in. slide lathe, with hardened collars, cut gears, and full set of 22 change wheels, is £26. It is possible to get such a lathe for £20, but it is not desirable, unless it were second-hand, for the work could not be properly done for that money. Such a lathe as that some years ago would have cost twice as much. Buck's price for a similar tool is £34 10s., whilst Whitworth's would be about £80, and would be more accurate—or should be; but these lathes of H. Milnes and the Britannia Company are fairly accurate, and suitable both for workmen and for amateur engineers.

We come now to consider the requirements of amateurs who like variety; they like to buy very beautifully finished and accurately made apparatus, and to be able to congratulate themselves on the wonderful and curious shapes and curves they *could* produce. Then, perhaps, the lathe room is wanted for something else, or the owner removes, and the lathe is sold for half its value, slightly rusty, perhaps, and the lacquer scratched, but with much of its apparatus still unused and destined to remain so even if it pass through twenty hands. Yet, though they often do not use the appliances they have, amateurs have a way of wanting still more and more combinations, more and more possibilities in their lathes. An ornamental turning lathe will only deal with small metal work, and a metal-turning lathe is not suitable for ornamental work. The best way out of the difficulty would be to have *two* lathes, each perfect for its particular purpose; and some adopt this plan. But some still wish to combine the two objects, and this can be done to some extent. An ornamental lathe, which means a lathe intended for ornamental or complex turning, is a very beautiful piece of work, and very expensive. There are only some five or six makers of this class of work, and it is not wise to order it from any ordinary maker who might think himself able to produce it. First comes the plain part of the lathe as the foundation; it has usually a wooden frame and an iron bed, and should have a traversing mandrel; this plain part alone costs about £60. Then comes the various apparatus: the slide rest £28, the overhead motion £10, the various expensive chucks and cutting frames, and the box full of beautiful little moulded turning tools, with goniostat for sharpening them, which soon brings the amount up to £100, about the lowest price at which a lathe and apparatus for ornamental turning can be obtained new. If the complete set of apparatus is required, the price goes up to £500 and more; in fact, there is no end to the curious and ingenious appliances that can be added to the lathe; a geometric chuck may cost £100 alone.

The old-established firm of Holtzapffel and Company, of 64, Charing Cross, were formerly without a rival in the business of making lathes and tools of the highest class, and some still put them first, as they are certainly the most expensive, numbering amongst their customers peers of the realm. J. H. Evans, of 159, Wardour Street, comes next, and some put him first; he has adopted some more modern methods, and his prices are a little lower. Then come Messrs. G. Birch and Company, of Salford, Messrs. Cooke and Sons, of York, and Messrs. G. Plant and Son, Nelson Street, Birmingham, who make good lathes, and the speciality of the latter is the geometric chuck which bears his name. Evans, Birch, Cooke, and Plant have made lathes in which both metal and ornamental work could be done. Birch makes the medallion machine invented by Mr. Jesse Lowe, by means of which very beautiful work can be done, and also a rose-engine arrangement by the same inventor. Quite lately, a new firm, The London Lathe and Tool Company, 37, Pomeroy Street, London, S.E., has been established, and are making very good lathes for scientific and ornamental purposes, of modern design and at somewhat lower prices than formerly prevailed.

My readers will find that if they go to the makers of metal-turning slide lathes, such as Milnes or the Britannia Company, they will get far more for their money than if they go to the regular makers of amateurs' lathes for wood or ornamental turning; but I warn them that however well such lathes may be suited for metal work, they are too heavy and hard to drive for wood. Perhaps, however, one way out of the difficulty would be to order a 5 in. slide lathe made with a small or light mandrel with shorter collars, so that it might run more easily and thus be more suitable for wood; but then it would be less fit for metal work. Also, in turning wood upon a slide lathe, the slide rest, etc., must be got out of the way, and the cogs of the back gear and other parts which are so useful in metal turning are apt to get filled with chips.

Having now gone through all that need be said about the *kind* of lathe, before passing on to advise my readers as to how they may test the *quality* of the workmanship of any lathe offered them, I wish to advise them to obtain one or two of the numerous books on turning, as this will greatly help them in coming to a decision.

First and foremost must be mentioned the best work of all, Messrs. Holtzapffel's "Turning and Mechanical Manipulation," in six volumes, five of which are published. The first three volumes are on: I. Materials; II. Cutting Tools; III. Grinding Processes; full of interesting and very clear descriptions of all kinds of mechanical manipulation. With Vol. IV. we enter upon turning proper, its subject being Plain Turning; its price is 25s. Vol. V. treats of Ornamental or Complex Turning; it is full of most beautiful plates, and its price is 30s. There is nothing equal to these books. I will mention some less expensive works in my next paper.

(*To be continued.*)

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

II.—Preliminary Exercises.

For reasons which I shall state hereafter, in the chapter devoted to a review of the alphabet in its relation to sign writing and lettering, it is very essential that some practical knowledge should be obtained of freehand drawing and geometry. A little only is better than none at all; but the more the student learns the more will he be a master of his art. There is no necessity to dwell at length upon them here, so I shall confine myself to a few examples, in which it is absolutely necessary for the student to become proficient before he can hope to make correct formations of each individual letter of the alphabet.

In the first place, he must learn to draw in a bold, fearless style lines straight, horizontal, perpendicular, and oblique; and afterwards graceful curves. It must be understood that I am commencing with a short series of drawing lessons, so that the student should provide himself with a few sheets of common drawing paper, an HB. pencil, and a piece of indiarubber. The paper should be pinned to a drawing board, which may be purchased for about one shilling. The lines I have mentioned are the first exercises in freehand drawing, and, until these are thoroughly mastered, it is useless to attempt to proceed further.

To do good work at the outset of his career the draughtsman's pencil must be properly pointed—that being the first tool he will handle. This being accomplished, let him endeavour to draw a perpendicular straight line, A, in Fig. 1. This may be done the more easily by first marking it out as a dotted line, B, and afterwards filling it in with a firm, decided stroke from top to bottom. Horizontal and oblique lines are to be practised in the same way as shown in the examples C, D, E, in Fig. 1. Lines should also be drawn to meet each other at right, acute, and obtuse angles, as illustrated at A, B, C, in Fig. 2. The practice of drawing lines parallel to one another (Fig. 3) should also be persevered with. The student must next pay attention to curved lines, A, B, C, D, E (Fig. 4), and compound lines (Fig. 5), which may either be continuous or broken; and, following these, the circle and ellipse (Figs. 6 and 7) must be taken in hand.

Great patience, I am aware, is necessary in this, the initial and most uninteresting stage of our work; but this virtue, if persevered in, will be amply rewarded in the near future. In order to give more variety to the drawing lessons, the learner may presently proceed to copy, until perfect, such subjects as are shown in Figs. 8, 9, 10, all of which immediately concern the subject we have uppermost in our minds As they are merely given as copies for incessant practice, they need no further description. These should be followed on with the alphabet drawn within faint-lined squares.

It will be helpful here to give descriptive definitions of those geometrical terms which the sign writer has most cause to make use of in his daily work:—

1. A *point* is a position in space which may be indicated on a plane by a simple mark or dot, or the intersection of two lines, or the extremities of two lines.

2. A *line* is an indication of division, or boundary generated by the motion of a point, and has only the property of length. There are straight or right lines, curved lines, and compound lines—the latter composed of right and curved lines. Compound lines are "continuous" when the curve continues the right line; and "broken," when the right and curved parts of the line form an angle. (See Fig. 5.)

3. When two right lines meet in a point, they form an *angle*, which is an indication of a portion of the space round the point; this space is, for the purpose of measurement of angles, supposed to be divided into 360 equal parts, called degrees. The length of the lines forming the side of the angle has nothing to do with its measurement. When two lines cross in such a way as to form four equal angles, they are said to be at right angles, or perpendicular to each other; an angle of one-fourth of the space, or ninety degrees, being called a right angle. An angle that contains less than a right angle is called acute; and an angle that is greater than a right angle is called obtuse.

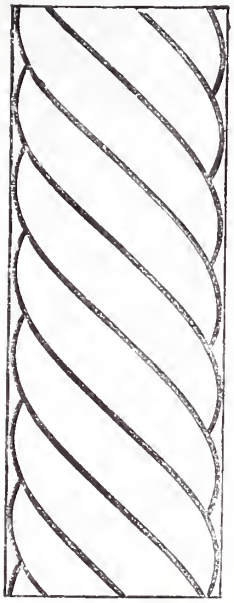
4. Lines that are at an unvarying distance from each other, and thus would never meet if continued in either direction, are said to be parallel to each other.

5. A line, or combination of lines enclosing space, constitutes a *figure*. *Figures* are either rectilinear—composed of right lines; or curvilinear—composed of curved lines.

6. Right-lined figures are divided into *triangles* or *trilaterals*, having three sides; *quadrangles* or *quadrilaterals*, having four sides; and *polygons* or *multilaterals*, having more than four sides.

7. An *ellipse* is a figure of one continuous curve generated by the motion of a point in a plane, the sum of whose distances from two fixed points is always the same; these fixed points are called the *foci*. A right line drawn through these foci, and produced to the curve at both ends, is the *major axis* of the ellipse; and a line through the middle of the transverse diameter, perpendicular to it and extended to the curve on either side, is the *minor axis*, or diameter conjugate to the transverse. The point of intersection of the axes is the centre of the ellipse; and

Fig. 8.—Example of Freehand Drawing—Coil Round Pole.



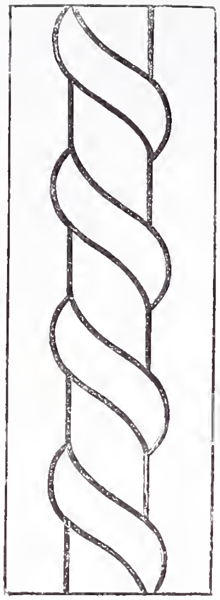


Fig. 9.—Example of Freehand Drawing—Twist as in Cable.

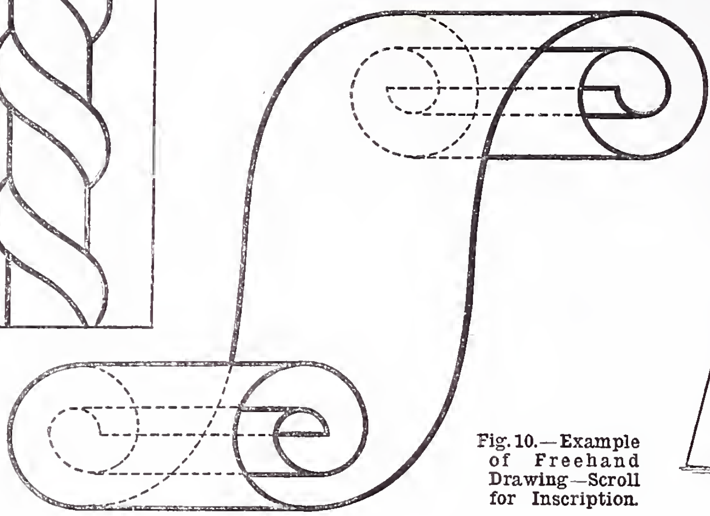
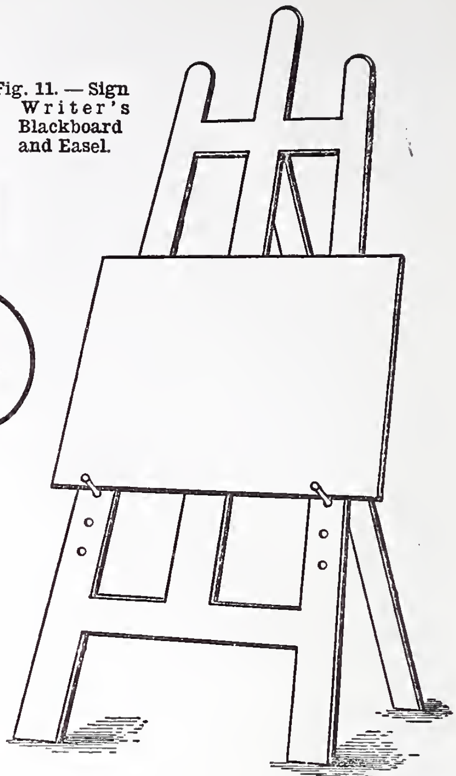


Fig. 10.—Example of Freehand Drawing—Scroll for Inscription.

Fig. 11.—Sign Writer's Blackboard and Easel.



any right line drawn through the centre cuts the ellipse in two equal parts, and forms a diameter.

I have not the space here to give any geometrical problems; but it is advisable for the learner of the art of sign writing to obtain a good work on geometry, and carefully work out all those problems which are likely to prove most serviceable to him in his work. The elementary problems are those which he will find most useful.

As he will have occasion to make use of a blackboard for future lessons, I at once give directions for making one similar to the board shown in Fig. 11. Procure from the timber merchant's a good yellow deal board measuring 10 ft. long by 9 in. wide by $\frac{7}{8}$ in. thick, and thoroughly dry and well seasoned. Also another board of the same wood, 12 ft. by 9 in. by 1 in., for providing the legs and cross pieces of the stand, as shown in the illustration.

Take the first board, and, having squared both ends six inches from the outside, saw those off, and then saw the board into three equal lengths of 3 ft. each; these three lengths should then be tongued and grooved in a workmanlike manner, glued, and clamped up until dry.

The framework, consisting of the two legs, the centre piece, and the two cross pieces, should then be put together with mortise and tenon joints, and this finally well screwed on to the back of the boards, and the hind leg attached with an ordinary "butt" hinge. The board must now have several coats of paint, containing plenty of dryers, and must be allowed to rest and be well sand-papered between each coat. When thoroughly dry it is fit for use, and should be in constant demand throughout the painter's lifetime for freehand sketching, lettering, and working out original designs that may suggest themselves.

If preferred—and this arrangement, possibly, will be found to be more convenient—the frame may form an easel, as shown in Fig. 11, the board being supported on pegs inserted in holes in the framework.

(*To be continued.*)

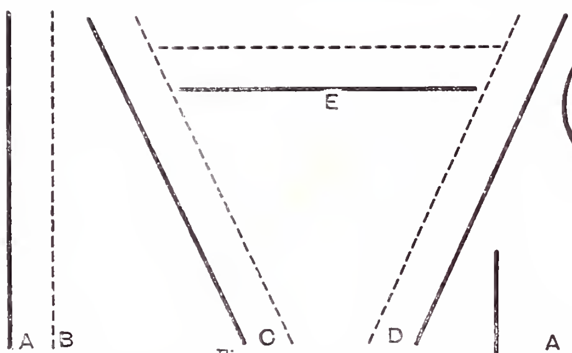


Fig. 1.

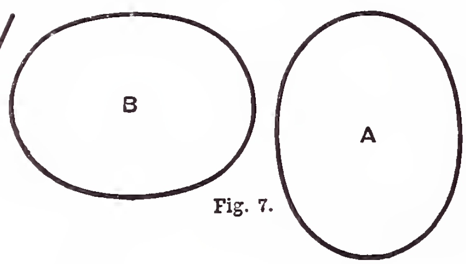


Fig. 7.

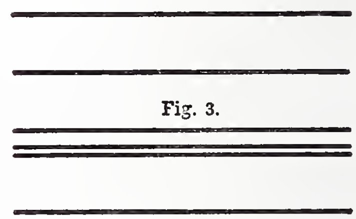
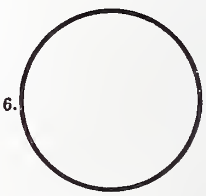


Fig. 3.

Fig. 2.

Fig. 6.



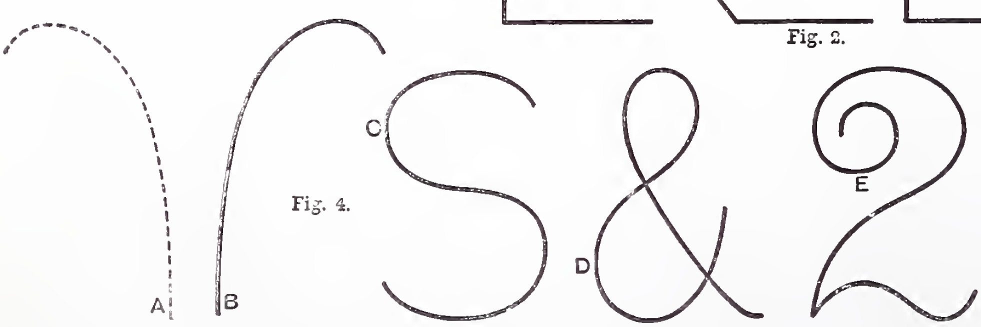


Fig. 4.

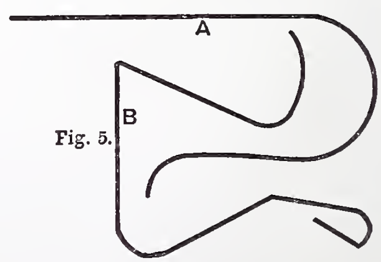


Fig. 5.

Elementary Lessons in Drawing for the Sign Writer. Fig. 1.—Straight, Horizontal, and Oblique Lines. Fig. 2.—Diagrams Illustrating the Meeting of Straight Lines in Points. Fig. 3.—Parallel Straight Lines. Fig. 4.—Examples of Curved Lines. Fig. 5.—Examples of Compound Lines, Continuous (A), Broken (B). Fig. 6.—Circle. Fig. 7.—Ellipse, Major Axis Perpendicular (A), ditto Horizontal (B).

WHY DOES A TOOL CUT?

BY J. H.

I.—Requisites in Cutting Tools—Strength and Support—Angle of Relief—Face—Practical Limit of Acuteness—Limiting Angle for Cutting Tools.

To some this may seem a stupid question, to which the obvious answer would be, "Because it is sharp." But that this is not a sufficient reply is apparent on a little consideration. Take a common wood-working chisel and try to cut a piece of iron or steel with it; the edge is turned over and spoiled directly. It fails to cut the iron or steel, not because it is not sharp enough, but because it is not *strong* enough; the form of the tool is such that it is too weak to do its work; in other words, the cutting edge lacks *support*.

It would, I imagine, be impossible in the absence of experience to predicate beforehand by a method of *à priori* reasoning what forms should be imparted to cutting tools in order to render them most suitably adapted for operating on materials of different kinds. A tentative method would have to be followed, and the tool-angles would have to be gradually increased until a happy mean was reached at which a reasonably permanent cutting edge should be secured. No such edge can be absolutely permanent, but in practice the tools used for metal working require, as a rule, regrinding and sharpening less frequently than those employed on the softer woods. This may appear paradoxical, but it is necessary, since it would be highly inconvenient when turning or boring work by slide rest which is required to be strictly parallel to have to remove the tool for grinding before the operation were finished.

When we have grasped the fact that *strength* is as important an element as keenness of edge, we may easily fall into error in the disposition of the necessary metal. We might so form our tools that they would be sufficiently strong, yet cease to act except by scraping. I will endeavour to render this matter clear by the aid of a few diagrams.

If we note the action of the chisel in Fig. 1, we see that the bevelled facet, A, is ground to make that angle with the lower face which happens to be best adapted for the removal of the largest quantity of material with the least expenditure of energy.

If the same chisel were presented to metal it would fail to operate. To make it cut metal, the angle of the facet would have to be increased in a tentative fashion (Fig. 2) until, say, for cast iron A would equal about 60°, and then, if thrust with sufficient force, it would cut after a fashion, because the cutting edge would be rendered sufficiently strong to withstand the stress imposed upon it. Actually, the tool used in practice would take the form of Fig. 3, in which the principle of Fig. 2 is embodied with certain necessary modifications. Let us look at this for a moment.

First, the absolute coincidence of the face of the tool with that of the work, which usually occurs in the wood-working chisel, would, when the contact of metal with metal is concerned, generate much friction and heat, with accompanying waste of power. The tool is therefore "relieved," or "backed-off," and the angle, B, in Fig. 3 is the "angle of relief," which is imparted to that extent which is necessary to prevent this injurious contact from taking place. By men ignorant of the principles of tool formation this angle is often unduly increased, and the consequence is that the cutting edge is much weakened by the unnecessary removal of the metal which is properly wanted to afford support to that edge. To take extreme cases, suppose the angle of relief were increased as in Fig. 4, it is obvious that the edge could not retain its permanence any better than that of the wood-working chisel when used on metal. Or, suppose the wood-working chisel to be thrown up at the angle indicated in Fig. 5, and thrust forcibly to its work by some strong coercive guidance—as the stock of a plane, for example—the edge would become blunted even on wood, and instead of chips or shavings being removed, fine dust only would be scraped off. We therefore find that we have not only to impart the angles

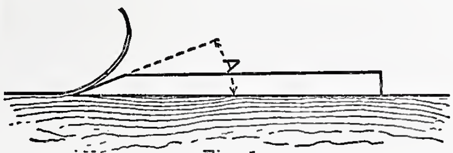


Fig. 1.

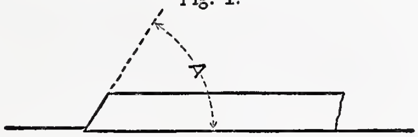


Fig. 2.

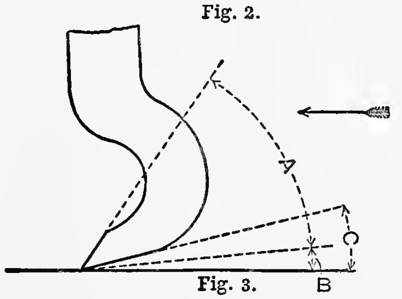


Fig. 3.

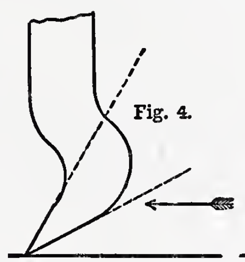


Fig. 4.

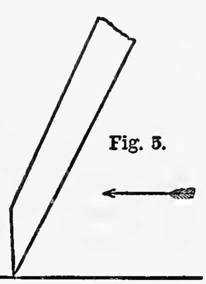


Fig. 5.

Fig. 1.—Wood-working Chisel. Fig. 2.—Angle necessary for Cutting Iron. Fig. 3.—Common Form of Tool for Planing or Turning Iron. Fig. 4.—Tool Badly Formed for Planing or Turning Iron. Fig. 5.—Diagram to Illustrate Improper Presentation of Chisel.

most suitable for cutting harder and softer materials respectively, but that we must, in order to diminish friction, have an angle of relief, whose amount, however, ought to be no more than sufficient to prevent rubbing of surfaces from taking place. The angle, C, in Fig. 3 is merely the angle at which the tool is roughly forged.

We may put this in another way, and say that the face of the tool ought always to approximate as nearly as possible, consistently with freedom from friction, with the face of the material which is being cut. After this, the settlement of the angle formed between the top and bottom faces is a matter to be determined by experience. But we may also say of this top face, too, that the nearer it can be made to coincide with the face of the material which is being operated on, the more perfect will be the action of the tool considered as a wedge. For all cutting tools, however uncanny their appearances, are in fact wedges, and operate by virtue of their wedge-like forms. The practical limit which determines the acuteness of the angles is the *permanence* of their edges. Hence, the harder the nature of the material, the more obtuse will be the angles of the tools. In the soft wood-working chisel, and spokeshave, and planes, the tool angles, A (Fig. 1), will vary from 15° to perhaps 25°. In the tools for turning the harder but fibrous wrought iron, the angle, A (Fig. 3), will be increased to about 50°. The tools for the still harder and more crystalline cast iron require to be ground to an angle of about 60°, while cast steel will often only yield to cutting tools whose angles are slightly more obtuse than this, or 65°.

We now approach the limiting angle for true cutting tools, namely, 90°. Yet there are materials, such as chilled iron and some kinds of steel which cannot even be cut with a tool, whose angle is as high as 65°; they, will only yield to a tool which is presented at an angle of 90° or thereabouts to them. But such a tool is no longer a wedge; it operates by scraping only.

To sum up, in order that a tool shall cut wedge-like action is necessary. But the degrees of acuteness of the wedges have to be widely modified for the operation of softer and harder materials, in order to afford sufficient permanence of cutting edge. The increase of metal imparted for this purpose must, for reasons of strength, be disposed as far as possible behind the cutting edge *in the line of action of the tool.* This cannot be absolutely the case, because of the amount of the angle of relief, which is necessary for clearance between the tool and the work; but this is the reason why the angle of relief should be kept as low as possible. These are axioms in tool formation, no matter how widely the shapes of the tools themselves vary. Practical conditions, however, often render such modifications necessary that the original idea or type becomes so disguised as not to be apparent at first sight.

Another matter, which has a marked influence on the action of a tool, is the frictional resistance of the shaving removed. Diminution of friction conduces to increased efficiency, and this is dependent partly on the nature of the material, partly on the angle of "top rake"—*i.e.*, of the upper face. Tools used for removing tough, fibrous material, such as wrought iron and mild steel, require a much greater amount of top rake than those employed on brittle cast iron, gun metal, and brass. In fact, in operating these alloys, whose shavings are highly crystalline, tools having no top rake at all—mere scrapes, whose faces stand perpendicularly to the work—are used. If such tools were employed on materials of the character first named, the continuity of the tough curling shavings would be very forcibly broken against the perpendicular face, and not only would a very wasteful excess of power be required to operate these tools, but it would be simply impossible to remove material in quantity. Giving ample top rake, however, the shavings curl down the top face, partly fractured, but with more or less of continuity remaining throughout their length.

In my next I will complete this subject by pointing out the application of these principles in the case of the common tools used for wood and metal working.

(To be continued.)

THE BUNSEN BATTERY.

Its Construction and Application.

BY GEORGE EDWINSON BONNEY.

II.—Acid—Solution for Outer Cell—Effect of Nitric Acid in Solution—Charging Battery—Chemical Action—Connection of Cells—Measurement of Power of Battery—Time of Running—Maintenance of Battery—Double Fluid Bichromate and Chromic Acid Batteries.

The acid employed in the porous cell of the Bunsen battery, with the block of carbon, is the strongest commercial nitric acid or aquafortis undiluted. This will cost from 6d. to 8d. per lb., if bought in large quantity.

The solution for the outer or containing cell of the battery, with the zinc, is made up of commercial sulphuric acid (oil of vitriol) diluted with water in the proportion of one part acid to 8, 10, 12, or 15 parts of water as may be desired. This acid will cost from 2¼d. to 2½d. per lb. In buying from a respectable dealer there is little danger of getting bad acid, but I may point out here some of the impurities likely to interfere with the working of a battery, and the means for their detection.

If the acid contains any nitric acid the zincs will be violently attacked, the amalgam undermined, and the plates or cylinders will be honeycombed. Filling the porous cell above the level of the outer solution, a flaw in the cell, jolting of the cells, and similar accidents will get nitric acid in the outer solution. If this is tested with a few drops of indigo sulphate solution, the presence of nitric acid will be shown by the colour of the indigo solution being changed from blue to red. If the sulphuric acid or its solution contains any copper, this metal will deposit itself on the zinc amalgam, form a galvanic pair, or short circuit with the zinc, and wear pits in the cylinder. The presence of copper is easily detected by immersing a piece of bright steel, such as the blade of a knife, in the acid or its solution, when a film of copper will show itself on the steel if copper be present. Zincs thus pitted are only cleaned and reamalgamated with difficulty.

In making up the outer solution, first put the requisite quantity of water into a stoneware pitcher, then measure out the acid, and pour this gently into the water. Never pour water *into* sulphuric acid, for it combines with water in such a violent manner as to cause great heat, and the boiling mixture is spurted about in all directions. It will cause painful blisters and sores if splashed on the skin, and will ruin any kind of clothing. Let the mixture get quite cold before using it to charge the battery.

All things being now ready we will charge the battery. First rinse the cells with water. Place the carbon block in the porous cell and the zinc cylinder in the outer cell. Fill the porous cell with strong nitric acid to a height equal to that intended for the outer solution; then place the cell and its contents in the outer cell. Fill the outer cell with the dilute sulphuric acid solution, pour a teaspoonful of mercury into each cell; then put on the binding screws and clamps.

As soon as the circuit of the battery is closed—that is, when the free zinc at one end is connected by a wire, or through the working line, with the free carbon at the other end—a chemical action and interchange of elements take place within the cells and set up a general movement in the whole circuit. The force thus generated is named electricity. The action going on in the cells is probably as follows:—Small particles of the zinc become oxidised, and the oxidised zinc is taken up by the sulphuric acid to form zinc sulphate. In this action a part of the hydrogen found in sulphuric acid is set free and is sent into the inner cell by the current. Here it would fix itself to the carbon and check further action if it could not be dissolved; but it is met in the porous cell by part of the oxygen present in the nitric acid, and unites with it to form water. In this way the nitric acid loses a part of its oxygen and becomes nitrous acid.

The cells may be connected up in one of two ways to form a battery. Connect the carbon in one complete cell with the zinc in the other cell by means of a short wire, and continue to connect up the whole in line one after another until they are all linked together, with one free zinc at one end of the line, and a free carbon at the other. This is termed connecting up in series, and is employed to get an intense current capable of overcoming high resistance, such as there would be in an electric lamp or an induction coil. By this arrangement the electro-motive force (generally expressed in print by the abbreviation E.M.F.) of one cell is added to that of the next, and so on through the whole series. For instance: Suppose we employ six quart Bunsens in series. We will put the E.M.F. of one cell at 1·86 volts. This, multiplied by 6, will give us 11·16 volts.—the E.M.F. of the whole battery. The other way of connecting the cells is known by the term connecting in multiple arc or in parallel. In this method we place the cells in two parallel rows of three cells in each row. The cells in each row are connected in series, and this leaves two free zincs at one end to be connected to one line wire, and two free carbons at the other end to be connected to the other line wire. The difference between the two methods may be graphically shown thus:—

Series: —o—o—o—o—o—o—

$$\text{Parallel:}\quad -<\begin{matrix}\text{o—o—o}\\\text{o—o—o}\end{matrix}>-$$

By this latter method we decrease the E.M.F., or pushing force of the battery, and increase the volume of electricity to be obtained from it, because we provide two conduits through which the current can flow. We therefore get a greater volume at a lower pressure.

The power of a battery, or any source of electricity, is capable of being accurately measured and determined according to a law called Ohm's law, discovered by a celebrated man bearing this name, several years ago. This law is expressed by the very simple formula, $C=\frac{E}{R}$, and is as simply interpreted thus:—The current of electricity equals the electro-motive force obtained from the generator divided by its internal resistance. Applying this law to the Bunsen battery, made up according to the two methods above indicated, we find the respective powers of the combinations to be as follows, the internal resistance of each cell being put approximately at ·08 volts:—

In series—

$$\frac{\text{E.M.F.}\quad 1{\cdot}86\times 6=11{\cdot}16\text{ volts.}}{\text{Resistance}\quad {\cdot}08\times 6=\ {\cdot}48\text{ Ohm.}}=23{\cdot}25\text{ Ampères.}$$

In parallel—

$$\frac{\text{E.M.F.}\quad 1{\cdot}86\times 3=5{\cdot}58\text{ volts.}}{\text{Resistance}\quad {\cdot}08\times 3=\ {\cdot}24\text{ Ohm.}}\times 2=46{\cdot}50\text{ Ampères.}$$

This large volume of current is available for the work of electro-depositing metals. As the pressure of the current is low, it is incapable of overcoming a high external resistance, so we must use thick conductors in the line wire to and from the work. In the parallel arrangement we have two batteries of three cells each, giving up their united currents together; and as this has to be carried by one line, we must increase its capacity.

The time during which a Bunsen battery will maintain a constant current, varies with the load of work put upon it. If short circuited or placed on one of low resistance, it will warm to the work and give a powerful current for a short time, whilst giving off dense and pungent fumes of nitrous oxide from the inner cell. On electric light work it will usually run from six to eight hours without recharging, if put up in a proper manner. On electro-depositing work, with a weaker solution in the outer cells, it will run for ten hours and do good work in the last.

To maintain the battery in good working order, it should have care and attention at the end of the day's work. When its task is done, unscrew all the binding screws and clamps and put them in a little water to dissolve any salts that may be formed on the threads by the fumes from the acid. Take out the carbons, wash them in water, and set them on a shelf. Empty the contents of the porous pots into a jug or pitcher, and note the colour of the acid. If this is dark green and emits orange-coloured fumes it may be used again; but if a pale green, or without colour and fumeless, throw it away, and use fresh acid when the battery is again charged. Take out the zincs and examine them for signs of pitting. Well brush each in clean water, reamalgamate them if necessary, and set them aside to drain. Pour the outer solution into a pitcher for use again (and again until it becomes too much charged with zinc sulphate), unless spoilt with nitric acid. Rinse out the containing cells, fill the porous and outer cells with water, and let them stand, one in the other, till wanted again. Wipe the binding screws and clamps on an old rag and smear the threads of the screws with a little oil or vaseline. Cells put away in this careful manner are always ready for use and will work well.

All this labour is deemed troublesome by some persons; but I can assure them that it is as necessary to be done as the unharnessing and grooming of a horse at the end of his journey; and it does not seem to me to be more troublesome. Men do not expect to work a horse, or a steam engine, day after day without daily attention in feeding and cleaning, but they want an electric battery to run for months without both.

The Bunsen is a useful battery wherever a full, strong, and constant current of electricity is wanted. It has been in use with experimenters in the production of electric light, and has been a necessary adjunct to the laboratory of the chemist for many years. Its chief fault seems to be that it gives off noxious and destructive fumes whilst at work. This causes its banishment from workshops to boxes or small houses built outside, from which the line wires are led into the shop. It has been suggested that the best way to mitigate the nuisance is to enclose the battery in a box and keep it packed with wadding or blotting paper soaked in ammonia. If the porous cell is filled with sulphuric instead of nitric acid, the battery yields a mild current suitable to the requirements of electro gilders and platers working in a small way, as it then does not emit any fumes whilst at work.

As the same cells and the same elements

may be used in making up double fluid bichromate and chromic acid batteries, I will conclude with a few remarks on these. In making up a bichromate battery a solution of bichromate of potash replaces the nitric acid in the porous cell alone, the charge for the outer cell being the same as that for the Bunsen. The bichromate of potash solution is made as follows:—Dissolve four ounces of bichromate of potash in one pint of hot water, and add to it, when cold, three fluid ounces of sulphuric acid. When this is cold it is fit for use in the battery. When this solution becomes green it is worn out, and must then be renewed. The fumes are not generally considered to be so objectionable as those from the Bunsen; the E.M.F. is higher at starting, but falls off slightly in a short time, unless the solution is kept heated or agitated; but the battery recovers itself when the circuit is broken.

If chromic acid is used, instead of bichromate of potash, in making up the solution, it will give better results, and will not so readily crystallise on the carbons and in the pores of the cells.

(*To be continued.*)

ARTISTIC FURNITURE

EASILY MADE AND CHEAPLY PRODUCED.

BY DAVID ADAMSON.

Introduction—Utilisation of Packing Cases—Joints and Jointing—Pinned Joints—Nailed Joints—Screws in Door Making—Materials—Seasoning—Staining, etc.—Full-size Drawing—Dimensions—How to Make Overmantel—Ends on Uprights—Bottoms of Cupboards and Shelves—Recess for Frieze—Frieze—Fitting Frieze—Fixing Parts—Skew Nailing.

In the present series of articles I hope to describe the construction of various pieces of furniture, not as usually made, but specially adapted for the amateur cabinet maker, whose skill, means, or time is too limited to permit him to be a proficient in wood working. At the same time, while the things are to be of the simplest construction, and of the commonest material, they must not so far depart from ordinary domestic furniture in appearance as to proclaim the fact that they are anything out of the common. If you will permit me to do so, I will, as it were, take you at once into my confidence and explain the origin of the furniture to which I refer, just by way of introduction.

Some time ago I had in my possession some large packing cases which seemed too good to break up for firewood, but were very much in the way. Those packing cases became at last a kind of white elephant. No one would take them unless made into small firewood, so they remained lumbering up till one day, in an idle moment, I did some hard work—I thought—and this is something how my ideas ran. I should here state that I had long been contemplating getting an overmantel for my workroom or study, or, as it is disrespectfully called sometimes by friends, my "den." A costly affair was out of the question, and as a few rough shelves would answer my purpose just as well, I had almost decided on putting them up. However, being tolerably familiar with construction and other matters pertaining to furniture, it occurred to me that something more agreeable to look at than plain shelves might be put up with very little more trouble or cost. Could not the packing cases be used up somehow? The wood of which they were composed was sound enough, fairly clean, and about an inch thick. Some of the planks had rather more knots than might be desirable, but, on the whole, two or three cases represented a tolerably large quantity of workable material, costing, under the circumstances, nothing. But then the time; how could that be obtained from more important work? I had no fancy for having a piece of unfinished work lying about for an indefinite time. This necessitated something much simpler in construction than that generally found in furniture, and—in short, the overmantel shown in Fig. 1 was finally evolved, the first of a series of things designed on similar principles.

Possibly some may ask why these details of a personal character should have been given. Well, there's an old saying connected with sauce and a well-known feathered biped. Consider the circumstances in which the furniture originated as the sauce, and apply them personally. In other words, whatever the reasons may be, no doubt I am not the only one who has wanted to make simple furniture cheaply and expeditiously, and I trust the directions, founded on my own experience, may be of service to those who want to make such. By way of encouragement to those who are not adepts in carpentering work, I may here say that very little skill will enable any one to make up the various articles with a few ordinary tools. Difficult joints, or those that are so to the novice, are dispensed with wherever it has been practicable to do so. I refer, of course, to dovetails, mortises, and tenons, and other details which are so easy to read about, and look so easy when done by an expert, but which are so difficult to construct properly by those who have not "served their time." Instead of these ordinary workshop joints, nails, glue, blocks, and square cutting have been relied on.

Now, at this confession, my readers, don't turn away in disgust with the idea that some puerile contrivances are to be shown, or that the articles are shams—unenduring, flimsy things, not worthy of serious attention. Nothing of the kind; they may be as well put together, and as honestly made, as the most costly furniture, only there is not so much work in them. It has been said that good joinery should be firm without either nails or glue, and if these articles of furniture are to be judged by that standard, they will most assuredly be found wanting. This time-honoured statement, however, is, I venture to think, fallacious, and will hardly be seriously regarded by any who are not prejudiced against modern work, or rather modes of work and construction. Even those who have by practice become proficients in wood working—*i.e.*, cabinet making and joinery—whether as professionals or amateurs, may be disposed to look askance at any furniture made as this is described. Their scruples are entitled to respect; and, at the risk of being digressive, I venture to make a few remarks, for the consideration both of the artisan and the amateur, in justification of the simple construction of this easily-made furniture. I shall presume that I am addressing reasonable men, not those who regard age and goodness in wood work as synonymous, but men whose practical knowledge is sufficient to enable them to discriminate between good and bad workmanship, irrespective of its antiquity.

Apropos of this, it is strange that those who are never tired of belauding old work and decrying new, seldom know anything practically of the work. These antiquarian "cranks" carry their notions to extremes; but when any new method of work is proposed, are we not all more or less actuated by the same spirit of conservatism? They advocate the retention of "pinned" joints, such as were used so much in old wood work. We know this mode of fastening to be quite unnecessary with a well-made mortise and tenon, but coming to every-day usage, what are we to say about some of our constructive detail, the dovetail joint, for example? Are we to consider that this is necessary, while the former—the pinned tenon—is useless? Now, I have not a word to say against dovetails, or any other joint which experience has proved to be good and useful, but I maintain that we are sometimes rather inclined to be governed by tradition in our constructive details. A certain form has been regarded as the only permissible one, and we adhere to it as if it were absolute perfection, and that any departure from it would proclaim bad workmanship. Possibly it might, but by no means necessarily so. We must not forget that under altered conditions in the way of improved tools, together with improved accuracy in work, it is unreasonable to suppose that new forms of construction may not sometimes be desirable.

Among other matters, we overlook the fact that screw nails, and, indeed, all nails, as now produced, are of comparatively recent introduction; and without going so far as to say they ought to supersede the more customary forms of joints in cabinet work—for I am not prepared to go that length—I think we might make more use of nailed joints than we do, when time, and consequently cost of production, are important items. That a nailed joint will be better than a dovetail of course cannot be argued, but there can be no doubt that it is much more easily made, and there is no reason why it should not be equally strong. On this account I have no hesitation in recommending its use among amateurs in such simple furniture as I am about to describe. Everybody knows the holding power of screw nails, which are now brought to such perfection that they can be used with the utmost facility by the merest tyro; nor can they be considered in themselves as detracting from the appearance of any work in which they may be visible. It is not customary for them to be so, but it is very easy to conceive that sometime or other they may be regarded as ornamental rather than the reverse. Surely nothing can be urged against the appearance of a well-finished brass-headed screw. I am sometimes surprised that those who profess to admire the old-fashioned so-called honest work of our forefathers—a long way back—do not recognise that much of the detail is barbarously crude and uncouth, and that we moderns may turn out work equally good, and better finished, and more simply constructed, by taking full advantage of modern facilities. If any one cannot manage to make a tenoned door frame hold together, or, in other words, cannot work so accurately that the parts all fit so perfectly together that glue alone may be depended on, and requires to use nails of some sort, why should he make use of wooden pins? Surely screw nails are better in every way. Their only disadvantage is that they have not the merit of having been used some three centuries ago, and that is not a serious one. Probably the only reason for pins having been preferred then was because they were Hobson's choice, but as for us, why should we use them when we can get the altogether more satisfactory screw nail?

Reverting to the door framing, and going a step further, why, when screws can be used, should the mortise and tenon be considered

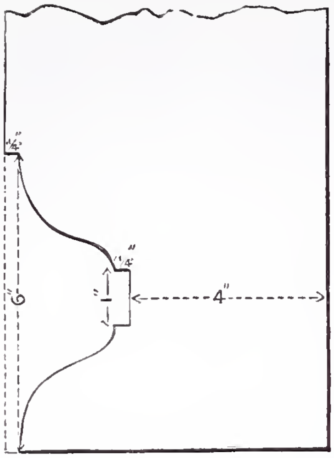


Fig. 5

Fig. 4

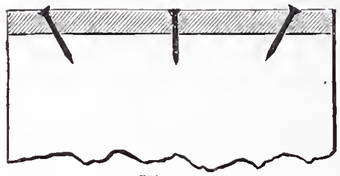


Fig. 6

Fig. 4.—Inner Ends of Overmantel with Recess. Fig. 5.—Outline of Bottom of Ends. Fig. 6.—Method of Fastening Shelves.

indispensable? Although I do not say it is not the best, surely it is not the only one, for if the ends of rails and styles are halved and screwed together, the desired object is attained. I would like to say more on this topic, but having shown, to some extent, the principles on which this easily-made furniture is designed, and, I trust, suggested, not only to the novice but to the professional worker, that it may be sometimes well to depart from inherited notions about construction, or, at any rate, that it is not altogether necessary to adhere to them, more need not be said at present. Those who differ from me in my advocacy of simpler, and what to them will seem "jerry," construction, will please remember that I am describing furniture for amateurs to make. I have no sympathy with slop work of any description, but I do most emphatically protest against the idea that only one method is permissible under any circumstances. At the same time I do not advocate that the tyro, either in theoretical knowledge or technical skill, should, without consideration and sufficient reason, depart from those details of construction which are generally employed, as they are the essence of generations of practical workers' experience, and it is seldom that any serious objection can be raised against them on the score of efficiency. Those who wish to make up any of the designs in a way more in accordance with the recognised cabinet-making construction will have no difficulty in doing so, if they are able to "set out" work, but I wish it distinctly understood that these chapters are intentionally of an elementary character, and complicated technicalities will as far as possible be avoided.

Reference has been made to packing cases as the source of the material. For those who are not acquainted with them, I may say, that those cases which have contained pianos or American organs, etc., are very suitable for the purpose. They are generally well made, and in many of them the boards being ploughed and tongued together dry, *i.e.*, without glue, a great amount of labour is saved in "jointing up" to obtain width. I have never experienced any difficulty in obtaining such cases at a price which renders them very economical material, and, as some idea to guide the purchaser, I may say that at 5s. or 6s. one will not find a good, clean case dear. They are, however, to be had lower than that occasionally. Perhaps other large cases would do as well, but I mention the kind I have, because I have used them satisfactorily. Of course, the people to purchase them from are importers of musical instruments, and I believe in the larger provincial towns, the cases can be more readily got than in London. Anyway, there is, beyond their cheapness, no special reason why they should be used in preference to new wood. This can be got anywhere, and as the wood of which the furniture is made is pine, it ought not to cost much. Mahogany or some of the choicer woods may be used instead, but for this particular furniture it will be seen as we proceed that they are not so suitable. The only caution I have to give the novice is to see that the pine is of the best quality. This will cost more in the first instance, but in the end will prove more economical than inferior descriptions, as there will be so much less waste from knots and other defects. Even with the best there will be some knots. If the furniture is to be painted, these will not be of so much consequence, but if it is to be finished by either varnishing or polishing, care should be exercised to use only pieces which are free from knots. In either case, the fewer there are of them the better, as no one who has done any carpentering will need to be reminded that it is much easier to work wood in which the grain is nice and even than to smooth a piece in which there are knots.

Perhaps I ought to say something about the necessity of the wood being thoroughly seasoned, and not only so, but thoroughly dry. For the first qualification, the timber merchant must be relied on; the second is more under the user's control, and as amateurs frequently complain of their stuff going—through what is almost invariably called the use of unseasoned wood—a few words of advice may with advantage be given. However well seasoned wood may be in the timber yard, it is rarely that it can safely be used up immediately without risk of its contracting, and of course splitting sooner or later—generally sooner. It stands to reason that, however well-seasoned in the open air, or even when under cover, wood may be, it can hardly be so free from moisture as to have shrunk to its smallest dimensions. If dried under those conditions, although to the touch or in working it may seem perfectly free from moisture, it will be found that if made up fresh it is sure to contract when placed in a warm, dry atmosphere, like that of an ordinary living-room with a fire in it. If the construction is such that the inevitable shrinkage has not been provided against, the almost certain result is a split; perhaps two of them, the second being with the timber dealer for having supplied unseasoned (!) wood. To prevent the wood shrinking, warping, or going wrong after it has been made up, give it a fair chance to do so beforehand. Keep it for a few days in a warm, dry place—if possible, in a room where there is a fire, especially in the winter time—before cutting it, or at any rate, before finishing it. If the wood has been well-seasoned there will not be much fear of it going or displaying any of these vagaries, generally attributed to the want of proper seasoning, and it must be confessed sometimes correctly so. Instead of pine, American whitewood will be a very good wood to use, but it is a little more expensive. For staining, it is, however, to be preferred. Nevertheless, there are now such an immense variety of the so-called enamel paints, that those who wish to do so can finish the furniture more easily with one or other of them than by staining and polishing.

We are, however, getting ahead to the final work before the overmantel is begun. The first thing will naturally be to make a full-sized drawing

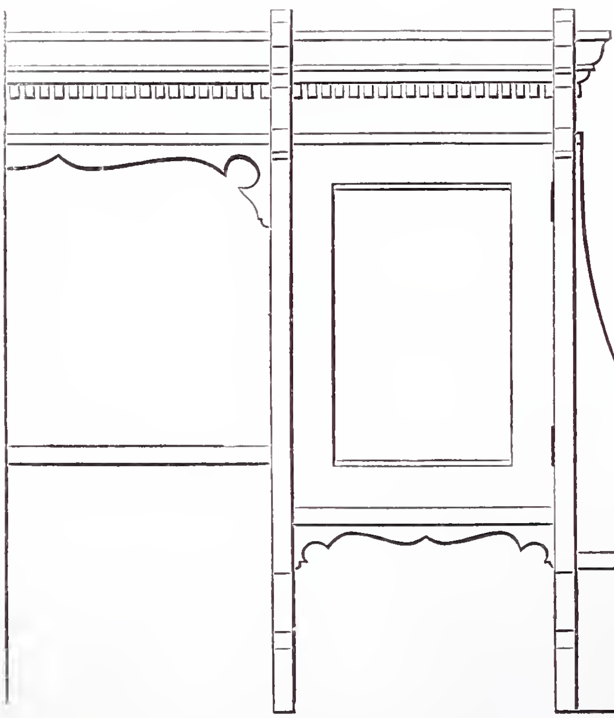


Fig. 2.—Half of Front Elevation of Overmantel.

Fig. 3.—End Elevation.

of the overmantel, as by its aid measurements of the various parts can be got much more correctly than without. The drawing need not be at all an elaborate affair; indeed, it will be far better not, for the simpler it is the less likelihood of any mistake being made, always provided of course that it shows sufficient to guide the worker. In such a thing as this it is not necessary to show joints. It will be quite enough if a front and end elevation are prepared, as shown in Figs. 2 and 3. For the sake of simplicity and to save space only one-half of the former is shown, the other half being exactly the same. As these drawings are made to ⅛ in. scale, there will be no difficulty in seeing that the size of the overmantel is as follows: Length, 4 ft. 8 in.; height, 2 ft. 5 in.; depth from back to front (on cornice), 8 in. These dimensions, of course, may be varied according to circumstances, for the veriest tyro need not be told that with a chimney breast only 4 ft. wide it would be absurd to make an overmantel as long as the one illustrated. It will be seen that the design is not one of the gorgeously reflective sort, but then it will be remembered the kind of room it was made for required something more useful than—I was going to say, ornamental, but I hope it is the latter as well. Utility, however, was of more importance than decoration alone, hence the small space available for looking glass. As a matter of fact, there is none of this latter in mine, but as an overmantel without glass might not suit every one, I shall, in due course, show how mirrors may easily be fitted without altering the construction. Possibly also some may prefer to have no shelf in the centre portion, and for the benefit of such I shall, in the proper place, explain the slight difference which its absence will render necessary or advisable.

In the meantime I shall show precisely and exactly how the overmantel as represented is made. The necessity—if the thing when made is to look well—of having the wood properly planed, and not only so, but perfectly smooth—no plane marks or flaws of that kind—is so self-evident that it need not be insisted on. To get the surfaces into this desirable condition first plane them, then scrape them to take out any trifling irregularities, and finally glass-paper. This latter, however, may be deferred till just before fitting together, particularly if the work is not to be painted. The edges of the wood must also be planed up as truly as possible, and of course every cross cut should be perfectly square. If it is not it will be hopeless to expect that the work can look well, however much pains may be taken with it otherwise. Roughness in finish may pass without offence; bad construction cannot be regarded with equanimity. The latter is the important part of the work; the former, the finish, is of secondary importance. Those who wish to excel will, of course, take the same pains with the one as with the other, for though our work may be cheap it need not be nasty. I saw somewhere lately—I think it was in "Every Man His Own Mechanic," though I am not able to verify the quotation—a sentence which puts the matter very neatly. It was as nearly as I remember in these words: "Though the work need not be well done it will be better if it is;" and whether they are exactly so or not that is their purport. I have insisted on these details because they are applicable not only to our present work but to all other of a similar kind; and having given these general instructions, I may now call attention to the various parts, their respective sizes, and the mode in which they are fitted together.

For the ends or uprights four pieces will be required, each 2 ft. 3 in. long and 6½ in. wide. By the way, as I have not mentioned it before, I may as well remind beginners that though wood 1 in. thick has been spoken of, it must not be supposed it will be of this thickness after having been planed. Even before this has been done it will not be fully 1 in. thick, unless it has been specially asked for, and paid for accordingly. Nominal "1 in. stuff" is what is supposed to be used, and this will measure, when "cleaned up"—*i.e.*, planed, etc.—little, if any, more than ¾ in. It will therefore be well to bear this in mind when setting out the work if, for any reason, exact dimensions, not only of this overmantel but of other furniture, are to be worked to. I may as well also state here that measurements are not given to within ⅛ in., as to do so would merely tend to error, and cramp the worker by imposing needless restrictions. Measurements will only be stated by

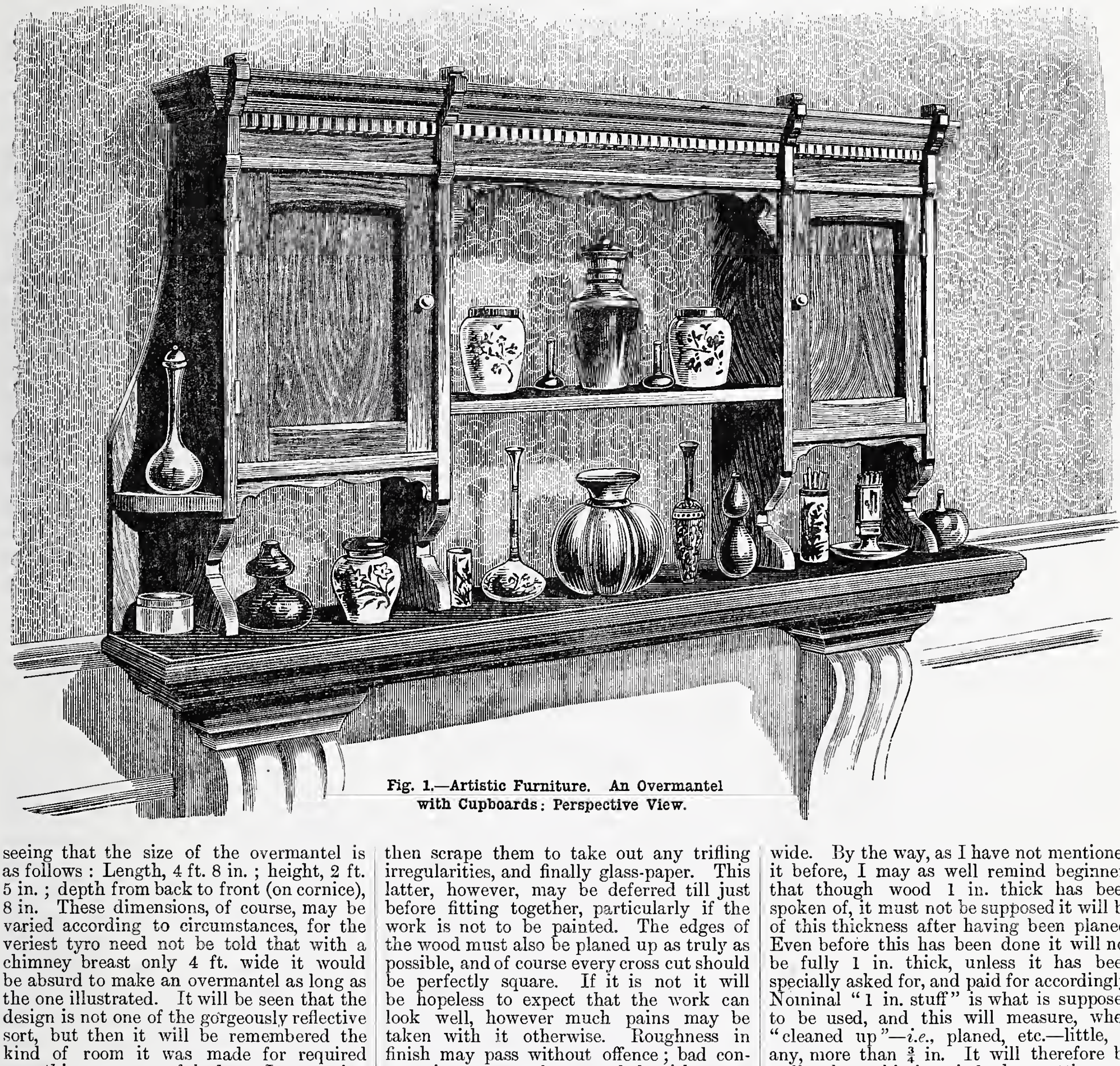


Fig. 1.—Artistic Furniture. An Overmantel with Cupboards: Perspective View.

the half-inch, which for explanatory purposes is quite sufficient, so that, in case of any dimensions not tallying exactly, it will be understood that parts less than half an inch are disregarded, except in the very few instances in which it will be necessary to mention them. Of course, in actual work the same disregard for fractions cannot be entertained, as they must be carefully noted.

Two pieces, each 11 in. long and the same width as the ends, will also be required for the bottoms of the cupboards, and two more of the same width, but longer than the bottoms by the thickness of the two ends. Thus, if these finish ¾ in. thick, the pair will make 1½ in., which, added to the length of the bottom of the cupboard's 11 in., gives us 12½ in. One piece the same width as the foregoing but 1 ft. 10 in. long will be wanted for the centre shelf, and another for the top of the same part of equal length, but ¾ in. narrower, to allow for the thickness of the next piece. This, which is 4 in. wide, and in length equal to the whole of the front less the thickness of the two outside uprights, will also have to be prepared before any of the fitting together can be done. To get at this length exactly, either measure from the working drawing or, what amounts to the same thing, add the length of the centre shelf (22 in.), the thickness of the two inner uprights (1½ in.), and the length of the two pieces for the bottoms of the cupboards (22 in.), giving a total of 3 ft. 9½ in. Now take the two inner end pieces, and from the top front corners of each cut a piece out exactly the width and thickness of the long piece, the frieze, just prepared.

To prevent any mistake as to how these spaces should be cut out, the diagram Fig. 4 is given. This represents the top of the inner end pieces, the part within the thick lines being that which is to be cut away. To mark these spaces out accurately, set the gauge—either the marking or the cutting variety being available for the purpose—to exact thickness of the frieze; then, with the block of the gauge against the front edge of the uprights, scribe for a length of at least four inches from the top. If the scribing is done on the top edge and on both sides of the wood the lines will furnish an aid to correct sawing, or to trimming up accurately afterwards with a chisel if necessary. This, of course, will not be requisite for those who are practised hands, but such adventitious aids are not to be despised by the unskilled worker, as by taking advantage of them he may turn out work as accurately made as that done by the most experienced. He will naturally require more time to get the same results, but these will well compensate for the extra pains taken. He must not hope to emulate the practised worker in speed, but he may reasonably expect to do so in accuracy—if he has the necessary patience.

The length of the piece to be cut away can most easily be ascertained by laying the frieze on the wood and marking off the width. When this is arrived at the square should be used to mark the lines, not only on the front but also on the sides, as far as those made by the gauge. Now it is evident that the cut made by the saw is of an appreciable width. It cannot be less than the thickness of the saw blade and set of the teeth, so that unless a very fine saw is used it will be found that if the wood is cut on the line, that is to say, if the saw passes through this, the space, when the waste piece is removed, will be found rather larger than necessary. In other words the frieze will not fill up the recess properly; it will not be a good fit. In this instance this would not be of much consequence, still it is better to form good habits of work at once. After what has been said, the natural inference will be that by cutting along the inner edge of the marked lines, *i.e.*, within the waste piece, so that a saw cut is formed in it, the space left will be just of the required dimensions. In any case if it is not big enough, a little paring with a chisel will soon effect all that is needful; for it is always easier to reduce wood than to add to its size when fitting; an axiom which the beginner will do well to remember.

When the frieze is fitted properly the pieces so far arranged may be fastened together if the shaping has been done on the lower parts of the ends, for this cannot be managed afterwards. Fig. 5 shows as clearly as possible, on a small scale, the outline of this shaping, all the principal measurements from which it can be set out being given in inches. The best way to get the outlines on the four pieces alike will be to form a template. As it may not be understood what this means, it may be explained as a piece of cardboard or thick paper cut with a knife or scissors to the exact outline. By laying this template, or mould, on the wood in position and drawing with a pencil along the shaped edge, all will be exactly the same. It will be noted that the upper curve is a counterpart of the lower, so that the drawing required for the outline is reduced to a minimum. The actual cutting may be done with a bow saw, but, of course, the work may be done with much greater facility with a good fret machine. I leave out of the question a band saw, as this is not often seen or required by amateurs. To prevent disappointment to those who are getting a fret machine, it may be said that I do not refer to makes which, though they may be good enough in their way, are too small to do such large work easily. With such a machine as the Britannia Company's No. 8, which for all-round purposes I consider the best in the market, there is, however, no difficulty in shaping such work as the present. The ordinary fret saws, however, even of the highest numbers, are hardly stout enough to be durable in cutting such thick stuff, and it may be news to some readers that, recognising this, the same Company have placed on the market some especially strong saws, which will be appreciated by sawyers who have once tried them.

Before fixing these parts together, mark with the square across the ends the exact positions of the shelves in order that these may be fixed truly and not sloping in all directions. The lines may be run across showing the thickness of the shelves, but it will only be absolutely necessary to make one for each shelf, indicating where either the top or bottom is to go. The first parts fixed together may as well be the centre shelf between the two ends. Its upper surface is 11 in. from the bottom of the overmantel, so the guide lines having been carefully marked on the inner sides of both the end pieces, mark with the square another line on the other side of each. These lines serve as a guide where to insert the nails, so that they should be drawn about half the thickness of the shelf nearer the lower ends, when if the nails are driven in straight they are bound to go well into the shelf. Screws may be used, but ordinary French nails will do well enough and hold just as securely if driven in as shown in the diagram Fig. 6. This represents the end in section with the shelf nailed to it. It will be seen that the end-nails instead of being driven in perpendicularly are inclined towards the centre of the shelf. Were they all to be straight like the middle nail, it is very evident that the pieces could easily be separated, but by inserting them at an angle they bind the pieces so firmly together that no stronger joint will be needed. The comparative strength of the two kinds of joint can easily be tested by experiment on a couple of waste pieces. To avoid repetition, it may as well be said, once for all, that, unless otherwise stated, it will be better in any of this nailed furniture to have one or two of the nails in a slanting direction, every precaution, of course, being taken to see that the slant is not towards the surface of a shelf. If preferred, the nails may be driven in straight, and in most instances would probably hold sufficiently, but as there is no more difficulty one way than with the other, it is just as well in case of doubt to choose that which seems the strongest. Three or four 2-in. nails, either French or of another kind, at each end of the shelf will hold it well enough. Drive the first nails in straight, and put the slanting ones in afterwards; and do not put more than one nail in any joint till it has been carefully noted that the pieces of wood are in their right position towards each other. To avoid accidents, of course, holes will be bored with a bradawl before the nails are hammered in. The holes need, however, only go through the first piece. The nails will easily make their own way into the end grain of the other, though just to guide them the bradawl may go a little way into this. These are very elementary details, but without some knowledge of them the beginner might fall into errors which could only lead to dissatisfaction with his work, so I trust those more advanced will not deem them needless.

(*To be continued.*)

"TIPS" FOR TYROS.

BY OPIFEX.

1.—Decorative Work for Panels.

Figures, flowers, etc., are very effective for decorative purposes when painted in oil colours upon a dull gold ground, and charming panels may be produced in this style. Cabinets, etc., with plain panels may be altogether transformed by placing other panels of tin, zinc, etc., thus treated, over them, cutting out the metal to fit exactly inside the moulding, then gold lacquering and painting, and, finally, securing by means of invisible pins.

Suppose we require a small panel 12 in. by 6 in. Cut a piece of common tin, or zinc, of the proper shape and dimensions; procure some gold size and best copal varnish, say half a pint of each, and mix together. Also a small packet of gold-bronze powder, costing about 1s. 6d. at any oilman's, and a camel's-hair brush—a gilder's "dabber" is best, and costs 6d.

Give the panel a thick, but even, coat of this mixture, or pour about a table-spoonful upon the centre of the panel, and let it run all over evenly—after the manner of photographers covering a plate with colodion—but this only in case of very small panels. This varnish will dry very rapidly, provided the ingredients are good and fresh, so must be carefully watched, as the gold powder must be applied before it is dry, and half an hour, or even less, will generally be sufficient time to wait.

Next dip the brush well into the gold powder, taking up as much as possible; dust it over the panel unstintingly, at the same time being careful not to touch the surface with the brush. This should be done several times until the panel is well covered with the gold powder. You may now venture, very gently and lightly, to apply the brush —and remember that you cannot have too much gold powder—and sweep it over the surface, hither and thither. The gold powder will protect the surface of the varnish from being abraded by the brush, and the result will be, if great care has been taken, that a perfectly smooth, gilt surface will be imparted to the panel. It may now be laid flat in a warm place until perfectly dry, when the surplus gold powder may be brushed off, and the surface rubbed lightly with a pad, formed by folding a piece of chamois leather several times.

The panel is now ready to be painted upon, after which, the whole should receive a coat of mastic varnish.

HOW TO MAKE A WOODEN COPYING PRESS.

BY DAVID DENNING.

THE press about to be described is essentially a home-made affair—one of those contrivances emanating from an amateur's brain, and capable of construction by hands almost unskilled in any handicraft. It is so simple that one feels almost that some apology is due for volunteering any instructions about it; but remembering that all amateurs are not adepts in contriving, any more than they are expert in making, the following hints may not be without value to some readers. The advantage of keeping copies of one's letters—at any rate, of those of a business character—is so generally recognised that nothing need be said about the desirability of doing so. The form of machine or press usually employed for the purpose is well known; but, if we except those of a portable character, they are entirely of iron, and quite unsuited for construction by amateur mechanics as a rule.

I had long intended getting a copying press for home use, but the cost had always been an obstacle. By degrees I began to consider if I could not make one which, even if not so neat in appearance, should be as effective as those sold for the purpose.

First question—Is it necessary that it should be iron throughout? Answer—No. Second question—Could not most or all of it be made of wood? Yes, certainly, except the screw. There came the stumbling block, for it seemed as if this must be of iron; or even if wood could be made to answer the same purpose, where could a suitable screw be got? On inquiring what one would cost, I found it was more than I cared to give, and it seemed a useless expenditure to buy a box and tap to make one, especially as there was no certainty that I should be able to succeed in working it. The matter remained in abeyance accordingly, till one day a discarded bench screw turned up among some rubbish. Why not make a trial with it? It was not wanted for any other purpose, and in the event of the press not being a success, no great loss would result. Anyhow, it seemed just the thing that was wanted, though, probably, if it had not been obtainable, some other arrangement whereby the requisite pressure might have been got could have been devised. Still, it was the ordinary screw press that appealed to my fancy, as no other form seemed so suitable. Perhaps, also, the knowledge that napkin presses, almost identical with copying presses, are made entirely of wood, first suggested the idea of making one. Certainly, compared with one made of iron, the wooden press is clumsy—even a makeshift, if you will; but are not practical "makeshifts," after all, the pride of the amateur? There is the satisfaction of having formed something useful out of what was probably little more than waste. Of course, it is very pleasant, no doubt, to be able to have the best and nicest thing of its kind; but, failing this, by a little consideration one may often be able to contrive a very fair substitute. That is all the wooden copying press pretends to be. It does not aspire to the dignity of a new invention; perhaps it is merely conceit that regards it as anything but a worn-out idea obtruding its insignificant self; if so, good readers, forgive it and pass on to a more congenial article. Allusion has been made to the press being constructed of waste material; and if pieces of an old packing case which had been put aside for breaking up into firewood can be called so, it is literally true. There is, however, no absolute necessity for getting a packing case for the purpose, as wood from the plank will do equally well—better, perhaps. The fact of my press having been made from an old case is merely mentioned to show beginners that they may make use of what may at first sight seem very unpromising materials.

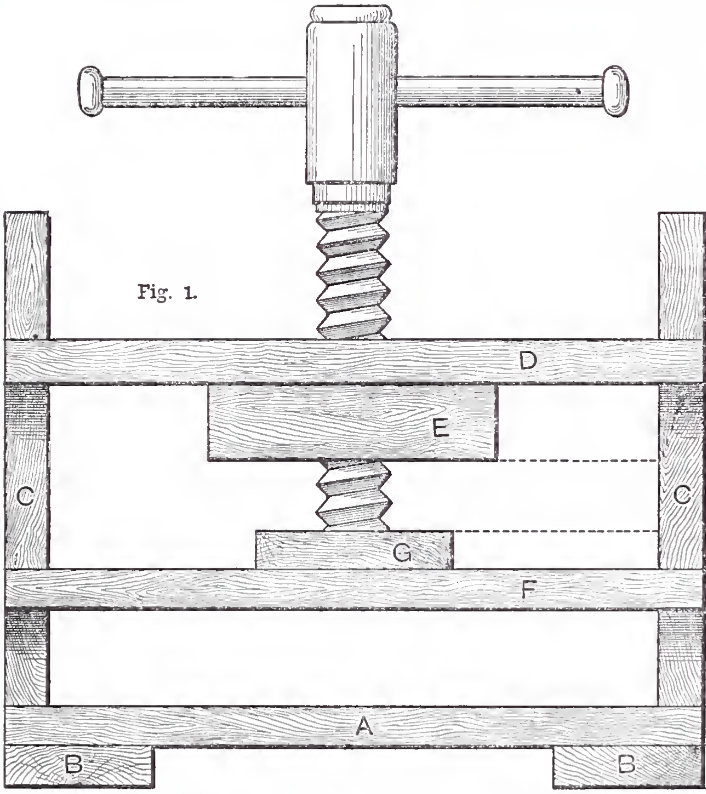
From what has just been said, it will readily be surmised that the press is made of pine, in the selection of which the only precaution taken was to get the pieces as free from knots as possible. The thickness was already determined for me, the case being entirely of 1-in. stuff, which, planed up, measures only a trifle over $\frac{3}{4}$ in. It does very well; but having got beyond the experimental stage, if I intended to make another press, a little more regard might be paid to appearance, in which case a harder wood might be used. Beech would answer well; while a really handsome press might be made by using mahogany or walnut, the cost of which is not great. However, enough has been said about material; and as for workmanship, I would merely caution the tyro against careless work under the erroneous impression that common wood deserves no better.

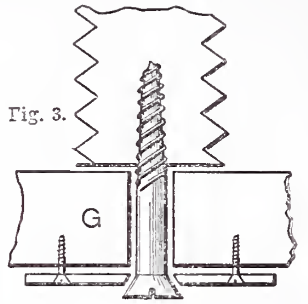
The general construction of the press may be gathered from Figs. 1 and 2, which give the front and end. The length is $14\frac{1}{2}$ in., and the width, 9 in., which allows of the ordinary quarto copying book being used. It will be seen that the only pretence at ornamental finish is in the rounded ends of the upright pieces, the remainder being "as plain as a pikestaff." The thing was made for use, not for show; and no unnecessary time was spent over it. Those who want to make something better looking will have no difficulty in making improvements, while following the same constructive details. For example, a moulding may be planted on the edges all round the bottom, and a small moulding may be worked on others. Chamfered edges would also be effective and not difficult; while various other details will doubtless occur to the worker. The bottom piece, A, or bed of the press, is $14\frac{1}{2}$ in. long by 9 in. wide. On the under side are screwed two pieces, B, one at each end, serving to give rigidity to the bottom. I am now inclined to think they might have been dispensed with, as the press is screwed to the top of the piece of furniture—a dwarf bookcase—on which it stands. This alone secures the stability of the press; but, as I was undecided where to place it, the cross pieces were used as an extra precaution against weakness. The two uprights, C, are 12 in. long by 3 in. wide, fitted to the bottom with a plain single dovetail joint. The transverse piece, D, 4 in. wide, and of course the same length as the bed, is $2\frac{1}{2}$ in. from the top of C, through each of which a couple of mortises are cut for corresponding stout tenons in D. Through this a hole is cut to allow the screw to pass freely, and on the underside the threaded block, E, in which the screw works, is fastened. I may here say that originally the block was placed above D, but on using the press for the first time this was found to be a fault, very little force—hardly, indeed, more than was required to copy a letter—being sufficient to pull the screw block away. Probably, had D been made of hard wood this would not have happened. Naturally, the tendency of the screw, when using the press for copying, is to force the block, E, upwards; so, to prevent further mishap, the alteration to the present position was made with very satisfactory results.

The movable board, F, is exactly the same size as the bed, which it resembles in every respect, except that at each end spaces are cut away to allow of the uprights fitting loosely into them; and that only one piece, G, instead of two, is fixed across. Now, all these parts might be fitted together, and the press would be effective so far as copying is concerned; but there is the objection that the loose board, F, would not rise with the motion of the screw, and I judged it would be awkward to lift it each time the book was put in the press. Some contrivance by which the action of the screw would raise as well as depress was wanted. Not being a mechanical genius this required consideration; but now that it is done the solution of the problem is as simple as that connected with the historical egg of Columbus. The end of the screw, as is generally the case, was tapered beyond the thread; and it did not seem as if this shape would conduce to effective action. I therefore cut the rounded portion off with a saw, leaving the bottom end of the screw perfectly flat. I then got a piece of zinc plate, about $\frac{1}{16}$ in. thick, and screwed it to the underside of the cross piece, G, about the centre. The size of this piece of metal is immaterial—all that is necessary being that it is large enough to allow of it being properly fastened with two or three screws, and to have a hole about $\frac{3}{16}$ in. bored through it. The shape also is of no consequence; and that of the piece I used may perhaps be best described by saying that it is irregular—very much so, indeed—for it was simply a scrap remaining from a plate out of which I had been cutting a piece of metal fret. In case it is supposed that only zinc would do, it may be said that the only reason for its having been employed was that it was lying handy, and that had a suitable-sized piece of brass presented itself it would probably have been used instead. Indeed, I am inclined to think that the metal might be dispensed with altogether without much, if any, disadvantage, especially if the piece, G, is of some hard wood. Still, I don't know; and the suggestion is only given for what it is worth to those who want to expend as little labour as possible on the press. It is seldom that one's first attempt at making anything is so good that it can't be improved upon, either by eliminating superfluous features of construction or by giving it an enhanced appearance—both considerations worthy of attention if they can be accomplished without detriment to utility. Therefore, it is to be hoped that these instructions will not be so far mistaken as to be regarded by any would-be press maker as admitting of no variation. They are merely given as a record of the way my press was made, and so far they are reliable. Whether the suggested alterations are improvements, or the reverse, must slightly exaggerated for the sake of clearness, for it will be understood that the more closely the parts fit without binding the better the work will be. In order that G may be screwed down closely to the piece F, the latter is slightly scooped out to receive the metal plate and screw head.

The parts are now ready for fixing together, and when done, the press as made is complete. Of course, I am supposing that each part is separate so far, and that any fitting together has been merely tentative. Perhaps it may be an assistance to beginners if they are told how to fit all the parts together.

Screw the two pieces, B, to A, though this has probably been done when cutting the sockets for the dovetails at the end of C. Pass the wooden screw through D and then through E. Fasten these (D and E) alluded to incidentally. These, though by no means generally met with nowadays, when we are apt to regard them as old-fashioned, are not to be despised as a convenient means of keeping such things as table-cloths, etc., nicely pressed. In some households they are still in constant use; and for the benefit of those who desire to make one, it may be said that the linen or napkin press very much resembles in construction that just described for copying. In size, however, it is considerably larger, but as the dimensions are governed by the articles to be kept in it, no specification can be necessary here. In construction the principal point of difference is that the handle of the napkin press, instead of being at the top, is usually found placed between the parts marked in the illustrations as D and F. In the copying press this would





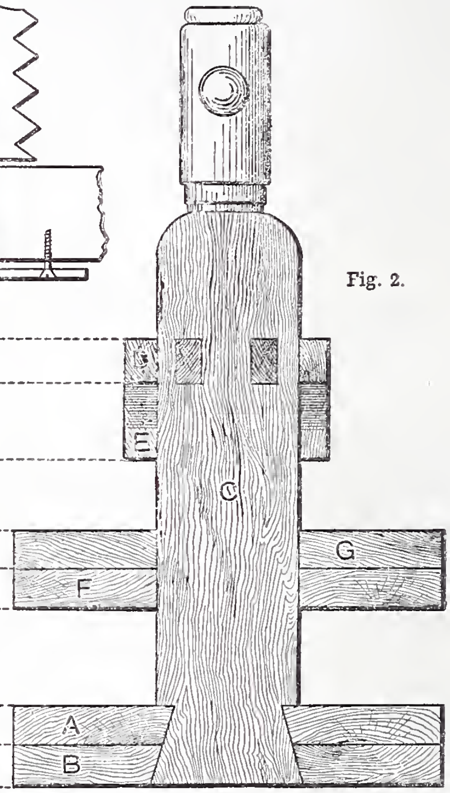


Fig. 1.—Front Elevation of Press. Fig. 2.—End or Side Elevation. Fig. 3.—Diagram Showing Mode of Attaching Wood Screw to G.

be left for each maker to decide for himself. For example, some may not have tools to bore the screw holes through the plate; and it would only discourage such at the outset to tell them they *must* use a metal plate. If I may offer a suggestion here, though one hardly directly concerning the subject, it is—that fellow-contributors, while telling us what ought to be done to produce the best results, might, when practicable, indicate "short cuts." But to make a "short cut" of this press: A hole was bored through the metal plate and G big enough to allow a large screw nail to revolve freely within it. This screw was then run through the hole and driven into the bottom of the wood screw, care being taken that while this and G were brought close together, the latter could be turned round easily on the screw nail as an axis. In order the better to explain this, Fig. 3 is given, showing in section the metal plate at the bottom, the wooden piece, G, above, with the nail passing through them into the screw. The spaces round the nail and between the bottom of the screw and G are together, taking care that the wooden screw does not jam in the hole through D, in which it should revolve freely. Then attach G to the end of the wooden screw. Next fix one of the end pieces, C, to the bottom, when F may be placed in position. The tenons at the end of D, corresponding with the mortises in the piece C, already fitted, may then be inserted; and finally the remaining upright, C, be fastened. Glue should be used at the mortise and tenon and dovetail joints; but it will be better to fasten the other parts together with ordinary screw nails. It now only remains to screw G to F, and the press is complete. Nothing has been said about the handle by which the screw is turned; but I presume it will be understood that this is the ordinary one supplied with it for bench purposes. Any tough stick would, however, do as well; and instead of leaving it loose, as it generally is in bench screws. I have found it convenient to fasten it in by a couple of brads—one on each side—so as to keep the handle immovable.

In the preceding page napkin presses were have been awkward, owing to the comparatively short space between the two uprights; but in the larger linen press this objection does not exist; and for practical reasons the lower position is generally chosen. There is, however, no actual necessity for this, so that those who want to make a linen press may, if they prefer to do so, make one in every respect like the press now described, merely altering the sizes to suit their own requirements.

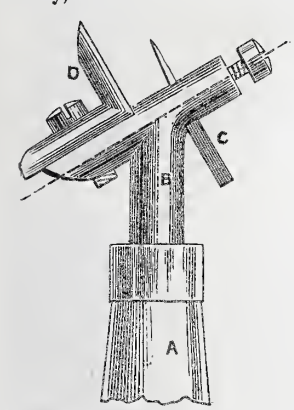
It will, no doubt, be perceived that such a press may be turned to a variety of uses, and that its utility is not confined to copying letters. For example, the amateur cabinet maker will find it handy in laying small veneers with a caul, the photographer in mounting and pressing his works of art, etc. etc.

So far, only the press as I have described it has been made; but, before long, it is probable that a stand will be contrived specially for it. If so, I shall have much pleasure in giving particulars in a subsequent article, and describing the methods that I may be led to adopt in making it.

OUR GUIDE TO GOOD THINGS.

6.—The Britannia Company's New Patent Saw.

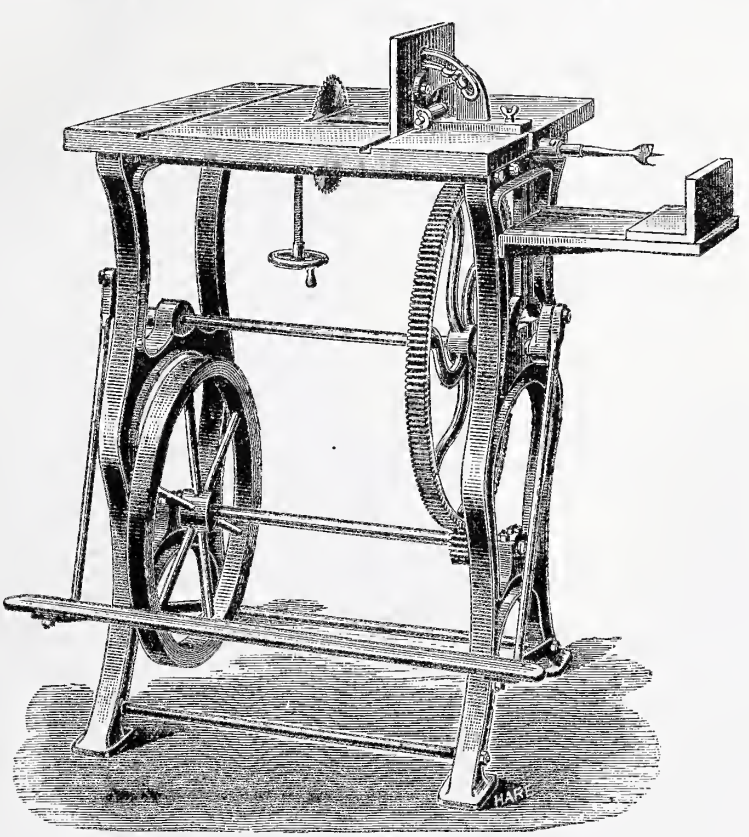
A circular saw is a tool which no workman who has once seen it at work would care to be without, for it is a labour-saving tool of the first importance, and enables its owner to do many things with an amount of ease, exactness, precision, and rapidity that cannot be attained with saws actuated by the hand and arm. When an amateur becomes the possessor of a lathe, one of the first things he will do is to have it fitted with a circular saw and the necessary appliances in the shape of table, fence, etc., to enable him to use it conveniently and with due effect. The professional workman, on the other hand, although he will not be without a circular saw to be worked on and by his lathe, wants something stronger and heavier that will save him the labour of using the rip saw, which has made many a man's arm and shoulder ache when the absence of suitable machinery in the workshop has compelled him to keep at this kind of work for many successive hours, perhaps, if not through the entire day; and every man who seeks to save time and labour, and therefore money, either for himself or for those in his employ, will, or ought to, take care to have a thoroughly efficient machine well suited to the requirements of his business in his workshop.



Adjustable Rebating Cutter.—A, Handle; B, Brass Casting; C, Cutter; D, Fence. Dotted lines show Angles of Inclination of Cross Piece to Axis of Handle.

I may say, with confidence, that I do not know a better all-round machine for general purposes than the New Patent Saw made by the Britannia Company, Colchester, Essex, of which the annexed engraving is an excellent illustration. It is a very powerful machine, well made and well put together, and suitable for workshops even of a small size, because it is compact in itself and does not take up much room. I have seen the saw in operation, and was astonished to note the "go" that is in it, if I may use the term, after the motive power has been removed from the treadle. When I saw the machine at work at the Company's London showrooms, 100, Houndsditch, where every machine and appliance made and sold by the Company may be seen and examined, the exhibitor set it running and then took his foot from the treadle. After some little time had elapsed, during which the machine continued in action just as if some invisible agency was keeping it going, I was asked to stand on the treadle. I stepped on it and stood there, but in spite of the dead weight that was then thrown on it, the machine went on as gaily as ever, and did not come to a full stop until some little time after I had stepped off the treadle and stood once more on the floor of the showroom. I regretted afterwards that I had not timed the duration of the running of the machine from the time the exhibitor ceased to actuate it until it stopped. I shall do so, however, the first opportunity I have of renewing my acquaintance with it, and then, through the medium of "Shop," I shall have much pleasure in answering the inquiries of an intending purchaser, or any one else who may be curious in the matter.

So much, then, in testimony of its power, which enables me to accept the assertion of its patentees and makers, that when the saw is worked by foot "4 ft. of 1 in. pine can be cut after the foot is taken off the treadle. It is claimed, moreover, for the saw that it will cut 10 feet of inch wood in a minute; and that with one man working at the treadle—for it may be worked by hand power as well—it will cut up to 4 in. square. This, in fact, bears valuable and incontrovertible witness to the worth of the saw as an economical machine, and goes far to make good the Company's claim that it will compare favourably in point of work done with any other treadle saw in existence, and that it will save its prime cost in the first twelvemonth of its use.



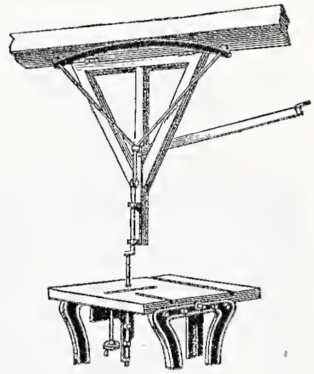
Britannia Company's New Patent Saw for Cabinet Makers, Joiners, etc.

The construction of the machine will be readily understood from an inspection of the accompanying illustration. The saw table is supported on a couple of standards, firmly connected and braced by bars, entering the standards a little above the feet on each side. Provision is made in the framing of the standards for the reception of two axles, the lower one carrying the heavy fly-wheel on one side, and on the other a pinion which gears into a large and heavy toothed-wheel, on the right side of the higher axle, to the ends of which are connected the bars that form the intermediate links between the treadle and the shaft that carries the large toothed-wheel. The end of the shaft to the left is so contrived that a handle can be fitted on to it, which may be used either as an auxiliary to, or instead of, the treadle. The large toothed-wheel gears again into a small toothed-wheel on the axle which carries the circular saw, which, when in motion, may be made to effect 1,500 revolutions per minute.

The table is fitted with the necessary appliances for the performance of various kinds of work in the form of fences, etc., and at the right side of the machine there is an adjustable table, on which dowelling is done, fitted with a special appliance for holding work and insuring uniformity. On this side is also a chuck for holding bits of various sizes for boring, which can be done with great rapidity and up to 2 in. in diameter.

In addition to dowelling and boring, grooving can be done at considerable speed, and mitre cutting is performed with such cleanness of cut and rapidity that the ordinary gilt mouldings used for picture frames can be cut without any shake, and will not require planing or finishing. For scroll cutting there is a separate appliance, of which the upper arm is suspended from the wall or ceiling, and only let down when wanted, thus leaving the table quite clear for work of any size. Timber, to the thickness of 4 in., may be cut with the vertical saw. The patentees and makers are about to add a moulding appliance to the machine, by which mouldings may be cut with a single cutter.

The adjustable table shown at the side in the illustration, for boring, can be removed at pleasure, and another table be substituted with suitable appliances for holding work for mortising. This operation is effected by using a fluted bit, which is placed in the same position as the centre bit shown in the illustration. The fluted bit, which cuts on the side, first drills a hole in the wood, and then completes the mortise by means of the screw movement. The price of the mortising appliance is £3 10s.



Vertical Arm for Suspension to Ceiling or from Wall, as Appendage to Patent Saw for Scroll Cutting by means of Vertical Saw.

The dimensions of the machine are as follows:—Height of upper surface of table from ground, 3 ft. 4 in.; length of table from back to front, 2 ft. 9 in.; width of table along front, as shown in illustration, 2 ft. 4 in. Area occupied by machine, or extent of base from outside to outside each way, including treadle, 2 ft. 9 in. by 2 ft. 9 in. In addition to what has been said above of the persistence of motion in the machine after the motive power has been removed or stayed, it may be said, in order to give a better idea of the momentum accumulated by the saw, that if six treads be first given you may then *stand upon the treadle*, and it will take you up bodily eighteen times. Generally speaking, treadle saws will cut no more than 6 in. by momentum of saw after motive power is removed, but the New Patent Saw will cut 48 in., or eight times as much as an ordinary saw.

The price of the machine in its simplest form and condition is £15, including a rip saw and a cross-cut saw, each 8 in. in diameter, and a 6 in. saw, with a pair of bevel washers for grooving. The fret arm for suspension from ceiling for fret cutting costs £2 10s. in addition, and 5s. more must be added to the price of the table if the purchaser desires to have a 12 in. cross-cut saw instead of the 8 in. saw usually supplied. An additional charge of 7s. 6d. is made for the crank handle to be used at the left end of the axle carrying the large-toothed driving wheel; and £1 2s. 6d. for the adjustable table at right hand side, and chuck for holding bits for boring. Centre bits suitable for the chuck are supplied at prices ranging from 8d. to 1s. 3d., according to size.

In conclusion it may be said that the Patent Saw Table is especially adapted to meet the requirements of cabinet makers, joiners, picture-frame makers, and pattern makers, and for the execution of circular work, grooving, dowelling, and drilling, as has been already pointed out. For amateurs who have room for such a machine, it is doubtful if anything more handy or more serviceable could be found.

7.—ADJUSTABLE REBATING CUTTER OR KNIFE.

This is one of many handy little tools that have been shown to me lately by Messrs. Richard Melhuish and Sons, 85 and 87, Fetter Lane, Holborn Circus, London, E.C. In the upper end of a nicely formed handle is set a round piece of brass about ¼ in. in diameter and ⅝ in. long. At the end of this piece of brass is set another piece, about 1 in. in length, obliquely, the two arms forming angles of 55° and 125° with the first piece on the opposite sides. The two pieces form a single casting, but I have described them as I have in order to make the construction of the tool as clear as possible to the readers of WORK. At all events we have a handle and a piece of brass at the end of it, inclined to the axis of the handle at the angles named. At right angles to the cross piece, at ¼ in. from its extremity, a cutter is inserted which is held in its place by a set screw in the end of the cross piece nearest to which the cutter is placed. Along the other end of the cross piece slides a guide or fence, also held in place by a set screw, which is adjustable, and can be moved a little more than ¼ in. from the cutter, which is ⅞ in. in length. For cutting small rebates not more than ¼ in. each way or for clearing the angle of a rebate already cut this tool will be found useful. It is, however, very limited in capacity, and would be far more useful if made in larger sizes. Its cost is only 1s. 3d., but any one who can manage to do a little brass casting can make one for himself on a somewhat larger scale. In order to give a little assistance to any would-be maker of a similar cutter I have given a sketch of the tool itself.

8.—FINE THREE-JAWED DRILL CHUCK.

This well-made little Three-jawed Drill Chuck, as its name implies, will be found of service by jewellers, and all who do small fine work, for holding drills in the lathe, to which the chuck itself must be fitted. It consists of a steel cylinder, into the upper end of which is fitted a tubular piece of iron, cut for the greater part of its length into three sections, the upper parts of which form the three jaws. A screw thread is cut along the upper part of the cylinder, on which a cap works, surrounded by a milled flange. This cap passes over the jaws of the chuck, and causes them by its pressure to grip tightly any small drill that may be placed within them. Its price is 6s. 6d.

9.—SHAPED WHETSTONES FOR WOOD-CARVING TOOLS.

Wood carvers, especially amateurs, often find a difficulty in obtaining, or even shaping, slips of a proper size and suitable form for giving a keen edge to wood-carving tools. A handy set of slips, four in number, has recently been introduced, which will obviate all difficulty in this direction in future. These slips are sold at 3s. 6d., enclosed in a box, in which they can be kept at hand, ready at any time for use when required. They are cut from the best Arkansas stone, and present in front and back every variety of form that can be required for carving tools, whatever may be their shape. They are about 2 in. long and ⅝ in. wide.

MEANS, MODES, AND METHODS.

*** *The Editor is not responsible for any statement made under this heading. Criticism and Suggestions are invited. Readers in possession of Tried and Approved Recipes, Formulas, and Processes, are requested to forward them for insertion in this column for the common good.*

PIANOS: HOW TO PRESERVE THEM.—It is remarkable how very oddly people proceed about taking care of their pianos—from sheer ignorance. It is a popular notion that pianos ought to be kept very dry. Nothing could be more fallacious. Pianos are not nearly affected so much by heat or cold as they are by dryness, but, reversely, also by dampness. It is not generally known that the sounding board—the life of a piano—is forced into the case, when it is made so tightly that it bulges up in the centre, or has a "belly," as it is called by pianoforte makers, on the same principle as a violin. The wood is supposed to be as dry as possible, but, of course, it contains some moisture, and gathers more on damp days and in handling. Now, when a piano is put into an over-heated, dry room, all this moisture is dried out, and the board loses its "belly," and gets flabby, and finally cracks. Even if it does not crack, the tone loses its resonance and grows thin and tinny, the felt cloth and leather used in the action dry up, and the whole machine rattles. Now how to prevent this. Nothing is easier. Keep a growing plant in your room, and so long as your plant thrives, your piano ought to, or else there is something wrong with it. It should be noted how much more water will have to be poured into the flower-pot in the room where the piano is than in any other room. In America it is the practice to keep a large vase or urn with a sopping-wet sponge in it near or under the piano, and keep it moistened. This is kept up all the time the fires are on.—*Iron.*

RUST JOINT.—For making a rust joint that will bear heat, cold, and rough usage, the following is said to be a good formula:—Iron Filings, 10 parts; Chloride of Lime, 3 parts; Water, sufficient to make the preceding ingredients into a paste. Put the mixture between the pieces to be joined, and bolt them together, leaving until dry.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

A Good Example.—C. R. (Glasgow) writes:—I have come across your prospectus of your new publication, WORK, and I think very much of it so far, and I believe it has a good chance. I shall be glad to act as your agent for this paper. I have a tool and cutlery business, and deal entirely with the working classes. Will you send me a quantity of your prospectuses (if possible, with my name and address), and also instructions, as this branch of business is a little new to me? I shall circulate your prospectus amongst my customers, and endeavour to get orders for WORK. Being a practical engineer, I also think I might at times send an article for publication.—[Your request for prospectuses has been complied with, and your communication holds the foremost place in "SHOP," as it is hoped it will be the means of stimulating many others in your position to follow the "good example" you have so aptly set in seeking to promote the circulation of WORK among workmen, for whose benefit and information it has been produced and published. Any letter or article from yourself or any other practical man will receive prompt attention.—ED.]

Picture Frames.—J. H. L. (Heywood).—An article on Picture-Frame Making, with illustrations of new forms of frames, will appear in an early number of WORK.

Ornamental Brass and Iron Work.—R. B. (Manchester).—Your suggestion is noted; and instructions for carrying out work of this description, with suitable designs, will be given in WORK as soon as arrangements can be made.

Working Models.—CHURCH.—Attention will be paid in due time to the construction of working models. It may be noted here that the particular model you require is that of a church, in which, when a penny is put in, the church bells will ring, and the figures of the ringers be seen to pull the ropes. Such a working model would be somewhat complicated in construction, and if you have never tried your hand at one before, it would be better for you to choose something easier and simpler for your first essay, before attempting anything of the kind described.

Trade Notes and Memoranda.

TOPICS OF THE HOUR.—Underground Railways in Paris.—Health and comfort in interiors.—Westminster Abbey additions.—Speculative building operations.—Oil for street lighting.—Portland cement and sea water.

SUGAR is suggested as a remedy for improving mortar.—In future none but certificated plumbers' work is to be permitted upon the Duke of Westminster's property.—£57,000 is asked to drain Margate, which needs drainage.—The fine parish church of Lyddington, Rutlandshire, is to be restored.—The Dean of Westminster has been asked to clear out some of the ugly monuments which now encumber the Abbey.—A temperance hotel is to be tried at the Devil's Dyke.—Electric headlights for trains have been successfully tried in America.—Another attempt is to be made to light the City of London by electricity.—Clacton-on-Sea has just started its much-needed sea-wall operations.

THE telephone is developing in Europe. There are now 33,000 telephone stations in Germany, 4,200 in Austria-Hungary, 4,647 in Belgium, 1,857 in Denmark, and 2,218 in Spain. France has 28 telephone systems, of which 2 are in Algeria, while Germany has 164. In 1888 the number of subscribers in France amounted to 9,847, and in Germany to 33,000. The United Kingdom had 122 systems with 20,426 subscribers; Italy 28 systems with 9,183 subscribers. Luxemburg has 15 lines with 483 subscribers; Norway 9 lines with 2,872 subscribers; Portugal only 2 lines, one of which is at Lisbon, and the other at Oporto, with 541 and 349 subscribers respectively. In Russia telephones have also been introduced. There are, in that country, 36 systems with 7,589 subscribers, of whom 1,500 are in St. Petersburg, 700 at Warsaw, 840 in Moscow, and 700 in Odessa. Sweden has 137 lines and 12,864 subscribers. Switzerland in 1888 had 71 telephone lines with 7,626 subscribers, of whom 1,533 are in Geneva, 1,066 in Zurich, 926 in Bâle, and 541 in Lausanne.

AT Pergamus a large sarcophagus has been found, near the Acropolis, determining the position of the necropolis of that city.

THE East Indian Art Manufacturing Company, situated at the foot of Cumballa Hill, near Bombay, has just laid down new machinery and sawmills, and has enlarged the workshops. About 170 workmen are employed, and some 225 tons of teak and blackwood are converted each year.

THE method of preparing the famous cæruleum or Egyptian blue has been discovered by a French chemist. The Egyptian blue is said to have been discovered by Vestorius, but it was not made after the fall of the Western Empire.

A COURSE of lectures on "Architecture," dealing with the practical side, illustrated by sketches, diagrams, and specimens of materials, are being delivered at the Central Institution of the City and Guilds' Institute, South Kensington, by Mr. Banister Fletcher, F.R.I.B.A., J.P., D.L., on Monday evenings, commencing 7.15.

A PARIS syndicate has purchased the tin mines of Villeder, which were about to fall into the hands of an English company. These mines are being erroneously represented as the only source of tin in France. But tin has been found in Bretagne from remote times. The tin mine at Montebras (Creuse) is still being worked.

A SERIES of examinations will be held under the auspices of the Carpenters' Company during the last week in June next, when gold, silver, and bronze medals (one of each), and certificates, will be awarded to successful candidates. The examination board includes Messrs. Banister Fletcher, T. Roger Smith, and W. Wilmer Pocock, and the presidents of the Institution of Civil Engineers, the R.I.B.A., the Architectural Association, the Builders' Institute, and the Clerk of Works' Association. Candidates must be between twenty-one and thirty years of age, and have passed at least in the ordinary grade of the examination in carpentry and joinery conducted by the City and Guilds' Institute.

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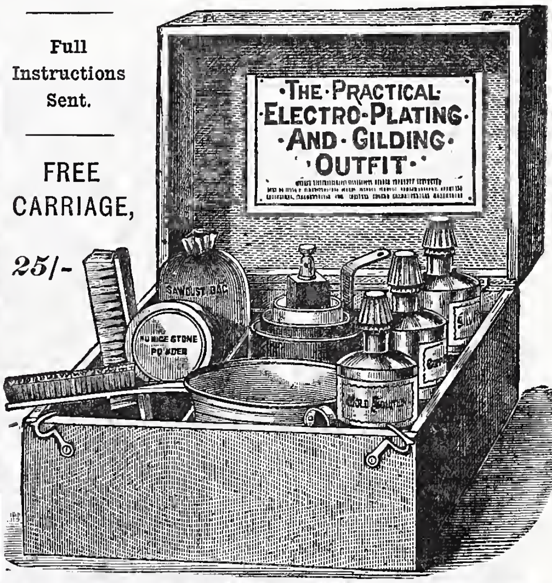

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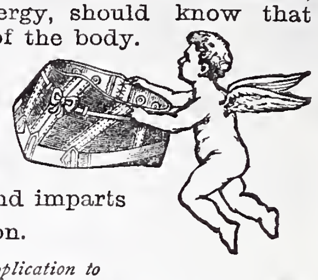

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 3.] SATURDAY, APRIL 6, 1889. [PRICE ONE PENNY.

PAPIER-MÂCHÉ.

How to Mould It and Ornament It.

BY SYLVANUS WARD.

I.—CONSTRUCTION IN PAPIER-MÂCHÉ—NAME AND ORIGIN OF MATERIAL—PULP—MOULDING ON MODEL—APPLIANCES REQUIRED—MOULDING ROUNDED FORMS—MAKING FLAT PANEL—MAKING VASES OF SIMPLE AND ORNATE FORMS.

PAPIER-MÂCHÉ, which, literally translated, means "chewed paper," is a term which we have been accustomed to hear applied to a great variety of products made by a pulping process, and some of which contain no paper whatever. If we look for the origin of the name we shall find that it was first applied to a coarse, unglazed paper reduced to a pulp, and then mixed with gum or glue paste, thus forming a substance plastic whilst wet, and when dry as hard, or harder than most woods, and unlike them not liable to crack. As the name would seem to indicate, the inventor, or reputed inventor, was a Frenchman—one Lefevre. About 1740 this person is said to have imparted his discovery to a German snuff-box maker named Martin, by whom it was found to be of commercial value in his trade. In or near the year 1745, John Baskerville, of Birmingham, the famous printer, took the matter up, and before long the manufacture of papier-mâché became an important industry in Birmingham and its district. Later on various fibres or fibrous materials, pulped and mixed with adhesive substances, have been known as papier-mâché; scrap leather, wood fibre imported from Sweden, potato peelings, and even sawdust, having, it is said, been made to take the place of paper; whilst in some preparations china clay, a substance apparently little suited for the purpose, has formed a large, if not an important, part of the admixture.

Fig. 1.

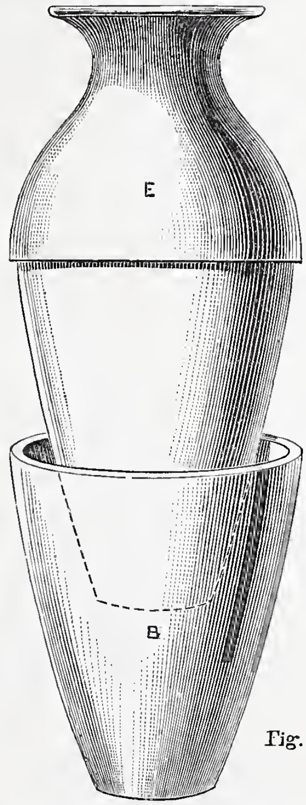


Fig. 3.

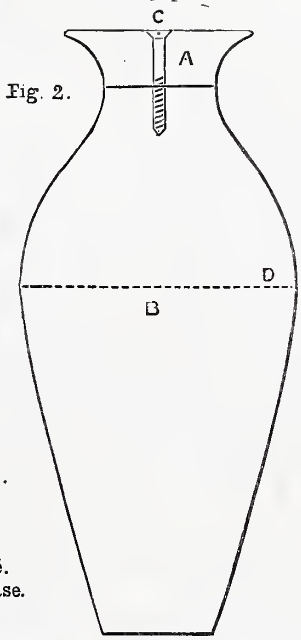


Fig. 2.

Fig. 1.—Plain Vase in Papier-Mâché.
Fig. 2.—Wooden Model for Plain Vase.
Fig. 3.—Taking out the Core.

In Baskerville's days there were reasons why an invention of the nature of papier-mâché should have been eagerly welcomed. The introduction of Oriental lacquered wares by the Dutch and English East India Companies in the latter part of the preceding century had created a fashion for such things, and roused a desire of imitation. Many of these imitations—the earliest efforts of the japanner's art in England—still remain. They are mostly clock cases, and the lids of corner cupboards, and are on wood, generally oak panel. Very curious some of them are; we call to mind one in which a shepherd and shepherdess, in the sham-pastoral taste of the day, are seated under a *bamboo* tree; the latter being, of course, borrowed from an Oriental original.

But wood, with its tendency to crack, and its rough grain, was not well suited to the japanner's art; and the advantages of papier-mâché were at once seen. It was plastic, and could be moulded to the required form; it would not crack, and, when dressed and covered with the black varnish of the japanner, it presented a level surface equal in uniformity to that of the lacquered wares of the East.

Yet this first papier-mâché did not prove to be altogether satisfactory. It is true that a fine surface was obtained, but that surface was not always to be relied upon as permanent; for if the article became overheated in any of the dryings to which it was subjected during decoration, it was apt to become wavy, or, in the technical language of the japanner, to go "curdled." Hence an improved material was a desideratum.

This was introduced in 1772, when Henry Clay, one of Baskerville's apprentices, took

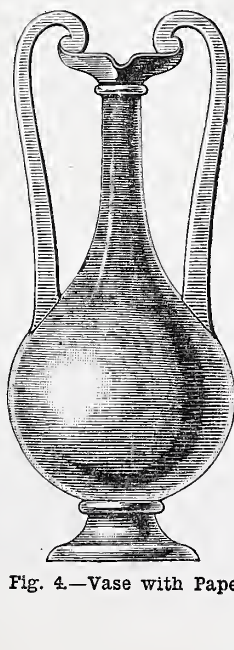


Fig. 4.—Vase with Paper Foot and Handles.

Fig. 5.—The "Lily" Vase.

out a patent for papier-mâché (though that name was no longer really appropriate), made by a new process. His plan was to form a solid mass of fibre by pasting sheets of paper together, and hardening it by saturation with oil. This gave a fine surface which, under proper management, was no longer liable to curdle. Thenceforward the pulped papier-mâché was used by japanners for inferior purposes only, their best articles being moulded by pasting.

In the process thus improved—and, it may be said, perfected, for a better substance in which to work, or a better ground on which to japan, could scarcely be desired—a rather thick, unglazed paper was used. The sheets of this were pasted together until (if a flat piece were wanted) a board or panel of some ¼ in. in thickness was formed; whilst rounded or ornamental forms were made by pasting the paper upon wooden models turned or worked into the shape which it was desired to reproduce in papier-mâché. By a combination of these moulded forms and panels it was found that any article within the range of the cabinet-maker's art could be produced, as well as others generally produced in plastic materials. The joiner could work in this paper substance precisely as in wood, except that carving was not attempted; but this was not wanted, its place being supplied by gold or colour decoration, or by pearl inlaying, or by a combination of two or all.

Of the strength of papier-mâché thus made an illustration may be afforded by the fact that when the writer was learning the business, he and his fellow-apprentices were accustomed to make cannons of it some 8 in. long, which would bear repeated firings, with fairly large charges of powder, without bursting.

For the worker in papier-mâché on a small scale, the pasting process has especial advantages. Instead of the moulds and presses wanted for pulp, he needs for this only a wooden model from which he can reproduce as many copies as he pleases.

Provided with this model, his requirements for making paper articles are:—

Rather thick unglazed paper in sufficient quantity.

Strong glue-paste, *i.e.*, paste in which some Russian glue has been boiled to give additional strength.

A brush and pasting board. The board should be somewhat larger than the sheets of paper which are to be laid upon it.

Grease or oil to anoint the models to make them leave; and a sufficient vessel of linseed oil to "bath" or soak the articles.

Also sand paper of various numbers, glue, and a few ordinary carpenter's tools; these are for treating the papier-mâché substance much in the same manner as wood. A tenon saw will in especial be necessary to saw the paper from the models; and rasps, it should be remembered, are more effective on this substance than files; whilst for planing it a toothed plane like that used for veneers is to be preferred.

Modelling.—Moulding a vase.—As a simple example of moulding on the model, let us take the plain vase (a well-known form in the trade), Fig. 1. For this the model must be in two pieces, as shown in Fig. 2, the top, A, being turned separately, and only attached to B by the screw at C. American birch has been the wood usually employed for such models, and before being used it must be thoroughly dried and repeatedly oiled with linseed oil till the surface ceases to be porous. The materials being provided, the operations of moulding are as follows:—

Rub oil or grease over the model, that the paper saturated with paste may leave it when required.

Cut up the paper into half or quarter sheets, or smaller if the size of the model demands it, and pile, say, half a dozen of these pieces on the pasting board.

With the brush dipped in hot paste, well saturate one side of the porous paper; then turn the piece over the sheet below, and treat the other side in the same manner. By thus doing the sheet below will be partially "satisfied," and surplus paste utilised.

Apply the saturated slip of paper to the model, covering as much of the surface as possible without leaving wrinkles, creases, or breaks. Continue this till the whole model is coated, pressing down the paper all over with the hand, and where needed with a smooth piece of wood, to squeeze out air bubbles. Note that the edges of the paper are to be turned down over the top and bottom of the model. At present these overlappings help to keep the coating in place, and they will be removed at the proper time.

The model having received its first coating, proceed to paste others above it to the number of four or five, taking care so to press each down as it is laid on as to squeeze out every air bubble, and to rub out wrinkles and creases as much as possible.

Place the model with its coverings in a stove or oven for the night. A gentle warmth is all that is required, the object being not to bake but only to dry. The domestic kitchen oven suffices for articles of moderate size. In the morning a hard shell of paper will be found to surround the wooden core.

Examine this to see if any blisters have arisen from the expansion of air bubbles, and if any are found cut them out. The holes so made must be stopped with a thick mixture of paste and paper dust—the latter being produced by sawing and rasping the papier-mâché, and of which waste, as the work goes on, there will soon be plenty on hand.

File off any inequalities, such as wrinkles, so as to get a fairly smooth surface to receive the next coat.

The wooden model or core may now be removed, and as a first step pare off the superfluous paper at top and bottom with a keen knife.

With a tenon saw cut through the paper along the dotted line at D, Fig. 2. The lower part of the vase will then slip off the model, as shown in Fig. 3. Remove the screw, C, and the two parts of the model becoming detached, one will slip upwards, the other downwards from the upper half of the paper vase.

The vase is now in two pieces, B and E, Fig. 3. These have to be glued together. The result is a thin, hollow, paper vase.

The glued joint having dried, the vase has to be covered with some four or five more coats of paper in the same manner as before. It has then to be again dried, air bubbles looked for and treated as before, and inequalities again filed down; these processes being repeated till the vase has reached the required thickness, which may, perhaps, be a quarter of an inch.

It should be borne in mind that it is better to build up the vase, or any other article, by several pastings of a few sheets at a time than to get the thickness by fewer and heavier pastings. The latter may appear to save time, but it would result in uncertain and inferior work. The exact number of sheets to be applied at one time must depend on the thickness of the paper, and as that may vary, it is impossible to speak on this point with precision.

Directions have been given for cutting the paper from the model after the first drying, but this must depend on circumstances. The thickness may not be sufficient for gluing, and in that case it will be better to put a second pasting of paper upon the first while the model remains within. Not only the glued joint, but the whole paper shell, needs to be strong enough to bear the rubbing it will receive in putting on the next coat.

The requisite thickness having been gained, it will be well to give the surface a rough dressing by filing and sand-papering—in a lathe by preference—in the case of a rounded object like the present. This preliminary dressing makes the paper absorb the oil better. The lower end has then to be smoothed off, and the bottom, which will be cut from a piece of paper panel, glued on.

The article is now ready to be laid to soak in a bath of linseed oil, in which it should remain for, say, two or three days. When taken out it will require to be dried in a warm, but not hot, stove or oven. The oil will be found to have penetrated every part of the mass, which will be hard enough to be turned in a lathe, or to be worked in any other way in the same manner as wood.

Mention has been made above of flat panel being required to form the bottom of the vase. Such panel will be required for many purposes, and making it is a very simple matter. The sheets of paper have merely to be pasted on a flat board (which will need to be cross-clamped to prevent warping), and the alternate pastings and dryings enumerated above will have to be gone through. If a panel becomes warped, as it may perhaps do, after being cut from the board, it may be straightened by being put in a cool place, as a cellar, under weights, and also weighted in the stove when drying.

As regards the paper to be used, it is no longer easy, or perhaps possible, to procure the thick, soft, unglazed paper manufactured for the trade in the palmy days of japanning; yet plenty of varieties are to be got well fitted for the purpose. It needs only that they should be thoroughly porous and pliable. With a thick paper the more rapid progress is made, but with a thinner one smoother and better work will, as is obvious, be secured, especially if the form be a difficult one.

Vases similar or approaching in form to Fig. 1 are frequently to be met with in old papier-mâché work fitted with brass feet and handles; but in Fig. 4, which is a vase somewhat more complicated and less easy to model, it will be observed that both foot and handles are made of paper. The handles are cut from a piece of flat panel and glued on. The core or model for this vase requires a separate piece of wood for the foot as well as for the lip.

Of a more ornate character is the vase shown in Fig. 5. This is a form sometimes to be found in old work, and was called the "Lily" vase. Its shape would seem to have been suggested by some favourite work in china. This vase is scarcely offered as an easy example for the beginner, but rather to show how the pasting process may be applied to designs of considerable intricacy. The rustic base and the stems which serve as handles are not like the vase itself, pasted, but are of pulp, built up a little at a time and stoved after each addition, the rasp being afterwards used to finish them.

(To be continued.)

ARTISTIC FURNITURE
EASILY MADE AND CHEAPLY PRODUCED.
BY DAVID ADAMSON.

An Overmantel with Cupboards
(continued).

Fitting Frieze — Bottom Boards — Moulding —Cutting Mitres—Mitre Box—Cutting Mouldings—Mitred Joints—Gluing—Ends of Cupboards—Dentils—Printers' Reglets as Dentils — Fixing Dentils — Doors — Framing for Doors—Rabbet or Rebate—Fastening up Frames—Panels—Fitting and Ornamenting Panels—Hinges and Lock—Shaped Pieces at Ends—Small Shelves—Painting and Finishing—Mantel Board—Fixing with Glass - Plates — Mirror for Overmantel.

When the shelf has been affixed to the two pieces, either the top or frieze may be fastened. Perhaps, as it will to some extent serve as a guide, the latter may as well be temporarily nailed into the recess made for it. Immediately behind it, and with the lower surface of the top flush with its lower edge, the frieze, the top piece or covering of the centre part must be nailed to the ends like the shelf. As it stands, if the frieze be taken away it is, in fact, another shelf precisely like the lower one, only set back ⅜ in. At this stage the job will consequently be as shown in Fig. 7.

Do not fix the frieze or top rail down yet permanently; better let it be removed altogether for the present, and continue the work by nailing up the two 11-in. boards. These are to be 8 in. from the bottom of the ends, and, it will be remembered, form the bottoms of the cupboards. The tops of the cupboards must also be fastened down, but, instead of them being within the ends, let them rest and be nailed *on* them. The job should now be as represented in Fig. 8, which is given to prevent any possibility of mistake as to the arrangement. One end, of course, only is shown. The frieze piece may next be finally placed and fastened down. See that it is quite long enough to fill up the whole of the space intended for it without leaving any unsightly gaps at the ends. Put one or two nails, or, in this instance preferably, screws through it into the inner ends of the cupboards, that is, those pieces in which the recesses were made; also a few, say, three or four, to hold it to the top of the centre part. Keep these latter as near the edge of the frieze as convenient, so that their heads may be covered by a strip of wood which will afterwards be placed there, and take particular care that all the screws are well sunk so that their heads do not project. A couple of screws should also be driven through the tops of the end cupboards into the frieze, when, if everything has been properly done, the whole structure should be perfectly rigid and firm. As the work proceeds, test it continually with the square. Do not be afraid of using this too frequently, and if it shows anything wrong do not pass the defects over without, at least, an attempt to correct them.

Now let us turn our attention to the moulding, which is such an important feature in the overmantel, and on which, with the shaped pieces at top of the centre opening and under the cupboards, almost the whole decorative effect may be said to depend. I do not advocate any beginner making his own mouldings, as they are not easy, and to form the various members properly not only implies skill but a stock of planes such as a novice is hardly likely to possess. Suitable machine-made mouldings are to be procured in any large town, and where the amateur cannot get the address of a maker or large dealer he may generally be able to obtain them through a builder, and many large cabinet-making firms will also be able to assist him. Still, as this may not be specific enough, it may be stated that in London machine mouldings may be obtained from Henry Smyth, 33, Wharf Road, City Road, N., who, as British agent for Ekman's Mechanical Joinery Company, of Stockholm, holds a large stock of them. The prices quoted are per 100 feet in lengths of about 12 feet. For mouldings of a finer character than those generally in request by builders, Mr. Samuel Elliott, Albert Mills, Newbury, Berks, may be recommended. In the overmantel the moulding is one of a very ordinary character, as will be seen by Fig. 9, where it is represented in section, full size. Of course, it by no means follows that others must adopt the same pattern, but the illustration gives a good idea of the size of what is suitable, and those who have the catalogues of either of the firms whose names have been given will have no difficulty in finding something appropriate. For example, among Smyth's architrave and panel mouldings there are over fifty designs, any one of which might be selected. I ought to say, to prevent disappointment in case of some choicer wood being used than that from packing cases or pine, that builders' mouldings are stocked almost exclusively in the latter wood only.

Whatever may be the pattern of the moulding, the only difficulty that it is possible there can be in adjusting it will be at the mitres or corners. If these are not accurately cut the members of the parts will not fit to each other, and no amount of "doctoring" can make them look right. Therefore, let every pains be taken to ensure a good mitre. It is not difficult with proper appliances, the simplest of which is perhaps that about to be described, and one which is as useful as any. It consists merely of three pieces of, say, 1-in. stuff, and of any convenient length—12 or 18 in. will be enough—fastened together as shown in Fig. 10. The sides must be parallel with each other and at right angles with the bottom. Saw cuts at an angle of 45 degrees (half a right angle) across the thickness of the sides must be cut perpendicularly through them from the top to the bottom, the position of the cuts being such that the saw will work through both sides, as in the plan, Fig. 11. The cuts form a guide for the saw, which it is evident will cut through any moulding held in the box, as shown in section, Fig. 12, at an angle of 45 degrees, and form a true mitre. By having cuts straight across, it will also be seen that this simple mitre box may be used as a guide in making rectangular cuts, as at the back ends of the mouldings. The manner of using this little appliance must, however, be so evident that it would be superfluous to make further remarks about it. A fine saw should be used in cutting the mitres, which I imagine there can be no doubt about; but in case any one should not understand, Fig. 13, showing a mitred joint, is given for his special benefit.

In cutting off pieces of mouldings for the ends, it will be as well for beginners to have them fully long. The surplus can easily be sawn off from the back afterwards. If preferred in this overmantel, mitred joints may be dispensed with altogether, and probably among experienced workers there would be considerable diversity of opinion whether it would not be preferable to shape the end to the moulding. After due consideration I am, however, bound to say that I do not fancy any but those skilled in such work would make so neat a job this way as by mitreing, nor would it have so workmanlike an appearance. Were we discussing this latter point, however, there is much that might be said on both sides, and it may fairly be left to professional technical journals to treat of. The moulding along the front may be cut of about the proper length, for as a break will have to be made at each of the four ends, any little irregularity can always be provided for when fixing up.

Before gluing any of the mouldings to the work it will be as well to make the mitred joint. To do so, cut the mitred end of the front piece, as shown in Fig. 14, where it will be seen that its length—if one may call it so—is just the same as the thickness of the end moulding. On fastening the two together it will be found that by this means the "return" of the moulding round the front end is effected. The result is, in fact, just what would have been got had the end of the moulding been cut as it was suggested above it might be, with the advantage, however, that there is no end-grain visible nor any unsightliness from the possibility or probability of the members not being evenly cut. Of course, both end mouldings must be treated in the same manner, the mitres being glued.

When the mouldings are ready for fixing they may be glued on to the ends of the overmantel, the upper surfaces of the mouldings being a little higher than the tops of the cupboards in case it should be thought afterwards that any blocking is necessary. This will be explained later on. A few brads may be used as auxiliary to the glue, but they should not be necessary, except, indeed, in hot, damp climates, where glue alone is not to be depended on. Without, however, giving here full instructions about the proper preparation and application of glue, both of which, especially the former, are of great importance, I may give the following hints:—See that the glue is hot; that both surfaces of the pieces to be attached are at least warm before gluing them; do not put the glue on too thickly; do not "dab" the moulding down, but slide it gently about to drive out air bubbles and superfluous glue; squeeze as much as possible of this out, and use cramps to hold the parts together tightly till the glue has set. Finally, those who do not understand the preparation of ordinary glue thoroughly will find it better to use Le Page's carriage glue. Why? Simply because this is always reliable, which even the best ordinary glue never is unless properly prepared.

The remainder of the moulding for the front must be cut into three lengths, one of them exactly the length of the centre opening, the other two the same as the cupboards. Perhaps before cutting them it will be as well to prepare the four small pieces of wood which are attached to the upper parts of the upright pieces or ends of the cupboards. These pieces, as will be seen in Figs. 2 and 3, rise above and project a little in front of the moulding, the shape of which they, to a certain extent, follow. The wood of which they are formed should be exactly the same thickness as that of the ends to which they are to be attached. Fig. 15 shows in full size the shape of these pieces with the relative positions of the moulding, etc. The work, of course, is done with the fret or bow saw, as already described. These pieces are merely glued on to uprights, though I have used a couple of fine brads as well, driven in through the thin flat part.

When the mouldings and these facing

parts are fixed as described above, the dentils under the former may be prepared and fastened as well as the small square strip just along the bottom edge of the frieze. The exact size of the dentils is not of much importance, but the same cannot be said of their uniformity, not only in size but in every other respect, such as thickness and spacing. The easiest way to prepare them is to get out slips of the required width and thickness. Place several of these pieces on top of each other, fastening them here and there with a small brad or screw nail so as to form a solid block. Mark off on the top piece the required width (or length) of each dentil, this being best done with a pair of compasses, and saw through the block at each mark. The box, as for mitres, but with cut straight across, may be used as a guide for the saw, but it need hardly be suggested that the fret machine affords a ready means of doing the sawing, especially as from the comparatively fine teeth of the fret saws the cuts will be so clean as to need little, if any, papering to smooth them down. I have used that excellent machine, the Britannia Company's No. 8, to make a number of dentils, and, by forming a kind of guide to work along and on the top of its straight-sided table, the sawing is bound to be even. If some contrivance of this kind is not used, it will be desirable to mark across the top piece of the dentil stuff with a square.

Those workmen who desire to reduce the preparation of the dentils to the smallest amount of trouble may be informed that printers' reglets come in very handy. They are pieces of wood about $\frac{5}{8}$ in. wide of various thicknesses, each of which is known by a special name, and is always true to gauge. The labour of cutting wood to the required size is thus done away with altogether by those who prefer buying a few reglets ; all that is then necessary being the cutting up into dentils. As some guide for the size of these it may be said that "pica" reglet is about the right thickness for such a piece of work as the present, and that $\frac{1}{2}$ in. is sufficient for the width of the dentils, etc. As all may not care about using reglet stuff, it may be said that $\frac{1}{8}$ to $\frac{3}{16}$ in. will do very well for the thickness of the stuff used for them.

Before gluing any of the dentils on to the frieze, mark this out for them in order to avoid irregularity in spacing. A dentil, not a space, should abut against each end, as shown in Fig. 2. In fixing them it will be just as well to use a needle point to each in addition to glue, which should be laid on as thinly as possible, for if any exude it will be found a tedious and troublesome job to remove it. The small piece along the lower edge of the frieze may be glued and bradded. Reglets, which, by the way, are sold at very low prices in lengths of 3 feet, will do very well for this, though perhaps the proportions shown on Fig. 15 present a more sightly appearance.

Now for the doors of the two cupboards. The construction of these will tax the novice's skill somewhat, though there is really nothing difficult about it. Naturally those who have acquired some facility in joinery will know that the top and bottom rails are attached to the upright pieces of the frames—or, as they are technically called, the styles, either with mortise and tenon joint or by dowelling. The tyro, however, may want something easier than either of these methods—or, if not easier, one more adapted to and likely to give better results in untrained hands. As has already been hinted, this may be managed by halving the pieces together. What this means will, I think, be understood without more words by Fig. 16, where the top rail is shown with half the thickness from the front, and the style with half the thickness from the back, cut away. On fitting these two together, it is evident that the front surfaces of both will be level.

Before showing how to manage this operation of halving in a systematic manner, let us see about the wood of which the door frames are to be made. From the directions already given, it goes without saying that the thickness is about $\frac{3}{4}$ in., though if they are more it is of no consequence. The width of the framing should be about $1\frac{3}{4}$ in. Four pieces will be required for each door—viz., two styles the exact length of the height, and two rails the width of the cupboard. These must be halved to fit each other, and, simple though the operation may be, it goes without saying that by method the work may be facilitated. In the present instance we will suppose that the different parts are to be literally halved, and the necessary rabbet in the frame for the panel to lie in to be cut afterwards. Not, perhaps, the most workmanlike way of proceeding, but the easiest for beginners. Skilled workers will know how to go about it otherwise ; and perhaps, by-and-by, other methods may be described in this series of papers, leading the novice from easy construction onwards. For the present, having got the four pieces for the frame of the door ready, proceed as follows :—Mark the width of the styles off from the end across the front of the rails. Do the same on the back of the rails, taking the width of the styles as a guide. Set the gauge to about half the thickness of the wood, and from the points mark off on top, bottom and ends. There are now guide lines for the saw to remove the pieces, and it will be well to saw within the lines, so that the space made by the saw is included in the waste to be removed. If not the spaces will be too large, and a good fit will not be obtained.

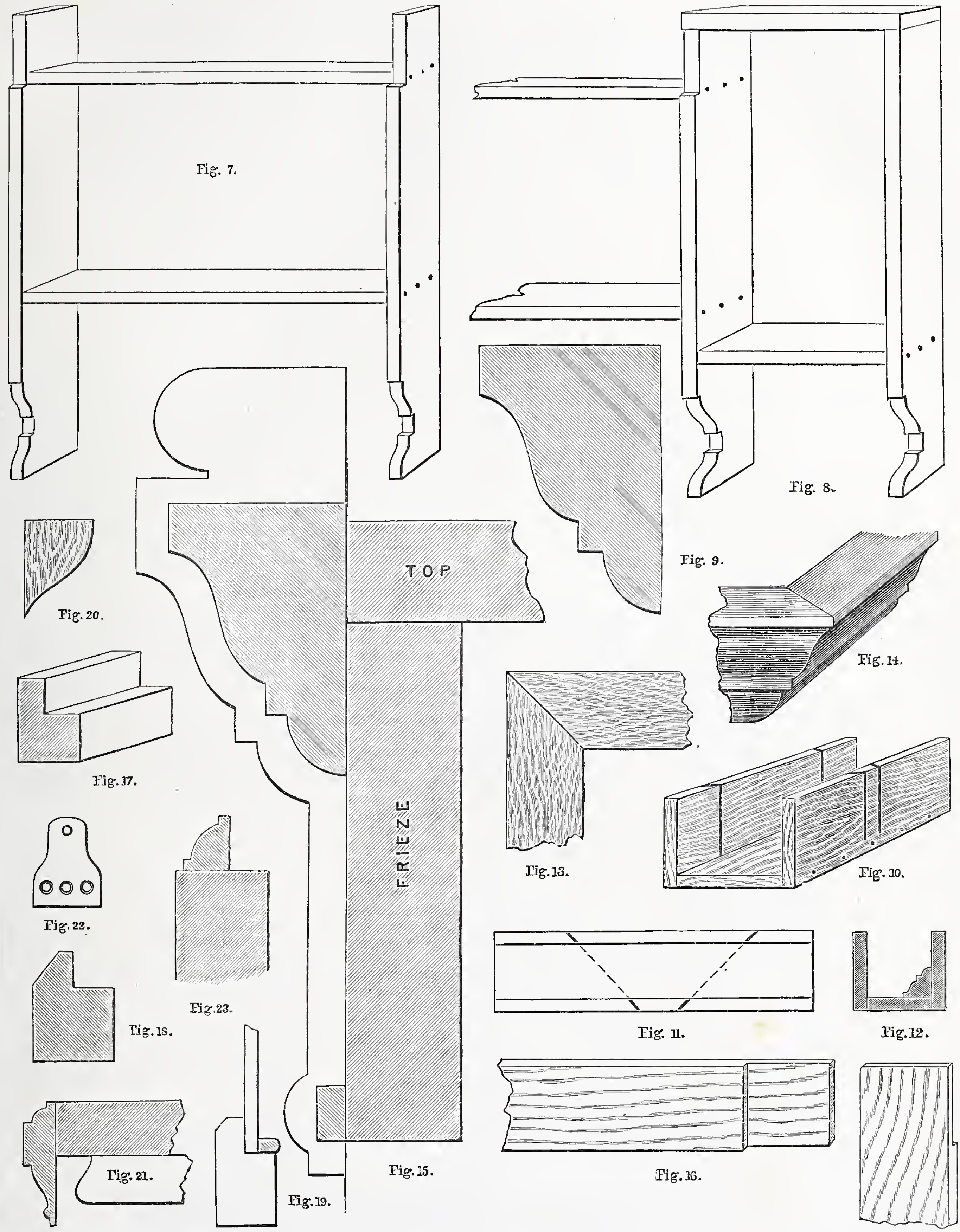
The rabbet or recess round frame has still to be cut, and to prevent any misunderstanding by the use of this technical expression a part of the rabbeted frame is shown in section by Fig. 17. The recess is the rabbet, or as it is sometimes written, and perhaps with greater regard to correctness, "rebate." The proper tool to do this with is the rabbet plane, but a gauge, preferably a cutting gauge on account of the deeper cut it makes, and an ordinary chisel may be made to do very well. The gauge should be set to mark about $\frac{3}{8}$ in., and a line scribed with it round the inner thickness of the frame, working from the front. The reason why the marking for this and for the halving should be done from the front is that, in the event of the thickness of rails and styles not being identical, any inaccuracy will be at the back of the door, where it will not be so conspicuous. The other dimension for the rabbet is not a matter of much consequence, provided it is sufficient to hold the panel in. The marking being done, the piece can easily be cut away with a chisel, especially if a cutting gauge with the blade set to cut a good depth has been used. It will be understood that the rabbet is only cut round the opening, and not extended to the ends of the frame pieces. The edges may be left square in front, but it will be neater to bevel off the rails, as shown in section, Fig. 18. This will be done by shaving off the sharp edge with a plane. The frames may be fastened up with glue alone, but perhaps it will be just as well to assist its adhesion by a couple of screws at each joint. As already suggested, brass screws driven from the front could hardly be regarded as objectionable, unless on the ground that they are not usually seen in furniture ; but there is no necessity for them being visible, except when the door is open, if they are driven in from the back. Care will, of course, in this case be taken not to bore the holes right through, nor to use screws as long as the thickness of the wood.

When the frames are ready the panels may be got out. They are only thin stuff, $\frac{1}{4}$ in. thickness being quite sufficient. In the illustration, Fig. 1, they are shown quite plain, but the intention is to cover them with lincrusta walton. As this may not be known, I may say that it is an embossed fabric somewhat resembling thin linoleum. It is principally used as a wall covering, but for decoration of a cheap kind it is admirable. The effect of a panel covered with it is very much like carving, and as the designs in which it is prepared are excellent it is superior in appearance to badly carved work. I shall, however, have more to say about lincrusta later on, but in the meantime I throw out the hint that it may be got through almost any high-class decorator.

The panels, whether plain or covered with lincrusta, should fit closely, and be fastened in with a few brads driven into the frame to prevent them falling out. Certainly a neater way would be to fix them in with small slips of beading, but this entails more labour, and so may not be judged necessary for such a piece of furniture. Still, for those who prefer this mode of fastening, Fig. 19, showing rail, bead, and panel in section, is given. The beading may be glued to the frame, but it will be better either to brad or screw it in case it should be necessary to remove the panel at any subsequent time for carving or other decoration. On no account, especially if the panel is not covered with lincrusta or something similar, glue it into the rabbet. If it is glued and the wood is not perfectly dry it will very likely split in shrinking. If unglued it will be able to "play" and contract without splitting.

When the door has been made it may be hinged, but as particulars of the whole of this part of the work will be fully treated in a separate paper it will be unnecessary to describe the operation in detail here. The size of the hinge is unimportant, but from $1\frac{1}{2}$ in. to 2 in. will be suitable, the "butt" variety being the proper kind. The door in mine has no fastening, as it is so hung that it keeps shut when closed, but of course a lock may be fitted if desired. "Cupboard" locks are the sort, one with "bolt shooting to left," and the other "to right;" but as lock fitting will come in in some other piece of furniture, description must be left for the present. To prevent the doors being forced too far in, a small block should be glued inside the cupboard. The block or stop will be more out of the way if fastened near the top, but if a lock is used perhaps the best place for it will be just behind the hole into which the bolt will shoot.

The shaped pieces placed at the ends of the overmantel and the small shelves have not been mentioned, but they require very little description. Like all the rest of the curved outlines, they were cut with a Britannia Company's No. 8 fret saw, and are of the same thickness as the ends. The only caution I would give is that the upright pieces should be long enough to fit closely



Artistic Furniture. An Overmantel with Cupboards: Details. Fig. 7.—Inner Ends with Shelf and Top. Fig. 8.—Ends of Overmantel showing Attachment of Shelves and Top. Fig. 9.—Section of Moulding. Fig. 10.—Mitre Box. Fig. 11.—Plan of ditto. Fig. 12.—Section of ditto with Moulding. Fig. 13.—Mitred Joint: Plan. Fig. 14.—Mitred Moulding. Fig. 15.—Facing Piece of End with Cornice. Fig. 16.—Construction of Halved Joint. Fig. 17.—Rebate or Rabbet. Fig. 18.—Bevelled Edge. Fig. 19.—Section of Rail, Panel, and Bead. Fig. 20.—Small Side Shelf. Fig. 21.—Bottom Board and Moulding Covering and Concealing Shelf of Mantel. Fig. 22.—Glass-Plate or Ear-Plate. Fig. 23.—Moulding.

up to the piece at the lower edge of the frieze, and that they should be neatly tapered off to its thickness. The shelves are shaped as in Fig. 20. By screwing the shelves to the shaped uprights or side brackets, as they would probably be called by most cabinet makers, and then to the ends, it will only be necessary to drive a brad or two in through the upper part of the brackets to make the whole secure without any unnecessary display of nails. Of course, screws may be driven through the ends at the back of the cupboard into the brackets to any extent. The shaped pieces under the cupboards and at the top of the centre opening speak for themselves so far as outline is concerned. They may be of wood ¼ to ½ in. thick, but no object is gained by having them too stout. They are fastened by small blocks of wood glued to them and to the parts above them, as well as glued up themselves. A couple of brads are also driven through each where the wood is narrowest.

This operation completes the construction of the overmantel as it stands, the finishing having been given by painting with an enamel paint of a dark chocolate colour. That, however, is merely a matter of detail, as in the event of any one finishing the work with paint the surrounding colour should be taken into consideration, and it is almost unnecessary to point out that both bright and light-coloured painted furniture seems to hit the popular taste just now. A sufficient range of colours in enamel paints is to be had, so that the overmantel may be finished in almost any tint.

Leaving this, therefore, it will perhaps be more serviceable to describe how the back of the overmantel may be fitted either with glass, wood, or other panels. Perhaps before doing so it will be as well to advise that the overmantel instead of resting on the mantelshelf should rest on a board, which of course will cover the shelf. My own reason for using a board was that the shelf is shaped in front—serpentine, I believe, is the correct description. Now, however beautiful the curved line thus indicated may be to some, it certainly does not accord with such an overmantel as the present one. The wooden board, as it may really be called, covers the embodiment of the "line of beauty," which, however, I am afraid Hogarth would scarcely recognise as such. A moulding is planted on the front and ends of the wood, so that the original shelf is not seen. (See Fig. 21.) The moulding at the front corners is mitred, and is attached to the shelf with glue. Instead of a moulding I may suggest a fringe or mantel-frontal for those who, like dust accumulators, though many of these frontals are so beautiful that one ought hardly to object to their use. Much, however, must depend on the kind of room the overmantel is for. In a work-room excess of drapery is objectionable, in a drawing-room tolerable, for it is elegant—no, that's not the fashionable word nowadays; call it rather artistic or æsthetic. Any way, the reason I advocate a wooden shelf is that it gives a finish to the overmantel, and on some future occasion I hope to prepare a woodmantel to complete the fireplace, and as soon as the design is ready I shall be pleased to describe it in WORK.

In ordinary circumstances no fixing will be required for an overmantel such as the present. The shelf is laid on the mantelpiece, and above it the overmantel. If, however, it is necessary to fasten it to the wall it may easily be managed with one or two glass-plates. These are made of brass, shaped as shown in Fig. 22, and owe the perhaps rather misleading name by which they are generally known to the fact that they are much used for fixing chimney glasses to walls. They are obtainable at most furnishing ironmongers. To use them, screw the broad part of the plate to the back edge of some part of the article so that the smaller end is uncovered. The plate then lies flat against the wall, into which a nail is driven through the remaining hole in the plate. It is just as well to keep the plate or plates as near the top of any overmantel they are used to hold to the wall. In the present one the most suitable place seems to be at the back of the tops of the cupboards, one to each if two are used, or if only one then at the back of the top centre board. The plates will, of course, be fixed so that they are upright, projecting above the tops, as the nails into the wall can be more easily placed than if the plates hung downwards. Like many others, however, this is a detail which can only be generalised on, and enough has been said to enable any one to do what is necessary.

Lastly, let me say if glass is desired behind the overmantel, or, to put it more widely, if the wall behind the overmantel is to be covered, some sort of rebate must be made for the glass or wood panel to fit into. A frame, similar to that for the doors, may be made to fit into the spaces, and either glass or wood let into them. A simpler way, however, will be to get some small moulding, such as shown in Fig. 23, and glue it round the openings, leaving just such space behind as will form the necessary rabbets. It must be mitred at the corners, and besides forming a rabbet will have a suitably decorative effect. No backs will be required for the cupboards as the wall closes these behind. I trust I have now shown sufficiently and clearly how a useful piece of furniture may be simply made from such unpromising material as an old packing case, and if it may seem that the instructions are lengthy, let me say that as many of them are applicable to the construction of the remaining articles of the same kind which are projected, and will be described in following parts of WORK, it will not be necessary to repeat them. It will be taken for granted that those who wish to make any of the other things which will be described have read the present directions. This will prevent a lot of recapitulation, and allow succeeding articles to be briefly treated, only details of any operation not necessary in the overmantel being subsequently described. Possibly by the time we have done the novice now may find that he has gained a very fair idea of general construction as applied to wood work.

PHOTOGRAPHIC NEGATIVES:

Their Reproduction and Multiplication.

BY L. IVOR POOLE.

IN connection with my business, which, I may say, is not photographic, I find it convenient to resort to photography occasionally. As the prints are sometimes wanted in large quantities, that is to say, a few hundreds from the same negative, some speedier method than that of printing one at a time naturally soon suggested itself as desirable. In other words, I wanted to print several from the same negative—a negative which should be a reproduction of the original. As the pictures are mostly small, it occurred to me that, by reproducing the negative several times on the same plate, not only might the plates be economically used, but several prints might be got on the same piece of paper—*i.e.*, instead of arranging the printing frame for each picture, and so losing much time, a number of prints might be got at one operation. I may say that for my purpose it is not necessary that the prints shall be first-rate specimens of photography, or that they are all printed and toned equally. In fact, not to make any mystery about it, they are required for advertising purposes. What they show or advertise does not matter, but having explained what they are wanted for, any business man will readily understand that economy of production, both as regards time and money, is essential.

Well, seeing that the desirability of producing them quickly and cheaply was so great, I made various inquiries. Whether these were wrongly directed I do not know, but it is certain I could get no satisfactory explanation of any process that would suit. I was recommended to try the various quick printing processes, but none of them, either owing to difficulty or expense, came up to my requirements, and I could get no information how to reproduce negatives easily and quickly. The thing seemed to be a very simple matter, and doubtless would have proved so in the hands of an expert photographer. Even to me the work was very simple in theory, but in practice the failures were more than I care to contemplate, though why should it be so? If a certain road is paved with good intentions, the road to success is marked with failures which serve as finger-posts directing onwards. This was how I worked my theory out—not an original one, no doubt. If a positive could be printed from a negative, could a negative not be printed from a positive? Certainly. Could not such a reproduced negative be used to print other positives from? Again, certainly. Further, could not several negatives be made on the same plate, just showing what was required, and leaving the superfluous margin out? Yes; it seemed easy, but I was a long time before hitting on a satisfactory method.

At last, after many trials, I did so; and the result is that, instead of printing each photograph separately, when I want a number of any I reproduce a number of small negatives on one large plate. For example, just in front of me as I write is a "whole plate," containing fifteen facsimile negatives, not, perhaps, all quite so brilliant as the original from which they are reproduced, but sufficiently good. The consequence is that it is only necessary to put one piece of the sensitised paper in the frame and fifteen photographs are printed on it. These fifteen are afterwards easily separated with a pair of scissors.

Without going into the details of the various methods I have tried and discarded as being unsuitable from one cause or another, I may describe the process I adopt now, as it may not only be useful to others who are experimenting in the same direction, but may give them hints which will enable them to improve on it. If they do, perhaps they will give us the benefit of their experience in these pages, which no doubt will be open for any hints based on work actually tried. The notions may be crude, and the methods apparently self-evident, but some of us want a good deal of assistance even in such, and for the sake of us "duffers" I take the liberty of hoping that any particulars likely to be of use will not be withheld by our more skilful brethren. This will partly explain my presumption in explaining what, for want of a better title, is called the reproduction of negatives; and now I may remark that though I have said several of these are wanted on the same plate for my purposes, the same principle may be applied to the reproduction of a single negative.

This reproduction, it will be understood, may be useful occasionally when the original negative has been destroyed before a sufficient number of prints have been taken; and, as a matter of fact, I believe some such method is followed when it is not convenient to reproduce by a camera. I suggest this, as one evening lately, when I was preparing a quantity of negatives on the same plate, a friend who was with me happened to mention that he had destroyed a plate after having only got one print from it, although several were desired. My work gave him the necessary knowledge how with his own print he could reproduce any number. From my original negative, or rather from the part of which I want to print a number of copies quickly, I take a sufficient number of prints on the ordinary silver paper.

For instance, not to specify the things shown on my photographs, let us suppose that it is desired to reproduce one head only from a plate containing a group of several people. A piece of the sensitised paper is placed behind this head, and exposed in the regular way. The depth to which the printing is done must depend on circumstances, but, as a rule, better results are got from prints not quite so dark as those which are printed for toning. I aim at getting prints of much the same depth as if they were toned; that is to say, they are not printed darker than a finished photograph would be, no allowance having to be made for lightening by toning and fixing. These prints certainly may be toned and fixed in the usual manner, but these operations only needlessly complicate the work, for no one will need to be told that it is much more difficult to get a batch of photographs finished exactly to the same depth and shade than merely to print them equally.

Of course, when the prints thus produced are taken out of the frame they are kept in the dark till they are wanted, and light being kept from them, they retain their colour well enough to serve their purpose for some time. When a sufficient number of them are ready, their edges are cut and trimmed, each piece of paper being cut accurately so that they may fit well together. They are then stuck to a piece of glass, usually a spoiled negative, with the film washed off. This glass serves merely as backing to hold them flat during the printing of the negative. The prints need not be stuck down all over, as a small touch of some adhesive material—strong gum, or, what I generally use, glue—on each being sufficient. As the printed side must be uppermost, the plain side of the paper is stuck to the glass; and as the glue, or whatever is used, has the effect of increasing the density of the position, or, as it may now be called, the negative, *pro tem.*, at that particular place, it should be applied just behind the darkest part of the print. If this be done it will scarcely leave a trace on the subsequent negative.

When the prints are all fixed to the glass, this is placed in an ordinary printing frame, and the reproduced negative is taken from it. I proceed as follows, all this part of the work being done by gaslight, which not only allows me to utilise spare time in an evening, but is more reliable than daylight. The time for the exposure having been once ascertained with the artificial light, no guess work or calculation is required, as it would be with the variable shades of daylight. I always expose for these negatives with one particular light, so that making very slight allowance, according to the depth or thinness of the positive, the precise time for the exposure can be told to a nicety.

As some guide for others, I may say that I print under a common "pendulight," with a white shade over it. The frame during exposure lies on the table underneath, at a distance of, say, twelve inches from the flame. Time of exposure under these conditions is about thirty seconds, with a variation of five seconds, more or less, according to the density of the (positive) negative, for Eastman's negative paper and ordinary Ilford's. With the gas out, and by the aid of the ruby lamp, the plate or paper is arranged in the frame, which is then placed back upwards on the table till the gas is lighted, when the exposure is made as already described. The plate is developed afterwards in the ordinary way. It will then be seen that on the one plate the original negative has been reproduced, and by putting it in a frame with a sufficiently large piece of printing paper, the saving of time and trouble in producing prints must be manifest.

As a rule, I use whole plates for reproduction, but of course there is no limit to size. I do not separate each print at once, but tone and fix first, washing, etc., as usual. The backs of the sheets are then gummed over and left to dry, after which they are stored away, and the separate photographs cut off with a pair of scissors as may be required. There is then no more trouble in affixing them to their mounts than if they were so many postage stamps. Of course, gum could not be safely employed if the photos were intended to be durable, but for the purpose they are intended for it answers very well. The use of paper negatives has been alluded to. I use Eastman's, but no doubt any other kind would do, and I much prefer them to glass for this kind of work. For example, when an unusually large number of photographs is wanted in a hurry, several sheets of the paper negatives can be stuck on one piece of glass, if necessary as large as a full sheet of the silvered paper. The paper may seem to militate against speed in printing, and no doubt it is a trifle slower than glass negatives, unless these be rather dense. A well-prepared paper negative, free from stain, however, prints with a rapidity when its opacity is reduced by oiling, which may seem remarkable to those who have not tried them.

Perhaps something ought to be said about this oiling and sticking to the glass, though this latter is only necessary in the case of very large negatives, say when more than one sheet of the negative paper is used in the same frame. One negative sheet may be simply placed on the glass, to which it need not be stuck in any way. For the oiling, almost anything greasy may be used. There is a stuff, a preparation I believe of vaseline, called "translucine," which is recommended as specially applicable, but never having tried it, I cannot speak positively of its merit. Melted paraffin is not a bad substance, but I always use something more easy. To touch on everything that I have used would be to give a tolerably long list of oleaginous substances. I will content myself with mentioning two or three. Castor oil is—apart from its smell, and, I may add, its taste—a favourite. It penetrates the paper well, and is colourless, the one quality reducing the granulation which is often noticeable in prints from paper negatives, and the other not hindering rapid printing. Vaseline is also good, but its slightly yellow colour is not always convenient. Butter has been employed when nothing else has been handy, and I am not sure that it does not do as well as any of the others.

Whatever may be the oil or grease used the paper must be well saturated with it, and sufficient time given to allow it to soak in. By degrees, some of the oil evaporates, and the negative, instead of being clear all over, becomes patchy, some parts or spots being more opaque than others. The remedy, of course, is to re-oil. I give a liberal quantity of oil, and rub off superfluity with a soft rag, being specially careful that none remains on the film side of the negative, as, of course, this is next the silvered paper, which, if not spoiled, would not, at any rate, be improved by grease.

When the newly produced negatives require to be stuck to the glass, which, as I have said, is only necessary when several of them are used in one frame, I do not stick them down all over, but just sufficiently to keep them in position. Glue or paste, of course, does not adhere properly to the greasy negative. This generally can be arranged with a margin round it or on one side, and some strong adhesive material may be used, but I find it very much simpler to use pieces of postage-stamp margins, part being stuck to the glass and part to the negative. It sticks well to the gelatine film, and if necessary can be easily removed by damping. As, however, one or two small pieces only are required, the negative can simply be torn away from the glass, and fastened down with fresh stamp paper a good many times without any necessity for damping.

I should not omit to mention that instead of silver prints for the preparation of the reproduced negative, prints on the Eastman film may be taken, and the multiplied negatives taken from them. The other operations are identical, and though this rough-and-ready way of practising photography may not commend itself to the "artist" photographer, it will no doubt be of some use to those who, without requiring perfect reproductions, wish to have them quickly and in quantity without much expense.

A SIMPLE CEILING IN WOOD.

With Hints for Wall Panelling on the Same Plan.

BY HIRAM PRICE.

I.—Ceiling with Longitudinal Arrangement of Mouldings.

In common, I presume, with many to whom this periodical promises to be a boon, I am accustomed to do many things which people generally consider it necessary to pay other men to do. Wishing to have a house of my own, and one after my own mind, I have constructed a dwelling without employing either architect or builder. With a bricklayer and a carpenter acting under my own directions and supervision, I have raised a structure which thus far answers satisfactorily all the requirements of a home, and one, moreover, which embodies most of my own theories and views with regard to domestic architecture. Its fittings are mainly the work of my own hands. In a house so built, I make no question but that there must be many features which would have an interest for the readers of WORK. That feature, however, which just now I desire to bring under their notice is the peculiarity that throughout my dwelling no plaster whatever has been used. I object to plaster. It is in my opinion at the same time a costly and an unsatisfactory thing, as well as being a material in which an unprofessional workman like myself does not care to dabble.

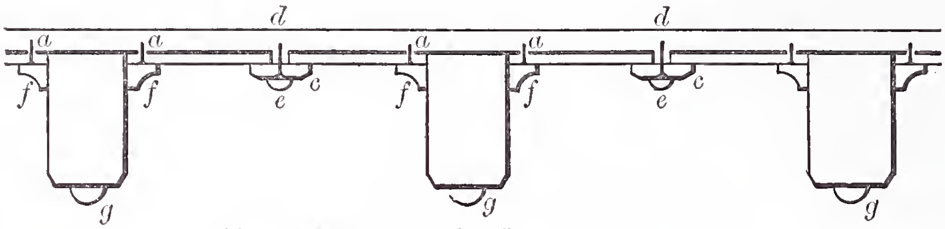


Fig. 1.—Wood Ceiling with Floor above, in Section.

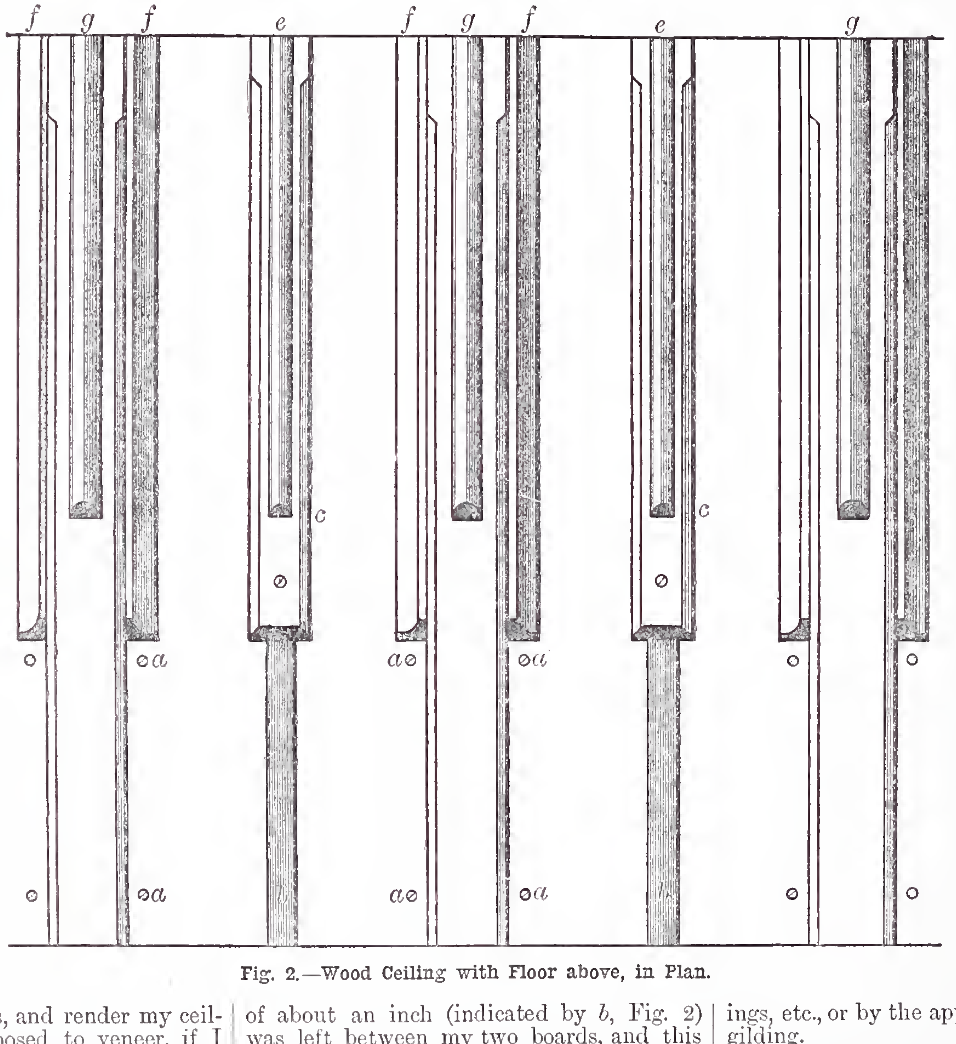


Fig. 2.—Wood Ceiling with Floor above, in Plan.

Now with walls there are abundant ways of dealing to the exclusion of plaster—you may batten and paper them, you may panel them, you may hang them with tapestry, or with pressed and moulded bricks laid carefully and neatly; you may, for certain purposes and situations, make the inside surface of your wall sufficiently pleasing to the eye to be left uncovered. There are such uncovered walls, relieved by ornamental brick mouldings, in my house. But, in the case of ceilings, one has fewer resources at one's command, and how I dealt with mine may be worth describing.

As I proposed to make an ornamental feature of my joists, I had them planed and stop-chamfered before being placed in position, and upon these the flooring boards were afterwards laid in the usual manner. My flooring boards were, as is customary, planed on the upper surface only, and left rough below; consequently, when nailed down by the carpenter, they presented anything but a pleasing sight to the spectator when seen from beneath. To do away with this unsightliness, and render my ceiling decorative, I proposed to veneer, if I may so use the term, between my joists with a second thickness of boarding which should be planed and finished.

In thus using thin board I knew that I should have a difficulty to contend with in the tendency common to all new timber used in a house, and which in thin board especially shows itself—that, namely, of shrinking whilst drying, and thereby causing the formation of ugly chinks; or, if so fixed as to be prevented from shrinking freely, of cracking and splitting. How I overcame this difficulty may be seen at a glance by reference to Fig. 1, in which is drawn a section of the floor and ceiling. The arrangement there shown has enabled me to avoid betraying any chinks, and to keep my wood from much danger of splitting.

The spaces from joist to joist which had to be covered were 15 in. wide. For each space I provided two 7 in. widths of planed ½ in. board; and laying them close to the joists, I secured them to the flooring above by screws driven 1 in. from the joists and a foot apart. These screws are shown in Figs. 1 and 2, and are marked *a*. A space of about an inch (indicated by *b*, Fig. 2) was left between my two boards, and this I covered by the strip of moulding marked *c* in the last-named figure, and also indicated by the same letter where seen in section in Fig. 1. This strip was 2 in. wide and an inch thick, and was fastened by screws to the flooring above. These screws, as shown in *d*, Fig. 1, were driven through its centre, and not, be it remembered, through its edges where they overlap the veneering boards. The object of this will be apparent—it is desired to *support* the edges of those boards without absolutely *fixing* them, that, thus being attached on one side only, they may have liberty freely to expand or contract with the alternations of damp and dryness, heat and cold. The most ordinary cause for the splitting of boards is thus avoided.

By this strip of moulding I hid the opening between the two boards, and I rendered the strip more ornamental, whilst at the same time I covered the screws which secured it by the piece of half-round beading (*e*, Fig. 1) which I fixed along its centre with needle points. The same beading is also shown under the same letter of reference in Fig. 2.

To cover the screws which fastened the veneering boards, and further to add to the enrichment of the ceiling, I then ran a strip of hollow moulding along the angle formed by the joist and the veneering board (*f*, Figs. 1 and 2), fastening it to the joist with needle points. Lastly, I gave a finish to the under surface of my joists by running a half-round moulding, similar to that before named, along their middles (*g*, Figs. 1 and 2), and fixing it in the same way.—N.B. Needle points are, for such purposes as this, far preferable to brads, as they can be broken off level with the surface of the moulding, and are practically invisible. Of course it is only for very light work that they are available.

For my own ceiling, I used only yellow pine and red deal, and these were merely stained and varnished. But I gained a certain amount of relief by staining some of my mouldings of a deeper shade than the general tone. I would, however, suggest that there are two ways in which a ceiling thus constructed might be made to give scope for considerable decorative taste: either by using woods of different and ornamental kinds in the veneering boards, mouldings, etc., or by the application of paint and gilding.

To a man handy with carpenter's tools, but not with the brush, the first method would no doubt chiefly recommend itself; and by a judicious selection of woods, in which colour and shade were well contrasted, a good effect might be produced. But the woods would be costly, and mouldings in such woods are not kept in stock by those who sell such things, and would have to be specially struck, which would cause additional expense.

To any one more at home with the paint brush, the second plan may seem the better:

it would cost less and be more effective. For such a purpose a good deal of bright and positive colour might be employed. On a ceiling brilliant colouring can be used more freely than on a wall. On the latter anything very pronounced looks crude and vulgar, because the eye is constantly resting upon and criticising it. But at a ceiling we rarely look directly; at most times we have but an indistinct sense of its existence; and to derive pleasure from any ornament upon it, our perceptions demand that that ornament should be pretty boldly made out. I am not, however, prepared to offer a scheme of colour for such a ceiling, and am now throwing out suggestions merely. My own wooden ceilings were merely stained and varnished.

In one respect I must admit that my work has not given me complete satisfaction: my ceilings transmit sound too freely. Now, this is a disagreeable, though, perhaps, scarcely to be called a serious, defect; for, without being a conspirator or murderer, one may have matters to talk over in one's house which it is not expedient to have heard by every person who may happen to be on the floor below, or the floor above, as the case may be. We like to feel sure of our privacy. Nor does any one feel at ease when he knows that every little sound he makes in moving about his bedroom—harmless as those sounds may be—is distinctly audible to those in the room beneath. Moreover, like thin partitions, floors which transmit every trifling noise are too much associated in our minds with cheap jerry-built houses to be ever altogether pleasing to us. I must own this defect to be a weak point. Yet I can now see how easily this inconvenience might have been avoided, and have a suggestion or two to offer on the subject for the benefit of any person who is inclined to ceil his rooms after my method. Sound might to a great extent be deadened by the simple and easy precaution of putting felt between the two layers of board; an inodorous felt of course to be used. Two or three thicknesses of the paper felt used for laying under carpets would, I imagine, be cleanly and effectual for the purpose. A felt in which the fibre is woollen is no doubt a more decided non-conductor of sound, as well as of heat, than one in which the fibre is vegetable, but it has disadvantages in other directions; and though I do not speak on this point from experience, I should say that a paper felt would be best for the present work.

Or, in case the worker prefers to cut off sound in a more thorough and substantial manner, he might adopt some such plan as that shown in Fig. 3: a space (h, h, h) might be arranged between the two layers, to be filled with some non-conducting substance, such as pugging or sawdust. Pugging—a rough mortar, that is—when thus used in Scotland is emphatically termed "deafening," and admirably answers the purpose of intercepting sound; it also goes far towards rendering the floor fireproof. It, however, weights the joists heavily. Sawdust, which is light, will to a great extent answer the purpose of a non-conductor of sound, and might, by putting a little powdered alum with it, be rendered fireproof. This would be adopting the plan employed in the packing of fireproof safes. Alum, it will be remembered, holds a large percentage of water in suspension, which, at a high temperature, it gives off in the shape of steam. Hence alum holds towards fire very much the attitude of a dog in the manger—it will neither burn itself nor let anything near it burn.

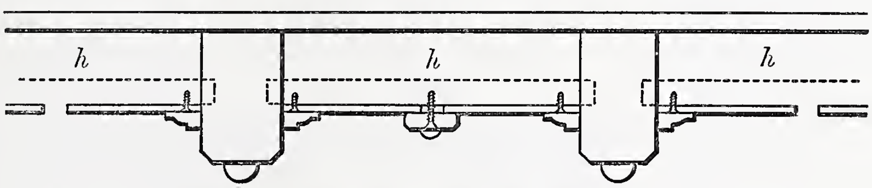


Fig. 3.—Wood Ceiling. Section, showing Space contrived under Floor for Packing.

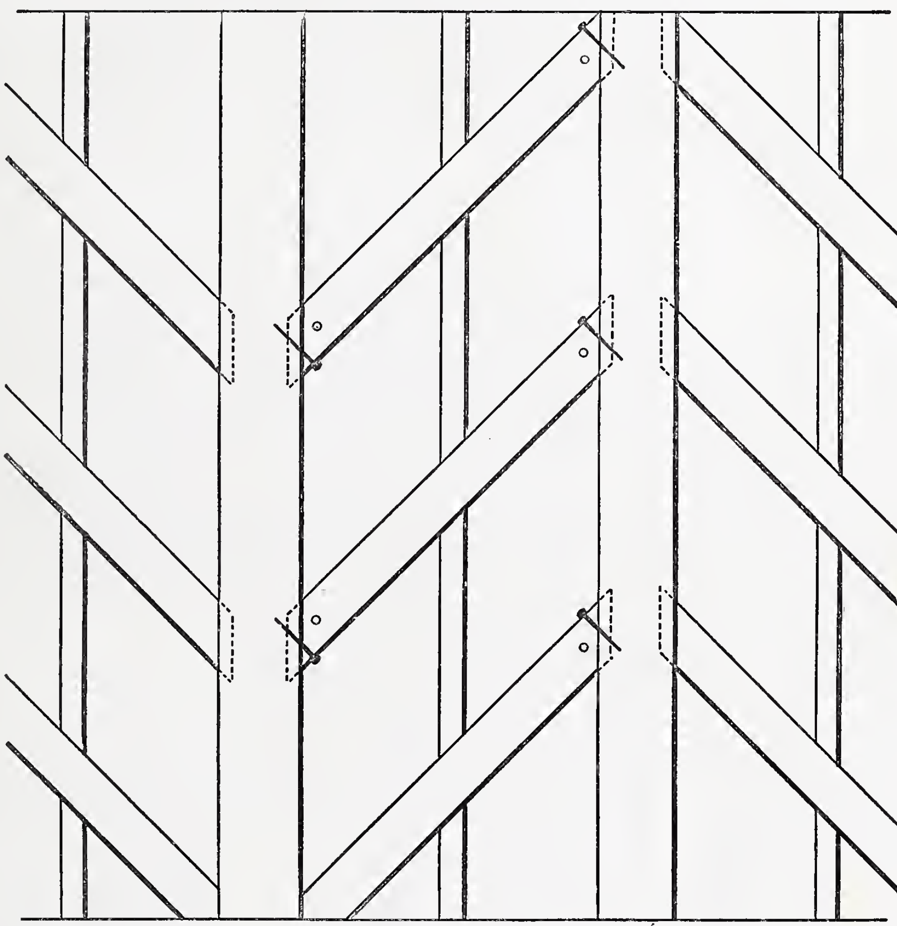


Fig. 4.—Wood Ceiling. Plan, showing Alternative Arrangement for Support of Veneering.

It is said that the discovery of this property in alum is due to a certain observant individual who was roasting a pinch of it in an iron spoon as a remedy for a gumboil from which he was suffering. Fortunately, his pains were not so acute as to prevent his remarking and speculating on the curious anomaly that this seemingly dry substance should, when heated, become moist, and exhibit all the characteristics of a moist substance. He reflected that if heat, which renders most things dry and inflammable, caused this to grow wet and to damp everything around it, it must needs be valuable as a fire resister. After experiments proved his conclusions to be correct: and alum has been used not only for admixture with sawdust in the packing of fireproof safes, but as a means of rendering fireproof a variety of inflammable materials, more especially the flimsy textile fabrics sometimes used for ladies' dresses. It is unroasted alum which has this property; by burning or roasting it all water is expelled, and it is thus rendered useless as a safeguard against fire.

This is a digression; but any means of guarding against fire are so important to all interested in building houses—and for that matter, to all interested in living in houses when built which includes a moderately large section of the public—that any apology for it can scarcely be needed.

Should the pugging or sawdust arrangement be adopted, the packing must of course be done before the flooring boards are laid, and the veneering boards and mouldings must be supported in some such manner as is shown in Fig. 4. Laths may be nailed diagonally at the proper height, from joist to joist, or, as there indicated, greater solidity may be attained by mortising them into the joists, and to these laths the veneering boards and mouldings are to be screwed.

In Fig. 4, an alternative arrangement for support of veneering, the ceiling is supposed to be seen from above before the flooring boards are laid down.

Thus far I have spoken of my simplest arrangement of wood work only; in the second part of my subject I shall deal with certain decorative arrangements which are somewhat more elaborate, with the application of the same kind of wood work to wall panelling, and some allied matters.

(To be continued.)

THE BUNSEN BATTERY.

Its Construction and Application.

BY GEORGE EDWINSON BONNEY.

III.—Constancy of the Battery.

The following table (from the *Electrical Review*) shows the constancy of the Bunsen battery. The experiments, which led to the results herein tabulated, were performed with one pint size cell of the Bunsen battery, or, rather, with two such cells, one of which was charged with nitric acid (specific gravity, 1·35) in the porous cell, and the other with the ordinary bichromate of potash solution in the porous cell. The outer cells of both were charged with a solution of dilute sulphuric acid (one part of acid to twelve parts of water) in each cell. Each cell was short-circuited through a wire connecting the zinc and carbon, the resistance of this circuit being 1·05 ohms. The cells were charged with their solutions one hour and three-quarters before the first test was made. The constancy of the Bunsen, when charged with nitric acid, should be noted and contrasted with the rapid failure of current when charged with the bichromate solution. During a working day of nine hours the first shows a vigour equal to its strength at the end of the first fifteen minutes, whilst the second shows only a fourth of the vigour exhibited at the end of its first five minutes.

Table, showing Constancy of Bunsen Battery, at Times as specified from Starting :—

After working	Nitric Acid.			Bichromate Solution.		
	E.M.F. in Volts.	Current in Ampères.	Internal Resistance.	E.M.F. in Volts.	Current in Ampères.	Internal Resistance.
			Ohm.			Ohm.
	1·71	1·21	·35	1·83	1·22	·45
5 minutes ...	1·70	1·21	·34	1·40	·90	·50
10 ,, ...	1·69	1·21	·32	1·32	·86	·48
15 ,, ...	1·69	1·20	·34	1·29	·86	·45
30 ,, ...	1·69	1·21	·33	1·24	·82	·46
45 ,, ...	1·68	1·21	·33	1·20	·79	·47
1 hour	1·69	1·23	·32	1·17	·79	·43
1½ ,, ...	1·68	1·24	·29	1·13	·76	·44
2 ,, ...	1·69	1·25	·29	1·10	·74	·43
3 ,, ...	1·69	1·26	·28	·99	·67	·42
4 ,, ...	1·68	1·26	·27	·90	·60	·45
5 ,, ...	1·65	1·23	·28	·76	·49	·50
6 ,, ...	1·64	1·22	·28	·61	·37	·60
7 ,, ...	1·64	1·21	·29	·48	·29	·60
8 ,, ...	1·64	1·21	·29	·43	·25	·67
9 ,, ...	1·63	1·20	·29	·41	·23	·73
11 ,, ...	1·60	1·17	·30	·35	·20	·70
22 ,, ...	1·45	·91	·53	·31	·17	·77
23 ,, ...	1·36	·83	·46	·31	·17	·77
24 ,, ...	1·17	·73	·54	·31	·17	·77
25 ,, ...	1·02	·63	·56	·31	·17	·77
26 ,, ...	·90	·55	·57	·31	·17	·77
29 ,, ...	·43	·25	·66	·31	·17	·77
30 ,, ...	·42	·24	·69	·31	·17	·77
31 ,, ...	·41	·23	·72	·31	·17	·77

If larger cells had been used, the internal resistance would have been reduced, and, if a stronger solution of sulphuric acid had been used in the outer cells, the E.M.F. would have been higher in each case. This would have given a stronger current. The results are most satisfactory, and should be carefully studied by all who wish to employ a powerful and constant battery.

The author concludes his short article with the following words :—"The nitric acid cell is far superior to the chromic, as far as the work is concerned, and, if it were not for the disagreeable and unhealthy fumes it gives off, would be used in nearly every case."

The above table will, I think, be found to be a valuable appendage to the remarks I have made in the preceding papers on the construction and application of the Bunsen battery. The papers themselves have been written with the view of affording assistance alike to the young electrician who has not been at work long enough to gain the experience which time and observation alone can bring, and to the amateur who may be attempting to make and work a battery perhaps for the first time. Should any readers need advice or assistance, I shall at all times be ready and happy to give it them through the medium of "Shop."

CRYSTOLEUM PAINTING.

BY O. BECKERLEGGE.

I.—Introduction—Colours—Brushes—Glass—Choice of Photo—Removal from Card—Corn-Flour Paste—Treatment of Photo—Shifting—Removal of Specks—Thinning Photo.

There are but few arts that are almost purely mechanical which yield such artistic effects as the one now about to be described. Like many other tricks and notions it is not of English birth, yet it can be easily practised by any one with the smallest amount of art instinct. It is in no sense a fine art, yet at the same time by it really beautiful and artistic-looking work can be produced.

In the hand of the artist photography readily lends itself as a foundation both for oil and water colour painting, but to lay colour on the photograph to produce a good effect requires the skill of a trained hand and great judgment. During the last few years a modification of an old art has come to us from over the sea, which has been improved upon by successive individuals until now it is so simplified that any one with an appreciation of colours can almost rival in effect the beautiful ivory paintings of our grandmothers' days. Moreover, it is one which can be learned almost as easily from reading as it can by seeing it done, and this, I presume, is the reason of its popularity. I learned the art in this way, and although I have the advantage of a knowledge of mixing colours and using the brush, yet I was surprised at the simplicity and rapidity of the operation. And to those who have not an intimate knowledge of colours, I think I can give such explicit directions that their want of knowledge shall prove but little hindrance.

Before commencing work we must supply ourselves with sundry requisites as follows :—

Glasses, two for each picture.

Paint, oil in tubes.

Cobalt.	Carmine.
Vandyke Brown.	Rose Madder.
Burnt Sienna.	White.
Naples Yellow.	Black.
Indian Yellow.	Vermilion.

And any other colour that any particular subject, such as landscape or drapery, may require.

Poppy oil.

Two or three brushes. They need not be sable—though for oil painting these are best in a general way—but fine hog would perhaps be equal to our work.

And last, though not unimportant, the subject to be worked on. The glass must be selected according to the subject chosen. Glasses can be procured as follows :—

Locket size, 3d. per pair.
Brooch size, 6d. per pair.
Carte de Visite, 6d. per pair.
Cabinet, 9d. per pair.

Larger sizes up to 10½ and 8½ in. varying from 1s. to 3s.

Round 3½ in., 8d. per pair.
Round 4 in., 1s. per pair.

These and all other requisites can be obtained of Messrs. Reeves, 113, Cheapside, London. I have found him ever ready to oblige, and his materials are the best of their respective kinds. I mention this as for a while I did not know where the glasses could be obtained, and possibly there are others in the same condition of ignorance.

Some care should be taken in the choice of the photo. As a first experiment take a head—good size, strongly marked features, eyes well opened. There must be good half tone and modelling—that is to say, there must be good shadows, as they can only be supplied by the photo, and unless they are fairly intense the picture will appear flat and without character. Good and suitable photos can be obtained of Messrs. Reeves, varying in price from 6d. to 2s.

But we will suppose that we are about to use a carte de visite. In the first place give it a good licking—but perhaps you will not relish that ; if not, take a little benzole and wipe it over—this will remove any trace of grease. Place it in boiling water long enough to allow it to come off the card. It must not be pulled off until the cement is softened, as if in any way the photo is torn it is spoiled. Whilst your picture is soaking, boil a little corn flour. See that there is not a trace of lumpiness in it. It must be thoroughly mixed before the boiling water is poured on it. If there be any suspicion of lumps, you had better strain it through a piece of fine cloth.

Press the picture between blotting-paper. In the meanwhile thoroughly clean your glass and rub the concave side with your paste, also rub some on the right side of the picture. Now lay it on the glass, seeing it sets square. Place a piece of strong smooth paper on the picture, and with the thumb squeeze the paste out from between the picture and the glass, beginning at the centre and working towards the edges. A wooden presser or squeezer is recommended by some, but I have never used them, and never found the need of them. For a while there will be a danger of the picture shifting ; if it gets out of square it must be screwed around to its proper position.

Looking at your work in some lights you will find the picture covered with small silvery specks—these are caused by a want of contact between the picture and glass. These must be entirely removed. Perhaps you may find your work so dry that you will fail to remove them ; if so, place your work in a bath of warm water—not hot, else you may require a fresh glass. I have found a good soaking almost entirely remove the offending specks, and a few judiciously applied rubs with the thumb have completed this part of the operation. When everything up to this point is perfect, let it stand till next day, say, to get thoroughly dry.

We must now reduce the thickness of the paper, so as to secure transparency. Take No. 1 glass paper and gently rub away at the back of the photo, watching it very closely, as a scrub too many may destroy all the work. You will gradually see the picture growing more distinct, and on holding it up to the light will see where the thickness of the paper is uneven. Rub the thicker parts down so that there is an evenness all over the picture. When your judgment shows you that the paper is almost thin enough, take No. 00 glass paper and give it a few gentle rubs to take away the rough marks left by the coarser paper.

(*To be continued.*)

"TIPS" FOR TYROS.

BY OPIFEX.

2.—Imitation of Wood Carvings.

Old oak, or other carvings in low relief, may be very effectively and easily imitated, almost in facsimile, by the following process:—

Procure some "basil" leather, and wet it thoroughly in warm water, in which a small quantity of size or glue has been mixed; wipe it as dry as possible with a cloth, then cut a piece sufficiently large to cover the carving, and allow a small margin; lay it upon the carving, and press with the fingers all over, in order that the leather may take the shape of the carving as much as possible. Next, with a smooth-pointed tool made of bone—say the handle of a toothbrush, filed down till it assumes a blunt knife shape — go over the surface carefully, pressing the leather into all the interstices of the design, and smoothing the larger or bolder portions until you have succeeded in bringing out all details. Of course, this process can only be applied to carvings, etc., which are not undercut.

If the superfluous moisture has been removed from the leather in the first instance, it may now be easily taken from the carving without interfering with its shape, but if not, it must be left until partially dry.

When taken off, the leather should be placed in a warm place to dry thoroughly, when it will be found to be quite stiff, and may be coated thickly at the back with a layer of gutta percha; or with the following mixture: pitch, resin, plaster of Paris, equal parts; melt the pitch and resin together, and then stir in the plaster of Paris. If a small quantity of wax candle be added to the mixture, it will be rendered tougher.

The imitation may now be applied to the use for which it was intended, and if treated with dark distemper oak-stain, and oiled, will look wonderfully like genuine carved oak.

3.—Reproduction of Medallions.

Very handsome and highly artistic medallions, which are capable of being applied to many uses, can be produced from the paper replicas of relievo subjects, which are sold at about 1s. each, and which can be procured from most artists' colourmen, etc. Those used by the writer are manufactured by Monrocq Fres., Paris, and are chiefly facsimiles of famous classical heads — *e.g.*, Minerva, Achilles, etc. etc.

The reverse side of the paper medallion is used as a mould, placed face down upon a table, the edges resting upon four pieces of wood; the edges are then built up by a strip of gutta percha, etc., to a depth of about an inch. Now mix in water fresh plaster of Paris which has been well dried in an oven to the consistency of thick cream, using about a pint of water, or more than sufficient to fill the mould; see that it is kept well stirred until it is perfectly mixed, and then pour into the mould to a depth of about half an inch at the edges.

The plaster should be carefully and gradually, yet quickly, poured. to ensure its running into all crevices and to avoid air bubbles. It will "set" very rapidly, and in half an hour may be safely, but very cautiously, turned out, and left to dry; after, say, twelve hours, it should be placed in a moderately hot, ordinary kitchen oven for two or three hours, when it will be perfectly hard.

It may be found that some particles of paper have stuck to the plaster, and these should now be removed, and the edges trimmed with a sharp knife, to fit it for whatever purpose it is intended. Next dip the cast into skimmed milk several times, until it will imbibe no more, and then dry thoroughly in the sun. When dry, dust over freely with French chalk, and rub lightly all over with an old silk handkerchief, or other very soft cloth.

The cast will now present a highly polished surface, and will look more like ivory than plaster.

These medallions make most artistic ornaments when mounted in either ebony or ebonised frames.

4.—Bronzing.

An easy and successful method of bronzing articles, such as metal chimneypieces, ornamental metal work of any kind, plaster figures, etc., is to give the subject a coat of japan, in which a small quantity of Brunswick green has been mixed, just sufficient to neutralise the brown colour of the japan; and when almost dry, apply bronze powder, either gold, silver, etc., freely with a large round camel's-hair brush to the more prominent portions of the articles in hand, but very sparingly to the other portions; in fact, in the hollow and flat parts only a mere "suspicion." Care and some practice will be required to soften off the more highly bronzed portions, so as to avoid abruptness, and also that the brush may not take up any of the japan or paint; but if applied with a light hand and a very soft brush the bronze powder will prevent this.

Large earthenware jars, when first sized, and then treated in this way, are most effective for decorative purposes.

A thin, even coat of good varnish will ensure the bronze keeping its colour for a very long time.

PRICE'S "UNIVERSAL" LATHE.

A Lathe with Front and Vertical Slides.

BY F. A. M.

As long ago as 1883, there arose a discussion in the *English Mechanic* upon two points in lathe construction, and this discussion was continued a very long while, and it continues to reappear still from time to time. In fact, the subject appears to have excited very considerable interest. The object of the proposals which were brought forward was twofold: first, it was felt that however convenient was the usual construction of the slide lathe, with its leading screw, and its saddle sliding on the bed, for self-acting sliding, or for slide-rest work; yet, when a piece of hand work was to be done, and, still more, if a piece of wood was to be turned, it was necessary to get rid of the saddle by sliding it to the right hand end of the bed, and lifting the poppet over it. Those who clung to the old system had much to say in its favour; they contended that, for a bit of hand work, a rest for the hand tool can be made by fixing a slide-rest tool with the blunt end outwards, and using that blunt end as a rest, and that can often be done; or, better still, the slide rest, in a small lathe, can be made with a tenon pin to fit into a socket; then it can be taken out when required, and a T rest for hand-turning put in its place. Very true; but that plan is hardly suitable for large lathes, in which the slide rest requires a more solid support. Again, it was shown how the washer securing the poppet beneath the bed could be so made that, when the fixing screw was released, it could be lifted out with the poppet, coming up through the opening in the bed, and so it could be easily and quickly removed. This, too, is quite correct, and it is a method of construction which should be always adopted. Still, there were some who considered it an annoyance to have to clear the tools off the bed, and move the saddle out of the way of chips, etc., when the hand rest was needed; and these were inclined to favour a separate slide running along the front of the bed, on which the saddle should move, quite independently of the top of the bed, on which the headstocks, hand rest, etc., were placed; so that, if it were desired to remove the saddle and rest in the middle of a piece of work, it would not even be necessary to take the work from between the centres, nor to disturb the poppet at all; but only to rack or slide the saddle away past it, to the right, and place the hand rest on instead. If those who have not seen a front slide lathe will look at Fig. 1, they will understand how this can be done, and the section of the bed at Fig. 2 will explain still further.

And now, as in most improvements, it must be confessed that the advantage above mentioned is not obtained without cost. Instead of the weight and wear of the saddle falling as usual upon the broad, flat top of the bed, it comes upon the somewhat narrow, oblique edge, marked X in Fig. 2. It must, therefore, of necessity, be more liable to wear down than with the old way. To prevent this tendency, which is not of great importance in a small lathe, the front slide is made of considerable length; and, though it might look strange, since there is no obstacle at either end, it might be well to have it longer than it is. Where two plates of metal slide on each other, the shorter must in time wear the longer hollow; but if both are of the same length, there seems no reason why they should not keep straight indefinitely. It has, therefore, been suggested that it might be an improvement in this lathe if the front slide were lengthened, and the planed part of the bed on which it moves shortened, so as to make both, as nearly as may be, of the same length.

A far more important advantage offered by the lathe must now be mentioned. The slide rest is mounted on a *vertical slide*. Now, a vertical slide is the great want of the lathes of the present day; it is useful in so many different ways, it is hard to name them all; and many have been the attempts to supply the want, by additions or appliances of more or less unsteadiness, in the shape of vertical slide rests bolted upon the tool plate of the ordinary rest, or upon the seat where the quadrant plate of the rest usually goes; and these attachments, although so unsteady and troublesome to apply and remove, are very useful. How much more, then, must be a *permanent* vertical slide, *always ready*, and *never in the way?* This last point must be insisted upon. How many useful appliances might be, and are, added to foot lathes, which, however ingenious and well suited to the special work they are intended to do, are, nevertheless, a real trouble, and even a nuisance, when ordinary work is being done! Rarely, indeed, is it possible to add any special appliance to a lathe without in some way interfering with its general handiness. Here, however, we have a most useful addition, always ready for use, and yet its presence might pass almost unnoticed were it not for the hand wheel underneath the front slide, by means of which the vertical slide is moved up and down.

About two years after the discussion on the subject of front and vertical slide lathes, there appeared in the *English Mechanic* an illustration of a beautiful little American tool, in which the idea was well carried out, probably quite independently, by the Ballou Company; but, though one or two English makers undertook to make lathes with front slides, the far more useful vertical slide was not made in England until recently it was arranged by Mr. Price, and is now being manufactured by the Universal Lathe and Tool Company, of 131, Leadenhall Street. The 3½ in. centre size is shown in Fig. 1.

The following is the description of the lathe by the makers :—

"The *Bed* is 3×4½ in. deep, so made that a leading screw can be applied if wanted for screw cutting, and has webs every 12 in. of its length. The metal is distributed to give it lightness and strength combined.

"The *Head* and *Poppet* are made so that the line of centre will be parallel with the edge of the bed. The *Mandrel* and *Collar* are of the best cast steel, and carefully hardened. The mandrel is hollow, 2½ in. deep, $\frac{5}{16}$ in. diameter; nose ⅝ in., Whitworth's. The *Driver Chuck* is of gun metal, with steel centre; drill or cutter chuck is of ¼ in. bore. Cone pulley has four speeds.

"The *Poppet* has a steel cylinder mandrel, and it is so arranged that the hand wheel does not project beyond the barrel of the headstock, so that the front slide will pass the poppet without its being loosened.

"The *Front Slide* is fitted so that it will slide along the front of the bed, and can be locked instantly by a cam lever; the vertical slide is well fitted to saddle and arranged to rise and fall; has steel square-threaded screw and gun-metal nuts.

"The *Slide* is fitted to vertical slide bracket, and indexed to take any angle; the transverse slide is made and arranged with two T slots, and is 8 in. long and 3 in. wide. All the slides are carefully ground in, and are as firm as if they were of one piece of metal. The slide and tool holder can be placed on any part of the T slot table, and is supplied with two T rests and socket.

"The *Standards* are of the best form to give it stability and strength without being cumbersome; the *Crank* is of forged iron with steel ends for centres. The *Fly wheel* is accurately turned, and has three speeds. Treadle motion is light and strong. Approximate weight about 3½ cwt."

The makers desire it to be known that they have altered the square-looking tool-holder shown in the illustration for one which enables the tool to be set at any angle. They have arranged a backstay for turning long bars. The screw in the bed is for adjusting the position of the work when milling; there is a collar upon the screw with holes for a tommy. In turning, the upper part of the rest being in position, the longitudinal feed can be given by that, and the small screw in the bed is not needed.

The following are the various advantages over ordinary slide-rest lathes which are claimed for Price's "Universal" Lathe by the makers :—

"1. Whereas an ordinary slide-rest lathe can only be applied to turning, this lathe can be applied instantly to milling of every description, by simply putting the cutter between the centres of the lathe; and then bolting the work to the table, the cut can be adjusted to a nicety. This lathe can be applied instantly to the following work, and

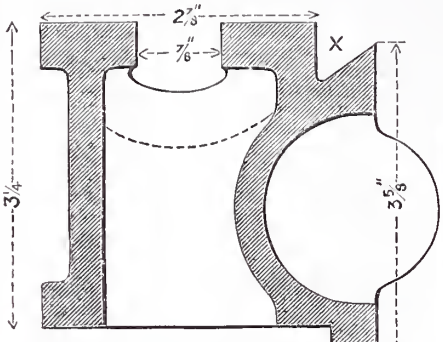


Fig. 2.—Section of Bed of Lathe (half size).

will save its cost in a few weeks in time and files. It is considered by the most scientific mechanics that it can be applied to any description of work, and that it will do the work of six different machines in one.

"2. The front slide has an enormous advantage; it can be put out of the way and replaced instantly, and is always at hand.

"3. Having a vertical slide fitted to saddle, the depth can be readjusted, and the tool can be raised and lowered according to the diameter of the work, and therefore does not require packing as in a slide-rest lathe.

"4. Poppet traverse screw is arranged out of the side of poppet, so that no chips will get into the screws, and the barrel is full length of the headstock, so that it will not spring when a heavy cut is taken."

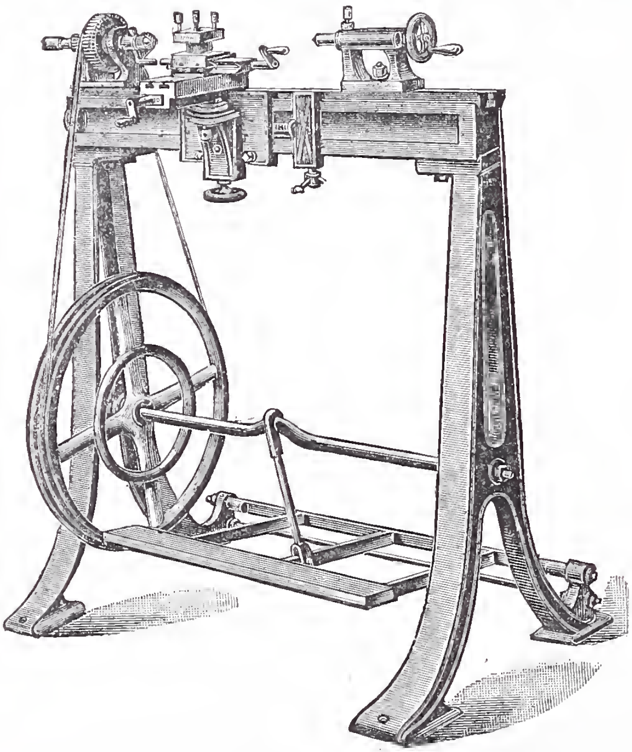


Fig. 1.—Price's "Universal" Lathe, with Front Slide and Canting Head.

The work that may be done by aid of this lathe may be summarised as follows :—

"(1) The vertical slide has a fall sufficient to cut gear wheels 3 in. diameter, and will cut them as small as ¼ in. diameter. (2) The lathe will turn and cut up its own cutters any form, according to shape required. (3) Most handy to mill up hexagon nuts and bolts to uniform sizes. (4) To mill up cams of any shape, face, or barrel. (5) For milling up key seatings in shafts. (6) Drilling and dividing hubs for tricycles and bicycles the same time. (7) Profiling steam ports of cylinders. (8) Profiling quadrant links of locomotives. (9) Milling the bearings. (10) Cutting slots in screws. (11) Shaping cranks. (12) Fluting taps and rimers. (13) Milling groves in dies. (14) Fluting drills that will cut equal to Morse. (15) Mill up slides for any machinery.

"Any one with ordinary skill can do all the work on this lathe without a vice or file, as it can be machined throughout."

Special attention has been bestowed on this lathe by the makers in order to render it one of the best universal machines that can be turned out. It is certainly most simple in construction, and its scope of work is wide, thus causing it to be a desirable machine for amateurs, electrical engineers, opticians, gunsmiths, and all other mechanicians.

The price of the "Universal" Lathe, with 2 ft. 6 in. bed, is £9 10s.; with 3 ft. bed, £10; with back gear, £12; if fitted for screw cutting, £20; dividing appliance, £2 10s.; vice for table, extra, 25s. It is made in larger sizes, with back gear from 3½ in. centre and 3 ft. bed, to 5 in. centre and 5 ft. bed. The prices for these sizes will be supplied by the makers to any applicant.

The writer of this notice took part in the discussion in the *English Mechanic*, and feels much pleased to see the ideas he there advocated so well carried out. The advantages of the lathe do not seem overstated, and one or two are not mentioned, perhaps because they would apply to rather larger lathes. For instance, if it were required to bore a small engine cylinder, the cylinder could be clamped upon the main transverse slide, and then by means of the screws of the slides be quickly adjusted, so that its bore would be true with the boring bar without any packing up.

Milling by circular cutters is coming into more and more extended use; but we cannot all afford to buy a milling machine. Now, only one thing is wanting to enable us to do milling in our lathes, and that thing is a vertical slide. If to that we add a bed, or table, to bolt the work down upon, as is done in this case, all we have to do, when we wish to go from turning to milling, is to remove the top slide of the rest, and we have a capital milling bed clear for the work, a mandrel to drive the cutters, and a back centre point to support and steady the end of the arbor that carries them. The lathe has become at once a very efficient little milling machine, and its powers as a tool are doubled.

OUR GUIDE TO GOOD THINGS.

10.—Self-Centering Simultaneous Grip Chuck.

Some handy and well-finished fittings for lathes and other machine tools have been recently introduced by the London Lathe and Tool Company, 97, Pomeroy Street, London, S.E.; and as they are mostly of novel design, it is desirable to call the attention of the readers of Work to them, and to describe and illustrate some of the most useful forms.

First among them is a Self-centering Simultaneous Grip Chuck, of which an illustration is given in Fig. 1. As may be seen from the engraving, from which the principle and action of the appliance will be readily recognised, this chuck is possessed of great strength, and yet is of simple construction. It is a very handy lathe chuck for general purposes, and the Company believe they are fully warranted in asserting that it is the best and strongest of existent self-centering chucks. It is made in eleven sizes, ranging from 4 in. to 42 in. in diameter, and in price from £4 10s. for the smallest size to £52 for the largest.

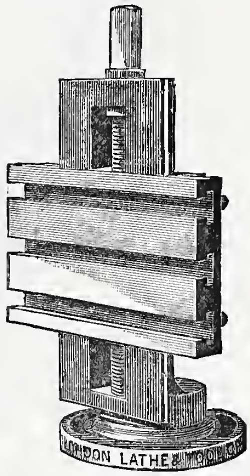


Fig. 5.

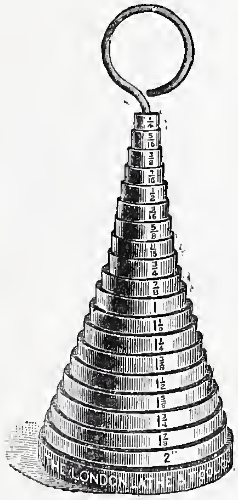


Fig. 3.

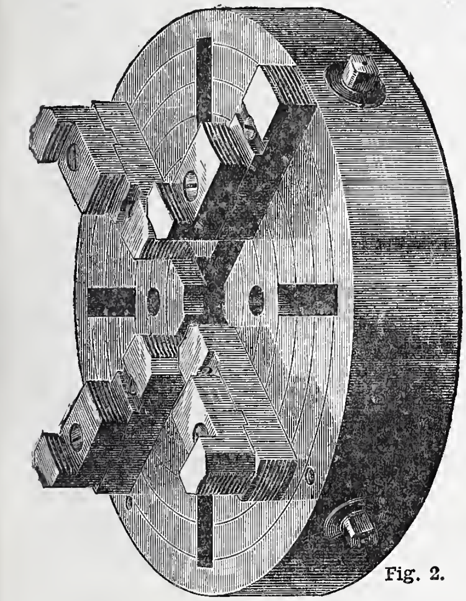


Fig. 2.

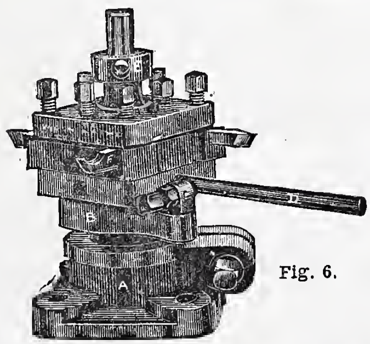
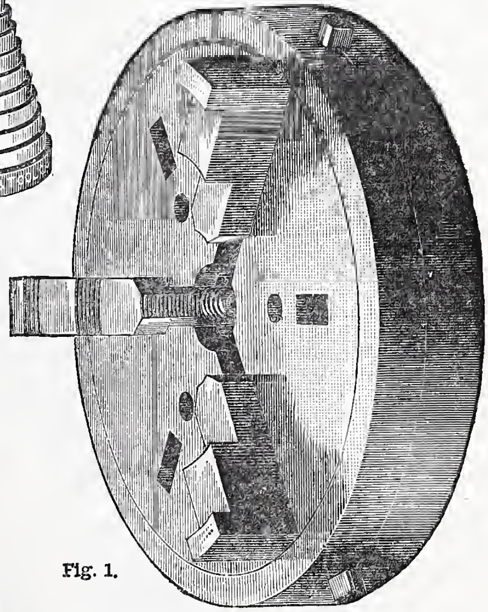


Fig. 6.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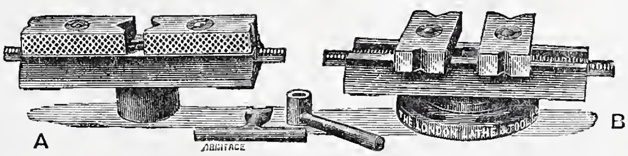

Fig. 4.

Some Specialities of the London Lathe and Tool Company. Fig. 1.—Self-Centering Simultaneous Grip Chuck. Fig. 2.—Independent Grip Chuck. Fig. 3.—Calliper Gauges. Fig. 4.—Useful Vice Chuck. Fig. 5.—Vertical Slide Rest. Fig. 6.—Revolving Slide Rest.

11.—Independent Grip Chuck.

Another well-made and beautifully-finished chuck is to be found in the Company's Independent Grip Chuck, which is effectively illustrated in Fig. 2. These chucks are furnished with four independent jaws, with changeable reversible grips, as may be seen by noticing the position of the jaws, as shown in the engraving, in which one is so placed as to show the reversed action. The screws used in this chuck are of steel, and the jaws of charcoal iron, case-hardened. They are made in ten sizes, ranging in diameter from 6 in. to 60 in., and in price from £4 10s. to £60. They are cheaper in first cost than the Simultaneous Grip Chucks, as will be manifest to any one who will take the trouble to compare sizes and relative prices.

12.—Calliper Gauges.

It is said that if half a dozen workmen take the same dimension from the same rule with callipers, and each man turn a shaft to such callipers, careful measurement will show that no two shafts are exactly the same, and that no one shaft will be of standard size, except by chance. To reduce the possibilities of such differences in work to a minimum, the Company have introduced a useful form of Calliper Gauge, which is illustrated in Fig. 3. The gauges are made in a variety of sizes, the divisions rising by eighths, tenths, sixteenths, twentieths, thirty-seconds, and hundredths of an inch, as may be required, or gauges to the metric system can be supplied to order. Callipers, as every one will readily see, can be set to these gauges in less time than to a rule, and the work, it is said, is nearly as accurate as when ring gauges are used. To give some idea of the price, a set of gauges rising from $\frac{1}{4}$ in. to 1 in. by eighths of an inch costs 5s., but one rising from $\frac{1}{4}$ in. to 1 in. by hundredths of an inch costs 50s. The Calliper Gauges, it should be said, are made up to 3 in. in diameter. Being really very cheap, and very useful, a set can be provided for each lathe. The Company also supply gauges of flat steel, carefully hardened, for both outside and inside measurements, and plug and ring gauges. These appliances range, in flat gauges, from $\frac{1}{4}$ in. to 4 in.; and in plug and ring gauges from $\frac{1}{8}$ in. to 4 in.

13.—Vice Chuck.

The London Lathe and Tool Company have also devised, and supply, a novel Vice Chuck, which is illustrated in Fig. 4. The chuck is made in two forms—the first to screw on to a lathe nose, as at A, and the second to bolt on to the receiving table of a lathe saddle drilling machine, or other tool, as at B. The jaws may be rotated or turned to take round or square articles at the V's, of which there are two sizes, as shown in the illustration, or to grip flat articles, or taper articles, when the jaws are brought into the position shown at B, in which their sides are opposed one to the other instead of the ends. Both jaws move together by turning the screw at either end. For light work it is believed that they will be found the handiest vice chucks that have yet been brought into the market. The price of either form for a 4-in. lathe is £2, rising to £4 for an 8-in. lathe.

14.—Vertical Slide Rest.

Vertical movements are very useful for many classes of work, and in Fig. 5 is shown a Vertical Slide Rest, specially designed by the London Lathe and Tool Company for the lathes manufactured by themselves, but which can be readily adapted so as to suit any other lathe. The receiving table may be placed at any angle, and as its slots are of the same size and pitch as those of the main table, any of the tools, sockets, or other apparatus usually fixed upon the main table may be fixed to the receiving table of the Vertical Slide Rest. The traverse screw is made with either 8 or 10 threads per inch, as may be preferred, and is finished with a micrometer collar. The constructive action and principle of the vertical slide rest may be seen from the illustration given in Fig. 5. The price of one suited to a 5-in. lathe is £3 10s., rising by £1 for each size for 6-in. and 8-in. lathes.

15.—Revolving Slide Rest.

A neat little Revolving Slide Rest to carry four tools is shown in Fig. 6. It is intended for the economical production of small screws and other articles required in large numbers and of identical shape and size; and for such a purpose as this it is clear that a revolving rest, such as the one shown in the illustration, is an absolute necessity. Hitherto capstan rests have been applied only to lathes specially constructed to take such rests, and unable, indeed, to take any other. This slide rest, however, may be used with any lathe or milling machine, and although simple in construction, it is as complete and as perfect and effective in its action as the most expensive rest in the market. It has been said that it carries four tools, such as may be necessary for the production of the article required; thus, supposing it desirable to cut some screws of a particular size and thread, the tools that are necessary are one for roughing a screw blank, a second for finishing the blank, a third for cutting the thread, and a fourth for cutting off the screw. Each tool may be separately adjusted, and the height and angle of the rest may also be adjusted, without disturbing the tools. The rest may further be fixed in a couple of seconds by tightening the central screw, and it may be removed from the lathe in half a minute should it be desired to make room for an ordinary slide rest.

There are many other appliances, fittings, and tools which the Company have lately introduced, and which, for simplicity, finish, and price, compare very favourably with similar articles in the market. It should be noted, however, that many of the appliances, etc., have been introduced now for the first time, and have been specially devised as labour-saving tools by the Company. I hope at some no very distant time to find space for the illustration and description of some of them in the pages of WORK.

16.—Wood-screw Cutters.

These new tools ingeniously contrived for cutting wood screws without the intervention of the lathe are a clever invention of Peugeot Brothers, a French firm of tool makers, whose name they bear. The specimen cutter that I have is numbered 12, from which it is to be inferred that the size is indicated by this number. From actual measurement I find that it will cut a screw thread about $\frac{1}{16}$ in. deep on a cylinder $\frac{5}{8}$ in. in diameter. These cutters are clearly made in graduated sizes, but I am not able to give at the present moment the limits of size in each direction. At the end of a handle, short in itself but of sufficient length, an iron casting is attached, in the centre of which is a circular tube-like hole cut on the interior with a thread, which is the exact pattern of the screw to be cut. This, of course, is of the kind technically known as a female screw. In a groove cut in the top of the iron is a V cutter, which is held in its place by a piece of iron projecting from a bar that passes vertically through the casting in a convenient position.

Another entirely distinct and separate casting fits on the top of the first casting, being placed in the bar already mentioned, and a pin projecting from the latter near the handle. This second casting forms a prolongation of the screw-cut tube and forms a convenient entrance for the end of the wood cylinder on which it is desired to cut a screw thread. The free casting is held firmly in its place when put in position by a nut working on the vertical bar which is threaded through its entire length. Its chief use is to admit of the easy withdrawal of the V-shaped cutter when it requires sharpening. The cutter, it should be said, is further fixed and held in place by a screw passing through the fixed casting and pressing against the cutter. All that is necessary when it is desired to cut a screw thread on a cylinder is to introduce the end of the cylinder into the upper end of the tube, the instrument being held in the left hand, and then work the wood round and round with the right hand against the cutter until a sufficient portion of the cylinder has been threaded. For cutting a wood female screw to receive the wood screw thus cut an iron borer or tap is used, which is introduced into a hole sufficiently large to admit of the entrance of the end of the tap that is not threaded, and which must be formed by a centre-bit or shell-bit. The top of the tap is square in form, so that a handle may be placed on it, and the tap actuated in precisely the same manner as a gimlet or auger.

The utility of these cutters will be obvious to all who consider how many kinds of wood work there are, and that it would be more desirable to put together, or fasten together, by dowels in which a screw thread has been cut instead of the ordinary means and modes that are usually applied. Wood clamps, too, for fret working and for other purposes can be made quickly and with the utmost ease by their aid.

These tools are of very recent introduction, and are scarcely yet on the English market as far as I am aware. As I have said, I do not at present know the sizes in which they are made, nor am I acquainted with the prices that are asked for them, but I can easily make inquiries on behalf of any one who desires further information on the subject, and give a reply through the medium of "Shop." THE EDITOR.

MEANS, MODES, AND METHODS.

*** *The Editor is not responsible for any statement made under this heading. Criticism and Suggestions are invited. Readers in possession of Tried and Approved Recipes, Formulas, and Processes, are requested to forward them for insertion in this column for the common good.*

A HINT FOR FRET-CUTTERS.—The song of the fret-saw makers might well begin:—"Break, break, break on the hard thick boards, oh, saw!" I would have put "don't" before the first break, only it would have spoiled the rhythm, but as I can't write poetry I will put in prose what I have to say, in the hope that it may be at least as intelligible as some poems. I refrain from mentioning names for obvious reasons. "It is only this," quoth the sawyer, "nothing more." Pieces of a broken band saw can easily be obtained. Bits to fit any good machine can be cut off as required. One that has been filed down till it is very narrow will do best. It will even then be much stronger than a large-size ordinary fret saw, these being all too thin and not increasing in thickness sufficiently with their width. Any ordinary work can be done with a bit of band saw more quickly and easily without such constant breakage as occurs with the usual saws. Try it, is the advice of one who knows.

SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

Bicycle Making.—H. W. (Newton Heath).—To lower the position of crank tread of an ordinary bicycle, I would advise you to dispense with cog wheels. You would not meet with success by the application of such to a bicycle. The best means for attaining your desire would be to fit your machine with reciprocating levers, links, and cranks, similar to those fitted to the ordinary "Facile" bicycle manufactured by Ellis and Company, London.—[C. I.]

Polishing Pebbles.—T. M. BEAR, Wellesley House, Colchester, wants books which will give information as to polishing Pebbles, Stones, etc., and show all the various tools that are necessary for the work.

Writing-Desk.—P. J. B. (London, E.).—It is satisfactory to learn that you are pleased with No. 1 of WORK, and that in writing of it you can say "it is a very good book, suitable for my purpose." The Magazine is intended to be suitable, not only for your individual purpose, but for the purposes of every workman of British and American nationality at home and abroad. Try your hand at cabinet making by all means. I can say from experience that you will find it a most pleasurable and useful occupation. If you are a novice, as I think you are, let me advise you to try your hand on something less ambitious than a writing-desk at starting, for this requires very neat and nice work, which is the outcome of practice and experience. Try some of the useful and tasteful articles that are to be described in "Artistic Furniture," and more especially the "Screen Secretary," which will appear very shortly, and which, I think, will go far to meet your present want. Instructions for making a handsome and serviceable writing-desk will be given by-and-by, with the necessary explanatory diagrams and working drawings. It is not possible to touch on everything at once, a fact which you, as a sensible man, will readily acknowledge. Meanwhile, to you and all readers of WORK, I must say, after the manner of notices that one sometimes sees in the shops—If you do not see what you want, ask for it. I can assure you that no pains shall be spared to comply with any and every request, at least in time, if not directly.

Photo-Lithography.—PEN AND INK.—In reply to your query on this subject, I cannot do better than direct your attention to the latter portion of the preceding reply. Will you kindly write again and specify distinctly what your special need may be, and the purpose for which you wish to acquire a knowledge of the art? It may be that I may be able to offer some suggestions that will serve your purpose in the interval before papers can be given on the subject you name.

Photography.—R. A. R. B. (Oxford).—The photographers are buzzing round WORK like flies round honey, and early in the field as you may seem to be, I am bound to say that arrangements are in progress for articles on this most interesting subject by an old photographic hand. The road, however, is open for suggestions on all branches of photography, and all who like to send in papers on special points will meet with due consideration.

*** *Many answers are held over for want of space.*

Trade Notes and Memoranda.

TOPICS OF THE HOUR.—The improvement of Public Buildings in London.—Ventilation of Schools—School Board architecture.—The Campo Santo and the County Councillors.—The Sanitary Registration of Buildings Bill.—Hardening and tempering by Electricity.—Our coal supply.—Smoke in the air.

STRATFORD-ON-AVON Church is to be lighted by electricity.—Portable wooden houses are being sold by a Swedish joinery company.—An improvement in grates is suggested, which enables the fire to be replenished with fresh coals below on to live coals above.—The London County Council wants a home.—An "Irving Safety" plan theatre is to replace the Exeter theatre burnt in 1887.—There are signs in the coal districts that English coal is becoming scarcer.—Sheffield requires a ship canal to the sea.—A Philadelphia company is supplying houses with heat from hot water mains.—It is proposed to rate advertising hoardings and places.

MR. OUSPENSKY, a Russian engineer sent to Central Asia on a special scientific mission, reports that the oil wells at Penjakend, near Samarcand, in the Zerafshan Valley, contain at least 9,000,000,000 lbs. of perfectly pure oil.

THE man with his barrow and his broom is to be brushed aside for ever. He is being crushed out of existence by machinery. There has been successfully tried in London a new machine which does all at once which the scavenger and his besom, and his shovel, and his scraper, and his barrow do, one after the other. It is a street-cleansing machine. Its horizontal brushes, fixed on a pair of endless chains revolving around spindles, sweep the mud into a receiver. From that receiver a series of buckets, fixed on endless chains, lifts the mud into a shoot, which delivers it into the mud cart. The travelling wheels on which the apparatus is mounted set the mechanism going.

VERY little is now wanted to complete the thousand feet of the Eiffel Tower. It is expected, therefore, that this modern Babel will be finished, as far as height goes, shortly. The lifts were to be in operation by April 1st. There is every appearance that all will be ready for the opening on the 1st of May.

A GENEVA firm have taken out a patent for a new alloy, to be used as a substitute for steel in the manufacture of certain parts of watches such as spiral springs and escapement wheels, which are at present liable to become magnetised. This alloy is composed of from 30 to 40 parts of gold, the same number of parts of palladium, 10 to 20 of copper, and small quantities of rhodium, silver, platina, and manganese. The copper and the manganese are first melted, and the other metals are subsequently added; or all the metals may be placed in a crucible at the same time, the manganese being at the bottom.

THE Edinburgh Lunacy Board are about spending £60,000 on new buildings on the Craighouse Estate.

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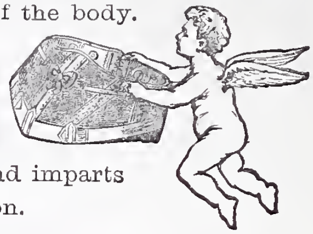

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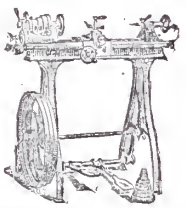

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 4.] SATURDAY, APRIL 13, 1889. [PRICE ONE PENNY.

HOME-MADE TOOLS.

BY J. H.

I.—AN IRON TRYING PLANE.

INTRODUCTION—PATTERN FOR STOCK—HOW TO MAKE PATTERN—CASTING—TRUEING UP SOLE AND SIDES—FILING—FITTING WOOD BLOCKING—PLANE IRON—FILING MOUTH—WEDGE—POLISHING—LEVER.

IN this series of papers I propose to describe the construction of many of those common tools which, though more or less costly to purchase, amateurs can very well contrive to construct for their own use. There are many such in our workshops — tools which workmen themselves seldom think of purchasing, and which require no very great amount of skill in their construction, but chiefly considerable patience, and much care. I think it well, in the absence of a very strict classification, to divide these tools into four main sections, as follows:—first, planes; second, tools used in measurement; third, miscellaneous tools; fourth, general shop tools. This will be sufficient for our purpose, and in carrying out my plan, as indicated above, I shall keep this arrangement in view and follow it.

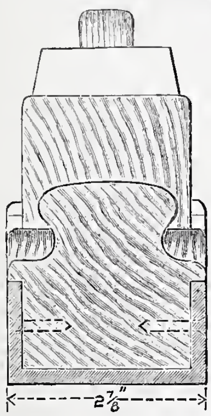


Fig. 2.

Let our first example be an iron trying plane, a tool which no wood worker who aspires to do the very best class of work can well afford to be without. Such a plane costs about thirty shillings in the shops, but it can be made for five shillings.

First, we want a pattern for the stock. This should be made of mahogany, planed very true and free from winding to a thickness of $\frac{3}{16}$ in. bare, say $\frac{1}{64}$ in. bare. But keep the bottom of plane *full* $\frac{3}{16}$ in., to have sufficient metal in case of possible curvature of the casting in cooling.

The shape of the pattern is seen in Figs. 1 and 2. The sides will be nailed on the bottom, perfectly square therewith, and the merest trifle of taper should be given to their inside faces, so that their thickness at the upper edge shall show slack by the callipers, when by comparison they are tight at the bottom edge. This taper is for clean delivery in moulding.

A strip, A, is glued across the inside face of the bottom, just behind the mouth, to form a good bedding for the iron, and also as a shoulder for the abutment of the hinder piece of blocking; and two pieces, B, C, at back and front, to terminate and stiffen the ends, and to act as abutments for the blocking. Two pieces, D, are fitted against the sides to take the resistance of the tightening wedge, if a wedge is used. If a lever is employed no such pieces will be required. These will not be fastened into the pattern, since they would then prevent delivery by pulling up the overlying sand in the mould. They must each be fitted with a vertical sliding dovetail, so that they will be left behind in the mould on the withdrawal of the main pattern. They are taken out subsequently sideways from the mould. Clean the pattern off with fine glass paper, varnish, and rub down.

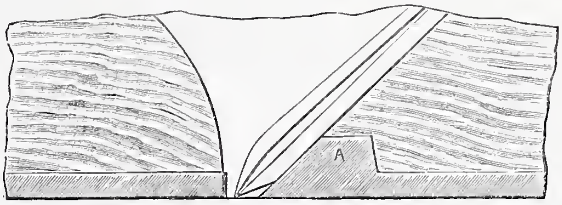


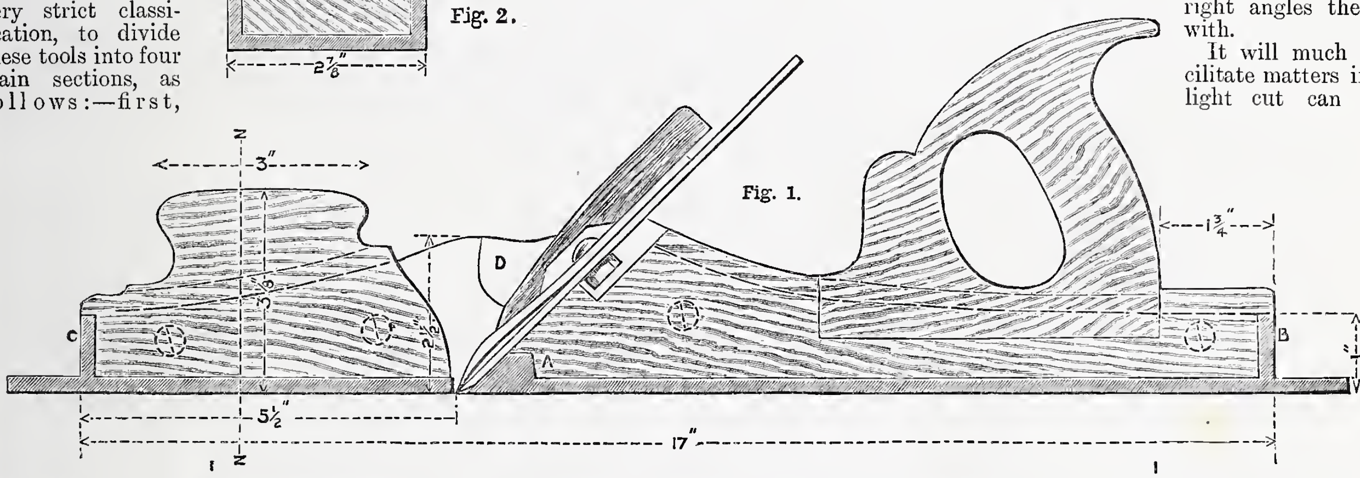
Fig. 3.

Be careful to take the pattern to a foundry where soft and clean castings are made. A hard, rough casting will be quite useless for the purpose. Stipulate that if the surfaces show blowholes when filed or planed, that the casting shall be replaced free of cost. This precaution is necessary in order to guard against any loss that might otherwise be brought about through the occurrence of a defect of this kind which will sometimes happen in the process of casting.

The most difficult task now follows—that of trueing up the sole and sides of the casting. These, especially the sole, must be straight and free from winding. For use on the shooting board it is also necessary that the sides be truly at right angles therewith.

It will much facilitate matters if a light cut can be taken off all over in the planing machine. But to pay for planing would run up the cost of the plane by about ten shillings. Hence, in most instances, the amateur or cabinet maker will have to true the stock by filing only—not a very severe task after all, provided he is fairly skilful in the use of the file.

Briefly, then, remove the outside hard skin either by grinding, or with an old, nearly worn-out file. Having done so, take a bastard file and go all over the surfaces carefully until they are very approximately level. Their accuracy would be best tested on a fitter's surface plate, supposing the use of one can be obtained. But if not, then a



Home-Made Tools. Fig. 1.—Iron Trying Plane: Longitudinal Section. Fig. 2.—Ditto: Transverse Section. Fig. 3.—Ditto: Enlarged Section of Mouth.

steel straightedge of sufficient length will answer the purpose, trying the plane lengthways, crossways, and diagonally; the latter for winding. It is quite possible to use a very true mahogany straightedge for this purpose if a steel one is not available. As the later stages of filing are approached, the coincidence of the surfaces of the plane and of the surface plate, or straightedge, is carefully tested by smearing a thin film of red lead and oil made to the consistence of thin paste over the plate or straightedge, and observing the extent of its transference to the faces of the plane. Finer files will afterwards be used, finishing with a dead smooth file. Scraping is hardly necessary.

The most troublesome portion of the work is now accomplished. The next task is the fitting of the wood blocking. This blocking may be conveniently made of rosewood, beech, oak, or hard Honduras mahogany. Whatever wood is used it must be perfectly dry. It ought to have lain in the shop under the bench for two or three years at least. Then, being once fitted, there is no reasonable likelihood of shrinkage and splitting occurring.

The pieces may be fitted flush with the inside faces of the sides of the casting, or they may preferably be shouldered over the edges and made flush with the outside faces. The latter plan is shown in Figs. 1 and 2. The fitting of the blocks into the interior and over the edges should be quite finished before the upper outlines are cut. No hard driving must be done, else the iron will probably become broken. Gentle tapping only must be given, and red lead or chalk may be rubbed over the iron to indicate where contact of the blocking occurs. When fitted, drill and countersink four holes in each side to secure the blocks in place permanently with wood screws. The hinder block will have a handle fitted into a mortise recessed therein, and the end which comes next the mouth will be bevelled to an angle of 45° for the bedding of the iron. This bedding face must be very free from winding, else the iron will rock, and so cause the shavings to choke the mouth of the plane. The end of the front block will be bevelled back as shown for the clearance of the shavings.

At this stage it will be desirable to procure the iron, which should properly be a "gauged" or parallel iron, because, unlike the common or tapered iron, its wearing backwards by regrinding does not cause that enlargement of the mouth of the plane which occurs with the tapered iron.

The filing of the mouth, about which I have said nothing, will be undertaken now that we suppose we have the iron bedded on its block, and both front and back blocks screwed in place, as shown. It must be filed, at both back and front edges, perfectly square with the edges of the plane, and with reference to its own iron and wedge, in such a manner that the slightest possible clearance opening for the shavings shall be permitted. See Fig. 3, showing a section of the mouth enlarged. The wedge is fitted at about the same time, the strips, D, being filed underneath to make good contact.

With this, the essential work of the plane is completed, and the cleaning up with glass paper and the polishing only remains. If the wood is of a light colour, staining will improve its appearance. The polishing not only adds to the beauty of the appearance of the tool, but also protects the wood to some extent from atmospheric influence.

The main points, then, to be regarded in the making of this plane are accuracy in the pattern, a soft, clean casting, free from blowholes, the selection of dry, hard wood for the blocking pieces, good fitting of the same, without such severe driving as would tend to break the casting, good bedding of the iron and wedge on its seat, and the most scrupulous nicety in the width of the mouth.

If we elect to use a lever instead of a wedge, the pieces, D, in Fig. 1 are omitted, and the wedge is made of brass, cast from a pattern. It is pivoted, and tightened on the iron by means of a screw of coarse pitch and large, coarsely milled lead.

This method is preferable to the wedge, but involves more work and slightly more expense. In the next article, however, I will describe a smoothing plane fitted in this manner, and therefore give no details of such fitting here.

(*To be continued.*)

LATHES AND TURNING APPLIANCES.

BY F. A. M.

II.—Introductory (*continued*).—How to Test a Lathe.

There is an enormous difference in the price of lathes of apparently similar design, so that the supposed purchaser I hope to help by these directions is by no means delivered from his perplexities when he has fixed upon the kind or design of lathe he wishes to possess. Why, for instance, should he pay three times as much to one maker as is asked by another? Ask the expensive maker and he will answer, scornfully, he does not wish to enter into competition with such work as that you have mentioned, and that if his men got such a thing in their shop they would quickly "throw it on the scrap heap." Ask the cheap manufacturer wherein the work of the dearer maker surpasses his, and he will descant on the worthlessness of polish and lacquer, and hint at the enormous profits made by some people, till the prospective customer becomes bewildered. Having passed through all these troubles and perplexities I should like, if possible, to help those who are still suffering.

First, then, let me say that, while there is certainly a great deal of real rubbish in the market, you may avoid that if you go to a reputable maker and attend to the following directions. Secondly, it is probable that amongst respectable makers, whether cheap or dear, you will get your money's worth. The profit is not very different with the one or the other, except that if you buy a lathe of which a great many have been made, it will cost a good deal less than if only a few of that kind had been produced, so that it is no doubt true that makers of cheap lathes are contented with less profit than makers of expensive amateurs' lathes, of which only a few are required. Perhaps the reason for the great discrepancy in the price of lathes will appear from the following little story:—An American applied to Henry Maudslay, some years ago, for an accurate screw some three feet long, expressing himself, naturally, with great emphasis on the high degree of perfection required. The screw was made, but what was the horror of the American when he found the cost was to be £100! He refused to pay, and a commission of experts was appointed to report upon the matter, and decide the true value of the screw. To them Maudslay explained the process of manufacture, the precautions taken to ensure accuracy, and the several methods for correction employed, when they decided that the charge was not excessive and the whole amount must be paid. Let us hope the American was consoled by the thought he could at any rate say he had a screw that would "lick creation." Now suppose that screw had been cut up in a tapping machine (as I am told the leading screws of some of the cheapest slide lathes are treated), and what would have been its value? Five shillings, perhaps! This story is given from memory, not as history, but because I hope it may explain wherein lies the difference between an expensive lathe by one of our best makers and a cheap one. Lay the five shilling screw beside the £100 one and, except for a little extra finish, you might not be able to tell them apart; but, if tested by the microscope or measuring machine, the thread of the good screw would be found to advance regularly by an equal distance each turn, not varying by the one-thousandth part of an inch, and it would be the parent of other screws almost equally correct, whilst the cheap screw would be afflicted with drunkenness; the thread would advance too fast or too slowly, and every screw cut by its means would partake of the same faults. An expensive lathe surpasses a cheap one in *finish*. True, but that is of small consequence. It surpasses it in *exactness of fitting* of the slides and other parts—this is important. It surpasses it in *durability*, which is most desirable; but chiefest of all it surpasses it in *accuracy of adjustment*. The true value of a lathe cannot be estimated until, besides its design and general arrangement, all these four qualities have been considered.

Before proceeding to show what kind of accuracy is required and how a lathe may be tested, it may help if I give a piece of experience with that same boy's lathe referred to at the beginning of this paper. It had certain serious faults of design and construction which will serve as examples in introducing the subject. These faults did not become apparent at first, but when the boy turner grew older he became somewhat disgusted with what had at first seemed absolute perfection. The first fault to be discovered was that when a long piece of work had to be hollowed out, such as a deep cup, and had been chucked by one end on the "taper-screw" chuck, the back-centre point could not be brought up to support the end while the outside was turned. If this was attempted, the point, instead of entering the little central hole made for it with the corner of a chisel, would scratch a circle round that hole of about ¼-in. in diameter. By degrees it dawned upon the mind that this was not a necessity but a fault of construction; the centre line of the mandrel did not point straight down the bed, but only met the point of the back-centre when this was brought close up to the "live" or "running" centre. Here then is an important point in lathe construction: the holes through the two headstocks must be in one straight line, and that straight line must be parallel with the bed, so that, if these holes were of the same size, the headstocks might be clamped upon the bed in any position, and a bar fitting the holes might be passed through both.

My readers will now understand more easily how they may test a lathe and try its accuracy. Take the *plain lathe* first, and begin with the moving headstock. Loosen the holding-down bolt and slide it on the bed, from end to end, to see that it moves freely—it is pretty sure to do so; now try whether it is at all loose; put both hands on it, front and back, and pull and push alternately, listening for a little knock that would prove the tenon underneath did not perfectly fill the space between the bed; slide it along to another place and try again. If there is a decided knock at any part of the bed, so that you can see the point of the back-centre makes a little movement across the bed, the lathe may do for wood turning, or, if fitted with slide rest and the knock is not much, it will do for metal; but it would not do for accurate work as a slide lathe because its centre line does not preserve any certain direction. Suppose, however, that you are satisfied with the fit of the moving headstock, you should next make sure that the cylinder of the headstock that holds the back-centre point fits, and slides in and out without shake; screw it half-way out, push forward the headstock and fix the holding-down bolt so that the point of the back-centre almost touches that of the running-centre; take the back-centre point in your fingers and, without having fixed the pinching screw of the cylinder, try to displace its point. If the cylinder fits the headstock and the centre-point the cylinder, it will feel quite firm, but if it is loose its proximity to the other centre-point will show how much it moves. The next thing to ascertain, since the cylinder of the poppet or headstock has a fixed direction, is whether that is the correct one? Screw out the back-centre point until it begins to feel loose, fix it with the pinching screw, and slide up the headstock till the centres meet. Now observe very carefully whether they come together exactly, looking at them from above and then from the side; if they do so, screw in the cylinder as far as it will go, move up the points to touch, fix the pinching screw, and look again. If they still correspond, the moving headstock is true, but it requires a trained eye to detect slight divergencies.

We may now turn our attention to the fixed headstock; its accuracy is even more important than that of the movable one. Usually there is a hole in the front end of the mandrel into which the running-centre fits, but in small lathes this centre forms part of a chuck which screws upon the mandrel. Now this hole is usually turned out, by a tool fixed in the slide rest, to a cone, each side of which is about 1°, so that the two sides of the cone would form with each other an angle of 2°. It appears to be almost impossible to get this hole perfectly true. To test it, wipe it out carefully; wipe the centre and press it firmly in; now turn the lathe rapidly and bring the point of a tool very carefully forward to touch the end of the revolving centre, when it is almost certain to be found slightly out of truth; turn the centre round to several positions in the mandrel and try again till you find the position in which it seems to run truly. Mark both it and the mandrel so that you can put it in always the same way, then turn the centre half round in the mandrel—*i.e.*, to its worst position—and observe how far from truth it is. You can measure this error approximately by bringing up the corner of the hand rest till it just touches the end of the revolving centre; then turn it half round from the touching point, when the distance between the two will be the greatest. Try first to slip in a piece of newspaper; if that will go, double it and try again. The *Times* paper is about $\frac{4}{1000}$ of an inch thick, say $\frac{1}{200}$, so that if you can get in two thicknesses, as is very probable, the point of the running-centre, instead of running truly, is describing a circle having a radius of $\frac{1}{50}$ of an inch. In such a case as this the hole should be very carefully rebored. Next proceed to take out the mandrel and examine the rubbing surfaces, both inside and outside, to see that they are perfectly hard, smooth, and evenly polished, showing that they touch all over. If the mandrel be fitted with a back-centre, it should pass through a plain, not a screwed, hole, which hole should point straight to the centre of the collar. To ascertain whether it does so, take out the back-centre, turn up a roller of wood to fit the hole, and, passing it through the back-centre hole from the left as far as the hole in the collar, look whether it takes up a position in the middle of that hole. If this were not the case, advancing the back-centre point to take up any wear of the wearing surfaces would throw the mandrel out of line with the lathe bed and cause it to jam in its collar. The last and most important point to examine, is, whether the centre line of the mandrel is in one straight line with the centre line of the moving headstock, and parallel with the bed. Begin, as with the moving headstock, by releasing the holding-down bolt and trying whether you can twist it sideways on the bed; if it prove loose, it may come true if pressed against one or other side of the opening in the bed, but this would be a bad fault. Supposing it is tight, and remembering that you have already satisfied yourself that the point of the running-centre corresponds with that of the fixed or "dead" centre, therefore *one* point of the centre line of the mandrel is right; but we must also ascertain that a *second* point in this central line is true before we shall know that the heads are in line. To ascertain this, prolong the mandrel by fixing a roller of wood in a chuck; let the wood be about 12 or 18 in. long, and melt a little wax on the end of it. Now, while the wood is revolving in the lathe, bring up the point of the back-centre to touch the wax; if the lathe is true it will make a dot; if it is tolerably true, a circle which will be small—say $\frac{1}{32}$ in. in diameter; but if the circle be $\frac{1}{4}$ in. or more, the lathe is not fit for boring, nor for accurate work, unless it can be adjusted. This last test is easily applied, and is more likely than any other to show whether the lathe has been conscientiously made. Now, since it is only a plain lathe we are testing, you can conclude by putting on the band, so as to give eight turns of the mandrel to one of the crank, and, after oiling all the centres and bearings, run the lathe by the foot, to try whether at that speed it goes easily and continues turning some little time after you take off your foot.

We come now to the *slide* lathe fitted with a long leading screw and a saddle to carry the slide rest. All the foregoing tests must be tried for this class of lathe, and that with additional care; besides these, we must test whether the lathe is true enough to turn up a face-plate quite flat, and to slide up a shaft parallel. Take the largest face-plate supplied with the lathe and try, with a straightedge laid across, whether it is perfectly flat; then screw it on, after carefully wiping the screw threads and faces of the chuck and mandrel. Put a point tool in the rest and bring it up carefully to the revolving plate, to try whether it is perfectly true. Let the tool be so fixed in the rest that, when the cross-slide of the saddle is fully drawn back, the tool will point to the face of the plate close to the outer edge. Adjust its distance from the plate till you can just get a card or a bit of paper in between the two; then screw the slide forward till the tool point is opposite the inner edge of the plate near the hole where the end of the mandrel nose appears, and try with the card or paper again. The last test is the one for parallel turning. Wipe the holes for the centres and put them in, taking care that the running-centre is true. Then take a bar about an inch in diameter, as long, or nearly as long, as the lathe will take in; centre it, and, putting it in the lathe, turn up about an inch at one end; then, after adjusting the tool point till it just touches the turned part, take off the handles of the slide rest, take the bar out from between the centres, rack the saddle to the left till the tool point comes opposite the running-centre, turn the bar end for end, and put it between the centres again. Now gently rack the saddle to the right to bring the tool point on to the turned end, and see whether it touches it just as it did at the other end. If you can get a bit of paper between, it would not be very bad, as the test is a severe one, but every thickness of paper you can get in detracts from the value of the lathe.

There are usually screws put through the tenon of the fixed headstock of an engineer's slide lathe, which screws afford means of adjustment; but it must be remembered that it will not do to move these screws to suit any *one* of these tests, since by so doing the adjustment would be thrown out in other directions.

I trust my readers will not have been puzzled by the foregoing attempt at explaining how lathes can be tested. If they will follow out my directions in testing their own, or a friend's lathe, they will, I think, obtain a considerable insight into the principles of lathe work which will be useful to them afterwards, and they will at any rate perceive that the value of a lathe lies not in its appearance but in its accuracy; also that if they buy a cheap lathe it may content them pretty well, for a time, till they become better workmen, and then they are sure to become dissatisfied, so that the quality of lathe they buy might well be made to depend upon the perfection of workmanship to which they mean to attain.

I will now redeem my promise to name some books on Turning, smaller and cheaper than Holtzappfel's voluminous work.

Mr. J. H. Evans has written and published a book on "Ornamental Turning" only, at 21s., which is very good.

Next to this comes "Lathes and Turning," by W. H. Northcott, of the London Lathe and Tool Company; it costs 18s., and covers the whole ground of plain and complex turning. I recommend my readers to buy that book, and to inspect the lathes and tools made at Pomeroy Street.

"The Lathe and its Uses," by the Rev. J. Lukin, costs 10s. 6d.; it contains matter not comprised in other books, but is rather marred by some bad engravings.

After these come a number of smaller books, such as "Lathe Work," by P. N. Hasluck, price 5s., and "Turning for Amateurs," an elementary work well suited for beginners, by the Rev. J. Lukin, 3s.

(*To be continued.*)

A SIMPLE CEILING IN WOOD.

With Hints for Wall Panelling on the Same Plan.

BY HIRAM PRICE.

II.—Panelled Ceilings and Walls.

In my former part I confined myself to speaking only of simple longitudinal arrangements of mouldings which followed the direction of the joists. By such means what may be called a handsome ceiling can be formed with little labour. But far greater decorative results are to be obtained by the additional employment of transverse or even of diagonal mouldings. I have myself attempted something in this direction in the small entrance hall—or, rather, the vestibule to the hall—of my house. The arrangement there carried out is shown in Fig. 5. The lines of the real joists, A, A, are crossed by imitation joists, B, B, which latter are for effect only, and form no part of the construction. The real joists rest on a projecting ornamental brick moulding of the walls, C, C—the walls themselves in this vestibule being, as was hinted in Chapter I., of uncovered but carefully finished brickwork. In this ceiling the four compartments are of course alike, but in the illustration I have (for economy of space, that I may furnish as many suggestions as possible) shown how four different patterns may be formed by the addition of some little moulding or turned work.

By using mouldings crossing diagonally, we may attain truly elaborate effects, nearly approaching in richness to the "artesonado" ceilings of Spain. Some partial idea of the appearance of these may be gained from Fig. 6, which shows one repeating compartment of a ceiling of the kind, sketched by myself, at the Café del Comercio, Murcia, the house having formerly been the mansion of a "Condé." Rich ceilings are an important feature in Spanish domestic architecture. One learns there to expect them, and to feel some disgust when remembering the poverty of our own ceilings at home. It was during a residence in Eastern Spain that I conceived the idea of trying something of the sort myself whenever I should build in England.

The joists used by Spanish builders are much thicker than those commonly used in this country. Those seen in the illustration (Fig. 6) are probably cut half through at their intersections, and still have sufficient strength left to carry the heavy quarry floor above them.

From what has already been said, it will be seen that any one with but a limited knowledge of the joiner's craft could put up a wooden ceiling like mine. No very accurate workmanship is required—a mere dabbler in carpentry could do it. And for that reason I would suggest that any person who may wish to panel a room with his own hands, and who has not the skill or tools to carry out the work in the orthodox fashion, should proceed on somewhat similar lines.

Had I the panelling of a room before me, this would be my way of setting to work. I should first surround my room with two horizontal bands of lath, one at the top and the other at the bottom of the walls; and between these, at proper intervals, I should fix upright laths, which might be said to represent the joists in a panelled ceiling. That the laths might be perfectly firm, it would be well to drive wooden plugs into the walls to which to nail them; the uprights must be in plumb and fixed at equal distances apart, those distances to depend on the width of the veneering boards employed.

My next proceeding would be to screw veneering boards to the vertical laths—two boards to each alternate lath, back to back. They would be fixed by one edge only, the other edge merely lying loose on the intermediate lath. Space would be left between each two boards to give room for expansion, as it was in the ceiling; these spaces to be afterwards hidden, as then, by mouldings laid over them. In Fig. 7 I have drawn a section of panelling thus arranged. The line, A, A, shows the surface of the wall; B, B, B, are the upright laths; C, C, C, are the veneering boards, which for wall panelling should be somewhat stouter than for ceiling work, say ¾ in. instead of ½ in.; and D, D, D, are the mouldings.

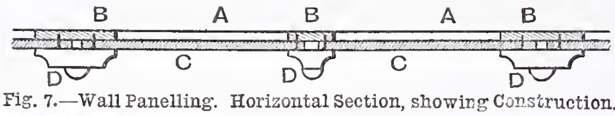


Fig. 7.—Wall Panelling. Horizontal Section, showing Construction.

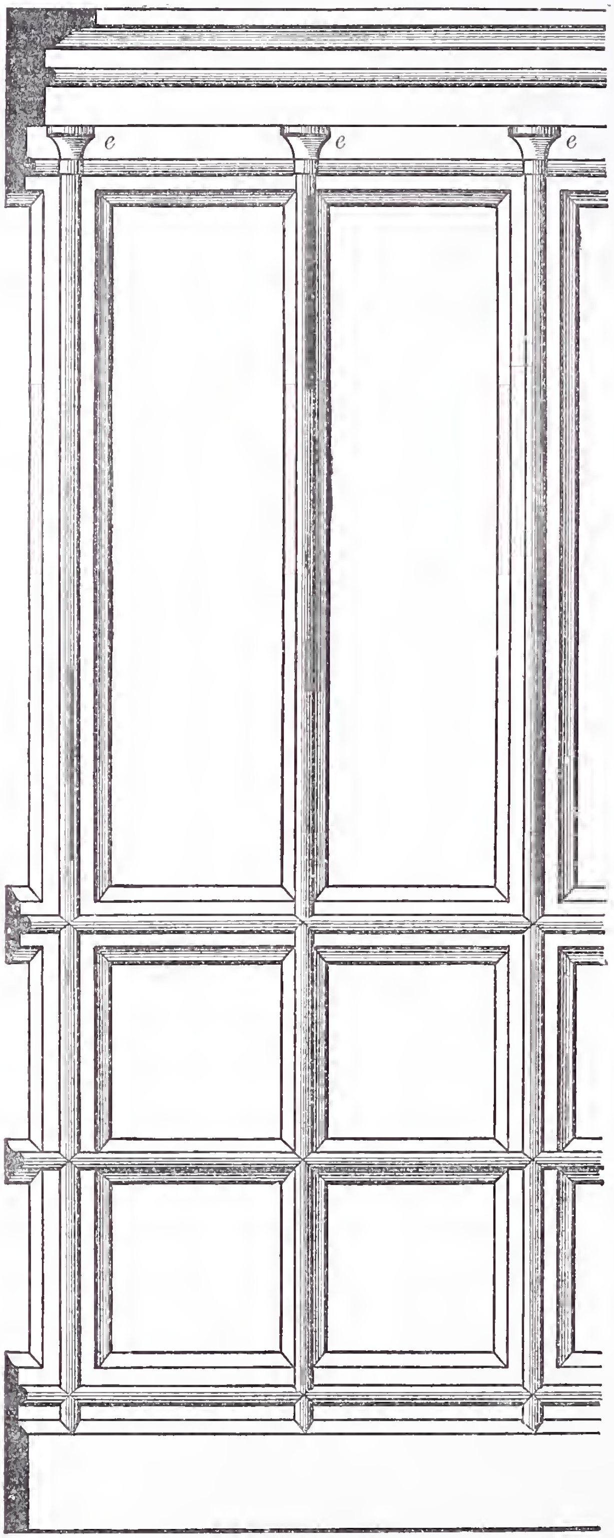


Fig. 8.—A Simple Method of Wall Panelling.

In Fig. 8 I have shown some of this panelling in a completed state. It will be seen that it is finished above by a cornice, which is supposed to be composed entirely of wood mouldings. The small capitals at *e*, *e*, *e*, are turned and then sawn in half; but a worker who has no lathe, but who can carve, might make a richer cornice with carved caps. In the lower part of the panelling I have indicated an arrangement of cross pieces which form a kind of dado, and not an unsightly one.

When panelling walls on this system, it will, I think, be found desirable, for the sake of effect, to keep the longitudinal divisions wider apart than in panelling ceilings. Were I dealing with a room to which I had made a ceiling of this kind, I should, if possible, get my veneering boards 13 in. wide, so that I might arrange to bring one of my larger upright mouldings under each alternate joist only, and one of my smaller uprights under the intermediate joists; for, taken with the ribbed ceiling, the walls would otherwise look too much cut up and crowded. If, however, I were panelling a room with an ordinary plaster ceiling, I should fear no such danger, and make my veneering boards — or panels, if you will—of the more usual 11 in. stuff.

Not much bench work is called for in the construction of these ceilings and wall panellings. Cutting to length, fitting, and fixing up, is nearly all that has to be done. All the stuff can be bought ready prepared. The veneering boards will be bought ready planed on one side; and steam-struck mouldings, which can be bought far more cheaply than such mouldings could be worked at home, will of course be used. The principal firms who sell such things issue price lists which show full-sized sections of a sufficient variety of mouldings, and these may be had at prices ranging from a couple of shillings to as many pounds for the hundred feet run. The wood in which they seem to be usually kept in stock is yellow pine. Such a moulding as that needed for the large upright in Figs. 7 and 8 (width, 2 in.; projection, ¾ of an inch) would cost about 7s. 6d. That required for the smaller uprights would be proportionately less. For wall panelling a *separate* circular bead down the centre of the moulding is not recommended. Needle points would scarcely be strong enough to hold it in place in such a situation; it would be better to have the moulding all in one piece. It will be necessary to screw through the centre, but the holes can be countersunk so as to let the heads well in, and they can be puttied over and coloured like the surrounding wood work. But for where such round beadings are wanted in ceilings (as at *e*, Figs. 1 and 2), they may be had of various diameters, from $\frac{3}{8}$ of an in. to 2 in., at prices from about 3s. to 16s. The top of the cornice, Fig. 7, will need a heavier and bolder moulding. I purchased one that is very effective for such a purpose, which shows a projection of nearly 3 in., for about 25s.

I may mention that I got my mouldings from Messrs. Joseph Sandel and Co., Waterloo Bridge Road, Lambeth, S.E., London. I found them quite satisfactory: good material and little waste.

Whilst speaking of these mouldings I may suggest another way in which they may be made serviceable in home-made house fittings. One of my friends bought an old-fashioned house in which none of the rooms had any cornices beneath the ceilings. My friend was of a mechanical turn like myself, and proposed to decorate his house with his own hands—and a little help from me. We all know how mean and unfinished a room looks with no cornice, and to remedy the defect we got some of these steam-struck pine mouldings, of three or four different patterns. We ebonised them with decoction of logwood and solution of iron, and polished them with beeswax and turpentine. This is quickly done with mere narrow strips of moulding, and after we had papered the walls we nailed up these mouldings in place of cornices. They look very well; the black line between wall and ceiling has a good effect, more especialy if the prevailing colour of the wall paper is green or red.

But in two rooms we did something more than this. In one—the dining-room—we used a large moulding of some $2\frac{1}{2}$ in. in depth and projection, which had a deep rounded hollow running along its centre. We cut from pine board a quantity of square ornaments, something like the "dog's tooth" at *d*, Fig. 5, gilded them, and fitted them into this hollow at intervals of about a foot. This had a very handsome effect. In the other room we used *two* bands of moulding, one ($1\frac{1}{2}$ in. wide) against the ceiling, and a second ($\frac{3}{4}$ of an in. wide) a foot below, thus forming a frieze round the room. The paper of the lower walls was green, that between the mouldings crimson and maroon. This, too, was successful.

This was not very costly work apart from the trouble, for a hundred feet of moulding go a long way (they will cornice a room 25 feet square), and some of the moulding which we used did not cost

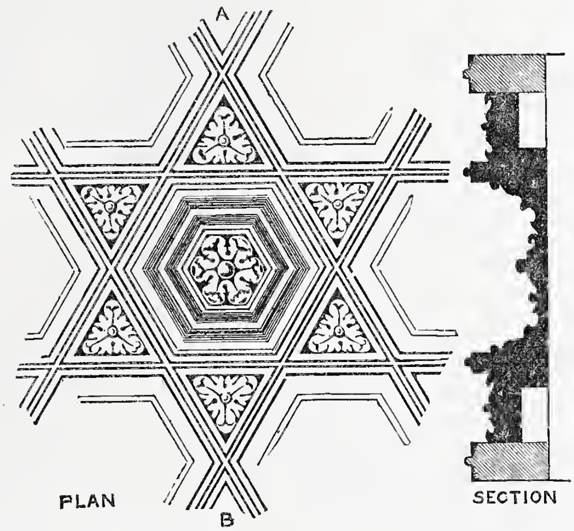


Fig. 6.—Single Compartment in Plan, and Section along A, B, in Plan. Café del Comercio, Murcia, Spain.

more than 3s. 6d. a hundred. To return to my wooden ceiling. I would mention one especial advantage which I find it to possess over a ceiling of plaster—it does not require the periodical nuisance of white-washing.

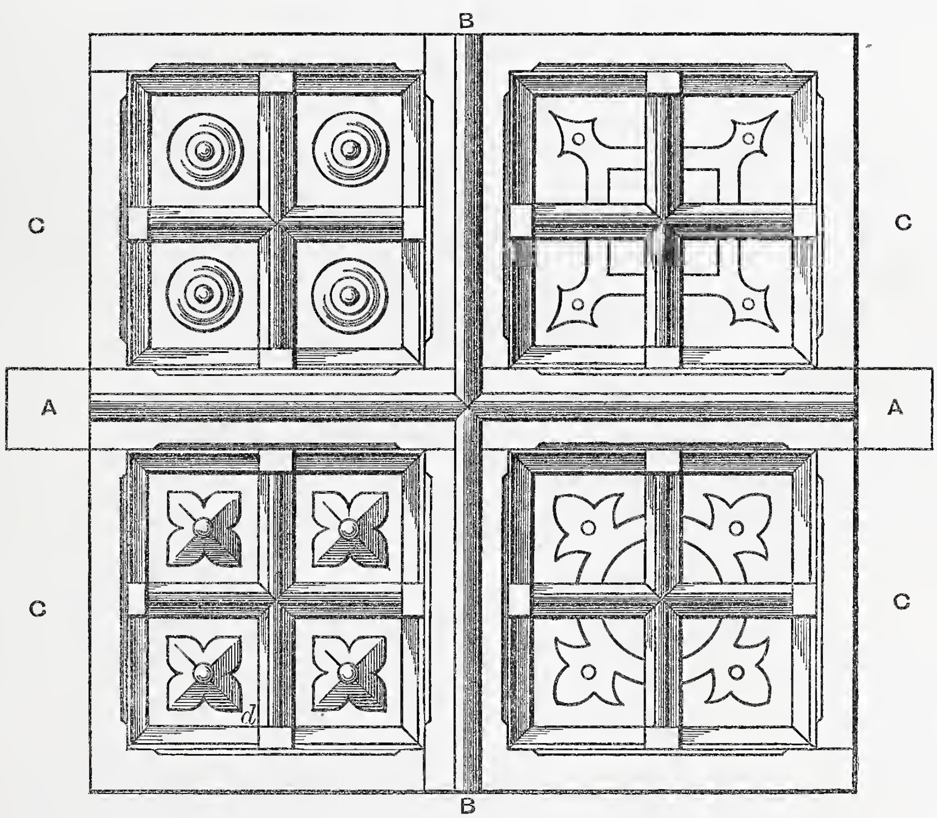


Fig. 5.—Wood Ceiling of Hall, with Four Alternative Designs for Panels.

On looking over the above, it appears to me desirable that in the matter of ebonising some more particular directions should be given; for not only is that process applicable, as above remarked, to cornice mouldings, but it might well be employed both in our ceilings and panellings upon projecting central beadings, etc., if an attempt were made to produce a decorative effect by staining the wood work of different shades.

The process of ebonising is of such simplicity, that any one with moderate care can do it successfully. My plan is to boil the logwood chips in an earthen pipkin, till I have a decoction sufficiently strong to show of a deep orange-red colour, wherever it is laid on the pine wood. This I brush over the wood whilst quite hot, and I go over it twice in order that no part may be missed. In a few minutes the wood is fit to receive the solution of iron, which I also brush on hot and apply twice over. I make my solution by dissolving any odd scraps of iron in vinegar, and dilute it before using with about half water. The wood when touched by the iron at once turns to a deep black, but with rather a purple tinge; this tinge, however, disappears with polishing. Before the polish is applied, the wood should remain for a night to get thoroughly dry, and thin boards, or anything liable to warp, should be weighted. The polishing, as mentioned above, is done with beeswax and turpentine. Pouring some turpentine into a saucer, I scrape into it as much wax as it will moisten freely, and then place the saucer near enough to the fire to melt the wax; but this needs care, as the mixture is highly inflammable. The polish thus made should be of the consistency of cream. It has to be applied with a hard brush and hard brushing; a little of the mixture and a liberal amount of brisk rubbing is the way to get a brilliant polish.

It is, however, rather for cabinet work that great brilliancy becomes a desideratum. For the purpose that we have before us—the ebonising for mere mouldings for our cornices, ceilings, or wall panellings—no higher polish is needed than is to be attained with a very moderate amount of rubbing.

I trust that the hints I have thrown out in this and the preceding paper on the treatment of ceilings will be found useful by many, and such as they may adopt with advantage. Generally speaking, the ceiling in rooms in English houses offers a wide expanse of whitened surface to the view utterly devoid of ornamentation. The only excuse for the invariable whiteness lies in the additional light that is gained by reflection from the ceiling. This would not be materially lessened by the adoption of a warmer tint or stencilled bordering.

FRIENDLY HINTS TO AMATEUR WOOD WORKERS.

BY DAVID DENNING.

I.—Difficulties of Amateurs—Matters often Overlooked—Unseasoned Wood—How to Season it—Warping or Casting—Why Wood should be Turned when Drying—Casting of Dry Wood—How to Distinguish Seasoned Wood—Sources of Supply—Making Glue—Appearance of Good Glue—Fracture of Glue a Test of Quality—Soaking Glue—The Glue-Pot—Melting Glue—Gluing up—How to Use Glue.

Few who have paid any attention to amateur workers' productions can have failed to notice the difference between them and those of the professional; and without any desire to disparage the former, it can seldom be said that they surpass the latter in those points by which superiority is determined. Even where they are not actually faulty either from carelessness or want of knowledge in some constructive detail, there is, if one may so call it, a want of breadth, a niggling kind of work, which proclaims the more or less unskilful artisan. It is, of course, not to be expected that the amateur can have acquired the same facility in working with the tools of any craft as the professional worker who spends a great portion of his life in handling them. In any special pursuit the latter has undoubted advantages not only by seeing how others work, but from constant opportunity of acquiring the manual dexterity which can only be the outcome of practice. The amateur seldom has opportunity of watching skilled craftsmen at work, but must to a great extent depend on what he can pick up by reading, with, perhaps, an ocular demonstration now and again by some friendly expert. True, the sources of his information are now much more accessible, so far as books are concerned, than they were a few years ago, but for all that he must rely to a great extent on his own versatility and ingenuity as well as on his power to "read between the lines" of any technical book or article he may be studying; for, speaking for myself—and I imagine the experience of other technical writers is not dissimilar—it is impossible to convey often what one feels must be necessary information to the novice in any particular branch of work. One may do one's best with pen and ink, both verbally and with illustration, but nothing can equal practical demonstration; and it is much to the credit of those who, without special opportunities of acquiring skill and knowledge of modes of working, have worked so assiduously that they can produce anything worth looking at.

Now, with this little preamble, which, it is hoped, no amateur will take amiss, or regard in any way as intending to discourage him or decry his efforts, I should like to mention a few matters in connection with amateur joinery or cabinet work, merely premising that though I am not an amateur at this, I am in other mechanical pursuits, so that the difficulties to be encountered by the amateur in it may fairly be taken as understood by analogy by the writer. Let me then point out to you, my amateur wood-working readers, a few little matters the neglect of which is often a source of blemish or weakness in your productions. I do so in all friendliness, and I trust that none will object to the remarks. I do not intend to perplex you with complicated technicology, or the insistence of hard-and-fast lines of working, but rather to reiterate those principles which, though well known and perhaps obvious, are apt to be overlooked in actual practice by those who are not continually putting them into operation.

First of all may be taken into consideration the material—wood—not so much with regard to kind of timber or quality of figure and those other features which give to the various sorts their value, as to wood that is fit for working. Now, I suppose every one knows that wood ought to be thoroughly seasoned before it can be prudently made up. If it is not, there is little chance of anything made from it being satisfactory; but it must not be forgotten that even thoroughly seasoned wood may not be dry enough for use. It is too often thought that if wood is seasoned nothing more is necessary, hence the complaints one so frequently hears of the difficulty in obtaining seasoned stuff. As a rule, however, there is no difficulty in obtaining well-seasoned boards of the ordinary kind of timber in any of the larger towns, but *dryness* is another matter altogether. How can it be expected that timber which has been exposed to all weathers, or at the most has only been covered on top, can in our climate be thoroughly dry? Well, when you get wood from the yard do not work it up at once, but let it stand awhile—it may be for days or weeks or only hours—in some warm, dry place before using it. There will then be fewer complaints of "unseasoned" wood having been supplied. Unless wood is thoroughly dry it is bound to shrink when made up, and unless due allowance has been made for this shrinkage it will certainly split.

Again, it is useful to note during the drying process, even while in the rough, boards are apt to cast or twist, or, in untechnical words, to become uneven, some woods being much more prone to this bad habit than others. As a rule, those with straight, even grain, like American walnut or Honduras mahogany, are more reliable than those with finely-marked, elaborate figuring, such as pollard oak, which is a timber that requires the utmost care if used in the solid. It twists and casts in a manner which would surprise any one unaccustomed to its vagaries. Whatever the wood is, planks should be turned occasionally when drying, unless there is an equal air space on each side, for if they are laid on the floor, or leaning against a wall, it will very likely be found that they become rounded, or convex on one side and correspondingly concave on the other. This is owing to the wood becoming either dryer on the concave side or absorbing moisture on the other.

As an effective illustration of this, take a piece of thin board—any will do for the purpose—and leave it in some damp place for a few days, or wet it well on both sides, allowing the water to soak in. If both sides be equally wet, the wood will remain level, but if damper on one side than the other, it will swell on that side. When the moisture has soaked in, hold one side to the fire and just watch how the wood curls. Hold the other side to the fire, and the board curls over in the opposite direction. If while the wood is wet—*i.e.*, after the water has soaked in thoroughly—it be nailed to a dry piece the grain of which runs transversely, in order that the experiment may be better tried, and then held to the fire, the wood, instead of bending, which it will be unable to do, owing to the rigidity of the board to which it is fastened, will, as it dries, naturally contract, and the chances are, will split. Of course, in nailing it down the nails must be put in near the edges, for were it just fastened by one or two in the centre, it would merely contract from the edges to this. Now, the heat of the fire merely accelerates the natural process, the movements in the boards being the same, whether the drying process takes months or minutes, so we see pretty well what course must be adopted if we wish to have good workable stuff free from "shakes"—*i.e.*, without cracks, and flat.

Sometimes the wood worker will find, whatever precautions are taken, that the wood will cast, and if it is really dry and the defect is only slight, it may be rectified by laying the board, hollow side downwards, on a cold floor, and leaving it for a time, or by exposing the convex side to the heat of a fire. In either case watchfulness is necessary to prevent the curve forming the reverse way. Very thin wood may often be flattened by simply placing it under weights, but this process is not altogether to be depended on. When boards are very badly cast and twisted, the only reliable way to level them, with any degree of certainty that they will remain so, is to plane them down. Please note, nothing has been said about unseasoned wood being dried, for it is assumed that every precaution will be taken to use only that which is seasoned; but to sum up, take equal precaution to see that it is *dry*. If this be attended to, most of the defects commonly—and no doubt often correctly—attributed to unseasoned wood will be found non-existent.

Perhaps it may be thought by some of my readers that something should be said about distinguishing when wood is seasoned or not. Much might be written about this, but after all it would simply amount to saying that experience is the best and almost the only guide. A fair idea may often be gathered by noticing the weather stains, but as these depend to a great extent on where and how the timber has been stored, unless the buyer is well acquainted with the material they are not to be regarded as "a fixed quantity," but rather as the unknown X of algebraists. It is true that to the experienced eye weather stains often indicate much, and where they are very marked the wood will generally be at least fairly seasoned—not necessarily dry, mind—but it will frequently be found that thoroughly seasoned wood has little or no stain. Hence the difficulty of giving reliable data on this score.

As a sound and indisputable general rule for the amateur to follow, the best advice that can be given him is to buy from reliable dealers only, and to put confidence in their judgment. As for the sources whence the amateur can draw his supply, it may be said that timber merchants' yards seem the most natural, especially for the coarser kinds of woods, but it stands to reason that many of them will not cut planks nor allow their stock to be turned over for selection when the purchase is only a small one. When there is any difficulty in getting suitable stuff in small quantities from timber yards, cabinet makers who actually make furniture—many of them do not—can generally be applied to with success; only as the bulk of the wood they use is selected for the purpose of furniture making, and therefore often above the average quality of that found in a builder's timber-yard, prices are proportionately higher. Speaking roughly, wood at very low prices generally means wood of inferior quality. Amateurs have been known to complain of one-inch thick mahogany at one shilling per foot being dear, but what would such say to mahogany in veneers at three to four shillings per foot? Yet possibly any of these figures might indicate better value than some mahogany at only sixpence per foot.

With this the remarks on timber must be concluded for the present, and a little may be said about another matter of almost equal importance to the wood worker—viz., glue and its application.

The mixing, or in colloquial language the "making," of glue is one of those little matters which the amateur sometimes seems to think will take care of themselves. No more serious mistake could be made, for glue must not only be good before it is made, but it must be made properly, neither too thick nor too thin, and when this has been satisfactorily arranged, it must be properly used. Any one can stick two pieces of wood together with glue, but whether the joint will be clumsy or neat, durable or only of a temporary character, depends almost entirely on the care and ability with which it has been made. Given good glue rightly mixed and used, the joint, say between two boards, may be so strong that it will be easier to break the wood than to separate the pieces where they are joined.

To begin with the raw material, the glue in the cake as sold in the shops, a few hints may be given which will be of service to the novice, to whom, however, it would be useless to give those finer distinctions and tests by which an expert in glue may fairly estimate its quality. The slightest observation will have shown any one who knows what glue is that there are very marked differences in colour in different makes. Some are almost black except when viewed by transmitted light, while some are almost like amber or gelatine in colour and transparency. Neither extreme is good where strength of joint is a primary object. The black, opaque, unclean-looking stuff proclaims its quality sufficiently even if retail prices do not indicate to the buyer that he can hardly expect much at considerably less than the best qualities are sold for in bulk. The very light-coloured glue is often fairly good and of medium price, but the bleaching to which it is subjected in order to obtain the captivating, and at the same time unnatural, transparency and light colour sometimes impairs its tenacity. For some purposes, such as gluing down thin, light-coloured veneers, it is very good, simply because it does not darken the tone of the wood, as some consider the darker glue does. This, however, may as a moot point be almost considered as beyond the amateur's ken. It is very seldom such extremely delicate veneer is used as to necessitate colourless glue, much of which, if not all, is of continental origin by the way. Those who are familiar with many Teutonic and Gallic productions will understand that they are often excellent imitations of English productions of the same type, but that after all there is something not quite right about them. So it is with glue. I have at various times tested, or had tested, many samples of continental glues which were nice to look at and offered at tempting prices by plausible German bagmen, but I never met with a sample which could be compared with the best British glue for strength and economy in use. I say *British* advisedly, for the best glue for general purposes is Scotch, and it is worthy of every care and attention that the worker can bestow. In colour it is a clear, wholesome, ruddy brown, not a muddy-looking compound, nor yet refined to gelatine.

The manner in which glue breaks when struck, or rather the appearance of the fractured edges, is often a good indication, as is likewise the feel when it is held or rubbed between a moistened finger and thumb; but to go fully into these details would give a quite too technical character to these hints. It will be more within their scope to give a few directions for mixing now that a few leading qualifications of good glue have been indicated, and in doing so it will be seen that there are other points to be observed.

The first thing in making glue is to break the cakes into pieces of moderate size. If the glue shivers easily like a piece of glass would do it may be looked on as too brittle to be perfect, and *per contra* it should not be tough and leathery. Any way, the pieces must be covered with cold water and allowed to remain in soak till they are soft. Mind, good glue should not dissolve in cold water; it should merely swell up and soften. If the water dissolves it as it soaks in and does not seem to penetrate to more than a slight depth there is something wrong. The quantity of water which glue will absorb is a fairly correct estimate of its value being arrived at. Roughly speaking, a glue which will absorb more water than another is the preferable of the two.

When the glue is thoroughly softened by soaking in water it must be liquefied by heat in an ordinary glue-pot, the general features of which are too well known to call for any remark. With regard to size, however, it may be said that a large pot does not require heating so frequently as a small one, which naturally chills more quickly. This leads me on to say that glue should always be used as hot as possible, merely warm enough to be sticky will not do, it must be as hot as it can be made. With the outer pot kept well supplied with water it is not possible to burn the glue, and it is to prevent this that a double pot is required. In its absence a very good substitute may be found in an ordinary jam-pot or similar jar and a small saucepan, the water in the latter, the glue in the former. Never attempt to heat glue in a single pot, or the contents will assuredly be spoiled.

With reference to gluing, while the glue is being rubbed on the wood, especially if a large surface has to be covered, of course it has a tendency to harden by cooling. To counteract this and to make the glue adhere it is generally advisable to warm the work to which it is applied, but in doing this bear in mind what has been said about heat bending boards. Occasionally both the surfaces to be joined should be glued before they are put together, which they should be while the glue is still hot on them. Do not wait till it congeals. If one may so express it, the glue is first stuck to each surface, and then the glue coalesces when they are brought in contact. When practicable—and it generally is so except in the case of large veneers—the glued pieces should be worked against each other with gradually increasing pressure, not only to expel any air between them, but to squeeze out as much of the glue as can be got rid of. On the extent to which this is managed much of the stability of the joint will depend. The thinner the film of glue between the pieces the more firmly will they adhere; nothing is gained by leaving a thick layer of glue. Indeed, the reverse is the case, and it is hardly too much to say that the effort should be to press out all the glue. Of course, to do this is not possible, but what remains will be so small in quantity—if the contiguous surfaces are true and bear uniformly on each other—that were it not for the thin hair line which marks the joint, and the different figurings on the pieces, it would be next to impossible to detect the presence of glue. To prevent the joint from opening, and to keep the surfaces in contact till the glue has set and can dispense with any auxiliary support, it is necessary to keep pressure on the parts. With large thin pieces such as veneers, joined superficially, not by the edges, the pressure is applied by means of a hot caul, which partially liquefies the glue in the joint and forces most of it out at the edges.

From all this it will be gathered that no benefit is gained by too lavish a use of the glue when rubbing it on the surfaces to be joined—unless it be by the glue vendors profiting by the waste. The consistency of the glue when made has not been mentioned yet, though it is an important matter. I mean, of course, its consistency when hot. The expert will adapt the thickness or consistency to the work he has in hand; but for the novice to do so would imply so much knowledge that he might fairly claim to rank as a skilled worker. It must therefore suffice to state that the glue should run from the brush like thick oil, not paraffin oil, but colza or olive oil, or to use other comparisons, which may perhaps be better understood, like melted butter or thin golden syrup. This may not seem very definite, but after all it is only an idea which can be given. A drop of suitably prepared glue if placed on a cold surface should quickly become a jelly. If too thin it will be some time in hardening sufficiently to be handled, and if it is so thick as to harden almost directly and be unworkable with the brush, it is obvious that more water is required. Another important factor in forming a strong joint is to use only freshly-made glue. The tenacity of glue is diminished every time it is heated up. In practice it is not necessary to make glue every time it is used, but certainly no one who knows anything about the way in which the strength deteriorates would think of constantly reheating the same lot. In the practical workshop this tendency to diminish in strength is of little moment, comparatively, as the glue-pot is in constant requisition; but with the amateur who, perhaps, uses it only at long intervals and in small quantities it should not be overlooked. Therefore no larger quantity should be mixed at a time than is likely to require heating up more than a few times. It is owing to neglect or ignorance of this quality in glue, as well as the mistaken notion that the more the better in a joint, that domestic gluing up is so often a failure.

(To be continued.)

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

III.—Freehand Drawing—Outlining Ornaments and Devices—Blackboard Practice.

I TRUST the student has been closely following the directions laid down in the last chapter, for as "lettering" is nothing less than a special class of drawing, more or less advanced, according to the proficiency attained by the pupil in the higher orders of ornamental lettering, a good deal of practice, after the plan laid down in these preliminary lessons, is an absolute necessity.

Before I leave the subject of freehand drawing, I would like to give one little hint for obtaining facility in describing the circle, one of the best examples of free-hand drawing the pupil in lettering could have placed before him for practice. Of course, a perfectly true circle is quickest done with the aid of compasses, and these are always used in actual work, but it is, nevertheless, possible to produce one just as accurate with the hand, guided by the eye alone. This entails a close application to practice, repeated

Fig. 25.

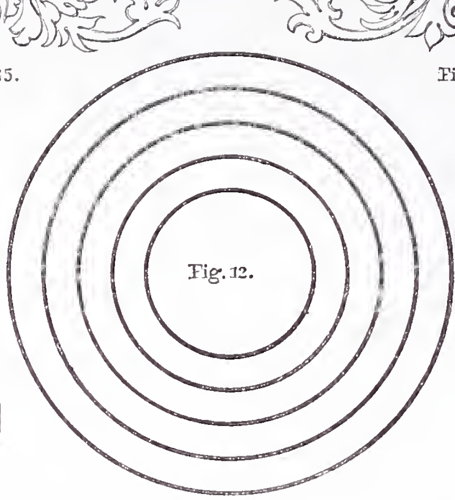


Fig. 12.

Fig. 26.

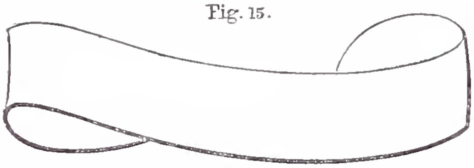


Fig. 15.

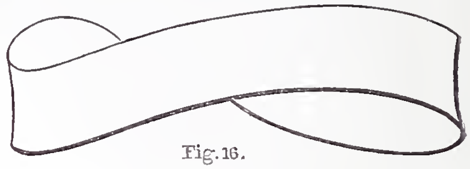


Fig. 16.

and repeated again: but in course of time success is an ensured certainty, and the man or boy who can, off-hand, draw a circle in this way, is competent to undertake any branch of work that may be placed before him. In fact, I do not know of any better method of educating the hand and the eye, and of enabling the former to obey the dictates of the latter, than repeated practice in drawing the circle in all sizes, and without any extraneous aid.

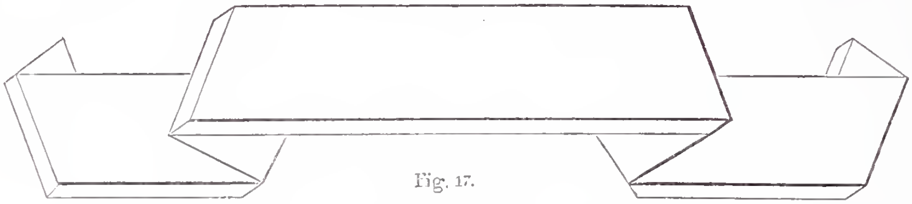


Fig. 17.

In order to make my method of study in the first few chapters more clear to the reader, and so enable him to pursue his studies as I would suggest, I had perhaps better explain how I am endeavouring to train him for accomplishing the work I hope to expound later on.

Now, the true essence of proficiency in the sign writer's art lies, firstly, in training the eye to that degree of perfection that it can instantly detect the perfect from imperfect, the truthful from the untruthful in form, and is capable of at once judging the result of any work it rests upon. The workman must, in fact, always be able to carry, "in his mind's eye," as it were, the accurate formation of all lines, curves, and objects incidentally portrayed in the usual routine of his work. And secondly, having advanced so far, he must next attain a perfect freedom and command over the hand, so that it is capable of giving a truthful rendering of the eye's invisible, but—let us hope—artistic will. Thus, to explain still further, we have before us a blank signboard, on which is to be written the name "JONES," and the usual lines being "mapped" upon it, we face it, and in our "mind's eye" we see the letters on the board, and at once proceed to put in a chalk or pencil mark around them—transforming the invisible into the visible, seen by all.

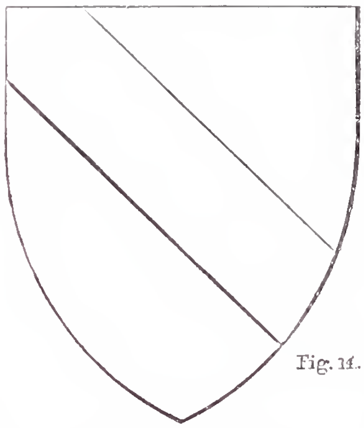


Fig. 14.

This is my own individual method of procedure, but I, of course, do not say it is followed by others, or, in fact, by anybody; but I do insist that, before a man proceeds to "chalk in" his work, he must, to a certain degree, picture to himself the size, shape, and construction of the letters, and the hand obeys the eye accordingly. And, regarding myself, I go even further, for I actually see the letters there before I draw them, so that the work resolves itself into a species of tracing. But this is theory, and open to contention, so I will say no more on the subject.

I have, I think, now explained the object of these opening chapters, viz., the proper and methodical training of

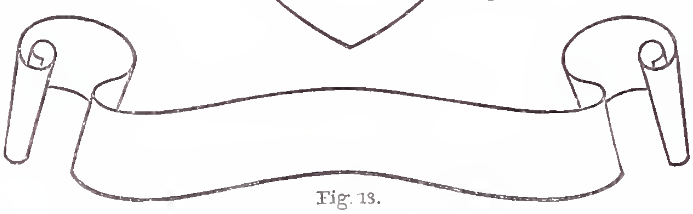


Fig. 18.

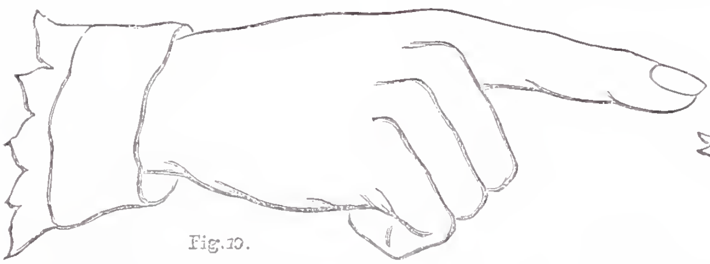


Fig. 19.

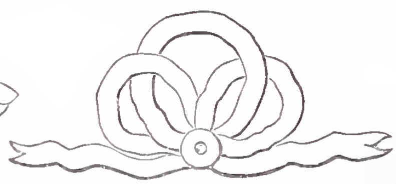


Fig. 24.

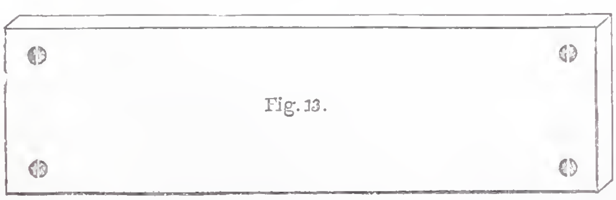


Fig. 13.

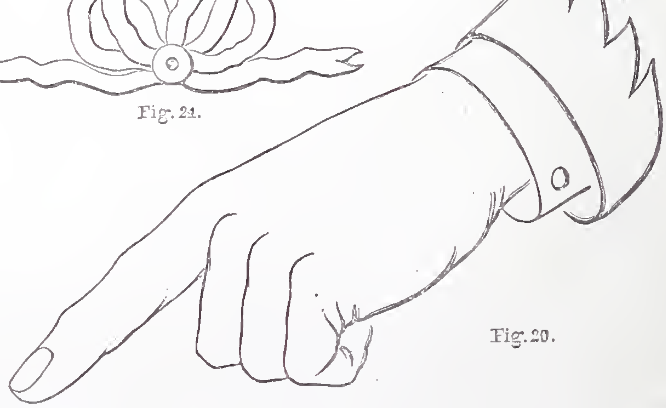


Fig. 20.

Fig. 12.—Concentric Circles. Fig. 13.—Plain Board with Screw Heads at Corners. Fig. 14.—Shield. Figs. 15, 16, 17, 18.—Scrolls. Figs. 19, 20.—Index Hands. Fig. 24.—Centre Ribbon Ornament. Figs. 25, 26.—Scroll Work Corner Pieces.

the hand and eye, and we trust the student will follow us with due appreciation, as it is a matter most other writers on the subject have entirely overlooked.

The illustrated examples of freehand drawing and outline subjects which I give have been selected, to the best of my ability, for the special purpose we have in view, but as I have so urgently advised the novice to diligently practise the circle, I had better make some remarks on the best method of proceeding to work in this direction.

It is, of course, much easier to draw a small circle than a large one. The beginner should therefore make a start by describing a circle three inches in diameter, persevering until he is able to draw it, time after time, tolerably correct. This is best done on a large slate with slate pencil, but the slate should not be allowed to lay down upon the table. On the other hand, it should be held in a nearly upright position, propped up with books, held by the left hand, or, better still, placed on a small home-made easel, which is easily constructed.

Having made satisfactory progress with the small circles, proceed as follows:—

Describe a circle three inches in diameter, and then continue to construct larger ones outside this, and all at a given distance from each other, until the whole surface of the slate is covered. (See Fig. 12.) Practice in larger circles may afterwards be transferred to the blackboard with both chalk and brush, but the student must by no means bore himself with this or any one class of work, but should change about from one subject to another, so as to infuse variety and interest into his work.

We will next turn our attention to a few subjects which the sign writer is frequently called upon to paint, and this being so it is, of course, necessary he should know how to draw them with accuracy. I give some examples with this chapter, a series of outline drawings only, as copies for repeated practice.

Fig. 23.—Crown.

Fig. 21.—The Royal Arms.

Fig. 22.—Prince of Wales's Plume.

In commencing practice use drawing paper tightly pinned upon the drawing board, and one of Rowney's twopenny HB. pencils, which is the best for beginners, as it gives a good bold stroke, and the lead is thick and very easy to work with. In drawing these examples compasses and rule are now permissible. Nevertheless, I would still recommend that they be drawn in freehand for a time—in fact, in order to set a good example, I have myself done some of these drawings with the unaided hand, and with the pen I am writing with, merely using Rowney's liquid Indian ink instead of ordinary writing ink; and, be it known, it is much more difficult to execute freehand drawing with a pen than it is with a pencil. It is good practice, however, to follow the pencil lines over with Indian ink, and as a suitable pen I use Gillott's school pen No. 351 F., and Cassell's series of drawing books.

Having tired of pencil and paper, the student must next bring his blackboard into requisition, a description of which has already been given. He will also require a box of Rowney's white demonstration chalks—this is a tapered chalk four inches long, and is more expensive than the ordinary blackboard chalk, which, however, would be of no use for our purpose — a camel-hair writer, a thin piece of "planed" board to act as a palette, and some white (zinc) paint thinned out to the proper consistency with a little *sweet* oil, and some old dusters or bits of rags.

We now commence at the beginning again, and proceed to draw the straight lines, curves, circles, etc., with the chalk, but on a larger scale. This last remark reminds me that I have omitted to say—as I should have done in the first chapter—that it is not necessary for the student to continue to draw his copies exactly the same size as they are given in these pages, although for the purpose of the eye training, as just laid down, he should for some time endeavour to draw them to the same scale, and ascertain by measurement how far he is out when his drawing is completed. After that it is also necessary to become proficient in both reducing and enlarging, and we would therefore advise that the student should, after awhile, make each succeeding drawing larger than the preceding one, and taking this last as his copy for the next one. He can thus go on until he reaches the limits of a full-sized sheet of drawing paper, so that when he comes to practise upon the blackboard he will gradually have worked up to the enlargements almost without being aware of it. He should keep all these intermediate drawings as copies to practise from on his blackboard, and it will be a good plan to work backwards until at last he actually makes an enlarged drawing on the blackboard from the drawings in these pages; but in doing this he should put his other drawings out of sight.

I will now suppose that the pupil has been practising for some hours on the blackboard with chalk, and has redrawn each subject several times over. He should now take his camel-hair writer, and having worked a little white paint on to his extemporised palette, and having thoroughly cleaned the chalk marks from his board, he should proceed to draw all the freehand subjects with his brush and paint, commencing with straight lines and curves. His first object is, of course, to be able to make a line, with his camel-hair writer, of the same thickness throughout. He may now use a mahl stick to rest his wrist upon, or may rest his right hand on the left wrist, the left hand being placed against the board. If his hand is steady and firm enough, however, he had better dispense with either in all his preliminary work, as he will then be the better able to appreciate the help of a mahl stick when it comes to the "grim reality." Here again I may say I have never had one, although, possibly, better work would have been the result if I had. It, however, shows they are not absolute necessities for a young man with a steady hand and of sober habits.

The workman should make his lines, as far as possible, with the point of the brush and not with the side. He must work with a bold, unhesitating hand, if he wishes to give a firm and finished appearance to his work. Any timidity or hesitancy on his part will only end in a very dubious result, and at once betray the hand of the novice. The white paint should be of just such a consistency as to flow freely and evenly from the pencil, and at the same time giving sufficient covering power on the board. The brush is held in much the same way as a pen in ordinary writing; it should not, however, be grasped too tight, as the strain on the sinews of the hand tends to cramp it, which very soon tires it and so renders it unsteady.

As soon as the board is covered all over with paint marks, it must immediately be wiped clean with a piece of rag, which has previously been steeped in a little common turpentine. It is as well to have the paint in a tin dipper, which will be described hereafter.

Coming next to the series of outline subjects given with this chapter, I would impress upon the student the desirability of practising these on the blackboard until he is absolutely perfect, and able to turn out a passable specimen of each one. Fig. 13 is a plain board with a screw head at each corner; Fig 14 a plain shield; and Figs. 15, 16, 17, 18, a series of four scrolls. Next we have a pair of hands (Figs. 19 and 20), one pointing in a horizontal direction and the other downwards. The Royal Arms (Fig. 21) will, no doubt, prove the most difficult subject to tackle, but as the sign writer is so frequently called upon to paint it, he must take it very seriously in hand, and, after he has gained some little experience in the manipulation of his brush, he will find it not so difficult as it at first appears, and he will soon be able to draw it in proper proportions with the greatest facility. He should firstly draw the subject on the board with chalk in a somewhat sketchy manner, allowing his hand a roving freedom, and relying more on his pencil brush for afterwards putting in the lines in a firm, masterly way. This subject is only treated here purely as an outline example; the method of shading will be described, and the colours to be used given, in a later chapter. The Prince of Wales' Feathers (Fig. 22), being a much easier subject, had better perhaps be attempted first. The Crown (Fig. 23) is more difficult, and a little practice will be necessary to draw it to the correct shape. Fig. 24 is a centre ribbon ornament, and Figs. 25 and 26 two scroll work corner pieces. The student should not confine himself entirely to the examples given here, but should draw anything that comes in his way, if it is likely to be of use to him. He will find plenty of other subjects in books and illustrated advertisements, and even on the poster hoardings in the street. He should also go round, sketch-book in hand, and jot down any little bits of good work which he may take a fancy to over the shop fronts and other places of business. He may afterwards make finished drawings of them at home for future use and practice. Making use of his brains in this way will prove of great assistance to the student in his course of self-tuition.

(*To be continued.*)

CRYSTOLEUM PAINTING.

BY O. BECKERLEGGE.

II. — How to Render Photo Transparent—Painting — Suitable Colouring for Portrait — Treatment of Details — Second Painting—Draperies and Background—Finishing and Mounting — Landscapes — Colouring Foliage, Clouds, etc. — Conclusion.

Our next business will be to make the picture transparent. To secure this end several modes are adopted. There is a crystoleum wax sold. This has to be melted in a bath, and the picture soaked in it until the transparency is obtained. I have no doubt this is a good plan, but I have not adopted it, as it necessitates bath, lamp, etc., and there is the danger of overheating the wax, when it is said to turn yellow. I have a shrewd guess that the so-called prepared wax is nothing more or less than paraffin wax. The plan I adopt is one which dispenses with the bath, etc., and saves the expense of wax. Take a little of the poppy oil and pour it on the picture. When it has stood an hour or two the picture will be beautifully clear. Drain off all the oil and it will be ready for painting. I have also tried copal varnish, using it as the oil, but I have the most confidence in the former. Some recommend sweet oil, by which I presume olive is intended, but of that I have no practical knowledge. It seems to me that almost any clear oil or varnish that will dry would answer the purpose.

Well, having got our work up to this point let us proceed to the painting. I will suppose it is your own portrait. According to your complexion, hair, etc., so must be your colours.

Presuming I am giving instructions to one quite unused to paint, let me mix the paint for you.

Eyes. — *Blue*, cobalt; *black*, vandyke brown; *grey*, cobalt and black; *brown*, burnt sienna.

Hair.—*Very light*, Naples and Indian yellow; *medium light*, burnt sienna; *dark*, burnt sienna and vandyke brown.

Cheek and Lips. — Carmine and vermilion.

Complexion. — *Light*, white, carmine, and Naples yellow; *dark*, white, Indian yellow, vandyke brown.

Silver. — White and black. Gold.—Naples and Indian yellow, burnt sienna. Of course, it will be understood that a variety of tints can be produced by the paints named. We must, therefore, use our judgment as to the quantities—as, for example, two persons may be dark, but the colour may be very different; in one case the yellow may prevail, in another the brown—so for hair. We must, of course, bring our judgment and taste to bear on these matters. I will make a few remarks on landscape painting further on.

Let us now proceed to details. With a very fine pointed brush put a point of light in the eye—any picture, even an engraving, will suggest where it should be placed. This representing the reflected light in the eye, gives brilliancy and character. Then the iris, blue or brown, as it may be necessary; the white of the eye, white and a tinge of Naples yellow. Next work on the lips and cheeks; the latter, carmine only, using judgment as to depth of tone. As Opie said once, "mix your colours with your brains." Then put in the hair, using only transparent colours, as I have indicated. Linen, lace, etc., white with just a trace of blue to take off the rawness; jewellery, as before indicated, whether it be silver or gold. Flowers and foliage, as per nature. All this to be painted on the transparent photo. There must be no attempt at shading, either now or at the subsequent stage. The photo, if it is a good one, will provide all that, and if it is not a good one you cannot improve it. All your various studies can be brought up to this point, supposing you have several on hand. They must now stand over till they are hard, which will be by the next day.

We must now proceed to the second painting. When the first paint is dry, remove any dust that may have settled on the glass. Take the second glass and rub it so that there may be no dust, fluff, or grease on it. Provide a strip of gummed paper—the margin off stamps will do admirably—let them be, say ⅜ of an inch wide, place the second glass on the first, and fasten them together on the edge by the gummed paper. Now take your colour for the face and hands, mixing it with a little poppy oil; it will be understood that the paint in every instance is brought into a fit consistency for work by mixing it with this medium. Pass the colour over face and hands, simply taking care to keep to the outline. By turning it over during the operation you can easily see whether you have come too far, or not far enough. Any alteration can easily be made —the entire paint removed, if needs be— without doing any injury to the picture.

Draperies must be painted in the same way, our judgment guiding us in the tint. The background will now claim our attention. The tint will, of course, depend to a great extent on the main subject. A nice effect will be produced if the several colours, blue, yellow, and red, be placed in patches on the glass, and then mixed all up together. A soft prismatic effect will be the result, one tint gradually fading away into another.

When the work is done as near to your satisfaction as possible, cut out a piece of cardboard the size of the glass, and with strips of gummed paper bind the edges all around to keep out dust, etc. It may then be mounted in a plush frame, or, if preferred, a narrow gilt frame will look exceedingly nice if a narrow fold of plush is glued in the rebate of the frame so as to project, say, ⅜ of an in. in the place of the usual flat. This narrow beading of plush will cover the strips of paper which bind the picture together. If in the progress of our work we find the details painted on the first glass are either too hard or not distinct enough, it can easily be remedied by cutting down the gummed paper on one side and opening the glasses, and retouching or softening the first colours as may be desired. Do not cut down the two edges, as you may find some little difficulty in bringing the two glasses in exact correspondence. By leaving one side secure the glasses will find their true position.

Should we purpose painting a landscape, then let the foreground with its details be painted on the first glass; middle distance, clouds, sky, etc., on the second glass. I can only indicate, of course, in a general way what colours to use, as every subject must be treated according to its nature.

A dry open road, Naples yellow, white, and tinge of red. Foliage, with a glint of sunshine on it, soft greens, yellow predominating; sombre greens, blue, burnt sienna; sky, cobalt, and white with a tinge of either red or yellow towards the horizon. Instead of putting on these in distinct washes, as would be done in a water-colour drawing, a dab of the colour should be put on the horizon, and then mixed together on the glass; this will give soft mysterious blendings of colour, the soft light melting into the blue above it. Very distant hills, blue and red; prominent spurs should be lit up with the colour of the horizon, but just a shade lower in tone. Water must take its tone from the sky. Clouds, various shades of grey made with white, blue, and red in different proportion, with a little Naples yellow. In all these cases the shadows in clouds, mountains, etc., must be put on first, the lighter tints behind them.

Any one following these instructions will be able to produce work which will give satisfaction. From briefer notes than these I acquired the art, and I know that persons have been able to turn their knowledge of the art to commercial advantage who have acquired that knowledge simply by reading instructions even briefer than those I have given. Should any little difficulty arise, I shall be happy to answer a question. On reading what I have written, I find I have omitted to mention that the eye-brow and nostrils must be painted on the first glass. For the eye-brow use colour as per hair; soften it towards the eye with a dry brush, stroking downwards.

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

I.—Introduction—Acid—Acetic Acid—Acetate of Copper—Acetate of Lead—Acetate of Silver—Acetate of Zinc—Acetate of Iron—Acetate of Mercury—Acetate of Alumina—Acetate of Cobalt—Acetate of Nickel.

The following notes have been collected from various sources of information, and have proved of some use to me in my work. I now offer to share the benefits I have received from them with my fellow-workers. They are here arranged nearly in alphabetical order for easy reference, and may thus be regarded as an Electro-plater's Dictionary.

Acid.—The acids in general use among electro-platers are: acetic acid, hydrochloric acid, nitric acid, nitrous acid, sulphuric acid, and sulphurous acid, all described under their respective headings. "Most of the acids are soluble in water; they possess an acid taste, and have the property of turning blue litmus solution red. All acids contain hydrogen, combined either with an element, or with a group of elements, which almost always contains oxygen, and in this case the substances are termed *oxi*-acids." (Roscoe.)

Acetic Acid.—French: *Acide Acétique.* Chemical formula, $C_2 H_4 O_2$. Common vinegar is dilute acetic acid prepared by the acetous fermentation of alcoholic liquids. Crude acetic acid (named also pyroligneous acid) is prepared on a large scale by the dry distillation of wood. Glacial acetic acid is obtained by heating acetate of soda with strong sulphuric acid. This acid is a colourless liquid, with a peculiar, sharp, pungent odour, and strong acid flavour. It will mix with alcohol, ether, or water in any proportion. When concentrated by distillation, it boils at 118° C., and solidifies at 17° C. to an icelike mass, hence its name. It will blister the skin, and dissolve camphor and several resins. It forms with bases some important acetates, described under their respective names.

Acetate of Copper.—French: *Acétate de Cuivre.* There are two substances commonly named acetate of copper. One of these—ordinary verdigris—is only a sub-acetate of copper obtained by spreading the marc of grapes (vintage refuse) on copper plates exposed to the air during several weeks. This forms a bluish-green salt, not entirely soluble in water. The true acetate of copper (sometimes known by the names: crystals of Venus, crystallised verdigris, and distilled verdigris) is made by dissolving common verdigris in hot acetic acid, and setting aside the filtered solution to cool. The salt forms beautiful dark-green crystals, which are soluble in water in the proportion of one part of the salt to fourteen parts of water. Mr. Smee says: "A solution of acetate of copper is difficult to decompose, requiring the intensity of several cells." Acetate of copper is used in making up brassing solutions. It is very poisonous.

Acetate of Lead.—French: *Acétate de Plomb.* Described as plombic acetate, Saturn's sugar, and sugar of lead. This salt of lead is made in large quantities for commercial purposes by dissolving litharge in strong acetic acid. It is generally met with in the shape of heavy white crystals, or a mass of them, resembling loaf sugar; this, coupled with its sweetish flavour, has ensured for it the name of sugar of lead. Sugar of lead is poisonous. It is soluble in one and a half parts of water, and in alcohol. "In a solution of acetate of lead, zinc is the only metal that receives a coating of lead by simple immersion." (G. Gore.) This property has led to the performance of a beautiful and simple experiment illustrating the arborescent formation of metallic crystals. A small piece of zinc is suspended by a fine brass wire from the bung of a pickle bottle nearly filled with a solution of lead acetate in distilled water. As the zinc dissolves, crystals of lead take the place of the dissolved zinc, and arrange themselves around the wires in the form of vegetation, and is then named a lead tree. This salt is also used in making up solutions for the electro-deposition of lead. (See *Lead, Electro-deposition of.*)

Acetate of Silver.—French: *Acétate d'Argent.* Mr. Gore has tried a solution of this salt, and says: "For depositing purposes, a solution composed of water twenty parts, cyanide of potassium four parts, and acetate of silver one part, conducts very freely, and yields a fine white deposit of silver." The salt may be made either by adding a solution of acetate of potash or of soda to a solution of nitrate of silver as long as a precipitate occurs, decanting the liquid, and washing the salt in the usual way, or by digesting the oxide or the carbonate of silver in hot and strong acetic acid.

Acetate of Zinc.—French: *Acétate de Zinc.* This salt may be made, either by dissolving zinc in strong acetic acid to saturation, or by adding a solution of lead acetate to a solution of zinc sulphate, as long as it produces a precipitate; filter, evaporate the liquid, and set aside to crystallise. This salt is sometimes mentioned in some formulæ for brassing solutions.

Acetate of Iron.—This has been recommended as an antidote to poisoning by cyanide solutions. There are two acetates of iron—an acetate of the protoxide of iron (crystals of small greenish-white needles), and acetate of sesquioxide of iron, "a dark-brownish-red, uncrystallisable liquid, of powerful astringent taste." (Fownes.) The ordinary "steel drops" sold by chemists will serve every purpose required here.

Acetate of Mercury.—A solution of this salt will deposit its metal on iron by simple immersion. Prepared similar to acetate of silver.

Acetate of Alumina.—A gummy mass used in calico printing.

Acetate of Cobalt.—A violet-coloured deliquescent salt.

Acetate of Nickel.—A green salt of this metal, soluble in water. Of no special interest to the electro-plater.

(*To be continued.*)

WHY DOES A TOOL CUT?

BY J. H.

II.—Sensitiveness of Tools—Impairing Wedge Form—Grinding Chisels—Facets made in Sharpening—Grinding, when Necessary—Drills—Lip Drill—Twist Drill—Reamers—Taps and Dies—When such Tools cease to operate—Saws and Files—Work done by Tool—Its Teaching—Presentation of Tool.

I will now briefly illustrate the principles laid down in my previous article by examples taken from common tools. Of these, the kinds used for wood working are more sensitive to ill-treatment than those used for working metal, and of the latter those which are operated by hand than those actuated by machine. The reason is, of course, that the more delicate the nature of the work, the more readily is the action of the tool felt. There are numbers of tools in daily use in the machines of our factories which are badly formed, so causing a great waste of power, that would not and could not be tolerated if they were hand worked, because the hand and arms soon rebel against the excess of energy required to operate badly formed tools. The stresses on the machine-worked tools on the other hand are only apparent in excess of friction, the evils of which are not so evident to some workmen as excess of muscular effort.

Take first those cases in which tools do not cut because the wedge form is impaired. The chisel, and all chisel-like tools, should be ground with one facet only, not with several. This applies alike to the chisel for wood working and for metal cutting, to the gouge, the axe, adze, knife, razor, plane-iron, spokeshave, and others of similar type. The reason why it must be so in order to develop the full efficiency of these tools is apparent from the illustrations.

Thus, comparing Figs. 6 and 7, which are slightly exaggerated for the purpose of illustration, Fig. 6 shows how a chisel-like tool ought to be ground, the concavity of the facet exactly corresponding with the curve of the stone upon which it is ground. To grind it like this requires some practice in the case of broad chisels and plane-irons, the tendency in unskilful hands being to produce a succession of facets like Fig. 7, due to the slipping up and down of the tool on the revolving stone. But the advantages of Fig. 6 are very great.

First, the necessity for regrinding is delayed much longer than in Fig. 7, where the facet is on the whole convex instead of concave. Fig. 6 approaches to the hollow razor form, Fig. 8, and for some little time the grinding angle and the sharpening angle will coincide; after awhile it becomes necessary to tip the facet in sharpening, Fig. 9, and the sharpening angle is gradually rendered more obtuse until regrinding becomes necessary. But in Fig. 7 the sharpening angle is obtuse from the commencement, and regrinding is soon required. Moreover, since the angle is so obtuse, a greater expenditure of energy is necessary to remove the shavings than in the former case, because the latter has less penetration than the former. This is apparent from the dotted lines, which show the effective angles of the two by comparison.

A good workman, therefore, always endeavours to preserve the wedge-like form to his tools as long as possible, regarding the grinding of the hollow facet as a matter of cardinal importance.

Chisels are often badly sharpened by tilting up the face for the purpose of turning back the wire edge. The result is that the face is like Fig. 10.

This again detracts from the wedge form. Worse than that, it vitiates a very important point in chisels worked by hand; it destroys the guidance afforded by a perfectly flat face. The chisel must be tilted before it will cut, and being so placed, there is no longer that contact of broad faces which is conducive to the guidance of the tool, and the difficulty of cutting surfaces and ends is much increased thereby.

No matter how flat the general area of the chisel face is, if there is a second facet, however narrow at the cutting edge, that determines the action of the tool. The tool angle is measured between that and the sharpened facet on the bevelled face. Hence the need of care in these little matters where amateurs are so apt to fall into error.

Of course, with all tools the labour of cutting becomes increased as the wedge form is unavoidably impaired by legitimate use, that is as their keen edges become dulled, in other words as their angles become more obtuse. When the amount of this is slight only, we resort to *sharpening*. When, by repeated sharpening, the tool angle becomes very obtuse we remove material in greater quantity by *grinding*.

There are many serviceable tools which we are accustomed to class with the cutting tools, which cannot be said, literally and strictly, to cut because they have not the wedge form. Among these are included the common drills, the screw taps and dies, the reamers, and other forms. Thus the common drill, Fig. 11, by reason of the overhang of its cutting face, A, makes an angle greater than 90° with the face of the work, and it is simply a scrape, though, by reason of the coercion exercised upon it, it really removes tolerable chips or shavings. But the lip drill, Fig. 12, is a cutting tool, being a true wedge.

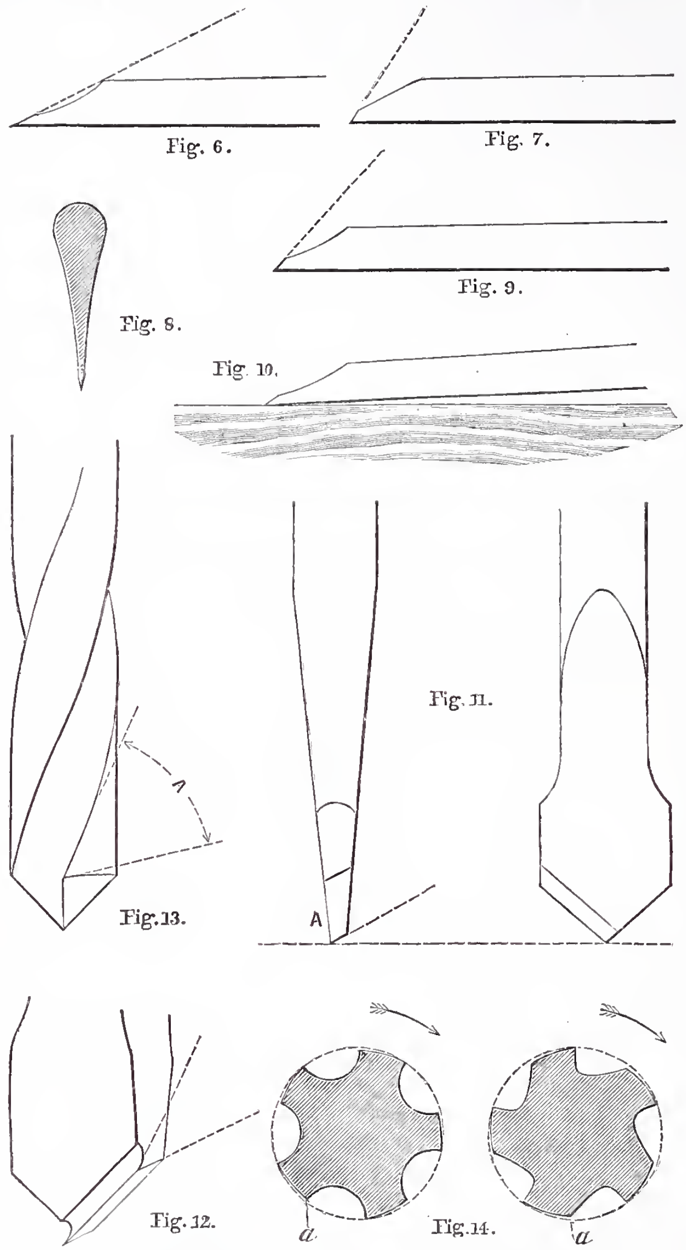


Fig. 6.—Chisel Ground Correctly. Fig. 7.—Ditto, Incorrectly. Fig. 8.—Section of Razor. Fig. 9.—Obtuse Sharpening of Chisel. Fig. 10.—Chisel Tilted by Bad Sharpening. Fig. 11.—Common Drill. Fig. 12.—Lip Drill. Fig. 13.—Twist Drill. Fig. 14.—Sections of Reamers and Taps.

But much superior as a cutting tool is the twist drill, Fig. 13, whose angle, A, is acute or wedge-like. The angle of the spirals remains constant throughout the life of the drill. Figs. 12 and 13, therefore, have the top rake, which is absent in Fig. 11. All alike have sufficient clearance, or relief angles. Very few reamers or taps have any top rake, and they are not therefore wedges. Even in the best designed forms the top or cutting face is perpendicular to the work, as in the reamer, two of whose sections are shown in Fig. 14, and the taps, whose sectional forms are similar to those which are shown in Fig. 14.

But then these remove material in fair quantity because of the strength and coercion exercised in operating them, and because they are all backed off, as at *a*, *a*, preventing excessive friction between the tool and the work. Each of these tools ceases to operate when the primary conditions become vitiated chiefly in their case by the wearing back of the keen edges obliterating the angles of clearance, to which the efficiency of Fig. 14 is largely due. Because their form is unfavourable for cutting, and because they so readily lose their pristine edges, very great care is necessary to avoid all contact with rough cast or forged surfaces, the case may be.

Saws and files operate not as wedges but as a multitudinous assemblage of scrapes. The minute teeth have abundant clearance, a highly important matter; but as the front faces of the teeth lean back beyond the perpendicular they cannot penetrate as wedges. One thing which tends to sweetness of working by diminishing the friction is the diagonal sharpening of the tooth faces in the case of the saws, and the diagonal arrangement of the lines of teeth in the files. By these devices the material is attacked in detail, just as when using a broad wood-working chisel we move it diagonally across the face of the material to ease the labour of cutting, or just as the shears or scissors divide material in detail.

The vast difference in the amount of work done by a tool that cuts efficiently and one that only scrapes, should read an instructive lesson both on the importance of correct tool formation and the maintenance of the same, which is seriously impaired by every departure from the wedge-like form.

The wood-worker's chisel, axe, and adze, keen and acute, remove material in large quantity. The screw tap, the die, the reamer, the file, the saw, remove only fine scrapings or "swarf" even when working at their best. The turner's roughing tool cuts off great shavings to a considerable depth; the broad finishing tool and the scrape remove only thin parings. In the one the wedge-like action is perfect, and seen at its best, in the other that action is nearly or quite absent.

Much might be said about the influence of the method of presentation of the tool to the work as affecting results. But this would really be resolvable into conformity with or departure from correct tool angles, so I need say nothing on this point just at present.

The whole subject of tool formation is one of a highly interesting and practical character, and one which every workman should study. I have simply endeavoured to touch the fringe of the subject by showing why some tools cut while others do not. In subsequent issues I shall have more to say about some of the common tools, their principles of action, and the manner in which they are used.

OUR GUIDE TO GOOD THINGS.

17.—Britannia Company's New Lathe Dogs for Face Plates.

In No. 2 (page 17) of this magazine instructions were given for making a home-made dog chuck or face plate, and the method to be followed in making lathe dogs for it was described as well. There may be some workmen, especially amateurs, who, though they may contrive to make the chuck, may not have either the skill or the time to make the dogs, and it is in the interest of such as these and many others who may be desirous of purchasing lathe dogs ready to hand, that I give in Fig. 1 illustrations of some excellent things of this kind that have been recently manufactured by the Britannia Company, Colchester, and may now be had from the Company direct or through any dealer in tools. The three varieties figured clearly show the purpose for which they are intended and the way in which each is to be used, so any detailed description is unnecessary. The price of the dog in the centre is 1s. 6d.; of the one on the right, 3s. 9d.; and of the one on the left, 5s. They are well made of black iron, and the screws externally and internally are carefully cut.

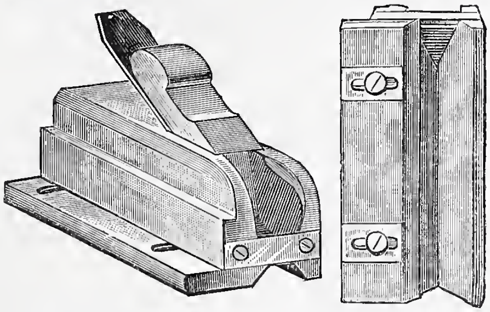


Fig. 2.—Chamfer Plane.

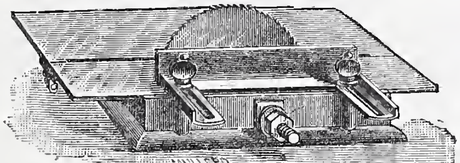


Fig. 6.—Circular-Saw Bench for Work-Bench.

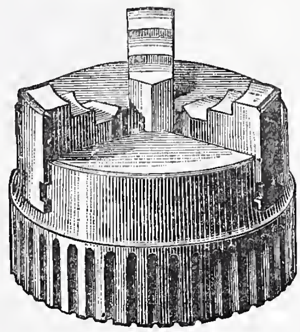


Fig. 3.—Small Three-jawed Chuck.

18.—Melhuish's Chamfer Plane.

To save repetition of names and at the same time to let every reader know where the articles mentioned may be obtained, if he cannot get them nearer home, I may say at once that the chamfer plane now under consideration and every other article yet to be described in this notice is supplied by Messrs. Richard Melhuish and Sons, 85 and 87, Fetter Lane, E.C., who have submitted specimens to me for examination. The make and action of the plane may be gathered from Fig. 2, in which the cut to the left gives a view of the plane when looked at from above, and that to the right of the bottom of the plane. The merit of this plane is that the cutting edge of the iron goes nearly up to the strip of brass that is screwed on to the front of the plane, so that even in the case of a stop chamfer the chamfer may be carried nearly close home to the stop. By means of the fence that is attached to the bottom it may be regulated by loosening the screws and permitting the fence to travel either way as may be required as far as the slots will permit. Chamfers ranging from $\frac{1}{8}$ in. up to 1 in. within may be readily cut. This plane is made in beech in two sizes, $4\frac{3}{4}$ in. and 6 in. in length, sold at 4s. 6d. and 6s. 6d. The fence of the larger plane is of boxwood. It works well and easily when in use, and should be found in the stock of every wood worker, being preferable in every way to the spokeshave-like tools of this class, which, although they are good and serviceable in themselves, are not nearly as handy as the tool just described.

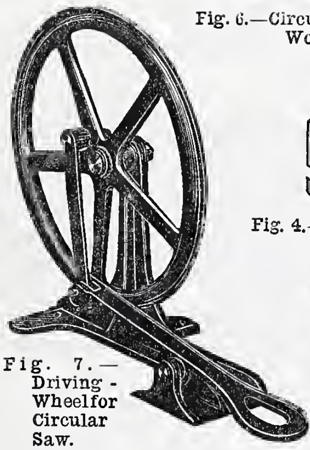


Fig. 7.—Driving-Wheel for Circular Saw.

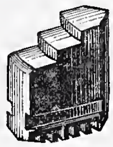


Fig. 4.—Jaw of Chuck.

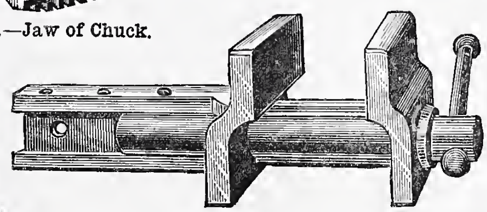


Fig. 5.—Joiner's Parallel Grip Vice.

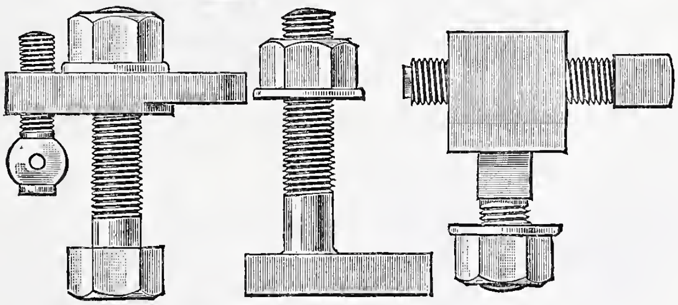


Fig. 1.—Britannia Company's New Lathe Dogs for Face Plates.

19.—Small Three-jawed Chuck.

This little Three-jawed Chuck which is illustrated in Fig. 3 is of French origin, and being much better finished than chucks of this kind usually are, will doubtless be welcomed by those who require a small appliance of this kind for light work, although its price is 32s. The general character and formation of the chuck is exhibited in Fig. 3; and in Fig. 4 is shown one of the jaws of the chuck, these being removable at pleasure. Each chuck has two sets of jaws. The jaw in Fig. 4 is formed reversely to those shown in the chuck in Fig. 3, being intended for drill work.

20.—Joiner's Parallel Grip Vice.

Vices of this pattern are apparently not so widely known and used as they ought to be, and many a carpenter and joiner still keeps to the old wooden bench vice with its wooden screw, although by the adoption of the Parallel Grip Vice much time is saved, because by the latter wood can be seized and secured instantly by the third of a turn of the hand, while with the former the jaws must be opened, perhaps with many a turn, to a sufficient extent to receive whatever it is wished to place between them, and then tightened with more turning—a marvellous contrast to the rapid and effectual action of the grip vice, whose rack can be thrown out of gear at once by an upward motion of the hand, and the front jaw pulled out, pressed against the wood, and then tightened in an irresistible and unmovable grip by a similar movement of the hand downward. The pattern shown in Fig. 5 is fixed to the bench from beneath as indicated, and the top of the jaws are level with the surface of the bench. Like all the grip vices, its holding force is so great that if a long piece of wood be clutched by one end in the vice its weight will be powerless to alter its position in the vice in the smallest degree. Its cost is 13s. 6d.

21.—Parallel-jawed Pliers.

When pliers of the old style are opened it will be noticed that, as a matter of course, there must be a greater divergence of the jaws at their extremities than nearer the axis about which they move, and this occasions a certain amount of inconvenience when trying to hold a piece of metal with them without injuring the corners or surface. In this tool, however, parallelism of the jaws is maintained by a simple mechanical arrangement contained within the jaws themselves. In the pliers before me the surface grip of the jaws is $\frac{3}{4}$ in. by $\frac{1}{8}$ in. at the extremities, and the jaws open to the extent of $\frac{1}{8}$ in. Thus a firm, solid hold is effected on the object grasped, and from the nature of the mechanical construction of the pliers, the power applied is from twice to four times that of the force exerted by the old kind of pliers. It is true that pliers of this kind have been in use for some little time, but not so long as to be generally known and used. They are made in three sizes—namely, $4\frac{1}{2}$ in., $5\frac{1}{2}$ in., and $6\frac{1}{2}$ in. in length. Sold respectively at 3s., 3s. 9d., and 5s. per pair.

22.—Circular-Saw Bench for Work-Bench and Driving-Wheel.

Maybe there is many a workman who desires, beyond all measure, to have a small circular saw for light work, but who has not a lathe which he can furnish with one or other of the circular-saw rigs described and illustrated in No. 1 (pages 8 and 9), or something similar. At all events, he has his work-bench, and on this he may easily place the handy little iron circular-saw bench figured in the accompanying illustration, cutting two or three holes in the top of the wood-bench, so that the saw itself may be actuated by the driving-wheel shown in the engraving (placed immediately below the illustration of the circular-saw bench) which is placed under the bench, and turned by means of the treadle.

The construction of the saw-table is apparent from the illustration in Fig. 6. It is made in halves, which are supported on the framing below, and which are removable, to allow of the easy removal or replacement of the saw when necessary. The fence is movable, and can be fixed at various distances from the saw, as may be required, by means of the thumb-screws, which pass through slots in pieces of metal projecting from the fence at right angles to it, and which work in projections from the frame which supports the table, being properly bored and cut with a screw-thread to receive the screws. The axle on which the saw revolves, is shown projecting from the frame, and secured by a hexagonal nut working on the screw-thread with which its end is furnished, as shown in the illustration.

The saw-table is 13 in. long by $7\frac{1}{2}$ in. broad, and its upper surface is just $1\frac{1}{2}$ in. above the level of the work-bench. The bottom of the frame projects beyond the face of the upper part, and is bolted to the work-bench. The saw is 6 in. in diameter, and projects 2 in. above the surface of the saw-table. The driving-wheel needs no description, as its construction is self-evident from the illustration given. The price of the saw-table, including saw, is £1 15s.; and that of the driving-wheel £1 10s.; or both are supplied together for £3 3s. The weight of the driving-wheel, it may be said, is 50 lbs., and can be used to drive any small bench lathe. Those who may desire to have the saw-table placed otherwise than on the work-bench can obtain it mounted on a strong and serviceable table or bench, which is 2 ft. 10 in. high, having a top 18 in. by 14 in. I must not omit to say that the iron saw-table is reversible, and can be reversed when required in a very short space of time. I have described the fence placed on one side for work parallel to the plane of the saw. On the other side are fences or flanges arranged at an angle of 45° for cutting mitres. Thus the whole affair is rendered of utility for a great variety of work, and will be prized by the workman who is engaged in light trades, such as picture-frame making, etc., as well as by the amateur.

The whole, indeed, may be said to form a very handy little appliance, well worthy of the attention of the amateur, and even of the professional workman, for carrying out such work as comes fairly within the capability of the circular saw with which it is furnished.

23.—New Adjustable Callipers.

To all callipers whose legs are drawn further apart or brought closer together by means of a screw, the chief objection has been the length of time that is taken up in working the screw, in order to bring the points of the legs into the required relative positions. A new and desirable make of callipers, however, has been recently introduced in which any delay of this kind is entirely obviated. The legs are fastened together by a steel stud at the top, and further connected by a strong steel spring, secured in place by wires or pins passing transversely through the legs, and which by its contraction causes extension of the legs to their utmost limit. At the distance of 1 inch from the stud that passes through both legs, and acts as a rivet to hold them together, are two more studs, one on each leg, projecting ⅜ in. beyond the surface of the side to which each is attached. In one of these a bar cut with a screw-thread for the greater part of its length is fixed by a pin with sufficient play to permit the end of the bar, which is about 2¾ in. long, to move freely in a plane parallel to the surfaces of the legs for about ⅛ in. Along the bar, when the legs are held tightly together, a broad piece of metal like a thick conical washer, and a steel tube with a broad milled flange at the outer end, move freely up and down. This steel tube is in reality an eccentric, which may be thrown out of, or brought into, gear with the screw-thread cut on the bar by a slight pressure on the milled flange. Thus supposing, for example, that the callipers are adjusted to take a measurement of ½ in. in diameter, and it is wished to increase the distance between the points to 2 in., all that need be done is to release the eccentric, allow the legs to fly apart under the extending power of the spring to the required distance as nearly as possible, and then to bring the eccentric and washer, as I may call it, in close contact with the stud through which the bar works, and finally regulate the distance required between the points with the utmost exactness by the aid of the eccentric, which falls into gear on the screw-thread as soon as it is brought into position and feels the pressure of the spring. The specimen pair of callipers before me opens to the extent of 5½ in., and costs 5s. Callipers of all shapes for inside and outside measurement are now made in this way, and are in every way preferable to ordinary callipers for the reason stated. THE EDITOR.

*** The London Lathe and Tool Company write:—"In describing the Simultaneous Grip Chuck and the Independent Grip Chuck, we should perhaps have stated that these chucks are American." It was too late to note this in the description of the chucks in "Our Guide to Good Things" in No. 3, but the earliest opportunity has been taken of supplying the omission.

SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

Building Construction.—G. C. (Kennington).—Every branch of the building trades will be treated in WORK, not, perhaps, in a set series of lessons on the subject beginning with excavating and laying the foundations, and ending with the finishing touches imparted by the paperhanger and decorator; but in papers that will deal sufficiently and readably, if I may use the word, with various parts of the subject. Thus in Nos. 3 and 4 you will find chatty articles very much to the point and purpose on "A Simple Ceiling in Wood," which I am sure will be suggestive and helpful to many. In many of the Devonshire farmhouses there is nothing but the "planching," as the floor boards are called, between the rooms above and the rooms below. Note, please, how these very papers show how to make the joists themselves ornamental, and how to cover the chinks between the floor boards, and if it is desired, to stop as far as possible the transmission of sound from one room to another. Suppose you write again and afford some tangible idea of the "series of lessons" for which you seem to wish.

Wood Carving.—E. B. (Eton).—I fear it is not possible to give the interesting little pamphlet you kindly send in WORK. It would serve as introductory matter to a study in wood carving, and as a series of remarks advocating the adoption of this art either as a trade or as a hobby. Why could not a skilled carver, as you appear to be, send in some studies in wood carving, with matter descriptive of the method to be followed in producing the effects depicted by the drawings?

Keys for Pianos, Organs, and Harmoniums.—G. D. (Upper Holloway).—Certainly your request shall be complied with whenever opportunity offers, and the subject of building these instruments is sure to come to the surface in WORK ere long. Meanwhile, why not advertise in our pages? There is nothing like advertising for nursing, helping, and making a business in the present day. Success, be it what it may, must be purchased by preliminary sacrifice. Even omelets, you know, cannot be made without breaking eggs.

Photography and Fretwork.—D. H. (Wandsworth).—See replies in respect to papers on the first-named subject in No. 3. With regard to the second, why not send in specimens of your work if you are a designer of fretwork patterns? I have on my staff very efficient writers on fret cutting.

Photography and Saddlery.—A. H. (Theale).—You will see what I have said above about papers on photography. With reference to the second subject please write again, giving more definite information and proposed mode of treatment, as it is now under consideration as one to be dealt with at no very distant time.

Wire Thread Fret Saw.—G. C. (Nunhead) writes:—"It is really a singular fact that there is nothing new under the sun. In your admirable little welcome arrival, WORK, I see you notice a 'New Wire Thread Fret Saw.' Perhaps you will be surprised to hear that the Chinese fret workers and the jade stone ornament makers of Canton use precisely the same wire jagged or tooth saw for their work, and have done so from time immemorial. I have seen these skilled ingenious workers plying their trades many times, and as far back as the year 1872."—[I am much obliged to you for the interesting nature of your communication, and so, doubtless, will be many of the readers of WORK. It is true that there is nothing new under the sun, but there is a time when anything and everything under the sun must be new to the person who comes across it for the first time. Thus the wire thread saw was new to me, and will be new to many besides myself.—ED.]

Wire Thread Fret Saw.—G. D. (Rhayader) writes:—"Your new Wire Thread Fret Saw is not a new thing. I have seen it used twenty-five years ago."—[Will you kindly write again and tell me for what purpose it was used—if for fret cutting, and under what circumstances? Also in what sizes it was made, and if it was an article commonly and constantly on sale.—ED.]

Our Advertising Pages.—L. S. L. (Kirkcaldy).—These in no way impair the utility of WORK, but, on the contrary, add to it. Your suggestion, however, shall be noted. Every suggestion, indeed, I may say, is carefully considered. If you will send in the article you name in your letter, on approval, it will be read with a view to acceptance, if suitable.

Theory and Practice.—W. B. B. (Brannox Town).—The title was very carefully considered; and although it may seem to you that Theory should precede Practice, the arrangement of the words was made purposely, because, although both Practice and Theory will find a place in the Magazine, there will be more of the former than of the latter.

*** *Many answers are held over for want of space.*

Trade Notes and Memoranda.

SOME TOPICS OF THE HOUR.—Professional differences as to Quantities.—Wall Papers.—Fireproof Construction.—The Dangers to Health of Stoves.

NOTES.—Hastings wants a harbour at a cost of £60,000.—The Department of Science and Art will hold Examinations from May 6th to 31st.—The new Post Office for Birmingham will cost £70,000.—Filtering of sewage is being successfully experimented in at Acton.

LITTLESTONE-ON-SEA, between Dungeness and Folkestone, is to become a new Sussex watering-place.

THE charge for ascending to the top of the Eiffel Tower is to be 5 francs; for ascending to the second platform, which is 700 feet high, 3 francs; and 2 francs to the first platform, 200 feet high. Visitors can use the lifts or walk upstairs.

THE new Berlin Cathedral will cover 7,053 square metres, or 900 more than Cologne Cathedral. The building will cost 22 million marks, and contain room for about 2,500 persons.

THE Metropolitan Police Receiver invites tenders for 11,500 pairs of boots, due August 1, 1889; and 13,000 pairs, due February 1, 1890.

THE Spiral Wood-Cutting Company (Limited) has lately been registered. Capital £1,500, divided into 1,500 shares of £1 each. Objects: To acquire letters patent of an invention of a new and improved tool for spiral turning, and to carry on the business of spiral turning in wood of every description.

PARCELS not weighing more than 7 lbs. can now be sent to Mauritius by the parcel post at a minimum charge of 3s. 2d.

OF the suburban bridges freed in recent years, Kingston cost £15,600; Walton, £7,012 (the amount of the claim being £29,510); Staines, £20,125 (the amount of the claim being £80,500); Kew, £57,300 (the claim being £73,832); Hampton Court, £48,048 (the claim being £61,600); Tottenham Mills, £1,750 (the claim being £7,245); Hellyer's Ferry, £1,568; Chingford Ferry, £4,082.

IT is proposed that the sum of £2,000 per annum for two years be given out of the City's cash in aid of the objects of the City and Guilds of London Institute, for the advancement of Technical Education, the first payment to be made forthwith, and the second payment on January 1st, 1890.

THE City of London School Committee intend to ascertain how best the space at their disposal can be utilised for the erection of a building suitable for the education of boys in carpentering and other useful pursuits.

AN artistic piece of wall decoration has been completed in the Nurses' Refectory, Guy's Hospital. It is the work of Mr. H. J. Draper, who in 1886 gained the Royal Academy students' prize of £40 offered for a design for the decoration of a public building.

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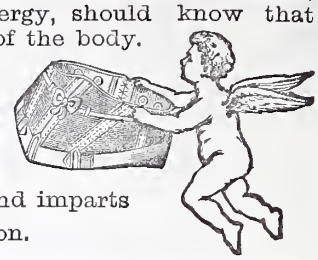

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 5.] SATURDAY, APRIL 20, 1889. [PRICE ONE PENNY.

A DRAWING-ROOM OVERMANTEL

With Lincrusta Decoration.

BY E. BONNEY STEYNE.

No sooner is a pretty fancy in furnishing floated and fashionable, than imitations abound and weary one. If the Venus of Milo were in every house, we should welcome "You dirty boy," by way of variety. Governed by this idea, I wanted to design a drawing-room overmantel that was not exactly after the sort so widely advertised, now almost as conventional as the old gilt-framed looking-glass they replaced. Two ends were clearly desirable — economy of material, and newness in shape and effect. Whether I secured them in the overmantel now to be described my readers can decide for themselves. I can answer for the economy, and am content to let the novelty plead for itself. If there is one distinctive feature common to nine-tenths of these things, it is that they are angular in plan, in section, in elevation—all square right angles. A right angle is a good angle, and if we must be overdone with any variety, certainly it is about the best; but in a room of rectangular furniture, a bold curve tells with increased effect. But working on a curved plan is wonderfully hard to an amateur, and in spite of my wish to indulge in sweeping lines, I feared I must stick to the simpler plan. But a way out of the difficulty soon appeared. It was obvious to the meanest intelligence—in this case my own—that a curved plain edge to a piece of wood was not extremely difficult; it was when mouldings on the curve, or panels constructed on that plan, came to be thought of, that discretion suggested a more simple shape. But reckoning up available material I thought of lincrusta as possible, and then planning how to keep the curved notion, soon found a way out of the wood. First I decided upon two panelled ends, fashioned in ordinary manner: these were fixed to a bottom board 5 in. by 8 in., itself raised about 3 in. above the level of the marble shelf on which it was to stand. Among the available material were a quantity of turned spindles in deal, that M. C. Duffy and Co. had worked for me at a cost of ten or twelve shillings a gross, I forget which. These were about $4\frac{1}{2}$ in. long. To avoid lodgment for dust, and economise my spindles, I cut them each in four pieces—that is, one across, and once in half, leaving half-round pieces $2\frac{1}{2}$ in. long; these I put on to a thin piece of wood, with a bottom rail, and so filled up the space just above the shelf. But in my case this base was larger than the stone ledge, and so hid it completely from view, which was, to me, a decided advantage. (I may say, in passing, that a mantel border of close-falling imitation Spanish lace and curtains were afterwards added, and hid the unsightly mantelpiece entirely.)

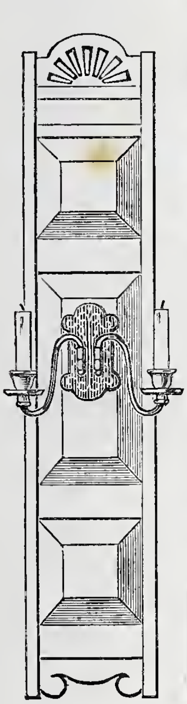


Fig. 3.

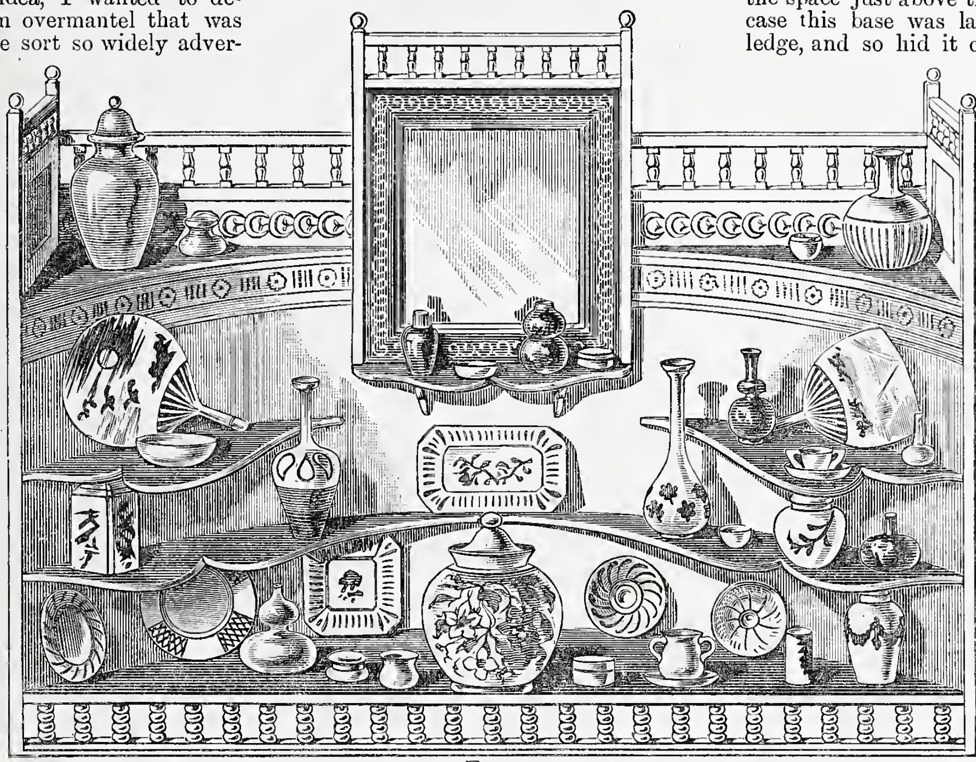


Fig. 1

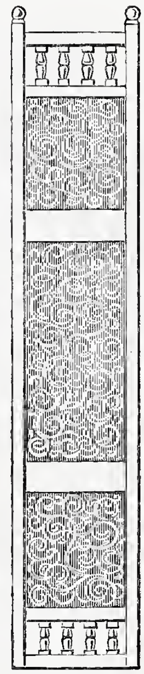


Fig. 4.

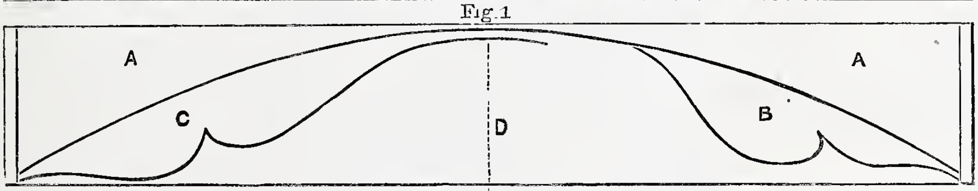


Fig. 2.

Fig. 1.—Sketch of Drawing-Room Overmantel, Painted: Lincrusta and Turned Ornaments. Fig. 2.—Plan showing Top Shelf (A), Second Shelf (B), Third Shelf (C), and Bottom (D). Figs. 3, 4.—Alternative Ends.

To this base I added a back, framed as shown in the sketch, but not solid, merely a rail here and there for the sake of stability.

Then taking the arc of a circle 4 ft. $7\frac{1}{2}$ in. in its radius, I cut out three pieces of common $\frac{3}{4}$ in. deal to this plan; this left a bare eighth of an inch in the centre, just enough to keep it from breaking. Having fitted these shelves in place to the uprights at the ends—one at the base, one at a foot above, and one at two feet—I obtained a piece of tin the required length—I forget the exact size—about 6 ft. long and 2 ft. high. I then nailed the tin round the sweep, as shown in the drawing, being careful to join it very truly to the top curved shelf. Next I cut out shelves of half-inch pitch pine, free from knots—sequoia wood would have been better had it been at hand—as shown, and fixed them from the back, screwing them to the tin, and adding small brackets, which I fixed to supports placed behind. This sounds complex, but was really a very easy process, for the back of the mantel now growing into shape was as easy to work from as the front. Having framed a looking-glass, with a rail of the same spindles cut to about 2¼ in., and carried a similar rail across the top, the whole was roughly ready for decoration.

Whether I have given the actual order I adopted matters little, provided the result is clear. Now looking from the front the mantel was like the sketch annexed, but, of course, perfectly plain. Having unscrewed the shelves, I covered the whole tin curve and the panels of the ends with a low-relief all-over pattern in lincrusta, adding a border at the top edge, and using a similar border beneath the top railing and between the outer and inner moulding of the mirror. As the widths varied, I chose the patterns as nearly in character as I could that were of the right size for each place.

The woodwork being all smoothed, I painted the whole a creamy white, and, as it suited the room, left it so; but I fancy a solid gold treatment of the lincrusta, or the design worked in different shades of metallic bronze to emphasise the pattern, or a gold Japanese paper used in its place, would suit many rooms as well, or better.

The overmantel thus made is, perhaps, the most satisfactory one for its cost that I know. Having so many of the materials by me, I cannot give the exact price like a cookery book, but a few shillings ought to buy them all and produce a rival to one at a dealer's shop costing some pounds; while not entirely destitute of individual character, and, if I may say so, of artistic effect. Although its construction is not calculated to survive a railway journey, if packed in wrappers only, an overmantel is not a piece of furniture given to roaming over the house, like milking stools or music stands. Consequently, if capable of holding well together when fixed to the wall, it may be claimed to have fulfilled its object in life.

FRIENDLY HINTS TO AMATEUR WOOD WORKERS.

BY DAVID DENNING.

II.—Le Page's Liquid Glue—Its Advantages—Treatment—Cane Glue Brush—Defects in Work Done by Amateurs—Accuracy in Marking Necessary—Testing—Superfluity of Tools a Hindrance—Planes—Utility of Scraper—Treatment of Edges—Fitting Joints—How to Cut Mortises and Tenons—Dowels and Dowelling.

Perhaps it may be expected that something should be said about the liquid glues, such as Le Page's, which have become so popular of late years both among amateurs and professionals. The advantages of these liquid glues are that they are always ready for use, requiring no heat, and they do not spoil by being kept if, be it said, the can is covered when not being used from. Even if exposed to the air the chief or only deterioration consists in the glue becoming thick, simply from the evaporation of moisture. The remedy, of course, if this happens, is to add a little more water, but in practice, with ordinary care, this is seldom requisite, and is not altogether desirable. In very cold weather a little warmth is necessary, but if kept in a warm room or placed near a fire for a time, it is soon fit for use. It does not require to be applied hot. For some kinds of work requiring a colourless or almost colourless glue it is unsurpassed, and as it does not set so quickly as the ordinary kind it is well adapted for marqueting and inlaid work generally. When it does set it possesses great tenacity if properly used, that is, thinly applied and well rubbed in. Without going the length of saying that it is better than animal glue, when this is of the best, and employed under the most favourable conditions, there can be no question that it is superior to ordinary common glue which has not been made, mixed, and used with skill and care. At first sight its cost may seem to render it rather an extravagant luxury, but as a little of it goes a long way, and it does not waste by keeping, practically it will be found to cost in the end little, if any, more than the usual kind. Mind, I do not say that where large quantities of this are used this would be so, for even if I cared to express a definite opinion it would not concern the amateur worker.

Before concluding these remarks about glue, it may just be suggested that as effective a brush as any may be made out of a piece of common cane. Whether from the ease with which it is made, its cheapness or its adaptability to its object, the cane brush is preferred by many competent and practical workers to any other. To form one, all that has to be done is to take a piece of cane, cut away the flinty skin for an inch or so at one end, and then hammer this till the fibres are softened and loosened, the only care required being not to cut them off while doing so. Such a brush will last a long time, in fact, as long as there is any stick left to hammer out a fresh end from.

Having done with glue for the present, it may be well just to consider how it is that beginners' work when glued or otherwise fastened up has such a lop-sided, out-of-the-straight look about it. Of course, a good deal must be put down to want of manipulative skill, but even after making due allowance for this there is no doubt that much is still left unaccounted for, and many defects which a little care would have prevented. How do they arise? Well—altogether apart from skill—there is undue haste in working. The practised workman may be able to do a thing quickly, but then if he be a rational being he puts accuracy before speed. Watch the skilled mechanic—see in what an apparently slap-dash manner he saws through a plank; but don't let the beginner try to do it in the same space of time, or the result will be disastrous. It cannot be done without practice. On the other hand, the most capable man would never think of sawing without some guide to cut to; yet, what he cannot manage, how often does one see the almost unpractised amateur, who probably does not saw as much in a twelvemonth as the other does in a week, attempt!

Let the hint therefore be taken to mark the work, and to do so as accurately as possible, whether it be plain cross-cutting, ripping, making dovetails, mortise and tenons, or anything else. Use the square and the gauge, and many a fault in work will be found *non est.* Never be afraid of *testing* the work as it proceeds, and don't pass on to the next part till that in hand is as nearly perfect as it can be got. I sometimes fancy if novices saw the frequency with which a skilled cabinet maker uses tests either by square, bevel, or winding sticks they would derive more substantial benefit than by laying in a whole roomful of the best tools, even though they included all the profusely advertised American novelties and so-called labour-saving inventions. Here again the amateur often makes a mistake. Good tools are an advantage, and so are plenty of them, but a superfluity is likely to be a hindrance rather than an aid. Let a man learn to use and understand a few tools thoroughly, rather than go in for everything he can lay his hands on. Some of our best workers use such a limited stock of tools that the well-to-do amateur would hardly say thank you for the whole chest full. I speak only of the general working tools rather than those out-of-the-way appliances which are seldom required, for, of course, there are some operations which can only be managed well with these. To use them and all the finer and more complicated tools, however, implies a power of handling the ordinary ones which can only be begotten of practice. The finest and most ingenious tools can only be appreciated or made use of to the full extent of their capabilities by those workers who are masters in their crafts. If there should be any doubt in some minds about the correctness of this, let me suggest, by way of example, a very finely set smoothing plane, and ask whether any man who could not manipulate an ordinary one would be able to work it as it might be worked. Could he by any possibility appreciate it and execute work worthy of it? It stands to reason he could not. Therefore, my amateur friends, especially novices, do not be discouraged if you cannot get the best of everything in the tool line, but make yourselves masters of those you have, and do not grudge a little extra time and trouble to do all that may be done with plain good tools. Speaking of using planes reminds me of another cause why amateur's work in cabinet making is so often rough-looking, not so much in the joints at angles, but in actual roughness or unevenness of surface. Much of this might be removed by the application of that somewhat, I fear, despised and neglected tool, the scraper. Its name is so significant that even those who have never seen or heard of it will have no difficulty in recognising its functions. By its aid all the little edges which are so apt to be left by the plane, and which show up so when the wood is polished, may be quickly removed, and the surface rendered so smooth that glass papering may not be required, though for cleaning up work this is invaluable. In using it, however, care should be taken not to round off the edges which are intended to be left square and sharp. To an educated eye—I mean technically so—nothing can look worse than a characterless-looking edge, whether on the square members of a moulding or other part. It is just by these little signs that the careful and skilful worker is distinguished from the sloven and the beginner.

Another matter on which caution may be counselled is that of fitting of joints. How often one sees these loose instead of firm and tight. Two pieces of wood dovetailed together, for example, fit almost as though there were an incipient hinge at the angle. Glue is trusted to to stiffen up the joint, but after what has been said it will be seen that this is not desirable, and it would be far better to make the joint, whether dovetail or tenon, as tight as possible. All very well to say that, some readers may think, but how is it to be done? Well, of course, I know that to make even a plain dovetail or tenon joint requires skill and practice; nothing more so, for if one can make a thoroughly good dovetailed drawer, say, he can scarcely pose as a novice, but need have no hesitation in taking rank as a competent workman. Still, many failures may be avoided by a little forethought and extra expenditure of time. How do I mean? Well, simply this. Instead of cutting either mortise and tenon or dovetail joints even a shade too slack make them rather too tight to fit, and then very carefully cut away the surplus wood till the parts fit each other. In cutting away mortises and spaces for dovetail joints do so from both sides of the wood, sloping the chisel slightly inwards, and be careful to have the wood scribed on both sides with the gauge. With attention to these apparently insignificant details a good joint, or at any rate a passable one, is to be made even without much skill. As a substitute for the mortise and tenon joint the dowel is not to be despised. It is easy and, if properly made, so good and reliable that even the purists who insist on the former cannot find much to urge against it, while many prefer it. To go into all the *pros* and *cons* of tenons *v.* dowels would, however, be beside the question at present, but as there is so much to be said in favour of either it may fairly be considered that each possesses merits peculiar to itself. The requisites for good dowel joints are that the pins or dowels should be thoroughly dry, so that they will not shrink and become loose after they have been inserted, and that they must fit tightly and be long enough to fill the holes they are put in as nearly as possible. These are the principal points, and if they are attended to the joint will be strong enough for any practical purpose in ordinary circumstances.

Many other matters might have been touched on, and perhaps may be at some no distant date. In the meantime, enough has been said to show the amateur a few of the pitfalls which beset him in his endeavours, I will not say to surpass, but to equal, his professional *confrère*, and it is to be hoped that while profiting by these hints he will take them in the friendly spirit in which they are given.

A GOSSIP ABOUT HYDROQUINONE.

BY AN AMATEUR PHOTOGRAPHER.

Hydroquinone has long passed the primary experimental stage as a developer, but many and various are the opinions which have been expressed about it. Some advocates of it would apparently wish us to believe that it possesses almost magical qualities, that no matter how it is used, or whether on under-exposed or over-exposed plates, the resulting negative will be equally good. Others again charge it with various kinds of disagreeable qualities. It is said not to produce density, to be very slow and unreliable. As all experimenters may be assumed to pursue their investigations without prejudice for or against a new claimant for favour, the varying opinions given are apt to create astonishment. They are not to be accounted for except by the supposition that the various ingredients which compose the formulæ of which hydro is the developer are the cause of such widely divergent results. It is perhaps a fortunate thing that so many experiments are made; but certainly the number of formulæ which have been given for hydro developers is apt to discourage those who have neither time nor desire to investigate. The most cursory glance over any half dozen of the formulæ will be enough to convince any one that they cannot possibly all be the best or give equal results.

Many of the hydro developers seem unnecessarily complicated. The one I use was first published, I believe, by H. C. Taylor, in the "Amateur Photographer," although I have made some slight modifications, as any one will see by comparing the following formula with that alluded to. The ingredients and proportions are, however, in the main the same :—

¼ oz. Hydroquinone, dissolved in 3 oz. water.
½ oz. Sulphite of Soda, dissolved in 3 oz. water.
½ oz. 5% Solution of Sulphurous Acid.

The hydroquinone dissolves only slowly in water, but the quantity named will be readily taken up by 1 oz. of alcohol, which may be substituted for 1 oz. of the water. However, with moderate heat, the water alone will dissolve the hydro, so that there is no actual necessity for the use of spirit. The sulphite will also dissolve more freely in warm water. When this has become cool, add the acid. The two solutions are then mixed in one bottle.

For the remaining portion of the developer ½ oz. sulphite of soda and ¾ oz. carbonate of potash are dissolved separately in three ounces of water, and then mixed. We have thus two stock solutions, which seem as though they would keep indefinitely. At least, I have some which were prepared months ago, and they remain as good as when they were prepared.

To use these for ordinary exposures 1 dr. of each is mixed with 1 oz. of water.

The development is slower than with a quick pyro developer; but speed may be increased by using the developer warm. This may easily be managed by standing the bottles of stock solutions in hot water for a few minutes, and using tepid water instead of cold to dilute them. If the water is too hot it will dissolve the gelatine on the film, so care is necessary. An ordinary Ilford plate, which is the brand I generally use, begins to show high lights in about a couple of minutes, and though the first appearance of the image is slow, the action of the developer afterwards seems to increase in rapidity, so that in from five to eight minutes the negative is ready for removal.

Plates so developed are beautifully clear, without any trace of chemical fog. In colour they are a bluish grey, which allows of very rapid printing, and owing to this freedom from any yellow stain, the density should be pushed in, developing to a greater extent than is necessary with pyro, though I am not altogether sure whether I should not say "apparent" density. Owing to this freedom from stain the hydro developer is admirably adapted for transparencies, lantern slides, and bromide prints.

One great recommendation that hydro has is the immense latitude which can be allowed in exposure for plates to be developed with it. Some writers have found it equally useful for under and over exposures. My own experience is that it is not so good for under-exposed plates as for over-exposures. At the same time, I have developed several instantaneous photos very successfully, but, as a rule, it may be said, I fancy, that under-exposed plates are not a success with hydro. However, even if this be granted, which it would not be probably by enthusiastic admirers of the hydro developer, there is still much to be said in its favour: for instead of being in doubt about time of exposure, all we have to do is to let this be full. A plate that would be altogether a failure under pyro, from over exposure, may be saved by hydro development. It may be a slow printing one, but detail will be there. While speaking of this I should say that I am referring specially to its action on Ilford plates, for not long ago I had a few of another brand—name forgotten—which, treated in the same developer as the former, came out a most gorgeous golden colour, looking very much as though they had been intensified with uranium. Possibly other brands may show similar or analogous vagaries.

If a plate is known to be very greatly over exposed, it is well to develop it with a developer that has already been used instead of with fresh. As the developer, even after it has been mixed and used, remains good for some time, a separate bottle may be kept for old developer. After a time it darkens, but not sufficiently so for some days to render it useless.

The cost of new chemicals is sometimes against their general adoption, not to speak of the difficulty of getting them. These objections might have been urged a year or two ago against hydroquinone, but they are no longer applicable. It is, I believe, kept by most dealers in photographic materials, but in case any difficulty should be experienced in getting it locally by any one, I may say that I buy mine from Atkinson and Son, Manchester Street, Liverpool, for 1s. 9d. per ounce bottle. This price, compared with pyro at 1s. per ounce, may appear high, but I question whether there is much difference in use, it being possible to develop so many more plates in the same lot of developer without staining them. I have developed half a dozen, one after the other, without, so far as colour was concerned, being able to distinguish between first and last. This could hardly be said if they had been developed with pyro.

The cleanliness of hydro is one of the greatest points in its favour. It does not stain the nails or fingers; and this good quality, apart from any others it may have, will assure it a welcome in many a photographer's laboratory. Ammonia should not be used with hydro as an accelerator. The use of bromide is also unnecessary.

Enough, I think, has been said to show that hydroquinone is worthy of serious consideration by all who desire to get fair results easily.

HOME-MADE TOOLS.

BY J. H.

II.—Iron Smoothing Plane—Chariot Plane.

In this article I will describe and illustrate a common iron smoothing plane and a chariot plane.

Fig. 4 shows the casting for an iron plane of the first-named type. There is nothing special to be said about the pattern. It is precisely like its casting. Two curved sides, and two ends, each ⅛ in. thick, will be prepared and glued upon the bottom, the merest shade of taper being imparted to the inside faces. The curved sides are properly cut from a piece of stuff which is planed to the depth of the pattern, its curves struck to the radius required, with a pair of trammels, and cut with paring gauge, chisel, and spokeshave. If a thin bit of stuff is planed, and simply bent to the curve, it will be of a less curvature at the top than at the bottom edge, and this will have an unsightly appearance; hence the reason for cutting the sweeped pieces from solid stuff. The bottom will be $\frac{1}{32}$ in. thicker, to allow of trueing up. The mouth will be a trifle narrower than the casting, for the same purpose.

The remarks made in the last article with reference to the soundness of the casting, and the operation of filing, will apply in the main to these examples also, and need not be repeated.

In thin patterns such as these, there is risk of the comparatively deep sides becoming rammed somewhat out of truth in moulding, and this not only involves more labour in filing up the outside, but also increases the trouble of fitting the wood-blocking. I need hardly say that the fitting of the blocking needs to be very close, and in its fitting there is the risk of fracture of the casting occurring if the blocks are driven in too hard. But the more accurate the inside faces of the casting, the less risk is there of fracture occurring. If the casting is not very true, therefore, it will be a judicious plan to true and smooth up the inside with a file before commencing to fit the blocks. Of course we cannot do very much in this way, but we can at least obliterate any rough excrescences; and if the space between the sides, measured at the top edge, is slightly less than that at the bottom, we can produce a fair approach to parallelism.

If several men in a shop were to club together to make several of these planes, it would pay to have a metal pattern—casting it first from a wood pattern made as here described. The metal pattern could then be filed all over carefully, and there would be no risk of its becoming rammed out of truth. All castings would be practically alike, the pattern would be everlasting, so that any number of moulds could be taken from it. This is a suggestion which holds good with regard to many other cast-iron or gun-metal planes.

The advantage of the use of an iron pattern is chiefly found, of course, when the pattern is like its casting, as in Fig. 4. When the casting is cored out as in Fig. 7, there is little advantage in the use of a metal pattern.

A pattern for a lever, to be cast in brass or gun metal, will have to be made to the dimensions in Fig. 5, also a pattern for the pinching screw, Fig. 6 A. In each case the dimensions will be slightly in excess of those of the drawings, to allow for filing, turning, and screwing—$\frac{1}{64}$ in. will be a proper allowance on the surfaces of the lever for filing, and $\frac{1}{32}$ in. on the screw for turning and tapping.

Prepare two blocks of beech, rosewood, or ebony, and fit them into the iron carefully, using red lead paste to indicate contact, and tapping very lightly with hammer or mallet, so making a perfect bedding, without risk of fracture of the iron. The blocks should touch on the bottom, and also be shouldered to fit the upper edges neatly. When fitted, put in the wood screws. The screws should be driven in normal to the curve of the plane body, not standing askew; and their heads may stand a trifle above the face to allow of filing off level. Mark the outlines of the blocks, and work them to shape, Fig. 6. Use a parallel iron, as in the trying plane, make its bedding on the hinder block perfect, and notch the block to allow the tightening screw, A, to pass freely down. Mark the centres of the screws upon which the lever pivots, keeping them precisely at right angles with the centre line of the plane, and at equal heights from its base, so that the lever shall not stand askew. Drill holes of $\frac{1}{8}$ in. or $\frac{3}{16}$ in. diameter at these centres, file the lever true and smooth, and mark on its edges corresponding $\frac{1}{8}$ in. or $\frac{3}{16}$ in. "tapping" holes; drill and tap. Two button-headed screws will be preferable to those of the common form, which would require counter-sunk holes for their heads, and so weaken the metal near the edge of the plane. When these screws are inserted and the lever thereby pivoted, try its bedding on the cutting iron, and ease it where necessary, until it beds fair right across the iron.

Now take the casting for the screw and chuck it in the lathe—either between centres or in some form of grip chuck—letting the free end run on the poppet centre. Turn first the end which has to be screwed, and then reversing it, turn the head. Mill the head—properly with a milling wheel in the lathe—or if such is not available, the serrations must be laboriously formed with the edge of a slitting or of a half-round file, the sharp edges being then removed with emery cloth. A milling tool used for this purpose consists of a hard steel wheel having a number of hollowed serrations around its circumference, and pivoted on the end of a stiff bit of bar iron so that it is free to revolve. The wheel may be about 1 in. in diameter more or less, by $\frac{1}{4}$ in. or $\frac{5}{16}$ in. in width. These serrations are cut in a lathe before the steel is hardened by means of a "hob," or master tap, set revolving slowly between centres, so gradually cutting the corresponding grooves in the wheel. The hob both turns the wheel and cuts the grooves. After hardening, the wheel is fit to cut a mulled head in a similar fashion. Thus, setting our brass screw revolving between lathe centres with its head next the poppet, support the shank of the mulling tool on the rest, and press the wheel against the edge of the screw head. The wheel will be thus set revolving by contact with the revolving head, and the pressure exercised will cause the hard steel to indent the soft brass, giving the counterpart of its grooves thereto. The latter must be run slowly, and the wheel be held steadily and stiffly to its work, to prevent slip, and the consequent formation of over-

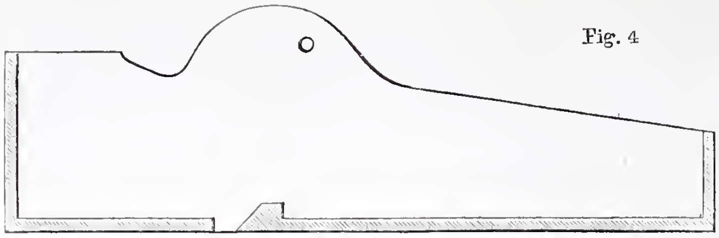


Fig. 4A.

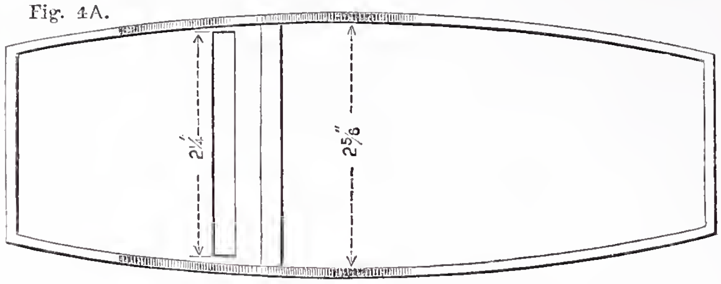


Fig. 4.—Casting for Iron Smoothing Plane: Section. Fig. 4 A.—Ditto: Plan.

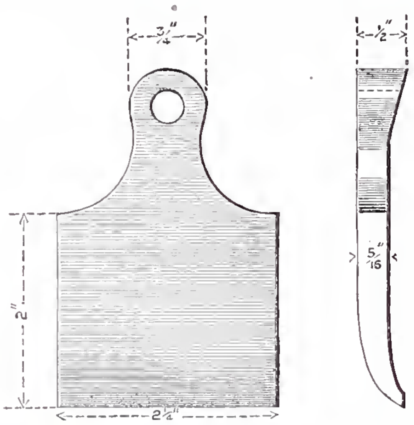


Fig. 5.—Lever: Front View. Fig. 5 A.—Ditto: Side View.

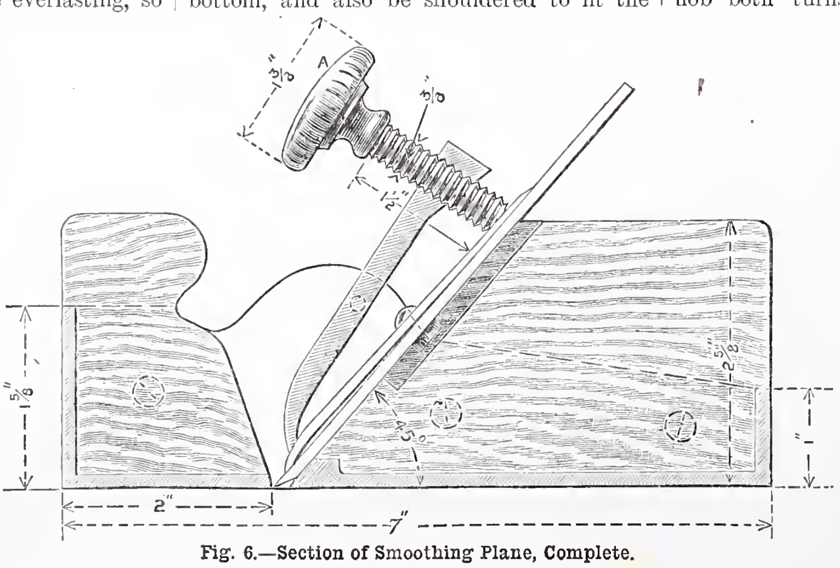


Fig. 6.—Section of Smoothing Plane, Complete.

lapping or of bastard cuts. Use $\frac{3}{8}$-in. dies for the screw. Drill the holes in the wedge to $\frac{5}{16}$ in. bare, and tap, and make the screw fit its tapped hole with as little slackness as possible.

The iron being now bedded, and the lever and screw fitted, slide the iron down into position, tighten it, note the mouth of the plane, and give to it such enlargement as may happen to be necessary to afford room for the escape of the shavings, but not a particle beyond that. Cleaning up the metal work with emery cloth, the wood work with glass paper, and polishing, will finish the plane.

Our next illustration is that form of smoothing plane called sometimes a "chariot plane." These are made in various sizes, but the dimensions given in the illustration, Fig. 7, are the most useful for general bench purposes. This plane differs from each of the forms yet described in this respect: that its pattern cannot easily be made like its casting, because of the presence of the bridge piece which takes the resistance of the wedge, and it is therefore properly cored out —that is, the interior is formed of a core made in dried sand, and prepared in a special box distinct from the pattern itself.

Fig. 8 shows the pattern of this plane with the outlines of the casting indicated thereon. Fig. 9 shows the core box by which the interior is formed. A comparison of the figures will render the following description clear :—

A piece of wood is planed to the thickness, A, corresponding with the inside dimensions of the plane, also to the depth, B, and one end is cut to the shape of the end, C. Upon this block are nailed the two pieces, D, D, forming the plane sides and the end E; and this completes the pattern. The portion marked F is the core print, into whose impression the core made in the box (Fig. 9) is placed.

The core box is framed together with grooved ends, as shown in Fig. 9, and its inside length corresponds with the length, G, and its width with the width, A, in Fig. 8. Into this box are fitted the pieces shown, which correspond with the interior faces and fittings of the plane. Some of these, it will be observed, are nailed on the "bottom board," A, which is a piece of wood dowelled on the box bottom specially to carry them. The piece, B, which takes the resistance of the wedge, is slid through holes cut in the box sides, and is drawn out sideways after the core is rammed, and before the box sides are taken apart. Screws, or else wooden clamps, hold the box sides together during the ramming of the core.

I think this description will be quite clear even to those who do not happen to have any knowledge of the processes of pattern making and of moulding.

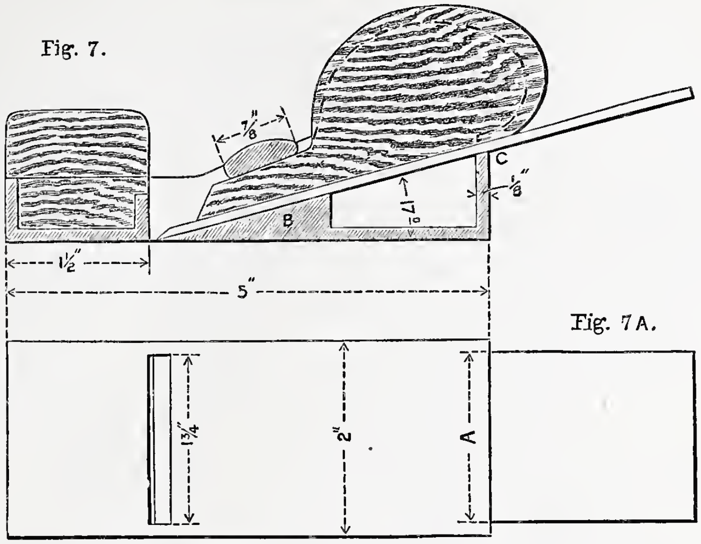


Fig. 7.—Chariot Plane, in Section. Fig. 7 A.—Ditto, in Plan.

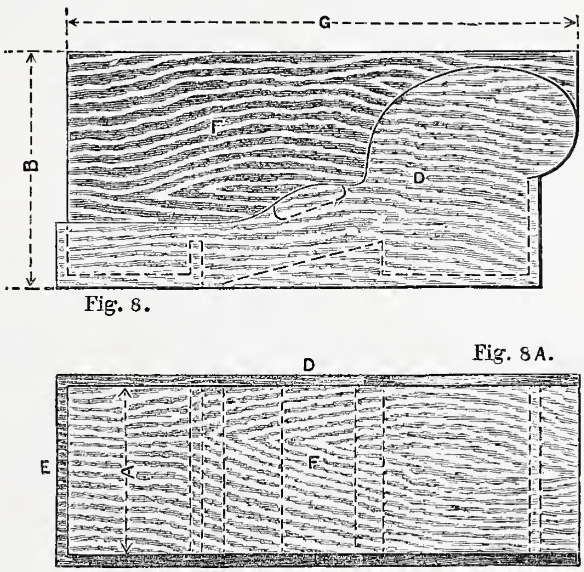


Fig. 8.—Pattern of Chariot Plane. Fig. 8 A.—Ditto: Plan.

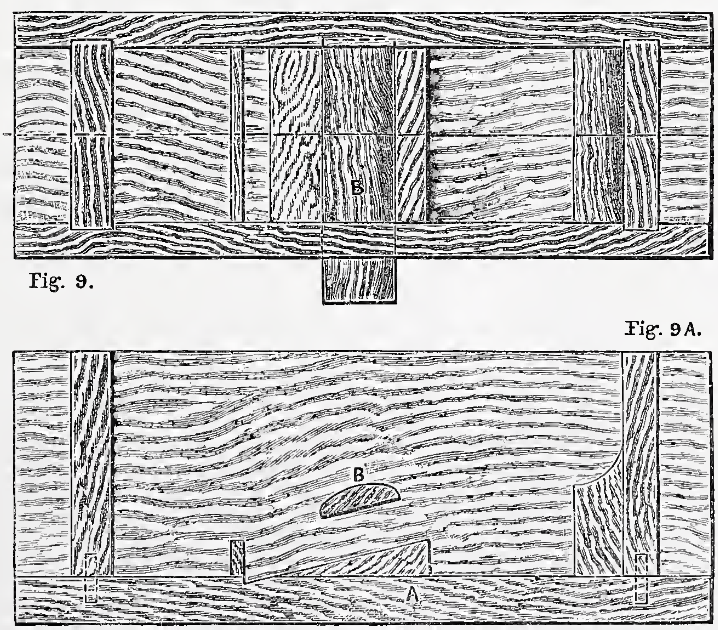


Fig. 9.—Core Box, viewed from Top. Fig. 9 A.—View of Side and Section.

The pattern might be made equally well by making the core print continuous with the outsides of the plane, in which case the pieces which are to form the plane sides would have to be planed to thickness, cut to outline, and put on the inside faces of the core box.

It is a matter of indifference which method is adopted; the important point in either case is to have absolute coincidence of dimensions in corresponding parts of pattern and core box, so that all thicknesses, etc., shall be accurate in the casting.

The filing and fitting generally will have to be done pretty much on the same lines as in the other examples. The under face of the bridge piece should have careful attention, in order that the wedge shall slide smoothly, and bed equally on the iron. The upper face of the V piece, B, in Fig. 7, must be filed very true also, so that no possible rocking or chattering of the iron, due to imperfect bedding, shall ensue.

In order to prevent the bruising of the plane—which follows on frequent repetition of hammer blows at the hinder end, for the purpose of loosening the wedge or cutting iron—it is a frequent practice to tap a screw into the hinder end. The hammer blows are then delivered upon its head, and the body of the plane need never be struck. A $\frac{1}{4}$-in. button-headed screw will be suitable, and it should be tapped in at about the central portion of the face of the back end of the plane. The screw is turned in until its head beds down firmly upon the face.

It will be noticed that the bevelled facet of the iron is placed upwards in this example, instead of downwards, as in previous examples. This arrangement is frequently followed in iron planes, as tending to sweeter working. The angle at which the iron is set in the block is correspondingly lower, so that there is really no difference in cutting angle in the two cases. In the former, however, while the lower or clearance angle is being constantly varied by resharpening: in this it remains constant, while the angle of top rake varies with the sharpening of the bevelled facet.

The great advantage which iron planes have over those of wood is, first, that they cut sweeter than wood, being more entirely rigid; and the other, that they are unaffected by changes of temperature. For cabinet makers, pattern makers, and joiners they are, therefore, of much service. There is a good deal of elasticity inherent in a plane made of wood which is absent in those of iron. Elasticity of wood tends to produce more or less of chattering and choking, especially on working hard, cross-grained timber. A good iron plane having its cutting iron well fitted, well bedded, and secured, will operate in any direction or condition of the grain in a superior manner to the best wood plane.

If any workman finds difficulty in following out the instructions I have given, I trust he will communicate with the Editor and so give me an opportunity of putting him in "Shop." I shall also be glad to hear from any workman who may be desirous of information on the method that he may best follow in making any special tool that he may require. I shall always be ready to help to the best of my power.

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

II.—Acetate of Potash—Acetate of Soda—Acetate of Ammonia—Accidents — Agate —Alkali — Alum — Alumina—Aluminium — Alloy.

Acetate of Potash. — French : *Acètate de Potassa.* The name of this salt is sometimes printed potassic acetate, and acetate of potassa. This salt is used in the preparation of metallic acetates, and in the formulæ of some brassing solutions. It is obtained by neutralising carbonate of potash with acetic acid, evaporating the liquid to dryness, and heating the salt to fusion. It is usually met with as a white, foliated, crystalline mass. It is extremely deliquescent, and easy soluble in water.

Acetate of Soda.—French : *Acètate de Soude.* This salt has uses similar to those of acetate of potash. It is prepared commercially on a large scale during the process of manufacturing acetic acid. The crystals of this salt are large, colourless, and transparent. They effloresce in dry air, and are readily soluble in hot or cold water, and in alcohol.

Acetate of Ammonia.—This is named in some old recipes "spirit of minderus." It is a liquid, prepared by saturating strong acetic acid with carbonate of ammonia.

Accidents.—Electro-platers and workers in trades where "chemicals" are used are liable to serious accidents, caused by ignorance of the nature of the materials, or a carelessness born of familiarity with their uses. These accidents are of such a nature as to demand the prompt application of remedies. These should be always kept handy, on an easily accessible shelf in the workshop, and every workman should know how to apply them when necessary. The accidents most likely to happen are those arising from careless handling of bottles containing acids; reckless handling of cyanide of potassium, or carelessness in working with its solutions; mixing one chemical with another in ignorance of its properties; indiscriminate experiments without any previous plan, "just to see what will happen, and what the mixture will do;" and poisoning of the hands and face through absorption of poisons in cuts and other injuries. To these may be added, injury to breathing and digestive organs by inhaling poisonous fumes whilst preparing pickles and other solutions.

Only a madman, intent on suicide, would attempt to swallow any of the poisonous preparations used in the workshop and laboratory, therefore, injury caused in this way can scarcely be regarded as an accident. Provision is made in these notes for all contingencies, and full instructions are given to guide any person in dealing with all accidents likely to occur. In addition to cautions respecting the proper and improper uses of dangerous substances given under their respective heads, consult also the sections on *Antidotes*, *Poisoning*, *Hygiene of the Workshop*, etc.

Agate.—This is a precious stone with a composition resembling flint, and almost identical with that of chalcedony, opal, quartz, and rock crystal. It is extremely hard, and is capable of receiving a high polish, only a little inferior to that of the ruby and diamond. It is much used in furnishing chemical balances with bearing points, and in the manufacture of the best burnishers in use by electro-platers.

Alkali.—This is the Arabic name originally given to potash, but now applied to those substances which are opposed in their nature to acids, as having the property of neutralising their action when added to them, and forming with them compounds named salts. They also restore the blue colour to litmus and other vegetable blues that have been turned red by acids. In commercial circles the term alkali is usually applied to carbonate of soda, to soda crystals, and sometimes to caustic soda. The principal alkalis are ammonia, lithia, potash, and soda. The two last in various forms and combinations are largely used by electro-platers. An alkaloid is a vegetable substance having many properties in common with the alkalis.

Alum.—Common alum is a complex compound of sulphate of potash and sulphate of alumina, represented by the chemical formula $Al_2 K_2 4SO_4 + 24H_2O$. It is obtained on a large scale whilst roasting shale containing clay and iron pyrites. *Ammonia alum* contains ammonia instead of potash. *Soda alum* contains soda instead of potash. It is more soluble and more difficult to crystallise than the other alums. *Chrome alum* contains the metal chromium instead of aluminium. *Roman alum* is made from alum stone, a felspathic rock. *Alum cake* is a mixture of silica and aluminium sulphate. It is used as a base by dyers. A solution of common alum in water has the property of absorbing the heat rays of the spectrum, whilst it allows the light rays to pass through freely. Its crystals readily dissolve in their own weight of boiling water, but form again as the water cools. Alum is an important ingredient in mixtures for colouring gold, and in the manufacture of acetate of aluminium. (See *Colouring Mixtures.*)

Alumina.—The earthy oxide of aluminium. It is found combined with silica in clays and felspathic rocks. It is the source of all our supplies of the metal aluminium. "It occurs native in a nearly pure and crystalline state as *corundum*, *ruby*, *sapphire*, and in a less pure state as *emery*." (Roscoe.)

Aluminium.—Sometimes named and printed *Aluminum.* French, *Alumine.* Chemical symbol, *Al.* A bluish-white metal obtained from alumina. It is the lightest of metals. Specific gravity 2·6. Combining weight 27·4. Melting point 700° C.

It stands third on the list of useful metals for tenacity; fourth for malleability; and sixth for ductility. Hardens when drawn or hammered, and is capable of receiving a high polish, nearly resembling that of silver. Does not readily tarnish in air. Castings of this metal acquire a delicate sharpness. Aluminium is not soluble in nitric or sulphuric acids, but is soluble in hydrochloric acid and in the alkalis. It is readily soluble in solutions of cyanide of potassium, ammonia, and the caustic alkalis. It is electro-positive to antimony, bismuth, cadmium, carbon, cobalt, copper, gold, iron, iridium, lead, manganese, mercury, nickel, palladium, platinum, silver, tin, and zinc; electro-negative to magnesium, and metals of the alkalis and alkaline earths. Owing to its characteristics and ready solubility in the free alkalis of depositing solutions, it is not suitable as a base on which we may deposit a coat of the precious metals. Articles made of pure aluminium will not receive an adherent deposit of gold or silver in the ordinary plating solutions, but will dissolve if left in them and spoil the solutions. This is a serious drawback to its use in the manufacture of ear-rings and light articles of jewellery. "Aluminium solder contains six parts of aluminium, four parts of zinc, and ninety parts of copper." (Bloxam.)

Copper, alloyed with ten per cent. of aluminium, so closely resembles gold in colour as to secure for it the name of aluminium gold. This alloy makes up well into pencils, chains, watchcases, and similar articles, and is most suitable as a base on which to deposit a good coat of gold. In the hands of the electro-gilder it should be regarded as brass, and treated as such in preparing it for the bath. An alloy of one part of silver added to three or four parts of aluminium is said to be strong, light, and very serviceable, being four times as light as silver. An alloy of steel with aluminium has been patented, and is said to be very useful.

Aluminium has been electro-deposited from a solution of aluminium and potassium, also from a solution of the double chloride of aluminium and ammonium. It has also been deposited from a solution of its chloride. No practical use has been made of the results thus obtained. Information respecting the processes employed in the reduction of aluminium may be found in "Watt's Electro-deposition," pp. 360—363. "Salts of alumina, when moistened with a solution of nitrate of cobalt and heated in the flame of a blowpipe, assume a characteristic blue colour." (Fownes.)

Alloy.—"To alloy," in the common acceptation of the term, is understood to mean the mixture of a baser metal with a finer one to depreciate the quality of the latter. But this meaning of the term has no signification or weight with the metallurgist, who mixes metals and melts them together to achieve a given purpose apart from the thought of debasing a fine or a precious metal. Alloys are usually formed by melting the metals composing them in a furnace, but they have been and can be formed by electro-deposition. Copper and gold may be deposited together in varying proportions to form red gold. Silver and gold may be also deposited as an alloy, the effect in colour being a pale yellow inclining to green in proportion to the quantity of silver deposited with the gold. Copper and zinc may also be deposited together to form brass or bronze, and copper and nickel to form German silver. The metals to be deposited may be melted together and cast in the form of a plate, or an anode plate of each metal may be hung in the depositing solution. The electro-deposition of alloys is far more difficult and uncertain than the deposition of a single metal by itself. Although the two metals to be deposited together are present in the solution in the right proportions to produce the desired alloy, and although they are also rightly proportioned in the anodes, the inexperienced depositor cannot be sure of success, for the deposit will vary in its character as the strength of the current of electricity varies, and the temperature of the solution alters. Only skilled experience can determine the right conditions all round, but a few hints may be helpful, and these will be found under the heads of *Brassing, German Silver, Gold, Deposition*, etc. Alloys of metals have superseded plain metals as bases for the electro-deposition of gold, silver, and nickel. The use of copper as a base for silver-plating has been superseded by brass, and this in its turn by whiter alloys resembling silver, such as German silver, nickel silver, and silveroid. It has also been displaced as a base for gold by such alloys as yellow brass, pinchbeck, and aluminium gold. Alloys of lead with tin and copper to form pewter and britannia metal have been largely used as bases for silver, but they are being superseded by the stronger and better white alloys now employed in the manufacture of best plated goods. This is a distinct gain to the electro-plater and to his customer, for the better alloys are not only less troublesome to plate, but also look well and wear longer.

(*To be continued.*)

FRAMES À LA MODE.

BY J. W. GLEESON-WHITE.

ARTISTS' DESIGNS FOR FRAMES — WHISTLER'S FRAMES—FRAMES BY MENPES—DECORATION OF ROOM IN JAPANESE STYLE—FRAMES SHOULD BE SUITED TO PICTURES — STEEL FRAME — FRAMES IN NATIONAL GALLERY—FOREGROUNDS ON FRAMES—OLD STYLE FRAMES—CHOICE AND POSITION OF PICTURES—FRAME COVERED WITH SACKING—FLAT OAK FRAME, GILT—FRAME WITH PILASTERS—WHITE MOULDED FRAMES—FRAMES IN FORM OF MEMORIAL TABLETS—TRIPLE FRAME—FRAME WITH FRET WORK—MENPES' JAPANESE FRAMES—FRAMES OF ROUGH SAW-CUT WOOD — FRAME WITH MOULDINGS AND PILASTERS — CORNER OF FRAME FOR ETCHINGS—WHITE FRAME STRIPED BY HAND —CONCLUSION.

ONE marked feature in the artistic temperament of to-day is that the painter is by no means indifferent to the setting of his picture, and having polished and wrought his jewel, no longer allows a mere workman to set it as he will. On the contrary, he is not only apt to design the frame himself, and bestow much thought thereupon, but, unless appearances are deceptive, occasionally does not disdain to add certain decorative adornments with his own hands.

Of modern artists who have specially distinguished themselves in this respect, Sir Frederic Leighton, P.R.A., Mr. Poynter, and Mr. Holman Hunt, may be named representing those who design their own frames upon the more conventional lines, but yet distinctly intended for the actual picture they enclose; while for those who have gone farther and pressed novel materials into their service, or struck out completely independent methods, the late Dante Gabriel Rossetti, Mr. Whistler, and Mr. Mortimer Menpes may be cited.

Since the frames of the first group are those calling out all the resources of the professional frame maker they do not concern the object of this paper; while those who were fortunate enough to see the two exhibitions of Mr. Rossetti's work, held respectively at Burlington House and the Burlington Fine Arts' Club, will realise that the gorgeously-designed shrines he adopted belong to the province of the carver and gilder, since their technical manipulation demands the highest skill to carry out the original design of their inventor.

Mr. Whistler, however, with still more novel treatment, has often suggested many motives that an amateur might paraphrase, if not actually copy. This artist, too, devoted no small thought to the production of novel and decorative frames, for water colours, pastels, and etchings, which are more likely to form the staple of the amateur's collection. To Mr. Whistler is probably due the more frequent employment of white frames, which have of late found such high favour, and most deservedly acquired it, for the white border is most effective, or, to speak more exactly, the white *and grey* borders, for the shadows cast by the projecting mouldings are an integral part of the scheme, and all-important in the production of the desired effect. Mr. Whistler was, perhaps, also the first English artist to forsake the monotony of ordinary yellow gold, and select from all the shades of metallic lustres from silver to copper colour; at times adding actual colour in broken Japanesque patterns of stencil work to the various shades of bronzes (as they are often called) that he selected.

Mr. Mortimer Menpes went still further afield in search of novelty, and brought home from Japan native-made frames of exceedingly novel fashion, which delighted the art-loving public at his exhibition of Japanese drawings, as much by their intrinsic beauty and simplicity as by their newness. The effect of his show was, perhaps (in spite of Mr. Whistler's Harmonies in Various Colours of previous years), the prettiest thing of its kind ever seen in England. For the benefit of those who were unable to visit it, a brief description as it looked on the morning of the private view may be pardoned. A gallery of moderate size was hung with material strained tightly over the walls, looking like silk in its texture, of a pinkish-purple colour—the colour of a particular chrysanthemum beloved of the Japanese, it was said. Festoons of the same material hung stiffly around the upper part of the walls, the ceiling was clad in white, the floor and the central settee being covered with a greyish-white felt; add to this a pure white chair and table, by the side of which a Japanese female attendant, in native costume of harmonious, low-toned, embroidered silks, with a poppy colour bow in her lustrous black hair, kept guard over the catalogues, and the room itself is suggested. But this was, of course, the background only, for the pictures—those in frames to be more fully described—hung in irregular fashion, like flights of birds on a Japanese fan, across the walls. These frames were of black and white for the etchings, and every shade of silver, copper, and gold for the water-colour drawings. It was hard to say which detail was most valuable in the general scheme, but since we cannot have peach-coloured silk hangings, or Japanese handmaidens, it will suffice to consider for our argument's sake the frames as being the next important item, after the pictures they enshrined.

In face of an easy objection that the pictures are of infinitely more importance than their frames, the fact may be frankly conceded. Yet while the face of an English maiden is more beautiful than her dress, she does not neglect the latter, or does so at her peril. The binding of a book is of small consequence compared with its contents, yet a tasteful and decorative cover is rightly held to be a necessity for a book of any value. Perfection, our ultimate aim, demands care for the trifles as much as for the important features; and a regard for beautiful frames by no means implies a neglect of appreciation for their contents. It is just those artists and amateurs who recognise the more subtle beauties of form and colour—those who demand *every* quality in a good painting—who also insist on the frame fulfilling its true purpose.

Briefly the ideal frame may be held to be one that best suits the picture, but keeping this end in view it may be as beautiful in itself as skill or thought can make it, provided that it never forces itself into the first place. Like a well-played accompaniment to a solo, it is only after the solo is ended that one should recognise how beautiful in its unobtrusive support and self-effacement the accompaniment was.

What a frame should not be was exemplified in a striking example in a recent show, when a portrait of Madame Sara Bernhardt, by Bastien Lepage, was exhibited in "a frame of carved polished steel. The completion of same took two and a half years, at a cost of no less than £720. It is considered a perfect work of art"—so ran the catalogue. Naturally such a paragraph set one looking at the phenomenal frame, in itself no doubt an admirable work of art, but challenging directly rival interest with the exquisite panel it professed to adorn. Small wonder if to many the portrait was remembered chiefly by its frame. This is, of course, a "frightful example," as a lecturer would say, and one fortunately out of the reach of most readers of this paper, who are not likely to copy its faults, but may easily err in the selfsame fashion by making the frame the chief end, and afterwards choosing a picture that happens to be of suitable size to fill up the previously planned opening. This is as absurd as it would be to design a wedding dress and, when it was finished, choosing a bride for yourself who happened to fit it.

There are frames which cannot well be made at home, and fortunately they are just the ones that are least suitable for the average house. Of burnished gold arabesques and marvellous plaster volutes and scrolls no word in praise or blame; they have their right and wrong use. In the National Gallery there are splendid examples, and horrors worthy of all rebuke are not unknown in our large exhibitions. Some on view this year, wherein the foreground of the picture was carried into high relief on the frame, or where by cheap symbolism (a tennis racket and ball for example) the motive of the picture was repeated on the frame, deserve a word of dispraise. But it may be sadly said, if the owner's taste is unconscious of the vulgarity of such meretricious adjuncts, there is little use in quoting instances. Even if he be polite enough to accept the warning and henceforth shun that particular form of vice, he will probably develop others seven times worse. If asked to define "good taste," it is to be feared "our own" would be the inward reply, whatever ingenious phraseology we used to express it. But there are canons of good taste easy to acquire in these days of much teaching, and while the best may sin at times, yet a man who has read his Ruskin and Pater, who has some knowledge of the tendency of modern art, is likely to abstain by a sort of acquired instinct from the most flagrant examples.

The orthodox gilded moulding, the ordinary oak or ebonised beading, and the once popular Oxford frame may be mentioned only to be dismissed without comment; their merits and demerits ought to be self-evident now. Each and all are the very best in the right place, and of varying degrees of badness in the wrong use. While simplicity looks so easy to novices, older hands know that perfect simplicity is the outcome of art, the *ars celare artem*, that is a proverb for refined expression. Novelty has a charm, say what one will; half of our lives are spent in search of it. The love of change is even more dominant than that of life or food, as we see by the countless numbers who leave every apparent comfort in search of what is new. Therefore let us not despise it, and profess to like old things best, for it will be found that, as a rule, it is only when the old has become rare, and therefore novel once more to common experience, that one begins to value it.

Again novelty is, like morality, a question of latitude. To an Orkney Islander a worn-out fashion of seasons ago in London may come with its original zest. Mindful of this, I have selected many examples that are well known to dwellers in large towns, nor have I, on the other hand, kept to the theory which I have tried to expound. It is so easy to quote the text, so hard to live up to it. Consequently, if the suggestions to be made embrace some flagrant examples of bad taste, I can but cry Peccavi! and implore those who discover them on no account to be tempted into imitating them, but rather practise a Spartan-like renunciation, and shun their meretricious allurements. But to the point; a preacher tries to bring you to a happy frame of mind by special pleading and winsome arguments. The happy frame I would bring you to, is the one of those to be described that suits you best.

The ordinary formula that oil paintings only suited a dining-room, water colours a drawing-room, and engravings and etchings a library or morning-room, is as conventional and absurd as most other formulas. The only sound advice is to choose the picture you like best, be it bad or good, hang it where it may be seen (otherwise why buy it?), and proclaim your own taste in your own house — better personal taste of the most vulgar kind, than badly digested "culture" which is a mere laughing-stock. I think as I write of a "Rossetti" that its owner fancies makes the most vulgar of vulgar drawing-rooms a temple of beauty. The room certainly fails to kill the picture, although it tries to do so; but the one bit of good art makes the rest more pinchbeck and more vulgar than ever. Then I recall another room plainly furnished in almost lodging-house simplicity, where a Corot reigns, yet the splendour of the picture, having no vulgarity to overcome, stands out the most precious thing of course, but making a commonplace room beautiful by its own great beauty.

This may be discursive, but frames are so varied, and their kindred pictures so near the subject, that it is harder than usual to keep to the point.

First, to dispose of a few simple materials. This year a frame made of common sacking, either in its native tint, or more often dyed a dull green or heavy peacock-blue, has found many admirers. The pictures in such were surrounded by a gilt moulding of rather ornate pattern as a rule, about half an inch to an inch wide, according to the size of the painting, then a plain deal border covered with the canvas or sacking surrounded the whole; this was at least six inches wide, often a foot, for large pictures. If the whole moulding and sacking is gilded in one shade of gold, the effect is really beautiful in itself, and isolates the panel from its surroundings. (Fig. 1.)

Admirable, also, was a frame of plain, flat oak, gilded to show the grain of the wood. About a fifth of its width from its edge was, apparently, a row of brass-headed nails, touching each other, or else a moulding inserted that simulated nail heads. (Fig. 2.)

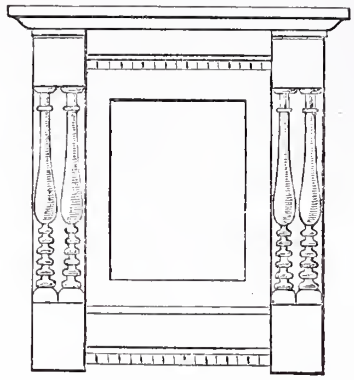


Fig. 3.—Effective Frame for Figure.

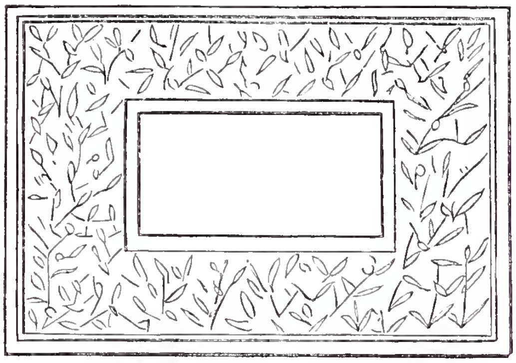


Fig. 4.—Ornamented Double Frame.

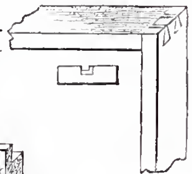


Fig. 11.—Corner showing Formation of Fig. 10.

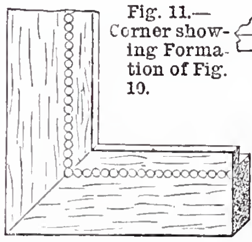


Fig. 2.—Frame of Plain, Flat Oak.

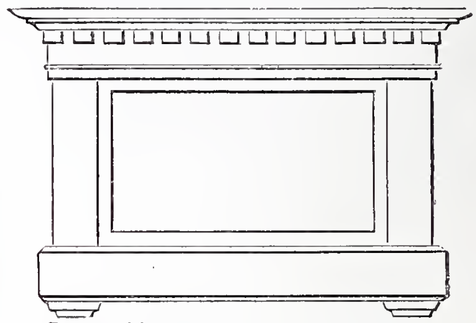


Fig. 5.—Memorial Tablet Frame, No. 1.

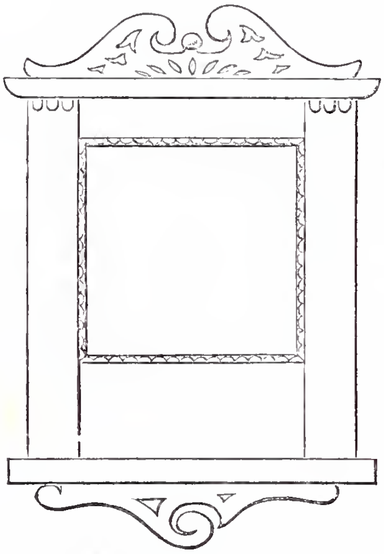


Fig. 6.—Memorial Tablet Frame, No. 2.

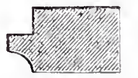


Fig. 15.—Section of Fig. 14.

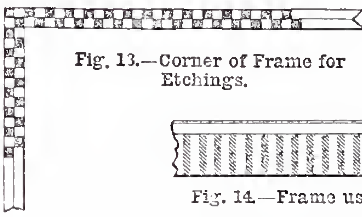


Fig. 13.—Corner of Frame for Etchings.

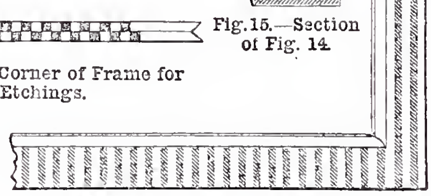


Fig. 14.—Frame used by Mr. Whistler.

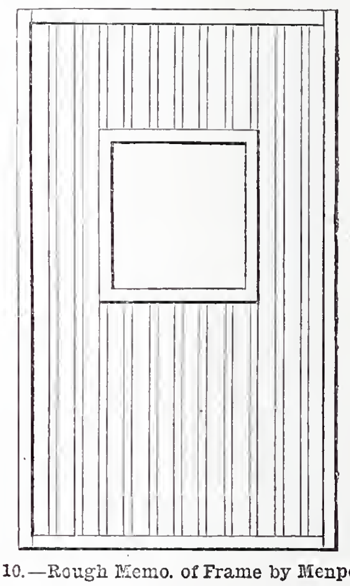


Fig. 10.—Rough Memo. of Frame by Menpes.

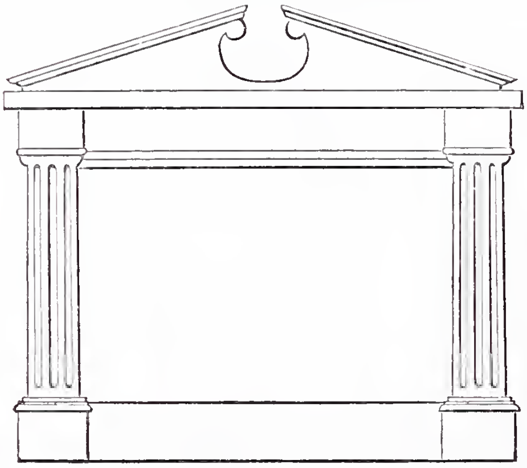


Fig. 7.—Memorial Tablet Frame, No. 3.

The frame in Fig. 3 is a most effective style for figure subjects, yet very simply made, as all the pseudo-classical decoration is applied, the twin pilasters being merely a bit of ordinary turned work, cut in halves. The mouldings and fillets are of the most elementary character, yet the whole frame, finished in pure white enamel, is exceedingly effective. It may be worked in oak and gilded with bronze powder, or in ordinary deal, with the usual plaster and gold-leaf finish. No frame of those chosen is less costly, and few look better when on the walls, as I can prove from experience. Of course, this idea may be enriched by the use of lincrusta frieze decoration, with very happy effects. In this and other frames to be described when a flat surface with low relief ornament is needed, lincrusta is admirable, being inexpensive, easily worked, and a capital surface for after decoration.

The design (Fig. 4) is intended to represent a white moulded frame, with an inner frame also white, the space between the two being filled with the monochrome paper of quiet design, such as one sees on the fly leaves of modern books. The same motive with richer mouldings and lincrusta, or Japanese leather paper substituted for the white and monochrome paper, makes a very effective and useful frame for water colours of a certain class, or oils. The proportions must be decided by the character of the painting; some subjects demanding a wide margin, others exacting very little, lest they are overweighed by their surroundings.

A society for the promotion of art has of late constructed frames somewhat after the fashion of the memorial tablets in churches of the Wren period. These, either finished in white, worked in dark rich polished woods, or solidly gilt, have probably a wide popularity in store. Every church suggests motives for adapting in this way, and the few sketches (Figs. 5, 6, 7) are intended less as designs for reproduction than rough memoranda of possible shapes worthy of being tried. The amateur who makes a good frame does a good thing, better than a useless piece of fret work, or an irritating dust collector of some passing fancy work. If he is not carpenter enough to mitre and dovetail it himself, he may yet draw out the design, and see that it is carried out by an ordinary workman,

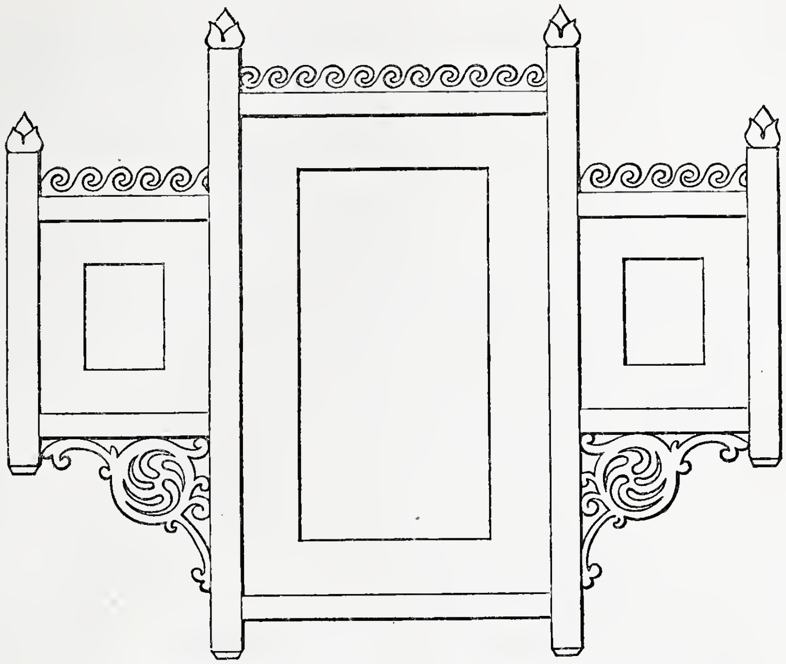


Fig. 8.—Suggestion for Triple Frame in Joinery and Fret Work.

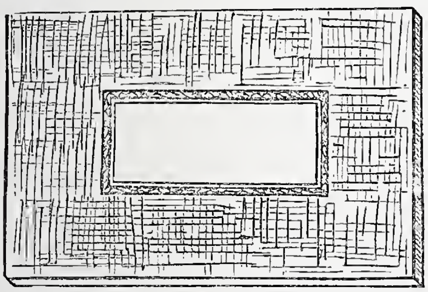


Fig. 1.—Frame of Common Sacking.

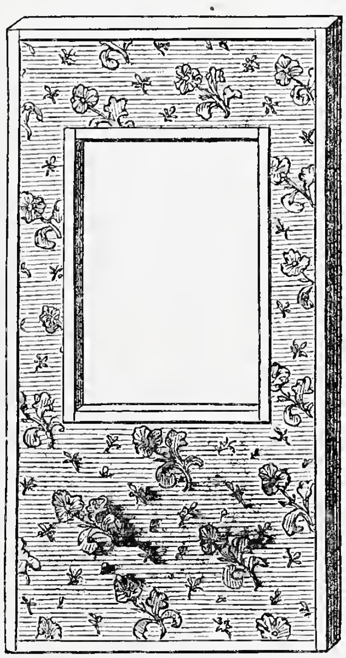


Fig. 12.—Frame, enclosing Panel covered with Japanese Leather Paper between two Mouldings.

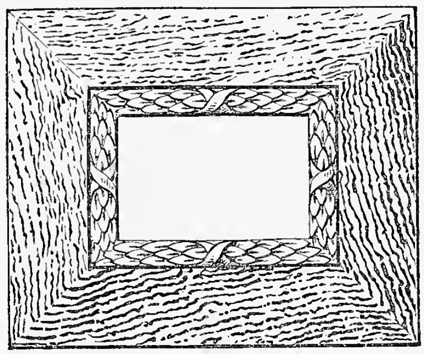


Fig. 17.—Rough Saw-Cut Frame.

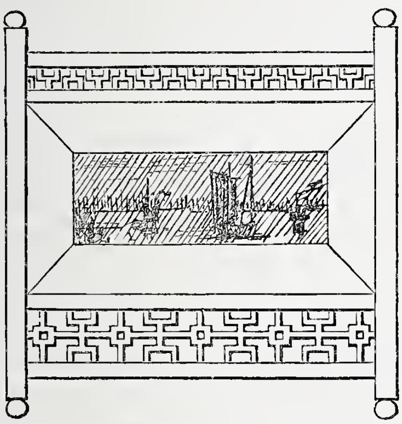


Fig. 9.—Gilt Frame with Oak Fret-work Strips.

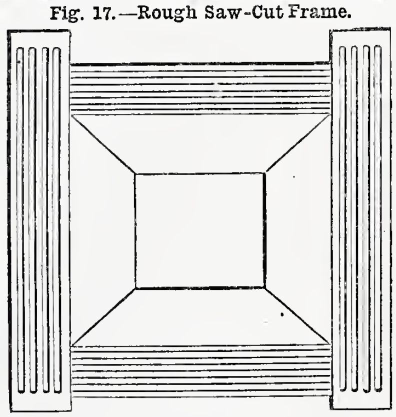


Fig. 16.—Frame of Reeded Wood without Mitres.

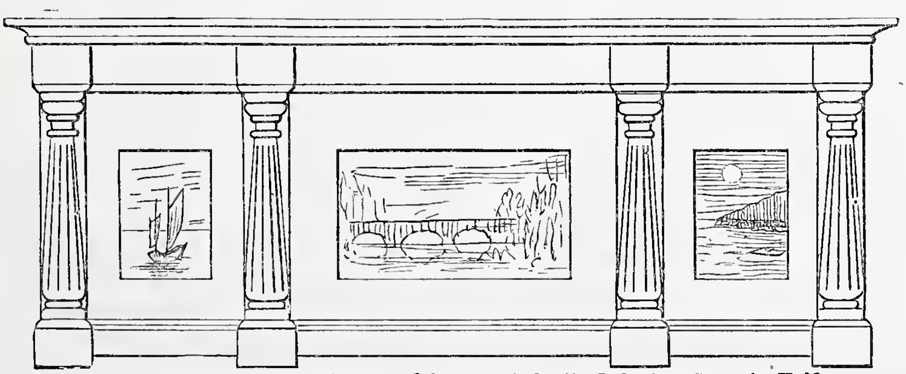


Fig. 18.—Frame with Mouldings, and Ornamented with Balusters Sawn in Half.

the acting partner doing his share, and the brain partner — ironically known as the sleeping one—doing his part, in the success of the whole. But with one of Melhuish's mitre-cutting machines, and set of cramps—costing less than a sovereign—the mystery of the art vanishes, and the most bungling of amateurs may equal a trained workman in the exquisite neatness of his angle joints.

A suggestion for a triple frame (Fig. 8) in simple joinery and fret work is given, under protest. If done simply and without undue fussiness it might look well; it is certainly in sympathy with the very popular so-called Early English of to-day (why so-called is a mystery too deep for probing). If worked in black and gold, or all black, it would balance the overmantel in a small room, or harmonise with the art furniture of the period, but I confess I love it not myself, although, so far as I know, it is my own suggestion.

The style of Fig. 9, also new (I believe), I must confess to liking, believing that the idea it embodies is both novel and workable, and in many variations calculated to make a pleasant bit of wall decoration, yet in no way to the detriment of the picture it encases. I should prefer it entirely gilded, but with the oak fret work strips and the flat oak mount gilded, and the framework finished in black, it might look well and please many people better. When I use the term gilded I do not mean the ordinary gold leaf, but bronze powder, applied easily by any amateur, for all to be done is first to paint over the surface with gold size, and when it is nearly dry—tacky is the technical term—powdering the gold on to it with a dabber of cotton wool. The said bronze can be had in a hundred shades of colour, is not expensive, yet extremely good in effect. The cheap bronzes look equally well at first, but for lasting work only the best should be chosen. There is a pale green-gold very pretty, also a deep copper-red, that in each case helps to break away from the monotony of the ever-present (except in our pockets) yellow-gold.

The sketch (Fig. 10) is a rough note from memory of the frames adopted by Mr. Menpes. These, however, merit fuller description.

Fig. 11 shows the section of the outer frame, a piece of simple dovetailed joinery, exactly like the carcase of a box or a drawer; this encloses a panel probably grooved into its place, like a drawer bottom, for instance. The hole for the picture is bordered by a beading also of plain square wood, the glass being either rabbeted into this or fixed with tiny wood beads. It will be noticed that the proportions of the frame are entirely distinct from European ones, and vary greatly. But roughly, it may be said, the sides are narrow, the top somewhat broader, but not so wide (or deep, call it which you will) at the bottom. The panel may be either of grooved wood—a wood panel with simple square grooves running vertically—or else covered with silk or brocade. The *whole* of the framing is gilded with the same shade of gold, and the effect is most sumptuous. The grooves should, I think, be nearer together than in the sketch, giving almost a corrugated iron effect (but not rounded projections and depressions); but this detail may be left to the operator. The round spot is a tiny speck of brilliant scarlet let in, as it were, bearing the monogram of Mr. Menpes, the well-known Japanese design on all his later work.

Not knowing whether or not these frames are "registered" designs, I must explain that the above is merely a description of the manner in which they appeared to be made, and that those who copy do so at their own risk. There was no warning, either in the catalogue or the exhibition, of the frames being protected against imitations.

In Fig. 17 is sketched a frame much used of late, but hardly within the amateur's power to finish; it is made of saw-cut wood, rough as it leaves the saw-pit, gilded with gold leaf, and adorned by a moulding of rich ornamental design around its opening for the picture. The surface of the wood should slope outwards—that is, the inside edge should be thicker than the outside. In spite of a little affectation of simplicity and luxury mixed, the broken surface of the gilded wood is very gorgeous, and admirably adapted to its purpose.

In Fig. 16 a suggestion for using reeded wood, without mitres, is given; this is as yet rarely adopted, but might be well worth trial, in the right proportions; it would be fairly dignified and individual in its expression, without the air of straining after mere bizarre novelty, from which some of those described are scarcely free.

In the diagram (Fig. 18), a simple frame, with mouldings, and the ends of two of the ordinary turned balusters, procurable for a few pence each, makes much effect at small cost. The round turned work is sawn in half and applied pilaster fashion to the skeleton framework. For an overmantel to a small room, or the wall above a piano, or a sideboard, this might look well, and be found perfectly manageable. In Fig. 12 a variation is shown, suggested by the "Menpes" frames, Japanese leather paper covering the panel, the frame itself being gilded to the exact shade to match, or, if that is not possible, the whole repowdered with bronze to be in harmony. These frames look so extremely well in actual use, that in spite of the crudeness of the sketches, which, roughly drawn and colourless, are lacking in charm, it is as well to reiterate the advice to make them. They also look exceedingly nice with white moulding, and a low monochrome paper, or white brocaded silk in place of gold; photographs or etchings might be framed in this fashion, but a gold frame would probably be too sumptuous and overweigh a monochrome picture, killing it entirely.

Fig. 13 shows a corner of some frames of Japanese manufacture. These were mere frames, with no inner panel, but just a white cardboard French mount for the etching; the moulding was inlaid (veneer) in black and white chequer pattern.

In Fig. 14 will be seen a frame used by Mr. Whistler; it is of a wood moulding, the section (Fig. 15) painted white, and striped with lines hand-painted in neutral tint, all going vertically as indicated; this also had a white cardboard mount. The mouldings of these last frames were about ¾ of an inch wide, certainly not more.

In concluding, it may be said that what the taste of generations has approved is more likely to be of value than a passing fashion, and that the conventional frame of old days needs little change. This is certainly true, yet there are divers kinds even of good pictures, and some are not in themselves decorative in their effect, neither do the old-style frames harmonise so happily with the bric-à-brac of a modern room. This last reason is probably the chief one for these suggestions, and may serve as long as the present taste in house decoration holds sway, to render the modern frame in some of its hundred-and-one varieties more desirable to its owners.

A point too sordid for dwelling upon at length need not be entirely overlooked. An attractive frame *does* draw attention to a picture, more particularly at an Exhibition; and since an artist must sell his pictures to live, he will not despise any harmless advertisement that brings his works to notice among the crowd of those that wait to be admired. Art disdains Commerce in theory, but in practical everyday life is as much swayed by the mighty £. s. d. as other things. Where a question of morals or truth is involved it is beyond question the nobler course to disdain novelty if it conflicts with either; but when the issue is but a question of taste, the rule may be less stringent; and even in so small a matter as the framing of a picture, some concession may be made to the passing fashion of the day, with no loss to the dignity of the artist, or the progress of education in art matters among the people. So, granting that the theme of this paper deals with ephemeral trivialities; yet are we *all* immortals, leaving work not for an age but for all time! As a poet has expressed himself in the envoy to his book—

> "There you and I at last will have to go,
> And if this book prevene us there or no,
> 'Tis but the difference of a year or twain
> If we or it find earlier sleep below;" *

so we may enjoy innocent trifles, in spite of the lofty scorn of severely "thorough" people.

HINGES:
THEIR VARIETIES AND APPLICATION.
BY D. ADAMSON.

I.—The Butt Hinge—How to Hinge and Hang a Door.

Among the difficulties which beset the amateur worker, or even the young workman, those of a minor character are often those upon which he is most likely to stumble. Whether it is that he does not regard little details till he actually wishes to put them in practice, or whether it is because technical writers consider it beneath them to write on elementary work, the fact remains that the amateur artisan is often at a loss how to proceed with some small matter which, to those trained in the ordinary workshop, seems to come as a matter of course. Writers on technical subjects freely discourse on out-of-the-way methods, but they very naturally assume that it is no use going into minute details of simple work. It is on this point that purely technical journals, valuable as they are to the professional worker, are of little assistance to the amateur; and it is just here that Work steps in and supplies the want. Were it not so, I should hesitate to offer any remarks on hinges, but as I have derived many a valuable suggestion from amateurs, not only in connection with "hobbies," but immediately concerning my own business, I venture to give a few hints which, however crude they may be, will possibly prove of service to novices in the wood-working handicraft.

The remark was once made to me, when I asked a question about the rules by which hinge fitting is done, that the only rule is to be guided by common sense. This might be sufficient for those who have already a general knowledge of the various kinds of hinges, and have acquired an almost intuitive perception how to act in any ordinary circumstances, but in my case it was somewhat equivalent to telling a man, who does not know the alphabet, that if he can't

* "On Viol and Flute." Edmund Gosse.

read he must spell the words. Since then, however, by keeping my eyes open, which, by the way, is not a bad plan to acquire knowledge, I have noted a few matters in connection with hinges which, in the absence of positive rules, may be of interest and save the amateur a more or less wearisome journey over the road of experience. A satisfactory path to have travelled, and one to be looked back on with respect; not, however, unattended by mishaps and delays which, perhaps, others may be enabled in some degree to avoid by the following hints. They are offered with diffidence, though so far as they go they are correct; and if the matter be stale to some, doubtless it will be new to others, and for the sake of these I write. This will explain any omissions, and also the elementary character of the hints.

It might prove an interesting task to trace the hinge from early ages, when some rude savage, an inventive genius though in his way, first applied the principle of the hinge by connecting two boards with a flexible joint—whether of raw hide or twisted fibre, who shall say?—to the ornate metal work of later times, and onward to the more serviceable if more prosaic contrivances of the present day. It is with these latter that we have to do; and, however pleasant from an antiquarian point of view it might be to dwell on the older forms, doing so could assist the worker little. We may be pretty well certain that, apart from mere ornamental variety, no useful form has been allowed to lapse; although, as in other directions, fashion exercises a powerful influence, and some hinges are no longer in such demand as they were. The tendency at the present day seems to be towards simplicity, and if one may venture to express an opinion on the subject, it is a move in the right direction, for surely there is no occasion to multiply work, unless there is something more than a fancied advantage to be gained by doing so.

Of course, I am now referring specially to hinges, and, as an instance, I may take the cranked centre hinge. This form, which was fastened at the top and bottom of, say, a wardrobe door, is no longer in such general use as it was only a few years ago. It has been superseded by the "butt hinge." This, in cabinet work, is *the* hinge, and, indeed, it may be taken as the typical form, or, at any rate, of that class which I think has somewhere been described as the "double jointed edge hinge." Under its technical name of "butt," it may not be known by the uninitiated, who will, however, have no difficulty in recognising it as the ordinary door hinge, as shown in Fig. 1. The general construction can so readily be perceived by any one who will take the trouble to look at a hinge that a tedious verbal description may be omitted. Suffice it to say, that it consists of two flaps connected by a wire, on which they are moveable to a certain degree. The side shown in Fig. 1 is known as the front, the reverse as the back. By back, however, is often understood only the rounded part, which is visible when the hinge is fixed and the door, or whatever it may be attached to, is shut. In the finer qualities of hinges, the "backs" are often polished and lacquered; the fronts also may be finished in the same way. Beyond this, it is hardly necessary to refer to quality, which varies considerably, both in weight of metal and general style. Roughly speaking, a good hinge is one in which the parts work smoothly against each other without twisting or straining.

It may be of interest to note that the joint of a hinge is usually unequally divided; for example, in Fig. 2, where the two flaps are shown apart, one of them has two projections, and the other only one. However many of these there may be, it will generally be found that one side has an even number of them, and the other an uneven; thus, two and three, the total consequently being an odd number. The side with the even joint pieces, however many there may be, is technically called the "double," and the other the "single." I have said hinges are made so usually, for the custom is not invariable, as in some, each side has the same number; but, with the exception of "lift off" hinges, where the reason is obvious, so far as my observation goes, such are generally of a lower quality; not perhaps sufficiently poor to warrant their rejection, but enough to justify the hint. Mind, I only say what I have noticed myself, for I do not pretend to have been a specially critical observer of hinges, and there may be good makes in which the usual custom is departed from.

Now with this preliminary talk about the "butt" let us see how a door is to be hung by it. The easiest way would be to screw the hinge to the outside, but such a mode of procedure would at once proclaim the novice. It would do for rough-and-ready work, but we aim at something more than that, and the butt hinge lends itself easily to neater manipulation. First of all let us take an instance where the door is hung *within* the ends, as in Fig. 3. The door ought to fill the whole of the opening, so that it is evident a space must be cut into which the hinge can be sunk. Must this recess be made in the door or in the end? To get an answer to this satisfactorily let us use a little of the "common sense" referred to a page or so back, for it will generally be found that where one method is almost universally adopted to the exclusion of another by skilled artisans there is some good reason for the preference. A moment's consideration shows us that, in such a case as the one before us, it will be a far simpler operation to let the hinge into the door than into the end, and recognising this we have the answer to the question.

A similar mode of reasoning will get us over the next question that may arise—viz., whether the hinge is fastened to the door or the end first, for it will hardly require a practical trial to convince any one that it is easier to screw the hinge first to the door, and then to fit this in its place. To do this in a workmanlike manner a marking gauge or similar contrivance should be used. With an ordinary butt the gauge is set from the pin in the joint of the hinge to the edge of the flaps, or, expressed otherwise, the distance between the marking point and the block of the gauge is equal to half the width of the hinge when opened out flat. This is then to be gauged on the edge of the door from its front, which will give the width of the recess for the hinge. Its length is easily arrived at by marking direct from the hinge, but it will be as well not to trust to this entirely, or if so to take care that the centre of the knuckle—the pin—of the hinge is exactly true with the edge of the door. Were one hinge of a long door to be inclined in a contrary direction to the other, instead of both being parallel with the edge, there would be an undue strain, and perfect action could not be expected. All risk on this score, however, may be avoided by the use of the square to mark off the ends of the hinges. The space thus marked out should now be cut away to a sufficient depth to allow the closed hinge to be laid in it so that no part of the flap is above the level of the wood. In actual practice it is customary to cut away the wood a little deeper towards the back than at the front, or where the joint of the hinge is. This, it will be understood, though flush on the end of the door, projects a little in front. The only reason for letting the hinge in deeper at the back is to provide against any accidental projection of a screw head above the hinge plate, which would prevent the hinge folding close.

The next thing is to screw the hinges to the doors, using screws of such a size that their heads can be properly sunk in the holes prepared for them. It will save a good deal of time to knock the screws in with a hammer for a short distance, not sufficiently to drive them home, but merely till they are far enough in to allow the screwdriver to be used without causing them to "wobble."

When the hinges have been firmly fixed, the hanging of the door may be proceeded with. In the case of large doors this is a somewhat troublesome operation, but in small work it only requires a little care. The method is the same, or may be, though later on a slight difference will be named applicable to large doors, though not absolutely necessary. Open the hinges out, and place the door against the ends in the position it is to occupy when the work is completed, holding it partly open, in order that the loose hinge plate may be got at. As a rule, doors in cabinet work are set back a little within the ends, an eighth to a quarter of an inch, according to the size of the article, but there is no practical necessity for this being done. The only reason is that it looks better, and as one way is as easy as the other that which appeals most to the eye may as well be chosen, for it is the attention to such apparently trivial matters that often makes the distinction between good and careless workmanship. As the door when fixed ought to open and shut freely without scraping against the bottom, the necessary space must be left between the two parts. This should not be great in a well-fitting door, and a sheet of glass paper or thin veneer will come in handy. Place anything of this sort on the bottom, and let the door rest on it. The top of the door may be left to take care of itself, for it can be eased off if it fits too close, and till the actual fitting up is all but done it is as well for it to fit tightly. The thickness of the paper which is between the door and the bottom will be sufficient space for them to clear each other. It is seldom that a door has only one hinge. Bore a hole for one screw through the top hinge, especially if the door is a long one, and drive the screw in. This will afford temporary support, and allow of adjustment of the door, which can be regulated till it hangs truly. Then fasten the other hinge or, in the case of more than two, the bottom one with another screw. The door may now be opened and shut, and if it can be moved properly the remaining screws may be driven in.

It may be wondered why only one screw is recommended before all are bored for or fixed, as it might seem simpler to finish off with each hinge before proceeding with another. If so I may explain that the reason as given to me by an experienced cabinet maker is that, in the event of a misfit, when the door is actually swung, one screw is more easily removed than a greater number, and that the bite of the screws is not weakened by unnecessary holes or enlargements of holes which may be required if the position of the door, or rather the hinge, has to be shifted a trifle. One hole to a hinge being a little bit out does not

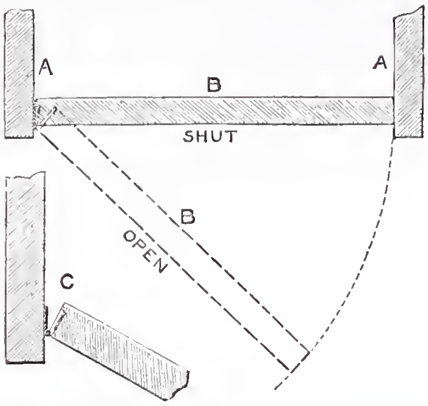


Fig. 3.—Diagram showing Door Hinged within Ends. A, A, Ends; B, Door; C, Enlarged View.

signify, as the other screws will hold well enough, and they can be fitted with certainty. We amateurs can learn a good deal from the professional worker in our favourite recreations, though some of us who have succeeded

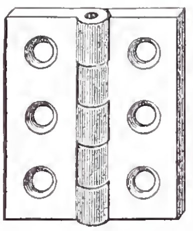


Fig. 1.—Butt Hinge.

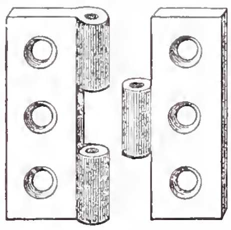


Fig. 2.—Hinge Divided.

in making a box or some equally complicated structure with its corners not so very much out of the square, and its dovetails easy—yes, that's better than badly—fitting, are perhaps rather apt to pride ourselves on our skill as being of quite a superior order. This, however, by the way; and having now given a few hints on one mode of fixing butts, I hope to treat of others, with remarks on varieties of hinges, in a future article.

(*To be continued.*)

BORING SMALL CYLINDERS.

BY OLLA PODRIDA.

I.—Chucking and Boring in Self-Acting Traversing Lathe with Slide Rest—Hand Tools, etc., in Ordinary Lathe with T Rests — Makeshift for Boring without Lathe.

To those possessing a lathe with traversing, or self-acting, motion, or even a good slide rest, the boring of a small or moderate-sized cylinder presents little difficulty; but in carrying out work of this nature in a common lathe provided with T rests only it becomes much more troublesome to produce a satisfactory result, owing to the necessity for special tools—such as D bits, broaches or rose bits, or parallel drills wherewith to finish the required bore, the preparation of which means an expenditure of time, labour, and material, the last-named being in many cases a serious bar in itself.

The immediate object of this paper is contained in the illustrations herewith, which represent a cheap and efficient makeshift wherewith such work of the smaller class may be successfully grappled with. Before proceeding with the description of this particular means, a few remarks, explanatory of the procedure followed under the conditions referred to in the opening clauses of this article, may be of assistance to those who may happen to lack the necessary practical experience.

Taking the first case—viz., a good self-acting lathe, fitted with a proper four-jawed expanding chuck of suitable size—then, under such favourable conditions the operation becomes a simple and easy one. First, the cylinder is set truly and gripped firmly by the back or bottom flange, it being important that the front or top flange which receives the cover carrying piston-rod stuffing-box shall be faced before shifting the cylinder after boring. This remark applies to all cases of facing and boring where truth is indispensable. If possible, sufficient clearance should be contrived for between the back flange and face of chuck or dogs, so that a hook tool may be used for partly facing this one also before removal; this will be found very handy in resetting the cylinder when turned end for end to finish the flange. In boring, an ordinary hook tool may be employed, or a cutter bar, but in either case they should be very strong and stiff, to guard against "chattering." In the case of a small cylinder, and in the absence of a four-jawed expanding chuck, a suitable bell chuck may be advantageously used.

With reference to the second case, where the boring has to be carried out in a common lathe provided only with T rests, it becomes a more difficult matter. D bits, broaches or rose bits, or drills, have to be specially prepared in accordance with the bore required, and this has to be done beforehand while the lathe is unoccupied by the cylinder. The method of procedure is as follows:—The D bits or other tools having been prepared, the cylinder is first chucked and set; then with the hand tools it is bored out to size of drill for a short distance—say one-eighth or one-quarter of an inch—so that the bit, broach, or drill may be started truly. The feed or advance of the tool is given by the poppet-head, and to facilitate this, the centres upon which the tool has been prepared must be left in. The tool may be kept from turning, under the strain of cutting, by means of a carrier or spanner, and the edges must be kept well lubricated with oil during the whole process. The rate of feed must also be, as far as possible, regular. One flange may, of course, be faced without shifting, but the other must be finished on a mandrel.

But comparatively few people possess first-class lathes replete with expanding chucks, etc., and it is not every one who can afford special bits and drills. It becomes necessary, therefore, that many cases of need must be met by makeshifts in some form or other, and this particular example may be overcome by the employment of a tool similar to that which is illustrated in Fig. 1, where it is shown in the act of boring a cylinder.

This simple but serviceable boring tool consists of a piece of hard wood—such as beech or oak—turned up truly in two sizes as shown, the larger equal to the finished bore, and the smaller to fit the rough bore as cast. Each of these sizes must accommodate the length of the cylinder. The large diameter should be rather longer, and provided with a squared end whereby it may be driven. A saw cut must be run up the centre, and a thin steel cutter fixed by screws, as shown. The thickness of this tool may be regulated by the saw cut, and the shape is given in Fig. 3. It must fit very nicely into the boring stem, so that when screwed up tight the cylindricity of the stem is not affected. Clearance, as shown at C, C, Fig. 2, must be cut along the small part to allow the borings to fall away and prevent jamming in working.

The tool may be actuated by means of a wooden cross handle fitted on the square, the motive power being supplied by hand, and the feed given by means of a suitable weight laid on the handle. The cylinder under operation may be held in a vice, or otherwise secured, provided always that there is room for the end of the tool to clear through the bottom. After boring, the flanges must be faced on a mandrel. It is advisable to smooth the rough bore, as it comes from the foundry, with a round file, so as to give the tool as much fair play as possible.

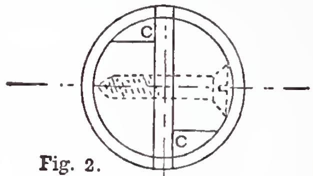


Fig. 2.

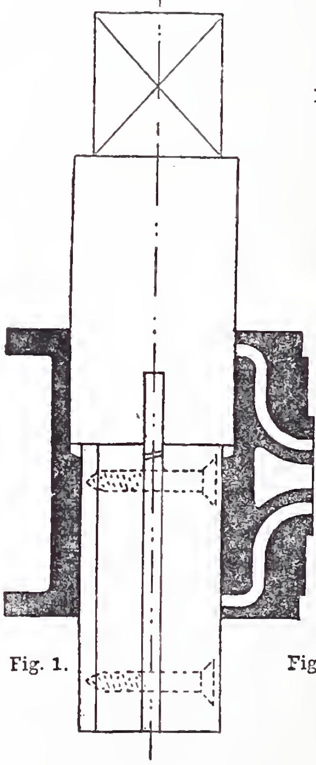


Fig. 1.

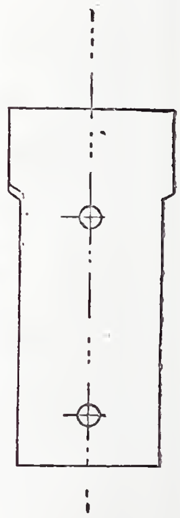


Fig. 3.

Fig. 1.—Tool in Position in act of Boring Cylinder. Fig. 2.—Sectional Diagram showing Mode of Effecting Clearance. Fig. 3.—Shape of Boring Tool.

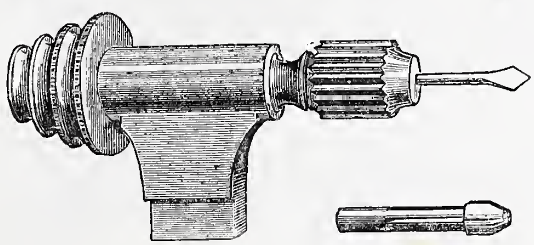
A very decent bore can be obtained at one cut, but to ensure accuracy, two operations with different-sized tools are necessary. Having successfully bored new, and re-bored old, cylinders by this method, I hope that a similar result may occur to all who feel the need of such a contrivance. In another paper a simple way of boring cylinders in a self-acting lathe with a saddle will be described, a process attended with many advantages.

(*To be continued.*)

OUR GUIDE TO GOOD THINGS.

24.—Handy Drill for Small Work.

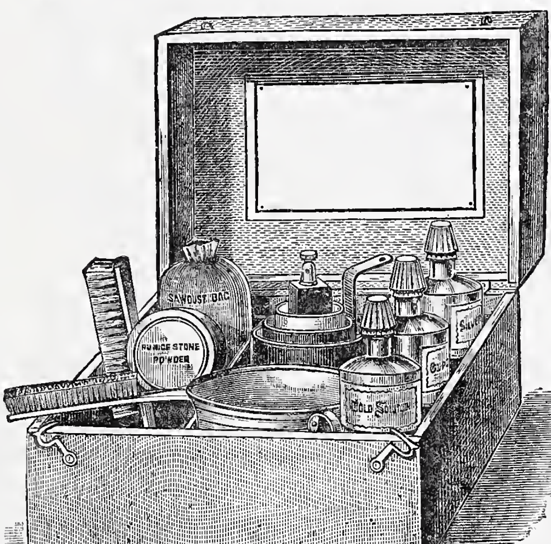
The drill that is represented in the annexed illustration will commend itself to the readers of Work as being an appliance that is admirably adapted for small work, in doing which it would be inconvenient to use a drill of a larger size or of a different kind. The drill itself (by which I mean the entire part of the apparatus that is set in motion, and not the drill point) passes through a steel tube, which is fitted with a foot rebated, so to speak, for $\frac{5}{8}$ in. from the bottom, by which it is grasped and held in a vice while the operation of drilling is being carried out. On one end of the shaft that passes through this tube is placed a pulley with three speeds, by which the drill is actuated by means of a bow, the string of which is passed round the groove that it is considered most desirable to use. The other end of the shank is hollow internally—a piece of iron tubing cut longitudinally through the greater part of its length into three jaws which hold the drill. A cap (surrounded with a band projecting slightly, and deeply grooved to render the operation of screwing and unscrewing it all the more easy) is used to tighten the jaws on the drill, and hold it fixed immovably. Internally the cap is cut with a screw thread, by which it is screwed on to the end of the shank from which the drill projects. Each drill is furnished with two sets of jaws for holding larger and smaller drill points; the drill points themselves ranging from a very small size to $\frac{1}{4}$ in., which, I am inclined to think, is about the largest that could be used with good effect in this appliance. It will be found useful in many trades in which small drills are required, and it will be highly prized as an addition to his ever-increasing stock of tools by the amateur. The specimen which I have described was shown me by Messrs. R. Melhuish and Sons, 85 and 87, Fetter Lane, London, E.C. Its price, as shown in the illustration, is 5s. I should say that the length of the drill, exclusive of the drill point, is $3\frac{1}{2}$ in., its depth $1\frac{1}{2}$ in., and the diameter of the speeds $\frac{3}{4}$ in., $\frac{5}{8}$ in., and $\frac{1}{2}$ in. respectively.



Handy Steel Drill for Small Work.

25.—The Practical Electro-plating and Gilding Outfit.

I am glad that it has been put in my power, at last, to call attention to something that is entirely different to the lathes, tools, and appliances that have hitherto been the subjects of notice. With regard to these, let me remind my readers, I have but little, if any, choice; for it is simply my duty to bring under their notice anything that is sent me, that appears likely to be useful and, therefore, worthy of mention. I trust that all inventors, manufacturers, and dealers will understand that "Our Guide to Good Things" is open to all alike for a description of their specialities, and that in order to obtain a notice, they have only to put themselves in communication with me, supplying me with some account of the object to which they desire attention to be called, if the article be too large to be sent to La Belle Sauvage for examination. The Practical Electro-Plating and Gilding Outfit, of which an engraving is given in this page, consists of a Bunsen battery, enamelled depositing cup, scratch brush, washing-out brush, boxwood sawdust, powdered pumice, copper wires, copper solution, silver solution, and gold solution, all contained in a neat polished case, or wooden box, as represented. With each outfit instructions are supplied, showing its possessor how to charge the battery in the first place, and then how to manage the plating process with copper, silver, or gold. Some practical hints which are concise, and apparently to the purpose, are further given to instruct the beginner in the management of the battery. I say "beginner" purposely, for it is only to such that the outfit really appeals; for those who are inclined to go into the work of electro-plating and gilding thoroughly would require plant on a more extended scale. I am the more inclined to think well of it, because one of my numerous correspondents wrote to me the other day to call my attention to it, and he spoke of it as being likely to be useful to many. If any reader tries it, I shall be glad if he will send me his opinion of it. Its price, complete, is 24s. No maker's name is attached to the instructions sent out with the outfit, but I believe it may be purchased of ironmongers and dealers in tools, and, probably, of chemists, who now deal largely in photographic appliances and goods of this sort.



Practical Electro-Plating and Gilding Outfit.

26.—"Ornamental Turning."

No turner, whether professional or amateur, who can afford to give a guinea for a book, should be without the very handsome volume entitled, "Ornamental Turning," a work of practical instruction in the above art, which has been produced and published by Mr. J. H. Evans, 159, Wardour Street, W., who is an authority on the subject, and a proficient in the beautiful work that he so ably describes. The work, to use the author's own words, has been "introduced with a view to assist amateurs who are interested in the development of the resources connected with this most interesting and scientific amusement; and it is hoped that the large amount of detail displayed will facilitate the manipulation of the various instruments and apparatus described." Mr. Evans enters at once on the subject of decorative turning, because plain turning has met with treatment by so many writers, that he deems it to be neither necessary or desirable to touch on it, so he commences immediately with a description of the ornamental turning lathe, the overhead motion, and the appliances that are used in connection with it; and the mode of chucking and adjustment of work, tools, chucks, etc., the division plate and index, the height and centre of the tools, and how to grind them and set them. From this, he passes on to the consideration of the different materials most appropriate to the work, and the mode of polishing, and the use of lacquers. Next, he brings under the reader's notice the numerous and various apparatus used in connection with the ornamental turning lathe, including the overhead motion, the sliding rest and its tools, the eccentric, vertical, horizontal, and universal cutters, the drilling instrument and curvilinear apparatus, the eccentric, ellipse, rectilinear, and dome or spherical chucks, the spiral apparatus and spherical slide rest, geometrical slide rest, and various cutters. Descriptions are also given of the modes of producing various elaborate pieces of turned work, including elliptic caskets, ivory candelabra, vases, frames, etc.; and the author concludes with a chapter on the advantages derived from electrotyping in intaglio and kindred work. The book is illustrated with numerous diagrams and illustrations of the ornamental lathe, and the apparatus used with it; and seventeen full-page autotype plates, exhibiting beautifully executed examples of the various kinds of work that may be executed by the aid of these appliances. I have sought, rather, to give the reader some idea of what he will find in the book itself than to select isolated portions for particular notice and comment; because I think that the former mode of treatment is more truly useful than the latter. Space has prevented me from doing anything like justice to Mr. Evans's work, and whoever becomes the owner of a copy will be agreeably surprised to find how much I have left untouched.

27.—Patterns for Fret Work, Stencilling, Turning, etc.

Amateurs and young workmen who are on the look-out for patterns of this kind will find much that is useful and suggestive in the parcels of these designs that are prepared and sent out by Mr. Fritz Collins, publisher of designs, Summerlays Place, Bath. They include examples for fret work, stencilling, turning, and even repoussé work, and the purchaser must be hard to please who cannot get out of them sufficient to remunerate him for the outlay of the shilling that is asked for each separate packet. Buyers must not expect to obtain highly-finished printed examples, because the patterns are all stencils, executed by Mr. Collins himself, and those in his employ; and, therefore, they present a certain degree of roughness, and, perhaps, unevenness of colour, that at first may prove somewhat disappointing. The forms given, however, are good; and the stencil patterns, especially, are useful for combinations, which any one can make for himself by the exercise of a little judgment. Mr. Collins also supplies all tools, materials, and appliances required in fret working, a detailed catalogue of which may be obtained for 3d.

28.—Trying Square for Metal Work.

In metal working it is always desirable to have means of testing its accuracy in a manner that will admit of no mistake, and will not allow any error to be allowed to pass undetected. For all rectangular work, and even for testing surfaces of no great extent, an excellent little Trying Square or T Square has been recently introduced, which is most accurately machined and may be declared infallible. It consists of a gun-metal bar nearly 4 in. long, $\frac{1}{2}$ in. wide, and about $\frac{1}{4}$ in. thick, being wider towards one end than at the other. A slot is cut in this projection about $\frac{3}{4}$ in. long by $\frac{3}{8}$ in. wide, and the metal at the top and bottom of this slot is perforated to admit of a steel bar which works up and down at right angles to the gun-metal bar. The steel bar is held immovably fixed at the will of the operator by a set screw with a milled head, which presses against a spring set lengthways in the slot in the gun-metal bar. This handy appliance, which was shown me by Messrs. Melhuish & Sons, costs 2s. 6d. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

**** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

Delay in Replies to Queries.—Correspondents must not think that their queries have been put on one side because they are not immediately answered. Mr. Bonney writes in reference to a question on electrical matters propounded by a correspondent:—"The query sent me from A. G. is of greater import than appears on the surface, and necessitates some experimental calculations which will take time to conclude. I have to decide upon the 'greatest weight' capable of being lifted with two cells, and the form of magnet best calculated to develop the full powers obtainable from two cells. I am anxious to give correct answers to all such queries, so as to make Work a reliable source of information. Knowing this, you will kindly excuse a little delay."

Choice of a Trade.—Excelsior.—Your query is a little out of the beaten track, but I do not like to refuse to answer it on that account. You are now, you say, a warehouseman in a tea establishment, aged twenty-five, in which you find there is no chance of obtaining a better position. The weekly earnings of some of your friends, who are mechanics, are considerably above the sum that you yourself receive, and you wish to qualify yourself for some trade. Your hours are from 8 a.m. to 7.20 p.m., which does not leave you much time. You ask me to recommend you "any trade in which by private study and class work at, say, a Technical College," you could fit yourself to earn a living. You should first ask yourself what trade you feel most inclined to adopt. If I were in your place my own tastes would lead me to take up with carpentry, joinery, cabinet making, or wood carving, and as a preliminary step in this direction, go and see Mr. Thomas Syer, who has, or had, a Technical School of his own at 1 and 2, Finsbury Square Buildings, Chiswell Street, E.C.

Leaded Glass Windows.—N. W. (Kilburn).—This subject, with Glass Painting, will be treated effectually in Work, and in the papers that will appear on this subject you will be told where to obtain the necessary tools and materials. You may rest assured that all articles in Work that can be illustrated will be illustrated as fully and as completely as possible.

Ladies' Glove and Handkerchief Boxes.—You tell me that you want designs for these "in oak with monogram L.K. carved on the lid." For the benefit of such amateur carpenters as yourself, illustrated papers giving designs for and instructions in making such articles as these, and others of a similar kind, shall be given from time to time in Work. It would occupy too much space to give what you require in "Shop."

Advertisements in "Work."—G. B. (Tadcaster).—Without doubt Work will be found in every way worthy of binding and preserving. It is not in any way an easy matter to regulate the advertisements as you wish and suggest. If it were possible to do so I can assure you it would be done. Thank you for your good wishes.

Patent Brass-Capped Bradawl.—C. C. E. writes:—"As to the Patent Brass-capped Bradawl, I made one fifteen years ago, and have it now, so there is not so much 'patent' to hold good." [It is a simple contrivance to be sure, but none the less useful and effectual because simple. You must have been aware, when you made the capped bradawl that you now have, that it was much superior to the ordinary bradawl, and as you did not take advantage of your discovery, or invention, call it what you will, the rights of the patentee of the bradawls thus made and now on sale must hold good.—Ed.]

Lukin Lathe.—C. C. E.—Your remarks, which I perfectly understand and appreciate, shall be submitted to the designer and manufacturer of the lathe in question.

Picture-Frame Making.—Mitre.—This trade, with carving and gilding, will be fully treated in due season in Work. In the meantime, you might apply for what you require to Mr. George Rees, 41, Russell Street, Covent Garden, and the Savoy, Strand. I am not acquainted myself with any special work on the subject.

Boatbuilding.—L. W. L. (Wolverhampton).—This subject will be taken up and thoroughly treated; but I fear it will not be possible to do much with reference to the approaching season, which is close at hand. At present I must ask you to be satisfied with the assurance that writers will soon be at work on the theme.

Working Mother-of-Pearl.—Edward.—Mother-of-pearl is cut into the shapes and forms required by means of a saw, and such devices, letters, and words as you describe in your letter are also cut in this material by drills, fine saws, and files. It would require a paper or two to describe the mode of procedure clearly enough to guide you in every step, and possibly some worker in mother-of-pearl may see his way to give instructions for the benefit of yourself and others. Etching on mother-of-pearl is executed in the same way as etching on metal. If a raised device is required on the pearl, the design is first drawn upon it with an opaque varnish, and the surface unprotected by the varnish is then brushed over with strong nitric acid. The acid eats away the pearl, and when it has been sufficiently treated in this manner the varnish is removed by washing, and the design appears in relief.

Gardening.—J. P. A.—It will not be possible to give papers on gardening in Work, as it is a subject that requires a periodical all to itself; but the appliances used in gardening and by gardeners indoors and outdoors will be described in due course. You will, I am sure, readily understand that it is not possible to take up every subject at once, but that every subject will have its turn in due season.

Suggestions for "Work."—S. (Edinburgh).—I have to thank you for your suggestions, to carry out which would take up much more space than can be spared, and require a very large editorial staff. Technical terms can be easily understood by reference to any good technical dictionary, or dictionary in which the leading technical terms are dealt with. Those who read Work are certainly supposed to know the uses of lathes, and tools, and appliances mentioned in its pages, and very few would look for an enunciation of first principles. You can scarcely be in earnest in expecting me to explain in "Our Guide to Good Things" that a bradawl is meant for boring holes in wood for the reception of nails, and to make provision for driving them home as straightly as possible, and to point out that a wrench is used for loosening or tightening a nut. These are things, to fall back upon a very threadbare expression, which "every schoolboy knows."

New Invention.—Quintuple.—No charge will be made for giving a description of your patented invention in Work. Send in an account of it on approval.

Dyeing Osiers.—Bunsen Battery.—Dyeing is chiefly resorted to for veneers, in which it is desirable that the colour should penetrate through the wood that is subjected to this process. For colouring the surface staining is generally practised. Possibly osiers or willows peeled for basket making might be stained by means of Judson's dyes, but I am not certain about this; but, perhaps, the safer plan would be to subject them to the action of dyes, treating them in the same manner as veneers. To give recipes for the preparation of all the colours you ask for, namely, "black, blue, scarlet, green, violet, yellow, and orange," would take up far more space in "Shop" than can be spared, and I can only promise you that the subject shall not be forgotten, and that a paper giving you the information you are seeking for shall appear in Work at the earliest possible date.

Strictures on "Work."—R. S. C. (Leeds).—Hammer away as much as you like. I am used to that sort of thing, and it does not in any way hurt me. I always bear in mind the fable of "The Old Man and his Ass," and steadily decline to imitate the Old Man, and try to please everybody, because I have long since recognised the utter impossibility of doing so. No writer in No. 1 said a word more than he ought to have said, and in that same number there was not an atom of "rubbish."

Practical Soldering.—Hohenzollern.—You shall have instructions on this subject very shortly, as an apt and clever writer, a thoroughly practical man, is engaged on it. In "Our Guide to Good Things," articles that are costly must be described as well as small things. I endeavour in this part of the Magazine to gather and give information that may be useful to all in turn.

Cyanotype Process.—J. W. (Darlaston).—The formula you refer to is correct, but may be misread through a comma being inaccurately placed immediately after ammonia, making it appear as if the ingredients are three. There are only two—viz., ammonia citrate of iron and ferricyanide of potassium. By using these in the manner directed, results ought to be satisfactory; but if you cannot manage, write, stating your difficulty, and I will endeavour to point out any error into which you may have fallen. An article will probably shortly be devoted to the Blue printing process. Thanks for your good wishes.

Circular-Saw Rigs for Lathe.—G. E. (Camberwell) writes:—"As a practical mechanic of twenty-five years, I have been much pleased at the way in which No. 1 of Work is presented; but with every apology, if you will kindly allow me, I would venture on one or two suggestions in connection with circular saw. Fig. 1 represents a superfluous amount of work for small results to an amateur in the screwing or tapping a chuck to obtain a counterpart. Fig. 3 much better adapted, but the square should taper 15°; yet again, the saw which is driven between centres of 60° is the most lasting—less liable to run out of truth. As regards the table, certainly the best is that let into rest bottom—wide but shallow shoulder to allow it passing below the saw spindle—the cut in the table (supposing it to be brass ¼ in. thick) to be made by taking diameter of saw, centering the table, drilling one hole at each end, then following line of holes opening one into the other with warding file. Again, you consider lathe saw essential to amateurs. Quite so; I take it to be equally so to practical men; that is my experience.—[Comments and criticisms are always welcome, as free discussion is always helpful all round.—Ed.]

**** *Many answers are held over for want of space.*

Trade Notes and Memoranda.

Some Topics of the Hour.—Sanitary Town Houses.—Public Baths and Laundries.—Convenient Traffic Streets.—Town Drainage.—Fashions in Joinery.—Combinations of Chimney Flues.—Preservative Processes in Architecture.—Sewage Purification by Electrolysis.—Air Pressure in Sewers.—Electric Lighting.

The County Council's Medical Officer of Health for London is to have a salary of £1,000 per annum.—A Shakespeare window has been presented to the Stationers' Hall, London.—Patents have recently been granted for improvements in Fire-grates, the Manufacture of Cement, Window Fasteners, an Endless Band Saw, and Stone Dressing Apparatus.—The English Iron Trade is still tending upwards.—The West Ham Council want Contracts for Wrought Iron Fencing by April 23; and the Metropolitan Asylums Board invites Tenders for Engineering Work at Leavesden Asylum by April 30.—Mr. John Aird, M.P., contemplates improving the Water Supply of Vienna at a cost of two million pounds.—The completion of the Tower Bridge Scheme is extended for four years.—The Sugar Market is rising.

The Town Council of Taunton offer premiums of £100 and £50 for the two best schemes for preventing the flooding of the north part of the town.

Liège has established a commercial museum, divided into two sections. The first comprises the articles that Belgium is obliged to purchase from other countries, while the second contains samples of articles which are manufactured in Belgium.

H. Graham Harris, M.Inst.C.E., will give four lectures on "Heat Engines other than Steam," before the Society of Arts, on May 6, 13, 20, 27.

Tenders for Stationery and Lithography are invited by the Great Western Railway Company by 29th April; also by the Controller of Her Majesty's Stationery Office by May 1.

Camberwell Vestry will ask the County Council for £50,000 for a new road from East Dulwich to Old Kent Road.

The buildings of the crematorium at Woking are nearly completed. The architecture is thirteenth-century Gothic, the body of the building being in red brick with Bath stone facings. The chapel is 48 ft. long by 24 ft. wide, and the height 28 ft. from the floor to the top panelling.

On the 26th, 27th, and 28th June next an international congress on Cheap Dwellings will be held in Paris.

WORK

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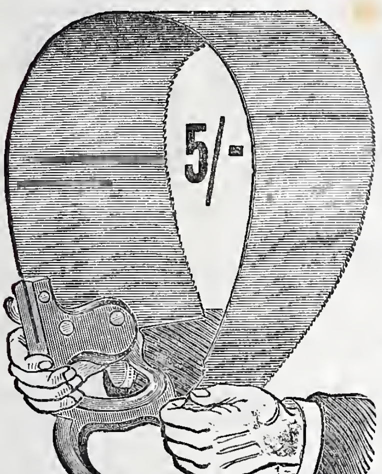

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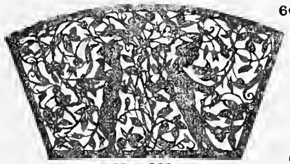

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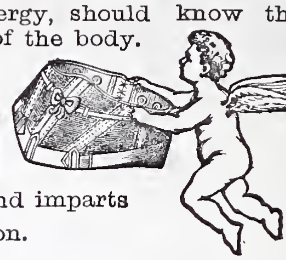

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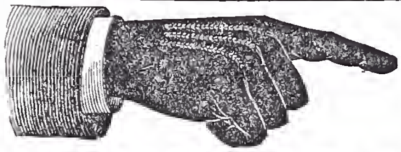

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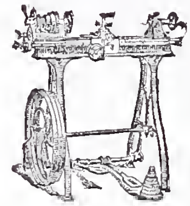

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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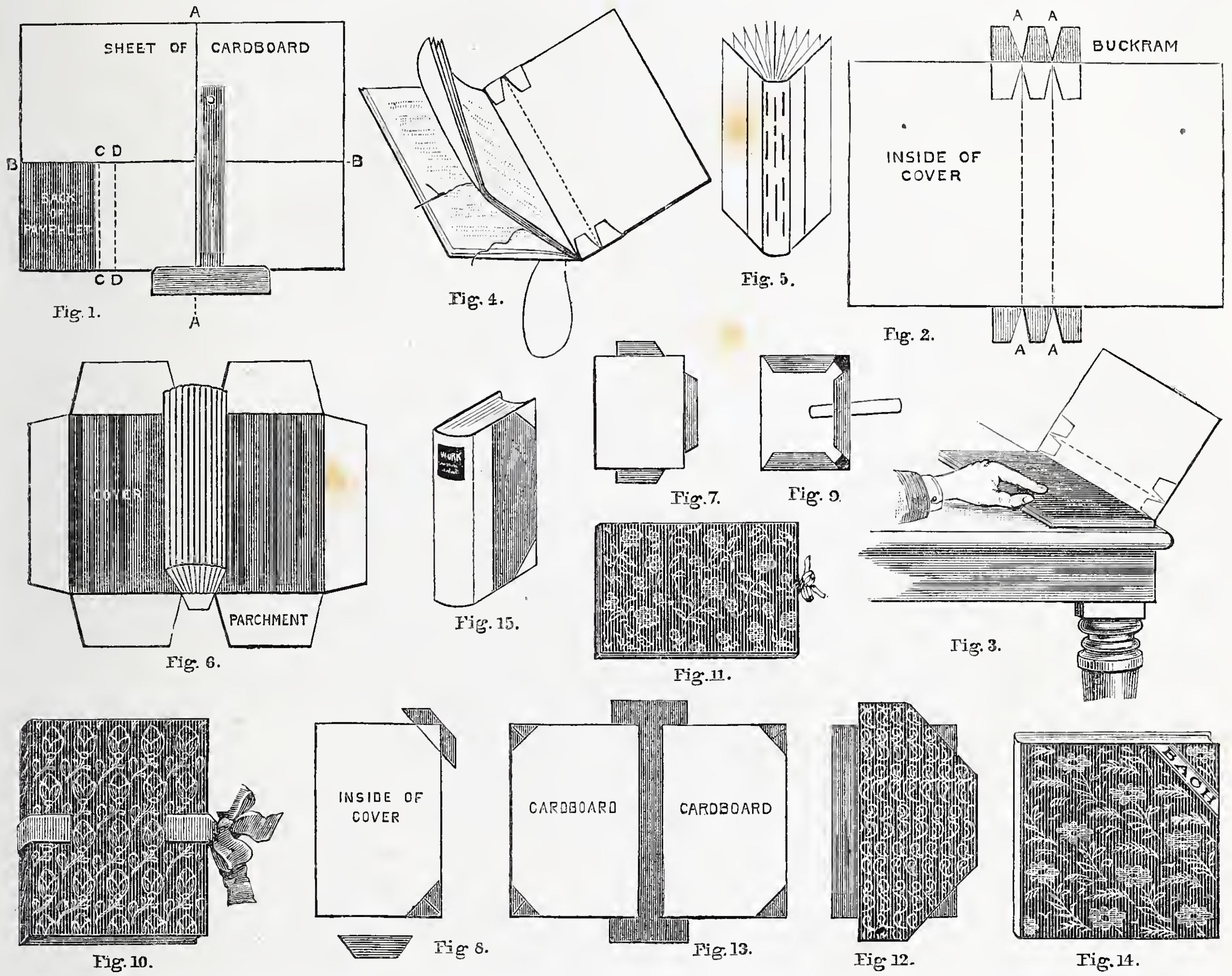


Fig. 1.—Marking Size of Pamphlet on Card. Fig. 2.—Buckram on Back of Cover. Fig. 3.—Fitting Pamphlet to Cover. Fig. 4.—Tying Thread and Stitching. Fig. 5.—Back after Stitching. Fig. 6.—Loose Cover of Vegetable Parchment. Fig. 7.—Cutting Paper for Sides. Fig. 8.—Pasting Down Corners. Fig. 9.—Paper Pasted Down and Ribbon Inserted. Fig. 10.—Ribbon Carried Round Back. Fig. 11.—Book Complete and Tied Up. Fig. 12.—Book Covered with Cretonne. Fig. 13.—Cover laid on Strip for Back. Fig. 14.—Book Labelled with Author's Name. Fig. 15.—Lettering on Back.

BINDING MADE EASY.

A CHEAP, STRONG, AND TASTEFUL METHOD OF TREATING PAMPHLETS, MUSIC, ETC.

With a Few Words on Portfolios and Blotting Books.

BY E. BONNEY STEYNE.

To hazard a guess concerning the regular contributors to this periodical, it would, probably, be safe to surmise that among the number are many professional men, experts in their own craft, who translate the technicalities of their profession into terms easily grasped by amateurs, and simplify the non-essential difficulties of the orthodox methods they are wont to employ by suggesting substitutes within the reach of unlearned people.

Also, that there are amateurs who tell the story of their own experience — the forecasts, failures, and ultimate triumph of a rough-and-ready method, evolved by themselves, to accomplish a certain aim—which, being to them good and useful, they offer as ensample to other unskilful ones to secure the desired result by unconventional ways and means.

In this paper, however, I wish to speak from the stand-point of one in the rather unusual position of having been in the first of these groups, and yet now quite in the second class. That is to say, not as an amateur who has acquired technical knowledge; but as one who, knowing the right way to achieve the end, has, by force of circumstances, entirely set it aside, and gradually evolved a makeshift, which suffices in its way.

Years since, I went through the various stages in learning the art of bookbinding, and bound unaided, at least, one volume, after the most strict precedents. I do not say it was a fine specimen of the craft, but it was a respectable second-rate attempt; differing only in its lack of that precise manipulation and exact finish which, at its highest, translates the trade of bookbinding to a fine art, and sets its artificers among the great names in the army of creative workers. My volume was sewn, hammered, and pressed in the routine way; it had mystic gluings to its back, slips of cardboard for the raised bands across it, edgings of coloured silk immediately at the top (the technical term for which has slipped from my memory), calf back and corners, richly tooled gilding, cloth sides, and marbled edges, after the ordinary pattern of half calf, extra bindings. This thing I did—myself—and yet I now explain a process that is makeshift and transitory, but to me (be it whispered where no professional may hear) seems really better for its particular purpose than any of the cheap and unsatisfactory bindings of the common bookbinder.

To a book lover—bibliophile is, I believe, the correct term now—the outside of a book either charms or repels one, quite apart from its contents; and from the yellow back paper novel, or the cheap cloth, with a mass of black printed lettering over it, to an inferior specimen of half morocco extra, each is unpleasant. Of course, good leather binding is far and away better than any substitute; the charm of a book well finished, be it in morocco, calf, or parchment, surpasses any inferior material; but not only are the substances costly for such work, but the time required in the process, too, adds to that cost, that it makes their use prohibitive for every-day purposes. Then, too, a cheaply printed book is ill-set in too luxurious a binding, unless the thing, by its accidental rarity, has acquired a value not its own; it gives as much disappointment to open a gorgeously bound tome, and discover the average "cheap edition" paper and ink, as it does to see an Elzevir or Aldine bound in half cloth, with marbled paper sides.

The wish to preserve in sightly fashion, clean, and handy for reference, many of the ephemeral publications of to-day, resulted in various attempts, which finally grew into a rough method of procedure, that I propose to explain fully.

This way of covering a few pamphlets, or similar publications, is not suitable for large volumes. When I want to have WORK bound I shall send it to my binder; but, with respect to that copy of Dickens' rarest tract, "Sunday under Three Heads," in facsimile, or these odd (ten or a dozen) numbers of the Browning Society Papers, or this first edition of "Called Back," and a hundred other little volumes, I bind them for myself, with great advantage. First, in saving of money, since the commonest binding costs almost as many shillings as these cost pence. Next, in perfect certainty that the thing, so bound, will be kept intact, with not only its original wrapper and uncut margin, but all its "waste" as issued (waste being the technical term for the added advertisements, wrappers, and all additions to the carcase of the book itself). Also, with the power of withdrawing any one pamphlet from the volume into which it has been stitched, or even adding a thin one or two to the already inserted group. And lastly, being able to clothe such volumes in vegetable parchment, Japanese leather paper, rich brocade, or plain brown paper, as the subjects treated, or the future use of the booklets themselves demand.

Although this expeditious and economic makeshift perfectly satisfies its contriver, yet I should have hesitated to offer it to others, had not I been so frequently asked by friends to give them a working lesson of the process. Fortified by these private demands, I have dared to address the wider circle of our readers, old and new friends as they are, although we wot not of each other's faces; and in this illustrated address, wish to speak as a fool—to fellow-fools—(after all, we are in majority, are we not?) instead of as a sage teacher to receptive pupils.

Suppose, then, that we have an imaginary pile of paper-covered books: a few of the "Book of the Words" of the Savoy Operas; two or three "Parliamentary Blue Books" of twenty or thirty pages each; a copy of "Pictures at Play"; three or four paper-covered "Cassell's National Library"; a pile of MSS. poems, written on ordinary note paper; a few specialists' pamphlets and scientific monographs; a similar heap of theological tracts. I take an actual pile by me to illustrate the various modes.

The first thing is, of course, to sort into sizes, but it is still more important, for future reference, to group into subjects. Clifford on "Atoms," and the libretto of a burlesque, may be the same size, as are three severely orthodox tracts near; but it would be a misuse of words to say there was any method in such mad grouping.

For this style of binding, the thinner, in moderation, the collected volume is the better. One inch in thickness is the most that I have accomplished successfully. More bulky volumes are loose and untidy, and in this case—thereby differing from orthodox binding—are more tedious to manipulate than the same material split into two or three volumes.

We begin, therefore, with the "Book of the Words" groups. The excellent wit and caustic satire of Mr. W. S. Gilbert are well worthy a lasting place upon one's shelves; but as he has already published a collected edition of his earlier works, we may reasonably hope for a third or fourth volume later on, and not have these bound formally. As these blue-covered pamphlets are the same size, and at present in good condition, they will be a simple first attempt. The initial step is to choose a piece of thin cheap cardboard, costing about one penny a sheet, as for these I intend to use vegetable parchment for the finishing covering. The cardboard should be white; for other materials, the common dark-blue "bonnet board," as it is called by the trade, will answer equally well.

On this card I place one of the pamphlets (Fig. 1). I mark the outline with a pencil, calculate the distance for the thickness of the back, rule a line there and then, and at equal distance rule the line for the cut. Here it may be said that all material cut with a sheet of glass underneath gives a clear edge to the cut, without the burr that is always present, if wood or cardboard is used for the table, which, with a sharp penknife, I run through the card at A, A, and B, B. At C and D I "score" the cardboard to ensure a clean fold; that is, I cut it half through with a lightly drawn knife, so that it folds without parting. Before going to the next process, it is necessary to impress the importance of judging correctly the probable thickness of the matter to be inserted in each cover. If insufficiently wide in its back, the covers will not close nicely; if too wide, the whole will be loose and untidy. As the thread for the stitching takes a certain space, it will be found that the natural thickness of a pile of pamphlets, after pressure, just when the pressure is withdrawn, will give a fairly accurate idea of the needful width.

I next cut out a piece of "ticket buckram" for the back. This is a stiff white material sold specially for ticket purposes. It costs eightpence a yard, is very wide, and fulfils its purpose so much better than any other substitute I have tried, that I should advise its use. Bookbinders' cloth or ordinary glazed calico are each possible alternatives, but neither take the paste so well, both stretching when moist, and shrinking when dry, which is not the case with the buckram; nor do they adhere so easily, or keep so firm and smooth when they are dried. For putting under parchment, the white buckram is the best, as its colour gives the vegetable parchment the look of the more costly material it imitates.

The buckram is pasted now on the outside of the cardboard; by outside I mean the side where the scoring was cut. While it is wet, cut out the gussets at A, A (see Fig. 2), or when the case is folded it will pucker at the back and disfigure it. Then turn down the buckram, and leave for awhile to dry under a light pressure, if convenient. For mucilage, I generally use the bottles of White Cross Official Paste, or Stickphast; but for any quantity it is much cheaper to use flour paste. Since, in many households, the art of making bookbinders' paste is unknown, I had better repeat it here; knowing that when, in most households, you send down an order for paste, the cook forwards a breakfast-cup of a thin drab-coloured gruel that is sloppy and wet, and peculiarly non-adhesive to the object to which it is applied, while it clings with impish vehemence to the various surrounding things it clothes, but does not adorn.

For good paste, mix a tea-cupful of flour smoothly with a very little cold water (it takes a little time to get the flour to a thick cream without lumps), then have ready sufficient *boiling* water in which a tea-spoonful of powdered alum has been dissolved, pour it gently into the basin where you have been mixing the flour, stirring it all the time, then pour back the paste into the saucepan and boil, still stirring until it gets to a thick consistency. Thus made, it is glutinous, a paste actually, not a liquid, and keeps for some weeks. It may mildew on the surface, after a time, but does not decompose. A drop of oil of cloves is often added to assist its keeping and impart a pleasant scent.

Now, the cover being dry, it is ready for filling; take it as shown in the diagram (Fig. 3); place it on the edge of the table. Take your first pamphlet. If it is composed of one set of leaves only, turn to the central one. With a large needle, and a long strong thread, pass the needle from the inside to the out, about an inch above the bottom margin of the page, and back into the centre of the book, say two inches above. Tie the loose end firmly to this as shown in Fig. 4; then running the needle out and in in wide stitches, go through the pile of pamphlets, laying each on face downwards on its predecessor until all are sewn, passing the needle at the last stitch back to the first knot, and securing the loose end.

Care should be taken to stitch each set of pages. For instance, in a weekly issue of this journal there is but one such set; in a monthly part four or five; now, to secure strength, each one must be stitched. It may happen, as in German music, that every two pages require a separate stitching, but if you would have the book open flat, and keep open, there is no other way to obtain it than this patient stitching of each group of pages. See, too, that the needle enters the cardboard back at the right place to exactly hit the fold of the pamphlet, not coming through the margin of the pages, some distance off this central crease. Be careful also that each successive pamphlet is pressed close down to its neighbour, and that each new line of needle holes in the back comes exactly where the thickness of the papers demands them; otherwise, the book will be loose and flap in its covers, showing the bare cardboard back when opened between the pamphlets, which it does not do if these hints are obeyed. This sewing is all important; if some of the pamphlets are likely to be wanted loose at any time, fasten each one separately, starting with a loose thread, and tying the ends once to each pamphlet. Then any one may be withdrawn and replaced by another without loosening its neighbours.

This sewing is very hard to describe, but very easy to do, and most important of all the stages of the process. In the cheap binding of to-day, the faulty sewing is the chief annoyance; either the thread used is rotten, or some carelessness in the work must occur, since nothing is more common, even in high-priced volumes, than to find a group of pages suddenly come loose, to the danger of their loss and disfigurement of the volume.

The use of the buckram back is now seen; it not only keeps the covers in their place with a strong joint to each, but also strengthens the back, for stitches into the bare cardboard would quickly tear away from their holding and render all the labour fruitless.

It is best to bind these loose pamphlets while they are in good condition, and to make a special point of this, taking occasional "wet days," or odd half hours, to overhaul their constantly accumulating mass, and bind a few volumes at a time, *before* they imperatively demand it. That is the secret of success in this home-binding; not to wait until loose pages, dog's-eared leaves, and torn wrappers insist upon being repaired, but to tackle the work while the pamphlet is yet clean, fresh, and tidy, and so prevent all these disfigurements. Then, with ordinary care in after use, they keep as fresh as the pages of a well-bound book, besides opening easily for use.

That they may open easily, it is well to use a thin cardboard. In my anxiety to obtain solid covers, I tried first very stiff cardboard. Not to recall the unspeakable agonies of stitching through a mighty piece of pasteboard, miscalculating the force, and pricking my fingers as often as the paper, when the whole was done, the volume would not keep open easily, and was not half so pleasant to handle as the flexible covers when thin card is used.

The cardboard case now will be somewhat unsightly, since it will have long stitches irregularly marking the buckram back, as in Fig. 5, and a very unfinished look about the sides.

It is best at this stage to rub a little paste along the thread at the back, working the brush under the stitches somewhat, so that the thread is well pasted down to the buckram.

For covering, there are several courses open, but vegetable parchment gives the best effect on the whole. To my own books I have almost invariably applied it, and find people generally prefer it to any other style.

The vegetable parchment is made in many qualities, and differs in thickness and appearance no less than in price. I have been charged so many different prices for this material that I hesitate to quote either. The sheets are a good size, cutting into at least four pieces for ordinary octavo books. As a rule, twopence to threepence the sheet would be probably the average cost. It is somewhat difficult to obtain. I have bought it of stationers and of chemists, and expect the various stores keep it on their list. But do not be tempted to adopt the thin cheap sort in spite of its price. It has a tendency to "cockle," it tears, and is generally unpleasant to use. This material defies pasting; it either refuses to stick, or if so, shrinks and curls up the cardboard on which it is mounted, and loses almost completely its skin-like appearance, looking like ordinary whity-brown paper.

But if cut as a loose cover, after the form shown in diagram (Fig. 6), and turned over firmly, the edges being creased down with a bone paper-knife, it keeps its place without any further fastening; but the turn-over must be left at least two inches wide to ensure this result.

It is best to fit the parchment to its place, and then remove it for lettering. I have tried gold ink, with only moderate success; probably gold size, with either bronze powder or gold leaf, would give a more workmanlike result. But gold lettering challenges directly the effect of the genuine impressed lettering on an ordinary leather-bound book, and fails dismally to equal it. Therefore, it seems best to be content with black letters and ornaments. In this, as indeed for all and every ornamental design or drawing, I use, not ink, nor Indian ink, but Stephens's ebony wood-stain. When an artist friend recommended this to me, he said, "that tip is well worth a guinea;" and his words did not exaggerate the case. If it were needful to pay a guinea, rather than forego the use of this excellent fluid, I would willingly do so. It flows freely, and gives a solid photographic black surface, as even and rich as the best impression by letterpress or lithography. Being black (not merely dark purple, like ordinary writing ink) it photographs satisfactorily, and is used by all who know of it for pen and ink work intended for reproduction by any of the numerous processes which supply a direct facsimile block for printing duplicates in any size of the original drawing.

There is a very fair imitation of leather known as leatherette that is good for some work, but possibly from the technical knowledge of consistent treatment of the material, I dislike any attempt to get the appearance of a leather-bound book without the inherent quality of lasting strength which the real material implies, and devoid of the artistic excellence of workmanship that it deserves. A really well-bound book is as much worthy of admiration as a finely inlaid cabinet or cunningly chased goblet. In no decorative art is there more need for intense care and manipulative dexterity, combined with true artistic knowledge, than in binding. The limit where beautiful design passes into vulgar ornament is keenly felt in this art. The true artist needs a complete repression of all meaner ends. No mere dexterous handling of his tools for display alone; fitness, as well as graceful design, is needed to make a good binding. A panel, gorgeous in itself, may be a poor book cover, and the more one studies the works of such men as Eve, Pasdeloup, Grolier, or Roger Payne, of older times, or of Zaehnsdorf to-day, the more we realise what a fine art it really can become. For most purposes in this home-binding, a few black lines, the title and the author's name, suffice. A book collector likes the imprint of the tome and the date at the foot on the back. It is handy for easy identification to have the title repeated in the right-hand corner of the side, as in Fig. 14, while the signature of the owner, somewhere outside the cover, may be made decorative as well as useful; for if a book, or umbrella, bears "its owner's" name conspicuously, it assists weak memories to return each to its rightful owner, and saves weak consciences hours of bitter misery, which, if vice be its own punishment, they must certainly suffer in secret, although we never, *never* see any trace of the hidden guilt.

But although sham leather is unsatisfactory, yet a substitute, in place of a richer material, is not necessarily bad. A pewter dish, in its way, may be infinitely better art than a poor design in electro-plate. The nineteenth century has been characterised as an age of shams, and, therefore, we need not to-day add to its heavy list of sins by suggesting imitative falsities in leather. There is, however, a paper leather of real Japanese make, so perfect in its colour, grain, and substance, that it would deceive even the elect, but it is rather thick and clumsy for an amateur to use, and when pasted, loses much of its beauty. The Japanese gold leather-paper is a totally different thing; for certain books it has a splendid effect, and used in one particular way, to be noticed later, it yields a novel and rich cover, in no way imitating anything we are accustomed to see in bindings.

In place of the vegetable parchment, a small printed cretonne, or some of the dainty cotton stuffs, with an all-over pattern, after the style of old chintz and the Liberty printed fabrics, look extremely well. But if the volume is thick enough to afford space for a label with title on the back, it is rather difficult to write one sufficiently neatly. It sometimes happens that the cover supplies a slip, which may be cut out and mounted for title, but this should be only resorted to in the case of really valueless books.

But here the exigences of space, as inexorable, after its fashion, as Time and Tide, compel me to reserve what I have yet to say for a future occasion, when I shall be able to explain the import of the remaining diagrams to which I am not able to call attention now.

(*To be continued.*)

A HOME-MADE WINDOW CORNICE.

BY OLLA PODRIDA.

Hanging Curtains—Undesirable Methods—Pole and Rings—Cornice—Plan and Elevation—Rod for Curtain Rings—Dimensions of Members—Members in Detail—Preparation of Upper Members—Length—Working of Members—Gauge or Template—Mitring—Fitting Together—Cutting Drops in Lower Members—Gluing up and Screwing Together—Corner Pieces—Pendants—Supports—Finishing.

The methods adopted in hanging window curtains are varied, and generally—not always—in accordance with means and circumstances. A simple and cheap, but—to the curtains—destructive, means is found in the humble nail and domestic tack.

A treacherous improvement on this primitive method is attained by threading the curtains on tape stretched between a pair of nails, one at each corner, and supported by a third nail in the middle. Either of these methods, when viewed from the exterior, or the street, leaves little or nothing to be desired in appearance, but seen from within, and the other side of the question raised, the most unprejudiced eye must admit that the effect is—well, rather bare, and that simplicity does not, at any rate in this case, possess much charm.

The height of ambition is reached, in other cases, by means of the antiquated window pole with clumsy rings in its unprogressive descent and guise of a family heirloom from generation to generation. But, putting this on one side, it must be admitted that the *ne plus ultra* of grandeur is attained when the best front room curtains flow gracefully from a fountain head of gorgeous gilding or cunningly carved handiwork — to wit, a cornice.

Now, it is not everybody that can afford such expensive ornaments, and they are expensive unless satisfaction is obtained from a common article probably not worth half the outlay. The question therefore resolves itself into this, either to do without such or manufacture them yourself. Speaking from experience, I support the latter alternative. It is easily done, and of this I hope you will be convinced after perusing the instructions herein. It will not by any means be found a complicated subject, but the appearance is good, and even if it does not please the more critical friends, you can stop the mouths of fault-finders by informing them that you made it all yourself, and your generous disposition will doubtless lead you to add something nice about Work.

Fig. 3 shows the cornice in elevation complete as seen from the front. Fig. 4 is a plan of the same looking down upon the top of it, showing the distance it stands out from the wall—this is a matter of taste or choice—and the position of the rod, R, for carrying the curtain rings. This rod is a plain round piece of wood, $1\frac{1}{2}$ inches in diameter, cut to fit between the upper end members, G, G, and notched or cut away at its ends so as to fit flatly and firmly on the second members, H, H; it is further secured at each end by small dowels or French nails, fitted so as to permit of its being easily unshipped if required. The length of the cornice is governed by the extreme width of moulding around the window frame or recess. This length is determined between the inside of the lower members at the ends, as shown by the arrows in Fig, 4, and it should be a couple of inches wider than the moulding referred to. The example in Figs. 3 and 4 is drawn to a scale of $\frac{3}{4}$ of an inch to the foot, and is suitable for a window recess 5 feet 8 inches over the moulding, thereby giving 2 inches clear each end. By thus spreading it slightly the appearance of a narrow window is greatly enhanced.

Fig. 1 is a half-sized section of the cornice, showing clearly the method of putting the various members together. Fig. 2 is a part front elevation at one end, and drawn to the same scale. Figs. 1 and 2 contain all the information necessary in building the cornice, except for the length and depth from the wall. The former is, as previously observed, governed by circumstances, and the latter is arbitrary. In the example under discussion, the length at the starting point between the arrows in Fig. 4 will be taken as 6 feet, and the depth or distance which it stands out from the wall as 9 inches. The dimensions in section of the various members are as follows:—A, the upper front member; G, G, the upper end members; B, the second front; and H, H, the second end members, are all 2 inches wide by $\frac{1}{2}$ inch thick, finished; stuff required, $2\frac{1}{8}$ by $\frac{5}{8}$ inch thick in the rough for these. The principal members, C in front, and J, J, at the ends, are formed out of stuff $4\frac{7}{8}$ inches wide by $1\frac{3}{4}$ inches thick. The lower members, D, D, and E E E, in which the ornamental drops are formed, are $4\frac{1}{4}$ inches wide by $\frac{1}{2}$ inch thick; F, F, are merely filling pieces $\frac{3}{4}$ inch square, and assist the mitre joints in lower members, D, D, as well as forming accommodation for the turned pendants or drops, P, P. The next thing to be obtained is the lengths of the various members. This, although at first sight, perhaps, confusing, is really very simple. Starting with the assumption that the inside distance by the arrows is 6 feet, it will readily be seen that the length of the front lower member, D, must be 6 feet 1 inch to cover the end members, E, E, which are each $\frac{1}{2}$ inch. D being settled, we find next the length of C, and this is done by adding to D twice the extreme amount by which C projects at one end; referring to Fig. 2, we find this to be $3\frac{1}{2}$ inches, which doubled amounts to 7 inches, and added to the length of D gives 6 feet 8 inches for C. The same remarks apply to B and A, and these are found to be respectively 6 feet 9 inches and 6 feet 10 inches long when finished. After what has been said the lengths of the end members should be found easily, but it may be as well to give them here. For *both* ends, E will be 19 inches, J, 26 inches, H, 27 inches, and G, 28 inches. A margin should be allowed on all the foregoing lengths to guard against accidents in mitring and fitting the joints.

The preparation of the two upper members and blanks for the lower members is a simple matter, and scarcely calls for any remark, except that each must be gauged carefully to uniform thickness with the edges, straight, especially on the front. The rounded or beaded members, B, B, and H, H, can be readily formed with a smoothing plane and finished with glass paper.

The working of the principal members, C and J, will involve the most labour. As already

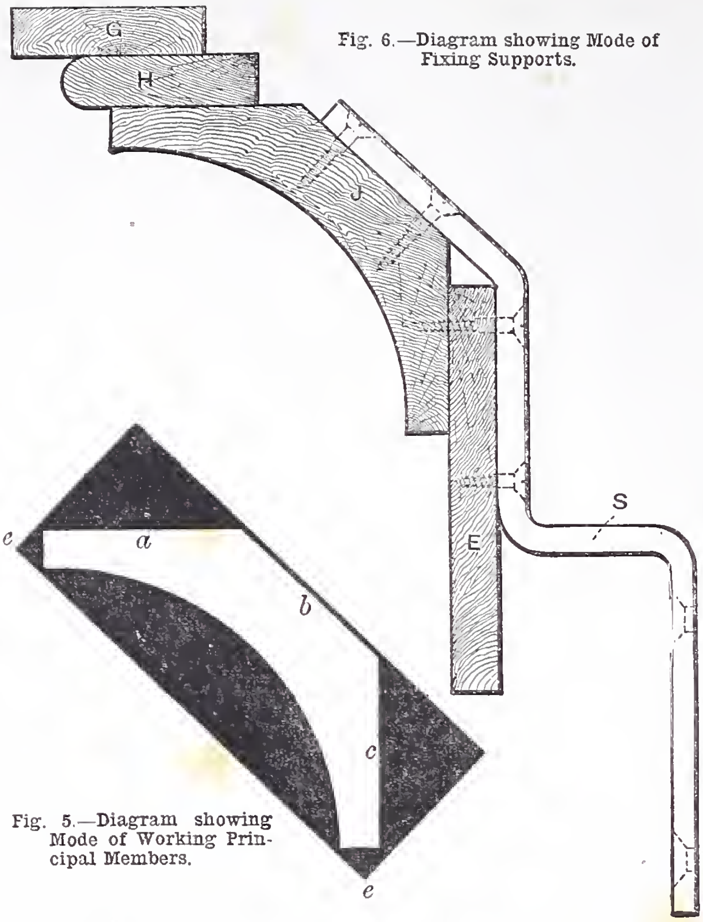


Fig. 6.—Diagram showing Mode of Fixing Supports.

Fig. 5.—Diagram showing Mode of Working Principal Members.

Fig. 3.

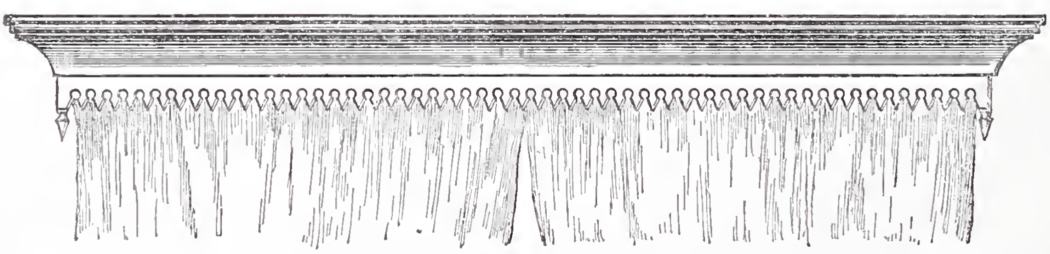


Fig. 3.—Elevation of Cornice Complete, as seen from Front.

Fig. 4.

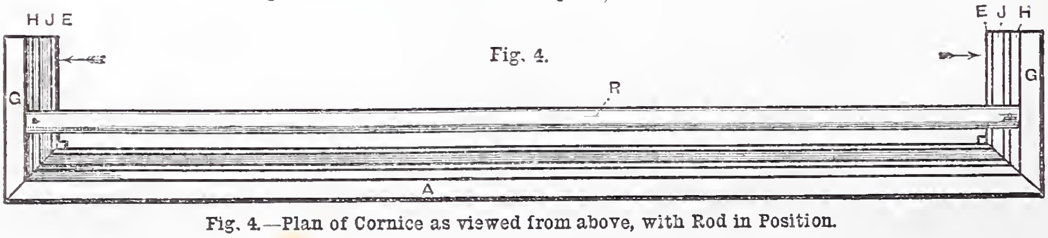


Fig. 4.—Plan of Cornice as viewed from above, with Rod in Position.

stated, these are obtained from stuff $4\frac{7}{8}$ inches wide by $1\frac{3}{4}$ inches thick. The method of working these out will be comprehended on reference to Fig. 5, in which the parts to be cut away are shown in black and the finished article in white. In commencing these the stuff should first be planed up straight and square to the outside sizes, and the outline marked on the ends, which must be trimmed to admit of this being clearly done. One of the sides, say that at *a*, must first be formed and carefully planed to an angle of 45 degrees, or strictly speaking 135 degrees with the back, *b*. This done, the other side, *c*, must be treated likewise, and worked square to *a*. The edges at *e*, *e*, are next planed square to *a* and *c* and the thickness gauged to $\frac{3}{8}$ of an inch for guidance in forming the hollow part. This latter is accomplished by first roughing out the bulk with a suitable-sized gouge, and finishing with a round-nosed plane and glass paper. Care must be exercised in gouging, and the grain of the stuff studied in order to avoid detrimental splintering or "spalling." The same caution applies to the using of the plane, the "rounding" of which should be to a much lesser radius than the required hollow, it being much better and easier to work out in shavings; besides, a round nose does not work freely when buried to the full depth of the iron. A male gauge or templet made to the radius of the hollow, and with projections to meet the edges, *e*, *e*, when down to the right depth, will be found of great value for checking the progress of the work in gauging and planing, and also in ensuring similarity between C and the end pieces, J, J.

Before putting the members of the front together, it will be an after advantage to mitre one end of each with the saw; but before doing this their relation must be noted, so that when put together the ends so treated shall mate and match. The end members will be likewise treated, but the square ends of these which butt against the wall must be left till the last. The various members in each part—front and ends—may now be screwed together, as shown in Fig. 1, bearing in mind that the lower member, D, need only be fixed temporarily on account of its having yet to be cut into a pattern on the lower edge. In mitring and fitting the ends and front together, the parts should be laid upside down on a level table or bench, and compared with adjustment by planing until they match accurately in the joint. Any trifling inaccuracies in matching of the members can be mutually adjusted after being finally put together. The mitring of the remaining front end will be materially assisted by measurements off one of the finished ends.

After the parts have been fitted together, the bottom members must be removed for cutting out the "drops." This is done by boring with a sharp bit a number of $\frac{3}{4}$-inch holes, one inch from the lower edge and about $1\frac{1}{4}$ inch from centre to centre; but the centres must be marked out first to ensure their coming right at each end. This having been ascertained, the diamond portion must be marked by means of a bevel to ensure similitude. The holes are then to be bored, and starting from one end, each space between the drops must be sawn out with a fine tenon saw, and finished with a sharp chisel. Care must be taken to avoid breaking any of them, but should this occur they can be glued back again. The "drops" in the ends need not be cut into the wall. After cutting out, the members must be carefully replaced.

The front and ends must be glued together at the mitres, and further assisted by means of French nails or slight screws where practicable. If these auxiliary fastenings are used—and they should be as provision against damp—they must be driven in the ends and not from the front. The cornice must be laid upside down on a level surface for gluing, same as in fitting the mitres, and one end only at a time must be treated. Care must be taken to get the ends fair with each other without twist. The corner pieces, F, are next glued or, better still, screwed in place as shown. The pendant, P, is a simple piece of turning, and is not permanently fixed, but merely a hand-fit, so as to be easily removed. After the glue has set properly and the joints been secured, the wall ends must be squared and the supports fitted, as shown in Fig. 6 at S. These supports are simply strips of iron $\frac{5}{8}$ or 1 inch by $\frac{3}{16}$ or $\frac{1}{4}$ inch thick, bent to shape, and screwed to the cornice and the projecting moulding around window. It may be found necessary to modify the support, and if there is no moulding or framework, pieces of wood about $1\frac{1}{4}$ inch thick may be fitted to the inside and under lower member of cornice and securely nailed to the wall, the cornice being afterwards shipped in and secured by screws.

The finish of the cornice is a matter of taste. I stained one of mine in imitation

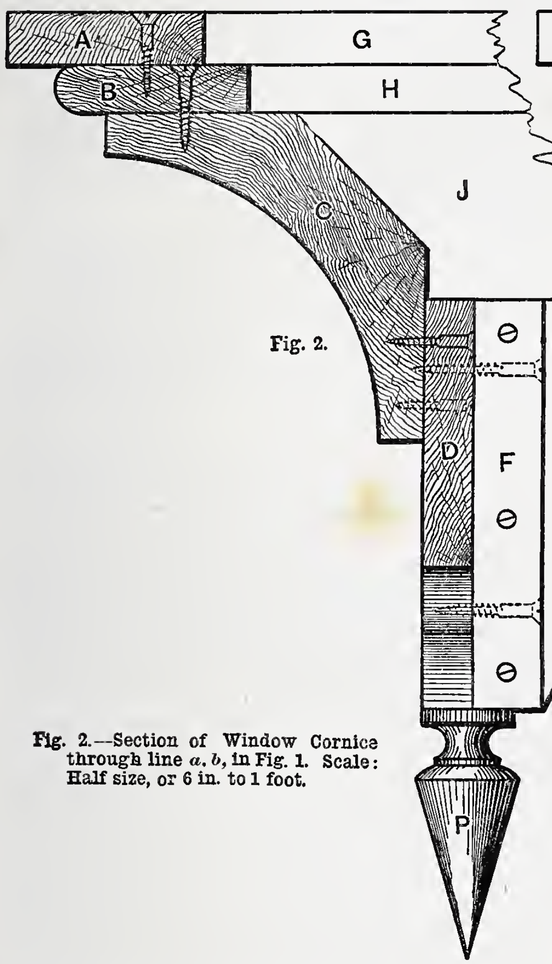


Fig. 2.

Fig. 2.—Section of Window Cornice through line *a*, *b*, in Fig. 1. Scale: Half size, or 6 in. to 1 foot.

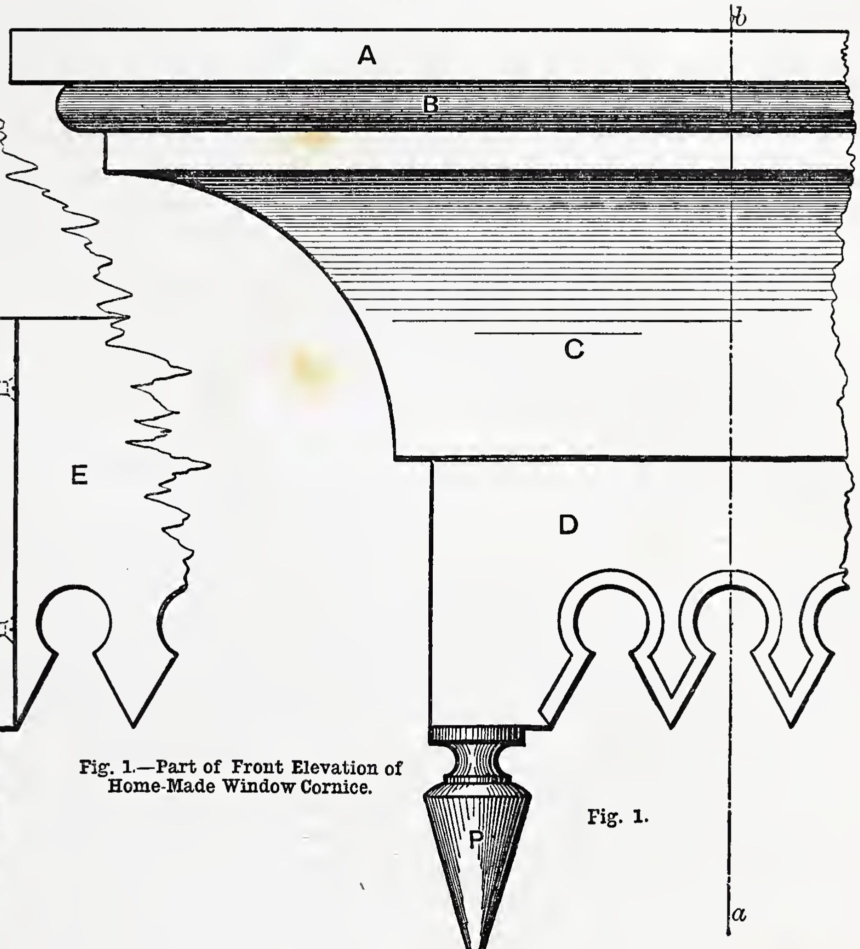


Fig. 1.

Fig. 1.—Part of Front Elevation of Home-Made Window Cornice.

rosewood, and when sized and varnished it looked almost as well as another which I painted in French grey and gilded the edges of the upper member, upper edge of the hollow moulding, and also a border round the open work in the lower member as indicated in Fig. 2. The inside edges of the open work were painted a warm brown, which might very well have taken the place of the gold leaf on the other parts. The conical portion of the pendants at the corners was also gilded.

I may add that in the case of a long heavy cornice of this description, and especially if it stands out far from the wall, it may be necessary to fit a stay or tie at the centre on the top to assist the supports in carrying heavy curtains or resisting juvenile larks.

In concluding this paper, it is hoped that the instructions therein will be easily understood, and that the matter will be of value to some at least of the *numerous* amateur workmen who read WORK. I am inclined to hope, too, that they will not be without their value to many professional workmen who may find a little job of this kind put into their hands when, perhaps, they may least expect it. If no other advantage accrues to them from the article itself, they will at least be able to show the drawings to any householder who may require a window cornice, and so give them a better idea of how the work will look when done than they could gather from mere words.

TONING PHOTOGRAPHS WITHOUT GOLD.

BY L. IVOR POOLE.

No photographer need be told that the recognised chemical for toning photographs is chloride of gold. Turn to whatever formula we may for the preparation of a toning solution we find that this in 15 grain quantity is the main ingredient. Those who are well up in the art may be aware that platinum, or rather some salt of this metal, may be used instead, but it seems to be regarded rather as a scientific curiosity than within the range of practical photography. So far as cost is concerned platinum compared with gold may be said to be out of the frying-pan into the fire. It must be admitted that the toning bath is an expensive item in the photographer's requirements.

Then again there is the liability to which it is constantly exposed of destruction by contact with hypo. If we have not practically experienced this through some temporary carelessness or slovenliness in handling our chemicals, most of us have, in our preliminary reading or teaching, been almost nauseated with the oft-repeated caution that the "smallest trace of hypo," etc. We all know how it runs. Further, there are in toning two operations involved, not to mention the intermediate washing between toning and fixing. If one can be made to answer it would be more convenient.

Now I don't profess to be well up in photography, but merely an amateur among many who are both better operators and more scientific in their aims. I know the general run of things and the difficulties which beset people like myself in riding their hobby. It was therefore with some surprise that I heard one day of something neither gold nor platinum which would do as a basis for toning solutions, and that by the use of this, to me then unknown, stuff, (as a toning medium) toning and fixing might be done together. Of course it is known that a combined toning and fixing bath may be prepared even when gold is used, but so far as I was concerned, the notion that common acetate or sugar of lead might be substituted for chloride of gold was an altogether new and welcome idea. As a matter of fact it was known in the early days of photography, but from inquiry among friends I am convinced that it has been so far forgotten that to the host of amateurs whom dry plates have produced acetate of lead as a toner will be regarded as a novelty. I don't want to affirm that it is as good a toner as gold, although a varied range of tone can be got with it; and, speaking for myself, I have no fault to find with it, but it may be said that few will object to be told about it. The knowledge may be convenient occasionally, and possibly those who have leisure to experiment may be able to improve its powers and produce better results with it than in former times. That prints toned with it and fixed with hypo at the same time are at least as permanent as those treated in the ordinary way, can be shown. My own trials have certainly not been sufficiently extended to enable me to vouch for this personally, but I am credibly informed that a local photographer, one of the pioneers in the art, has some prints which are now as vivid as when they were made some thirty years ago. To him, indirectly, I am indebted for the formula which was given me thus: Acetate of lead, ½ oz., hypo, 4 oz., dissolved in 1 pint water, and mixed. Simple and cheap enough, surely.

The best way to prepare the combined toning and fixing bath seems to be as follows: Dissolve the chemicals separately in about half the water to each. Warm water is best for the lead. Then mix, being careful to pour the lead solution into the hypo, and not the reverse. The mixture is then ready for use. The prints are washed in the ordinary way, and treated exactly as if the gold toning bath were being used. Almost immediately, owing to the hypo acting more rapidly than the lead, the prints will assume the peculiar colour caused by hypo alone, but they will gradually "tone" down through the various shades of chocolate to purplish-black or grey. The time required is a good deal longer than with the gold toning bath I use, but not so long as first toning, then washing, and finally fixing. As the formula given is very strong, comparatively, in hypo, which seems to act on the print the whole time simultaneously with the lead, it stands to reason that the photograph must be deeply printed to allow for the prolonged action of the hypo; and I may say that lately I have been trying the effect with half the quantity, viz., 2 oz. of hypo to ½ oz. of the acetate, with improved results. With the smaller quantity of hypo the reducing action of the bath is not so vigorous, and consequently the toning may be prolonged without detriment to the print.

The solution may be used over and over again till the lead is exhausted. I am not, however, prepared to say that it will keep indefinitely, for even if not used it seems to lose strength for toning purposes. It will, however, keep for a considerable time, and by having the solutions in separate bottles and mixing them when necessary for use, the bath can always be kept up to toning strength.

It will, I hope, be remembered that these notes are not written with any intention of persuading photographers that lead is better than gold for toning. It may or may not be, but it is at any rate an alternative, and a cheap one, obtainable from any chemist at 1d. per ounce—at least, that is what I pay for it. The cost, therefore, need not be an impediment in the way of any one wishing to experiment with this new old toner. Whether the fact of lead being usable instead of gold has ever been published before I know not, but I may say that I have not seen it mentioned in any handbook on photography, of which I have read a good many, and it is certainly not acknowledged among the standard formulæ of the craft. It will not, on that account, however, I trust, be less acceptable to readers of WORK, and if I, as one of many of those who admire this periodical as being unique, may venture on a suggestion, it is that any one who knows of anything useful should not keep it to himself, but send on word about it. Much valuable information can be acquired by this means, even though the subject is not treated from a more scientific standpoint than these few hints on lead toning.

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

III.—AMALGAM—AMALGAMATION: AMALGAMATE—AMALGAMATING SALT—AMMONIA—AMMONIUM—AMMONIUM CARBONATE—AMMONIUM CHLORIDE—AMMONIUM NITRATE—AMMONIUM SULPHATE.

Amalgam.—When mercury is alloyed with another metal the mixture is named an amalgam. For details relating to amalgam, see under head of *Mercury.*

Amalgamation: Amalgamate.—To combine mercury with other metals. The process of amalgamation is carried on in gold mining, where the fine gold dust is caught in troughs filled with mercury, and this metal afterwards recovered from the amalgam by distillation. The word is generally applied by electro-platers to the process of covering zinc battery plates, cylinders, and rods with mercury preparatory to their use, for the purpose of protecting their surfaces from the action of the exciting solutions when the battery is at rest. The process of amalgamating zinc is, briefly—first clean the zinc from all traces of grease and dirt; next dip the zinc in a bath of mercury, and rub this metal well into the surface of the zinc; lastly, set the zinc in an inclined position over a vessel and drain off excess mercury. Now for the details. Zinc, as it comes from the maker of plates, rods, or cylinders, is often coated with some lubricant, such as grease, or some greasy substance. This may be proved by trying to coat it with mercury, when patches will be found to refuse the mercury. Even if we try to cleanse it with acid the patches remain obstinate. The zinc must first be cleansed in a hot solution of some alkali, such as potash or soda. Next wash in clean water. In the next part of the process, the zincs are pickled in acid and dipped in the bath of mercury. The acid pickle may be made of dilute hydrochloric acid, but I do not advise its use, for it gives off an abominable stench of hydrogen and chlorine. I prefer an acid pickle of one part sulphuric acid in three parts of water. This is mixed in a stoneware or good earthenware baking dish, and the bottom of the dish is covered with a layer of mercury. Plunge the zincs in the acid mixture whilst still hot, and they will take the mercury more readily than when the acid mixture is cold. Brush the mercury well over every part of the zincs, on all sides alike, using for the purpose a plate brush, a hare's foot, or a pad of flannel on a stick. If some fine copper or brass wires are introduced among the hairs of the brush, or in the flannel, the process of amalgamation is much facilitated. When the zincs are well coated, set them in an inclined position over a battery cell or other vessel to drain off the superfluous mercury. In amalgamating zincs be careful in the use of sulphuric acid, as its action is very corrosive on skin and clothes. Do the work carefully, without any fuss or haste, or splashing about, and then no harm will result. The zincs will probably get uncomfortably warm, but will not scald the fingers if their position is shifted a little. Brush the zincs downward toward the dish, and away from the person. Do not be afraid to handle the amalgamated zincs firmly, for the mercury will do no harm to the fingers. In reamalgamating zincs it is not necessary to use such strong acid mixture unless the zincs have got black from disuse.

Amalgamating Salt. — French: *Sel à Amalgamer.*—Various devices for lessening the labour of reamalgamation of zincs have been devised from time to time. It has been proposed to cast zinc with a small quantity of mercury added at the time of casting. This has not been attended with any practical benefit. The simple plan of putting a little mercury in the cell with the zinc when the cell is charged very much lessens the labour attending reamalgamation. In a book on electro-plating and gilding, by M. A. Roseleur, an amalgamating salt of mercury is mentioned as a means to lessen the labour of reamalgamation. This salt is made in the following manner:—Prepare a strong solution of nitrate of mercury, boil this for half an hour in a porcelain capsule, and add, whilst boiling, equal parts of bisulphate and bichloride of mercury in excess. Allow the liquid to cool, then filter it through a piece of linen or calico. A wine-glassful of this liquid is mixed with the acid mixture to be used in a quart Bunsen or Grove cell, and this will serve to amalgamate the zinc whilst the battery is working. A table-spoonful of the liquid added to each cell just when the battery appears to flag after a day's work will revive its energies, and the zincs will brush up as if newly amalgamated. This liquid salt of mercury is slightly tinged with green, but otherwise clear. It is very heavy, and very poisonous. It stains the skin a violet tint. When added to water alone, it falls as a yellow precipitate, but if the water is acidulated with sulphuric acid no such precipitate occurs.

Ammonia.—Chemical symbol, NH_3, combining weight 17, density 8·5. It will be seen that ammonia is a compound of nitrogen and hydrogen. It is obtained from the decomposition of animal or vegetable matter containing nitrogen and hydrogen, as from the horns, hides, and excrement of animals, and from coal when heated. Its name is derived from sal-ammoniac, a compound of ammonia and chlorine, obtained by Arabs from camels' dung, which they heated for the purpose near the temple of Jupiter Ammon, in the deserts of Libya. It is now mainly obtained from the ammoniacal liquors of gasworks.

Pure ammonia is a colourless gas of powerful and pungent odour, much lighter than air. This gas is soluble in water, and its solution is known as the ammonia (*liquor ammoniæ fortissimi*) sold in druggists' shops. In all operations wherein ammonia forms an ingredient, this is the solution intended, unless otherwise specified. Its action is distinctly and strongly alkaline. Its presence in solution is generally indicated by its odour, which is unmistakable. A very dilute solution of copper will indicate the presence of ammonia, unless cyanide of potassium is present in one of the solutions. Some very dangerous explosive compounds can be made by mixing ammonia with solutions of the noble metals. (See *Fulminates.*) The strong fumes of ammonia act as a poison by producing violent inflammation of the air passages and the mucous lining of the throat and stomach. The antidotes to this poison are dilute vinegar and olive oil. Ammonia must be kept in glass-stoppered bottles, with the stopper tied down.

Ammonium. — Chemical symbol, NH_4. This is supposed to be a metal, but it has not yet been obtained in a free state. It has been separated from ammonium chloride and made to form an amalgam with mercury, but this soon decomposes into ammonia, hydrogen, and mercury. It forms the base of several valuable salts of ammonium.

Ammonium Carbonate.—Chemical symbol $(NH_4)_2\ CO_3$. This is a compound of ammonium, carbon, and oxygen, obtained by heating a mixture of chalk and sal-ammoniac, and is named *sal-volatile.* On exposure to the air this absorbs water and carbonic acid gas, and becomes ammonium bicarbonate. This is, probably, the white crumbling salt obtained from shops under the name of carbonate of ammonia. It is used as a substitute for liquor ammonia in the preparation of some depositing solutions. It should always be kept in closely-stoppered bottles, or it will lose its most valuable properties.

Ammonium Chloride.—Chemical symbol, $NH_4\ Cl$. Named also, *muriate of ammonia* and *sal-ammoniac.* This compound of ammonium and chlorine is obtained by neutralising the distilled ammoniacal liquor of gasworks with hydrochloric acid, and evaporating the liquid to dryness. It is also prepared from a mixture of ammonium sulphate and common salt. Sal-ammoniac, when heated, completely volatilises without melting. It is very soluble in water, to which it communicates intense cold whilst dissolving. Its solution is used as an excitant in the zinc compartment of electric bell batteries, notably the Lèclanchè battery. It has also been used in making up solutions for electro-depositing iron and cobalt. For these purposes the crushed commercial sal-ammoniac will do very well.

Ammonium Nitrate. — $NH_4\ NO_3$. This is prepared by neutralising ammonia with nitric acid. It crystallises in long transparent elastic needles, very soluble in water. Used in making up Brunel's, De Salzede's, and Walenn's hot brassing solutions.

Ammonium Sulphate.—$(NH_4)_2\ SO_4$. This useful salt of ammonium is prepared on a large scale for commercial purposes by adding sulphuric acid to gas water, the liquor of gasworks. Used in making up the double sulphate of nickel and ammonium solution, and also in the make-up of Jacobi and Klein's and Boettger's iron solutions, Hermann's zinc solution, Walenn's hot brassing solutions, and the double sulphate of cobalt and ammonium depositing solution. The salts of ammonium may be recognised by their odour when heated with caustic lime, caustic soda, or caustic potash; the odour of ammonia being characteristic and well known.

(*To be continued.*)

PAPIER-MÂCHÉ.

How to Mould It, and how to Ornament It.

BY SYLVANUS WARD.

II.—CONSTRUCTION (*continued*). — PAPIER-MÂCHÉ IN CABINET WORK—WORKING IN PULP—A BRACKET—A DAVENPORT—PAPIER-MÂCHÉ AS A SUBSTITUTE FOR CARVING—ELIZABETHAN PANEL WORK — SIMPLER ARTICLES — TEA-TRAYS, ETC.

IN the present paper it may be well to explain the construction of more important articles than those mentioned in the last, and such as, together with moulding, combine a considerable amount of joinery work.

There are certain purposes in cabinet making for which papier-mâché has advantages over wood.

1st. It is lighter, because in many cases thinner work can be used without any sacrifice of strength.

2nd. In it all kinds of *curved* surfaces can be made as strong and as easily as plane ones.

3rd. It is more suited to fret work on a large scale, because as there is no grain there is no danger of splitting. Hence very large curves may be fearlessly cut in it with the bow saw.

It can, moreover, when required, be made equal, if not superior, to wood in a solid mass; as, for instance, say, in the pillar of a table. The shell formed by moulding, or by gluing panel together, can be filled up with pulp; so much strength as would be thus attained is, however, rarely needed.

As regards *pulp.*—The Swedish wood-fibre pulp is now much used. Paper pulp is made by beating up scrap paper with water till it is thoroughly disintegrated; then squeezing out the superfluous water and mixing it up with strong glue-paste to the consistency of mortar. This can be pressed in moulds, or built up and shaped with a spatula to any desired form; but in the latter case a little only can be done at a time between repeated dryings. When only a small quantity of pulp is wanted, a mixture of glue-paste with the paper-dust formed in rasping, sawing, and otherwise working the papier-mâché, will suffice. In Fig. 6 is shown the spatula, or small trowel used for working in pulp.

The *bracket* (of which Fig. 7 is a front, Fig. 8 a side elevation, and Fig. 9 a plan of shelf) may most easily be made in two pieces, exclusive of the acorn pendant, which will form a third. The back is sawn from panel, say, two ¼ in. thicknesses glued together. The trefoil may eventually be fitted with mirror, or left open, as preferred. The projecting portion is pasted in one piece on a model, but some little after-dressing is required to bring up the mouldings clearly and well. The back in the lower part passes within the mouldings, which are a comparatively thin shell, to give the necessary strength. The acorn pendant will be most readily turned in wood, and formed with a little stalk to its cup, to be glued into a hole made to receive it. Possibly this bracket, especially in its lower part, may give the impression of being somewhat heavy, but this will not appear when after enrichments of gold and pearl have been added.

Figs. 10 and 11 give front and end views of a "Davenport" writing table. Of this article the most important and elaborate parts as regards our present business—construction—are the legs. These should be an inch in thickness—that is, they should consist of four thicknesses of ¼-in. panel glued together. These are cut out to pattern with the bow saw, and finished with rasp, sand paper, etc., as if in wood. At *a*, Fig. 11, is indicated a groove cut on the inner side of each leg, a quarter of an inch deep, to receive the end of the ornamental cross rail which connects them.

This ornamental rail, shown in the front elevation, will be seen to be of fret work, designed with a lightness and boldness which the danger of splitting would render impracticable in wood. A less stout panel is used for this, say $\frac{3}{4}$ in. thick.

Still thinner panel will be used above in the desk portion, of which it needs only to be said that it is made in precisely the same way as if the material were wood. In the interior fittings of drawers and compartments, some economy of space may be effected by the use of papier-mâché, as very thin panel, say $\frac{1}{8}$ in. thick, will suffice. The desk will be screwed down upon the legs after both it and they have been decorated.

In making such an article as the present, a considerable quantity of panel will have to be planed. This can only be properly done with a toothed plane, as the tendency of an ordinary smooth plane is to tear up the sheets of paper in flakes, rather than to reduce the surface to a true level.

Where there is a considerable amount of joinery work, as in many parts of the article before us, it is well, previous to gluing together, to give the material a coat of the black japan varnish (of which more presently), which, after drying, should to a great extent be scraped off again with a chisel worked backwards. This last operation removes any glossiness of surface which might have interfered with gluing; and the varnish hardens the papier-mâché, and prepares it for future treatment. After this, the little compartments within the desk will need only one coat of the varnish subsequent to putting together, and that will have in some measure to be scraped off as above, in case they are finished, as they will most likely be, by papering with some kind of ornamental paper. When also silk or velvet is used to line or mount, the surface of the varnish has in the same way to be scraped off before it is glued down.

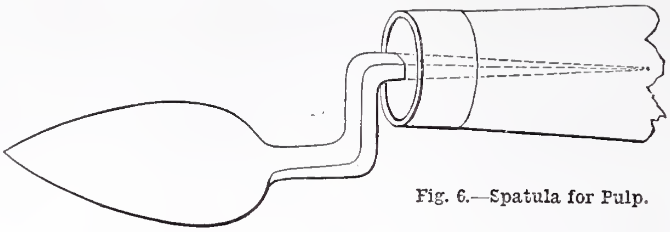


Fig. 6.—Spatula for Pulp.

All joinery work should, however, be done before the final coat of japan varnish is given to any outer part, since it is next to impossible to cut the hard and highly polished japanned work without chipping the edges.

The ball feet and the acorn pendants are, of course, made separately. Such things are usually turned from wood—American birch wood by preference. It is true that in wood it is not possible to get a surface equal to papier-mâché, but the ball feet are much below the eye, and not being highly ornamental, they will escape any particular scrutiny; whilst the small size and rounded form of the pendants will also, to some extent, exempt them from close observation. The inferior material is held to be sufficient; though there is no reason why the pendants, if of no great size, should not be turned from paper; or if large, why they should not be pasted on models. The ball feet are fixed in place with screws; the acorns end above in little stalks, which are glued into holes bored to receive them.

To the worker of artistic tastes all these instructions for the merely constructive part of the art will doubtless seem tedious; for the effect of the work in the articles hitherto spoken of almost wholly depends on the after decoration, about which we have not as yet touched, but which will be fully dealt with farther on.

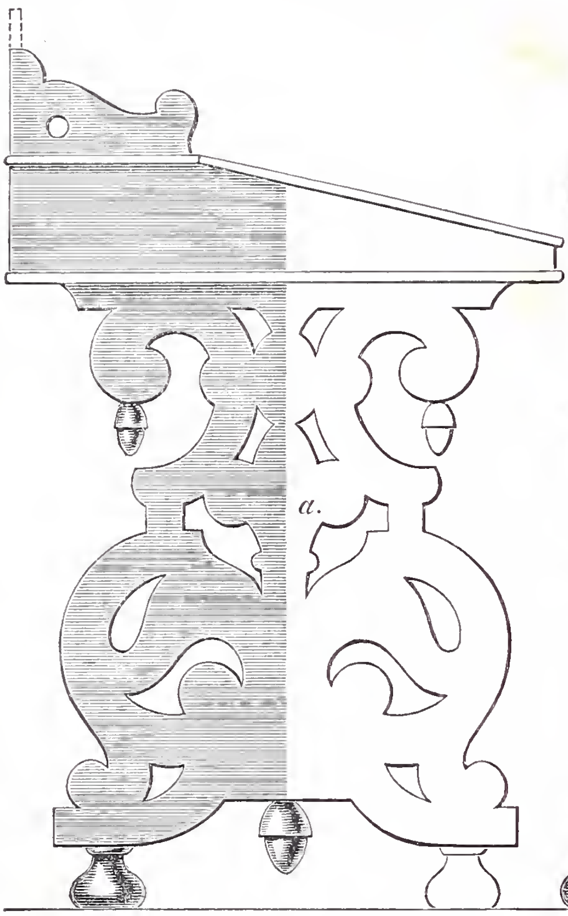


Fig. 11.—Davenport in Papier-Mâché: End Elevation.

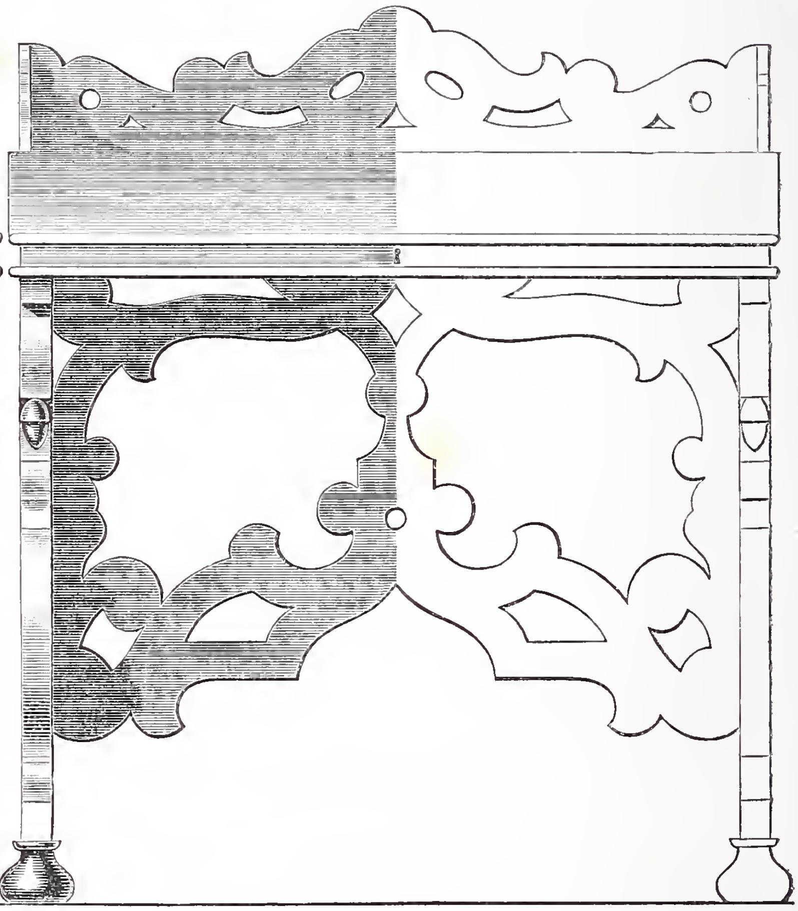


Fig. 10.—Davenport in Papier-Mâché: Front Elevation.

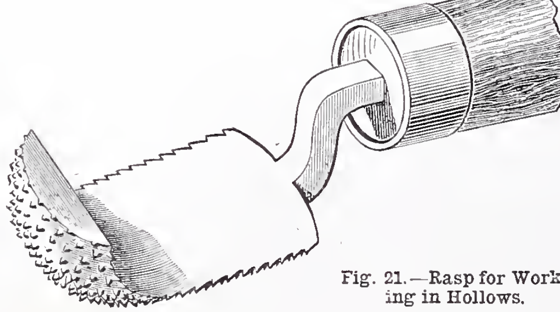


Fig. 21.—Rasp for Working in Hollows.

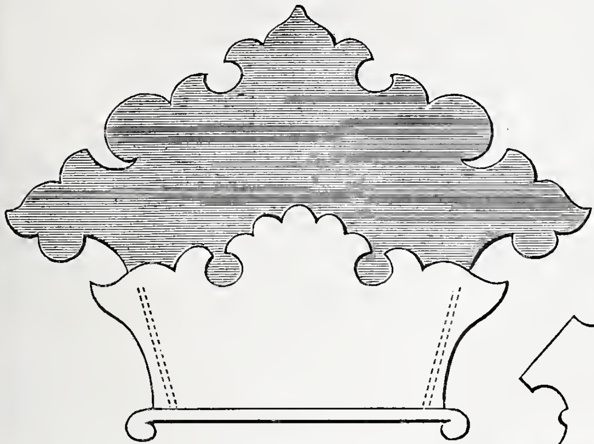


Fig. 19.—Card Rack from Flat Panel.

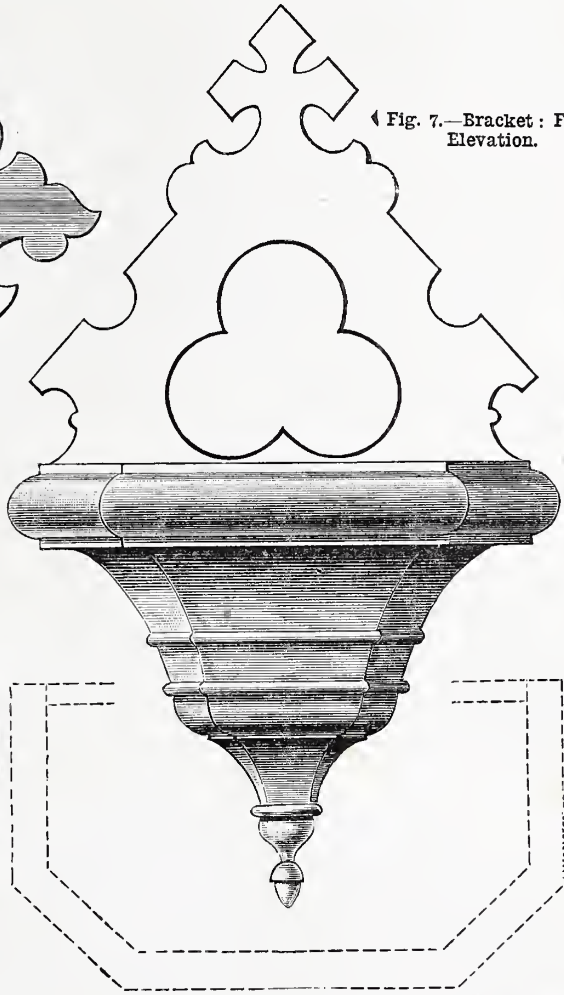


Fig. 7.—Bracket: Front Elevation.

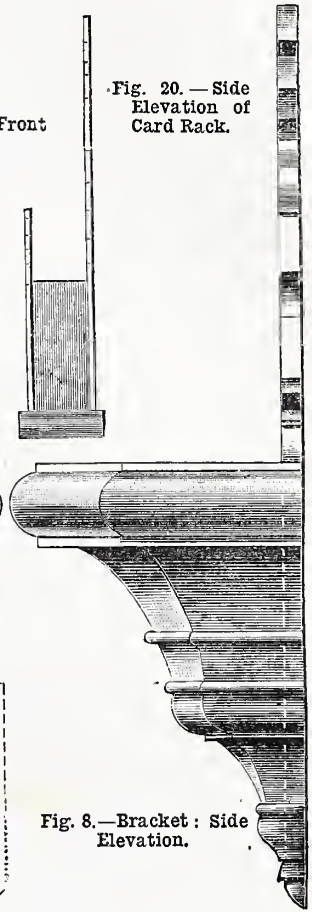


Fig. 20.—Side Elevation of Card Rack.

Fig. 8.—Bracket: Side Elevation.

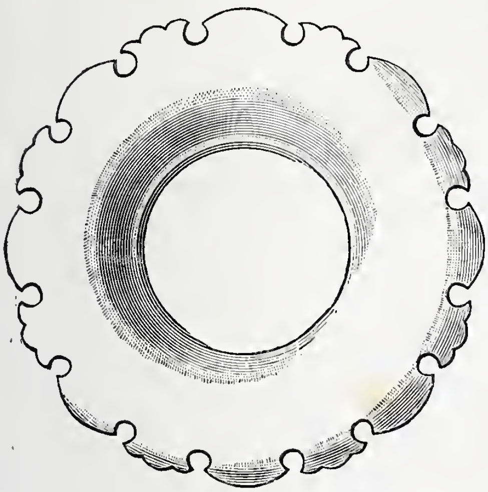


Fig. 15.—Tray of Saucer-like Form: Plan.

Fig. 9.—Plan of Bracket.

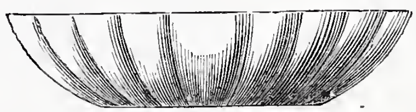


Fig. 17.—Tray of Saucer-like Form.


Fig. 16.—Tray of Saucer-like Form: Elevation.


Fig. 18.—Tray of Saucer-like Form.

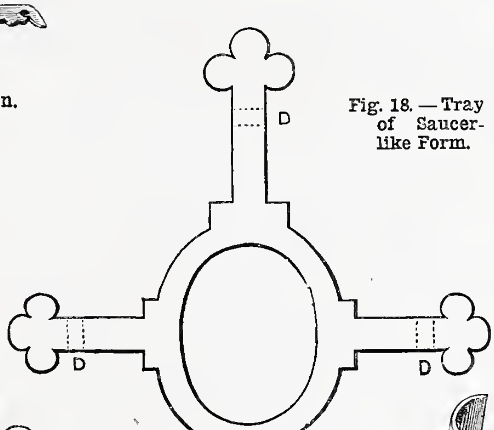


Fig. 14.—Cross from Flat Panel.

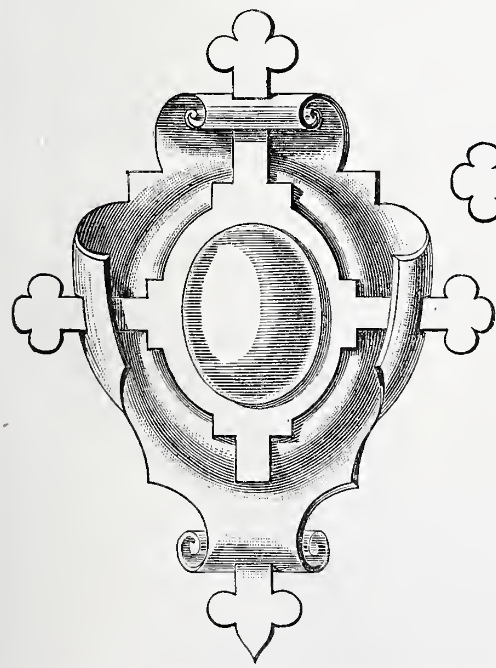


Fig. 12.—Elizabethan Centre Ornament in Papier-Mâché.

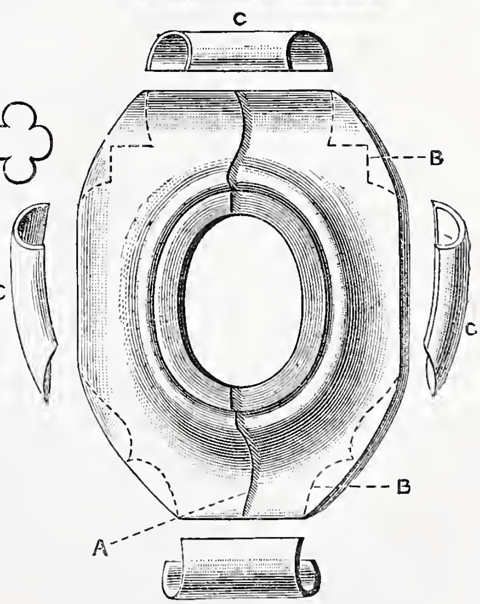


Fig. 13.—Parts of which Fig. 12 is composed.

There are, of course, ways in which papier-mâché is made decorative by form alone. Many architectural ornaments for interior work are now made of pulp (shaped in moulds) instead of plaster of Paris, over which this material has an advantage as being less liable to break or chip. Such things scarcely come into our province; but something in the way of ornament is to be done by modelling pulp with the spatula, as well as by pasting on the model. For house decoration papier-mâché may be made to serve as a cheap and easy substitute for wood carving, especially in the production of the style of ornament known as Elizabethan.

The chief characteristic of this style is the manner in which the extremities of its shields or cartouches are bent, rolled up, pierced, and interlaced with other members of the composition, to an extent which induces the conclusion that they must have had their origin in ornaments cut in leather, or some such pliant material, and afterwards curled and arranged in this fantastic fashion. Yet by whatever it may have been suggested, there is no question but that such ornament, when carved in wood or stone, is highly pleasing from its richness and variety.

But to carve it is laborious and costly, as must have been felt even in the Elizabethan age; for in an elaborate house of the period with which the writer is acquainted, the decorator has formed his shields, scrolls, etc., of sheet lead, rolled and interlaced in the usual manner. These are nailed to the oaken panels, and painted so as to make them look, as far as possible, a part of them.

A later decorator, having a like object in view, would have made his ornaments of plaster, which would speedily have chipped and exposed the deception. The lead has not chipped, but it has bent, and become indented wherever it has received a blow, and thus betrays itself; besides, there is a certain thinness and meagreness about it which to a practised eye at once distinguishes it from wood carving.

Yet the idea of producing a rich effect by inexpensive means was a good one; and had the decorator been acquainted with papier-mâché he might have made a complete and enduring success. His enrichments would then have been strong and rigid; they would neither have chipped like plaster, nor bent like lead, and would have been less liable to suffer from accidents than oak itself.

Fig. 12 is an Elizabethan enrichment which might serve as the centre of a panel, either on a large scale in a panelled room, or on a smaller one in cabinet work. The models for pasting once made, it can be reproduced to any desired extent.

It will be seen that it consists of three members—the cartouch, the cross, and the carbuncle or rounded centre. Each of these will have to be made separately. For the cartouch the models are drawn in Fig. 13. The comparative projection of its parts is shown by the sectional line, A. The main portion is first pasted, cut from the model, and sawn to shape as at the dotted lines, B, B, and partly dressed. The curved portion, C, C, pasted on separate models, can be glued on; and the rolls at top and bottom completed by gluing on additional strips of panel and giving the little shaping necessary with chisel and gouge. The cartouch can then be dressed altogether as described above.

Fig. 14 shows the cross, which is cut from flat panel. The dotted lines at D, D, indicate where parts of the limbs are cut out, and it is so fitted to the projections of the cartouch as to give the effect of piercing through them. Pieces of thicker panel will need gluing behind the ends to bring their backs level with the general plane of the back of the cartouch; and between the cross and the cartouch, where it does not touch, the spaces can be filled in with the paper-dust mixture.

The carbuncle requires a separate model. This is turned simply to an oval. The paper shell is sawn, when pasted, down the longest diameter of this oval, and thus two carbuncles are formed at a time. The carbuncle is, like the cross, glued into its place.

When finished, this piece of ornament may be fixed to the panel either simply by gluing, or better, by fancy-headed screws, or by common screws the heads of which are sunk and concealed. It should not, like papier-mâché in general, be coated with the ordinary black japan varnish, but should be painted with the panel so that both may appear one piece.

The above examples have rather been chosen as showing how for certain purposes papier-mâché possesses advantages over wood; and as also showing how the difficulties which may arise in working it are best to be overcome. But the variety of articles suited to, and ordinarily made in, papier-mâché, in which the construction is so simple as to need little or no explanation, is very considerable; and on some of these the beginner may, perhaps, rather choose to exercise his skill. Instance, for example, all the variations of what we may call the saucer-form: trays for smokers, for pins, for pens, for pools at round games, etc. etc., which can be made of many shapes, more or less ornate, by pasting on one model only, as may be seen in Figs. 15, 16, 17, and 18 (15 and 16 are two different views of the same tray). Or such articles as are made by a simple combination of pieces of panel—flat brackets, pipe racks, card and letter racks, etc. Figs. 19 and 20 show a card rack thus made.

Whilst speaking of such simple matters some mention ought to be made of a class of articles for which, perhaps, more than for any others, papier-mâché has been employed, namely, for tea and other flat trays. In making a tea-tray the rim is pasted, in a single piece, on a model which, if large, is necessarily somewhat cumbrous, since it has to be a sort of wooden frame, strengthened with cross pieces. The bottom of the tray is of flat panel, glued to this rim.

Almost all articles of furniture may be, and in the days when papier-mâché was a fashion have been, made of this material; and these admit of an amount of surface enrichment which would not be attempted on wood. Perhaps it has been most successfully used in small tables; chess tables especially. The alternating squares in pearl and black, tastefully ornamented, may often be works in papier-mâché that leave nothing to be desired.

While I am writing of furniture made of papier-mâché I may as well take the opportunity to point out that many things much in request in the present day may be easily and successfully made in this material. For example, nothing is easier and more simple than with a core of wood, on which to paste the sheets of paper, to imitate one of the Japanese umbrella stands, as a counterfeit of which many are content to use earthenware drain pipes, painted and otherwise ornamented to suit their fancy. The paper stand, to my mind, would be infinitely preferable.

Fig. 21 gives a form of rasp very useful in papier-mâché for working in hollows.

(*To be continued.*)

"TIPS" FOR TYROS.

BY OPIFEX.

5.—FIXING TRANSFERS FOR CARBON PAPER.

THOSE who use carbon paper for transferring designs, and for the other various uses to which it is put, often find that when freshly made the transfers, etc., are very liable to get "smudged" and spoiled. This evil may be avoided by sprinkling French chalk upon the transfer, rubbing over with the hand, and then dusting off the chalk.

Transfers upon brass for *repoussé* work treated thus will even stand the process of "pitching" without being obliterated.

6.—MUZZLE FOR FERRETS.

Should any of our mechanical friends be of a sporting tendency, it may be useful to them to know how the best kind of ferret muzzle may be made.

Chuck a piece of beech, 3 in. diameter by 4 in.; turn it into a conical shape, and then turn off the point right across, until the diameter of the face is an inch. Now take a piece of sheet brass No. 22 gauge, B. W. G., or about $\frac{1}{32}$ in. thick, and mark out with a compass a disc 2 in. diameter. Place and centre it upon the face of the chuck, fastening it thereto securely with strong tacks, or by a screw arrangement; when perfectly secure spin it rapidly and, using oil freely, apply a smooth, blunt tool to the brass, commencing at the shoulder of the cone, and applying considerable pressure. Work out gradually to the circumference of the disc; in this way the metal will assume the shape of the chuck, and when it is sufficiently bent, a band about $\frac{3}{16}$ in. wide may be cut with a sharp-pointed, graver-shaped tool.

This band constitutes the muzzle, and the size will, of course, depend upon the size of the animal for which it is intended.

Having smoothed the edges of the brass with file and emery cloth, drill two holes at the opposite sides, so that the line between the holes shall divide the diameter of the circle one-third of its length from the circumference. Between these holes a small rod of iron wire is to pass; this rod has an "eye" turned upon one end, while the other is passed through a small screw plate. Next "tap" one hole to suit this screw, and rime out the other so that the wire may pass through it.

When the muzzle is placed upon the ferret, this wire rod is inserted behind its long canine teeth, and screwed up, which effectually prevents the animal laying hold of its prey, while it does not otherwise interfere with its comfort in the slightest.

LATHES AND TURNING APPLIANCES.

BY F. A. M.

III.—THE OVERHEAD MOTION.

OVERHEADS—AMBITION OF AMATEUR WORKMEN—OBJECT OF PRESENT PAPER—ADDITIONS TO PLAIN LATHE—RESULT OF WORK DONE IN PLAIN LATHE—REVOLVING TOOL IN SLIDE REST—ITS ACTION—DRILLING SPINDLES IN PLAIN LATHE—CYLINDRICAL WORK—FACE WORK—FACE PLATE—HOLTZAPFFEL'S OVERHEAD—MILNES' OVERHEAD—EVANS'S OVERHEAD—BIRCH AND COMPANY'S OVERHEAD.

HAVING considered with my readers the most desirable mode of procedure to be followed, both in choosing a lathe and testing a lathe, we may now pass on to consider some of the appliances that have been added to the ordinary plain lathe, in order to enable the turner to produce turned work of an ornamental character.

In the present paper I propose to give some account of several of the best forms of "overheads," as the overhead motions of turning lathes are often called, to point out their advantages and disadvantages, and to conclude by giving drawings and description of a simple form of overhead which our readers will probably be able to make, in part at any rate, and add to their lathes.

Amateur workmen take much more pleasure in contriving and inventing an arrangement for themselves which they fondly suppose will surpass those contrivances which are the result of the accumulated experience of many workmen and designers who make a life study of their work. If professional workmen proceeded in the same way, they, too, would meet with almost as many failures as the amateur. Instead of doing this, the professional will set before him some tried scheme known to answer its purpose well; and, copying that, will not deviate from it until he finds by experience that it has defects which he sees he can remedy.

While not desiring that our readers should follow in a slavish way what has been done by others, even though it might be by far the safer road to success, yet we may at any rate press upon them the necessity for making themselves acquainted with what has been done by others, before attempting to strike out an independent path for themselves. The following descriptions are intended to help them to do this, and to form a foundation on which they can build constructions less likely to prove disappointing, and also to enable them to choose which of the several plans to be described will be most likely to suit their own particular circumstances.

The first addition to the plain lathe will be the slide rest; then comes the division plate and index; and then the overhead motion. Leaving the division plate for a future paper, let us now consider the overhead, an extremely useful addition for metal and ornamental work, and one which an amateur may make, in great part, for himself.

When the work is revolved in the plain lathe and cut by fixed tools held either in the hand or in the slide rest, the result is naturally of circular section. But if, while the work is firmly held in the lathe as before, instead of revolving the work we rotate *the tool*, and, while so rotating, we bring it up to act upon the work, we can then produce an infinite variety of different forms. Now, the revolving tool may be a drill or a single-point "flying" cutter, or it may be a serrated disc, something like a small circular saw called a milling cutter; all these are carried by "frames," in which they revolve, which frames are grasped and held and guided by the slide rest. From this explanation it will be seen why all these different appliances depend one upon another, and that the overhead is of no use without the slide rest and division plate; and only when the turner is provided with these three can he go on to add the drilling instrument, vertical, horizontal, universal, eccentric-cutting frames, and other instruments used in connection therewith. All these revolving tools being held in the slide rest, require to be set in motion from the treadle and fly wheel, and this is the peculiar office of the overhead motion; it should be noted, however, that the revolving tools do not remain in one fixed position like the mandrel, but they must be capable of being applied to their work in several positions, and must be capable of being moved whilst at work without throwing off the band or cord by which they are driven.

Let Fig. 1 be the plan of a lathe bed, with headstock and chuck in position; then *a*, *b*, *c*, and *d* are four different positions, which a drilling spindle might be required to occupy whilst its pulley is being driven by the band from the overhead. For instance, suppose Fig. 2 were placed upon the mandrel; here we have the base of a column to be fluted; we require for this a drill with a rounded end fixed in the drilling spindle, which must then be approached by one screw of the slide rest till it cuts into the work to the proper depth, and then by the other screw of the rest it must be slowly traversed to the right, as from *a* to *b*, while rapidly revolving all the while, so as to cut out each of the flutes. The band then must lead down to the pulley of the drilling spindle and drive it in position *a*, and also in position *b* about 12 in. from it; also in any intermediate position between the two; and it must allow of the driller being withdrawn from the centres backwards towards the workman at least 3 in., as would be required if it were operating upon a larger diameter. It might also be necessary to traverse the driller still further to the right, say 2 or 3 feet; this is provided for in some "overheads," but is rarely required.

Besides cylindrical work, such as is shown in Fig. 2, we require to do "face work," such as that shown at Fig. 3. Fig. 3 may represent a face plate, requiring to have a long hole made in it by slot drilling—that is, by a drill made so that it will not only bore a round hole while being pressed forwards, but also cut while it is slowly traversed sideways, much after the manner of the fluting drill in the preceding example. This necessitates positions *c* and *d* (Fig. 1), which positions, like *a* and *b*, are also liable to a variation of several inches, endways of the drilling spindle, according to the length or overhang of the work.

Many other positions may be required, but if the overhead will guide the band fairly to the pulley of a driller in these four positions, it will also act satisfactorily in any other position that is likely to be required.

Fig. 4 shows the kind of overhead which is made by Messrs. Holtzapffel, of 64, Charing Cross, who are considered the first makers of ornamental turning apparatus, as they are also the most expensive. The drawing is taken from the most excellent book on ornamental turning, which forms the fifth volume of their work, "Turning and Mechanical Manipulation;" the headstock and lathe bed have, however, been added, for clearness' sake, in their relative position beneath the overhead. The apparatus consists, first of a shaft or spindle, *s s*, about 22 in. long and $\frac{5}{8}$ in. diameter, carrying at the left-hand end a small stepped pulley, by means of which motion is communicated to the spindle from the fly wheel of the lathe by a catgut band; the rest of the spindle is occupied by a roller of about 4 in. diameter, lightly made of wood, and mounted on the spindle by means of brass ferrules, one at each end. The spindle runs on points carried by a bent bar, *b b*, which bar is hung by adjusting screws to the ends of a spring supported by its middle by a tall iron bar, *a a*, bent over at the top, and fixed to a second upright, *c c*, which is supported by the bracket, *d*, on the left end of the lathe bed, whilst the socket, *f*, holds the lower end steady. Thus the upright is formed of two pieces, *a a*, *c c*. It is grasped by the screw of the bracket, *d*, so that while it can turn in *d* and *f* it cannot rattle or shake. To bring the roller over the pulleys of the drilling spindle at positions *a* and *b* (Fig. 1), the top of *a a*, where it carries the spring, would be pulled forward so that the band would run straight down, being twisted one quarter round. As the drilling spindle traversed from *a* to *b* (Fig. 1) the band would travel of its own accord along the barrel or roller.

The positions *c* and *d* (Fig. 1) present no difficulty, and here the band has no quarter twist. The tension of the bands is regulated by the milled headed screws at each end of the spring. The spindle, *s s*, is adjusted fairly horizontal by regulating the length of the shorter band; and, for some of the less used instruments, it is necessary to have separate bands of slightly different lengths. This and the fact that one cannot act upon long work reaching more than a foot from the mandrel are the only and slight disadvantages of this excellent arrangement. Its chief and very important advantage is that it runs more easily than any other kind of overhead, its only friction being that at the ends of the spindle, *s s*, where it runs on points. Two lesser advantages are that the oil is not so liable to be sprinkled upon the work from the ends of the spindle, *s s*, as from the guide pulleys employed in many other forms of overhead, and that the interposition of the spring between the spindle and the upright, besides keeping up the requisite tension, absorbs any tremor that might otherwise have been communicated to the lathe bed. This form of overhead is often called "the goose-neck."

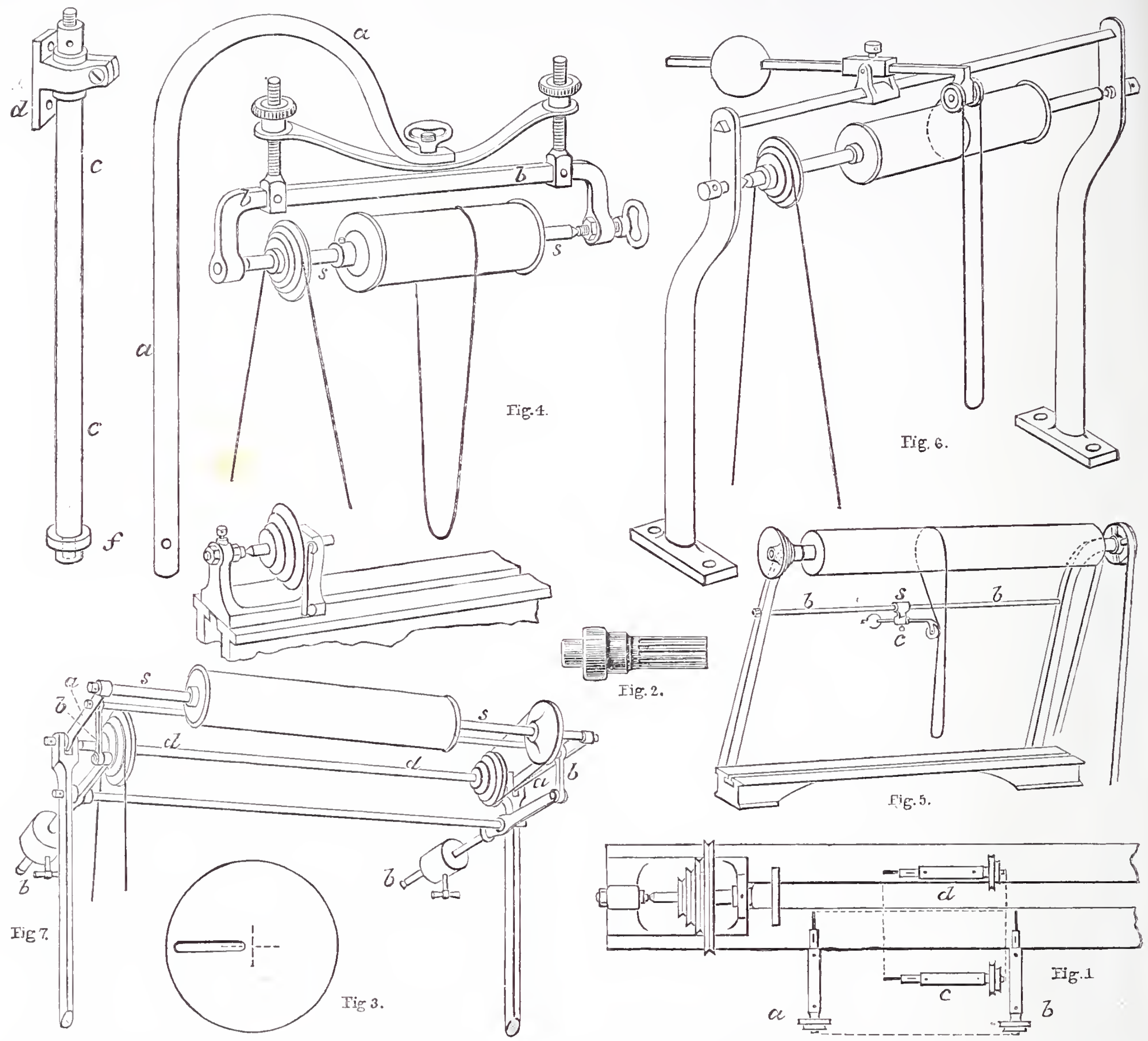
Fig. 5 shows the arrangement adopted by several makers. The illustration is copied from a woodcut of a lathe by Milnes, of Bradford. The overhead shaft carries a long roller which makes the overhead effective upon any part of the lathe bed, an advantage not possessed by the last example. The overhead shaft is not capable of being drawn up by a spring to tighten the belt, and therefore some other plan must be found for regulating the tension. Upon the stay bar, *b b*, slides a socket, *s*, which is bored through transversely so as to take a small bar, *c*. One end of this bar carries an adjustable spherical weight, and in a fork at the other end runs a small pulley. The bar swings on the stay bar so that the weight bears up the pulley against the band, giving it the proper direction and regulating the tension. The danger here is that the oil applied to the small pulley should fly upon the workman and damage the work with spots, but this is partly obviated by making the pulley with a long and very small boss. It might be still better to cause the little pulley to run on points by driving through it a small spindle, and putting small centres, in the shape of pointed screws, through each side of the fork. Mr. Milnes now prefers to make the roller 10 in. long, to slide on a feather upon the shaft wherever it may be required; also the stepped pulley to the left has been omitted, as it was not found to be of much service.

So long as the drillers, etc., are used in positions *c* and *d* (Fig. 1) this overhead works well; but with the positions *a* and *b* it will be less satisfactory, since, though the band will travel of itself along the drum, the socket, *s*, will have to be pushed by the hand if the driller traverses far.

Coming now to Fig. 6 we find another plan, which but slightly differs from the foregoing. Here the stay bar is uppermost; it carries the weighted lever above it, and the lever carries at its front end *two* pulleys which draw up *both* sides of the driving band, giving an ample allowance for those cutting frames which would have required bands of shorter lengths if driven by the two foregoing examples. But then its second pulley adds slightly to the friction. On the roller shaft is seen a speed pulley, driven from the fly wheel below, and allowing of a variation in the speed: a decided advantage which this form has over the preceding. Mr. J. H. Evans, of Wardour Street, London, makes an overhead motion of this type for his high-class lathes for ornamental turning. The two tightening pulleys are further off than the one pulley of Fig 5, yet the oil may injure work in ivory or white wood.*

Fig. 7 shows a much more elaborate arrangement, by means of which almost all the disadvantages of the former devices are avoided. Except for the extra complication and expense, very little can be said by way of criticism except that the standards are bolted to the lathe-bed and may possibly communicate to it a slight amount of disturbance. The arrangement, however, would only be applied to a rather strong lathe. The particular example illustrated is taken from a photograph of a lathe made by Messrs. G. Birch and Company, of Islington Tool Works, Salford. The lathe to which it is applied is of $5\frac{1}{2}$ in. height of centres; it is suited both for metal work and ornamental turning; it is expensive of necessity, yet not so expensive as some, and it is believed by the present writer to be the most perfect overhead motion mounted upon the best lathe that he has yet seen. This does not prove that it would suit all our readers equally well, nor that all should go to the extra expense involved; some who wish to do ornamental work only, would probably be best suited by the first example given; whilst others who could not afford to buy the overhead under consideration, and yet wished to do long work, would find the example in Fig. 6 cheaper and efficient. Looking at Fig. 7, it will be seen that the spindle, *s s*, which carries the drum is supported by lever arms, *a*, *a*, turning in the forked tops of the uprights. These arms are held up by links, supported by other levers, *b*, *b*, carrying weights, which weights serve not only to support the weight of the spindle and arms, etc., but to put the proper amount of tension upon the band which runs on the drum. The drum, then, is capable of vertical adjustment, and no tension pulleys are required. There are, however, two other centres of motion at the ends of the first motion shaft, *d d*, which shaft receives the motion from the fly wheel upon its speed pulley at the left-hand end, and communicates it to the spindle, *s s*, at its right-hand end, by means of another pair of speed pulleys, so that changes of speed can be made from the fly wheel to *d d*, and from *d d* to *s s*, giving great variety.

(*To be continued.*)



The Overhead Motion. Fig. 1.—Plan of Lathe Bed with Drilling Spindles in Position. Fig. 2.—Example of Cylindrical Work: Column for Fluting. Fig. 3.—Example of Face Work: Face Plate. Fig. 4.—Overhead by Holtzapffel. Fig. 5.—Overhead by Milnes. Fig. 6.—Overhead by Evans. Fig. 7.—Overhead by Birch and Company.

* Since the above was written, Mr. Milnes has adopted the form shown at Fig. 6.

OUR GUIDE TO GOOD THINGS.

29.—New Patent Tool-Cabinet and Work-Bench.

Viewed from a purely utilitarian and economic standpoint, it is difficult to conceive any means or to call to mind any article in which the object in view is attained so completely and thoroughly as it is in the New Patent Tool-Cabinet and Work-Bench which was thought out and patented by the head of the firm of Messrs. Richard Melhuish and Sons, 85 and 87, Fetter Lane, Holborn Circus, E.C., and is now manufactured and supplied by the firm for home use and for export.

When closed, the cabinet has the appearance of a handsome piece of furniture, which might, as far as the eye of the observer can determine, serve various purposes for which drawers are generally required. If measured in each direction as it stands, it will be found to be 3 ft. 6 in. long, 1 ft. 7 in. wide, and 3 ft. high, occupying a space of about 16 cubic feet, not to go too closely into its exact contents. When the top is lifted up, and the doors at the sides are opened, its actual purpose is at once revealed; and the observer, perhaps, will be somewhat astonished to see how much has been accomplished in so small a space.

The top of the cabinet, an illustration of which will be found in our advertisement pages in No. 2 (page 31), is recessed and of sufficient depth, not only to contain a considerable number of tools, but also to cover and hide from view, when it is shut down, the small but convenient work-bench that covers in the drawers below. Within the lid are contained a variety of the smaller tools which are frequently required, and which it is desirable to have immediately within reach. Among these are, as will be noticed, a couple of squares, rule, compasses, wrench, spokeshaves, brace, several bits, gas-pliers, gauges, bradawls, gimlets, and a few useful bits for use in the brace. The larger and heavier tools are contained in the cupboards at the sides—room being found in that on the right for a good panel-saw, tenon-saws, bow-saw, hammers, auger, mitre-box, mallet, screw-driver, rasp, and gauges; while on the other side are packed away various planes and other tools, provision being made even for a glue-pot of handy size. The work-bench, which is very nearly 3 ft. 6 in. long, and 1 ft. 6 in. wide, although not very large, is of sufficient size for all practical purposes; although, for large work, a bench of larger size would have its advantages. It is fitted with a patent bench-stop, and a small but serviceable grip vice, for which provision is made in the interior of the cabinet when it is not in use and is closed. The drawers, which are six in number, are fitted up with partitions, and are thus fitted for the reception of carving tools, and other tools necessary for the prosecution of any kind of work which the owner of the cabinet may adopt as a hobby, besides joinery and cabinet making. Thus, for example, room may be found for appliances for fret cutting, a branch of art wood work which finds favour with a great number of amateurs. Provision is made on the right of the front for a peg, on which to support any board or slip of wood, whose other end is gripped and held in the vice, to allow of its edge being planed up. The whole of the six drawers, the two cupboards, and the top, can be instantly closed up and fastened with one small lock and key; which is of great advantage when the owner, perhaps, is suddenly called away in the midst of his work, and yet wishes to leave his tools secure and in safe keeping. "Safe bind, safe find," runs an old saying; and this is as applicable to tools as to anything else which it is desired to keep out of the way of meddlesome intruders.

The tools which are supplied with the cabinet are specially selected, it should be said, as being the most suitable. All are of the best quality, fully warranted, and of full size; precisely the same, in point of fact, as are supplied to practical workmen.

The price of the cabinet, fitted with tools as shown, and made in walnut wood, is £17. It may be made in plainer material; but there is little, if any, advantage gained in using an inferior wood, especially if the cabinet occupies a conspicuous place in an amateur's own room, in which he is accustomed to do any kind of work that would not be permitted in any other room in the house. There is a special form of the cabinet, made for export, to stand hot climates, with solid brass corners, and all parts dowelled and screwed together. This is of walnut, polished, and costs £22 13s. with tools, or £10 12s. 6d. without tools.

Many officers have a fancy for carpentry and joinery, especially of an ornamental character, but occasionally are required to shift their quarters at very short notice, both at home and abroad; and even to go abroad with very little time for preparation. To such as these, the Tool-Cabinet and Work-Bench will not fail to be a most welcome means of securing the prosecution of their favourite work without much trouble or inconvenience in packing and removal. Many amateurs at home will prize it for almost identical reasons, and perhaps more for the *multum-in-parvo* characteristics of the appliance, which enables much to be done in confined space. Lastly, many a professional workman who is cramped for room at home will be pleased with it, because, although he will not dream of becoming a purchaser, it will show him how he may manage to dispose of his tools within the limits of the work-bench itself, and yet always have them close at hand. And this, I know, is a desideratum to many a workman who seeks to help his family and himself by doing an occasional odd job at home out of hours.

I may add that important modifications are being effected in the cabinet, which will render it more acceptable as a piece of furniture, and more serviceable to wood carvers, artists, draughtsmen, and others. Space forbids me to say more about these modifications at present, but they shall be described at a future time when fully matured.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

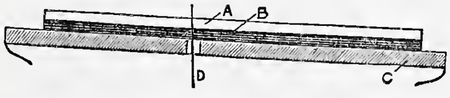
*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

Cost of a Patent.—G. B. B. (*Portsmouth*).—The preliminary expenses of taking out a patent are not very heavy, amounting only to £1 10s., if you yourself take the matter to the Patent Office. If, however, you find it necessary to seek the intervention of an agent, the outlay will be increased, as the agent must, of necessity, be paid for his services. It would not be possible or practicable for us to offer a monthly prize for the best invention out of all that might be submitted to us during each month, the prize to consist of the cost of obtaining provisional protection. Any advice I can give you with regard to your proposed patent is much at your service.

Cutting Rebates with Circular Saw.—C. C. E. writes:—"The circular-saw table should be sloped down towards the operator, about 2 in. below the horizontal, then when raised for cutting rebates, etc., it is not in an awkward position as it would be if made horizontal in its normal position."

Electro-plating and Gilding. — A. W. Y. (*Neasden*).—Instructions on these subjects will be given in Work in due course.

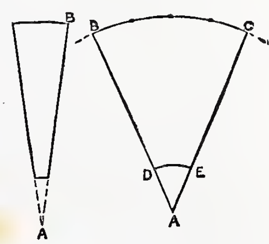
Fret Cutting.—Inlay writes:—"I think it may be useful to some of your readers who are amateur fret workers, and who have fret machines, to know another method of inlaying than the one mentioned by Mr. J. W. Gleeson-White in his article in No. 1



A, White Holly. B, Ebony. C, Tilted Cutting Board. D, Saw.

of Work on 'A Cabinet in Fret Work.' This method has the advantage of being an easy one, and is, at the same time, a sure way of getting a good result. Say that you wish to inlay a piece of white holly into a piece of ebony, the method is this:—Having your woods of the same thickness, you fasten them together by means of a paper between, gummed on both sides, the pattern being on the holly. Then you tilt your cutting table to a slight angle, and cut with a vertical saw, so that the piece to be inlaid is rather larger than the piece below it, which falls out, and the edges are not quite square, but bevelled, as in the annexed diagram. With a slight force the holly (A) can be driven into the ebony at B, and the piece is inlaid. You then divide the pieces of wood by inserting a chisel and splitting the gummed paper. This method does away with any necessity for a back-board, or of filling up with 'glue and sawdust,' and ensures a perfect fit. Neither is there any trouble about fitting the parts, as each is driven into its place before the woods are divided. It will then stand 'papering,' and even planing, if need be. At the same time, it is all done with one cut. I am sending a sample of what I have done in less than three minutes, and I think you will agree with me that the result is fairly successful. There is no glue about it, as you may ascertain by pressing the back, when the inlaid piece will come out; but, of course, glue should be used for anything permanent."—[The specimen sent was admirably cut, and fitted most accurately in every part. Yet inlayers and marquetry cutters often resort to the mode of filling up chinks and misfits as spoken of by Mr. Gleeson-White. It is a difficult matter to determine where the cutting was commenced—so good is the fit.—Ed.]

Scale for Metal Open Diapason.—Amateur.—A fair scale for a chamber organ metal open diapason would be as follows:—C, C, 5 in.; Tenor C, $2\frac{5}{8}$ in.; Middle C, $1\frac{1}{2}$ in.; 1 foot C, $\frac{7}{8}$ in.; 6 in. C, $\frac{5}{8}$ in.; Top G, $\frac{9}{16}$ in. Thickness of metal would vary according to its stiffness; but if C, C, is made of metal about $\frac{1}{16}$-in. thickness, and top, G, about as thick as a visiting card, it will be sufficient. The feet patterns can be cut out as follows: Having decided on the length of the foot—say 12 in. long—draw a section of it full size, as in diagram herewith, and continue the sloping lines down till they meet in the point A. Then take the distance A to B in the compasses, and strike an arc, B, C. The circumference of a circular pipe is $3\frac{1}{7}$ times its diameter, so with the compasses step that distance round the arc, and join the last point thus gained, C, to the point A. Then take the distance from point A to the bottom of the foot, and strike the smaller arc, D, E, and sheet, B, C, D, E, will be the sheet required to form the conical foot of the pipe. This is cut out and turned up on a conical pattern of wood, soldered down the back, and the lip formed by rubbing down on the portion of the cone which has been flattened for the purpose. The lanquid is then soldered in its place and the foot joined on to the body of the pipe.



Handrailing. — Excelsior. — You wish that "some practical reader of Work would explain the difference between the tangent system and the falling rail system of handrailing, and point out the advantages and defects of each, and also advise a young worker as to what books he should study in order to obtain a practical knowledge of this mysterious art." The tangent system was introduced by an American of the name of Riddell, who wrote two or three works on the subject, which were published in this country. To go into a thorough explanation of the method adopted by Mr. Riddell would take up considerable space, and would prove next to useless to you, because his system is faulty, and involves much waste of material. The falling line system is based on Euclid's "Elements of Geometry," which you should study in the first place in order to get a clear perception of the first principles of the art. Without this you cannot understand the method of drawing sections of solids, and unless you attain to a fair comprehension of this you cannot hope to be proficient as a handrailer. To give adequate instruction in such a subject as this, which may be regarded as being one of the most intricate and difficult branches of joinery, requires a series of papers, and I am glad to be able to say that I have obtained from a practical handrailer of nearly forty years' experience a promise to write some articles on the subject in which the falling rail system as practised by himself shall be fully explained for the benefit of yourself and all readers of Work who may be interested in the matter. This writer will prepare models one-fourth size, which may be obtained at small cost, comparatively speaking, and will show practically how handrailing may be executed in the most economical manner, and the least possible expenditure of material, time, and labour. He is prepared, further, to teach the art of handrailing as practised by himself to any young workman who might be able and willing to place himself under his tuition for a short time.

Printing and Lithography.—J. D. (*Perth*).—Both subjects will be treated in due course. Meanwhile, if you and your friends will mention any particular thing connected with either art on which you may be in doubt or difficulty, you shall be helped if it be possible to do so. Do not hesitate to write, for it is earnestly desired to afford help to all who need help.

Carpentry and Joinery. — A. H. S. L.—Arrangements are pending for a complete series of instructions on carpentry, joinery, and cabinet making. I should recommend you to wait for these.

Spots on Mirror.—W. C. T. (*Ardgowan*).—You ask how to remove spots from the back of a mirror, which, you think, have been caused by damp. These spots you describe as "circular with black centres about ¼ in. in diameter shading off to grey." Looking-glasses are silvered with quicksilver and tinfoil, which combine to form a fragile coating easily susceptible of damage. Possibly the spots on your mirror are numerous, and, if so, the best course you can adopt is to have it resilvered. It is said that damage to the silvering of a looking-glass may be repaired by first removing the amalgam from the injured part, and making a wall of beeswax round it to receive some nitrate of silver, which must be poured into the shallow receptacle thus made. The silver must then be precipitated by means of sugar or oil of cloves and spirits of wine. But to do this to every spot would be a troublesome business even if you were successful, so it would be better and easier to resilver the whole plate. Kindly give particulars of the Patent Darning Weaver you mention in your letter.

Telephone.—H. B. O.—Yes; a paper, or papers if necessary, will be given on the telephone and its construction, but it is not possible to do everything at once. If everything was done, or could be done, to-day, there would be nothing left to do to-morrow.

Working Marble and Stone.—DEAN FOREST.—I am not acquainted with any book that is devoted to an exposition of cheap sculpture likely to be useful in grave-stone making. Tools and appliances for cutting and dressing stone may be obtained of most dealers in tools and hardware. They are chiefly saws for cutting blocks into slabs, and mallets and chisels for dressing and cutting letters. If you are a novice seeking to gain some knowledge of the art, any stone mason would tell you what is required for the manipulation of the stone, and how the work is done; but for the higher branches of the art you would have to seek the assistance of the monumental mason, who devotes himself more particularly to this kind of work.

Electricity.—J. G. (*Portsmouth*).—You will find that electric lighting, bell work, and instrument making with sketches and working drawings will form a prominent feature in WORK. A contributor is now at work on a series of articles on Burglar Alarms, showing how to protect the house against the intrusion of burglars in the most simple but most effective manner.

Wire Thread Fret Saws.—B. and S.—As I explained in my notice, these saws are not yet on the market. As soon as they are on sale, the sizes in which they are made, and the prices at which they are sold, will be announced in this Magazine.

Violin Making. — B. and S.—This subject is down for treatment, but there is neither space nor opportunity for going into it immediately. If you require assistance on any special point in connection with violin making, write, and your question shall be submitted to one who is skilled in the business.

Mixing Paints.—F. A. (*Lambeth*).—This will be fully explained in articles bearing on House Painting, and possibly a paper or two may be devoted to this specially describing the mode of procedure to be followed at an earlier date than it would be possible to enter on a consideration of house painting. Moreover, it would be of assistance to many in enabling them to better understand some papers that will appear at no very distant time on a new mode of decorating surfaces with oil colours.

Sheet Metal Working.—W. H. L. (*Crewe*).—An experienced worker in sheet metal is now about to prepare a series of papers on the business in which you are engaged, and they will be commenced as soon as opportunity offers.

Joinery and Cabinet Making for Beginners.—H. D. (*Bury, Lanc.*).—You ask for a series of papers on articles that can be made with about three shillings' worth of tools, and wish me to say what tools it would be best to buy with that money. You continue:—"By small articles I mean those that can be sold at a little profit so as to get more money, and therefore more tools. If you could state what they would cost and what they would sell for, I should be very thankful." I should very much like to hear more about yourself; that is to say, how old you are, and how you are employed, for you are evidently bent on doing the best and utmost you can on a very slight amount of capital. Now, if I am not very much mistaken I think there will be help in store for you, and that some of the readers of WORK, whose eyes light on this, will send you an odd tool or two that they do not want, to help you make up a kit of the most necessary articles. But supposing that nothing of this kind were forthcoming, I should advise you to commence with fret sawing, and buy a bow saw frame and a few saws, a piece of wood, and a simple pattern of a bracket or tray, or some article that is quickly and easily made. You will want nothing in addition to the fret saw beyond a light hammer, a fine bradawl, and a few fine brads or French nails wherewith to fasten the pieces of fret work together. With regard to the price you are to ask for any article that you make, it is difficult to advise you. Things in fret work are sold in fancy goods' shops at prices ranging from sixpence upwards, and supposing at first you were to ask for each article twice as much as the materials cost you, you would get back the cost of the materials, and as much again for labour, and with this you could buy more materials, and, after a bit, more tools, as money begins to gather a little. Always bear in mind that excellent advice or rather injunction, "Despise not the day of small things." Practically you are laying this to heart and acting upon it, and although I am far from being "among the prophets," I dare venture to say that with your spirit, combined with patience and perseverance, you cannot fail to succeed, God permitting. Let me hear from you again, for I can assure you I take a deep interest in your proceedings, and the doings of all such as yourself. If it be possible to introduce a few papers describing the mode of making a few small articles that may be quickly and easily made for sale, you may rest assured that it shall be done in order to help you and all others who show so earnest a will to help themselves.

Power Loom.—J. A. A. (*Manchester*).—You ask if it be possible for me to devote a portion of WORK to the construction of the power loom with wheel calculations, etc., adding that it would be of great service to scores in Lancashire, and make WORK doubly valuable in that county. I am glad to say that I am in communication with a contributor who is prepared to write on the construction of both the hand loom and power loom, and so it will not be very long before the desire of yourself and others is satisfied. There are emigrants from the old country in Manitoba, and elsewhere in the colonies, who have plenty of the raw material, but want the means of spinning it into yarn, and then weaving it into stout homespun material for clothing, and so, you see, there is abundant reason for moving in the matter as soon as may be, in order to meet their wants and yours. Write again and explain to me how the knowledge of the *construction* of the power loom, etc., "would be of great service to scores in Lancashire." Is it sought in order to lead up to better work, or to the making of looms?

Cabinet in Fret Work.—T. F. (*Willington-on-Tyne*).—The wood is too thick to give the required effect. The thinnest veneer—2-ply if possible, or a thin 3-ply—should have been used. This, with plentiful rubbing down with sand paper, would have avoided the result in your case, which is certainly disappointing. Your kindly expressions regarding the design itself are welcome, and the designer is sorry the first worker found obstacles in the way. Whether it would be possible to fill up the spaces cut out with any composition to obtain the effect of inlay seems doubtful. Yet the honour of being the first to use No. 1 is not marred by the failure, and we shall always recall the effort, and remember the name of the first reader who recounted his experience. (J. W. G-W.)

Hand Circular-Saw Benches.—A. R. (*Scorrier*) writes:—"These machines are very useful in joinery works or saw mills, where there is motive power to drive them, as they will do work that cannot be done by frame or hand saws, such as grooving, rabbeting, etc., and will cut rafters, staves, laths, etc., with greater despatch than any other kind of saw. But how often do we see timber presented to such machines that should not be. I believe some employers think if they have a circular saw at work that it and the man that has to work it are capable of cutting almost any depth of timber with it. This is a great mistake, and one, I think, that should be looked into by our Government Inspectors. How often have we seen a man at a saw bench trying to push a piece of timber from 9 in. to 16 in. deep against a circular saw. He will push it 2 or 3 in., and then through overfeeding, or through being unable to push any farther, he has to stop. After a pause he pushes an inch or two farther, and so on, until he pushes through the cut, doing the saw no good, and himself harm. There are benches made with rope roller and rack feed to bring the timber to the saw, and all benches in which saws are being worked above 24 in. should have one of the above appliances. Again, when a man has to push a piece of timber above a certain depth he is obliged to stand behind the timber, and directly in front of the saw, and should the timber close or catch the back of the saw it is liable to be flung against the sawyer; therefore, you will at once see the man is in a dangerous position. Had the bench either of the above feed motions the man could stand by the side of his work and near the saw bench, and be near at hand to stop the saw or the feed should it be required. Shallow and short stuff, such as laths, staves, etc., requires but little power to push or feed it, therefore the sawyer may stand on one side, and not put himself in such danger as if directly in front of the saw. As WORK is a new paper, no doubt many will avail themselves of writing to it, therefore I will take up no more space in this number, but, with the Editor's permission, will write more on saws in future numbers." [The pages of WORK are always open to workmen on any subject connected with their trade, and I have much pleasure in inserting your communication, which, I trust, will lead to the adoption of the course you advocate with circular saws that are used to cut wood of considerable thickness.—ED.]

REPLIES to the following correspondents are held over for want of space:—H. D., W. J. B., J. G., F. A., J. C. (*Aberdeen*), J. D. N., E. P. W., SARA, H. T. C. (*Leytonstone*), A NOVICE, PROGRESS, MECHANIC, W. H. (*Liverpool*), F. S. (*Newcastle-on-Tyne*), C. L. (*Uxbridge*), G. E. D. (*Liverpool*), W. G. P. (*Fenny Stratford*), G. W. (*Liverpool*), A COTTAGER, H. D. (*Haverfordwest*), H. S. (*Bebington*), A. R. (*Scorrier*), W. T. (*Leyton*), H. W. (*Gateshead*), NULLI CEDO, H. S. (*Exeter*), F. F. (*Peckham*).

Trade Notes and Memoranda.

THE first Exhibition of Blacksmiths' Work, under the auspices of the Worshipful Company of Blacksmiths, was held towards the close of March, 1889, in the Hall of the Ironmongers' Company, in Fenchurch Street. The exhibition of the work of the journeymen and apprentices of London was a small one, the number of contributors not exceeding thirty.

SOME TOPICS OF THE HOUR.—The Registration of Architects.—Fireproof Floors.—The Utility of Local Museums.—Architects' Fees.—English *v.* Continental Doors.—The Shaftesbury Avenue Architecture.—Trade "Discounts," alias "Commissions."—The Restoration of Westminster Hall.

PATENTS have been applied for in fireproof wall and ceiling papers, for drawing the outlines of objects and scenes in correct perspective, brick ovens for bread baking, moulds for pressing bricks, etc., and for improvements in glazed structures.

THE Society of Arts has guaranteed £100 towards the Autumn Exhibition of the Arts and Crafts Exhibition Society.

"SECONDARY BATTERIES" will be the title of a lecture by W. H. Preece, F.R.S., before the Society of Arts on an early date.

SHIPBUILDERS continue to be well employed upon the Wear, and there are about 10,000 tons of shipping on the stocks and in the water in excess of what there was at the beginning of the year, the output for the last three months being in excess of the corresponding period of 1888.

THE iron trade of Dudley is well maintained. There is a good demand for tin plate and sheet iron, and manufacturers of boiler plates are fully employed.

ENORMOUS quantities of goods are being sent out from the Boot and Webbing warehouses of Leicester.

THE method of lighting the channels of harbours by means of electric buoys, which has been tried in New York Harbour, is likely to be adopted in this country, as it has been favourably reported on by officers appointed to examine the system.

THE following is a formula for a wash for lime walls, so as to bear washing. Mix the powder from three parts silicious rock (quartz), three parts broken marble and sandstone, also two parts of burned porcelain clay with two parts freshly-slaked lime, still warm. The four constituents mixed together give the ground colour, to which any pigment that can be used with lime is added. It is applied quite thickly to the wall or other surface, allowed to dry one day, and the next day frequently covered with water, which makes it waterproof. This wash can be cleansed with water without losing any of its colour; on the contrary, each time it gets harder, so that it can even be brushed, while its porosity makes it look soft. The wash or calcimine can be used for ordinary purposes, as well as for the finest painting. A so-called fresco surface can be prepared with it in the dry way.

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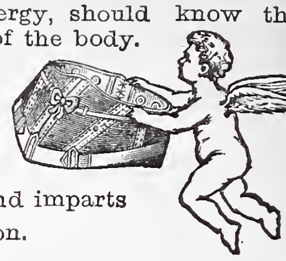

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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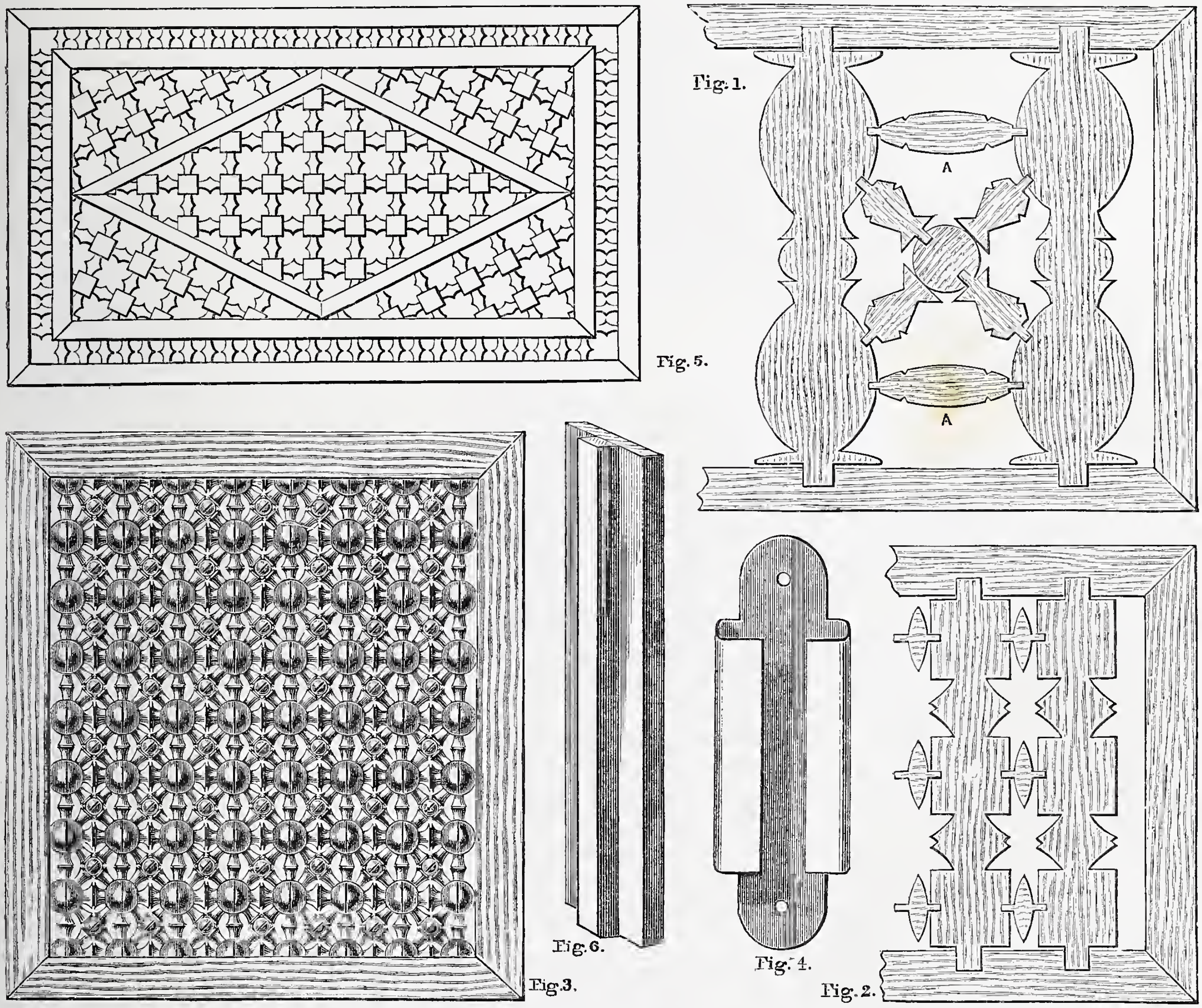


Egyptian Trellis Work. Fig. 1.—Pattern for Work Turned in Lathe. Fig. 2.—Simple Pattern of Blocks alternating with Turned Work. Fig. 3.—Panel in Turned Work complete. Fig. 4.—Brass Guide to take Frame of Panel. Fig. 5.—Example of Trellis Work made up into Panel. Fig. 6.—Projection on Side of Frame, as shown in Fig. 5, to run in Brass Guide (Fig. 4).

EGYPTIAN TRELLIS WORK.

BY C. H. OZANNE.

Though there are occasional specimens of this work to be seen in England, it is not nearly so well known as it deserves to be. Most of the readers of Work who visited the Italian Exhibition last year will have observed some pieces of furniture decorated with very poor examples. If so, they gathered a very moderate idea of its capacities. Perhaps the illustration given in Fig. 3 may enable them to form a better idea of what can be done.

It is difficult in an engraving to give a perfect rendering of what the panel is in the solid. To indicate the colour of the various woods used is difficult. The rows of beads, separated by turned intervals which run horizontally across the panel, are of walnut; the stars are arranged in squares, alternately lemon and ebony. The series of stars forming the outer square is of lemon; the series forming the square within that is of ebony; the next, lemon; and, finally, the two stars remaining are ebony.

Of course, such elaborate patterns are only used for small ornaments—such as brackets, panels, etc. For larger work the beads are coarser, and the open spaces are of sufficient size to allow the ladies of the harem to see what is going on on the other side of the screen, which protects their beauty from exposure to the vulgar gaze.

In Oriental lands this trellis work is largely used. Of course, in England we do not sit in balconies, as everybody does in a hot climate; and we do not appreciate the advantage of allowing every breath of fresh air free circulation. It is not so rare a commodity with us. To fully value the trellis work, it is necessary to be the wife of a jealous pasha. You are as carefully guarded from every male eye as a rare tropical plant from frost. In the harem, or women's quarters, you are allowed to remove your veil, but then every care is taken to prevent your beauty from rousing the admiration of any passing Lothario. Your gorgeous cage is hot and close, and female society is apt to pall—I do not speak from a masculine point of view. Man was not born to live alone, nor was woman.

No doubt the harem ladies appreciate the trellis that allows nothing of their faces to be seen but the occasional flash of a bright eye. But that they would prefer less careful protection is manifest from the way in which they allow their veils to fall forward —by accident—as they are driven in closed carriages along the fashionable promenades, and expose the greater part of a round, somewhat vacant face, leaving the rest shrouded in a transparent film of gauze. That this accident is designed is evident from the way in which the white veil tones down the complexion, which is pasty, and throws into strong relief the large black eyes, which they know how to make the most of, in spite of the two repulsive blacks who take charge of the fair bevy.

Though it is not the custom in this enlightened land to seclude the fairer sex from male society other than that of their lords, we still desire to a certain extent to shut off the gaze of the curious from the privacy of our homes. In passing along the street the lower half of many a window is screened by a blind of muslin, wire, laths, and, occasionally, fret work. None of these is artistic, and all more or less prevent the inmate of the room from seeing the passers-by.

In Fig. 5 is shown the framework of a simple half-blind. The centre is intended to be filled in with the trellis work, shown in Fig. 3, turned to suit the design of the frame fixed upon. In Fig. 5, I have merely indicated the position of the trellis work, and leave the pattern to the taste of the worker. In Fig. 6 is shown a projection for the ends of the frame; this is to run in the brass guides (Fig. 4). The practical workman will know many ways of fastening the blind. I merely give this as a suggestion.

In Fig. 2, an example of the simplest style of work is given in section. It is composed of strips of wood squared. These are turned up, leaving square blocks alternating with the turned intervals. As many as necessary of these strips are turned, and then the pieces to connect these strips with one another. Generally a lot of these latter are run out in one length, and then cut up as required. Holes are bored in the square blocks of the strips, and the little pegs inserted in them. The whole is tied up with string, and slipped into the holes in the frame.

Fig. 1 is not quite so simple. The strips are entirely rounded in the lathe—the pattern can be varied to any extent. The star is composed of three separate pieces, as shown. To put it together when the panel is a large one requires practice, and, if fine work, a very delicate touch. A strip is placed in the hollow of the hand; the long piece of the star is inserted in its hole in the bead; the second ray of the star is put into the next bead of the same strip; then the last piece of the star is inserted in its centre. One of the little pillars, A, is put into position, then a second strip is added, and held by the fingers. The two other ends of the strips are then slightly opened to allow the second piece, A, to be inserted. The two strips are then pressed together, and will not fall apart if gently handled. The holes for the pegs should be slightly large; this makes it easier to be put together. When framed up it is very strong; more so than fret work, and the effect is richer. The solid bars should always run the shortest way of the panel.

To build up a large panel will require some practice and patience, as it frequently falls to pieces as the last bit is being put into position. The result will fully repay the little trouble necessary to attain the requisite dexterity.

In the illustrations enough is given to put any one who takes trouble into the way of producing a variety of patterns. The shape of the beads, and of the pieces forming the star, can be varied to a great extent. In a long strip one of the stars can be replaced by a little pillar, and the corresponding bead lengthened to suit.

In future papers I hope to be able to give some examples of the application of this style of ornament to ordinary pieces of furniture. Many of these are far from artistic.

I am sure that any workman who fitted up a half-blind in the style of Fig. 5, selecting his trellis work from Fig. 3, and mounted it in his window, would have his hands full for many a day.

I have several specimens of this work in my drawing-room, and every visitor with any eye for artistic furniture is at once struck with it. It is, in my opinion, one of the most effective styles of decorative wood work that I have seen; and I am sure that if any reader of Work saw the general effect he would agree with me. It has an advantage over relief carving in that it shows up well against the light, and that various coloured woods can be used in combination. It is not nearly so difficult to learn as carving.

REPOUSSÉ METAL WORK.

BY GAWTHORP.

For Illustrations of Articles in Repoussé Metal Work, see Art Supplement issued with this Number.

Before touching on the various designs embodied in the Art Supplement presented with this number, let us see what repoussé work really is. Every one knows that "repousser" means "to push again," and hence "to push back" or "away." The simplest definition of the work is pushing the metal from one side and pushing again on the other side, until it assumes a "bold relief" and "correction of redundant form;" in short, raising and modelling the metal. Here we would point out that that class of work done by many amateurs on wood or lead, and which consists simply of hammering with a nail or punch upon the groundwork of the design, until by the expansion of the metal the pattern rises up in formless lumps, is *not* repoussé work at all. We therefore strongly urge those who fondly hope to imitate the great masters, or even to produce something artistic, to give up this method at once, for though by it "bold relief" may be obtained, yet there is no beauty of form nor correct modelling.

It will therefore be seen that flat chasing, for which designs (Nos. 2, 4, and 6) are intended, is but a step in the right direction, and should almost only be employed upon those articles which, of necessity, must be kept quite flat, such as tea trays, teapot stands, etc.

But to return, it is quite evident that the metal must be solidly backed up by some plastic material which will give at just the right spot, and at the same time possess an adhesive power that shall make the metal and itself one solid but impressionable mass; one, in fact, that would keep a true impress of the work were the metal suddenly and adroitly removed. What material will answer these requirements? Some writers mention wax; and no doubt wax was used by the earlier workmen.

Many amateurs (and, unfortunately, some school teachers) choose wood or lead, but none of these fulfil all requirements. Pitch, toned down with tallow and plaster of Paris, is very largely used by professionals, and is, no doubt, well adapted for the purpose; but as many amateurs and ladies have complained of the annoyance caused by the splintering off of fine chips which adhere to hands, face, and clothes, the writer has invented a composition which avoids the unpleasantness, and has been pronounced excellent by those who strongly object to a "mess."

Pans of pitch to be put in the oven or on the fire should *never* be used.

The metal to be decorated should be brass, copper, silver, or gold, and should in all cases be properly prepared; by which, we do not mean highly polished, but carefully planished and freed (by facing) from the scarcely visible flaws that will afterwards mar the work. The metal should also be selected for its softness, for some rolled metal, especially brass, is exceedingly hard and liable to crack. The metal must now be attached to the cement. This is effected by heating the metal, warming the cement, and pressing the former upon the latter by weight or otherwise, until absolute contact is obtained all over the metal.

The choice of tools is a very difficult matter, in which many amateurs have been grossly imposed upon; and our advice is, unless the buyer is an experienced workman, never buy of mere salesmen. The tools should be light, well tempered, and carefully faced.

The hammer should consist of a light steel-faced head, as shown in Fig. 1, upon a slender but strong handle. Mallets are not suitable for striking the tools. The tracer (Fig. 2), which is gently and rapidly tapped as it is steadily drawn along the outline of the work, as shown in Fig. 3, must be a well-made tool, properly pointed, without being too sharp, or the worker will be under a great disadvantage. Next in importance are the raising tools (Fig. 4). These are used after the metal has been turned face downwards upon the cement, and are hammered into the back of the design to produce on the face the required height and form. Having once more turned the metal face upwards, any "redundant form" is corrected with the modelling tools, which are very similar to the raising tools. Before removing the metal from this position, texture, surface, and matting tools (various forms of which are represented in Fig. 5) may be used to "superadd diversity of texture and even colour," and also to mat in the background. Other useful tools are: a mallet for roughly raising large and unimportant surfaces; a drawing point, with which to mark out the design on the metal; a pair of strong shears; a spirit or other lamp, and blowpipe to fix the metal on the cement; an iron for smoothing the surface of the pitch; a sand-bag to set the work upon; and a few unimportant sundries.

The metal used should always be large enough to allow of a margin, and in the case of trays and salvers, it is advisable to purchase them ready made, especially as it is impossible to make up some forms, such as those with plain spun edges, after working, without injuring the pattern thereon.

"But to what use can I put this work?" asks the amateur. The following list of articles to which repoussé work may be adapted will perhaps satisfy such an inquirer. Tea trays, salvers, card trays, ornamental shields, plaques, candle sconces and rings, alms dishes, spectacle cases, match boxes, flat candlesticks, menu holders, teapot stands, glove and handkerchief boxes, crumb trays and scoops, photo frames,

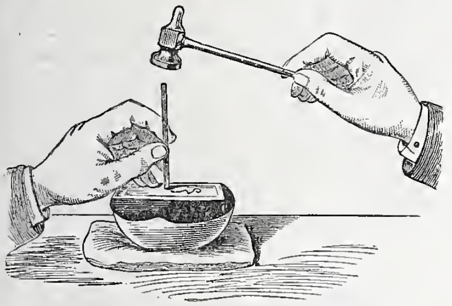


Fig. 3.

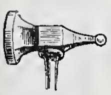


Fig. 1.

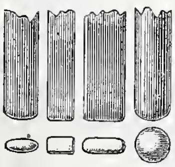
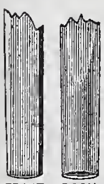


Fig. 4.



FRONT BACK

Fig. 2.

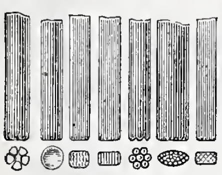


Fig 5.

Fig. 1.—Hammer for Repoussé Work. Fig. 2.—Tracer: A, Front; B, Back. Fig. 3.—Mode of Using Tracer. Fig. 4.—Raising Tools. Fig. 5.—Surface and Matting Tools.

finger plates, ash trays, brush and mirror backs, letter racks, panels for firegrates, coal boxes, cabinets, bellows, book mounts, and innumerable articles for which there is a great demand at bazaars and fancy fairs.

We will now make a few notes on the designs accompanying the present number, hoping at some future time to give more minute details of the actual working and use of the tools. The designs for flat chasing (Nos. 2, 4, and 6), should be traced, after they are drawn on the metal, with a medium tracer, not too blunt, carefully copying every line, endeavouring to produce the effect of an engraving. This done, the groundwork in Nos. 4 and 6 should be punched. That of No. 6 with a small ring tool or perloir. No. 5 may have a background put in with any fine tool. In No. 2 the ornament is to be matted or tooled over, leaving a bright background. As No. 6 is intended for a teapot stand, it should be worked on thick metal, and, when finished, have four small brass balls screwed to the back.

In Nos. 1, 3, 5, 7, 8, and 9, the outline should be traced with an ordinary tracer, moderately thick and not too sharp, tracing lightly where little relief is required, and more strongly in those parts that should be more highly raised. It must here be noted that in designs for true repoussé, no shading lines or marks to represent shading must be put in, as all effect of light and shade must be obtained by proper modelling; indeed, very little more than the mere outline should be traced. For raising, five or six modelling tools and a blunt tracer are required. Start with the bolder parts, taking them down in one surface, leaving details to be put in after general effect is obtained. Where sharp relief edges are required, use the blunt tracer just inside the outline. Having modelled the design as well as possible, turn the metal over again, thus bringing the work face uppermost; then trace round the outline with a blunt tracer. Touch up the modelling, smooth away roughness and excrescences, and then put in the background with suitable mats.

Some work is greatly enhanced by tooling over the raised design, but this requires much practice to produce a good effect, but, nevertheless, is well worth the painstaking effort necessary to learn this really difficult part of the art.

BORING SMALL CYLINDERS.

BY OLLA PODRIDA.

II.—Simple Way of Boring Cylinders in Self-acting Lathe with Saddle—Packing Up—Mounting and Setting Cylinder—Roughing Tool—Facing Flanges—Boring Bar—Wedge—Conclusion.

In the previous article on this subject, three different methods of manipulating work of the above nature were described. First, by chucking and boring in a self-acting traversing lathe with slide rest. Next, by means of hand tools, D bits, etc., in a common lathe provided with T rests only; and lastly, a makeshift, whereby the boring could be accomplished by hand without having recourse to a lathe for that purpose. All of these methods, and the last two in particular, are suitable only for small work, or where the bore is short, the difficulty of obtaining a smooth true bore with—in the case of deep works—a necessarily long and unavoidably springy tool being obvious.

The present article takes us a step further in describing a method whereby large as well as small cylinders may be treated, provided that a suitable self-acting lathe with a good saddle is at hand. The advantage of the method about to be described is that a practically parallel bore is obtained with a minimum amount of trouble. I use the term *practically*, because the wear of the tools in cutting prevents a perfectly true result being obtained in any case where a large surface has to be operated upon. This is of course unavoidable; all that can be done is to make sure that the tools used for the finishing cut are of good temper, and stand well, and this selection can only be made from experience, or rather actual experiment. When such a tool is found, carefully note it, and place it aside for such special duty only.

The process about to be described will be more clearly understood by reference to the illustrations. Fig. 4 is a front elevation of the lathe, showing the cylinder in black, mounted and fixed on the saddle ready for operation. For the sake of clearness, the cylinder is shown in section, and to economise space, part of the lathe heads and bed is omitted. The cylinder is held down to the saddle by bolts, *b*, *b* (see also Fig. 5, end elevation and cross section through boring bar and cylinder), and straps or plates, *p*, *p*. These straps bear on pieces of hard wood, *w*, *w*, fitted to cylinder body. Liners, or packing pieces, for keeping the cylinder at its proper height are interposed at *l*, *l*; these are also of hard wood. B is the boring bar, *c* its carrier, and *d* the driver. The T-shaped slots at *g*, *g*, are for the holding-down bolts, *b*, *b*. Figs. 6 and 7 give details of one method whereby the tool, *t*, is adjusted and secured in the bar, B.

Before proceeding with the details of setting and boring, it may be observed that in cases where the cylinder may appear too large for the lathe, the heads can be packed up to meet the case. This is commonly done in practice, and more especially in small shops where the choice of machines is limited, and their range small. Some engineers keep cast-iron packing pieces for this purpose, but hard wood will answer quite as well, at a pinch. The only thing to be watched is that, when the lathe feed is taken from the leading screw, the heads are not packed up beyond the reach of the change wheels; where the feed is obtained from an independent back shaft, it is only necessary to lengthen the small driving belt as required. The illustration given herewith may be taken as representing the boring of a $3\frac{1}{2}$-in. cylinder in a $4\frac{1}{2}$-in. lathe, with a boring bar $2\frac{1}{4}$ in. in diameter.

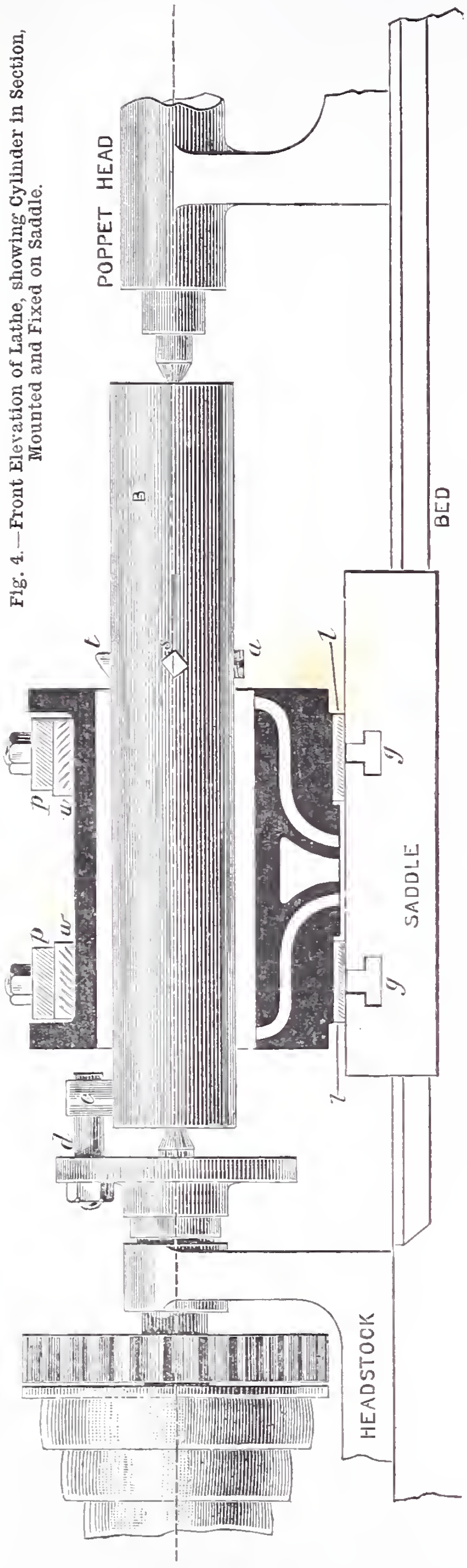
The procedure in mounting and setting the cylinder is as follows:—The slide rest having been removed, and the face of the saddle cleared, the cylinder is packed up to agree roughly with the lathe centres, and lightly bolted down by means of the straps, *p*, *p*, and bolts, *b*, *b*. The bar is then shipped in place between the centres, and the bore of cylinder set carefully to it by means of a tool stuck in temporarily for the purpose, or by the callipers or V-foot scribing block. If found too low, small alterations can be effected by strips of paper under the liners, *l*, *l*; if too high these liners must be planed down, always, and in either case, making allowance for compression of the liners. Lateral adjustment can be readily given by blows, where required, with a wooden mallet or block.

It is a good plan to check the bore with outside of cylinder, so as to ensure the thickness being equal all round. An important point to be observed is the adjustment of the saddle upon the lathe bed. If this is neglected, and it happens to be slack, an oval bore will occur, owing to side play. If too tight, undue strain will be thrown upon the self-acting gear, and a breakdown may result.

It will most likely be found that the strain on the holding-down bolts, *b*, *b*, has sprung the saddle slightly, and caused it to bind on the V's of lathe bed. This must be watched, and the wedge piece in front of bed adjusted accordingly. Everything having been set and adjusted, a fair start on the boring may be made. Two cuts, a roughing and a finishing one, will be sufficient, and the feed should not be heavy, say at the rate of forty cuts per inch. The roughing cut should be arranged so as to leave about $\frac{1}{32}$nd of an inch for the finishing one. Unless a circle has been struck on the flange for guidance, the tool will have to be set to depth by trial, a sharp look-out being kept with a pair of inside callipers set to size.

The roughing tool may be of the shape given in Figs. 6 and 7, but the finishing one must be flatter on the cutting edge, not so

Fig. 4.—Front Elevation of Lathe, showing Cylinder in Section, Mounted and Fixed on Saddle.



pointed, but thicker and bluffer, so as to guard, as far as possible, against "chattering." A slight alteration in the shape of the cutting edge of a tool often makes a wonderful difference in its performance, and, in this direction, experiment is by far the best guide.

By substituting knife or side cutting tools for the boring ones, the flanges may be faced in position, but the operation must be carefully carried out to avoid shifting the job; the whole surface of the flange should not be attacked at once; a narrow ring should first be faced commencing from the bore, then another larger one brought to the first, and so on, shifting or lengthening the tool by degrees until the whole surface has been roughed down. During these operations the feed must be given by hand, and the rough facing should be done after the rough and before the finished boring cuts. If possible, the flange of steam chest, or rather slide face, on which the cylinder is shown resting, should be secured by wedges or stops to prevent its twisting or shifting laterally upon the saddle. Before running the finishing cut through bore, the holding-down bolts must be slightly slacked off equally, so as to avoid, as far as possible, flattening or springing the cylinder; but in the case illustrated, owing to the proximity of the bolts to the flanges, and the small size of cylinder, this would not amount to any appreciable extent. It is, however, important in the case of large cylinders. I may add that where a suitable mandrel is at hand, the flanges may be faced upon it by a distinct operation, and with considerably less trouble than by the boring bar.

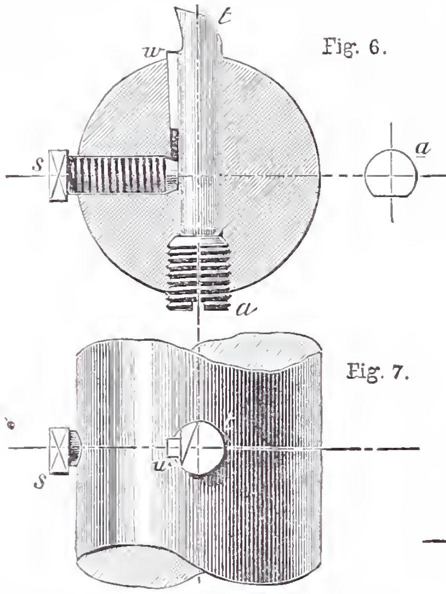


Fig. 6.—Section of Boring Bar, showing Method of Fixing Tool. Fig. 7.—Bar in Elevation.

Before concluding, a word or two about the boring bar must be added. It should always be as stiff as possible, and, therefore, as large in diameter as reasonable clearance for chips will allow. For large work, a block or head is keyed on the bar, and the cutters carried therein instead of in the bar as illustrated. The centres in ends of bar should always be carefully drilled to fit those of the lathe, and it is imperative that the one which runs on the dead centre of poppet should have a small hole drilled up a short way so as to clear the centre point, as well as to hold a small supply of lubricant; and with regard to this matter the centre must on no account be allowed to run dry or squeaky. This is important, as the finishing cut must be kept going *without the least stoppage* from start to finish. Fig. 6 gives a section of the bar, showing the method of fixing and adjusting the tool. Referring to Figs. 6 and 7, *t* is the tool adjusted vertically by the screw, *a*, and secured by the setscrew, *s*, the latter being further assisted by the wedge, *w*, which fits into a suitable slot and tightens against a flat upon the front of tool, which is shown clearly in the section at *a*, to the right hand of Fig 6. The setscrew, *s*, should be of steel, and slightly hardened at the point. The hole through bar for tool is drilled, in the first place, and then tapped at the bottom to receive the adjusting screw, *a*. The hole for setscrew is then drilled and the slot for wedge cut, after which the setscrew hole must be tapped. Both of these screws must fit well into the holes so as to guard against their working loose. The wedge, *w*, must also be of steel, but it should not be hardened. The tool should fit well into its bed, not too tight, but just a nice driving fit. It can be easily backed out when necessary by removing the adjusting screw, *a*, and using a drift. If at any time on account of limited clearance there is no room for head of setscrew, *s*, it may be taken out and the tool held only by the wedge, *w*, but this wedge must on no account be omitted, as on it depends the rigidity of the tool.

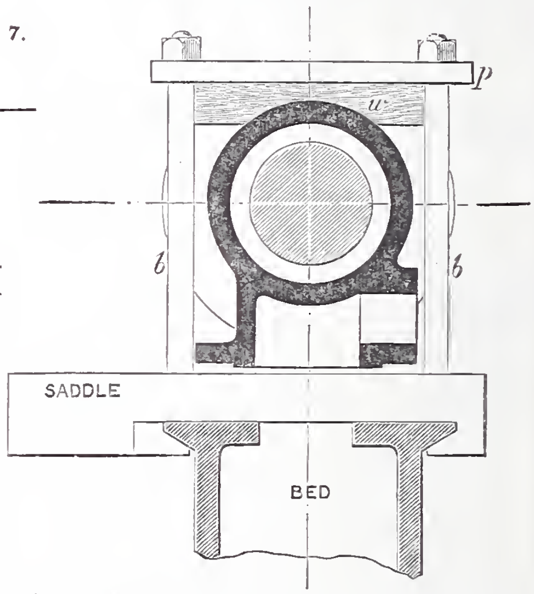


Fig. 5.—End Elevation and Cross Section of Fig. 4, showing Straps in Position.

In concluding, I venture to express a hope that the foregoing may be of assistance to some of the professional as well as amateur readers of WORK. The instructions given above are not necessarily confined to cylinders alone, but equally applicable to any form of work which may be more economically treated in the manner described. I hope to return to the subject or rather to a kindred branch again, and still further illustrate the simple extended uses to which a lathe may be put. Should there be any doubt attached through want of clearness in the above, I shall be happy to render what further assistance lies in my power through the medium of "Shop," which, I am glad to notice, is gradually growing, a proof of the interest taken in WORK by its readers, and the manifest utility of "Shop" to all who seek assistance in matters of doubt or difficulty.

THE SCRATCH OR BEADING ROUTER.

How to Make and Use it.

BY DAVID DENNING.

Utility of Scratch—Its Object—Its Action—Formation of Beading—Shapes of Cutters—Mouldings on Edge of Wood—Points to be Looked for in Scratch—Stock—Fence or Butt—Screwing Stock Together—Working with Scratch—Cutters—Combination of Beads by Simple Cutters—Moulding Curves—Stopping and Finishing Beads—Formation of Cutters—Cleaning up Work.

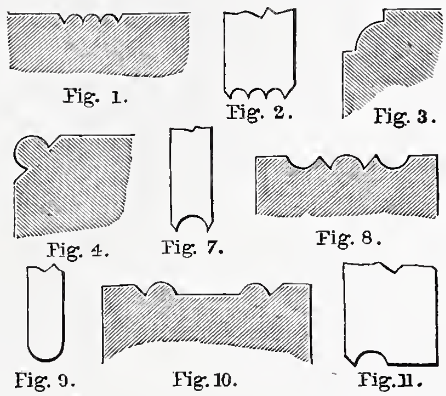
It is well known to those who are constantly in trade workshops that, whatever the handicraft pursued in them, there are little appliances for facilitating operations which are seldom seen by the outside public; that is, the tools are home made, and such as are not articles of sale in the ordinary tool shop. One of them is the "scratch," a tool much used by cabinet makers in forming the beads which play such an important part in modern furniture of the so-called Early English type. It is, however, not strictly correct to say that the scratch is not obtainable at tool shops, for, in a more elegant shape, it is offered for sale under the name of "bead router," or some similar title which has a better sound than plain, commonplace "scratch." However called, it is nevertheless only a modified form of the tool about to be described; and without wishing in any way to disparage the router, I do not think it can claim any advantages in practical work over the scratch. In point of economy, the latter has the best of it, for it can be made for as many pence as the other costs shillings, without any very great demands on time or skill. Another thing to be preferred about the home-made article is this: extra cutters can be prepared with the minimum of trouble as they are wanted to cut or scratch any particular form of beads or small mouldings. Still, as I have said, I do not want to decry the ready-made router of the shops; and the rougher variety, which, by the way, is the only one I have seen in use among practical workmen, may be offered as an alternative form for those who for any reason are debarred from purchasing ready-made tools.

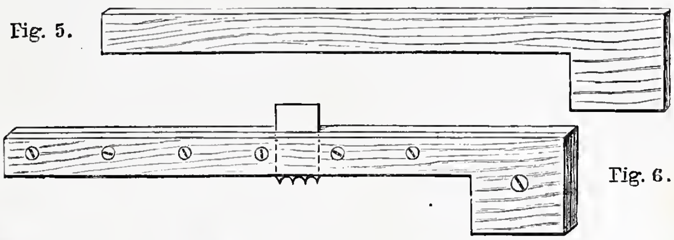
Perhaps, however, there may be some who do not quite understand what the object of the scratch is; and as it is more than probable that some of our readers are not acquainted with it, some little explanation of the work that can be done with it may be given before describing the tool more minutely. To begin with, it may be described as a kind of cross between a plain scraper and a moulding plane. Its action is a scraping one, but the cutter is held firm in a stock, which is so contrived that the edge of the cutter, when fixed for any given piece of work, shall always act on the same place on wood being beaded. A rebate plane does the same, but the blade of a plane works by cutting, and not by scraping. By filing the scraping end of the scratch cutter to any desired outline, it will be seen that the wood brought under its influence assumes a corresponding outline. Thus, for instance, if we want to cut on the surface of a piece of wood—say, on the square rails between two drawers, on the drawer fronts, on the framing of a door—three beads as in Fig. 1, all we have to do is to shape the end of the cutter accordingly, as shown in Fig. 2, where it will be seen that the beads are replaced by hollows.

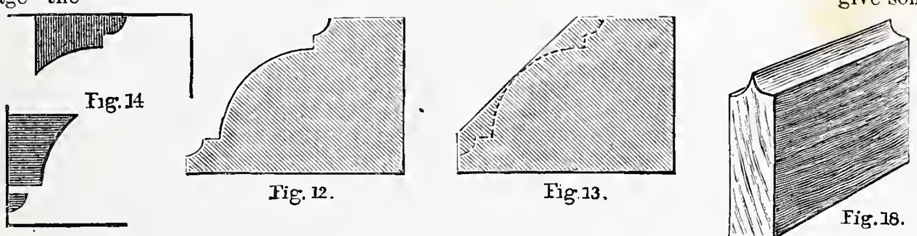
On the same principle, any desired section of beading can be formed by preparing a cutter of negative or reverse outline. An immense variety of the shapes that may be assumed by beadings is, therefore, at the disposal of any one who will take a little trouble to work them out. We are, perhaps, rather too apt to forget that the plain beading (Fig. 1) is not the only form this simple and effective means of decoration is capable of assuming, but that others are just as easy, although more complicated-looking. When the cutter is made, and of course the handle or stock to hold it in, there is no more difficulty in forming one outline than another.

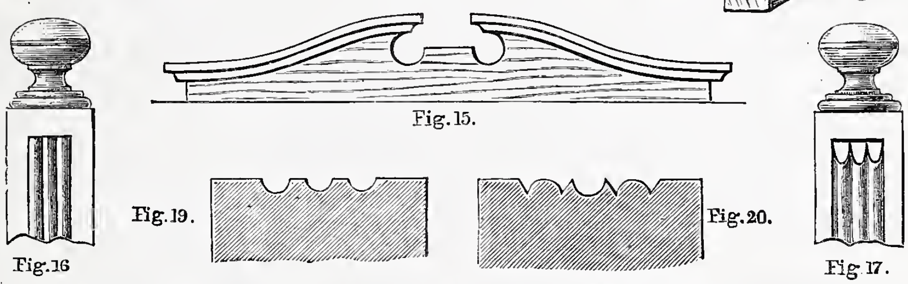
A further use that may be made of the scratch, and one that will probably commend it to those wood workers who are, as yet, unacquainted with its powers, is the facility with which small mouldings or beads on the edges of wood may be made with it. Take the common one shown in Fig. 3, so useful for the edges of shelves, etc., or the more elaborate-looking beaded edge in Fig. 4. No expensive tool, nor yet much skill, is needed to work these. The scratch will do them both; or if a stop-clamper is wanted, it may still be pressed into the service. Surely, enough now has been said to show the utility of the tool, and also to give some idea of its scope; so, without more ado, let us see how it may be made. Please note that the form and general construction are only to be regarded as typical; for one peculiarity of those tools which are generally made by the user of them is that they are seldom found alike in minor details. The things, not being made by machinery, or to a given pattern, are generally modified in some way or other to suit the fancy or convenience of the workman; and if a number of them were examined, it would most likely be found that, though there might be a general resemblance, no two would be exactly the same.

In the scratch, broadly speaking, the following points would be found in all, as without them it could not be a useful working tool:—They are, firstly, a cutter of sufficient strength to cut or scratch; and, next, a stock which, while holding the cutter firmly, shall yet allow its position to be altered when desired, and of such length and shape that it can be conveniently held, and the efforts of the workman applied with the best advantage. Further, as already hinted, there must be some guide by which the bead can be worked in a uniform line. These being the requisites, all other details are merely matters of









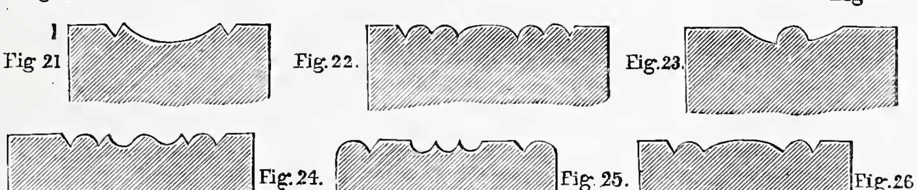


Fig. 1.—Beads. Fig. 2.—Cutter. Figs. 3, 4.—Moulding on Edges. Fig. 5.—Shape of Stock of Router. Fig. 6.—Scratch or Bead Router Complete. Fig. 7.—Cutter for Bead. Fig. 8.—Bead between Hollows. Fig. 9.—End of Cutter for Hollows. Fig. 10.—Beading with Sunk Flat between. Fig. 11.—Cutter for Fig. 10. Fig. 12.—Moulding. Fig. 13.—Wood prepared for Moulding. Fig. 14.—Position of Cutters for Moulding. Fig. 15.—Curved Moulding on Pediment. Fig. 16.—End of Upright with Knob. Fig. 17.—Alternative Finishing for Beads. Fig. 18.—Piece of Wood for Rubbing between Beads. Figs. 19-26.—Sections for Scratchings.

personal convenience, and for the present, at any rate, may be left out of consideration.

The stock is composed of two pieces of wood shaped as shown in Fig 5. The size is not important, but for ordinary work 8 in. to 12 in. in length will be found convenient, as it is sufficiently long to allow of being firmly held, and not so long as to be cumbersome. For the thickness, ½ in. will do very well. The width of the narrow part may be about 1 in., and of the wider part, forming the shoulder or fence, 1½in. to 2 in. The wood should be hard and strong; but, beyond this, it does not much matter what it is. Beech, ash, oak, and others of similar character, are all suitable, though, if equally convenient, the preference should perhaps be given to that first named.

It may be well at this point to say something about the width of the fence or butt end of the stock. When beading the edge of a board, this is not of much consequence, as the only difference with a deep fence will be increased friction; but if the surface is the part to be beaded, it will readily be seen that the fence should not be thicker than the board, if this is laid on a bench. With a wide board, such as a panel, the edge may overhang the bench, so that in this case the size of the fence does not much matter. As, however, rails and styles have frequently to be beaded, it will be found convenient to keep the fence narrower than the thickness of the wood it is to be worked against. Theoretically, a shallow fence is best, though, in practice, not much attention is paid to the theory. However, all that is necessary is that the fence shall be a little deeper than the projection of the cutter, in order that when this is applied to a new surface. it may be guided properly. Of course, it is necessary that the shoulder must be at a right angle with the lower edge of the stock, *i.e.*, those parts which will come in contact with the wood being beaded, will be at this angle. It does not matter whether the two parts of the stock are made separately, or are cut from one thick piece and afterwards sawn apart; but, in either case, it will be well to round off the lower surface a little, much as the stocks of cutting and marking gauges often are. In fact, if we take one of these tools as exemplifying the scratch, we shall not be far out; the essential difference being, that in a gauge the block or fence is movable with a fixed cutter, while in the scratch the cutter is movable.

The two parts of the stock are held together by screws — ordinary screw-nails, which should be stout. Three, or at most four, nails will be required for each stock, though it is quite possible to manage with only two. Still, it will be better to have one through the shoulder end. The position of the other screws is not of importance, provided they are so placed that they clamp the wood sufficiently to hold the cutter. As this may have to be moved to any part of the stock, it will be convenient to have several holes bored for screws, so that they may be used in whatever position may be most convenient for the work in hand. Fig. 6 shows the completed scratch, with the cutter fixed; and the mode of working it is as follows, though it may be almost superfluous to give this, as the manipulation must be almost self-evident:—The wood to be beaded is placed against the bench stop, or otherwise held, as if it were to be planed. The cutter (by the way, this, the stock, and the two combined are all, in workshop parlance, generally called the scratch, though, for the sake of description, I have particularised them) is placed at the same distance from the fence that the intended bead is to be from the edge of the board. Screws are tightened up — with an ordinary screwdriver—so that the cutter will not slip.

In working with the scratch, the right hand grasps the butt end, and the left the other end of the stock, which is held at a right angle to the edge of the wood to be worked on, with the shaped end of the cutter downwards. The fence is pressed against the edge of the board, and the scratch worked backwards and forwards till the beading is formed. Now, very little experience will show that the cutter should not project much below the lower edge of the stock, and that much of the appearance of the beads will depend on the way the cutter is set. Remembering that the cutter acts till the stock comes in contact with the surface, there will be no difficulty in understanding that it ought not to project much—only sufficiently, in fact, for all the members of the beading to be exposed. If it project too much, the beads, instead of being on the same surface as the level of the wood, as they generally are, will be sunk. If they are intended to be the latter, no difficulty will be experienced in making them so, by slightly projecting the cutter a little more.

Now about the formation of the cutter, to which some attention must be given, that cleanly-made beads or moulds may be the result. Steel is the best metal to use, and it goes without saying that it should be hard, such as that of which scrapers are made. The thickness is immaterial, so long as the metal is sufficiently rigid, but in excess, the difficulty of shaping the cutters will be increased. It may be said that the thickness of an ordinary scraper will do for any ordinary purpose, and, if desired, a scraper may be used for forming the cutters from. To do so, however, entails some labour, and pieces of broken band saws are generally employed for cutters—partly, no doubt, because they are little more than waste, but especially because the width is already prepared. Of course band saws vary in this respect; and to say that the width of a band saw is the proper dimension for a cutter, is much like telling one that anything is about the size of a piece of wood; so it may be said that the width of a cutter must depend on the size of the bead to be formed. This must not be too large, as the scratch, though a useful tool, is not a powerful one, depending entirely on the strength of the operator; and in unaccustomed hands, at any rate, the labour of cutting a wide series of beads, say anything over ¾ in., is not a slight one. Perhaps ½ in. would be a good limit for the novice; but so much depends on the hardness of the wood to be scratched, that no definite rule can be laid down. As this may seem a small limit, it may be suggested that any width of beading can be got by simply altering the position of the cutter, so that it scratches parallel with any that have been already made. Thus with a single narrow cutter with one recess, as in Fig. 7, a series of beads, which need not be limited to three, as in Fig. 1, may be scratched. It may, however, be said that three is a very usual number for these beads. Working on the same principle, it will be seen that almost any combination of beadings may be made by using different single cutters; thus the beading shown in section (Fig. 8), consisting of a bead between two hollows, may be made by using two cutters shaped as in Figs. 9 and 7, the former being for the hollows and the latter for the bead. Again, a beading such as Fig. 10 may be formed by simply reversing a cutter shaped like Fig. 11.

Hence it will be seen that a combination of beads to almost any extent may be made by a few simple cutters. What applies to beads on flat surfaces, it will also be seen, applies to mouldings, though these will be found more troublesome to work if the members are of large dimensions. Generally speaking, for obvious reasons it will be found that the work of shaping a moulding is much reduced by, as far as possible, preparing the wood—that is, cutting as much of the superfluous stuff away as convenient with a plane or other tool (say, a spokeshave for curved mouldings), and merely leaving the outlines of the moulding to be scratched with the bead. Thus, supposing that a length of moulding of the section given in Fig. 12 is intended to be worked from a piece of rectangular section, it will be obvious that the work of the scratch may be greatly lessened by planing the wood to the section shown in Fig. 13, leaving comparatively little waste to be removed by scratching. Though the large member of the moulding may seem a big one for the scratch to work, it must not be forgotten that the cutter may be reversed, for, the member being ¼ circle, it will be seen that a small cutter of ⅛ circle will do for it. Care will be required in cutting such mouldings, to see that the cutters are set at proper lengths, so that there may be no serious inequalities. Slight ones are of small consequence, as they can be removed with glass-paper. For such a moulding as that shown, the cutters, therefore, will only be two in number, their respective positions when in the scratch tool being as in Fig. 14, where, for the sake of explicitness, a short space is shown between each.

Perhaps, however, the chief use of the scratch—at least, where moulding planes are not available—is not so much in forming straight mouldings as in moulding curves—as, for example, that for a curved pediment like Fig. 15. When only a bead is to be scratched, or a small moulding planted on, it can be done much more easily with the scratch than by carving. In preparing curved beads or mouldings, the only special caution that need be given is that the stock should always be at right angles with the bead, in order that this may be parallel all through with the edge of the wood.

Now, when scratching a bead, or beads, these may either be extended to the end of the wood, as in a panel or the frame of a door; or they may be stopped, as they often are when they are on the front of pilasters, especially when shelves are supported by these, or when a little piece of carving is added. To discuss when a stopped bead or one extended to the end is best is out of the question here; but to "point a moral," take Fig. 16, representing the end of an upright surmounted by a turned knob. There is no special reason for taking this, beyond the circumstance that it is very often seen in modern furniture. With such a termination, there can hardly be two opinions about the desirability of the bead stopping a little below the end instead of running right up to the knob. On working the scratch, it will be found that a clean stop cannot be made, so the only thing is to scratch as far as convenient, and trim off the roughness at the end with carving tools, or, in default of them, with the next best substitute, a fine firmer chisel, taking care that the cut across the end is decided and sharp without encroaching on the flat. The beads should be neatly rounded right up to this cut. Another method of finishing the beads is simply to shave them off to meet the transverse line, as shown in Fig. 17. This entails less work of the two, but has, perhaps, hardly so sightly an appearance as the other. In beading the edges of shaped work, it will also be necessary generally to finish them off by carving; but as outlines vary so much, it is impossible to say that this will always be the case. A trial will always show whether it is necessary to cut or not; and the hint is given, more that recourse may be had to cutting tools when required than to say that they must be used.

Possibly something should be said about forming the cutters and preparing them, though most people will be able to devise means of doing so without being told how. Briefly, it may be said that they are merely filed down, small fine files of the ordinary kind being used. Too much care cannot be taken in shaping the cutters, for, whatever the outline of these, the worked beading will have the same. The action of the scratch being a scraping one, not a cutting one, the edges should be square and sharp without any "burr." As a rule, careful filing will do all that is necessary; but those who know how a scraper is sharpened need not be told that a scratch cutter may be finished in the same way. In order to ensure perfect accuracy in filing the scratch, it is not a bad plan to form a kind of mould of two pieces of thin wood, ½ in. or even less, with ends shaped as the cutter is to be. By placing this between them (using screws to clamp them together, or fastening them up in a bench vice) the cutter may be shaped with very little trouble. The wood serves as guide, not merely for shape, but by it the edges of the steel can be filed up truly square, even by those who are not skilled in the work.

When beads have been worked by the scratch, it will generally be found that they need "cleaning up" by papering. Only fine glass-paper should be used, and care be taken that the papering does not destroy the character of the beads by blunting corners or destroying rounds. To use the paper properly, it should be held over the edges of thin pieces of wood rounded off to fit the various members as nearly as possible; thus, between two plain beads a piece of wood trimmed off at the end, like Fig. 18, would be useful as a support for the paper; in the use of which, however, I must repeat, caution and discretion are required. A good bead should be clean, with a well-defined outline; and the advantage that may be taken of such a simple mode of decoration is by no means trivial.

The combinations that may be made are almost endless; so that, with a little consideration, many surfaces that it would otherwise be necessary to leave plain may be relieved from utter flatness without materially increasing the amount of labour bestowed on them. By way of showing what may be done in this direction, a few beads—or, rather, combinations—are given in Figs. 19 to 26, and from these suggestions no doubt the intelligent worker will be able to form others. He will also be able to determine the application of this kind of ornamentation to many surfaces which would otherwise be left plain and untouched, and the kind of ornaments which would be best suited to the article of furniture under treatment; there being no difficulty in preparing a cutter to carry out the style of adornment required.

"TIPS" FOR TYROS.

BY OPIFEX.

7.—Buhl Work.

Many amateurs, perhaps, do not know that what is known as "Buhl Work" is simply fret work executed in a peculiar way, and applied to the decoration of furniture, etc.

Very handsome frames and other small articles may also be produced by any one who possesses a fret-sawing machine, as this class of work cannot well be done with an ordinary fret saw.

Procure a sheet of thin sheet brass of the required size, which must be perfectly flat and free from dents; also a sheet of ebony veneer (true buhl work requires tortoise shell) of the same size and thickness as the brass; glue these securely upon the sides of a piece of cardboard, and then paste a sheet of white paper upon each side; place between two flat smooth boards, and apply good pressure. When dry, draw your design, and cut in the ordinary way with a fine saw; next damp with warm water, when the metal and veneer may be easily detached, and we now have two designs in the different materials, and the desired effect is produced by mingling the brass and ebony, the cut-out portions of the brass being inserted in the ebony background, and *vice versâ*.

This is accomplished by gluing upon a suitable foundation of some hard wood, as in veneering, again pressing, and when dry cutting out your frames, etc.

The surface should then be rubbed down with a flat pad—*i.e.*, a small piece of perfectly flat wood, round which is rolled a linen cloth; using emery flour and oil, and finishing with rottenstone.

The result will be that we have two articles, the one with brass design upon ebony, and the other ebony upon brass; a thin coat of varnish will complete the job, and prevent the brass losing colour.

8.—Artificial Marble.

A substance which shall resemble marble or alabaster, and be found useful for various purposes, may be made as follows:—

Mix fresh plaster of Paris with a strong solution of alum and water into a smooth paste, and bake in an oven till hard; when cold grind to fine powder, and mix with water. At this stage any dry colour may be mixed with the plaster in such a way that it shall run in streaks but *not* get thoroughly incorporated with the mixture. Now run into mould, and when set again bake, and when hard and cool dip in skimmed milk, dry, and polish with soft cloth and French chalk.

HINGES:

THEIR VARIETIES AND APPLICATION.

BY DAVID ADAMSON.

II.—Another Mode of Hingeing a Door.—Forms of Hinges.

Having in the preceding article named one way in which a door is hung and hinged, another method of doing so may now be instanced. Those who have paid the slightest attention to door fitting cannot have failed to notice that, instead of the door being within the ends or framing to which it is attached, it is often found covering these or outside of them. A very common example is in an ordinary wardrobe with sliding trays, and another in the small drawer pedestals on top of a "registered" writing table. In the latter the drawers are secured by a small hinged slip of wood which, for the present purpose, may be regarded as a door. Now it is obvious that were the door in such cases as these fixed as already described within the ends, the trays in the former and the drawers in the latter could not be drawn out. The hinged edge of the door would stop them. Of course, the end by the door may be, and often is, thickened up to allow of the drawers sliding, but then this naturally means that the length of the drawers is curtailed by at least the thickness of the door framing. If any doubt is felt about this explanation, a slight examination of a few articles of furniture will make it clear. It is an ordinary method of construction in sideboards of modern style. If two or three of these are examined, the pedestal containing the cellarette is almost certain in one, if not all, of them to be blocked to allow of clearance. I have said "almost certain," but I may go further and say positively certain if the door is hinged *within* the ends, so that a glance at the door will show whether the inside of the pedestal will answer the inquirer's purpose. With such a construction, however, we have nothing further to do at present, and it has only been named in order to indicate how the desired object may be attained by hingeing the doors on the end, and to make the reasons for such an arrangement clear. It must not, however, be supposed that it is only applicable when there are drawers and trays. Many reasons govern the causes why it is sometimes to be preferred, but it will be unnecessary to consider these, as it may fairly be supposed that the worker, when he understands the principles of both methods of hanging doors, will be able to decide for himself which he prefers. As a general rule it may, however, be said that doors should not be hung on the ends when it is necessary to cut away the thickness of the door frames from these, and leave an overhanging part, as, for instance, when there are drawers above the door, not behind it. Thus sideboards often—indeed, generally nowadays—have drawers above the doors, and it is for this reason the doors are within the ends. When, however, the door goes up to the top, or, as in the case of a wardrobe, runs right up to the frieze or cornice, there is no reason—at least as far as construction is concerned—why the door should not be hung on the ends. For the rest it is simply a matter of design, for no one, I imagine, would, unless from some very exceptional cause, wish to make a sham pilaster to move—that is, to form part of the door. To show more clearly when it would be right and when wrong to hinge a door on the ends, Figs. 4 and 5 are given illustrative of the foregoing hints. I trust these are made so clear that the amateur need not feel perplexed as to which construction he ought to adopt for anything he may make. Nor, I may add, will he vex the soul of the art furniture designer who knows his business by requiring him to "make up a lie in wood."

It is just as well to understand why and when to prefer one form of construction to another, so supposing we wish to hinge a door *on* the end, let us see how to do it in a workmanlike manner. Most of the work is done just as already described, the chief point of difference being that the hinge must be sunk in the end with, of course, the joint outside as before. The mode of fixing and general regulation are the same, but if anything, rather more care will be required to see that the bottom of the door does not drag. The edge of the door frame should be flush with the external surface of the end, and the hinge pin be in the same relative position as before. As an illustration has been given of the door hinged within ends, one (Fig. 6) is given in the same form for purposes of comparison, which will render any further explanation superfluous, especially as the letters refer to the same parts in each.

So far only the ordinary butt hinge has been referred to, but there are many modifications which come in useful at times, and though no detailed directions concerning the fitting of any of these need be given, a few of the varieties most commonly required may be named. It must, however, be understood that these are what may almost be called "articles de luxe," and if it is not thought worth while to avail oneself of them, they may generally be dispensed with, and the ordinary butt be substituted by a little ingenuity, though perhaps at a sacrifice of appearance. Try the effect, for example, of allowing the knuckle of the hinge to project further than stated, and it will be found, of course, that as the centre or pivot is further from the front the swing of the door is altered. Now it is easy to understand that in many instances—such as with carriage doors, where, owing to their curve, the pivot could not be fixed close up, as in the case of the doors described—a hinge which will allow of more throw must be used, by which all the centres can be got in one straight line, or when a door must swing clear of a moulding. For these purposes, therefore, there are hinges with comparatively wide flanges and screw holes bored near their edges. In addition to straight hinges of this kind, as shown in Fig. 7, they are made with the flaps bent. Figs. 8 to 12 show specimens, but there is such an immense variety of these cranked hinges, as they are called, that it is not possible to give anything like a complete list. Nor is it necessary, as they will seldom be required by the amateur. Indeed, the same may be said of almost all the fancy hinges, or those only used in special trades like the carriage hinges mentioned above. Probably, therefore, it will be sufficient just to name a few of the better known kinds, or those likely to be of more general use. Let us take first the heave-off hinge, the construction of which will be readily understood from the illustration (Fig. 13). From this it will be seen that the flaps are easily separable, and consequently a door or lid hinged with them can be removed without the necessity of unscrewing the hinges. A familiar example of their use will be found in Lancaster's original patterns of cheap cameras, which, it will be remembered, are fitted with them, one half of each hinge on the bottom board, and the other on the casing of the bellows body. Then there are the "stop butt hinges," which can only be opened half way, or to form a right angle, as in Fig. 14, instead of flat. These, of course, are very useful for fixing on box lids with, or a door which it is not intended should swing too far.

Sometimes with a heavy door it is desirable to use a hinge with one plate broader than the other, as in Fig. 15, the extra width of one flap allowing a greater "grip" to be taken on the wood than when both are narrow or only the width of the thickness of the door frame. These are known in the trade as wardrobe hinges. I think mention has been made that sometimes each

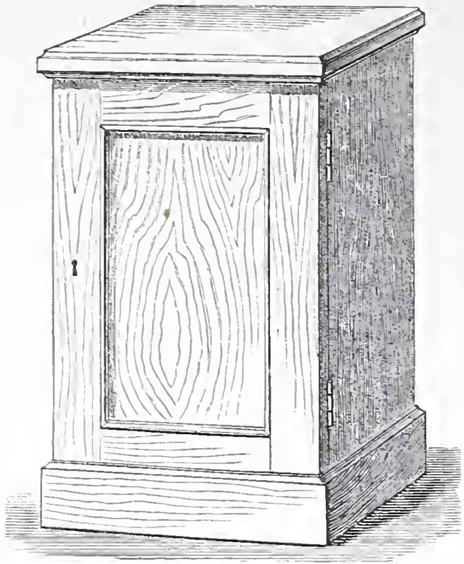


Fig. 4.—Door Hung on End: Correct Construction.

part of a hinge is sunk within the wood, and it may be said here that in furniture this is seldom done except when the weight of the door is so great that any additional support gained is required to relieve the downward drag on the screws. Both hinge plates being sunk this is reduced to the minimum. In Fig. 16, a hinge with plates

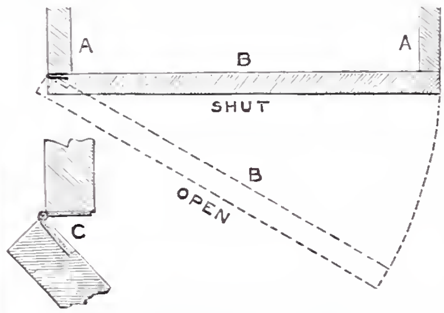


Fig. 6.—Diagram showing Door Hinged on End. A, A, Ends. B, Door. C, Enlarged View.

thickened to form a shoulder against the wood is represented; but they are seldom used, although their peculiar construction gives an appearance of great massiveness, besides other advantages in some cases. Another and more ordinary way of giving a slightly ornamental or more finished appearance to the hinge is by means of

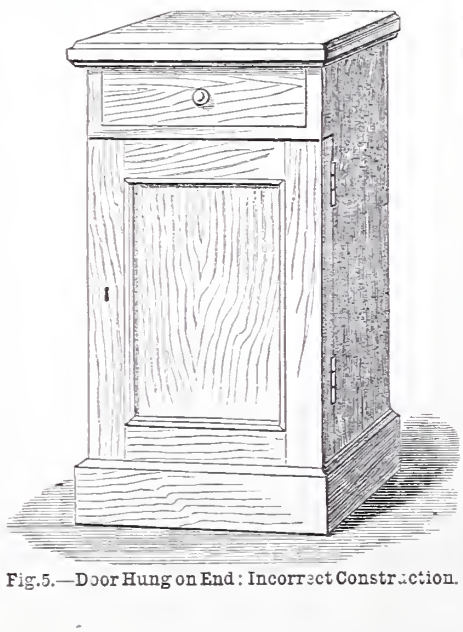
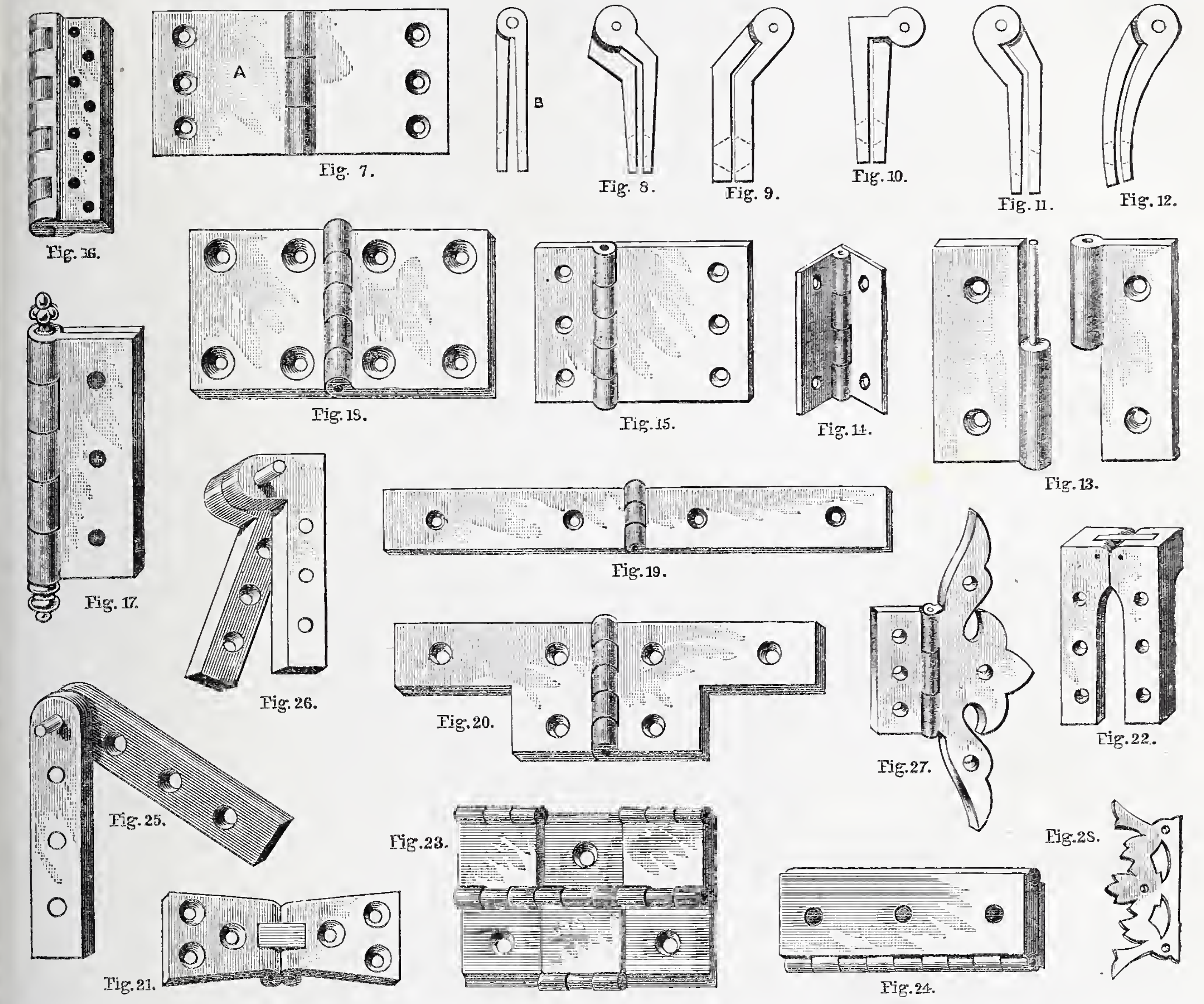


Fig. 5.—Door Hung on End: Incorrect Construction.

small knobs at the ends of the pins. These hinges are generally used in the better class of furniture, and should be inquired for as knob hinges or tipped butts. No difficulty will be experienced in recognising them from the illustration (Fig. 17), but it should be said that there is a large variety of patterns to which the knobs are made; for example, in a catalogue before me there are about thirty of them. As a rule it may be stated that knob hinges are generally well made and carefully finished, so that the apparently high price of hinges of this class is not caused solely by the knobs, but by the general quality.

But we must now take leave of the butt hinge for the present, and turn attention to other kinds. Perhaps next in order to it for general utility is that known as the "back flap," of which an illustration is given in Fig. 18. From this it will be seen that the proportions are quite altered, the plates instead of being long and narrow being wide and short. This indicates that their peculiar function is to connect two flat surfaces which it may be desired to hinge in such a way that they may be level when the hinge is opened out. A common use to which they are put in furniture is in the construction of flap tables, *i.e.*, tables which may be enlarged or diminished in size by raising or lowering a flap. The hinge plates are let into each piece of the table on the underside with the knuckle downwards, or the reverse way to that shown in the illustration. Another instance of their use may be seen in the old-fashioned bureau. In nearly all of these this kind of hinge is used to connect the lid or writing table part with the carcase. The hinge then is let in on top with the rounded joint upwards. From these two instances there ought to be no difficulty felt by the greatest novice in knowing in what cases to use the "back flap," and it is hardly too much to say that with either the "butt" or this, almost anything may be hinged. All others may be looked on as modifications of these. Take, for instance, the "portable desk" or "bagatelle hinge" shown in Fig. 19. It will at once be seen that this is nothing but the back flap hinge greatly narrowed in the direction of the knuckle with long, projecting plates. As I daresay is well known, and as its name indicates, this form is used for small writing desks and folding bagatelle tables, the long, narrow plates being sunk into the edges of the sides of these so that only the rounded part projects above the surface. Another variety of these hinges is shown in Fig. 20.

A distinct form of hinge is found in card-table or counter hinges, which may be used with advantage whenever it is not desirable to have any projecting knuckle. Fig. 21 is typical of them all. The flaps, it will be seen, are connected not by a pin running through them, but by a separate plate which is pivoted to each of them. As with all other hinges these vary considerably in detail, some having only one connecting piece, some two, and so on. It is, however, unnecessary to specify these, and after what has been said any remarks about fixing them are surely uncalled for. Without, however, giving numerous illustrations of these hinges, it will not do to pass over a distinct form for the same purposes, and known by the same name. This variety is shown in Fig. 22. The only special mention they require is that being fixed to the ends of the pieces they connect—not to the surfaces—they are used in pairs only. Therefore for very long joints, which, however, seldom occur in amateur work, they are not always desirable. Closely allied to the card-table hinge, among which they may be classed, are those like the one shown in Fig. 22, a form very convenient for attaching the folds of a screen or similar purposes. The plates are of course sunk in the top and bottom edges of the framing. It must not, however, be inferred that they cannot be used in other situations, or that they are suitable for screens which are intended to fold in any direction. When this is required of the hinge shown in Fig. 21. To describe their construction and fitting (a somewhat difficult job, by the way) would, however, require more space than can be spared at present, and no doubt for all practical purposes enough has been said by calling attention to the fact of there being such a hinge for those who wish to use it. While treating of fancy or special hinges omission must not be made of the butler's tray hinge, which, however, is seldom required except for the piece of furniture from which it that the hinges should not be seen, though what objection there can possibly be to a good hinge being visible may be a puzzle to which some of us can give no satisfactory answer. However, the fact remains that some prefer to use a secret hinge, or to give its more ordinary name, a centre hinge, of which a plain one is shown in Fig. 25. It does not occur to me that they are used except for hanging doors, which may either be within or on the ends. In either case their use entails more labour than the



Illustrations of Various Kinds of Hinges. Fig. 7.—Wide Flat Butt or Coach Hinge: A, Plan; B, Section. Figs. 8-12.—Sections of Bent or Cranked Hinges. Fig. 13.—Heave-off Hinge. Fig. 14.—Stop Butt Hinge. Fig. 15.—Wardrobe Hinge. Fig. 16.—Narrow Brass Projecting Butt Hinge. Fig. 17.—Knob Hinge. Fig. 18.—Back Flap Hinge. Fig. 19.—Desk or Bagatelle Hinge. Fig. 20.—Ditto: another Form. Fig. 21.—Card-Table or Counter Hinge. Fig. 22.—Ditto, for Fixing on Ends. Fig. 23.—Double-Action Screen Hinge: Open. Fig. 24.—Ditto: Closed. Fig. 25.—Centre Hinge. Fig. 26.—Cranked Centre Hinge. Fig. 27.—Ornamental Hinge. Fig. 28.—Hinge Plate.

the regular screen hinge must be used. These are perhaps the finest and most ingenious of the various kinds of hinges usually met with, and this is equivalent to saying that they are, compared with single-action hinges, expensive. To derive the full benefit from them they must also be very carefully fitted, even more so than in ordinary hinges, but beyond this caution it will be unnecessary to say more about fitting them. The ordinary double-action screen hinge is shown open and closed in Figs. 23 and 24; but there is another very important variety somewhat on the principle takes its name. It has a kind of what in default of a better term may be called a spring stop, by means of which the sides of the tray are kept upright when required. Their upper surfaces are flush with the wood, without any projecting knuckle. If, however, the tray is made with square-ended flaps, it is not necessary to have this form of hinge, as for the spring stop may be substituted a special catch let into the flaps of the tray. It is, however, advisable to use a hinge which does not, even at the joint, project above the wood.

Occasionally it is considered desirable ordinary butt hinge, for either the door must be rounded off or a shallow groove for its edge to turn in must be cut in the piece against which it works. Much might be said about this and the general fitting of centre hinges, but they are so seldom used that anything like full directions would only encroach needlessly on valuable space. Should I be mistaken in supposing that the information is not of much use to readers of this magazine, I shall be happy on some future occasion to give all necessary instructions, and the same may be said about any other kind of hinge and hinge fitting.

At present I must content myself with saying that great care must be used to get the projecting pin seen in the illustration correctly centred in the door frame. One part of the hinge, of course, is let into this, and the other into the wood above it. These centre hinges are also to be had "cranked" or bent in a variety of ways, one of which is shown in Fig. 26, in order to suit different kinds of doors and throw them back as may be desired. A few years ago these centre hinges were much used for wardrobes, and there is perhaps this to be said in their favour, that when the construction of anything seems so ashamed of itself that it wants to look like something else, or in plain English, a sham, the centre hinge is an admirable contrivance. But with all this, occasionally it may be used with advantage; all I want to impress on those who have no very definite ideas about propriety in construction is, not to make use of the centre hinge unless there is some better reason than the false notion that a hinge is an ugly thing in itself, and should be kept out of sight when possible. This leads me to say that a hinge may really be made a very ornamental adjunct to any piece of furniture by using a strap hinge, in which the flap is placed outside. Some made for this purpose are highly decorative, but the same effect may be gained by the use of hinge plates, which are merely pieces of ornamental brass. They are screwed on to, say, a door, close up against the hinge, to which they must, of course, be equal in length. If there is any other brass work, such as handles, about a piece of furniture, it is desirable that the hinge plates should correspond with these in general design. Fig. 27 gives a complete hinge with ornamental flap, and Fig. 28 shows a separate plate. Both of these are reproduced from Messrs. R. Melhuish & Sons' admirable catalogue, in which several ornamental hinges are pourtrayed.

In addition to the hinges of which mention has been made, there are a large number of others used principally by builders, or at any rate in building construction, and differing in shape as well as in size from those used in cabinet work; but space forbids for the present more than this passing notice, and any remarks about them must be deferred.

NOTES AT THE ARCHITECTURAL AND BUILDING TRADES' EXHIBITION, 1889.

It may seem to some that such a display as the above would only appeal in interest to the thoroughly practical man. The title, "Architectural and Building Trades' Exhibition," brings to the mind of many people visions of nothing but bricks, mortar, and sewer pipes, interspersed, perhaps, by way of variety, with chimney shafts and roofing tiles, and they hold aloof therefrom in consequence. It is, however, only necessary to give the matter a minute's thoughtful consideration to effectually dispel such an illusion; for, with the immense progress of modern times, there have been produced a thousand and one contrivances, in connection with our houses, which are of the greatest interest to one and all alike, indispensable as they are to their daily comfort. Our habitations are, nowadays, from the front door to the roof, fitted with innumerable inventions calculated to increase the comfort and, what is more important, the safety of the people who live therein, and to those whose desire it is to be up to date in their knowledge of such matters, a visit to the Agricultural Hall, during the period in which the Building Exhibition is held, cannot but be profitable.

For the benefit of those, however, who, by reason of time and circumstances, have been unable to go in that direction, a few notes on the most interesting and useful exhibits there may be welcome; and to that end we took an opportunity to visit the Exhibition and review the goods to be found therein.

As the most usual and generally accepted way of entering any house or building is through the door, it is fitting that inventions connected with that piece of wood work shall be considered first, and of these there were shown many possessing great practical utility.

Mr. Robert Adams, of 67, Newington Causeway, S.E., had, in his exhibit, a variety of contrivances associated with the opening and closing of doors, which showed the strides made in that direction of late years, and of these, the "Victor" spring hinges were, perhaps, the most admirable. These hinges are, of course, more adopted in public buildings than in private houses; but there are few people who have not, at one time or another, to use doors so fitted. Some forms of the "Victor" hinges are, doubtless, well known to our readers, but there is a development of the action which has been recently introduced, and which demands notice. It is styled the "New Crown Victor Silent and Non-silent Patent Double-Action Door Spring Hinge," and is certainly one of the most compact hinges of its kind. The mechanism is so contrived as to be always compensating, the result being that no slackness can arise from wear; and one of the principal objects of it rests in the fact that the weight of the door is so provided for, that it cannot possibly cause the pivot to wear, thus precluding any likelihood of the heel of the door rubbing against the hollow of the frame. The "Hurricane" spring hinge, also by the same firm, is so arranged as to resist any force of wind in exposed positions, and yet to allow of being opened by a child in an opposite direction.

Certainly, one of the greatest difficulties in the domestic routine of the household is cleaning the outside of upper windows; and it sometimes really makes one shudder to watch the acrobatic feats of servant girls on a high, narrow window sill. To provide for this, and, indeed, entirely remove all danger from the operation, the new sash gear, from the hands of the same inventor, shows what appears to be a perfect solution of the question; and were it employed more generally in extensive buildings, the number of accidents which one hears of from time to time would considerably diminish.

In the same direction, Messrs. Hill and Hodges were showing a floor spring hinge which they are putting into the market; and for bank, lobby, and other double-action spring doors, its efficacy seems indisputable. The main point with regard to the hinge in question is that, instead of having an ordinary square or pivot, it has a solid arm on its axis or pivot, which projects on end; and the advantages accruing from that arrangement certainly call for notice from those who have to do with such matters.

From the door to the hall is but a step, but in that short distance there arise new requirements and necessities, which have called forth multifarious inventions. In the entrance halls of houses of a more pretentious character, floor-cloth, linoleum, and carpeting have given way before that description of flooring known as parquetry. That such should be the case cannot for a moment be wondered at, for good parquet is characterised by a durability, evenness of surface, and beauty of appearance, which combine to make it a powerful rival to other materials of a softer description. To those anxious to discover how far the manufacturers of that particular flooring have extended their operations, the exhibit fitted up by Turpin's Parquet Floor, Joinery, and Wood Carving Company, of 22, Queen's Road, Bayswater, constituted a good index by which to judge. With some people, the one great objection against the adoption of parquet flooring has been its expense, but with the ever-increasing capabilities and improved facilities possessed by makers to-day, it is being brought more within the reach of all; and one thing is certain, housewives will be the first to welcome the advent of such a decorative and highly sanitary flooring. Of the latest of Messrs. Turpin's productions, the patent thin parquet flooring is, perhaps, as important as any. This latter quality is $\frac{5}{16}$ths of an inch thick altogether, including ornamental pattern and backing; the latter of which is made of either one, two, or three wood laminations, laid crossways of the grain of the wood at right angles. By that means, the thin parquet is rendered as strong and durable as that 1 in. in thickness, and is capable of resisting the strain of heavy bodies placed upon it, without any ill effects whatsoever. As must be apparent to those who are compelled to study economy, and yet desire to embellish their houses in that direction, this latter description appeals very strongly; and the fact that it can be removed at pleasure from the under flooring, without either sustaining any damage, is an additional commendatory qualification. In these days, when bad, "puddingy" carving is so rife, to see really good cutting is refreshing, and it is only due to say that several panels shown by Messrs. Turpin were of the highest order. Some dado panelling, also emanating from the same workshops, called up the "good old times" when wood-panelled rooms were more in vogue than they are to-day.

Mr. Henry Bassant, of 87, Charlotte Street, Fitzroy Square, further represented the parquet industry; and good workmanship, combined with artistic judgment, characterised the selection to be seen on his stand. Up to a very recent date, the patterns worked out in parquet were somewhat restricted, the difficulty of disposing the blocks of wood in free decorative schemes being no small consideration. Now, however, designs are being produced which show that the difficulty specified is giving way before modern improvements; and many patterns shown by Mr. Bassant were of a really free and artistic character.

From the floor to the walls is the next most natural step, but, strange to say, what is technically known as the "decorating" section of the building trades was left almost entirely unrepresented in the recent display. There was, however, one exhibit of great interest to those who study the development of wall decoration. It consisted of a new Cordovan leathern wall decoration, styled "Calcorion," manufactured by the "Calcorion" Decorative Company, Limited, Addison Works, Woodstock Road, Shepherd's Bush, W., and there is no uncertainty in predicting that it will be sure to find favour in the eyes of high-class decorators. The rare beauties of old Spanish leather hangings, authentic examples of which are now so scarce, have been expatiated upon by painter and poet; and when one looks at such rooms as are to be found in, for instance, the Musée Plantin in Antwerp, it is impossible not to regret, in a measure, the disappearance of that material from our walls. It is to satisfy this want that "Calcorion" has been devised; and certainly, as far as appearance goes, it seems fully qualified to do so. From an economical point of view, the new wall covering would not, perhaps, find favour everywhere, although the simpler designs are reasonable in price. Economy is not, however, quoted as a qualification thereof, and the more elaborate schemes of decoration, worked out in that material, are altogether *recherché*, and would grace the highest palaces in the land. In texture, "Calcorion" is much akin to leather, and when embossed and decorated, it would require an experienced connoisseur to detect the difference. Its natural colour is buff, but, as may be readily understood, a pattern embossed on it may be treated in any colours that may be deemed desirable, thus allowing great scope in treatment. It is manufactured in pieces of 12 yards length and 36 inches in width, and the method of affixing it to the walls is much the same as that employed with other thick materials of a like description, strong paste being the chief factor in the operation.

Further continuing the decorative line of thought, a fine ceiling in fibrous plaster was shown by the Hitchins' Fireproof Plastering Company, Limited, 1, Gresham Buildings, Basinghall Street, E.C.; which served to further substantiate the claim of that material for use in extensive schemes of decoration. Fibrous plaster is, by this time, so well known, that to lengthily describe it here is unnecessary, but there are one or two improvements introduced by the above firm to which attention must be drawn. What are termed wirework slabs, that is to say, a thickness of fibrous plaster, having through the centre, and forming a foundation, a square of wirework netting, form a new feature; and, from the method of their manufacture, are absolutely fireproof in every respect. By the use of that description of slab, the necessity for ordinary lath and plaster is avoided; and, in addition, the work can be painted, papered, and finished within a very short period of completion.

Architectural wood work, as might be surmised, played an important part in the year's show, and among those manufacturers of wood mouldings for interior decoration, Mr. Samuel Elliott, of the Albert Steam Joinery and Moulding Mills, Newbury, exhibited a choice selection. In this section, again, we find the influence of modern progress, for, whereas in days gone by a skirting board and cornice moulding were deemed sufficient, nowadays, dado and picture mouldings are indispensable, and the industry has undergone further development in consequence.

It is often the case that the beauty of an interior, especially one of a less elaborate character, depends on the sharpness and disposition of the mouldings employed in it, and for the architect to have such a selection to fall back upon as that shown by Mr. Elliott is half the battle. Mouldings in oak, walnut, and other woods served to show that manufacturer's capabilities in that direction, and also gave the uninitiated an idea as to the development of that particular branch of wood work.

Another excellent display of turnery, joinery, and interior wood work came from the Keighley Timber and Saw Mills Company, of Lawkholme, Keighley, Yorks., and the north country certainly could not have sent to town better representatives.

As a selection of high-class joinery and turning it was to the fore, and such indispensable factors as balusters, skirtings, mantels, windows, and examples of panel work were shown by that Company, and went to prove conclusively that a builder nowadays is not under the least necessity to send abroad for his wood work, as some seem inclined to think that they are.

Another stand of a similar character was that of Messrs. L. W. Ransom and Company, of the Britannia Works, Kensal Road, W. Staircases, handrails, newels, balusters, scrolls, wreaths, caps, etc., were there to be seen in abundance, and indicated that the requirements of the trade are well understood and studied by those wood workers.

The importance of the window-cleaning difficulty, already referred to, is so great that numerous inventors have made it the subject of study, and of those the "Millar's Patent Reversible Window Company" offer an admirable solution of the question. Windows fitted after the manner shown by that firm can be easily reversed—that is to say, the outside brought inside—by anybody, and any necessity to sit out on the sill is completely done away with. A more practical and admirable arrangement few would desire, and the combination of simplicity with perfect efficiency is there successfully accomplished.

When one compares the gasfitting and general domestic metal work of to-day, more particularly in the way of chandeliers, gas-brackets, etc., with that of years ago, the result is decidedly satisfactory; and people are, fortunately, beginning to appreciate the fact that metal work, in the hands of an artist, is one of the most charming materials for decorative purposes. The idea entertained by some, that to be a metal worker is lowering, is fast being dispelled, and the world-wide reputation made by Quintin Matsys at the forge is proof enough as to the absurdity of that notion. Indeed, one of those artificers in metal who exhibited (Mr. A. G. Hamilton), has called his works "The Quintin Matsys' Forge," and it was gratifying to observe that the work shown by him was of such a high class that the great master himself would not have taken exception to it. To attempt to describe all the knick-knacks on his stand would be futile, but we may briefly say that several standard lamps and hanging lanterns in wrought iron by that maker were equal to any being produced. Some gong stands in the same material constituted rather a unique speciality; and one or two decorative wrought iron kettle stands were of a character to elicit admiration from the artist and the housewife alike. There is a sturdy grace associated with wrought iron work which appeals to our English tastes, and to those who love to see the imprint of the workman's tool on artistic productions, the study of that special branch of metal work is full of enjoyment.

Electricity as applicable to the house received a full share of attention, and of those who make a special study of that branch Messrs. Verity Bros., 137, Regent Street, had fitted up a most interesting display. To those who consider the electric light inapplicable to the private house the stand in question would have been a revelation, for chandeliers, or, to speak more correctly, electroliers, side brackets, standard lamps, and others, all illuminated by electricity, were the most incontestible proof of the way in which that wondrous fluid has gained ground. A somewhat recent invention shown was a combination of gas and electric fittings, so arranged that a bracket could be used for either purpose at will, without any difficulty or alteration. Messrs. Verity also exhibited specimens of their wrought iron work, which was of the highest class, and, indeed, did space permit, their stand invites further description; but we must proceed.

One of the most important and extensive sections of the Exhibition was that devoted to machinery, and it is in that department, above all others, that the stamp of modern progress is most unmistakably affixed. Machines for this purpose and that purpose, for making bricks and executing the most delicate mouldings; mechanical contrivances from a steam engine to a fret saw, all demanded attention; but to attempt to particularise one tithe of the good qualities claimed for them would be folly. A cursory glance is the most that is possible in such a connection; and to start with motive power, Messrs. Crossley Bros'. gas engines took a high place. The "Otto" gas engines are far too well known to require comment here; and any one visiting the Exhibition who desired testimonials as to their reliability had only to glance up at the array of prize medals shown, and doubt was set at rest.

Following in the same line, Messrs. J. E. H. Andrew and Company, 80, Queen Victoria Street, London, showed several of their "Stockport" and "Bisschop" engines, and the best test of their quality was the manner in which they fulfilled the duties allotted to them.

Messrs. Dick, Kerr, and Company, 76, Queen Victoria Street, had an array of their "Griffin" engines working away, and to judge from such a collection as was there shown they fully justified the description given of them.

Of wood-working machinery the display was large and satisfactory, and whether the visitor was an amateur or artisan there was sufficient to interest him for a long time.

Messrs. J. Sagar and Company, of Stone Dam Works, Halifax, showed by their exhibit that they have a perfect grasp over the manufacture of all branches of wood-working machinery, and to adequately review their stand alone would fill a small volume. Of the machines at work there, the "Self-contained" band sawing machine, the "Premier" combined hand and roller feed panel, etc., planing machine, and the "Hand-planing and trying-up machine," were some of their latest productions, each possessing qualifications which go far to recommend them for high-class work. Fret saws, from the simplest to the most elaborate, were in active operation, and one particular machine, constructed to work with either strained or unstrained saws, at pleasure, attracted much attention. The "Variety" wood worker is the style and title of another contrivance from the Stone Dam Works, and as it successfully performs the operations of planing, sawing, moulding, grooving, jointing, rabbeting, squaring, chamfering, tenoning, mortising, and boring, the name is certainly fully justified.

Machines of a great diversity appeared in the stands adjoining, but space will, unfortunately, not permit their description on this occasion.

OUR GUIDE TO GOOD THINGS.

30.—The C. H. M. Improved Flooring Cramp.

Notice has been taken in this part of Work of some lathes, lathe chucks, and excellent tools of various kinds used for ornamental turned work and in joinery. Our attention is now turned to appliances that are different in character to those which have just been mentioned — appliances that are chiefly useful in building and carpentry strictly so called, and which may be termed the C. H. M. specialities. This, at first sight, appears a somewhat singular and quaint distinction; and many, perhaps, will be puzzled for a moment to determine what C. H. M. may mean. The difficulty, however, will vanish when they are told that all the articles to which reference is made, and which are illustrated in this page, are manufactured by Mr. C. H. Matthews, 13, Charles Street, Wolverhampton, who has utilised the initials of his name in this way as a sort of trade mark by which to distinguish goods of his own make from all other goods of a like kind and serving like purposes that may happen to be in the market.

The first of these, the C. H. M. Improved Flooring Cramp, is illustrated in Fig. 1, in which are clearly shown its construction, the manner in which it is used, and the purpose which it serves. It is serviceable in laying down flooring, and by its aid the floor boards are forced into as close contact as possible along their length before they are nailed to the joists. The ends of two floor boards are shown in position on a joist; one of them has been already nailed down, and the other is being tightly jammed against the nailed board by the machine before it is itself secured by nails. The cramp rides, so to speak, on the joist, and is gripped tightly to it by the handle and contrivance shown at the side of the joist. By turning the handle shown on the opposite a bevel cog wheel is turned, which gears into a larger wheel of the same kind, from the centre of which a deeply-cut screw proceeds, whose extremity works freely in a metal plate perpendicular to the joist. The screw works through a piece of metal with a rounded head attached to one end of the bar, which is driven by the action of the screw against the floor boards, exciting considerable pressure, and compelling a close joint between the boards. The cramp is made of malleable castings, and is furnished with wrought iron wormed pins and steel lance-blade teeth. It is light, compact, steady in its action, and serviceable, being formed to grip joists from $1\frac{1}{2}$ in. to $3\frac{1}{2}$ in. in thickness, and by reason of its construction, compressing floor boards with the greatest possible force directly applied. These cramps are sold singly at 21s. each, and in pairs at 40s. per pair.

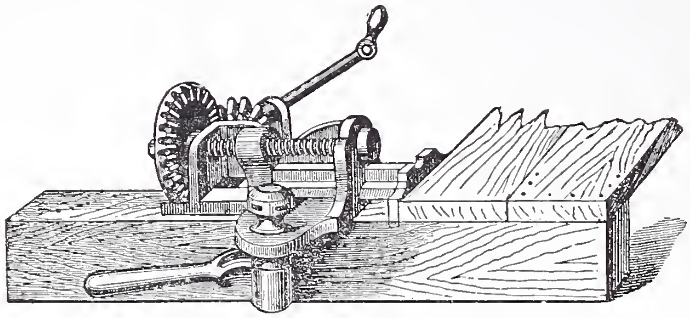


Fig. 1.—C. H. M. Improved Flooring Cramp.

31.—The C. H. M. Lever Handle, Bright Bar, Planed Wedge-Action Bench Cramp.

The Bench Cramp, whose name has just been given in full, differs in many particulars from similar contrivances in general use, but the principle on which it is made and its action are very much the same. Both parts, B and C, are movable along the bar, D; but the portion C may be rendered immovable to resist the pressure of anything impelled against it by the part B. When in work, B is moved towards C, on the bar, D, by action of the screw turned by the bar inserted in the head of the screw at A. The part C, which, as it has been said, is movable, becomes immovably tightened on the bar, D, by depressing the handle, E, and forms a line of support on the bar, D, for direct pressure transmitted from B. Under ordinary pressure, C may be rendered movable by raising the handle, E, upwards with the hand, and under severe pressure a blow in the direction indicated by the arrow will effect this without injury to the cramp. This cramp is made for setting out for joiners, cabinet makers, etc. It is made with bars from 1 in. × ¼ in. × 16 in. to 2 in. × ½ in. × 66 in.; sold respectively at prices ranging from 11s. to 50s. Couplings and lengthening bars are supplied for cramps above 48 in. in length, ranging from 48 in. to 66 in., and sold together at prices from 16s. to 24s.

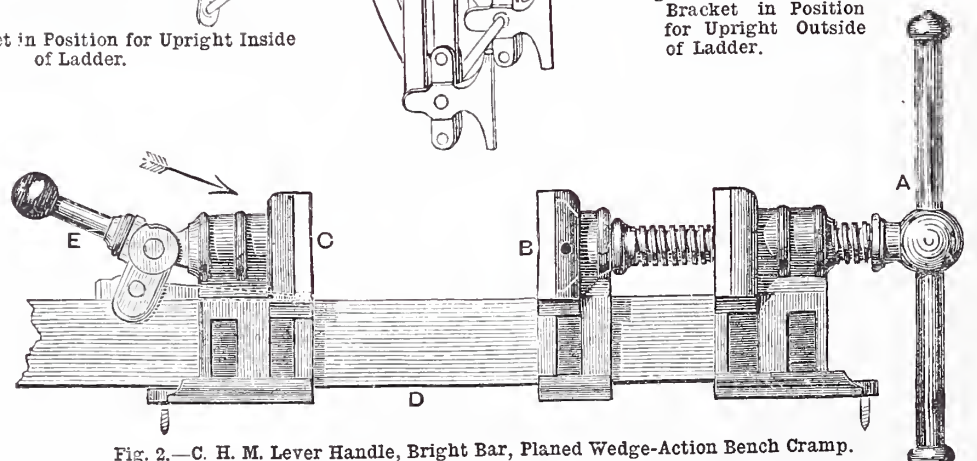


Fig. 2.—C. H. M. Lever Handle, Bright Bar, Planed Wedge-Action Bench Cramp.

32.—The C. H. M. Improved Bracket.

These brackets are made in wrought iron, and are useful for bricklayers, plasterers, painters, etc., when it may be found necessary to form a temporary scaffolding by means of planks and ladders. The brackets may be used with ladders at any incline as far as the perforations in the brackets will admit, and on either side of the ladders. In Fig. 3 the bracket is shown for use on the outside of a ladder, the ladder being upright, and the bracket being hung on it by hooks, which are placed two on one round, and two on the third round below. As the ladder's incline is greater, the bars on which the planks rest must be lowered as shown by the holes pierced on the framework of the bracket. Fig. 4 shows the mode of slinging the bracket from the inside of the ladder; it is, in fact, reversed. Fig. 5 shows the bracket closed for removal. The brackets are strong, light, portable, and safe in use. They are made in three different sizes to suit rounds $1\frac{1}{8}$ in. in diameter and 9 in. apart, and $1\frac{1}{4}$ in. in diameter and 10 in. apart. Prices range from £2 4s. per pair to £3 6s. per pair. Brackets to suit ladders are made to order.

The Editor.

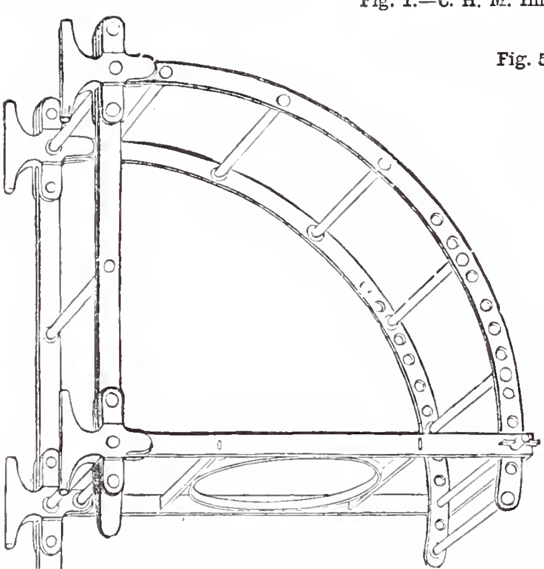


Fig. 4.—Bracket in Position for Upright Inside of Ladder.

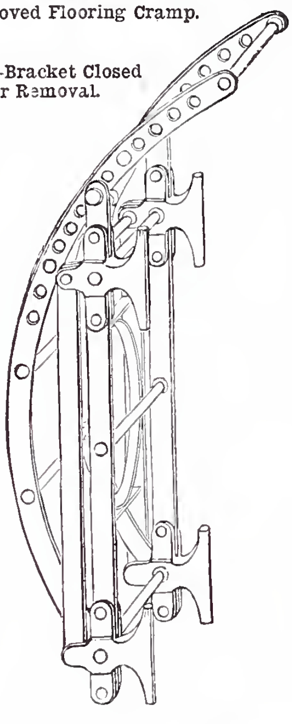


Fig. 5.—Bracket Closed for Removal.

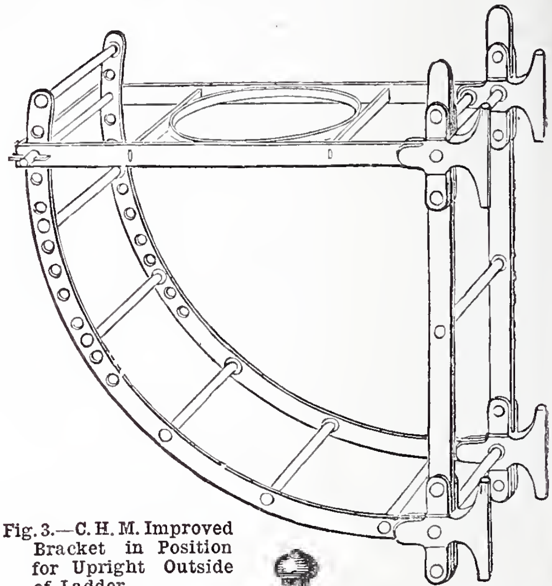


Fig. 3.—C. H. M. Improved Bracket in Position for Upright Outside of Ladder.

SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

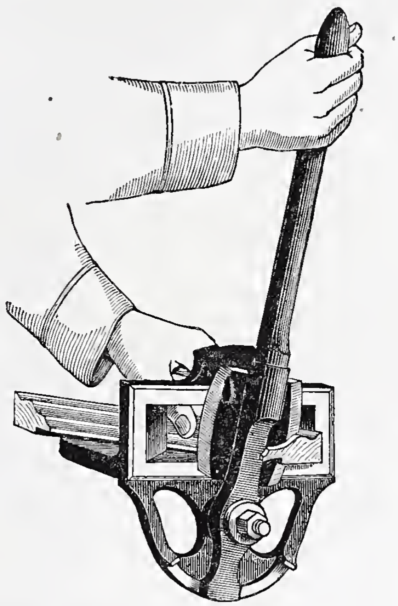
I.—Letter from a Correspondent.

A Good Word for "Work."—E. D. (*Old Kent Road*) writes:—"It was with pleasure I saw the announcement of Work in *Cassell's Saturday Journal*, about three weeks before the first number came out. I said to myself, this is the very thing that is wanted, and at once made it known to several of my acquaintances, five of whom have commenced to take it in. I shall continue to make it known as much as I can, as I am sure it will be a great boon to many like myself who are fond of making things, having been an amateur workman for more than twenty years. I am sure it was really wanted. I am also pleased with the article by David Adamson ('Artistic Furniture' in No. 2), not so much for instructing us in utilising old packing cases, which often spoil our tools (new stuff is so cheap that it is not worth while to use old), but for advocating the use of nails or screws in making up work. I have made a good many things in my spare time: tables, chairs, book-cases, cabinets, and overmantels, all of which are screwed and glued, or nailed. I never could make a proper dovetail, it being so difficult, and I am sure that inability in this respect has deterred many from making anything really useful, otherwise than mere ornaments or knick-knacks. One thing I will ask of you: that is to announce any exhibitions of mechanical work, so that myself and others can have time beforehand to send in any articles to exhibit. I wish your Journal every success, which I am sure it will have."—[Thank you for your goodwill towards Work, and your good words and deeds in its behalf. You must remember that although new stuff may be cheap enough, it is by no means well seasoned, and therefore often inferior to packing-case material, which frequently has this advantage. All mechanical exhibitions of which we may have notice shall be duly announced in Work.—Ed.]

II.—Questions Answered by Editor and Staff.

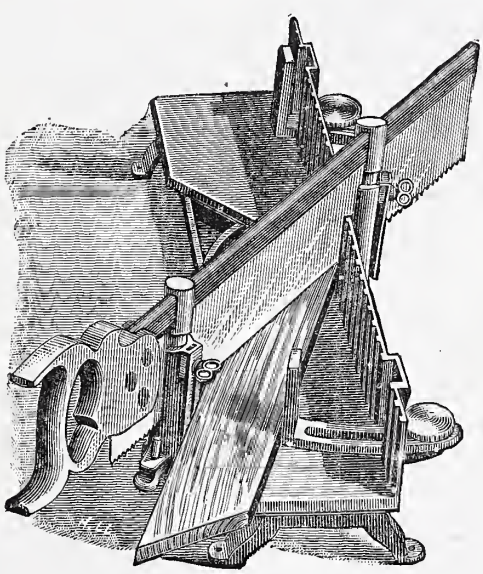
Picture-Frame Making.—W. B. W. (*Liverpool*).—You ask "that some practical illustrations be given as regards the best and easiest method for an amateur to form the right angle in sawing the pieces from the long slip of gilt or other frame, so that they may join exactly and neatly in framing a picture;" and you then proceed to describe the home-made mitre box you have put together to aid you in cutting the pieces of the frame from the moulding, and say that "although you saw it through according to the angle slit, invariably the corners will not join in an exact and neat manner." This, I must first remark, shows that the "angle slit," as you call it, in your mitre box, otherwise the transverse saw cut or saw kerf through the upright sides of the box, is not truly made at an angle of 45°. Were it so, the joints at the corners of the frame could not fail to be made exactly and neatly, to use your own words, because when two pieces correctly cut at an angle of 45° are put together, edge to edge, one piece being cut in one direction and the other in a direction precisely opposite, they cannot fail to make a true right angle or angle of 90°. You will find a mitre box correctly illustrated and described in Mr. Adamson's paper on "Artistic Furniture" in No. 3 (page 35), the illustrations being Figs. 10 and 11 in page 37, the former showing a perspective view of the box, and the latter the box in plan, or as viewed from above, exhibiting clearly the directions of the transverse cuts that must be made downwards through the sides. I venture to recommend you to have a mitre box made for your own use by a skilled mechanic, and you will then find no difficulty in cutting your mouldings properly, because you will have a true and reliable guide to cut them by. If you are disposed to lay out a few shillings in providing yourself with a machine for cutting mouldings, I have given here an illustration of an "Improved Mitre-Cutting Machine" made by Messrs. Booth Brothers, Dublin, and sold by all dealers in tools, etc. The price of this machine to cut 2-in. mouldings is 12s. 6d., and an extra cutter may be had for 2s. 3d. There was an American mitre box in the market some years ago, with which a tenon saw or a panel saw could be used equally well; but this seems to have been superseded by the "Improved New Langdon Mitre Box," of which an illustration is appended. Ordinary mitre boxes cut from right angles to angles of 45° inclusive, but this mitre box cuts, by using the circular arm or guides, from right angles to 73° on 2½-in. wood. In addition to this, it is claimed for the Improved Langdon that it is the only box adjustable for mitring circular work in patterns, emery wheels, and segments of various kinds. The prices for the four sizes in which it is made range from 24s. without saw, and 34s. with saw, to 70s. and 84s., without and with saw respectively. The first size will cut 3½ in. at right angles, and 2¼ in. at the mitre, and the largest size 9½ in. at right angles, and 6½ in. at the mitre. You are now in possession of the best existing means for cutting mitres correctly. Thank you for your efforts in making Work known to your friends.

Electro-magnet.—A. G. (*Croydon*).—Your query, relative to an electro-magnet required "to lift the greatest weight with two quart Bunsen cells," cannot be exactly answered, unless we know the conditions under which the magnet will be worked. For instance, a magnet working at some distance from a battery through a line of wire will not develop as much magnetic power as the same magnet worked up close to the battery. In planning a



Booth's Improved Mitre-Cutting Machine.

magnet to develop the greatest capabilities of a battery, we must take into consideration the resistance of the whole circuit, and proportion the coils of wire to that resistance. Then, again, the nature of the work to be done must be considered, whether the magnet will be required to simply hold up a weight *placed to its poles*, or to *attract and lift* a weight to its poles from a distance. The power of a magnet on an armature detached from its poles varies in an inverse ratio with the square of the



Improved New Langdon Mitre Box.

distance of the armature from the poles of the magnet. The best *holding* power is secured by a horseshoe form of magnet with the cores placed close together, whilst attractive power is slightly increased by placing the cores wider apart. Assuming that you will use a magnet close up to the battery, the following instructions will enable you to utilise the full power obtainable from two cells placed in series. Use a 9-in. length of ⅝-in. best Swedish iron made soft by annealing, and bent into horseshoe form, with its legs or cores 2 in. apart. Get two ebonite or boxwood bobbins 3 in. in length by 1½ in. in diameter, and wind on them (as a reel of cotton is wound) nearly 1 lb. of cotton, or silk-covered No. 16 B. W. G. copper wire. Silk-covered is best if you can get it. Wind one bobbin from right to left, the other left to right, and join the inside end of one coil to the outside end of the other. Fill both bobbins. The bobbins may be had from Messrs. H. Dale & Co., 26, Ludgate Hill, E.C., who will also wind the wire on them if you desire them to do so. No. 18 wire may be used if the magnet is to be worked at a distance from the battery.—G. E. B.

Wood Screw Cutters or Boxes.—R. R. (*London, E.C.*).—The screw boxes and taps described in "Our Guide to Good Things" (No. 3, p. 46) may be purchased of Messrs. Richard Melhuish & Sons, 85 and 87, Fetter Lane, E.C., or direct of Messrs. Alexander von Glehn & Co., 7, Idol Lane, London, E.C., agents for Messrs. Peugeot Brothers in the United Kingdom. The specialities of this firm of French manufacturers seem well worthy of attention. Having given the information you ask for, I will append the concluding paragraph of your communication, and express my pleasure at finding that Work has been so heartily welcomed by yourself and others. You write:—"Allow me to congratulate you on the success which must attend the publication of such sterling information in such a readable form, and at such a popular price. I am sure Work will do good work."

Coloured Cement.—J. H. C. (*Bow Road, E.*).—I am not acquainted with any firm that make coloured cement, but it is possible for you to give any colour you please to cement, whether chocolate, black, or any other, by adding to the cement colouring matter which you can purchase of any oil and colourman.

Advertisements in "Work," etc.—F. T. (*Bristol*).—It is difficult, I can assure you, to locate advertisements otherwise than where they are at present. I can only submit your views to the Manager of the Advertisement Department, to whom I will also mention your wish to see a "Sale and Exchange Column" opened in the Magazine. Your newspaper cutting—*i.e.*, "Lighting by Electricity"—has been forwarded to Mr. Bonney, who will readily tell you what he thinks of the statements set forth therein. Stereotyping will be treated in Work in due season.

Slips for Wood-Carving Tools.—Tom.—You ought to be able to procure these through any dealer in tools, etc. If, however, you are unable to do so, apply to Messrs. R. Melhuish & Sons, 85 and 87, Fetter Lane, London, E.C. In reply to your query as to how these shaped slips are to be used, you will understand that as it is not possible to sharpen some varieties of carving tools, as V cutting and veining tools, on a hone or sharpening stone, as ordinary plane irons, chisels, and gouges, the sharpening must be effected by rubbing the shaped stone on the edge of the tool. In order to effect this in the most thorough manner possible, the slips are shaped to suit the conformation of the tools for which they are intended.

Marking Steel and Iron Tools.—W. L.—Put a coating of yellow soap or beeswax on the steel or iron on which you wish to write your name. Then, having written your name on the soap or wax with a bone point or quill point, taking care to mark through the soap, raise a small wall of the material used for coating the iron round the space on which the name is written, and fill with a mixture of strong acetic acid 3 oz., and sulphate of copper, sulphate of alum, and muriate of soda, each 4 drachms. Let this remain until the name is sufficiently bitten in, and then pour off acid and clean the iron.

Overmantel.—Barrington writes:—"The overmantel shown in No. 2 can be made from old tea chests. I think they are made of a kind of cedar. They can be had for threepence each—good-looking wood." [This is going to a "deeper depth" than Mr. Adamson even contemplated. Will you kindly send me a sample of the wood, as I should very much like to have a look at it? I have never been able to put tea-chest wood myself to any other use than that of lighting fires, and it will be quite a new experience to me to find that our friends the Chinese have used any material in this way worth having. It is otherwise with the lead lining.—Ed.]

Elizabethan Twist in Lathe.—C. C. E. writes:—"May I remark—as you invite remarks—upon your description of the 'Lukin' Lathe, that a spiral chuck, without the addition of a costly set of change wheels, is of no use even for a spiral; and that with them you cannot cut an *Elizabethan* twist, which has a convex contour; and that although I have *heard* of two lathes that can cut them, I do not believe there is any lathe in existence by which they can be produced. Hence the word 'Elizabethan' is misleading. They are effected by cutting a spiral groove, and then finishing approximately by rasps and files and paper, as you probably know." [If the spiral groove can be cut in the lathe, why cannot the sharp edge of the spiral groove be also removed, and the Elizabethan twist finished, without rasp or file? After receiving your letter I called on a turner, in whose shop I had seen some Elizabethan twists, and he assured me that they had been produced entirely in the lathe, and were turned, I think, at Bristol. He also showed me a double spiral that he had begun to cut himself, but which had broken through a flaw in the wood.

Further, to make sure that I was not mistaken in the matter, I put the question to another workman, who has gained his experience under one of the first, if not *the* first, lathe-makers in the United Kingdom, and he, too, said there was no difficulty whatever in *completing* an Elizabethan twist in the ornamental lathe, with proper tools. I am aware that your experience is also great, and I shall be happy to insert any communication from you *per contra* to what has been stated as to the possibility of doing what you say can only be partly done, hut not finished, in the lathe, leaving it to be taken up and answered by those who, like yourself, are skilled turners.—Ed.]

Bookbinding.—J. S. (*Moss Side, Manchester*).—Papers on this subject are being written for Work.

Violin Making.—J. S. (*Moss Side, Manchester*).—A skilled maker of violins is intrusted with the preparation of a series of thoroughly practical papers on this subject. These will be brief, and to the purpose, and will be commenced at the first convenient opportunity.

Coal Mining.—Fretwork.—You say:—"Will you kindly let me know if you intend devoting any part of your paper to the art of mining, such as coal? I hope this will not offend you. As I am a collier, it is natural I should ask such a question."—[To this I may say that no question, he it what it may, that is put with reference to any kind of work that is done by man, can give offence. On the contrary, your query, and all queries, are heartily welcomed, because they evince the wide and earnest interest that is taken hy workmen of all grades and trades in Work, which is intended hy all who are concerned in its production to he truly and honestly helpful to workmen. You may rest assured that when any opportunity offers of touching on matters connected with your calling, it will be done; and that when any invention is produced likely to lessen the perils of mining, and to be helpful to the miner, it will be described. Meanwhile do not hesitate to ask any special question bearing on your trade on which you require information.—Ed.]

Cabinet Making.—R. G. (*Birmingham*).—You will soon have detailed instructions in cahinet making to help you. It is scarcely worth while to devote a supplementary sheet to working drawings of a cahinet in fretwork large enough to keep the weekly numbers of Work in. Make a plain hox of the proper length and breadth, and 3 or 4 in. deep. Ebonise it, and cut an overlay in white wood to he attached to sides and top. You will soon find suitable patterns in fret work for overlays of this kind in Work. There are pleuty of good things of this sort in store for you.

Thin Circular Saws.—A. R. (*Scorrier*) writes:—"It is every employer's place to get as much work done with as little cost as possible; some try to do it hy having cheap tools and cheap machines, and employing men that have had little practice at low wages, which, in the long run, proves to he the dearest. A bad machine, a bad saw, and an inexperienced man is dear at any price. To work a thin saw—in the first place, there should be a good machine, a good saw, and a careful practical man to work it. I say 'careful,' because I have seen men that have had much practice very careless, and no hetter men than those that have had little practice. We often see in sawmills where there is hard and soft wood nearly all the time cutting, that the saw that has to cut the hard wood has to cut the soft wood as well; this is a mistake. A saw to cut hard wood should he stouter than for soft wood, and sharpened differently; consequently it will require more power to drive it, which means cost. Again, should saws that are stout enough for soft wood be used in cutting hard wood, they soon get crippled, and run untrue. Therefore you will see that by having saws for each class of work, thinner saws may be used in cutting soft wood to advantage. Again, how often do we see deals up to 11 in. deep, having only two cuts put in them, sawn in the deal frame, when with care and a little skill they could he sawn with a circular saw, and more than twice the amount of work turned out in a given time, and with a very little more waste than if sawn with frame-saws. As a rule, deal frame-saws are from 16th to 15th gauge. A circular saw 30 in. diameter, of 14th gauge (which is less than the 80th part of an inch stouter), could be used for cutting deals, etc., up to 11 in. deep if kept expressly for such work, and worked hy a careful man. Another advantage in cutting deals with thin circular saws, is to have a curved wedge made of steel fixed close to the teeth at the hack of the saw—the front of the wedge to be the thickness of saw-kerf, and the hack of wedge one-half thicker than saw-kerf; this will prevent a certain amount of friction on saw-plate; and on the timher leaving the saw, the teeth at the back are not so liable to catch the timber and throw it back to the sawyer, doing him, perhaps, great injury. Much more might he said in reference to thin circular saws, hut I will take up no more valuable space in this number."

Electrotyping.—J. O. A. (*Manchester*) writes:—"I shall be much obliged if you will give me a little information on electrotyping. I have been trying to make an electro for letterpress printing, but I cannot get the deposit to go into the hollow parts of the mould. The mould is $2\frac{1}{2}$ in. × $3\frac{3}{4}$ in., the anode is $4\frac{1}{2}$ in. × 7 in., and the battery is a three-cell quart Daniell coupled in series. The solution in porous cells is about 12 water to 1 acid. I have a zinc cylinder in one cell, and a cast zinc plate in each of the other cells. The mould is suspended in a solution of cupric sulphate in the usual manner, and the connections are made with No. 16 copper wire. Does a stronger solution in porous cell give a stronger current? also, do the zincs require filing smooth when they hecome pitted or eaten hy the acid? I find that I do not get as good results when I only use one or two cells, but I do not want to add to the number until I get some information as to the cause of failure." [To the above the reply is:—All your arrangements are right as far as I can see. Have you used the best hlack-lead, and brushed this carefully into the deeper parts of the mould? The deeper hollows must receive careful attention to insure success. Use a small sable pencil to hrush the lead in the hollows. Have you any acid in the cupric sulphate solution? It must have some free sulphuric acid to dissolve the anode, or the work will not go on right. A stronger solution in the porous cells would strengthen the current, but 1 of acid to 12 of water is quite strong enough for a Daniell battery. Have you amalgamated the zincs? No need to file out the pits in the zinc plates; but well hrush them, and keep them amalgamated. All that I have written on this subject in my article on the Bunsen battery applies with equal force to the Daniell. A bunch of copper wires as an anode, with the tips of the wires pointing close into the hollows, may help to start the deposit in those parts.—G. E. B.]

Proportion of Fly-wheel.—J. P. A. writes:—"I should like to know the proper rule for finding the diameters of the driving cone, when the diameters of the cone on the spindle are known. I have a small one; the diameters are $1\frac{1}{2}$ in., $2\frac{1}{4}$ in., 3 in., and $3\frac{3}{4}$ in., and I want to make the driving cone, so that the hand will be as tight on one speed as another, for turning metal."—[To this the answer is:—It would be very much less expense and trouble if J. P. A. endeavoured to find some one who has a pattern, as it is a costly one to make; hut by finding the proportion between the relative speeds, the tension of the hand may be made to coincide with each. At the same time, for such diameters as given ($3\frac{3}{4}$ heing the largest), it is not worth the trouble, as little metal-work can he done in such a lathe, except of a very small size.—J. H. H.]

Polishing Metal.—Machinist.—You ask:—"How are the finely-polished surfaces seen on the lathes and machines sent out hy such firms as the Britannia Company obtained? Especially those of the cog-wheels, where it is impossihle for an emery disc to be used, seeing that the part hetween the edge of the face and the boss is recessed. Then, again, there are the mouldings, and small hand-wheels with circular rims." [To this the reply is:—The process of polishing and finishing lathe and other work will depend a great deal upon the way in which it is manufactured. Such work as referred to is generally left from the machine, and very little time spent on it after. With regard to the finish of cog-wheels, these should not be polished in any way whatever, hut left entirely from the cutter.—J. H. H.]

III.—Questions Submitted to Correspondents.

In deference to a wish evinced hy many, that their queries should he suhmitted to correspondents and readers *en masse*, presumably in the hope that many may be induced to give their experiences on the points and questions raised, this section of "Shop" has been commenced for this purpose. Correspondents and others answering inquiries in this section are requested to head replies with the number, subject, and initials, etc., or *nom de plume*, at the commencement of each query, and append their own initials, etc., or *nom de plume*, as they may prefer.

1. Lawn-Tennis Court.—J. H. C. (*Bow Road, E.*) asks:—"Can any one tell me if there is any sand which would bind without cement, for covering a lawn-tennis court? I am told that in the south of France the lawn-tennis courts are covered in with such a sand."

2. Elastic Moulds for Electrotyping.—T. W. (*Foley Street, W.*) writes:—"Will any one give, under the preceding heading in Work, a receipt for making elastic moulds for taking impressions from metal medallions slightly *undercut?*"

3. Graduation of Hydrometer.—Barrington writes:—"Will some one tell me how to graduate a hydrometer? I have made one of tin, and I do not know how to mark the scale. I want to use it for liquids between 1010 and 1040."

4. Cheap Still.—Barrington asks:—"What is a cheap way of getting up a still to produce small quantities of distilled water, using the heat of a grate?"

5. Solidifying Petroleum Oil.—W. H. (*Liverpool*) asks:—"How can I solidify the common commercial petroleum oil, such as is sold for lighting purposes?"

Letters awaiting attention have heen received from the following correspondents:—X. Y. Z. (*Orkney*), G. M. (*Calvin*), S. A. C. (*Coventry*), W. H. D. (*Edinburgh*), W. D. (*Newcastle-on-Tyne*), W. J. W. (*Henley-on-Thames*), A. C. J. (*Regent's Park*), F. S. (*Exeter*), W. R. S. (*Croydon*), F. R. S. (*Kentish Town*), A. E. G. (*Ipswich*), R. O. (*Soho*), W. J. P. (*Portslade*), "Moulder" (*Limehouse*), J. B. (*Longfleet*), H. B. (*Glasgow*), O. H. (*London*), H. H. (*Gosport*), T. E. (*Stamford Hill*), S. H. (*Esher*), F. B. B. (*Colchester*), J. I. (*Longsight*), J. W. L. (*Sheffield*), A. E. (*Liverpool*), Amateur (*Liverpool*).

Trade Notes and Memoranda.

The Taff Vale Railway Company has introduced the electric light into its passenger trains. The power is obtained from Brush machines run off the axle of the van.

Edison's newest phonograph, comprising all his most recent improvements, is now on view at the Gainshorough Gallery, Old Bond Street, London, W.

A new patent safety lamp for miners, the invention of Mr. Clifford, was recently exhibited at a meeting of the Manchester Geological Society, and has been described as sound in principle, and eapahle of giving very good results, hoth as to safety and all-round illuminating power.

A light hammer, weighing 10 ozs. only, faced with hide, for jewellers' use, has heen designed hy W. Oliver, of Buffalo, U.S.A. It is useful for striking an elastic hlow without inflicting injury upon delicate work.

M. Chevreul, chemist, author, and centenarian, has just died. He was the last witness of the Great Revolution, having been horn on August 31, 1786. In 1813 he was a professor in the Lycée Charlemagne, an officer of the university, and Director of the Chemical Department at the Gohelins-Tapestry. It was here that he devoted himself to those studies in colours which have made his name famous. It was his researches into the composition of fatty suhstances that led to the invention of the stearine candle. He was a Fellow of the Royal Society of London, and a Commander of the Legion of Honour.

Noel Masson, who died a few days ago in Paris, was so unfortunate as to lose hoth his hands in the Franco-German War. In spite of this misfortune he became one of the most expert etchers of his time. He was hest in landscape. At the time of his death he was only in his thirty-fifth year.

Woods of British Borneo.—The principal and most useful wood found in British Borneo is "bilian," or iron wood. Its characteristics are these:—hardness, density, and the heing ant-proof. The logs run from 2 ft. 3 in. to 2 ft. 6 in. square, and, say, 40 ft. in length. It affords excellent shingle wood, and is a most valuahle timher for general purposes, heing large and plentiful. Other sinking woods are "russock," "grealing," and "mirahou," the last named heing a heavy, dark, yellow wood, valuahle for furniture, and taking a fine polish. Camphor wood also, and a red wood, "sirayah," which gives logs 5 ft. in diameter and 40 ft. long, are also found in abundance; in fact, the woods of Borneo are so various that, as yet, most of them are comparatively little known. Some of them are already in demand for Australia, and so good a customer so near to Borneo will work, it is to he hoped, for mutual benefit.

One of the largest wire ropes ever made for use in this country has been recently sent out from the works of Dixon and Corhitt, and R. S. Newall and Company, Gateshead. Its circumference is 5 in., and its length 4,560 yds. It weighs over twenty-three tons, and occupied three large railway trucks. It was made for the North British Railway Company, and is to he used for drawing their trains from the Queen Street Station, Glasgow, to Cowlairs.

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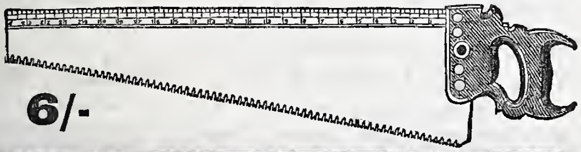

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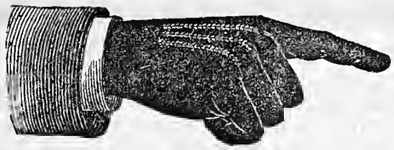

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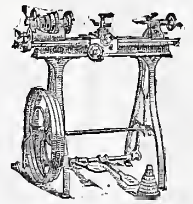

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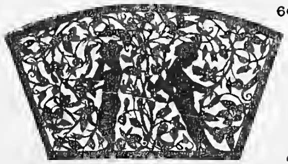

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BY DAVID ADAMSON.

I.—MODERN WRITING APPLIANCES—ADVANTAGES OF BUREAU—SCAMPED WORK IN THE PAST—SPACE TAKEN UP BY BUREAU—ACCOMMODATION AFFORDED—DEPARTURES IN STYLE—COMPARATIVE CHEAPNESS OF BUREAU—VENEERING—MATERIALS—WORKING DRAWINGS—WIDTH AND THICKNESS OF PIECES—LIST OF PIECES REQUIRED.

POSSIBLY on seeing the above heading the reader may be inclined to wonder what occasion there can be to describe the construction of such an old-fashioned piece of furniture. We have now so many modern contrivances for the purpose—from the plain leg writing-table to the pedestal cylinder fall, the register, and a number of others, not forgetting several American "patents" of marvellous ingenuity and cumbersomeness (structures formed for the exemplification of the good old injunction to have a place for everything, even though the place may sometimes be forgotten)—that the bureau has somewhat fallen into disrepute, or, at any rate, neglect. It is now so seldom made that it may, perhaps, be supposed that its descendants fulfil its purpose better, or it would not have ceased to be an article of modern manufacture. The fact, however, must not be overlooked that many forms of furniture and useful varieties, in every respect equal to, and in many instances superior to, those looked on as the best, have come to be regarded as obsolete. They have, however, merely been forgotten and relegated to the shops of dealers in second-hand furniture, whence they will, no doubt, some day emerge from their temporary obscurity—in modified design, perhaps—as novelties. Let us see in what respects the old-fashioned bureau is deserving of recognition as a modern piece of furniture, and, if possible, do something to rescue it from untimely demise; for, slightly altering a well-known address to another article of domestic comfort, it may be said—

> "I love it—I love it, and who shall dare
> To chide me for loving that old 'secretaire'?"

No contention is made that the bureau

surpasses all other forms of writing-desk, for each has special advantages of its own in a greater or less degree; but that is far from saying that all of them are superior to it. Like its younger brethren, it has features peculiar to itself; and if any of these remarks may seem to imply that it is better than any of them, please bear in mind what was stated in the previous sentence. Now let us look at the bureau (Fig. 1), and, comparing it with other forms of desk or table, note what appear to be its chief characteristics, and the points wherein it may be considered superior to them. Perhaps the first that may occur to the amateur cabinet maker is its extreme simplicity; for though some of the old bureaus are complicated and elaborate, the one before us is as plain almost as it could well be. A plain honest piece of work—more agreeable to look on, perhaps, than if it were more pretentious—and it may well serve as our model. If nothing better is learned from it, at least it will show that plainly-made furniture is not necessarily ugly. Elaboration and ornamentation are pleasing only when judiciously employed. If over-done, the effect may be striking, but it soon palls, and the eye is wearied with its ostentation. To design a plain piece of furniture is not difficult, my amateur friends; but when you get ambitious and want to make a handsome thing, that's where the difficulty comes in. This old bureau, and many another old piece of woodwork, remind us that soundly-constructed furniture has a charm of its own, even when there is no pretence at ornamentation, and the finish is a little rough. It certainly is somewhat crude and rough—do not let any prejudices against modern things, as compared with those of an older date, blind us to this fact. In a few choice specimens of old furniture we may find evidences that the old workers were not a whit behind those of the present, either in artistic or technical skill; but candour compels us to admit that most of their work was not equal to the bulk of that which is now made. That much rubbish is made now, no one who knows anything about modern furniture will deny; but can anybody say that scamped work is a recent production? If there be one rash enough to make such an assertion, will he allow me just to remind him of the discoveries made during the restoration of, I think, Peterborough Cathedral, as to the plan adopted by its builders. That was a practical comment of a rather startling kind—one which should make those very enthusiastic belauders of everything that is old calm down in their affected admiration of it.

If they really appreciate good work, they will see more of it in any half-dozen first-class furniture shops than in an equal number of museums. Is it not blind, unreasoning veneration, the tribute to antiquity, which may be more or less influences us all, that calls forth so many remarks in favour of old furniture, rather than an intelligent acknowledgment of good qualities, wherever they may be found? I do not now refer to the old work stored in our treasure-houses of art, but to the every-day specimens one comes across, which is surely the fairest way of judging the class of work our forefathers made. Let any one carefully examine such things, and he cannot help acknowledging that they are mostly coarse and clumsy by comparison with modern work. The most that can be said in favour of them is that the makers made the best of their opportunities; for I fancy it is sometimes forgotten that many appliances and tools are only of recent origin. We have now better tools than ever, our workmen do not remain in one district, nor are they behindhand either in their endeavours to turn out honestly-made articles, or in intelligence. Those who delight to sneer at the British workman may not agree with these remarks, but they are nevertheless true; and the real cause of so much faulty work must be attributed, not alone nor principally to the tradesmen, but to those buyers who want to get things under their value. But what has all this to do with the bureau? Nothing directly with its construction, though indirectly we may learn to appreciate not only it but other things, and to regard them as objects for intelligent study. Hence I trust the few hints may not be amiss.

Briefly, let us imitate what is worthy of imitation in old workmanship, but do not let us fall into the error of supposing that want of finish is in itself meritorious. It cannot be anything but an indication either of carelessness or incompetence in modern work, though in the old it may have been unavoidable, and consequently is not to be found fault with. Well, having delivered my little lecture, we turn again to the bureau, and note some of its excellences. For one thing, it does not occupy much space—only 3 ft. 6 in. across by 1 ft. 8½ in. from back to front; and yet there is an available table-space of about 3 ft. 3 in. × 2 ft. 1 in. when the lid is opened. Now, suppose we compare this with any ordinary writing-desks. In these, with the exception of the cylinder fall, we find that they occupy as much space when not required for use as when being written at. The old bureau on this point clearly has the advantage. Again, look at the drawers. Where can one get such accommodation in any of the pedestal writing-desks of the ordinary "knee-hole" form? Then see how easily and quickly any writing that has to be suddenly left can be secured from prying eyes. It is only necessary to push back the papers, lift the lid, and turn the key—nothing can be simpler. What other desk is equally convenient in this respect? Inside are convenient receptacles for small documents, etc., in the form of pigeon-holes and drawers; which, however, are not singular to the bureau. In case the arrangement shown in Fig. 2 does not suit the fancy or requirements of all, those who prefer some other may be reminded, in the words of a cabinet maker (Heppelwhite), referring to the bureau (or, as he called it, simply a desk) nearly a century ago, that "the drawers and internal conveniences admit of much variation." By the way, it is not uninteresting to notice that Heppelwhite gives us the general sizes for bureaus as follows:—"Length 3 ft. 6 in., depth 22 in., height of desk (*i.e.*, overall) 3 ft. 2 in., including 10 in. for the inside of the desk." These measurements differ only slightly from those of the one under consideration. But more of some of the older cabinet makers' designs, etc., later on; for though this bureau is a very plain one, I hope to show how it may be altered in detail, or, rather, how ornamentation may be added to it to make it represent various styles—for example, Chippendale, Sheraton, etc. The general construction will, however, remain the same. But, some one may ask, has the bureau no disadvantages to counterbalance its good qualities? and the answer may fairly be in the negative, unless, indeed, some may be inclined to object to a level surface for writing on, instead of a slope. Those who think thus will have a plan suggested to them for making the desk to their liking—one which, I think, will be found practicable without seriously increasing the difficulties of construction. Perhaps the only particular in which it may be said that the bureau is not so convenient as the ordinary knee-hole pedestal table is in getting access to the drawers in the lower part when the writing-flap is down. To get anything out of them—especially out of the two top drawers—that may be wanted while writing, the flap must be raised. After all, however, one cannot have everything, and the inconvenience—if it can be called one—is so slight that it is almost unworthy of consideration. Perhaps as a set-off against this it may be said that, for the accommodation found in it, the bureau is the cheapest form of writing desk and table; though, if it is to be made properly, it will be found to cost a fair sum for materials, and I purpose giving, as nearly as possible, the specification of that from which the drawing (Fig. 1) is made. That it might be made at a less cost I do not deny, but it does not come either within the province of this journal, nor yet of my own inclination, to give instructions for the manufacture of shams. By this I do not wish to say that it must be of oak if it is to be genuine, for it may be equally well and soundly made in pine; only, if it is of pine, let it be either painted in plain colour—not grained—or simply stained and varnished. Nor would I go the length, as some do, of objecting to veneer, for experience shows that veneered work, when *properly* done on a suitable base, is not to be despised, although some critics, who know little or nothing about it, condemn it utterly. However, as veneering is hardly likely to engage the worker's attention while making the bureau, the various *pros* and *cons*, whether of a theoretical or practical kind, need not be considered here.

The only remark I will at present offer about veneering in connection with the bureau is that those who prefer making it in mahogany will be able to get finer figured wood in veneers than in the solid, and that therefore they may as well make it of some cheap mahogany—such as bay-wood or Honduras. This has very little figure, but it serves excellently as a foundation on which to lay the choicer and more beautifully-marked veneer. Those who can lay veneer need scarcely be reminded that they are not likely to get good figure in "knife-cut."

But let us suppose that we are to commence making a bureau, for which the one represented is to serve as a model. As it is of oak, it will, perhaps, simplify the instructions to assume that the one to be made is the same, and I shall, therefore, refer to oak only, whenever it is necessary to distinguish between the principal wood and the pine which enters into its construction. Those who prefer to make the thing in some other wood—say, mahogany, ash, etc.—have only to substitute it for oak whenever this is mentioned. It will be noticed that I have not mentioned that now popular wood, American or black walnut; and it may occur to some that this is an oversight. The fact is, I hardly know what to say about it for the purpose of this piece of furniture—so much depends on the maker. If his intention is to make a bureau which shall be a verisimilitude of the real old-fashioned thing, then American walnut will be decidedly wrong, for it is, comparatively speaking, only a very recent introduction, and was quite unknown, in this country at any rate, at the date when the bureau was still an every-day article. This, however, rather savours of inculcating the notion that the new bureau is to appear as if it had been made years ago—in other words, that it is to be a spurious antique. This, it is almost superfluous to say, is not a desirable ambition to be entertained; but as there may be some who, without any desire to deceive, wish to avoid an anachronism and to be strictly correct from an antiquarian point of view, the suggestion is given. Apart from this, there is no reason why American walnut should not be used. While mentioning American woods, I may just put in a caution not to use the stuff known as satin walnut. The name is taking, and almost seems to imply that the wood is a superior kind of walnut. It is, however, nothing of the sort, being in reality a very inferior timber of little or no intrinsic value as a furniture wood, for which, however, it is now being used. Possibly some good qualities may be discovered in it later on, and there is no saying that it may not become popular, for it must not be forgotten that American walnut only a few years ago was a drug in the market; but in the meantime I would strongly advise no amateur to make anything valuable in it. It is very unreliable.

Before actually beginning to make the bureau, or, indeed, any other piece of furniture, a full-sized working drawing or plan should be set out. It need not be a troublesome matter, even for those who are not draughtsmen, as all that is absolutely required is that it shall show distinctly the sizes of the various parts. When this is done, it greatly facilitates work, besides preventing mistakes in cutting up the wood. If the maker can show details and sections, well and good; but if not, he can easily supply the needed reminders by a written word or two. All that is wanted is that the drawing shall be a serviceable guide to him when working; and whether the explanation is given partly in words or altogether in lineal representation, is of little consequence. Theoretical working drawings and useful practical drawings for the workshop are by no means necessarily the same. In the present case, two drawings will suffice—one of them showing the shape of the end, and the other the plan of the front. This latter shows the arrangement of spaces for drawers, etc., and need only be drawn of one half of the bureau, as the other portion is exactly the same. Of course, in measuring from it, all horizontal lengths must be doubled and the other parts duplicated. In case the novice may be in any difficulty about this — for working drawings are too often regarded rather as a source of mystification than of elucidation — Figs. 3 and 4 are given to serve as a guide. On the former, which is a drawing of the end (without the plinth), the measurements are shown in inches. On the latter, to prevent confusion, they are omitted, but it will be understood that the full-sized drawing must show them in actual measurement. The width of the various pieces from back to front, such as the divisions between the drawers, may be stated on them. Thickness will show itself. One rather important matter may be mentioned here, viz., to show the thicknesses as they will be when the wood is planed and cleaned up, not as it nominally is. Thus the said rails are of 1 in. stuff, but as this will be, when finished up, only some ¾ in., or at the most ⅞ in. thick, it will easily be perceived that the working drawing would be misleading if the full nominal thickness were shown. The same principle applies generally to all wood, and it is important when mentioning thickness to understand whether the measurement is given of the finished or rough stuff. To prevent any confusion arising to the reader in the present instance, I may say that all *thicknesses* that will be given must be taken as indicating the nominal measurements of the rough stuff, so that due allowance must be made for waste and finishing. As this method may seem strange to the inexperienced wood worker, I may explain, for his benefit, how it comes about, and it will then be seen to be perfectly natural. A log of, say, 12 in. thick, has to be cut into twelve planks of 1 in. each. If these could be, so to say, sliced off, they would be actually 1 in. thick, but as they are cut with the saw, which forms a passage of its own thickness and removes a certain amount of material in the form of sawdust, it needs no great discernment to recognise the fact that the twelve (nominal) 1-in. boards will not be equal in bulk to the original log. Besides the saw-cut—or kerf, as it is technically called—a further deduction must be allowed for roughness to be removed by planing, etc., so that altogether a fair margin must be allowed for finishing. Sometimes, it is true, planks will be found which are fully up to their nominal thickness, but so seldom that it would be unsafe to rely on meeting with them just when they are wanted. Indeed, they may almost be said to come under a separate standard of measurement, though not exactly a recognised one, in which they are described as "full" ½ in. or "full" 1 in., or whatever the thickness may be.

When the working drawing is prepared, it will be found to be a very convenient plan to make out a list of all pieces required. Much time is thereby saved, and uncertainty avoided in fitting the parts, which, as they are got out, should be numbered to correspond with the list. So far as I know, this method is not adopted generally in either trade or amateur workshops, but its advantages will be manifest to, and not readily relinquished by, those who have tried it. It is well to have the list legibly made out and placed so that it can easily be referred to as the job progresses. The precise arrangement of the list, of course, does not matter very much—some preferring one, and some another, for reasons which, though, perhaps, important in a large factory, are scarcely likely to be of much importance in small shops or to the amateur. All things considered, the tabulation adopted in this case is probably, at least, as convenient as any other. In it some of the smaller pieces, such as drawer stops, are omitted, as they can be made from waste or short ends, and their enumeration would only encumber the list with needless details. It will be seen that the wood is classified according to thickness, not according to the position it is to occupy in the bureau, as some might prefer. This, if one may judge from some remarks that have lately appeared in an important technical contemporary, is a point on which opinions differ, as each plan has its own peculiar advantages, and it is one that cannot be fully discussed here. The choice must be left for each individual to decide for himself, and he may extend it, as some do, by specifying the small bits left out if he thinks it necessary. The annexed Table gives a list of the timber required to construct a bureau measuring 3 ft. 6 in. wide × 3 ft. 4½ in. high × 1 ft. 8½ in. back to front; unless, indeed, any one wishes for special reasons to use other thicknesses, etc. Perhaps, instead of saying that they are required to be as stated, it will be better to understand them as reliable thicknesses, given as suggestions in case of doubt, though I would not advise any departure from them unless by an experienced worker.

In addition, there will be required about 7 ft. of moulding for plinth; the material for the plinth itself; blocks,

List of Pieces of Timber required in Construction of Bureau.

No.	Pieces.	Length.	Width.	Thick.	For	Remarks.
1	2	3 ft. 1½ in.	1 ft. 7¼ in.	1 in.	Ends.	Full width made up by facing slips.
2	1	3 ft. 4½ in.	9¼ in.	,,	Top.	
3	1	3 ft. 3½ in.	1 ft. 7 in.	,,	Table top (or lid).	Or pine under pigeon-holes.
4	4	3 ft. 3½ in.	2 in.	,,	Drawer bearers.	Ditto, or pine faced up.
5	3	4 in.	2 in.	,,	,, ,,	
6	2	1 ft. 5¼ in.	3½ in.	,,	Drawer fronts.	
7	1	3 ft. 3 in.	4½ in.	,,	,, ,,	
8	1	3 ft. 3 in.	5½ in.	,,	,, ,,	
9	1	3 ft. 3 in.	6½ in.	,,	,, ,,	
10	2	1 ft. 4 in.	3 in.	,,	Lid.	
11	1	3 ft. 4 in.	3 in.	,,	,,	
12	1	2 ft. 10 in.	1 ft. 1 in.	,,	,,	
13	10	6 in.	—	¾ in.	Top side drawer fronts.	In pairs, width increasing from 1½ in.
14	2	5 in.	3 in.	,,	Fronts of drawers under pigeon-holes.	
15	1	1 ft. 4½ in.	3 in.	,,		
16	1	3 ft. 3 in.	9 in.	¼ in.	Bottom and ends of pigeon-holes and under bottom row of drawers.	
17	1	2 ft. 3 in.	,,	,,		
18	2	11½ in.	,,	,,		
19	8	6¼ in.	,,	,,	Between side drawers.	
20	6	8¼ in.	,,	,,	Pigeon-hole partitions.	
21	2	3¼ in.	,,	,,	Between drawers.	
22	20	8½ in.	—	,,	Below ,, Small drawer sides.	In fours, same width as corresponding fronts.
23	10	6 in.	—	,,	,, ,, backs.	In pairs, width ¼ in. less than corresponding fronts.
24	10	5⅝ in.	8½ in.	,,	,, ,, bottoms.	
25	6	8½ in.	3 in.	,,	Sides of Nos. 14 & 15.	
26	2	5 in.	2¾ in.	,,	Backs ,, ,,	
27	2	4⅝ in.	8½ in.	,,	Bottoms of No. 14.	
28	1	1 ft. 4¼ in.	8½ in.	,,	Bottom ,, 15.	
29	1	1 ft. 4½ in.	2¾ in.	,,	Back ,, 15.	
30	2	1 ft. 3½ in.	3½ in.	1 in.	Lid bearers.	
31	8	1 ft. 6 in.	2 in.	,,	Drawer slides.	
32	1	3 ft. 4½ in.	1 ft. 8 in.	,,	Bottom.	
33	10	1 ft. 7 in.	—	½ in.	Drawer sides.	In pairs, same widths as Nos. 6 to 9.
34	2	1 ft. 5 in.	1 ft. 7 in.	,,	,, bottoms.	For No. 6.
35	2	1 ft. 5½ in.	3 in.	,,	,, backs.	Ditto, ½ in. narrower.
36	3	3 ft. 3 in.	—	,,	,, ,,	For corresponding fronts, Nos. 7, 8 to 9, ½ in. narrower.
37	3	3 ft. 2¾ in.	1 ft. 7 in.	,,	,, bottoms.	For Nos. 7, 8 & 9.
38	3	2 ft. 10½ in.	1 ft. 6 in.	,,	Dustboards.	

The exact measurements will, of course, be taken from the maker's working drawing, and, if necessary, be altered accordingly.

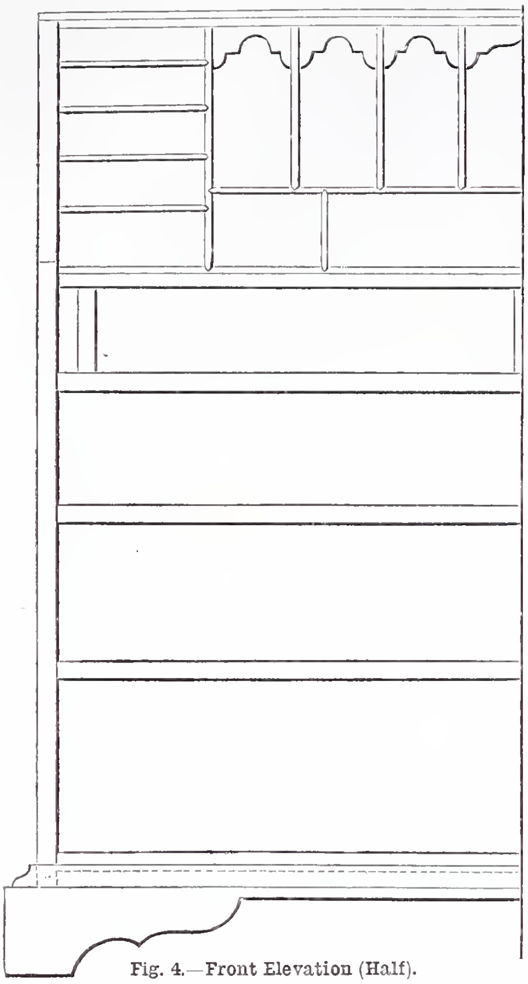


Fig. 4.—Front Elevation (Half).

without incurring, on the one hand, needless waste, and, on the other, allowing sufficient for trimming and fitting. If there is any doubt, it is better to cut the pieces rather over than under the sizes, for these can always be reduced by a shaving or two being removed. It will be noticed that in one or two instances $\frac{1}{8}$th of an inch is given, and this may seem to imply that absolute exactness has been studied in such cases. It has to a certain extent, but the principal reason they are given is to show the approximate proportions these pieces bear to the corresponding parts to which they are to be attached, but they must not be taken as exact when finished. It is in making them fit each other accurately and correctly that the skill of the maker shows itself. Measurements are all very well in their way, and indeed necessary, but no measurement will overcome the need of fitting and adjusting the various parts to each other. The list may seem a somewhat formidable one, and its preparation is not accomplished without an expenditure of time; an expenditure which is more than repaid by the increased speed and facility of working. Before going any further, it may be stated that all the

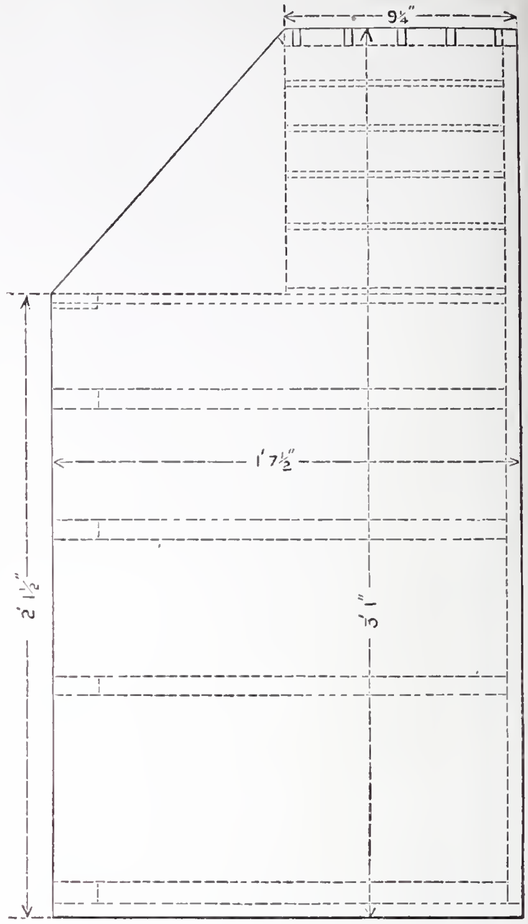


Fig. 3.—End of Old Bureau.

drawer-stops, and beads, which will be dealt with later on, as well as the back of the bureau, when referring to the parts with which they are connected. The sizes given are taken as nearly as possible, but they do not all include small fractions of an inch. They give approximately the measurements to which the material may be cut in the rough parts to No. 29 inclusive are of oak. The remainder may be pine, or any wood that may be preferred to it. Pine is named, as those portions of the bureau from which this description is given are of it, and they do very well. The only alteration that I would suggest with regard to them, were I asked to improve on the material, is that the insides of the lower drawers, *i.e.*, the large ones in the body or "carcase" of the bureau, would be better in something else.

But here I must stop, trusting I have given every reader who may make up his mind to construct a bureau something to do in getting out the timber required.

(*To be continued.*)

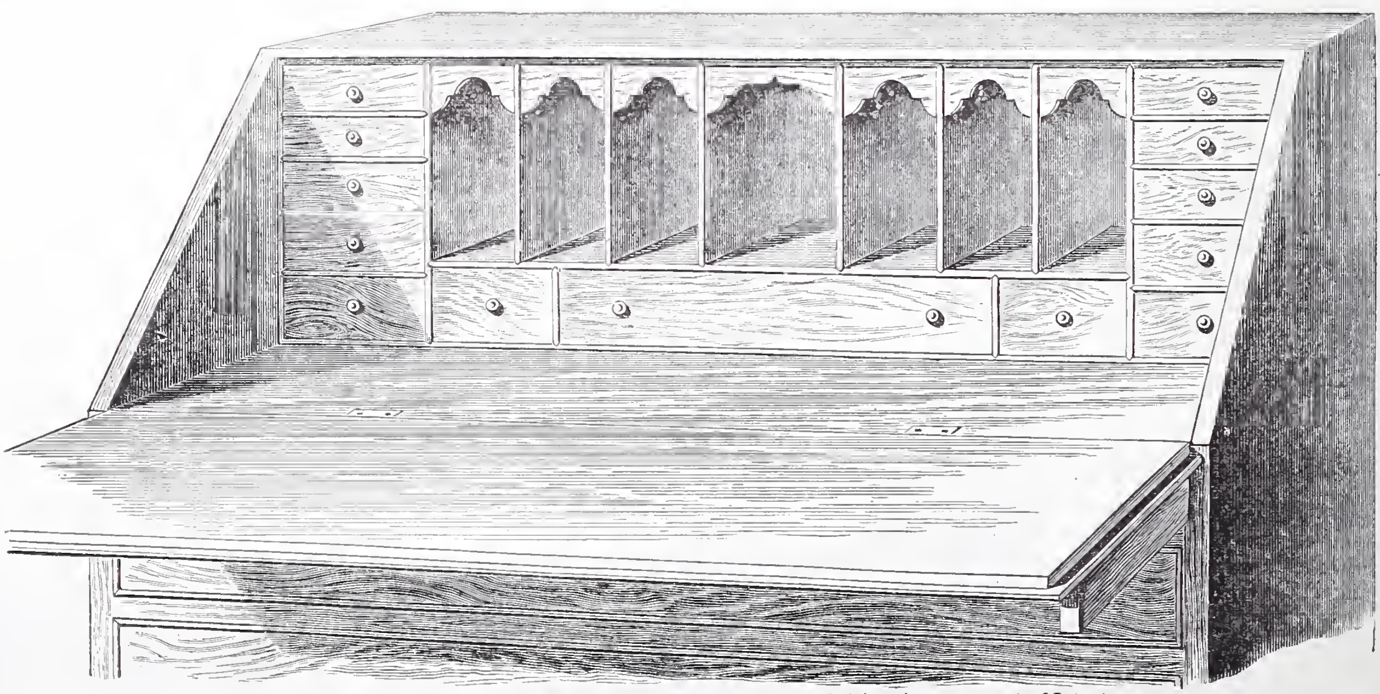


Fig. 2.—Upper Part of Old Bureau or Secretaire, Open and Exhibiting Arrangement of Interior.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

I.—Iron Lists—Templates—Marking.

In the present article I purpose dealing with the construction of girder work in the iron yard, starting from the completion of the general drawings, and when, therefore, all the purely theoretical calculations have been made and the manufacturing or practical stage is reached.

It sometimes happens in preparing the designs for works of novel or intricate character that points affecting the manufacture of the work are overlooked, and it is, therefore, incumbent on the leading hands in the shops to examine the drawings very carefully in the first instance, in order to avoid subsequent hitches during the progress of construction.

The mechanical processes commence with the rolling of the iron or steel plates, bars, and other sections required for the job, and the preparation of templates for marking the positions of the rivet holes.

All flat pieces over 12 in. wide must be rolled as *plates*, and this will involve some unevenness of the edges, the plates being rolled between plain cylinders, and their edges subsequently sheared to the sizes ordered; this shearing cannot be effected with the accuracy necessary for neat work. The narrower *bars* being rolled in grooved cylinders will have their edges as well as their surfaces smooth; but all the parts on leaving the rolling mill require some amount of straightening before being built up into the structures of which they are destined to form parts.

If two or more thicknesses of plates are to be riveted together, it is evident that they should be of exactly equal widths, and have truly-formed edges; and in such cases, even when they are less than 12 in. wide, they should be rolled as plates and planed to the required dimensions.

On the iron lists sent to the rolling-mills, the dimensions marked must be sufficient to allow for the reduction by planing. On the amount of allowance to be made on this account there exist differences of opinion, and it will be affected by the accuracy observed in the particular mill to which the order may be sent; but the practice I have found most satisfactory is to allow a quarter-inch on all edges and ends of plates for working. This allowance is, of course, so much waste; and some small firms, after tendering at very low prices, have kept it down to as little as one-eighth of an inch; but this is very risky, and I have known cases of whole plates having to be thrown aside through the insufficiency of the margin to cover the irregularities of the edges.

While the iron is being rolled, the templates for marking the rivet holes may be proceeded with. These will be made of strips of wood formed into frames to suit the shapes of the plates and bars, and perforated with holes corresponding to the intended positions of the rivets.

It is necessary before proceeding further to make some observations upon the different methods of making the rivet holes, as upon that adopted the arrangement of the templates will depend in some measure. There are three ways in which the holes may be made: by punching simply, by drilling out of the solid, and by punching small holes and drilling or rymering them out to the required size. Formerly punching was universal, or almost so, but in recent years, with the advent of improved machinery, drilling has been gradually superseding it for large and important works, the magnitude of which justifies the construction of special machines for their execution. In the old style, punches with flat ends and a good deal of taper were commonly used, and the holes made by them were not of equal diameter throughout. To mark the plates, stumps dipped in white paint were used. The perforated templates were clamped on to the plates and bars, and the stump passed through the perforations, and their positions thus marked by white rings upon the material to be punched, which, the templates having been removed, was then ready for the puncher. The marked work being passed under the punch by hand, it is evident that the quality of the result is dependent upon the accuracy of eye and steadiness of hand of the workman attending the machine; hence it is almost impossible that the punched holes can be exactly in the position marked; and in work done by an inferior hand, their eccentricity may become very appreciable; then when the plates are laid together to be riveted up, the holes will not coincide, and either the rivet will be distorted in closing, or the holes must be broached out to a larger diameter to make them concentric, and thus the plates are weakened by losing more of their substance than would be necessary with more exact work.

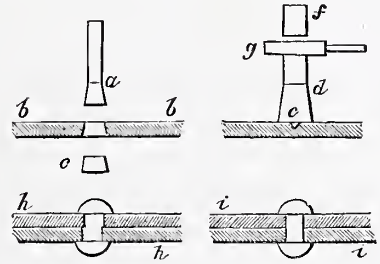


Fig. 1.—Punching and Riveting Plates.

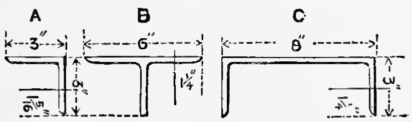


Fig. 2.—Position of Rivets in Angle Sections.

In ordinary punching, the material is partly cut and partly burst out of the solid, and therefore around the edges of the holes some injury must be caused, and the strength of the plate for some distance—probably about one-tenth of the diameter—deteriorated. This difficulty is, however, overcome by punching the holes smaller than the finished size, and drilling or rymering out the damaged part; thus for the finished diameter of $\frac{3}{4}$ in. the holes may be punched $\frac{5}{8}$ in. and then drilled out to $\frac{3}{4}$ in. Here also we are in the hands of the puncher as to accuracy of position; therefore, to ensure accuracy, recourse is had to the process of "nipple" punching, which is slightly more costly, but much more satisfactory. There is no difficulty whatever in correctly making the templates, as the centres of the rivet holes are set out by dividers, and the perforations made by an accurately formed centrebit; and lest there should be the slightest deviation from the vertical direction during the drilling of the wood, the template when used is turned over, and that face upon which the holes were set out placed in contact with the metallic surface to be marked.

If the work is to be "nipple" punched the plates are marked with a centre punch instead of a stump dipped in paint, and thus the centre of each intended hole is indicated by a conical depression, into which the "nipple" of the punch falls, thus securing the proper adjustment of the plate to the punch.

In the accompanying Fig. 1, *a* is the working end of an ordinary punch, and *b b*, is a section of a plate from which the distorted "burr," *c*, has been punched out. The more nearly cylindrical the punch, *a*, can be kept, the better will be the work executed by it. Great care is required in grinding these punches, in order that they may take their bearing fairly, otherwise constant breakages will result. At *d* is shown a "nipple" punch, of which *e* is the "nipple," and beneath this is shown a section of a plate with a countersink, into which the nipple falls. *f* is a rising and falling block, by which the punch is driven through the plate; between this block and the head of the punch is a wedge, *g*, so arranged that by drawing it back the block, *f*, can make its stroke without acting on the punch, thus allowing time for the plate to be fairly adjusted to the nipple, when the wedge, *g*, being pushed in the hole, is punched. This operation for each hole takes some time to describe, but in practice it is fairly rapid, and it is certainly a very great advance upon the older method. *h*, *h*, shows a section of two plates, in which the rivet is distorted through bad punching; and *i*, *i*, a section in which the rivet is properly formed.

Multiple punching machines have been made to punch a number of holes at one stroke, the plate being automatically moved forward after each stroke, and the punches acting at each stroke being determined by templates working on the principle of the Jacquard loom. These contrivances have, however, been found very costly to construct, and are very rarely used; hence I shall not occupy the space allotted to me with a description of them.

If holes are to be drilled under a single drill, the same marking as that used for the nipple punch will be suitable; but girder work is generally drilled in a multiple drilling machine, and in this case the centres of the holes do not require marking throughout, as the drills themselves are adjusted to the required "pitch" or distance from centre to centre of rivet holes, and templates only will be necessary for marking the positions at joints and connections of rivet holes which are out of the general run of the work, and such as have to be drilled by hand or small portable machines after the girder has been built up.

If every department fully and faithfully performs its duties, the *working* drawings when they reach the yard should have *every dimension* clearly marked upon them; but experience shows that this does not always happen. The reasons for this might be discussed, but they would not be edifying. It is therefore highly necessary that the template maker should know just what is required for the practical execution of the work, as any mistake which escapes him will appear in the work itself.

Some very awkward places often occur in making joints in bridge girders, especially where several members meet together; and here may be a temptation to overcrowd the rivets in order to avoid clumsy-looking joint plates, but it is important that this be not done to the detriment of structural strength; and the most carefully made general calculations will be frustrated if even the smallest details are improperly arranged.

The distances of rivets from each other, and especially from the edges and ends of plates and bars, is a matter of great importance, as if they are reduced below their proper limits there is danger of the material bursting out. Under no circumstances should the centre of a rivet be closer to the edge of a plate or bar than one and a half diameters, and that only when the strain on the rivet does not act towards the edge of the plate, but parallel to it; this would give $1\frac{1}{8}$ in. for the distance of a $\frac{3}{4}$-in. diameter rivet; and although a great amount of work has been done to this proportion, it is, in my opinion, very little. Similarly three diameters will be the very least distance allowable between two rivet centres in girder work; this would be $2\frac{1}{4}$-in. for $\frac{3}{4}$-in. rivets. This close packing of rivets cannot but cut up the grain of the plate, especially when they are irregularly placed, as in some joint plates; and it must be remembered that the strength of a plate across the grain is less than that in its direction—in the ratio of about 6 to 7.

In joining angle and other sections together, the space allowed for the rivets is often very limited, in which case the rivets should be placed in the centre of the width. In Fig. 2 are shown three sections of iron or steel; A is angle; B is tee; and C is channel section. The distance of the rivet centre from the edge of any limb is found by deducting from its width the thickness of the adjoining limb and halving the remainder. Thus, if the angle iron is 3 in. by 3 in. by $\frac{3}{8}$ in. thick, the distance of rivet centre from the edge should be $3-\frac{3}{8}$ divided by 2 equals $2\frac{5}{8}$ in. divided by 2 or $1\frac{5}{16}$ in. The 6 in. by 3 in. by $\frac{1}{2}$-in. thick tee iron, and the 8 in. by 3 in. by $\frac{1}{2}$-in. thick channel iron, will each have their rivet centres $1\frac{1}{4}$ in. from their edges.

When the strain on the rivet is towards the nearest edge, tending, therefore, to tear it out, it must be much further in, two diameters being the least to be allowed between the rivet centre and the edge of the plate or bar. Should distances less than those I have here given appear upon the drawings, they should certainly be referred back to the drawing office for verification before being worked to.

The templates having been properly prepared, and being ready for use, we have to take in hand the material supplied from the rolling mills. All this, as it is delivered to the girder yard, should be put under cover to protect it from rusting; then as soon as the inspecting engineers have made such tests as may be specified, and passed the iron or steel, work may be begun on it.

It will generally be found that the plates require more or less straightening, as in cooling they will take on some twist; this may be removed by hammering, but that method is very rough, and it is altogether better to straighten them in machines made for that purpose, consisting usually of three rollers.

(*To be continued.*)

"TIPS" FOR TYROS.

BY OPIFEX.

Moulded Corners for Picture Frames.

Picture-frame making is a very favourite amusement with many amateurs, and from its nature is likely to continue so always; yet there are few things more difficult to do well, notwithstanding the helps which have of late years been invented, such as mitre-cutting machines, corner clamps, etc.

Picture-frame moulding being covered with a white composition, it is hard to carry out the various operations of sawing or even cutting with mitre machines, "shooting" or planing the surface of the mitres, gluing, and nailing, without chipping off some of this composition; and besides this difficulty, there is oftener the other, and greater one, of cutting exact angles, so that, from some of these causes, the result too often is that we make a "mess of the job." Now although we strongly recommend the reader to overcome these difficulties by patient painstaking and practice, yet before this desirable end is attained many amateurs become tired of trying, and we therefore suggest a remedy for spoiled corners which will not only hide the evil, but if well done will be an improvement to almost any ordinary picture frame.

Procure a small piece of good basil leather, say about 5 or 6 in. square, and soak it in lukewarm water in which some glue has been melted—about a wine-glassful of melted glue to half a pint of water. Next select a leaf, which is about the length of the joint at your mitres; the kind of leaf is of course a matter of taste, but a narrow, pointed leaf will suit best for a beginner. Now, having rubbed your leather as free from water as possible, wiping it on both sides with a cloth, flatten it out smooth, and lay the leaf upon it, mark the shape exactly, including a short stalk, and then cut out cleanly with a very sharp penknife. Now with a blunt, smooth, pointed instrument—*e.g.*, a small paper knife—mark out clearly the veins as upon the natural leaf, and otherwise model it as faithfully as possible. Repeat the operation for the number required, and lay aside to dry thoroughly in the sun, or other warm place; when dry, give each leaf a coat of gold size, and when it is dry give another. When this second coat is almost dry apply gold leaf, gilding the leather leaves all over on right side and edges. Glue these securely to the corners of your frame, being careful to place them exactly at the proper angle, and most picture frames of ordinary moulding will be improved by this addition.

Gold Leaf: How to Use It.

Gold leaf is a thing which is impossible to manage unless one knows how, and yet we often have occasion to repair gilt articles of various kinds, or "touch up" a picture frame, etc. The usual practice is to apply some of the many gold paints, and the invariable result is a nasty patch, which, to a critical eye, is worse than the original flaw.

But besides patching and mending, gold leaf is highly effective in combination with black for the ornamentation of various articles of furniture which amateurs often construct for themselves. A book of "gold leaf" which is quite good enough for such uses may now be bought for sixpence; indeed, this German gold is quite as good for inside work as the "real thing."

Having procured a book, lay it flat upon a table, and carefully open the first leaf, when the metal foil will lie before you; with a pair of sharp scissors cut off the paper leaf you have just raised; lay it flat upon your open hand, and rub it on your hair; whether you use pomatum or not, there will be quite sufficient grease to answer the end in view. Now lay the paper upon the foil in its original position and press firmly with the hand; lift carefully, and the gold will be found adhering; this paper leaf with foil attached will now bear to be carried about, and may be cut up with scissors to size and shape required. The same process may next be carried out for as many leaves as we need for the job in hand.

Having said so much about gold leaf, we add a hint as to the method of laying it on, in case the reader does not know.

Paint the part you wish to gild with gold size, and be very accurate, as the leaf will stick to every spot touched; this size will dry rapidly, and when it is just *not dry*, or "tacky," *i.e.*, sticky, cut a piece of your leaf a little larger every way than your design, etc., press it firmly, and then lift the paper; do not touch it again till quite dry, when you may remove the surplus foil with a large, soft, camel's-hair brush, or "dabber."

For illuminations, etc., gum arabic may be used instead of gold size, and may be allowed to dry, breathing upon it for a few seconds when you wish to apply the gold.

LATHES AND TURNING APPLIANCES.

BY F. A. M.

IV.—The Overhead Motion (*continued*).

Another Arrangement of Overhead—Its Defects—High Speed for Drills and Cutters—Construction—Crossway or Fourway—Horizontal Bar—Ball—Castings and Forgings—Guide Pulleys and Sliders—Assistance Rendered by Overhead—New Overhead of London Lathe and Tool Company.

We come now to an entirely different arrangement, which is simpler than any yet described. It is also very fairly efficient. It has its advantages and disadvantages which will be stated, and then detailed drawings will be given so as to enable those who wish to make it for themselves. At Fig. 8 will be seen the general arrangement of the overhead. Here there is but one long band which is quickly adjusted for use, and, when not required, is not removed, but simply slipped off the large wheel to the right with the left hand, while with the right hand the slack loop is pulled so as to draw up the lower end which embraced the large wheel close up to the crank shaft; then the slack loop can be turned back and wound round the horizontal bar out of the way, leaving the fly wheel free for the ordinary band. Since the bands for the mandrel and for the drillers and cutters have to be frequently changed, it is a matter of some importance to be able to do this quickly.

We will now confess the defects of the arrangement. One is that since there is only one band, no variations in speed can be made but those due to the different diameters of the grooves of the fly wheel and those upon the pulleys of the various instruments employed. The greatest speed then will be determined by the ratio between the largest groove on the fly wheel and the smallest on the pulleys. Now these latter cannot be less than $\frac{3}{4}$ in. in diameter, because, if so, the hooks of the $\frac{1}{4}$-in. band, used for overhead motions, could not go round them without too severe a jerk; the utmost speed will therefore depend upon the size of the largest groove on the fly wheel. If the lathe is provided with a 24-in. wheel, the speed will be sufficient, but if the lathe be a small one, having a fly wheel of 20 in. or thereabouts, it would be better to adopt the plan shown at Fig. 4, or some other, which enables more speed to be obtained.

Here it may be well to draw attention to the great advantage of a high speed for the small cutters and drills: they *must* run fast if they are to work well. When they run at a proper speed and are kept sharp, it is astonishing how much hard wood they will remove, and how smooth a surface they will leave. A ratio, then, of 24 to ¾ will do very well; that makes the cutters revolve 32 times as fast as the foot wheel. Now the speed of the foot wheel may vary from 30 to 160 revolutions per minute, but we may consider 100 revolutions per minute of the fly wheel as pretty fast treadling to keep up continuously; let us, therefore, take 3,000 revolutions per minute as about the correct speed for the drilling spindle and small cutting frames for ornamental turning. A band ⅛ in. in diameter is quite strong enough, and much better than a thicker one, since it must bend easily round the small ¾-in. pulleys. If it be of catgut it may be joined with the usual hooks and eyes, sold at the tool shops; or it might be of Binn's endless blind cord, if a piece could be obtained of a suitable length; if not, it might be of whipcord or string, long spliced. It is a great advantage to avoid the jerk caused by the hook and eye as they pass over the small pulleys; this is sure to leave a slight mark on the work.

Proceeding now with our description of the overhead illustrated in Fig. 8, it will be seen to consist of a piece of iron gaspipe, 1¼ in. bore and 1⅝ in. external diameter, extending from floor to ceiling, and fixed so as not to touch the lathe at all. If, however, the ceiling cannot be utilised there must be a bracket as at B, and the upright pipe would end about 6 in. above the cross bar. There is, however, a considerable advantage in the first plan, since, when the overhead motion is fixed to the lathe, a slight amount of tremor is communicated to it, which interferes with the perfection of the work. Let it be understood, then, that the bracket, B, would not be used except when the upper end of the standard could not be supported from ceiling or wall. The top and bottom of the upright pipe are screwed into 1¼-in. flange plates. The lower of these is screwed to the floor, and the upper one to a board about ¾ in. thick, which board is fixed by long screws passing through the plaster of the ceiling into the joists above. This arrangement fixes the pipe firmly in a vertical position, yet allows of its turning on its own axis in the two flange plates, so that the horizontal bar may swing partly round in a horizontal plane. About 6 ft. high up the pipe from the ground is what gasfitters call a "cross" or "fourway," shown quarter size in Fig. 10. This cross is not screwed to the pipe in the usual way, but is bored out so as to remove the thread in such a way that it can slide up and down, the pipe from flange to flange being in one piece, and the cross slipped upon it and secured by the screw, A. This screw is obtainable from the gasfitter like the rest of the fittings. It is called a plug, and it serves here to fix the cross upon the pipe at the height most convenient for the band, a piece of wood being fitted into the arm of the cross to enable the screw to press upon the pipe.

We come now to the horizontal bar shown at Figs. 8, 9, and 11. This may also be of gaspipe of about ¾ in. bore, and it will require to be from 4 to 5 feet long. Its length should be such that a perpendicular dropped from its right-hand extremity would fall from 15 to 18 in. in front of the headstock. This bar should be smooth, because at one end there slides on it a heavy ball, and at the other two small sockets carrying a pair of pulleys each. To make a good job it should be turned up (though gaspipe is not nice to turn), and probably it would be better to employ for this purpose a piece of smooth steel tube of about ⅞ in. external diameter and ⅛ in. thick. We have now to connect the horizontal bar with the vertical so that it may swing or rock, like a see-saw, or like the beam of a steam engine, in a vertical plane: this we can do by means of the remaining arm of the cross. At B, B, Figs. 10 and 11, is shown a diminished T piece, one branch being the same size as the branches of the cross—*i.e.*, that for 1¼-in. pipe—and the other two branches being suitable for ¾-in. pipe. A rymer would be put through those two arms to remove the thread so as to make a thoroughfare hole to fit the turned gaspipe or the steel tube chosen to suit it, which would then be driven through half its length. At C, Fig. 10, is shown another way of fixing the bar. Here a piece of solid bar iron is screwed with the proper thread to suit the cross, and bored across with a hole of about 1 in. diameter to fit the bar, which is then driven in, and, if necessary, may be held by a pinching screw. Both these plans, while holding the bar, allow of the required see-saw motion. The second is the best, as it brings the bars a little closer together. Also it may be difficult to meet with the requisite T for the other plan. The ball is 5 in. diameter of solid iron; it may be obtained finished, with screw fitted, for about eight shillings. On the end of the bar, at D, is seen a stop screw tapped into the pipe, intended to prevent any possibility of the slipping off of the ball.

All this work the amateur is advised to order from the foundry; it requires tools which he has not got, and whatever overhead he undertakes he must of necessity spend something in castings and forgings. The main standard, being of 1¼-in. gas "barrel," can be bought in 14-ft. lengths at sixpence per foot. Let the height of the workroom be measured, and give that measure to the workman after subtracting ¾ in. for the thickness of the board for the ceiling. Order the two flange plates fitted so that they can be turned round by the hand; they cost 9d. each. Order the cross (at 1s. 9d.) bored out so that it will slide upon the pipe; the screw plug costs 4½d. Then comes the ¾-in. pipe: that costs 3½d. per foot; the T and stop screw about 1s. 3d. Allowing 3s. for boring the cross, 3s. for turning the ¾-in. pipe, and 8s. for the ball, we come to about 27s. Fix the standard yourself, using a plumb line, then you will not be charged for journeys, fetching tools, etc.

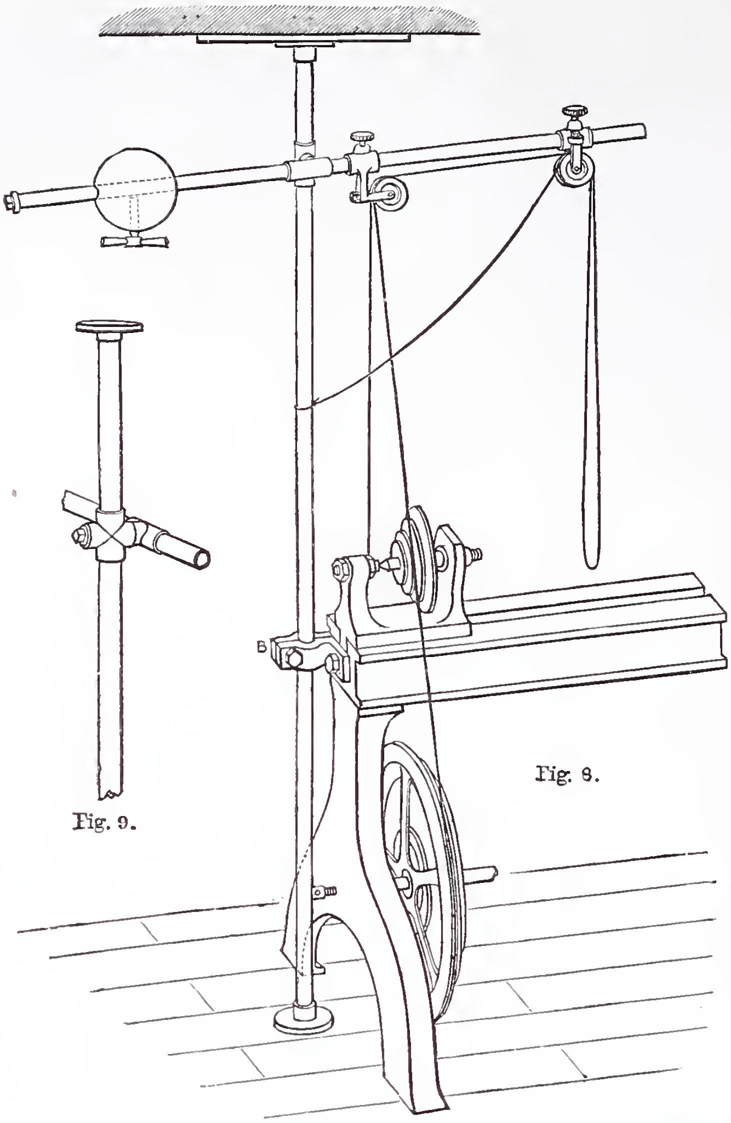
We come now to the four guide pulleys and their sliders, which the amateur is to make himself; a very nice little job, which should be well within the powers of any amateur turner in metal. In Fig. 11 the bar is seen in plan looking down upon the sliders, to which are attached the stirrups of the pulleys; Figs. 12 and 12A show the side elevation; Fig. 13 the end view of the left-hand slider and pulleys, and Fig. 14 the end view of the right-hand slider with its pulleys. The stirrups are to prevent the possibility of the bands flying off the pulleys. The shape of the left-hand slider is clearly seen in Figs. 11, 12, and 13. It is made in that way to enable the workman to incline the pulleys, as seen in Fig. 13, to suit the slant of the band as it descends to the different speeds on the fly wheel. The right-hand slider need not be made in that way, but as Fig. 14; however, it might be made like the other to save a second pattern. At Fig. 14 is seen between the stirrups an eye-hole cast in one with the slider. This is intended for the attachment of a small cord or chain, best seen in Fig. 8, which is looped round the upright, so that if the band were to come off the pulleys or wheel, the weight would be checked before it could fall far; the loop would be slid up or down to suit the position of the right-hand slider upon the bar. As to the construction of these sliders, they are made from castings of brass or gun metal; patterns must be made, or one pattern will do if preferred. When received, the castings would be chucked and bored out to fit and slide upon the bar, and the flat wings filed flat and drilled to receive the stirrups; these stirrups may also be of gun metal together with the pulleys. The pulleys are shown 3 in. in diameter, and they should not be less. They should be chucked and bored first, and bushed with hard steel, driven firmly in, and then driven on to a mandrel and turned true with the hole. The pins on which they run must also be of hard steel, as if not, owing to the great speed at which they run, they will soon wear loose and make a disagreeable noise. Here we have then four guide pulleys, each with its centre requiring oil and liable to sprinkle that oil on the work; also the friction of our apparatus will about equal that of Fig. 5 and Fig. 6. To prevent the dispersion of the oil and diminish the friction we may, however, adopt the form of stirrup shown at Fig 15, which is but little more trouble to make. Instead of a steel bush inserted in the pulley we have a small steel spindle with both ends hardened, running on two small pointed screws, also hardened; these screws have heads which are screwed hard up to the sides of the stirrup, but wear can easily be taken up by lightly tapping with a hammer upon the bow of the stirrup so as to condense the metal and close slightly the arch upon the little spindle within. These little pulleys, so mounted, will not disperse the oil unless too much is applied, and they will run without noise or rattle. The little centres of the spindles should be carefully coned, and then a small hole drilled up for ¼ in. to contain oil, then when properly hardened they will wear very well.

Made as above described the overhead represented at Fig. 8 will be very cheap, will run lightly, will not disperse the oil, will be quickly and easily adjusted for work, and will therefore, in spite of its simplicity, bear comparison with any of the foregoing examples. To shorten the band it is only necessary to unfix the screw at the hinder arm of the cross and to raise and fix it a little higher on the upright; to lengthen the band so as to reach further from the mandrel the cross is lowered in a similar way.

To complete the subject it should perhaps be stated that it is possible not only to drive revolving cutters, etc., from an overhead, but also to give a regular feed to the slide-rest screw by connecting it with the mandrel, so that whilst one part of the overhead is driving a cutter or drill, another part is feeding along the cutting instrument to produce a screw or spiral. Fixed tools, both for wood and metal, have been guided in this way, and screws have been cut even in steel as coarse as 8 threads to the inch, and fairly accurate in pitch for 3 or 4 in. in length, by Mr. Haydon, the inventor of the system, which system would prove very useful to those who possess neither slide lathe nor spiral apparatus. Special precautions, however, have to be taken against slip of the band.

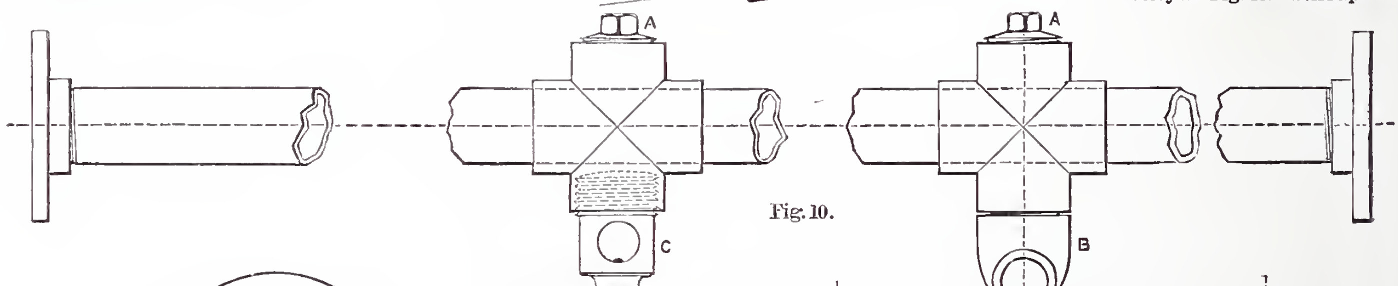
Since the above was written, yet another form of overhead has been brought out by The London Lathe and Tool Company, of 37, Pomeroy Street, London, S.E. It is a very good one, and of an interesting description. In this, as in some other forms, there is a long horizontal shaft, raised above the lathe bed, which runs in bearings and is supported by tubular stays. This shaft is driven from the fly wheel as usual, and upon it are two large and light pulleys, one of which is fitted with a key which slides in a long groove, or key way, cut in the shaft; so that though it may be pushed along by the hand to any part of the shaft, yet it must turn with it; this is the driving pulley. The second, or companion pulley, also slides freely along the shaft, but it is not keyed in any way, but acts merely as a guide pulley. The overhead band passes round a pulley which forms part of a weight, then over the two pulleys on the horizontal shaft and down to the driller, cutter, or grinder, or whatever it be required to drive, fixed in the slide rest; thus the tension of the band will remain constant, and yet its length may vary as the driller, etc., is moved by the slide rest. The guide pulley revolves in the opposite direction to the drive pulley, whilst the shaft which carries it is turning within it in a contrary direction. The size of these pulleys will diminish friction by allowing of a slower motion of the overhead shaft. The weight hangs just above the lathe board, so that in case of accident it would not have far to fall. The pulley in the weight can be taken out to put the band round it, and therefore the band may be without any hook and eye to jerk the spindle of the cutters, and injure the perfection of the work. The whole arrangement appears to be very convenient, and capable of giving a high speed, so important for ornamental turning. If there is an objection, it is that the pulleys would require to be pushed along the shaft by the hand if the length of the flute or cut exceeded 4 or 5 inches. The guide pulley being loose would follow of itself, but the driving pulley will not follow so easily, owing to the extra friction caused by the key. [The lathe to which the overhead just described is fitted, namely, the "Five-inch Geometric Lathe," of the London Lathe and Tool Company, will be noticed, and an engraving of it given in an early number.—Ed.]

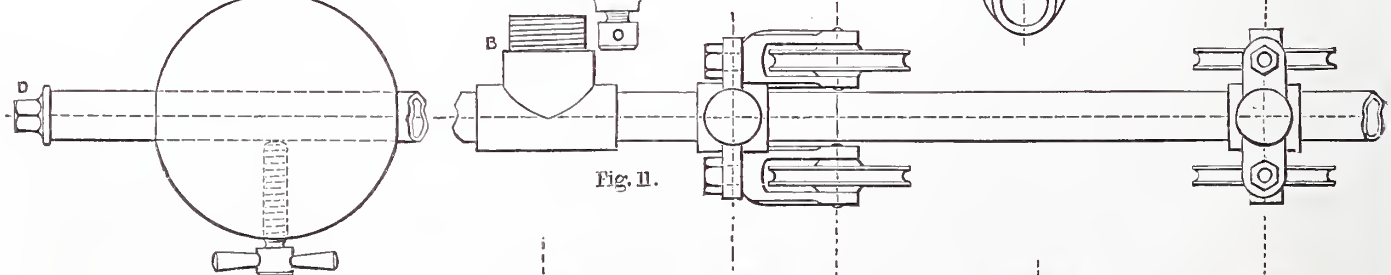
(*To be continued.*)

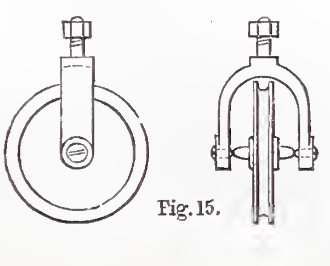


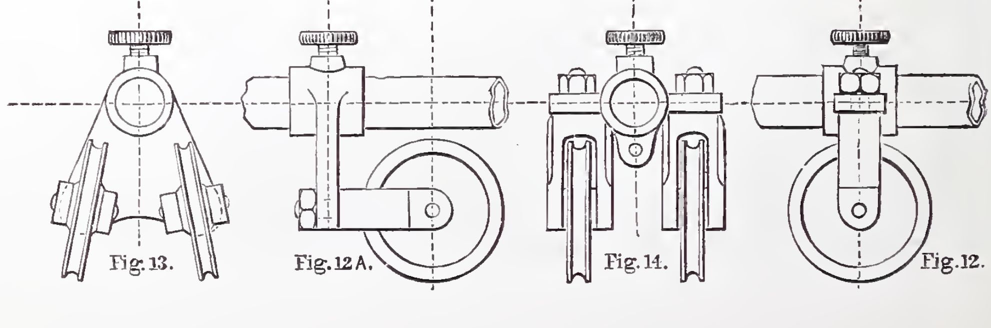
The Overhead Motion. Fig. 8.—Simple Form of Overhead. Fig. 9.—Upright Bar and Cross Piece. Fig. 10.—Cross or "Four-Way" (quarter size). Fig. 11.—Horizontal Bar.

Figs. 12, 12A, 13, 14.—Side Elevation of Horizontal Bar. Fig. 13.—End View of Left-Hand Slides and Pulleys. Fig. 14.—End View of Right-Hand Slide and Pulleys. Fig. 15.—Stirrup.









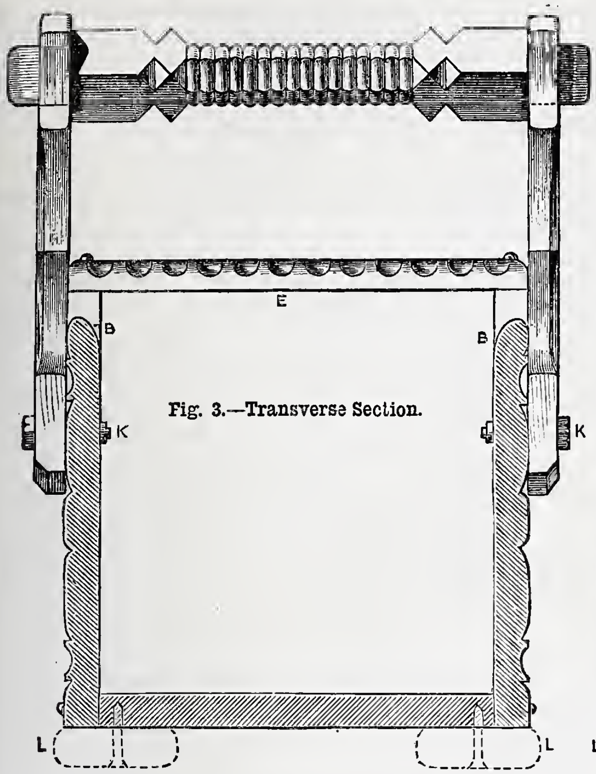


Fig. 3.—Transverse Section.

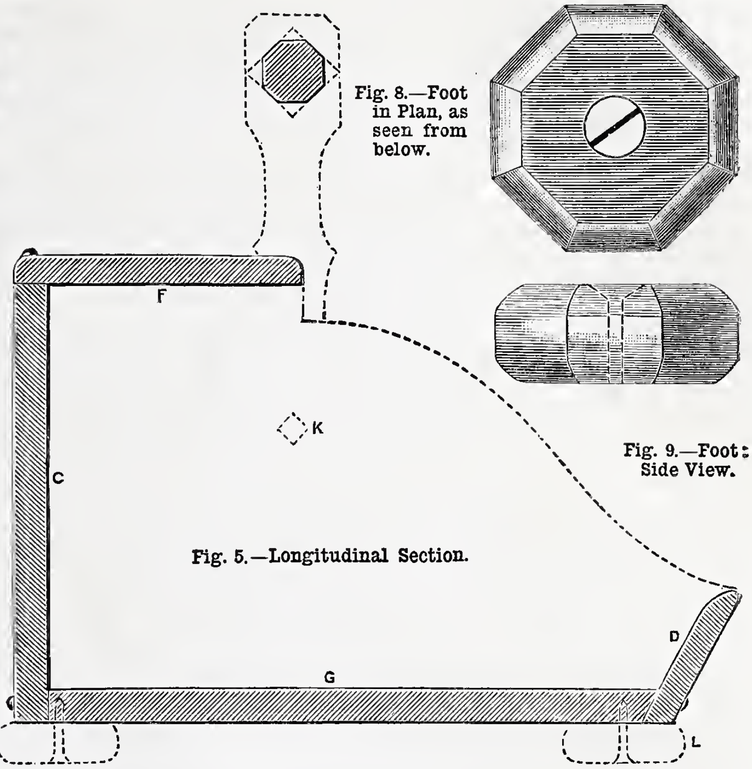


Fig. 5.—Longitudinal Section.

Fig. 8.—Foot in Plan, as seen from below.

Fig. 9.—Foot: Side View.

A COAL BOX IN CARVED OAK.

BY HIRAM PRICE.

CARVING—MATERIALS—SCALE AND DIMENSIONS—JOINTS—SIDES—BACK—TOP—HANDLE—SUPPORTS—FEET—IMITATION OF OLD OAK.

IN designing any household article in carved oak, and more especially if the article is intended to be in keeping with real old carved oak furniture, the designer naturally looks to the remains of the seventeenth century for guidance. But when that article happens to be a coal box—a matter not less necessary in oak-furnished rooms than nobler things—there is, so far as the writer is aware, no authority to which reference can be made. Our ancestors of the early Stuart Period burned logs, and had no need for coal scuttles. The consequence has been that, in devising such a convenience (originally for his own particular sanctum), the writer has had little to guide him, beyond his own sense of the fitness of things. As, however, he has succeeded in making a scuttle which, whilst serviceable, harmonises well with its genuinely old surroundings, he has pleasure in offering its design to others.

It will be observed that the carving on the sides and top, though original in its arrangement, is in a style frequently met

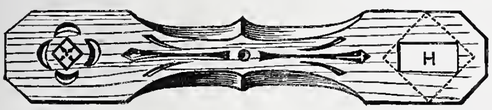


Fig. 7.—Support of Handle.

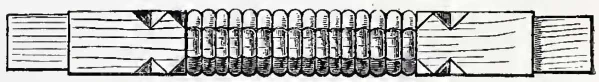


Fig. 6.—Handle.

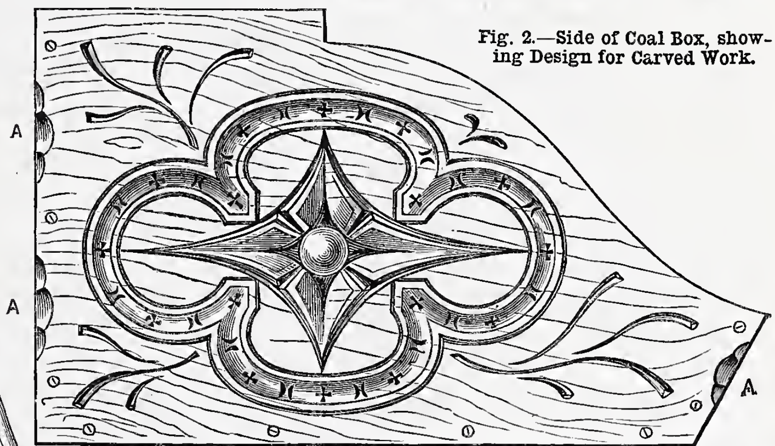


Fig. 2.—Side of Coal Box, showing Design for Carved Work.

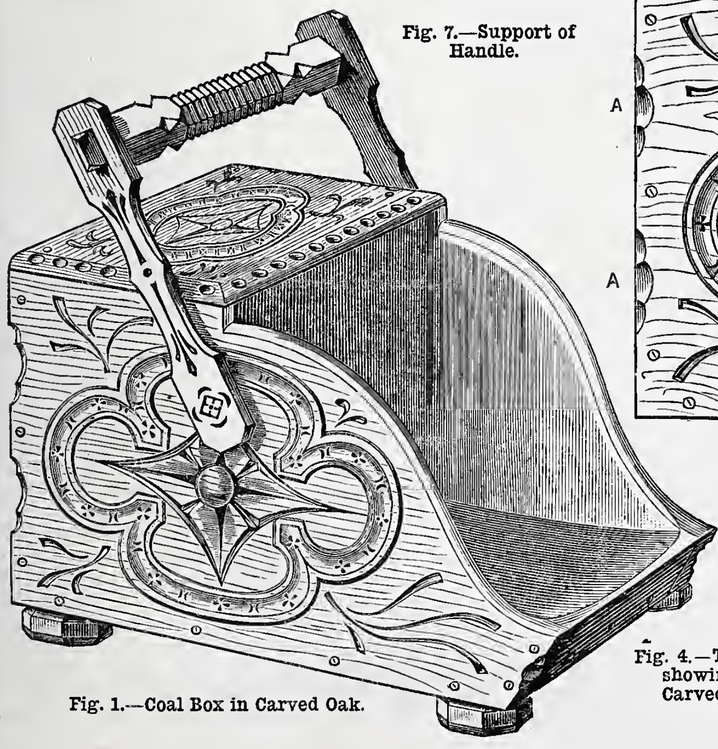


Fig. 1.—Coal Box in Carved Oak.

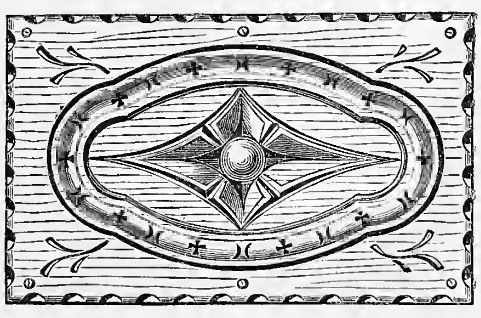


Fig. 4.—Top of Coal Box, showing Design for Carved Work.

with on seventeenth century panels; and it is one which, with a very moderate amount of labour, produces a rich and artistic effect. Whilst sufficiently deep to give a pleasing play of light and shadow, it is not of a kind liable to weaken the wood work of an article in which strength is a first essential.

The sides, top, front, and supports of handle, are in oak of about $\frac{5}{8}$ in. thick, after planing down. The back also is of oak, and is, for obvious reasons, somewhat stouter, about $\frac{3}{4}$ in. The bottom is of similar thickness, but in this place elm is preferable, as being more tough, and better fitted to withstand the rough usage to which it must be subjected. It can readily be stained to match the colour of the oak, though this will matter little, since a few days' use will make it black enough for anything.

It will be seen from the illustrations that the joints are not dovetailed, but merely screwed together, the position of the screws being, in most instances, indicated. Dovetailing would interfere much with the effect of the carving, whereas the black, round-headed screws employed are rather ornamental than otherwise; and with sound oak of the thickness specified, and $1\frac{1}{4}$-in. screws, there will be abundant strength; whilst to many home workers, the simpler mode of construction will be an advantage. If glue is not used in putting together—and there will be no necessity for using it—a mere streak of soft putty along the middle of each joint before screwing will effectually prevent any possibility of coal-dust working its way through.

Fig. 1 gives a rough sketch of the scuttle as a whole in perspective; this is not to scale. The remaining illustrations, 8 and 9 only excepted, are on a $\frac{1}{4}$ scale. The box has an internal measurement of about 14 in. by $8\frac{1}{4}$ in., and $8\frac{1}{2}$ in. high.

Fig. 2 shows one of the sides—dimensions, $15\frac{1}{4}$ in. by 9 in. A reference to the transverse section (Fig. 3) will give some additional idea as to the character and depth of the carving which ornaments it. Even in the deepest cuts — the veins, namely, which meet round the central boss—the wood is only penetrated about $\frac{1}{4}$ in. In those bands which form the quatrefoil the middle will be seen to be hollowed out by a single draft of the gouge, and this hollow bears an enrichment which may be given entirely with grounding punches (it often is so, as we see these bands in old work), but in the illustration, double nicks with a gouge are shown alternating with punched crosses. The back and front edges at A, A, A (Fig. 2), are seen to be scooped out with triple drafts of the gouge between the screws; this gives a little diversity to the straight lines, and does not weaken the joints. The manner in which the exposed lip is rounded off, somewhat more on the inner than the outer edge, is shown at B, B, Fig. 3. This piece is screwed to the bottom, back, aud front.

The back (seen at C in the longitudinal section, Fig. 5) is nearly square, being $8\frac{1}{2}$ in. by $8\frac{1}{4}$ in. As before mentioned, it should, if practicable, be a trifle stouter than the sides, etc. The front, marked D in the same figure, measures $8\frac{1}{2}$ in. by 3 in. Except at the ends, where against the joints the edge is left square (as seen in Fig. 1), its lip is rounded off as shown in section, in Fig. 5. The bottom, G, Fig. 5, is 13 in. by $8\frac{1}{2}$ in.

The top, of which the dimensions are $9\frac{3}{4}$ in. by 6 in., appears in Fig. 4; its front is also seen at E, Fig. 3, aud its shorter section at F, Fig. 5. It is like the sides, carved, but its smaller size renders a somewhat smaller and simpler design desirable, the character of the carving being, of course, precisely the same. The upper edge is taken off all round, and relieved with hollows made by single strokes of the gouge, as shown. This piece is screwed down to the back and sides.

The handle and one of its supports are shown in Figs. 6 and 7; in Fig. 3 also, which should properly be a section merely, a front elevation of handle and supports mortised together has been introduced for economy of space. In Fig. 1, the handle appears turned back at an angle of about 55°, as it generally will be when the coal box is standing at rest; but in Fig. 3, that it may explain its construction more clearly, it is directly upright. The supports, Fig. 7, are of similar board to the sides, etc., and are 10 in. by 2 in. Through the upper end of each is a mortise, H, cut to receive the tenon of the handle. The handle itself (Fig. 6), and of which the centre appears in section in Fig. 5, is $12\frac{1}{4}$ in. long by $1\frac{1}{4}$ in. square. How its central part is brought to an octagon, and made better for grasping firmly, as well as more ornamental by incised bands, may be seen in Figs. 1, 3, and 6. A dotted line surrounding H, Fig. 7, indicates how it is mortised diagonally into the supports, beyond which its tenons project some half inch, and are then rounded off. A small screw through the *back* edge of each support secures the tenon. The supports are fixed to the sides of the box by a small screw bolt and nut, as shown at K, Figs. 3 and 5. If an ornamental bolt is not to be bought, any one can, with a hand-saw file, in a few minutes alter an ordinary bolt-head to the form seen in Fig. 7.

The appearance of this handle and its supports in Fig. 3 may possibly raise a doubt as to whether it is not somewhat heavy for the box, but no such question is suggested by the actual thing. In Fig. 3 we get but a mere skeleton of the lower parts, and thus the handle, the whole of which is seen, looks unduly large. Its bolt-upright position also causes it to appear full high, but it is not felt to be too high when pushed a little back, as in Fig. 1.

In Figs. 8 and 9 is shown one of the octagonal feet, which are only indicated by dotted lines at L, L, in Figs. 3 and 5. These are merely sawn from inch board and the edges rounded off; if preferred, there is no reason why they should not, instead, be turned round; they could be made more quickly in the lathe than by hand. They are $2\frac{1}{2}$ in. in diameter, and are fastened to the bottom, as shown, by stout screws. These last two diagrams, 8 and 9, are drawn to $\frac{1}{2}$ scale.

In carrying out these plans in a scuttle for his own use, the writer has employed *old* oak, and this, when it is desired to make one's work have the appearance of real old carved work, is much to be preferred. No process of colouring with which the writer is familiar will give to altogether new wood the rich and mellow tone of ancient oak; and though in course of working-up much of the colour of old wood is apparently destroyed, it is easily restored by treatment, and the surface will become undistinguishable from one which has weathered a couple of centuries. To restore old oak after working up, nothing more is necessary than to make a solution of iron, by putting old nails, etc., in a bottle with vinegar; and this for use must be weakened with water, or it may make the wood too dark. Except when very thin, as in panel, the old wood will always show comparatively light where deeply cut into, and such light places it is safer to go over two or three times with a hot weak solution, and so gradually bring all to one uniform tone: then rub with boiled oil, and polish with beeswax and turpentine.

HOW TO DRY NEGATIVES QUICKLY.

BY L. IVOR POOLE.

There is an old saying "Curiosity is woman's curse, but in a man 'tis ten times worse." Surely when it originated photography was unknown, or an exception would have been made in favour of the mau who happens to be a photographer, for most of us are anxious to see how the print will look without unnecessary delay. Of course, heat can only be used to a very limited extent in drying a negative, so, in the long and tedious interval after the washing, till the negative is ready for printing from, there is nothing for it but to sit down and wait, or get on with something else in the meantime. Any way, we must exercise our patience, for drying in the ordinary way cannot be hastened. Sometimes, however, there are other reasons besides curiosity for wanting a print as soon as possible after exposure, and then the necessity for quick drying of the negative is important. It can be managed so rapidly, that more than once I have had a negative in the printing frame within a quarter of an hour from the exposure of the plate. True, when treated so hurriedly as this, the hypo. has not been thoroughly washed out, but this can be done afterwards, without any harm apparently to the negative. After fixing it, just rinse under the tap for a minute or two, after which it is dipped in methylated spirits, where it is allowed to remain for a few minutes. Before placing it in the spirits, however, much of the water on the surface should be removed from the film either by "dabbing" the film with a soft silk handkerchief, or with a piece of blotting paper. The glass side of the negative may be rubbed, but, of course, to do so on the gelatine side would simply be to destroy it. By taking care, a soft handkerchief may be used with impunity. Blotting paper sometimes leaves a fluff adhering to the film. After the negative has soaked a sufficient time, say from three to five minutes in the spirit, it is taken out, and the spirit allowed to drain from it or mopped up with the handkerchief. If the negative is then placed in a strong current of air it will be ready for printing from on the ordinary albuminised paper. A sufficient draught of air may be got by blowing with the mouth, or a pair of bellows may be substituted for the human blower. As often as not, I simply flog the film with my handkerchief loosely spread, and though it is the roughest way, I think it is as good as any.

The drying may be still further hastened by immersing the plate, after it has been in the spirit, in ordinary sulphuric ether, but as this is so very volatile, its use is somewhat expensive, and the time gained is hardly commensurate.

The action of the spirit is no doubt this: it unites with the water, of which there is only a very small quantity in the film, and disperses it. The spirit which soaks into the film quickly evaporates, and leaves the negative free from moisture. Ether evaporates more quickly still, so may be used as a final dryer if necessary. As the spirit every time it is used takes up some water, it loses its quick-drying powers, hence the reason for removing as much of the moisture as possible before putting it in the spirit. I find it more economical to use a small quantity of spirit at a time, renewing it frequently, than to have a large quantity constantly going. Though methylated spirit has been mentioned, it does not follow that it and no other alcoholic preparation would do, for anything that will mix readily with water and evaporate quickly will answer the purpose. For instance, two table-spoonfuls of any kind of spirit from gin upwards would be ample for an ordinary quarter plate, with the advantage that it—the preparation—could still be used —medicinally—afterwards.

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

IV.—Analysis—Anion—Anode—Gold Anodes.

Analysis.—A correct quantitative and qualitative analysis of all the substances and solutions used by electro-platers can only be made by a chemist trained in this special work, and with the aid of apparatus only found in a well-appointed laboratory. But it is most desirable that operators in this art should be well acquainted with the nature and quality of the materials used by them in the make-up of solutions; be able to detect impurities and adulterations; and determine in a short time by a mode of rough analysis the identification of a salt or a solution. Some substances can be easily recognised by some characteristic colour, form of crystal, odour, flavour, or general appearance, and thus adulterants may be easily detected. With others it would not be safe to use the senses of smell and taste in their detection; in fact, those senses should always be warily employed in the detection of any chemical, and the practice of smelling indiscriminately at bottles, and tasting of salts, cannot be too strongly deprecated. Nearly all substances and solutions give characteristic results when treated with certain other substances or solutions, or when heated over a gas-stove, or in the blow-pipe flame. For instance, the presence of silver in a solution may be indicated by adding to the solution some hydrochloric acid, or some chloride of sodium, or any other soluble chloride, when the silver present will combine with the chlorine of the added chloride, and fall down as a white curdy precipitate. This precipitate is insoluble in hot water and in nitric acid. The only precipitate nearly like it is chloride of lead; but this is *soluble* in hot water, and so can be detected and separated from chloride of silver. Compounds of sodium can be detected by the yellow colour of the flame in which they are burnt, potassium, by a violet tint, and copper, by a green tint. The presence of copper in an acid solution of this metal can be shown by immersing therein a piece of bright iron, when some of the iron will be dissolved by the acid, and copper be deposited on the iron to take the place of the dissolved iron. In a similar manner a piece of bright zinc will reveal the presence of gold; and a piece of bright copper, that of silver or mercury. The analysis of gilding and plating solutions, to determine the quantity of metal contained in them, and also the quantity of free solvent present, should be understood by every electro-plater. The apparatus is not very costly, nor is the task a difficult one when the method of doing it is understood. The same may be said of the analysis of potassium cyanide. Full directions will be given for the analysis of each in the article or note under their respective headings. See *Gilding Solutions, Analysis of; Silver-plating Solutions, Cyanide of Potassium, Free Cyanide*, etc.

Anion.—This term was invented by Dr. Faraday to indicate the radical of an acid, or the portion of a salt set free at the anode during electrolysis. It is defined by Mr. J. T. Sprague as "the electro-negative, or chlorous radical of the acid or salt decomposed." For instance, suppose we are using a solution of the double cyanide of silver and potassium in the work of electro-plating. The salt of silver in this solution is combined with a salt of potassium, and three distinct substances are present, apart from the water which holds them all in solution; these are—silver, potassium, and cyanogen. When the electric current is passing through the solution in the process of plating, silver and potassium are set free at the goods being plated, and cyanogen is set free at the silver anode. The salt is thus broken up or decomposed, and cyanogen is the anion of this salt. The following is a list

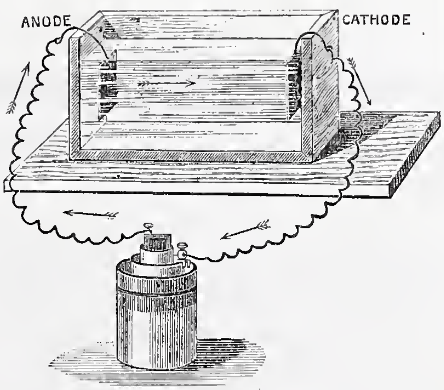


Fig. 1.—Diagram showing position of Anode and Cathode.

of anions given by Mr. Gore:—"Oxygen, fluorine, chlorine, bromine, iodine, and cyanogen; probably, also, sulpho-cyanogen, and also the various mineral acids. See also, *Anode, Cathode, Cations*, etc.

Anode.—A name given by Dr. Faraday to the positive plate or wire in a solution undergoing electrolysis. It is derived from two Greek words: *ana*, meaning "upwards;" and *odos*, "a way"—the way in which the sun rises. This term, applied to the action of the electric current, as used in electrolysis, signifies the way by which the current rises from the battery to enter the bath, or vat containing the solution to be electrolysed. This way is *from* the negative element of the battery *to* the positive element in the solution to be electrolysed. To make matters still plainer, let me say that the negative element of a battery is that part which receives the electric current and transmits it to the anode; this element is, therefore, the positive pole, and, by virtue of its connection to the anode by a wire, makes this also the positive pole or element in the solution. By way of illustration: the carbon element in a Bunsen battery is the negative element, because it receives the electric current generated by the positive, or zinc, element of the battery; but it is also the positive *pole*, because, through it and its metal connections, the current is transmitted to work outside the battery. The accompanying illustration will show this to the eye of the reader at a glance. See, also, notes under heads *Positive, Negative, Battery, Cathode, Current*, etc. Anodes may be soluble or insoluble in an electrolyte, as may be required to suit the nature of the work in hand. Insoluble anodes are used when we wish to decompose an electrolyte, and break it up into its several component parts without adding another element to it; as when acidulated water is decomposed by the electric current to form oxygen and hydrogen—in which case a platinum anode is used, because platinum is not soluble in the acidulated solution. Insoluble anodes are also used when we wish to extract all the metal from its solution, and deposit it in a pure condition on the cathode. Anodes are said to be insoluble when they are made of elements which are neither soluble in the solution to be electrolysed, nor can be made soluble therein under the influence of the electric current. Some solutions of the acids and alkalis will act very feebly, or not at all, on an element, even when heated to boiling point, but will dissolve it freely when a current of electricity is passed from it through the intractable solutions. For instance, gold is only feebly soluble in a strong solution of potassium cyanide when exposed to air, even when the solution is heated; but it is freely soluble in the same solution when only a feeble current of electricity is passed from it through the solution. Insoluble anodes are generally made of platinum or carbon. Soluble anodes are used when we wish to maintain an electrolyte at its original strength—that is, to contain the same quantity of metal in the solution after it has been worked as it had when first made up. To do this, the anode must be only soluble in the solution whilst the current is passing, and must then be dissolved therein to an extent equal with the rate of metal deposited. Unless an equivalent of metal is dissolved from the anode for each equivalent of metal deposited at the cathode, the original composition of the solution cannot be maintained during the process of electrolysis.

Gold Anodes should be made of pure gold plate or ribbon, not less than $\frac{1}{16}$ in. in thickness. Thin gold leaf or sheet is apt to become ragged at the edges as the anode gets worn; these ragged edges drop tiny pieces of gold to the bottom of the bath, and thus the solution, or the gilded goods, gets credited with an undue portion of the wasted anode. Plates of pure gold $\frac{1}{16}$ in. in thickness can be easily bent over a platinum wire, and this forms the best support for the anode, since it is not acted upon at all by the gilding solution or the fumes arising therefrom. Copper, silver, or brass wires dissolve and contaminate the solution with an alloy. Alloyed gold may be used as anodes, but the deposited metal will soon become an alloy of gold instead of pure gold; and the alloy is as likely to be as variable in composition as most deposited alloys are, and thus give trouble to the gilder. If gold anodes have been hardened by hammering, they should be annealed before being used. As a rule, the surface of anode presented to the solution should be slightly in excess of the surface to be coated with gold. As anodes are more quickly worn away at the surface of the air on them, they should be lifted out when not in work, and their position frequently changed.

(*To be continued.*)

OUR GUIDE TO GOOD THINGS.

33.—Winn's New Patent Water Director.

The New Patent Water Director is, as its name implies, an appliance for throwing water, so to speak, in the form either of a jet or spray, on anything on which it may be desirable to cause water to impinge. It is not a syringe, in which water is first drawn in by the withdrawal of the piston within from nozzle to top, and then driven out by pushing the piston back again from top to nozzle; but it is simply a contrivance to take the place of the ordinary nozzle or tube, which is usually fitted to the end of the flexible tube that is attached to all garden engines and pumps, as a means, with the nozzle, for the direction of the water which is ejected from such machines by the operation of pumping. This, at all events, is the inference to be drawn from the annexed illustrations of the New Patent Water Director to be found in this page. Illustrations of this kind are most helpful to the comprehension of the description of any article; but it is by no means an easy matter to give a really good and intelligible description of anything, especially if it be a machine of any kind, from an engraving. To help me, therefore, in writing such descriptions, I shall always take it as a personal favour if manufacturers, patentees, and dealers will send me a specimen of the appliance to be described, that I may be enabled to thoroughly understand its construction myself before I attempt to describe it for others. I shall be glad, also, if they will name retail prices, for I have always held it to be neither of advantage to the reader, nor helpful to the maker, to say nothing about price; for many a man who will readily buy an article if the price suits his pocket, will take no trouble to make even inquiries about the thing if he be kept in the dark on this most important of all points. Apparently the Water Director under consideration is a useful and desirable contrivance for the purpose for which it is intended, more especially as the jet of water may be turned to spray, or the water entirely shut off by simply sliding the upper part or outer case upon the inner pipe or stalk, which terminates in a piece of metal twisted into a spiral form. There is no cock of any kind, and the movement is effected easily and smoothly, without concussion. That it is made and supplied by Messrs. Charles Winn, brassfounders, St. Thomas's Works, Granville Street, Birmingham, is, I think, a sufficient guarantee for its goodness, as far as make is concerned, and its utility. Messrs. Winn and Company state it to be "the simplest and most effective thing yet offered for the purpose." It is sold in three sizes—namely, $\frac{1}{2}$ in., $\frac{5}{8}$ in., and $\frac{3}{4}$ in., which, I presume, is the diameter of the inner pipe; but whether externally or internally, I am unable to say, for the reason stated above. The prices are 35s., 45s., and 60s. per dozen, respectively, according to size; or 45s., 60s., and 75s. if supplied with union.

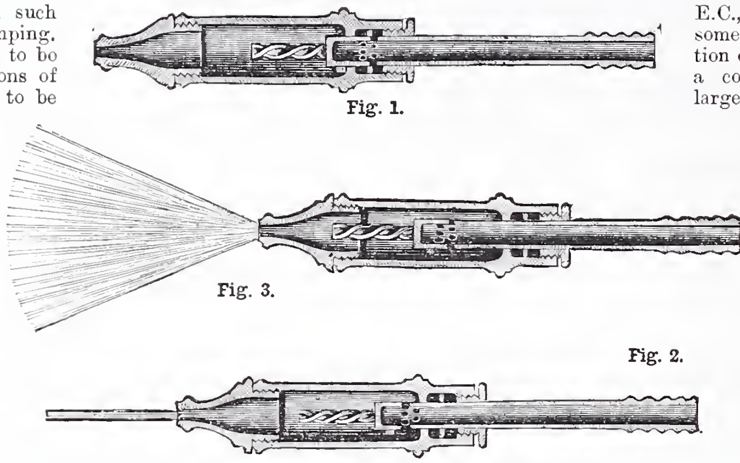
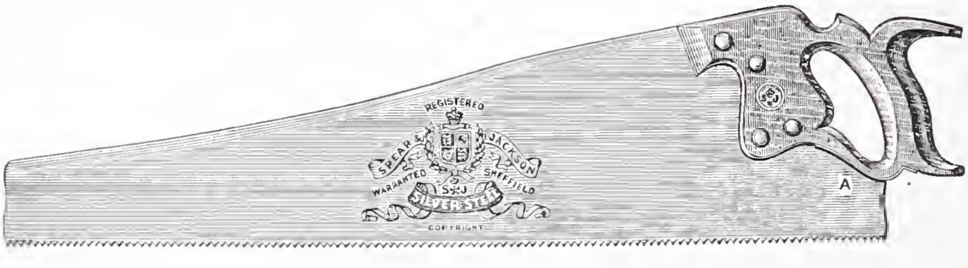


Fig. 1. Fig. 3. Fig. 2.

Winn's New Patent Water Director. Fig. 1.—Showing Director in Section with Water Shut off. Fig. 2.—Section showing Jet. Fig. 3.—Section showing Spray (No. 1594).

34.—Spear and Jackson's Improved Pattern Silver-Steel Handsaw.

This excellent saw, described in Messrs. Spear and Jackson's price list as No. 1887—a number which, perhaps, it will be well to quote in giving orders—is in every respect a nice tool to look at, and a capital tool to handle and work with. An old professional to whom I showed it, one of the best handrailers in the United Kingdom, fairly smiled with pleasure as he took the specimen saw sent to me into his hands, and examined it from handle to point with the utmost interest. "Yes, that's something like a saw," he said, as he handed it back to me with a lingering touch, and then asked the price, as though he would have liked to have made it his own. I could not tell him then, as I can tell my readers now, that this particular saw of silver-steel, full polished, with apple-wood handle, fitted with registered brass heel supporting and protecting plate, raised brass screws, and highly-finished blade, costs 120s. per dozen 26 in. long, and 130s. per dozen 28 in. long. And his approval was in no way diminished when, taking the saw in both hands, I brought point and handle together in pretty close proximity, and, letting go the point, allowed the blade to spring back smartly and sharply to its original position. The appearance of the blade is very good, being well-nigh as bright as silver; all the dirt, if I may so call it, being taken out of the metal—probably, by the Bessemer process and hammering combined. This saw, as well as all other best saws manufactured by Messrs. Spear and Jackson, Ætna Works, Sheffield, is tempered and ground by patented machinery, and is accurately tapered from the tooth to the back, and from the heel to the point, the teeth remaining the same thickness throughout, so that the saws work clean and sweet, with the least possible set. The reinforce plate of polished brass, attached to the outer edge of the handle at A in the accompanying illustration, and extending on both sides of the blade the entire width of the handle, not only supports and stiffens the heel of the blade, but protects and strengthens the handle at its weakest place. The handle, moreover, being carried well forward on the blade, as shown by the illustration, the weight of the saw is brought nearer the wrist of the operator, who has thus greater control over it, and the feeling of weight at the point is avoided. The blade also is materially stiffened by this arrangement, and may therefore be thinner than is usual in saws of the ordinary pattern, and still, at the same time, as rigid. I do not think that any workman, whether professional or amateur, would regret becoming the possessor of one of these saws. It may appear to be somewhat expensive when the price is contrasted with the cost of other saws of the same size. Its form is similar to that of the handsaws made by Henry Disston, an American manufacturer; more especially in the curved line of the back, which will only be regretted by those who are in the habit of using the back of the saw sometimes as a straightedge.



Spear and Jackson's Improved Pattern Silver-Steel Handsaw (No. 1887).

35.—How to Select Wood-Working Machinery.

This is a handy little volume, forming No. 3 of the "Timber Trade Handbooks," published by Messrs. William Rider and Son, *Timber Trades' Journal* Office, 14, Bartholomew Close, E.C., and written by Mr. J. Stafford Ransome, Associated Member of the Institution of Civil Engineers. It is devoted to a consideration more especially of the larger machines used in felling and preparing timber for the various purposes to which it is applied; reviewing in order the machines themselves, as regards power, construction, and purpose, and the various motive powers in use for actuating them. There is much to be learnt from its pages on the points already stated, as well as on purchasing machines. Some chapters are devoted to tree felling, the handling of logs after felling, and handling and cross cutting logs in the yard.

36.—Practical Iron-founding.

This useful and well-illustrated work is from the pen of "A Foreman Pattern-maker," one of the contributors to Work, as its readers will recognise. It is published by Messrs. Whitaker and Company, 2, White Hart Street, Paternoster Square, E.C. It is, to use the author's own words, "an attempt to give a condensed account of the principles and practice of iron-founding"—an attempt in which the writer has been entirely successful. It further contains the most recent practice with regard to machine moulding and the working of iron. It may be said to be replete with information on sands; on moulding both in green and dry sand, loam-work, etc.; and on the mode of going to work in moulding, and the tools that are used. The book is well illustrated with various diagrams and engravings, most of which are apparently from the pencil of the writer of the work.

37.—Barry's Patent Model Apparatus for Teaching Applied Mechanics.

This is the title of a small pamphlet in which an account is given of an apparatus devised and constructed by Mr. E. Barry, 75, St. Donatt's Road, New Cross, London, S.E., for the purpose of "making youths conversant with mechanics and with what are called the mechanical powers, and induce in them habits of scientific reasoning." In the apparatus the whole of the mechanical powers and their action are clearly exhibited, and practical illustrations are afforded of simple machines used in raising weights, moving heavy bodies, horizontally, vertically, and on inclines, and overcoming resistances by the aid of the working models. It contains, in fact, thirty-six distinct machines with accessories, with which endless experiments and combinations can be made. Its cost, complete in case, is £5 5s., no great sum when its practical value as a means of teaching mechanics by ocular demonstration is considered. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

**** All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters From Correspondents.

Plans, etc., for Building.—A Subscriber who wants to Build writes:—"Having entered my name as a subscriber from the time I first received your circular giving a description of your new publication entitled Work, I have, with pleasure, perused its pages, and derived therefrom much valuable and useful information. I venture to suggest and ask you from time to time to favour us with a sketch and specification for building neat two-storied dwelling-houses at a moderate price. I am sure it would add additional interest and instruction to numbers of your subscribers. I know a few who would be delighted to receive such valuable information, and would myself gladly embrace the favourable opportunity of turning to good account the plans and information which, I am sure (judging from other suggestions and plans), would be worthy of carrying into effect. I hope ere loug to be favoured with such when time and space permit."—[I insert your letter with pleasure as a means of ascertaining the views of readers on this subject. The difficulty would be to please all who may want to build, and to meet their wants in every particular. To my mind, the better way would be to begin with pairs of cottages of four or five rooms, giving types of two kinds—one suitable for towns, and the other for the country—and then to proceed onwards and upwards to what are usually known as villa residences. This mode of treatment would give an opportunity of describing new materials, modes, and appliances used in building; and readers who required any departure from the types given could be told how they might best effect their purpose in "Shop." I shall be glad to have a full expression of general opinion on this subject.—Ed.]

Our "Cabinet in Fretwork."—Samuel Cosgrove (*Macclesfield*) writes:—"I beg to say that I have prepared, and am exhibiting at the Town Hall, Macclesfield (April 9), a cabinet from your drawing issued with No. 1 of Work."—[I am obliged to you for the programme of the Exhibition sent with your letter. I am glad to find you have cut and made up the design, and trust that you may be successful in securing the first prize. Let me hear the result.—Ed.]

II.—Questions answered by Editor and Staff.

Plumbing, Joint Wiping, etc.—Plumber.—You will, I hope, soon see papers on these subjects.

Lithography in all its Branches.—W. R. S. (*Croydon*).—Lithography will be taken up in due season.

Etching on Steel.—Excelsior wishes to know the composition of a powder used for etching on steel. The powder is strewed over the tracing made in soap, and moistened with water, then allowed to penetrate the steel. I have bought such a powder in the streets of London, but do not know its composition. I have tried a mixture of common salt and saltpetre crushed to a fine powder and spread over the tracing, then moistened with water. This bit into the steel, but it had not made much progress in two hours. When moistened with a drop of nitric acid its action is more rapid. Common salt spread on the tracing, and then moistened with very dilute nitric acid, has a rapid action on steel. Perhaps a brother etcher will oblige by sending a few hints for publication in "Shop."—G. E. B.

Batteries for Electric Lighting.—F. T. (*Bristol*).—I have not tried the Lalande battery for electric lighting; but others not connected with their manufacture and sale have done so, and have printed their experience. This is what one says:—"I had two years' practical work at lighting by the Lalande-Chaperon oxide of copper battery. The batteries used comprised large cells $1\frac{1}{3}$ ft. deep, 2 ft. long, and 1 ft. broad; these were very heavy, as each cell, when complete and charged, weighed 384 lb. We used 10 c. p. lamps of 20 volts, and as the electro-motive force of each cell was ·6, we required about 35 of these cells to obtain the necessary voltage." Finding the labour and cost of maintaining such a battery so great as to render their use impracticable, he next used only six cells during the day to charge 10 accumulators, using the current from these at night. He then gives results. "The quantity of current from each cell being large, it was possible to light ten 10 c. p. lamps of 20 volts for thirty hours, or six days of five hours; but not being able to regenerate the potash of battery and recover the zinc, this became impracticable on account of cost." Place these practical remarks side by side with the glowing account of the battery in the newspaper cutting sent, and draw your own conclusions. During the last ten years many of these so-called regenerative batteries have been invented and placed on the market. They are will-o'-the-wisps among batteries, for they only beguile persons from the right path by their flashy claim to inexpensiveness. A few moments' thought will serve to convince any unbiassed mind of the hollowness of the claim. The electric current required to regenerate them costs as much, or more, to produce than the current obtained from a charged battery. The principle can be applied to the Daniell battery, but not economically. You cannot get any of these batteries to retrace their action and work backward. I propose writing a short paper on the Daniell battery at some future time. The subject of electrotyping will also be taken up at some time by myself or one of my colleagues. Stereotyping will also receive attention from one of us. To sum up: all that is of interest to workmen in their work will be treated of in the pages of Work. The remaining suggestions in your kind and interesting letter have been handed on to the publishers, whose business it is to arrange the advertisements.—G. E. B.

Electro-gilding.—Nemo (*Norwich*).—Work your gilding solution with current from one quart Daniell cell, or one Bunsen weakly charged. The solution must be worked hot (160° Fahr.), and may be heated in an enamelled saucepan. Iron or any other metal vessel will not do for the purpose. Use an anode of pure gold attached to the wire leading from the copper or carbon of the battery. If the solution does not work freely, add a small piece of cyanide of potassium to it. If you want any further advice, please write again, and I will gladly help you. Look out for my forthcoming articles on "Notes for Electro-platers."—G. E. B.

Brass Casting.—Brassworker writes:—"Will you say how antimony acts upon usual pig brass, and how much should he added to pot of metal of, say, 40 lbs., and if any beneficial result is obtained from using same in brass? Others advise a little lead to soften brass. Will this do, and, if so, how much should be added to pot of metal of, say, 40 lbs? Should the softening be correct, does it at the same time become more breakable or 'short,' as metal is called that breaks readily?"—To the above the reply is:—Antimony acts by facilitating the combination of the mixture called "pot metal" (copper and lead). 1 of antimony to 7 of lead and 16 of copper, mix well, and give a harder alloy than the lead and copper alone. There is a red brass composed of copper, 160 lbs.; zinc, 50 lbs.; lead, 10 lbs.; antimony, 44 oz. The metal is not short, but soft. The effect of lead upon common yellow brass (copper and zinc), when added to the extent of $\frac{1}{4}$ oz. or $\frac{1}{2}$ oz. to the pound, is to render it more malleable, and to make it cast more sharply. The lead must be added last, and stirred just before pouring. If excess of lead is put in, it will ooze out, and partially separate in cooling.—J. H.

Building Model Locomotive.—Amateur writes:—"I intend building a model locomotive 3 ft. long. Now, what I want to know is—(1) Can I get a casting of the bed-plate in iron 35 in. × 9 in. and $\frac{1}{8}$ in. thick? My impression is that I cannot. I would prefer a casting, as it is such a lot of trouble cutting out the various dimensions. (2) Where can I get the boiler tubes brazed in? There does not seem to be a brazier about here (*i.e.*, Wimbledon). Can you recommend me one in London?"—To these queries the following replies are given:—(1) It is quite possible to make a casting of a "bed-plate" (frame-plate) for a model locomotive in iron, measuring 35 in. × 9 in. × $\frac{1}{8}$ in., but then it would be of no use when done. Wrought iron or steel plate is the proper material. (2) Any of the model-makers would braze your boiler tubes. Batemau & Lee, High Holborn, do plenty of this kind of work.—J. H.

Scrolls and Designs for Monumental Work.—J. C. (*Aberdeen*).—No branch of manual work will be neglected in Work, but as I have already said, to touch on every trade at once is not possible. I can only say that papers on the art of the stone mason will be given as soon as it is practicable with designs for the special work to which you allude. Meanwhile, you will not fail to find in every number of the Magazine some hint, suggestion, or piece of information that will be well worth its price to you for home adoption and use.

Pit Frame for Wheel Making.—E. J. E. (*Abingdon*).—Your inquiry for the method of "making a good frame for wheel making" requires a longer reply than can be given conveniently in "Shop." I have much pleasure, therefore, in saying that provision shall be made to meet your requirement in the form of a paper with illustrative diagrams, which, I hope, you will find helpful to you.

Plasterers' Work.—C. L. (*Uxbridge*).—This subject, in commou with the work of other trades, will receive mention at any and every opportunity.

Violin Scroll.—T. D. N.—The instructions for making violin scroll would require much more space than could be devoted here, but articles on violin making are in progress, when the subject will be fully dealt with.—B.

Violin Cramps.—E. P. W.—Please accept latter part of answer to T. D. N. on "Violin Scroll" in reply to your queries on violin making. A joiner would not be likely to have wood screwing tackle small enough ($\frac{3}{8}$ or $\frac{1}{2}$ in.) for making violin cramps. These can be bought from either Lafleur & Son, Green Street, Leicester Square, London, or J. Scheerer, Covered Market, Leeds.—B.

Treatment of Gold Rings after Soldering.—Dean Forest.—After soldering wedding rings and keepers, drop them into a mixture of sulphuric acid 1 part, water, 10 parts, and leave till the borax is dissolved. They must then either be gilt or polished; wedding rings would do scratch-brushed and burnished, but keepers would require to be gilt, and if required to look as new, also lapped.—Aurolectric.

Model Beam Engine.—W. J. P. (*Fenny Stratford*).—I do not know of any book that will tell you how to make a model beam engine. It is a thing amateurs seldom think of attempting. But there is a very clear sectional view of a beam engine in "Stationary Engine Driving," by Michael Reynolds, p. 42. It is a folding plate, and can very well be worked from by scale. It is published by Crosby, Lockwood, & Co. Any information you may require as to the details of work of this kind can be had for the asking.—J. H.

Mounting Tracing Linen.—Lara asks:—(1) "How to mount drawings made on tracing linen. I have tried it a few times without success. It always becomes *baggy*, and loses its polish. (2) Can tracing linen being damped be restored its original gloss, and how?"—Your query is not sufficiently defined. I may assume, tracing cloth being in itself sufficiently durable, that it is not intended to mount on canvas. If for an ordinary picture strainer or board, the simplest way is to glue the outer edge of the strainer on one of its longest sides, turn the tracing cloth down, say, $\frac{3}{8}$ths of an inch, and fix. Allow time for this to set. Next glue opposite edge of strainer, and pull the tracing tightly down, pressing firmly to the glued edge, repeating the process for the other two sides; cut out the corners of the cloth to prevent creases. On most tracings you will find one or more selvage edges; these should be cut off before mounting, otherwise the cloth will give when tightened more in other parts than on these edges. If objection is taken to the cloth showing on outer edges, glue $\frac{3}{8}$ths of an inch on flat surface of strainer, and proceed as above. Use Le Page's glue or transparent cement, cold; hot glue will affect surface; indeed, any glue or cement used is sure to show through even if the surface is otherwise unaffected. If the tracing is for show, put a strip of coloured paper over the part affected by the glue, and so form a border. A sheet of white paper under the tracing shows it up to advantage. Above all things avoid damping or wetting. Tracing cloth wet is practically spoilt, and I believe any solution you might try to regain the lost gloss would only add to the mischief. The Aladdin remedy, new lamps for old, is about the only way to effect a satisfactory issue.—Joachim Miller.

Bunsen Batteries.—H. D. (*Haverfordwest*).—(1) Porous cells for quart Bunsens, 6d. each. (2) Zinc cylinders, amalgamated, 1s. 3d. per lb. Both procurable of any dealers in electric sundries. Here in London, of Messrs. H. Dale & Co., 26, Ludgate Hill, E.C. (3) One cell for electro-plating and gilding on a small scale, or working a small shocking coil, or small magneto-motor. Two cells in series for working larger coils, magnets, or motors. Three cells in series for electro-coppering and nickelling and lighting a small lamp. Four cells in series will light two small incandescent lamps. (4) Although I mentioned electric lighting as one of the kinds of work suitable to the Bunsen battery, I am not favourable to this system of lighting by means of a battery. There is too much trouble, and mess, and expense attached to it, to make it pleasant. See reply to H. S. on this subject. (5) The cost of a Bunsen battery will be about 3s. per quart cell, complete. Acids will be extra cost, of course. That is about the cost here in London.—G. E. B.

Internal Resistance of Battery.—G. W. (*Liverpool*).—All conductors of electricity offer a resistance to the passage of this force. This differs with different conductors. Its nearest equivalent in mechanics is friction. The internal resistance of a battery is the total resistance of the conducting fluids and elements within the cells. This is ascertained by balancing against it the known resistance of certain coils of wire and instruments. The coils are known as resistance coils, and are equivalent to electric weights. The balance beam, so to speak, is named a "Wheatstone Bridge," and the indicating instrument is named a "Galvanometer." The resistance of wires is ascertained by the same method. Electrical measurements and measuring instruments will receive our attention, and be treated of in future numbers of Work.—G. E. B.

Glazier's Diamond.—N. T. (*Leyton*).—Superior diamonds will cost about 30s.; from this price downwards for a good tool to 21s. You may get a fairly good one second-hand at a pawnbroker's shop for 10s. 6d.; but second-hand diamonds may he damaged or out of set. To use a diamond, place the sheet of glass on a cloth-covered level board, measure off the dimensions, lay a straightedge along the intended line to be cut, hold the tool in the right hand, with the steel holder close to the straightedge, find out by trial the cutting edge of the diamond, then draw the tool along in this position to the end of the line. You can feel and hear when the diamond is *cutting* the glass, then keep the tool in the cutting position all along the line to the edge of the glass, but not over it. The pressure on the tool should he only enough to keep it in cut, but must be uniform throughout. Of course the tool will wear out, but will last a lifetime with good care. If the diamond spark is injured or torn out of its setting, it must be reset. Tool vendors will get this done.—G. E. B.

Electric Lighting by Battery.—H. S. (*Bebington*).—Four quart Bunsen cells in series will light up two small incandescent electric lamps. These lamps are small glass globes fitted with platinum wires attached to a thin filament or string of carbon. The globes are exhausted of air, and sealed

One wire of the battery is hooked on to one of the platinum wires on the globe, and the other battery wire to the other bit of platinum, then the carbon filament gets white hot and glows, emitting a soft, white light. Proper holders for the lamps are supplied by those who sell the lamps. Having tried lighting by batteries on a small scale, and experienced the cost and trouble, I do not advise any other person to follow my example, save only as an experiment to see what can be done this way. —G. E. B.

Small Dynamo.—A COTTAGER.—Small dynamos are preferable to batteries for lighting up small electric lamps. I am trying to arrange for a few papers on dynamo building. Before you decide on electric lighting for your cottage, you must arrange for power to drive the dynamo. Have you a gas engine, steam engine, or water motor?—G. E. B.

Circular Saws.—A READER.—You ask for a "simple rule to calculate the power, not nominal, it would take to drive a circular saw of any diameter up to 60 in. to cut, both soft and hard wood the depth it will reach."—For every square foot of hard wood with a 60-in. saw and ¼-in. kerf 2-horse power —actual, not nominal—is required to drive saw only. To this must be added, say, 1-horse power for shafting, etc., and the result doubled to provide for contingences. You would, therefore, require about 6-horse power actual. It is always best to provide a good margin of power, so that when the saw is working at its full capacity, the engine shall only exert at most about three-fourths of its full power.—OLLA PODRIDA.

Power of Engine.—A READER.—You ask what would be the real horse power of a "semiportable engine with two 11-in. cylinders, 24-in. stroke, and from 90 to 100 strokes per minute;" and "what pressure of steam should steam gauge indicate to get full power; and how to calculate the power of the above, or of an engine with one cylinder."—In finding the horse power of an engine, each cylinder —when there are more than one—is treated and calculated from separately. To do this in any case, the mean pressure of the steam in the cylinder during a revolution must be known. In practice this is ascertained from indicator diagrams. You do not give the boiler pressure, nor do you state the cut off of slide valve, both of which govern the power also. This information being absent, I cannot give much more than the method by which the horse power is worked, and in doing this will assume that the boiler pressure is 40 lbs. per square inch, and the slide valve cuts off at three-quarter stroke. This will give approximately and practically a mean pressure of 30 lbs. per square in. on the piston. The actual horse power of an engine is found by multiplying the area of the piston in square inches, the mean pressure in lbs. during the stroke, the length of stroke in feet, and the number of revolutions per minute together, and the result by two; which total, divided by 33,000, will give the horse power. Taking your case, for example, where the diameter of piston is 11 in., stroke 2 ft., and number of revolutions 100, the mean pressure being 30 lbs., we have as follows:—

$$\frac{(95 \times 30 \times 2 \times 100) \times 2}{33{,}000} = 17{\cdot}27 \text{ Horse power.}$$

for one cylinder, and 34·5 for the two cylinders. As to the pressure which steam gauge must indicate to get full power, I can give no information, not knowing what boiler and engine were designed to work at. If you do not know what pressure to work your boiler at, get it surveyed at once by a competent authority. If you neglect this, and go on working in the dark, as you evidently are, something serious may happen. If you will describe your boiler, giving its age, situation, method of seating, length, diameter, thickness of plates in each part, and general construction, I may be able to give you some idea of working pressure.—OLLA PODRIDA.

Standard for Porous Pots.—BATTERY.—The question of the suitability of porous pots need not cause you any trouble. In practice, the eye alone guides one in the choice of pots. The only tests are those mentioned in my article on the Bunsen battery. These were given as aids to those who wished to put up a perfect series of cells, all having the same resistance. Any cell may be used, whether hard or soft; but the best are, of course, those of medium porosity.—G. E. B.

Organ and Harmonium Building.—H. B. (*Glasgow*).—In reply to your letter, arrangements for papers on the construction of the instrument known as the American organ are now in progress.

Circular Saw.—J. B. (*Poole*).—I do not see how I can well add to the description of the circular saw noticed in WORK, No. 4 (page 61). You ask, "Can you give some idea of its capabilities? Will it saw inch boards lengthways and across? Is it properly finished, and will it saw mitres true? Has it 'continuity' of action?" As to capabilities, the amount of work that can be done by and with the saw is indicated by what was said of it in the description. It will certainly saw wood one inch thick both with the grain and across the grain. It is well finished, and will saw mitres true, provided you keep the edge of the wood you are cutting well against the fence, so that the saw may enter it at the right angle. As to "continuity of action," I can only say that the saw will keep going as long as motive power is applied to it. It is intended for small work; but with somebody to help you, and trestles whereon to support the board, you might rip up boards of any length. The fly-wheel is heavy enough for the saw. Rapidity of motion, of course, depends on the amount of power applied. You will find it a useful little saw for all ordinary purposes and light work; and by following the principle of construction and adding means of working the saw by hand power, and using an 8-in. saw instead of a 6-in. saw, you might easily construct a bench saw as an adjunct to your carpenter's bench, which would do heavier work than you can get out of the saw in question. You cannot expect a boy to do the work that a full-grown, able-bodied man will get through, and it is pretty much the same with large and small machines of the same class.

Casting in Plaster.—MOULDER.—I know of no good work on casting in plaster; but I may say that in time the fullest and clearest instructions on this subject will be given in WORK. Meanwhile, you shall have brief instructions for taking a plaster cast from the figures you have modelled in clay.

New Invention.—W. J. P.—The cost of obtaining provisional protection for nine months if you go to the Patent Office direct is only 30s. If you will send me a sketch of your invention, or, better still, a working model, I will submit it to a man in the trade to which your invention applies, on whom I can rely implicitly, and he will advise you as to its merits and value. That being settled, I will see what can be done towards helping you to secure the benefit of your invention, if you cannot help yourself to the extent first required. You see I have given no clue in my reply to the nature of your invention. I might have answered you direct by letter, but I have replied through "Shop," as you requested, on much the same principle that Admiral Byng was said to have been shot—namely, "to encourage the others"—the "others" in the present case being those who may happen to be in the same predicament as yourself. I hope and trust, by God's blessing, that WORK will prove the means of bringing help to many a man who may have inventive and creative brain power, but lacking the means to turn the products of his thought to good account.

Wood and Machinery for Fret Sawing.—A. E. G. (*Ipswich*).—You ask me to tell you "the best firm for all kinds of wood for fretwork, saws, and designs, etc." To begin with: every firm of dealers in these articles consider themselves to constitute the "best firm." Suppose you were asked to declare whom you might think to be the prettiest and most charming of a dozen young ladies, and you were rash enough to do so. You would certainly offend eleven, and, perhaps, not make any decided advance in the good graces of the twelfth. Now, unwittingly, of course, you seek to place me in precisely the same predicament with the firms. I will tell you some *good* firms from whom you may get wood for fret sawing, and apologise to all who may be omitted, on the plea that I am either not acquainted with their names and addresses, or have forgotten them in a brief spell of temporary insanity, induced by your question. In London, wood may be bought of R. Melhuish and Sons, 85 and 87, Fetter Lane, E.C.; Henry Zilles, 23 and 24, Wilson Street, Finsbury; and Charles Churchill and Co., 21, Cross Street, Finsbury. In Liverpool, of G. Busschotts, Park Lane. In Bath, of Fritz Collins. In Settle, Yorkshire, of Harger Bros. In East Dereham, Norfolk (which is about the nearest to you, failing any dealer in Ipswich), of J. H. Skinner and Co. In Dublin, of Booth Bros. Of saws, there is a good German make with a thin rounded back and narrow blade to be had of Mr. H. Zilles; and there is an equally good kind of saw imported from Italy to be had of Mr. G. Busschotts. The Griffin saws, and the Star or Hibernia saws, are also good. Of fret machines, the best undoubtedly is the Britannia Company's No. 8 fret saw.

Advertisements in "Work."—AN AMATEUR.—As I have said before, the appearance of advertisements in WORK does not interfere with the utility of the magazine. You must try to persuade yourself that the value of the information you derive from WORK outweighs considerably that which may possibly appear to yourself and others to be a detriment and disfigurement. At all events, your suggestion shall be taken to the proper quarter for its consideration.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

6. Steam Siren or Fog-Horn.—H. T. C. (*Leytonstone*) wishes to know "how to make a steam siren or fog-horn. Working drawings required."

7. Old Coloured Print.—W. H. (*Liverpool*) asks for "instructions how to remove old smoke-dried varnish from a coloured print, 'The Farm Yard,' by Bowles & Carver, 69, St. Paul's Churchyard, London." He adds:—"Can you give me an idea of the date, or tell me how I can get it? The size is 34 in. × 22 in., and it is printed on two pieces of paper joined down the centre."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Cutting and Polishing Stones, etc. (See No. 2, p. 30).—J. H. writes:—"Mr. Bear will find a great deal of information on polishing processes in the third volume of Holtzapffel's 'Turning and Mechanical Manipulation.'"

Address Wanted.—CHARLES S. WHITING (*Dublin*) will oblige by sending his full address to the Editor of WORK.

Trade Notes and Memoranda.

SOME TOPICS OF THE HOUR.—Conditions of Tendering.—District Surveyors' Fees.—The Condition of the National Portrait Gallery Pictures.—Compressed Air Systems.—Registration and Education of Architects and Surveyors.—Water Waste.—Improved Processes for Tanning.—Artificial Illumination.

THE Westinghouse automatic brake is in future to be the standard brake upon the trunk lines of Switzerland.

AN American writer recommends red ink in which gum arabic and washing soda have been dissolved, as a suitable solution for making legible alterations on blue prints. The action of the soda is to decompose the blue matter of the print, leaving the white paper exposed. The gum arabic is added as a thickening solution to prevent the ink from flowing too freely from the pen and spreading on the paper. Red ink is simply used as a colouring agent. If the soda alone is used, the lines show white. Caustic soda is recommended as being better than washing soda.

TIMBER in Guatemala is abundant. There are forests of mahogany and pine with a great variety of other woods which are capable of being used for manufacturing purposes. The balsam tree grows wild. There are forests of the indiarubber tree, beside the textile plants, such as the maguey, the saltwort, the soft rush, the soft aloe, all capable of becoming the bases for remunerative industry. Resins, gums, and balsams are met with, such as the liquid amber, the copal tree, the turpentine fir, vegetable wax, etc.

AT the Central Institution of the City and Guilds of London Institute, Mr. T. Bolas is delivering a course of six lectures on photography, on Wednesday evenings, at 7.30. Lectures I. and II. will deal with the use of artificial light in photography; lectures III. and IV. with photo-mechanical printing methods; and lectures V. and VI. with direct contact printing methods.

WORK

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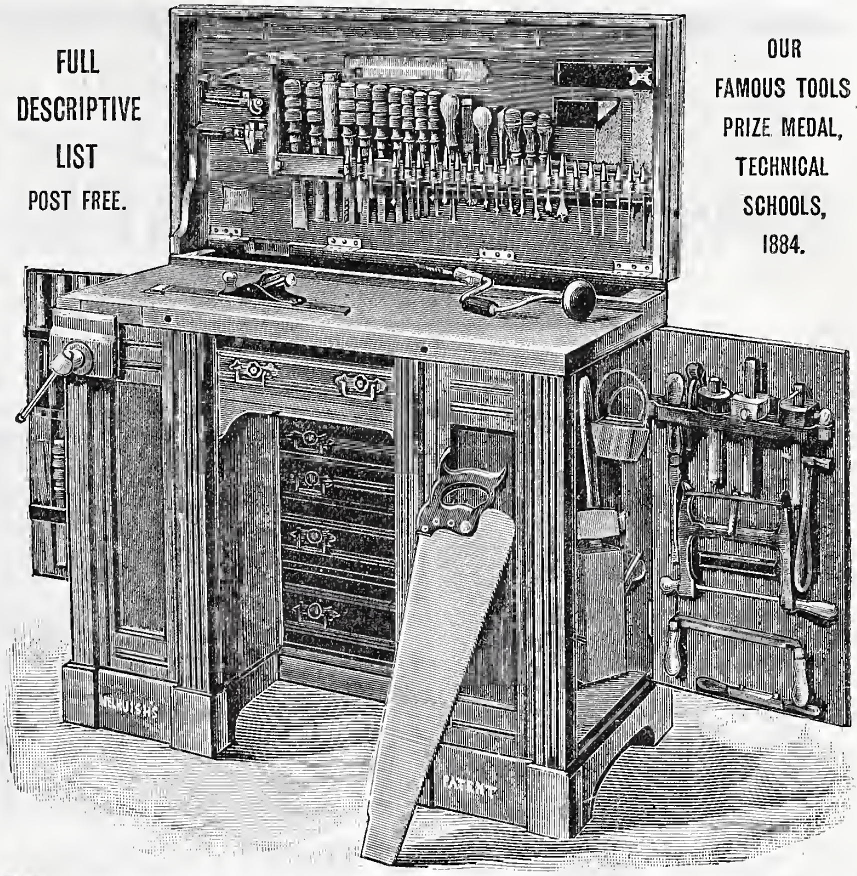

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WORK.

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 9.] SATURDAY, MAY 18, 1889. [PRICE ONE PENNY.

A SUMMER FITMENT FOR THE FIREPLACE.

THE time has now come when means and methods will be sought by which the black, comfortless, unused fireplace may be embellished or hidden, and our shops will soon display the latest novelties to meet this demand. Amongst the many patterns and designs which will be shown, will be the new screens or fitments which are intended to entirely enclose the fireplace: they will be of more substantial make than the printed cards, etc., generally used, being made of wood, with shelves for plants or china, and panels of Japanese matting, paper, plush, and other materials; the wood work being enamelled in various light tints, such as cream, salmon, bird's-egg blue, etc. The construction of these fitments being simple renders them a very suitable article for the amateur cabinet maker to try his hand upon, and when made there would be a place for them, not as is the case with most amateurs' goods, there being no use for them. Thinking it may be an acceptable novelty for some, I propose to briefly describe how one may be made quickly and effectively.

Pine or American white wood is the wood required: packing cases some might suggest, but that depends upon the amateur being a "glutton" for work and desirous of spending his energy on working out dents and bruises, rough knots, nails, etc., but, as a rule, I think the amateur likes to see the result of his work as quickly as possible, so the quickest way is to get from a timber yard the wood required, which in this case is not much.

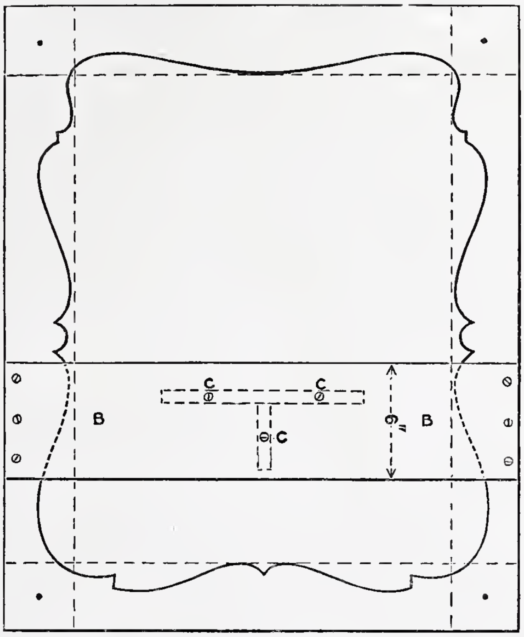


Fig. 2.—Shaped Frame for Fitment, as seen from the Back, showing Strip to support Bracket.

Fig. 1 gives an idea of the fitment about to be described. It consists of a shaped frame of enamelled wood surrounding a surface of Japanese matting, from which projects a shelf supported by a bracket. The width and height of frame must of course depend upon the space to be covered in, and should be measured exactly so that the frame may fit tightly and be self-supporting.

Having ascertained the size, cut two strips the full height and two strips the full width from a so-called 1 in. board 4 in. wide, one strip 6 in. wide the full width, and a piece for the shelf 14 in. long by 6 in. wide, whilst the bracket will require a piece 4 in. each way; this is the wood required. The four 4 in. strips are to form the shaped frame, and the 6 in. piece is to fasten at back to carry the shelf. To make the frame it requires the corners to be halved, as shown in Fig. 4; before that is done the wood should be planed and edges squared. The wood being thus prepared, lay one end across the other, as in Fig. 3, at right angle, and mark underneath the board from B to C; repeat this to the eight ends. Then with a gauge draw a line, A, at exactly half the thickness of the wood, so that when the half of each end is cut away, the two ends being placed together will form the exact thickness of the board, as shown in Fig. 4.

Having carefully marked the ends as

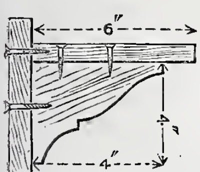


Fig. 5.

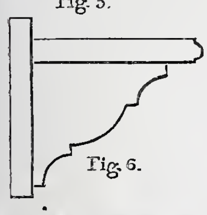


Fig. 6.

Figs. 5, 6.—Alternative Brackets to support Flower Pot.

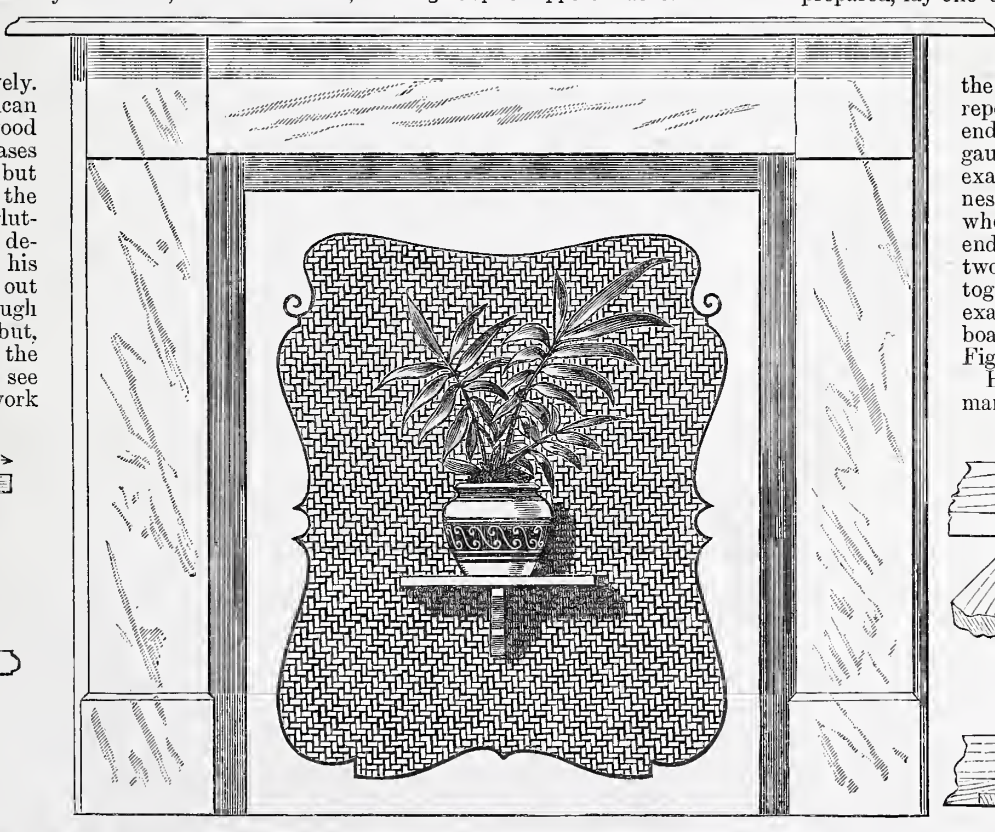


Fig. 1.—Summer Fitment for Fireplace complete.

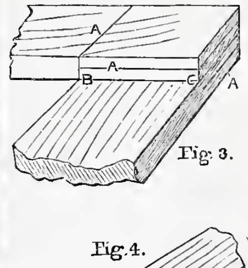


Fig. 3.

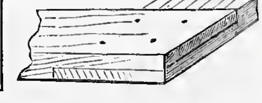


Fig. 4.

Fig. 3.—Halved Joint set out.

Fig. 4.—Halved Joint set out, completed.

directed, place the board in bench screw upright and cut down as far as the cross line, taking care that the saw does not deviate from the pencil line, then saw on the cross line till the half comes away, and then with a chisel remove inequalities and saw marks, that the two halved pieces may bed exactly. Now fit the frame together, and secure at each corner by a brad just sufficient to hold the pieces together; rub a little whiting or chalk on face, which will enable the line to be more plainly seen, and also allow alterations in drawing, and set out the shaped line to be cut as in Fig. 2. It is better to fix the frame in position, and then trace out the shaped outline, than to draw on each piece separately, as it will better be seen where the line will pass from one slip to another, and thus enable the workman to avoid the chance of the line not exactly following on. When the setting out is completed, the pieces may be knocked apart for convenience of handling whilst cutting. After the cutting out of the shapes is finished, well glass-paper the edges, keeping the face-edge sharp; the frame can then be glued together and a few brads driven through corners, avoiding bruising the wood with the hammer. Whilst the glue is setting clean up the shelf, the top edge of which can be rounded or bevelled to take off the thickness; also cut out the bracket and fix it to shelf by two screws passing through shelf into bracket, Figs. 5 or 6, well sinking the heads. The curved lines at top of frame in Fig. 1 are cut out with a V chisel.

When the frame is fit for handling, give a final clean with fine paper, and stop cracks that may show in joints with wax; also cover screw heads in shelf with the same; it is then ready for enamelling. Three thin coats should be given to obtain an equally flat and glossy surface. The Japanese matting, or other material that may have been chosen, is then to be tacked on at the back. The 6 in. strip of wood is then to be secured to the frame over the matting, at the height that may be thought best according to the proportion of frame, as in Fig. 2, and long thin screws passed through that into shelf and brackets, Figs. 5 or 6, and C, Fig. 2. The summer fireplace fitment is then completed.

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

V.—Silver Anodes—Nickel Anodes—Copper Anodes—Brass and German Silver Anodes—Antimony—Ampère—Ammeter or Ampère-meter.

Silver Anodes should be made of pure silver, sheet or ribbon, ⅛ in. in thickness, well annealed. All that has been written respecting gold anodes in the preceding paragraph may be applied to silver anodes. The anode-plates may be suspended from the anode-rod by wires of pure silver, or hooks of the same metal. Alloyed anodes, even to a small extent, contaminate the bath with copper, and the alloyed deposit presents a dark tint, instead of the beautiful whiteness so much admired in electro-deposited pure silver. The deposit is also hard and intractable under the burnisher.

Nickel Anodes should be made of pure rolled nickel plates, of a thickness suitable to the work in hand. Small anodes for small operations should be thin, the thickness increasing with the superficial size of anode required. Plates of cast nickel are always clumsy, because heavy and thick; they are also brittle and porous, whilst the pores are apt to contain impurities. Mr. A. Watt, author of "Electro-deposition: A Practical Treatise on the Electrolysis of Metals," states that he has found "a considerable percentage of loose carbon—graphite—interspersed with badly-cast nickel. The advantages claimed for rolled-nickel anodes over the cast metal are:—The constant and steady way in which they give off the metal; they never become soft or fall to pieces while in the bath, as cast-nickel anodes do; they may be light and thin to begin with (of course, being far less costly in consequence), and they last a very long time." The firm of Messrs. H. Wiggin and Company, Birmingham, has a good reputation for best rolled-nickel anodes. Anodes of nickel may be suspended from strong hooks of copper, inserted in holes punched or drilled in the nickel plates.

Copper Anodes should be made of electro-deposited pure copper, well annealed. The cast-off plates or cylinders from a Daniell battery will do fairly well for anodes.

Brass and German Silver Anodes should be made of an alloy corresponding with the composition of the solution in which they are used, and the desired deposit of metal. They should be well annealed before being used, and may be suspended from the anode-rods by hooks, as directed for nickel anodes. For information on the working of anodes, see *Free Cyanide*, *Free Acids*, etc.

Antimony.—French, *antimoine*; Latin, *stibium.* Chemical symbol, Sb.; specific gravity, 6·71; combining weight, 122; melting point, 800° Fahr.; electric conductivity, 3·88. Electro-negative to all the well-known, and most of the rare, metals; electro-positive to carbon, boron, tungsten, molybdenum, vanadium, chromium, arsenic, phosphorus, selenium, iodine, bromine, chlorine, fluorine, nitrogen, sulphur, and oxygen. Antimony is a bright, bluish-white metal, so brittle that it may be powdered in a mortar, and is easily fusible. "It melts at 450° (C.); rapidly oxidises if exposed to air when melted; and if heated more strongly, it takes fire and burns with a white flame, giving off fumes of antimony trioxide. Antimony is not attacked by dilute hydrochloric or sulphuric acids." (Roscoe.) It may be slowly dissolved in hot strong hydrochloric acid, and in hot concentrated sulphuric acid. Strong nitric acid attacks it and forms a white substance (insoluble in acids or water), to which has been given the name of antimonic acid—a pale, straw-coloured powder, soluble in solutions of potash or of ammonia. Aqua regia dissolves antimony readily, and forms antimony trichloride, otherwise known as butter of antimony. Antimony is a valuable metal, because it forms with some other metals a number of useful alloys. With bismuth, copper, and tin, in certain proportions, it forms Britannia metal, best pewter, and Queen's metal; with lead and bismuth it forms stereotype metal; and with lead it forms type metal. It is also an ingredient in a recipe for fusible metal. See *Fusible Metal*, etc. The electro-deposition of antimony has received the attention of Mr. Gore, who has obtained a series of most interesting results from his experiments. An account of these will be found in his treatise on "Electro-deposition" (*Circle of Science Series*). I am not aware that the deposition of this metal has been put to any useful purpose.

Ampère.—An ampère is an electrical unit of measurement, generally accepted by English-speaking peoples. It is the unit of current strength, or volume of force given by any electrical generator. Its meaning may be learned by comparison with other units of measurement. For instance, in trades where the foot rule is used, the inch is a unit of measurement of surfaces. Where steam engines are used, we speak of pounds as a unit in estimating the pressure of steam; and horse-power as a unit in estimating the work done by steam working through a steam engine. Where water is used as a motive power, we speak of its pressure or "head" as measured by foot-tons; and its volume by square inches, or gallons per minute. In dealing with the measurement of electric force, neither the foot-rule nor the spring-pressure gauge can be used as instruments of measurement, so electricians have had to invent a new set of instruments, and new names for the units or divisions marked on them. The ampère is a work unit, telling of work done, and is calculated on the known power of electric force to do the chemical work of decomposition; that is, the work of breaking up chemical compounds when the current is passed through their solutions. "An ampère is that quantity of electric force which liberates ·000158 of a grain of hydrogen in one second. This is equal to one grain in 6,338 seconds." In the same *time* it will liberate the grain-equivalent of any other element—that is to say, of zinc, 32·5; of copper, 31·7; or of silver, 108 grains. "For all practical purposes, this means 18·5 grains of zinc per hour." Professor Thompson estimates the following deposits of metal to be done by one ampère in one hour:—Nickel, 1·099 grammes; copper, 1·1739 grammes; gold, 2·441 grammes; silver, 4·025 grammes. These figures will represent nearly in English grains:—Nickel, 16·958; copper, 18·115; gold, 37·669; silver, 62·106. The "grain-equivalent" on which these calculations are based is the *electrical equivalent* of each metal; and this differs in some instances from the chemical equivalent, or atomic weight of the same metal. For further information on this subject, see notes on *Atomic Weight*, *Combining Weight*, *Equivalents*, *Valency*, etc.

The ampère is also defined as "that quantity of electricity obtained from an electro-motive force of one volt passing through a resistance of one ohm." If we can determine by measurements the electro-motive force of an electrical generator, and also the total resistances of the electrical circuit, then by dividing the total electro-motive force of the current by the total resistances of the circuit, we obtain the value or strength of the current in ampères. See note on *Ohm's Law.*

Ammeter or *Ampère-meter.*—An instrument for measuring the strength of an electric current in ampères. Various forms of these instruments are made and sold. In one form, the instrument is like a galvanometer furnished with a coil of thick wire surrounding a steel permanent magnet. In all other particulars it is made like a galvanometer, but the divisions on the dial are graduated and marked to represent ampères. In another form, the instrument is made to work out the principle or law that a permanent magnet, being free to move, will place itself across the path of an electric current passing through a conductor near to the magnet. The conductor in this instrument is a broad strip of sheet copper. A magnetised steel needle is suspended vertically on a nicely-adjusted axis close to the conductor, and a pointer of aluminium, or some light substance, is also fastened to the needle, or on its axis. The needle is deflected out of its vertical position by the influence of the current passing through the conductor, and these deflections are governed by the strength of the current passing through the instrument. These two forms of ammeter cannot be relied upon to give exact readings for any length of time, because of the tendency on the part of so-called permanent magnets to lose a part of their magnetism, and thus be less influenced by the electric current passing through the instrument. It is therefore necessary to frequently readjust and calibrate the readings by an electrolytic ammeter.

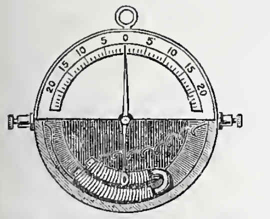


Fig. 2.—Small Electro-Magnetic Pendulum Ammeter: Lower half of Dial removed to show Magnet and Pendulum.

Another form of ammeter is constructed to make use of the well-known property of soft pure iron to become an electro-magnet when wound with an insulated conductor carrying a current of electricity. A piece of soft bar iron is bent to horse-shoe form, and wound with thick copper wire, insulated or covered with silk or cotton. A small pendulum of soft iron is suspended between the poles of the magnet, and a pointer is connected to the staff or axis. The bob of the pendulum is drawn toward the ends of the magnet poles in proportion to the strength of the current passing through the magnet coils; and the pointer shows on a dial the movements of the pendulum. The main objection to this form is found in the fact that much of the current must be absorbed in doing electro-magnetic work and in heating the coils, thus increasing the total resistance of the circuit. The same may be said of those instruments in which solenoids (*i.e.*, hollow electro-magnetic cores) are employed to draw in a movable iron core attached to multiplying gear.

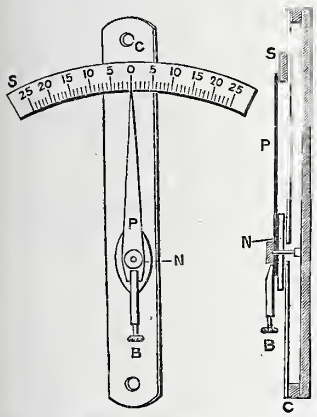


Fig. 3.—Working Parts of Vertical Magnetic Needle Ammeter: B, Balancing Screw; C, Copper Strip; P, Pointer; N, Magnetic Needle; S, Scale.

Electrolytic ammeters, or measurers of electric current, are constructed to make use of the law already given in the note on *Ampères*—*i. e.*, the known ability of the current to do a certain quantity of chemical work in a given time. In some forms of this instrument, two metal plates are suspended from a delicately-balanced beam in a standard solution of the metal composing the plates. The current to be measured, or a known part of it, is made to pass through this solution, and do electrolytic work by dissolving the metal off one plate and depositing it on the other. As one plate gets light and the other heavy, the balance of the beam is disturbed, and it tilts toward the heavy plate, just when a certain quantity of current has passed and done its quota of work. This tilting action of the beam is made to reverse the direction of the current at the same time as it moves gear to register its action; and in this way the work goes on in the opposite direction until the light plate has been weighted by deposited metal. The total work done in a given time can therefore be reckoned up and calculated, and the calculation will show the number of ampères employed during that time. The imperfections found in this instrument are due to friction of gearing, not always constant, and to alteration of the electrolyte, consequent upon changes of temperature and evaporation of solution. There are not, therefore, any perfect ammeters made; but perhaps the best of the electrolytic ammeters may be regarded, after all, more perfect measurers of electricity than the best gas-meters are measurers of gas.

All ammeters have to be calibrated, and their marks adjusted by reference to electrolytic work done in a depositing cell. The method advocated by Mr. S. Bottone, in his book on "Electrical Instrument Making," is as follows:—Procure a generator of electric current calculated to furnish the necessary strength of current; then prepare a strong solution of sulphate of copper, slightly acidulated with sulphuric acid; also two plates of thin sheet copper, at least six inches square. Weigh the copper plate intended to receive the deposit in a balance capable of weighing to the 100th of a grain, and note down the exact weight. Place the two plates in the depositing solution, with the instrument to be graded in circuit with the work and generator. Allow the work to go on for exactly an hour; then take out the weighed copper plate, wash it in hot water, and dry perfectly without rubbing; again weigh the plate, and note exactly how much copper it has gained. If it has gained 18·35 grains, then the current passing through the solution and ammeter measured exactly one ampère, and the plates must be restored to exactly their former position. If the plate has *not* gained this weight of copper, the two plates must be put closer together; if *more*, they must be placed further apart, and the experiment repeated until the right quantity of copper has been deposited in the hour. Then the instrument must be disconnected, and the pointer of the instrument must be allowed to fall back to a zero-mark on the indicating dial. Again connect all up, and mark the part of the dial to which the pointer points as one ampère. The greatest care must be taken to maintain all the conditions of the room and apparatus as they are at the end of this first test. Then increase the current so as to deposit 36·70 grains in an hour, and mark the deflection of the pointer two ampères. All the other degrees required on the dial may be got in a similar manner. Daniell cells of quart capacity will furnish a constant generator, and the number of cells will depend upon the required strength of current, each cell being connected in parallel with the work, not in series.

(*To be continued.*)

A FOLDING CHAIR FOR HALL OR GARDEN.

BY J. H. MOODY.

Introduction—Peculiarities of Chair—Probable Date of Type—Conversion and Adaptation of Form—Material—Pieces Required—Cutting Mortised Bars—Putting Frames Together—First Frame—Second Frame—Seat and Seat Pieces—Back Piece—Knobs—Finishing.

The several kinds of folding seat to be met with nowadays are all so good that it is a difficult matter to pronounce any one among them to be the best, and in submitting the accompanying design I am somewhat exercised, because I do not feel assurance enough to proclaim the chair which is the subject of my article to be a better one than those rendered familiar to us by the dealer in cheap furniture; but if I do not assert that all others are failures, or if I do not say that to obtain a better one than ours were beyond the bounds of possibility, I am still confident in declaring that the one I describe is distinguished by a simplicity of construction that will attract the worker, whoever he may be.

Very frequently it so happens that we come in contact with persons who feel disinclined to exert their mental faculties in giving shape to original ideas, and there are also many who are too cautious to tread out of the beaten track. There are, however, a few who bravely venture on notions of their own, and to those I would say that they will find it a good plan to make mental notes of every worthy suggestion that passes within range of their observation. A store of information thus accumulated is worth a great deal when occasion arises for its application, and the assistance that may be extracted from that source is of such practical value, that I make no doubt it was never rejected by our most eminent inventors. For the cautious ones, however, whose faltering progress is like an infant's tottering footsteps, I desire to provide every assistance; their trepidation will not allow them to quit leading-strings, and it is for their guidance I have written this article. These prefatory remarks are patent to all as they acquire experience, and the argument I wish to advance is simply that the so-called spontaneity of invention is neither more nor less than the outcome of a system of observation such as we advocate co-operating with ingenuity. Amidst all this theorising, I fancy that I hear someone say—"Why not buy the seat that is wanted? Surely, from among the many that are to be met with in shops, one could be found wherein reposed all the virtues a folding chair should possess; all labour would thereby be spared." But I who aspire to proficiency in the mystery of carpentry, give answer that "I will have none of them." My aspirations accordingly tend toward making for myself the seat I require, and I direct my energies to devise one, both strong and steady, to be useful alike in the studio or in the garden, yet withal so tractable as to readily fold up into a small compass.

It is true I could find the comfort I desire were I to borrow a chair from the house, but my hardihood would experience a check if confronted by an indignant housewife objecting to the denudation, or perhaps fearful for her furniture, lest adverse weather should arise; consequently I hesitate to adopt those means for securing my ease, for never shall it be said that I at any time deserved the displeasure of the good lady of the household. No! perish the thought. My aim is, and always shall be, to conciliate and not to vex that mind which is so severely adjusted to ideas of neatness and order. Moreover, I have my own "den" to repair to, from whence have issued so many dainty brackets and imposing overmantels, beside other articles for ornament or utility, every one of which was especially intended to gladden the good dame's eyes; there I indulge in litter to my heart's content, for the offence is condoned; there, in solitude, I am accustomed to arrange my plans for work. Perhaps I am often reminded of the story which tells of a certain clever youth, of whom no doubt every one has heard, and who, when questioned respecting the originality of a bit of carpentry which he had successfully completed, replied that he had "made it all out of his own head." On the present occasion I, like him, must summon from out of the chaos and lumber of my thoughts the image of my subject, and from another wooden source must evolve the substance : then, presto ! I shall have the folding seat that I require.

Not exactly in fact, however, will my conjurations proceed with this juggling rapidity. Oh, dear no ! in these matter-of-fact times our sleight-of-hand must be governed by deliberation in order to ensure the magic of success. In strict observance of those canons I, in the first place, give my ideas colour and tangibility upon paper, or, in other words, I make working drawings of the article I am about to manufacture, and having accomplished that, I may then consider the stuff of which it shall be composed.

I will mention that the chair I am about to describe has a peculiarity which distinguishes it from many others that I have seen, insomuch that neither webbing, canvas, or carpet are used in its construction; even the bottom is composed of wood, although its collapsibility is unimpaired thereby, for it will obediently fold up simultaneously with the closing frame, and how all that is accomplished will be made evident as the description advances. This departure, I imagine, will obtain the approval of a great many.

In the absence of authorities bearing upon antique furniture, I am unable to make reference for the precise origin of this form of chair; but the principle of construction seems to have been pretty freely used in Italy in the sixteenth century; and, at the present moment, there are in the South Kensington Museum several specimens which fold up in a like manner ; the labels of these pronounce them as derived from an Italian source, and also fixes the period that I have quoted. I have given a drawing of one of these chairs (Fig. 1) for the benefit of any one who may desire to make a similar one, but I am afraid the bent work will be a barrier to success; let us see, therefore, whether we can adapt the principle to straight stuff.

We find there are certain difficulties besetting the conversion; for instance, curved supports such as are shown in the drawing of the old Italian chair admit of a wide and safe base when the chair is in use, but straight stuff necessitates the placing of the centre, upon which the two frames are connected, rather low, in order to obtain a proper width for the seat at a suitable distance from the floor ; the base of our chair, therefore, is narrower, and the top is wider than we would wish them to be, but the lack of stability is not, in fact, so great as it appears to be. See Figs. 2 and 3.

Either beech, mahogany, or oak may be employed in making, but the choice will depend upon the embellishment hereafter to be put on the finished work. If we mean to polish, perhaps one of the two

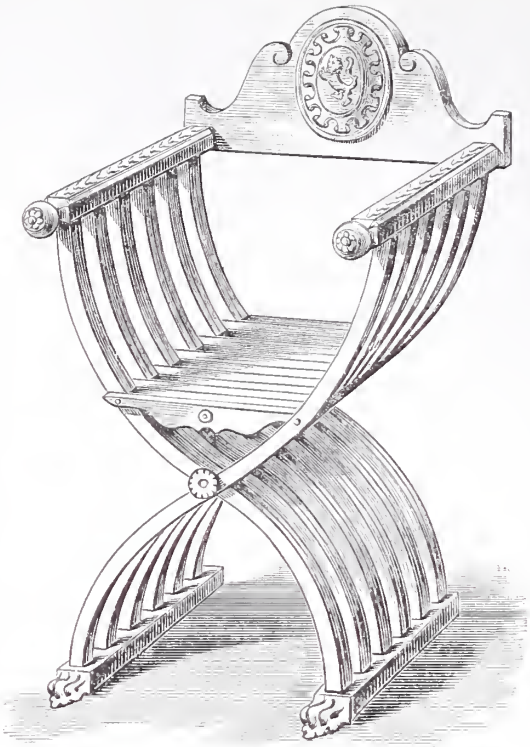


Fig. 1.—Folding Chair in South Kensington Museum. Italian, 1550.

latter kinds of wood is to be preferred ; but altogether beech will, I think, be adapted to receive any kind of finish that we shall employ, and whilst it is procured with little trouble, it will render our work of satisfactory and enduring quality, and that I imagine is a result in perfect consonance with the highest ideal of completed work.

Having procured our stuff, we get out four pieces, each 12 in. long and 2 in. square, and dress one side of them down to an angle, as shown at Fig. 4. These pieces will maintain their severity of shape until the mortise cutting is accomplished ; in fact, all items of ornament were best left alone until the rougher work is completed.

The first necessary operation, after the four pieces are cut to the desired shape, will be to set them out in preparation for mortising in the following way : Taking each piece in succession we gauge for $\frac{1}{2}$-in. mortises right along its angular face, then to indicate the exact position of the mortise, we place the pieces in pairs, side by side (Fig. 5), blocked up to level them, and whilst they are in that position, we will rule upon them 11 lines intersecting the gauged lines. These cross lines must be at intervals of 1 in., the first of them being $\frac{3}{4}$ in. from the front ends of all four pieces as they lie together upon the bench. It will be necessary to mark these front ends to be kept as such, and if we number the division on each piece 1 to 10, our description will be clearer, and annoying mistakes be avoided.

I have said that the divisions will show where mortises are to be cut, but further explanation is necessary as to the manner of doing it. In the first place, we will select the pieces in pairs, respectively, arm or bottom pieces, and mark them individually for right or left, taking note that the mortised face is inwards when the chair is completed. We then take the left arm piece and the right bottom piece, and cut mortises upon divisions 1, 3, 5, 7, 9 ; next taking the right arm piece and the left bottom piece, we cut mortises on divisions 2, 4, 6, 8, 10. These mortises will be cut at right angles with the angular planed surface of each piece, and they should not be a full inch long, but with a slight rebate in length, in consideration of a shoulder of the tenon at the end of the upright bars. These arm and bottom pieces, now that mortises are cut upon them, may be dressed into shape (Fig 4); the half-round moulding on bottom pieces is extraneous, and is added last.

The preparation of the bars does not necessitate a very profuse description. They are 10 in number, each being a trifle less than 1 in. square, with a tenon cut at either end to fit a mortise ; they are 32 in. long between the shoulders of the tenons. Holes are bored in them, from front to back, through each bar with a $\frac{3}{16}$ bit, respectively, at $12\frac{1}{2}$ in. and $23\frac{1}{2}$ in. from its bottom end, that is to say, from the shoulder of the tenon.

We now have before us the necessary number of each of the parts that are required to build up the two frames constituting the supports of the seat proper, and we will put one frame together first, thus : Taking the arm and bottom pieces, whereon the mortises bear odd numbers, and taking also six of the bars, we insert the tenons in their proper places, and use glue to fasten them there ; that done, we will put the frame aside to dry. Meanwhile, we provide ourselves with four iron rods $\frac{3}{16}$ in. diameter ; these rods will be 10 in. in length, and their ends will be prepared accordingly as tools are available — that is, they may be tapped and fitted with nuts, or they may be filed off taper ready for riveting, and provided with washers.

The first frame being made we may fix up the second one. In doing this, however, the insertion of the bar in top and bottom pieces will not be done at one and the same

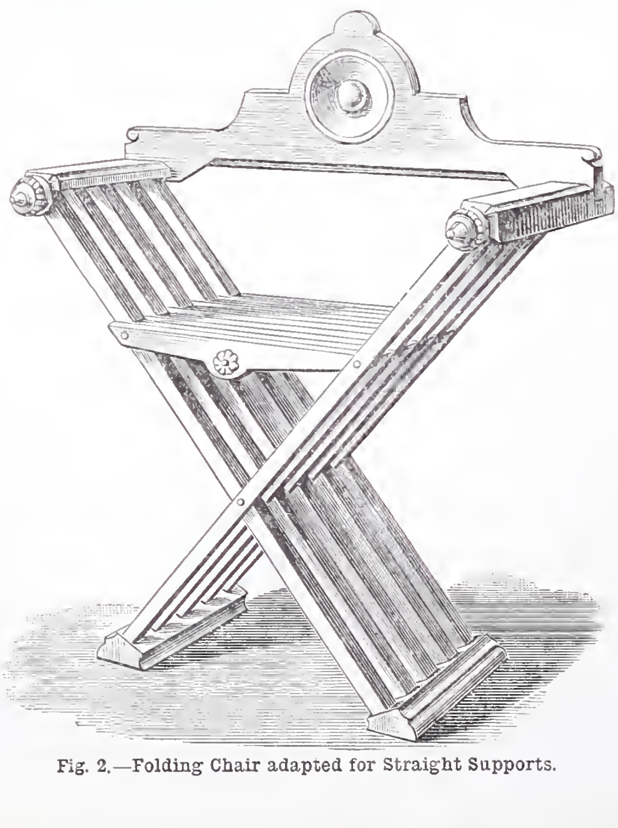


Fig. 2.—Folding Chair adapted for Straight Supports.

time, or at least we had better proceed systematically, and fit the lower piece with bars first; then occurs the interlacing or crossing of the bars which engages the two frames, and that being accomplished we may attach the top piece and glue all up. I will just mention that unless the interlacing is done with deliberation the amateur will be in an awkward muddle. The proper relative positions of bars and also of arm and bottom pieces must be rigidly preserved; for instance, the first bar of the frame we last made will be inserted behind the first bar of the other frame, and if I repeat that the top piece of the frame we first constructed will be the left arm of the completed chair, it will go a long way to prevent confusion.

get out ten pieces, and cut them at both ends to agree with the angle that the opened frames present. Each piece must be bored with a couple of holes from side to side, and the places for these can be best indicated by ruling lines at $\frac{3}{4}$ in. to right of centre, and also at $\frac{3}{4}$ in. from their left-hand edges, across their faces as they lie.

We will suppose that the boring of the seat pieces is completed, and that we have maintained intact their arrangement, but they must be altered in order to get the seat ready to fix. To that end, therefore, we will reverse the position of piece No. 2, but still keep the hole near its centre in a line behind the corresponding hole of No. 1; No. 3 will not be disturbed, but No. 4 will be reversed, so

the seat in order to ease the projecting ends that hinder; we may then replace the seat and secure the rods, of course not forgetting the countersinking.

The back piece of necessity is separate, and is of inch stuff; it may be plain or carved according to the design that is chosen. It is cut away in two places to slip on to the back ends of the arm pieces, which are also cut with laps to receive it. (Fig. 7.)

There are now certain items of extraneous ornaments (see Fig. 4) to provide for in the larger knobs which form the terminals attached to the arm pieces, and the smaller knobs or plugs, which serve to hide the ends of the rods at the junction of the seat and

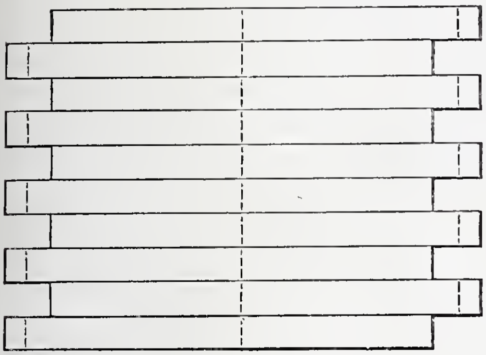


Fig. 6.

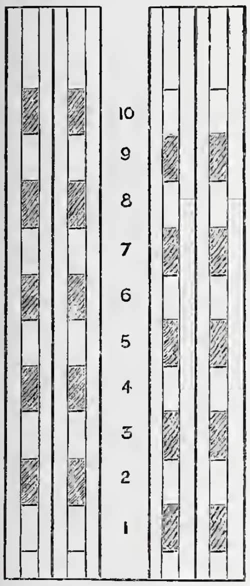


Fig. 5.

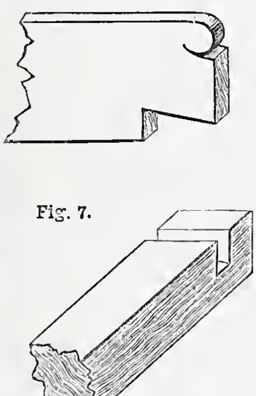


Fig. 7.

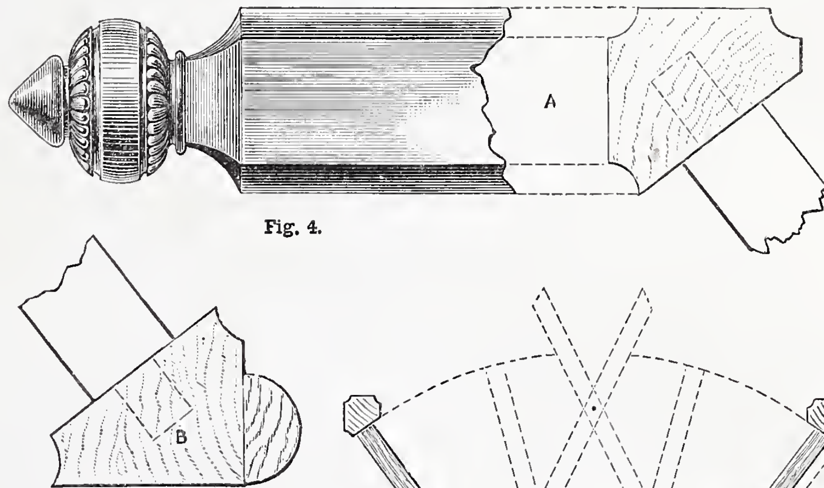


Fig. 4.

Fig. 3.—Section showing Disposition of Seat Pieces during Closing Operation.

Fig. 4.—Details of Knob, and Section of Arm Piece (A) and Section of Bottom Piece (B).

Fig. 5.—Arrangement of Arm and Bottom Pieces for Mortising: A, Right Arm Piece; B, Left Bottom Piece; C, Left Arm Piece; D, Right Bottom Piece.

Fig. 6.—Arrangement of Seat Pieces in readiness for Fixing.

Fig. 7.—Method of Attaching Seat to Arm Pieces.

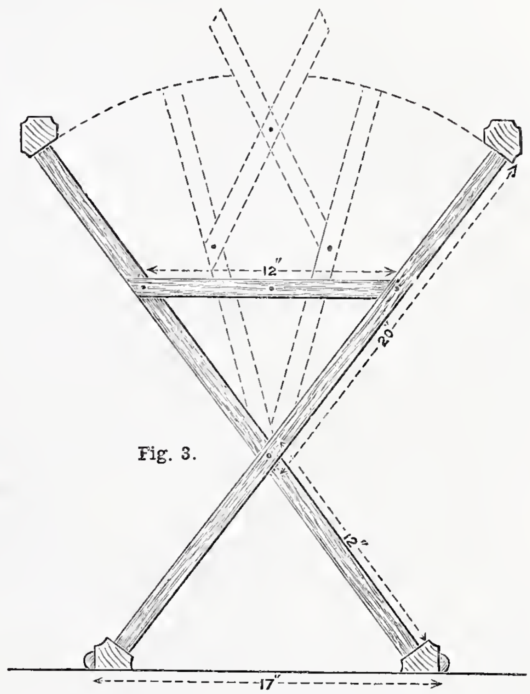


Fig. 3.

The holes in the bars at Fig. 3 are provided as a centre to connect the two frames, therefore these holes when placed in a continuous line will allow the passage of a rod right through the whole of the ten bars; the two end bars may, with advantage, be countersunk rather deeply for the reception of nuts or washers for screwing or riveting, as the case may be.

The frames being ready for the seat, the pieces which comprise it may be prepared. They are to be the same thickness as the bars, and their length may be arrived at by standing the frames open at the required distance, and maintaining their position by tying the top pieces together. I have arranged the drawing, Fig. 3, for a 12-in. seat—it should not be less—therefore, the span across the bars from the top hole on one side to the top hole on the other should be set accordingly. We shall find that our seat pieces must be cut 13¼ in. by 20 in. We

also will Nos. 6, 8, and 10. The seat pieces will then be arranged as Fig. 6, and while they are in that condition we will pass one of the iron rods through the centre holes. We must not omit to countersink the two end pieces before we rivet or screw on nuts.

If the work has been properly done we shall find the projecting ends of the seat will drop easily and exactly into the intervals in either frame; the holes in seat pieces and bars will also agree and be continuous. We prove all this by placing the seat with the bored end of its first piece in front of the first bar supporting the right arm, and with the other end resting on the first bar of the opposite frame. We ought now to be able to slip our two remaining rods right through the holes in seat pieces and bars on either side, and before we fasten them we will test whether the opening and closing of the seat are effected with facility; if not we must take out the rods again, and remove

bars; these last are to fix into the countersinking; there is also a piece of ¼-in. stuff to form a finish for the front, and which is fixed to the first seat piece.

Lastly, we will deliberate upon the quality of treatment which is to qualify the crudeness of white wood, and which will be the conclusion of our labours. We are offered two methods to choose from: first we have heard of wonders achieved with the enamel paint to be obtained of various makers, severally, and all of which are proclaimed as the best by their proprietors, and there comes to our mind's eye a presentment of how handsome our chair would look if covered with a coat of one of those paints mixed to a neutral tint, say salmon, green grey, or blue grey; but this hint is only thrown out on the supposition that we have worked to a plain design. If, however, the design we have adopted is in any way florid, there are sundry clever combinations of stain and polish which may be used and which likewise will contribute greatly to the good appearance of our work.

In conclusion, I would observe that the procedure of manufacture is identical in both the curved and the strength designs; but those who are unprepared with bending appliances had better adopt the straight work unless they like to undertake the labour of sawing out. However, our chair-maker must measure well his resources before commencing, for when precipitancy lands one in failure, the position is quite as ridiculous to my mind as when hesitancy deposits one "between two stools."

"TIPS" FOR TYROS.

BY OPIFEX.

Useful Indiarubber Cement.

Old tobacco pouches, etc., if made of non-vulcanised indiarubber, may be dissolved in chloroform, benzine, etc. Cut the rubber into thin strips, and put into a stoppered bottle, then add the solvent; let it stand till the rubber swells, add a little more solvent, and shake up well; the strength may be regulated by adding either ingredient; the proper consistency is like that of thick treacle.

This is a most useful cement for many purposes, and will join leather straps, fasten on soles on tennis shoes, etc.; it is also a capital cement for paper, cardboard, cloth, mending books, etc., and one of its chief recommendations is cleanliness, as it will cleanse by being smeared upon the most delicate paper and rubbed off when dry.

Cement for Lathe Work.

The cement used for fastening on the rubber tires on cycles is a most useful article in the workshop, especially for lathe work; the writer has often joined two flat surfaces with the cement when making special wood chucks, etc., and finds that a perfect joint which will stand "anything" is the result.

Heat and coat both surfaces with the cement, and allow it to cool under considerable pressure.

Imitation of Ground Glass.

It is often desirable to muff a window in order, either to shut out an objectionable view, or to prevent outsiders seeing into a room.

The usual way is to "dab" the glass with the end of a paint brush and white paint; this is certainly effectual, but not artistic.

We recommend the following: Make a lump of ordinary putty, *i.e.*, whiting and linseed oil, about the size of an egg, mix it rather drier than for glazing; then add half the bulk of fresh white lead, and about a teaspoonful of gold size. If it is too wet, *i.e.*, if it sticks to the fingers, add a little more whiting, and work the whole well, until it is perfectly "smooth."

Roll into a ball and apply by pressing upon the glass, which should be thoroughly cleaned first. In this way a good imitation of ground glass is procured, which may be ornamented when dry by using a stencil made of strong paper, in which any simple pattern is cut, *e.g.*, a fleur de lis, or other device according to taste; or a line may be taken out about an eighth of an inch wide, and an inch from the edge of each pane, with a device at the corners, the centre portions being "powdered" with the fleur de lis, etc.; a thin coat of very clear varnish will then protect the muffing from becoming scratched.

If it is desired to imitate tinted ground glass, use any of Aspinall's enamels instead of gold size, as above.

JAPANESE MOTIVES FOR FRET CUTTING, STENCILS, AND SIMILAR PURPOSES.

Illustrated from Native Books.

BY J. W. GLEESON-WHITE.

I.—Of Bird Forms.

To all who are familiar with the silk-sewn flexible volumes of Japanese origin, that when opened reveal such a marvellous wealth of suggestions for decoration, the first surprise at the fecundity of invention, and almost limitless variety of ideas displayed by those born decorators, in no way diminishes with increased knowledge. The more thoroughly one investigates even the popular volumes (that have been obtainable in England for trifling sums, at the principal Oriental warehouses, for the past few years), the more the wonder grows, first, that such novel discoveries in decoration could be possible at this stage of our art-history, and still more that so little of this splendid material has been welcomed by our designers.

That Japanese art has been the fashionable tendency in decoration of recent years, that hundreds of designs purporting to be based upon it have flooded our markets, is patent enough; but to those who really try to grasp the principles of its construction, who realise how thoroughly the instinct of the native artist adapted his ideas, with subtle changes according to the mood of the worker or the object he was decorating; the entirely mechanical imitation of a few details hardly proves that a paraphrase of the real art of the Oriental artist has been even attempted, but that just a few evidently characteristic touches of the lowest class of ornament have caught the popular taste, and satisfied both those who produce and those who buy.

The Japanese books more usually met with in England are reprints of Hokusai's sketches and Battei's bird and flower decorations, with similar volumes of pictorial designs; and a few volumes that, like Owen Jones' "Grammar of Ornament," are composed of patterns rather than pictures. The latter class are especially valuable to all decorators, whether those who design, or those whose handiwork carries the idea into execution. Not only do these volumes reveal thousands of beautiful patterns to be copied literally for borderings, diapers, and panels, they are teeming with suggestiveness for all who can take a hint. It is a simple fact to say that one of these pamphlets, studied carefully, might supply a designer with motives year after year, and yet fail to be exhausted. I myself know of a case where one single page of ornament from, perhaps, the most superb specimen of their skill that is to be found at South Kensington, has supplied a clever decorative artist with ideas for years past. But it is not given to all to take a hint, and there are excellent workmen who may be trusted to carry out a given design accurately and faithfully, but give them an inch of design for motive, and ask them to evolve from it a consistent plan for the decoration of the whole thing to be ornamented, whether a six-inch tile or the interior of a theatre, and they would be at a loss at once.

One of the comic papers started a joke of a certain architect who said he could reconstruct a whole cathedral from a broken piece of its floor tiling, and this pleasantry has been often repeated. Yet it is certain that a design based upon one definite piece of work, and consistently evolved in keeping, would probably yield a more satisfactory result than a medley of accurately copied details from a hundred sources dovetailed and fitted together.

Too often in modern English decoration—supposed to be of true Japanese character—the only idea the decorator has grasped appears to be the half-truth, that Japanese ornament is not symmetrical. That it does not rigidly repeat on one-half of its design the facsimile of the other is, of course, true, but symmetry is not always a merely precise balance of parts. Gothic architects showed that a harmonious whole could be obtained by other ways than the classic repetition of each detail, where, as in an Italian façade, one side of its centre was a perfect counterpart of the other.

Starting with this idea of the Japanese hatred of symmetry—an entirely erroneous one—any haphazard of odds and ends of ornament, always provided it was diagonal or one-sided, has been called Japanese, and the name has become hopelessly vulgarised, and made certain of its achievements marvels of decorative depravity, monstrosities of ornamental crime.

This symmetry of unequal parts is one of the triumphs of Japanese design; if you study a panel by a good artist (for be it humbly said, all Japan was not decorated by *one* artist, and bad taste, although rarer than in England, has occasionally found utterance in Japan), one who is master of his craft, you will find that, although the disposition of the parts is not always upon a geometrical basis, that not a few of the wildest and most unfettered designs resolve themselves into certain regular patterns, on the skeleton of which the ornament has been elaborated.

But of those quite contrary to the spirit which governs European symmetrical ornament, you will find a balance of parts—a mass of design on one side is set against a small group or a few dots of ornament on the other. The Japanese appear to have studied nature thoroughly, for in it, although details are frequently of exact symmetry, yet the disposition of groups of them is rarely, if ever, so, and this apparently unconscious arrangement is no mere illustration of what has been quaintly termed the glorious gospel of haphazard, but the result of a higher sense of beauty than mere arithmetical balance can yield.

Better mechanical imitation of another nation's art than such folly as attempting to modify it before even the rudiments of its laws are known; but if, on the other hand, you patiently study and follow out the Japanese artist's line of thought, and realise his very systematic method, that produces results as free and unfettered as Nature's own decoration, then the foolish absurdities—such as the cheap fire-stove ornaments, the hideous dinner services, and advertising placards that pretend to be in Japanese style, and cause the name to be a synonym for vulgarity and worthlessness—will quickly be replaced by better things.

But as the pages of Work, wide though its programme be, can hardly be devoted to the discussion of Japanese art in the abstract, I propose here to reproduce a few suggestive designs for everyday ornament that are original Japanese. Among a hundred volumes I have collected from time to time, as opportunity offered, there are only two that appear to be designed actually for fret cutting; but in others—especially a series of designs reproduced (by order of the Japanese Government) from existing examples of old embroideries—there are not a few that are from *appliqué* work, and the difference between sewing on a self-coloured ground portions of another coloured material to form the pattern, and cutting holes out of a piece of wood for the same purpose, is not very great, for of these designs there are many that, without modification of their detail, may be used for fret cutting or stencilling.

Of the enormous mass of suggestive material in this century of volumes, it is curious to observe how few bear adapting. For the purpose they were designed they are supremely fit, but once attempt to modify them for foreign purposes, and you lose half their charm. By this feature the native artist proves his knowledge of one of the most important principles of true design, if indeed it be not the very first, namely, the perfect grasp of the properties and limits of the material, so that he thinks out his idea in stone, metal, woven fabric, whatever it may be; emphasising the peculiar qualities of his material; knowing that stone is brittle in delicate open traceries; that iron is capable of infinite curves and slender projections; that the threads of a fabric will display themselves, however you try to hide them, and so on. Thus he misses a fatal fault of inartistic modern ornament, where wrought iron is parodied by cast, where fabrics try to look like painted decoration, and where one material apes another instead of being employed in the most natural way to obtain the result.

For if a pattern can be used on stone carving, textile fabric, and applied painting with equal effect, it must needs be either of extreme simplicity, or at best only a passable substitute in each of its applications for a more genuine design, whereby the material itself would be really decorated.

Probably this failure to realise the perfect unity of design and material is responsible for many a failure in the attempts at "ornament in the Japanese style." As one who has often tried and failed, I can speak knowingly and feelingly of the unsatisfactory effect of a beautiful idea, expressed in substances that compel a modification of its details. For example: a lacquer pattern does not come well if cut in fret work, a textile pattern is poor on the flat rigidity of a tile. But apart from this, even when the material to be embellished is similar, the European craftsman often betrays himself in carefully precise finish of some little niggling bit of detail, left with the careless suggestiveness of a sketch in the native original; or else by adding European features that ill accord with the spirit of the Eastern art.

In these papers, therefore, I propose to let Japan speak for itself, and offer not *my* idea of the art of the Rising Sun, but the designs themselves, traced roughly, but correctly, from the actual books. The volumes at my side teem with (doubtless) pregnant sentences of advice and description, but my knowledge of the Japanese language is limited to painfully and pilulously minute acquaintance with a few odd words; so all the comment of the Eastern artist must be left untouched. But the designs speak plainly and unmistakably to all who care to hear, in the universal language understanded of all peoples, the picture tongue, that which, before Volapuk raised its hideous standard, was an open secret to all the world, and united again the tribes dispersed at the Tower of Babel.

Fortunately for the accomplishment of my purpose it is that so few of the tens of thousands of suggestions here close at hand are related to either of the subjects that head this paper; or, to put it more correctly, are capable of use untouched as they stand in those branches of workmanship. The gorgeous wealth of subjects in one of these little tomes makes Owen Jones' "Grammar of Ornament" a poor thing in comparison, and the richest museums of European art mere hackneyed repetitions of a few wearied motives, when set against the immense fertility of these Eastern fancies. For they hold not only the splendour of the East, but at least the prototypes of all the West regard dear. Here is the Greek fret, the Gothic diaper, the Celtic knotwork, and the Renaissance arabesque. If I piled up all the flattering adjectives of Murray's stupendous dictionary itself in praise of these things, they would be hardly exaggerated. For conventional ornament and natural devices modified within decorative limits, those who do not hold Japan the most fecund and wealthy, simply thereby prove their ignorance of her stores. To any lover of æsthetic design (and æstheticism, remember, is pure beauty in its first significance), the contrast between the wearisome iteration of the few forms that the West borrowed so early from the East, that we style them European, and the source of these fancies—be it India, Persia, or, last and greatest, Japan—is like comparing an illustrated encyclopædia with the book of nature itself.

It must, in justice, be said, that only a portion of all this store is available for adaptation to English needs; once modified to suit our conventional shapes, it has a knack of losing no small part of its charm. Reproduced exactly, it is sumptuous and perfect, harmonising well with many schools of art, but distorted to come nearer the canons of the other school, it resents the attempt, and hopeless vulgarity is too often the result. For example: at a recent exhibition there was a mantelpiece of marble and stonework, in Gothic style, evidently a commission to a Japanese artist, who had patiently endeavoured to grasp the main features of English Gothic and infuse Japanese spirit into the details. The pointed arch lost its mouldings, natural branches of bamboo replacing them; panels of peach blossom tried to go well under Gothic canopies, but it is needless to recall each detail, as the well-meant attempt was a failure. Yet it is almost certain that Japanese panels, or rich native stuffs, could be employed *without alteration* in the choir of an English cathedral with much less sense of unfitness than the Brummagem metal work and floor-cloth-looking tiles of the most "correct" church furnishers.

But I have said too much in theory, let us go on to practice. Out of the books I named above are two intended, beyond doubt, for pierced-wood work; and here for the first time the Japanese fertility seems to fail. There are about a dozen good ones which I have copied here, but in fairness it must be said the others are comparatively poor. This is owing chiefly, I take it, to the fact that, as a rule, in Japan fret work receives the final labour of carving; and also that these two happen to be the only books of wood design I have been able to secure. The details of the cut-out panels used in the lattice-work screens now freely imported, show that this paucity of material for fret-work pattern is a mere accident of my collection, and not the result of poverty in that school of design. But in the embroidery books are so many designs, intended, no doubt, for cut-out pieces of cloth, that are so perfectly of the character of fret work, that they cannot, I feel sure, be picked out amongst those given by any but an expert in fret design. Having a certain claim to that title myself, I own at once they are precisely the same to me, and when my memory of the actual source from which I traced them fails, I shall be unable without reference to the volumes to pick out the wood from the cut-out cloth designs.

This appears to be against the theory of design advanced in the opening paragraphs, but only appears to conflict with that view. It shows to me, rather, how clear to the artist was the true likeness between art and material, whether it be with a saw leaving the holes to supply the pattern, or with scissors, putting the pieces cut out to a new ground to form the design.

And this leads the way directly to the question of fret design, viewed from an abstract standpoint, singularly disregarded by modern publishers, designers (*mea culpa*), and fret workers generally.

A great authority—Mr. Ruskin—has said, that all fret-work ornament should show the design by *the parts cut away*, not by the part left after cutting. Whether this is an inflexible rule of good taste in fret work I should not care to decide; because, if it be indeed a fundamental axiom, at one fell swoop the million designs in the market are condemned. For, of the great army, not one in a hundred thousand is designed upon that principle.

However the verdict may be, there is no doubt that Mr. Ruskin's advice is sound, and worth following. We nineteenth century people have a power of holding diametrically opposite opinions with a bland severity that would paralyse the strict partisans of earlier epochs. The gospel according to Darwin *and* Genesis (as the author of "Obiter Dicta" wittily puts it), Socialism *and* Toryism, Wagner *and* the Savoy operas, with dozens of other parallel cases, come at once to mind in support of this argument. Consequently, let us believe Mr. Ruskin, and if we cannot discard the more popular faith, let us remember that even the great critic himself is fallible, and can be quoted with contradictory force by those who delight in seeking the flaws of a great man, and love his failings, since they are then in touch with him, rather than his merits, which are transcendentally above them.

The common-sense reasons for the pattern itself being cut out are easy to see. Other things being equal, this style of design is likely to be stronger by leaving wider spaces of uncut wood to add to its rigidity. Again, the stencil-like character of such a design is much more decorative at a distance. And here, it may be said in passing, there are two classes of ornament: one that needs close view, since from afar it fades to an inchoate mass—this is the right style for all background decoration; the other, where the lesser details are so grouped that the bold design, unseen close to hand, is made up by groups of the details, and tells with a new force at a distance. This feature may be best exemplified by quoting its abuse—where, in wall papers, owing to

unskilful placing, the main features of the design form themselves into diamonds or lines, only noticeable when a large part of the surface is seen at some distance from it. But this applies not only to repeated designs. A small panel painted in all-over fashion like a piece of cretonne, to choose a familiar example, may be very decorative near, but one with just a few shapes, a conventional primrose or star dotted over it, may be more telling at a distance. It is hard to explain these things curtly, but quite needful to keep them in mind, when we come to apply the motives, and vary the theme in its actual working out.

Of the designs illustrated, those numbered Figs. 1 and 2 are distinctly Japanese, the peculiarly conventional treatment of seascape and birds being all their own. If any one doubts which form of art is higher, let him compare these two patterns for fret cutting with those of one of the popular publishers, where ships, and animals, even portraits figure, in horrors enough to scare away gods and men. The depth of bad taste, in some of these terrible instances, is enough to condemn the art of fret cutting for ever.

Fortunately, *all* modern designs are not so bad; even the commonplace German pattern, consisting of capital C's and S's writhing in mortal agonies together, is comparatively harmless by the side of fret-work pictures in English or American fashion. The Japanese artist boldly seizes upon the prominent lines in a rolling sea, suggests a moon rising from it, the toss of the spray, and a bird poised above; without one bit of actual imitation of nature, he yet gives a suggestion of real objects in a way that is both true and good art; and, *in its own way*, as good as the design of the frieze of the Parthenon. "There are bests and best so many," but we may as well have the best of each; good fret cutting is better than bad statuary. There is more real art in a few inches of Japanese wood work, a rough bit of Indian pottery, or a bit of old English wrought iron work, than in the white marble atrocities of the modern Italian school of sculpture.

These two designs (Figs. 1 and 2) would need enlargement for all but very skilful workmen. The usual plan of ruling squares to one scale all over the design and copying on a much larger set of squares may be resorted to with ease and success. There is a sectional tracing pattern, covered with pencil-lined squares, sold in various sizes that simplifies this process, and avoids disfiguring the printed copy.

More of these conventional ornaments derived from bird forms are to be seen in Figs. 3 to 13. Some are most pictorial in their scheme, others merely symbols of the prominent features, in the shape of a bird. Take Fig. 9, for example, a wholly delightful thing, although simplicity itself, yet full of humour. It is so marvellously like a bird, and yet so utterly wanting in all the accepted details. Perhaps no one ever expressed bird-form at once so simply and yet so truly. It is a concentrated joke, a petrified pun, a kind of Japanese witty epigram that once having found

Fig. 1. Japanese Wave Forms, Fig. 2. Sun, Moon, and Birds, Conventionally treated, showing effect in Stencil.

Figs. 3-13.—Japanese Bird Forms. Fig. 14.—Insect Form conventionally treated for Fret Sawing and Stencilling.

voice, said, the only wonder is, that so evident a truth was not uttered ages ago. Yet this little bird is an excellent decorative spot in itself; whether used at irregular intervals or repeated in regularly designed order over the whole pattern, it is fit and proper, aiming at nothing more than it amply performs; a verdict that would not disgrace all that can be said of the highest art.

Fig. 14 and others to appear are insects treated in like fashion. Birds again form the motive of Figs. 3, 4, 5, 6. These, if worked on a small scale, might, perhaps, be still more simplified; but if enlarged to about five or six inches, the details will not be so minute as to afford special anxiety on that account.

Figs. 7, 8, 10, 11, 12, 13, are excellent specimens of what I have tried to explain in the former part of this paper. They are decorations good and adequate, if looked at by themselves; when seen at a distance, the circular (or diamond) shape they offer tells us a distinct ornamental effect. To grasp this fully, notice how unshapely a blot the average fret-work bracket is when viewed from across a room, whence it appears a nondescript outline, no more truly adorning the wall on which it hangs than would a damp duster hung on the same nail.

Some of these designs may be used even in the small scale for which space is found here, but most will bear a certain amount of enlarging without loss. There is a limit, however, to this alteration of scale, and rather than lose the design by too great an increase in its size, it is best to choose a plan that will admit of two or more repetitions of a more handy size.

(*To be continued.*)

BINDING MADE EASY.

A CHEAP, STRONG, AND TASTEFUL METHOD OF TREATING PAMPHLETS, MUSIC, ETC.

With a Few Words on Portfolios and Blotting Books.

BY E. BONNEY STEYNE.

(*Continued from page* 83.)

COLLECTORS know how very rare many of these ephemeral publications become, especially in a perfect state; for, while well-bound books get cared for by all sorts of owners, purely out of respect to their outsides, the mass of ephemeral literature and fragmentary publications—such as reports of learned societies, pamphlets of all sorts, some of them of no slight value in after years—gradually, but surely, disappear. The original of one rare Dickens, already mentioned, I myself bought for threepence, kept it many years, and sold it for ten pounds easily in the open market. In fact, a single advertisement in a literary journal brought me three telegrams from would-be purchasers within an hour of the time the issue was on sale. But that pamphlet had chanced to escape free and scatheless from all mischief; yet this personal instance will show that a careful preservation of much comparatively worthless material may be at the same time guarding treasures for the future profit of the possessor.

In the method still under consideration, the stitches visible at the back demand a covering, but the covering need not be applied all over like the parchment. It often answers the purpose to put a second strip of buckram (or even white paper) over the stitched back, mounted so as to adhere to each cover only and be free from the back itself. If this is used, any sort of paper (a dull blue or grey wrapping paper looks excellent with a white back) may be used for the sides, cut as in Fig. 7; if it is desired to simulate corners, the way they should be cut out and mounted previously to using the paper for the sides is explained by Fig. 9.

The side papers being pasted, an inner piece of plain paper with a flyleaf—in other words, a piece like a whole sheet of note paper—the size of the pamphlets themselves should be pasted inside each cover; pieces of tin should be placed between the cover and the unpasted leaf, and the back left awhile in a press or under a few heavy weights.

There is another method I have used with success, more particularly for sheet music and larger periodicals—such as two or three numbers of the *Magazine of Art*, or the Christmas numbers of the illustrated papers; also for books already bound, after a way such as Cassell's National Library, the Pictures at Play, Shilling Shockers, and other railway literature. In this case I fold a piece of stiff cartridge paper the size of the music or magazine, as the case may be, and paste it at the inner margin on the top and bottom of the little pile of numbers or single volumes to be bound. Then I paste a piece of buckram over the backs as though they were one solid book. When this is dry, the several pieces (or the series of numbers that compose a volume) are stitched to this buckram back, exactly as described in the other method. Having made a portfolio the precise size (in the way about to be explained), I glue the buckram and insert it in the portfolio when the glue is quite dry, pasting the leaf of cartridge paper to the cover at either end. This method has been entirely successful. I have books of music that have been in constant use for the last ten years, and are practically as good as the day they were finished. For music, noting the increased comfort in its use when the volume opens easily and keeps open without the need of employing a catch on the desk to prevent the pages turning over of their own accord, I candidly prefer this way of binding to any I know. A cheap and nasty way the professional binder would call it, beyond doubt; the clever amateur (and there are many such) who binds his own books in the proper way, would laugh to scorn these feebler attempts, but in the one quality quoted, they will beat any but the very best work. Those who have known how few books will keep open where you leave them, unless they are old and with broken backs—to use the slang of the book trade—will agree that it is no slight gain to have secured this one feature.

Some books are improved by the addition of ribbons to tie, and keep the volume closed. Especially is this the case with MSS., quarto, or folio volumes, such as we use for the offspring of one's own invention, or the transcription of other people's efforts.

Besides the usual way of securing ribbon or tape for this purpose, there is another, probably of Japanese origin, that is still easier to apply, and much more effective when applied. But first to the orthodox method. At a point about an inch inside the cover, and midway in its height, you make a slit with a sharp penknife, the width of the tape or ribbon, after the paper for the sides is pasted on, and before the inner flyleaf is pasted down; then the tape is inserted, leaving an inch or so to be pasted to the inside of the cover, when the flyleaf secures it there, so that the ribbon itself, or the cover, will yield before it quits its place.

In the other plan, the ribbon, in one length, is carried all round the back (as shown in Fig. 10), showing over the back, disappearing for a short distance on either side, and coming out again at a suitable place to tie the volume and its contents.

This form of cover makes admirable blotting books, which sell well at bazaars, and make most useful and acceptable presents. When covered with the gold Japanese paper, or some pretty brocaded material, and tied with a wide ribbon of suitable colour, they are really delightful adjuncts to a writing-table.* The way they are made is exactly like the portfolio, with a narrow band of ribbon or elastic sewn inside, to refill with blotting paper at pleasure. The usual shape is to cut the ordinary sheet of blotting paper down the back and divide the half sheets. But I have made many, cutting the whole sheets once across, thus giving an oblong quarto in place of the usual upright quarto. This is at once more novel, more suitable for decoration, and more convenient, as the lesser height goes better on a writing-table, and yet opens out a wider surface for use when writing letters. This subject comes so naturally into home methods of binding that the digression must be forgiven.

But to hark back to materials suitable for our covers. There is a thin whity-brown material, a sort of canvas, that music-sellers use for the portfolios in which they keep their stock, that is pleasant to touch, cheap, and durable. Also a grey calico or linen that looks sober and quiet. But after all, the best thing is for each to adapt the nearest material to his purpose. Given a little natural ingenuity, it is surprising what good notions are arrived at by sheer force of circumstances. Then, again, the subject matter has much to do with a fitting binding. A privately-printed poem, of a few pages, sumptuously produced on rough hand-made paper, may fitly be adorned with a regal brocade, or a certain amount of finery that befits the subject; but what adorns an Oxford Prize Poem would be absurd upon a blue book or a sheaf of scientific tracts. I have seen a Bible bound in cretonne cornered with a lily of the valley pattern, but I cannot conscientiously recommend the innovation.

To make a portfolio strongly and neatly is—or ought to be—within the limit of every one's skill. Few things are more homely in any household with musical, literary, or artistic tastes, than a sufficiency of portfolios of various sizes. The usual music folio is excellent for sheet music, but to hold part-songs on the one hand, or etchings and drawings too large for it on the other, it becomes an untidy makeshift. The materials for a portfolio are cheap, the process is simple, and the cost slight. With very little practice a good portfolio, equal in every way to the best that are on sale, may be made for a few pence.

The cheap German millboards are retailed at fourpence a sheet in small towns, perhaps as low as twopence in large ones. This stuff is rather nasty to cut, but a sharp penknife and a straightedge of wood soon accomplish the severance. Beware of trying scissors or even shears, unless they be of the bookbinder's gigantic variety, upon this material. There is a quiet

* I made one recently of a white and gold-tinsel brocade, sold at Liberty's at 4s. the yard, tied with a wide yellow ribbon, that was really a thing of beauty.

obstinacy about millboard that beats the best scissors. Anything more hopeless than to see a well-meaning female trying to cut a complicated shape in thick cardboard with a pair of embroidery scissors, is hard to parallel. With a T-square mark out the needed size in pencil. Then placing the millboard on a flat surface—the kitchen floor, if no table that will be allowed to receive a chance cut is available—place a straight piece of wood up to the line, and press the left hand firmly on the wood. First pass the knife lightly down the line, and then, in a succession of quick sweeping strokes, persevere until the millboard is parted asunder. The straightedge may slip; if so, woe betide unwary fingers. A pin tack on the left-hand side of the edge, top and bottom, if it be a long cut, will help the inexperienced to accomplish their purpose, by keeping the ruler firmly in its proper place. There is only this one way to cut a clean straightedge to cardboard; it is worth practice, for all scissor cuts are abominable, and must be ruthlessly condemned. Having cut the millboard to the required shape and size, or procured some of the thrown-aside advertising cards so freely bestowed on every tradesmen, or even the tops and bottoms of the cardboard boxes such as linendrapers use, the next thing is to decide upon the covering. If old cardboard is used, it often happens that paper pasted on it raises blisters on the already existing paper, which defy any efforts to disperse them; once having risen, there they stay; whether it would be possible by cutting each one, laying it back, and pasting it, to press it down again, I cannot say; but even if so, it really is not worth the labour, for new millboard is very cheap. For use under chintz, cretonne, canvas, or any woven material, or under thick Japanese gold leather paper, any roughness of surface is of small account; but for marbled paper, or still more if smooth self-coloured paper is to be used, it is extremely important to have the millboard itself smooth to ensure a good finish.

Although embroidery is lavished in its various forms upon all sorts of purposes, I do not ever remember seeing it used for portfolio covers. I have noticed it in German illustrations of fancy work, but there is always a latent suspicion that many of those fantastic electrotypes that do duty in the fashion books and illustrated magazines for lady readers all over Europe are creations of the inventive genius who produced them, and destined never to take tangible form, but to appear in rotation in all the civilised countries of Europe, in one fashion paper after another, and then go to the end of all their kind, the waste-paper basket.

Yet embroidery might well be pressed into the service, but as that art is most probably outside the scope of this magazine, it is enough to have mentioned it, and to pass on to practicable materials. First, of course, comes leather, but I hesitate to recommend its use, for the reasons before named—that so good a material is worthy of being treated with technical skill. Next comes bookbinders' cloth, cheap, and fairly satisfactory, not very easy to work neatly, and in certain localities difficult to procure in small quantities. Then American cloth may be noticed; but this is clumsy to use, and, speaking personally, not pleasant in its appearance when used; still, it is cheap, strong, and serviceable, and amongst its varieties there is one sort with a dull morocco-like grain, that is not quite so cheap and nasty in its effect.

Cretonne, so rarely used, is often very happy for this purpose. I have made many such for my own music, for the immense variety of patterns available makes it easy to keep all one's portfolios of different design. To those who have fifty or a hundred portfolios in use, it is a distinct gain to remember that such a pattern denotes the particular composer whose works are kept therein. When I hunt for Grieg, I recall a red butterfly design. For Scharwenka, a blue and white; for Moskowski, a red and white; Bach, a sombre green; and so on. To any collector who employs portfolios, whether they hold music, engravings, sketches, botanical specimens, or what not, this grouping of species in distinct coverings is a great assistance to methodical classification. Besides, cretonne wears very well, better than any other cheap material, and I speak from a long experimental trial of various substances. Chintz and printed dress materials answer equally well.

Plain canvas is useful, but gets dirty very soon; buckram, recommended for books, is also too delicate for the rougher use of a portfolio, and soils very soon.

On the whole, for hard work, next to a dark-patterned cretonne, marbled paper is probably the best for wear. Plain paper is neater in appearance, and allows a list of contents to be written on the outside, but it looks shabby long before a patterned one. But it is needless to say more of the materials available; they are legion, and vary in every household.

To begin with the work itself—we may suppose the cardboard to be cut to the size, perfectly square and true, as the T square will ensure, if you use it properly. If cretonne is used, a piece sufficient to cover the sides and back should be cut out; if cloth or leather, it will suffice to cut enough for back and corners. For the back, cut a slip, say, an inch wider each way than the thickness you wish to devote to the back; let this slip also be an inch, more or less, longer each way. For the corners, cut out pieces the shape shown in Fig. 12, and paste these first on each corner, in the way indicated therein. Then paste the strip for the back, lay it on a clean table, and place the boards on it, parallel with each other, and at exactly the same height as the strip, and turn over the ends. See that your corners come with the joints of their covering uppermost; this is a trifle easy to overlook, and worrying in its after effect. Now paste the inner strip to the back; this should be as wide as the back strip, but not so long, being a quarter of an inch shorter than the height of the cover; paste this in its place, and with a bone paper-knife, work it on each edge of the cover, so that it sinks between them, forming a shallow gutter, so to speak, with edges, and leaving the back itself uncreased flat on the table. Now cut your side papers in the shape shown, Fig. 12, measuring them so as to overlap the already affixed cloth, by a quarter-inch or so, both at the back and the corners. Have ready two pieces of lining paper, just a shade smaller than the covers themselves, and having put in the ribbon or tape to tie, as explained earlier in this paper, paste them inside the covers. As the cardboard is certain to warp with the applied moisture of the paste (even although that be the thick bookbinders' paste, proper for such work), it is best to go through these processes as quickly as consistent with neat finish, and then leave the whole under pressure. Where it is practicable to put a block of wood with a rounded back, or a worthless volume the right size for such purpose (I keep a few condemned books for this purpose), the portfolio dries nicely with the back curved to a good shape. If such be not handy, place it to dry between sheets of dry paper, under a board, with the heaviest weights at hand, say bricks, old volumes of sermons, or speeches on the Irish question.

For covering with a material that is used for the whole surface, the process is even more simple; since then it is practically the back slip enlarged to do duty for sides and corners. It is not needful to reiterate the instruction, since the advice for the other will apply to each stage of this also.

Cretonne being curiously hard to paste at times, some sorts taking it as freely as buckram, and others with a fluffy texture that repels the adhesive matter, it is as well, in such a case, to give the boards themselves a good pasting, and thus merely reverse the usual order. For a way to affix label, on which to write name, see Fig. 14.

To add flaps to the portfolios is a rather tedious process; but after all, each flap is but another cover with another back; so that having done one, similar care will overcome the increased labour, and turn out a workmanlike article.

For railway novels in good condition, bound in stiff boards, and all such volumes, a sightly covering may be easily secured by pasting ordinary white note paper over the back, in imitation of half vellum, and covering the sides with a dull blue, sage green, or grey paper. There is usually a loose page of advertisements that may be pasted down inside. Thus treated, and neatly lettered in black (Fig. 15, p. 81), such a volume may take its place among well-bound books, without the degradation that a "yellow back" offers to a well-chosen case of books, decently and quietly bound.

As far as memory of my own failures helps me, I have tried to anticipate the hindrances and obstacles that occur at each stage of the work; but if there be any unforeseen that I can explain, a letter to the Editor in "Shop" will be read, and every effort made to offer a solution of the difficulty.

As the proud possessor of several hundred folios and volumes of my own making, I know the advantage they yield, and appreciate their aid to order, being of an unmethodical character by nature. If, therefore, one who is not precise and accurate praises their use, how much more should such methodical tidy persons—as all readers of WORK must be—be glad to avail themselves of my trivial suggestions.

OUR GUIDE TO GOOD THINGS.

38.—London Lathe and Tool Company's Improved Front Slide Lathe.

In this number of Work I am enabled to place before its readers an illustration and description of a Five-inch Geometric Lathe, constructed by the London Lathe and Tool Company, 37, Pomeroy Street, New Cross, S.E. The lathe presents many features of novelty, the front slide rest being one of the most important. Fig. 1 shows the lathe as used for ordinary wood and metal turning, but it is also supplied with overhead gear, as in Fig. 2, when required for ornamental work. The slide can be moved past the poppet head out of the way when the hand rest is being used, and this will be found very convenient at times. Another advantage of the front slide is that, the face being vertical, chips and grit are not likely to insinuate themselves between the working parts, and the saddle being clear of the bed, the lathe will take in larger work than ordinary lathes. Notwithstanding the necessary overhang of the front slide, it is perfectly rigid. The hand traverse of the saddle is effected by means of the handle shown in front. This turns a spiral pinion which gears into another spiral pinion of twice the size, forming a nut on the leading screw. The leading screw is of steel, having four threads per inch; one revolution of the handle, therefore, moves the saddle one-eighth of an inch. There is also a division plate on the front of the saddle, by means of which a movement of $\frac{1}{500}$th of an inch may be determined. This capacity for minute adjustment makes it unnecessary to have a compound slide rest. The absence of a rack is partly compensated for by the rapidity with which the handle can be rotated, and the bed being short, there is no practical loss of time in the movement of the saddle by this method. The tool box, shown in the illustration, is clamped in a socket bolted down on the top of the surfacing slide, which is actuated by means of a handle turning a screw of ten threads per inch. The head is divided into ten divisions, each of which denote a movement of the surfacing slide of $\frac{1}{100}$th of an inch. These minute adjustments give the slide rest all the advantages of a compound slide without its multiplication of parts. The socket which takes the tool box and other fittings is divided down one side and provided with a clamp which gives a better grip than a set screw. The hand rest is made the same way.

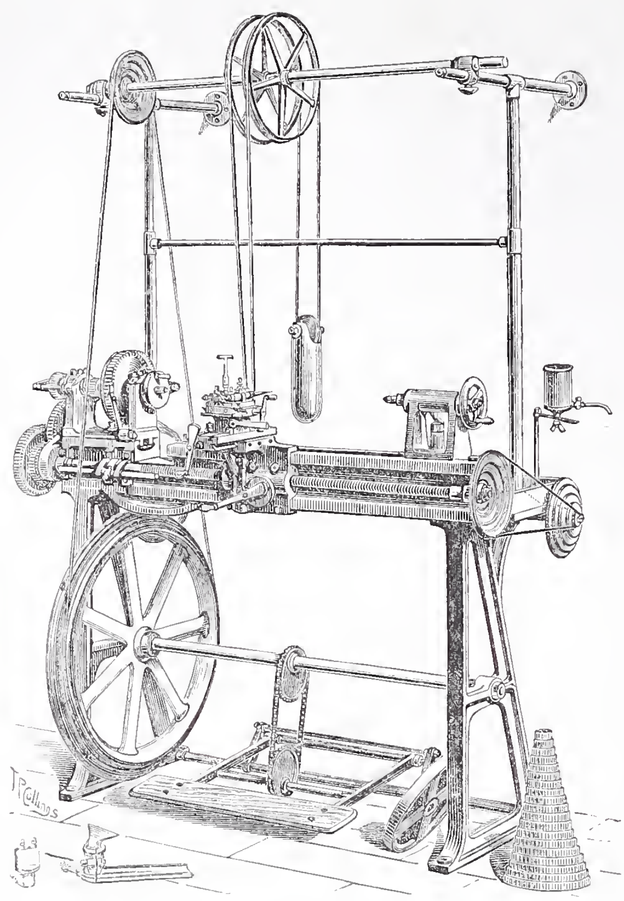


Fig. 2.—The Lathe, with Overhead for Ornamental Turning.

The headstock is back geared, the wheels being of gun metal, with machine-cut teeth. The construction is modified so that the front gear wheel is utilised as a division plate. To effect this the common locking nut, which in ordinary lathes passes through a slot, in this wheel is dispensed with, leaving the face of the wheel quite plain, and free for the holes drilled for the index pointer. The clamping is effected at the back, or smaller end of the cone, by means of a nut on the mandrel, which is screwed hard against the cone by means of a "tommy," the pressure being sufficient to lock the gear wheel and cone, and make them revolve together. A great point in favour of this arrangement is that it is evenly balanced, whereas, by the old method of using a nut near the rim of the wheel, it is impossible to properly counterweight it, as its position is different when in and out of gear, consequently, at high speeds the machine is subject to constant vibrations. The index peg is capable of being moved on its stem and adjusted, and this allows of its being shifted from one circle of holes to another, without affecting the accuracy of the work, and without the necessity of arranging the peg holes on an arc struck from the pivot on which the index arm moves. The index pointer is not shown in the engraving, which only shows the boss on which the pointer is fitted.

The circles on the division plate are divided into 192, 180, 160, 120, and 100 holes respectively, giving the following divisions:—

96, 64, 48, 32, 24, 16, 12, 8, 6, 4, 3, 2.

90, 60, 45, 36, 30, 20, 18, 15, 12, 10, 9, 5, 4, 3.

80, 40, 32, 20, 16, 10, 5.

60, 40, 30, 24, 20, 15, 12, 10, 6, 5, 3.

50, 25, 20, 10, 5.

Another feature of this lathe is an ingenious arrangement of mechanism, by means of which the motion of the saddle obtained from the leading screws may be instantly arrested at any given point; or the lathe may be used for plain turning, without disarranging any combination of change wheels which may be on the headstock at any time. This arrangement is shown on the left hand of the engraving. It consists of a rod sliding in two lugs on the front of the bed, a small fork being fitted on the rod by means of a set screw, which fork actuates a sliding clutch. The clutch, when in gear, establishes a connection between the leading screw to the right and the change wheel train to the left. The rod may be set in any position required within certain limits, so that when the saddle comes to the position where a thread should finish, or the work is to be stopped, it comes in contact with the rod, and the clutch is thus thrown out of gear. This motion is quite automatic when once set, and saves the close attention which the turner would otherwise have to give to his work when cutting screws or cutting up to a shoulder. It will be understood that to set this mechanism, the saddle must be put in a position where the work or thread is to be stopped, and the rod brought against it whilst the leading screw is in connection with the wheel train. The rod is then clamped in position by means of the small set screw on the back of the fork. There is also a provision for driving the leading screw from the right-hand side by means of a small cone pulley, which fits on the end of the screw, and is driven by another pulley on a shaft which runs along under the tool board at the back of the lathe. This is very handy for some purposes, as the clutch may be thrown out of gear, and the leading screw worked for turning without interfering with the arrangement of the change wheels.

The poppet head mandrel is provided with a screw of ten threads per inch, so that a complete turn of the hand wheel advances the mandrel one-tenth of an inch. The body is marked with inches and eighths; thus, an advance of the mandrel of eighths or tenths of an inch can be noted. The headstock mandrel is hollow, to receive rods for turning, screwing, and cutting off short pins or studs in quantities; the back screw being, in this case, removed to allow the rods to pass through. There is a change wheel stud for reversing the direction of the leading screw for cutting left-handed threads. It may be noticed that the holding-down bolt for the poppet head has a deep boss to fit into, and is turned to fit, so that the poppet head will slide without jerking when the nut is slackened out. The lathe is so designed, that the usual bridge or gap piece in the bed is not required.

The gearing between the treadle and the main or fly-wheel shaft is also arranged in a novel manner, which has several advantages over the ordinary method of driving. There is a chain wheel keyed on the main shaft, and another wheel of the same size loose on a spindle carried by the frame of the treadle, as seen in the engraving. The chain transmits the motion and takes the place of a connecting link, with this advantage, that the stroke of the treadle can be varied by slacking off the chain and shifting the position of the lower wheel, in relation to that on the main shaft, both wheels being eccentric on their respective

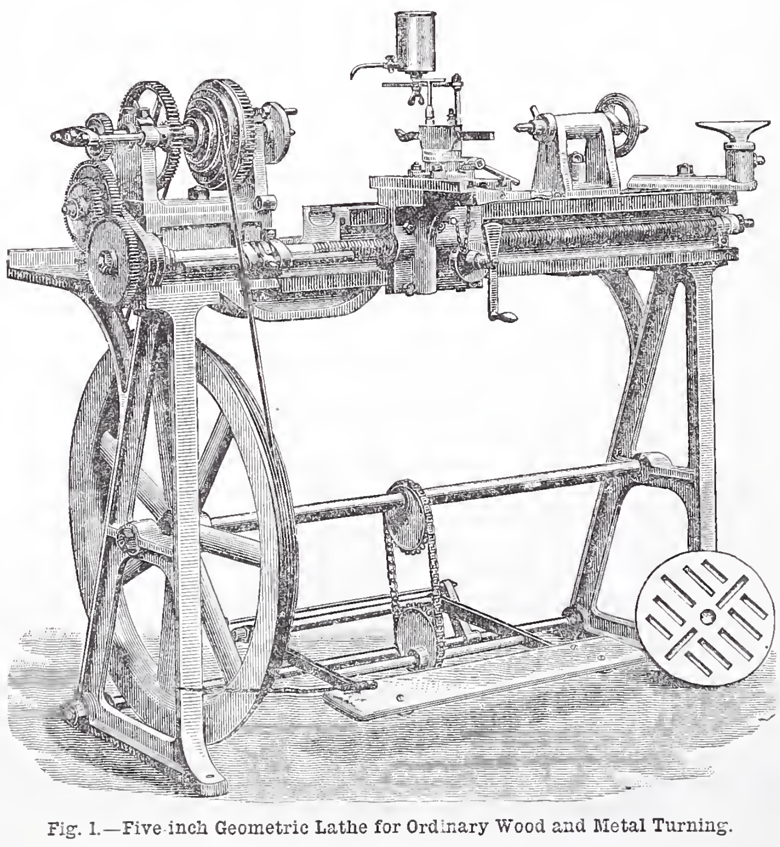


Fig. 1.—Five-inch Geometric Lathe for Ordinary Wood and Metal Turning.

shafts. There is also an arrangement by which the pivots on which the treadle moves may be raised or lowered, or its position altered, by moving the arms shown at the back. The treadle may also have a quick return, or a quick descent, by altering the position of the eccentric wheels in relation to one another.

There is also a neat arrangement for retaining the oil poured on the bearings, instead of letting it run on to the floor, and returning it again to the pivots. This consists of a little brass cup, fitting over the ends of the main shaft, and so constructed as to retain any oil which runs off the centres. The recess of the cups projects over the end of the shaft, and the cups can be moved back out of the way when required. The fly-wheel is fairly heavy, and has five speeds.

There are a variety of fittings designed for this lathe; amongst others there is a vertical slide, a very useful appliance for many kinds of work. Altogether, the lathe is well designed and neatly finished off, the workmanship being of the best all through. For description of overhead shown in Fig. 2, see No. 8, page 120.

One of the Company's lathes is on view in the Science and Art Department of the South Kensington Museum.

SHOP:

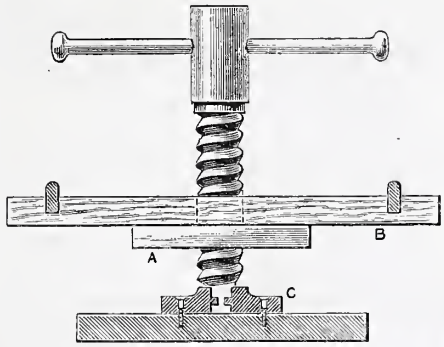
A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters From Correspondents.

Preservation of Pianos.—Progress writes:—"I notice in your second issue of Work, a cutting from a contemporary on the subject of the 'Preservation of Pianos.' As you invite criticism, and I consider the information misleading to your readers, I need hardly apologise further for writing to you. In the first place I venture to remark that it was not written by a practical man; I will go further, and say, or by a man who had seen a piano constructed. The sound board is not forced into the case so tightly that it bulges in the centre, nor is it forced in at all, but is fitted to the back of the piano before the case is made. The mode of construction of the sound board is thus:—Some selected Swiss pine boards ⅜ in. in thickness, and about 6 in. wide, are jointed together, edge to edge, until the required width is obtained, after thoroughly drying, and being gauged to the requisite thickness. Bars of spruce wood from eight to twelve in number are glued in a vertical direction across the back. To give the sound board rotundity on the front, the edges of the bars are planed round in their length. These bars are placed on after the bridges. It is then thoroughly cleaned with scraper and glass paper, and varnished on both sides to protect it from damp, and make it resonant. I have never heard of a sound board splitting for want of moisture, but often when the wood has not been dry it has shrunk, and so caused the splitting. As to placing a vase with a wet sponge in it under the piano, it is simply absurd. I have before me a catalogue of Chickerings', who claim to be the largest piano makers in America. In it there are some hints on the care of pianos, but I see nothing about a wet sponge or a growing plant. I should say keep the sponge as far away from the piano as possible, because if placed in close proximity to the piano, the damp would be drawn to it, and rust all the strings, and do other damage. If your readers wish to preserve their pianos, I would advise that the piano be placed in a dry room, standing by an inside wall, as a rule behind a door, so that it does not stand in the draught from door to fireplace, as draughts often carry damp air, and cause rust. In sweeping the carpet do not wet the floor near the piano, as the damp rises. See that a fire is lit occasionally in the room in winter time. A piano always sounds brightest when it is kept dry. Keep it well dusted, and do not load the top with books, vases, etc., as these deaden the tone, and often cause noises in the piano by their vibrations. Have your piano tuned at least four times in the year, when it is new; after the first year, three times in the year will probably be sufficient, as the strings would have got settled to their bearing."

Wooden Copying Press.—W. H. D. writes:—"In the second number of yours, which promises to be one of the valuable assistants to all tool users—amateur or professional—I was struck, or, shall I say amazed (Scottice, amused), at or by the long description and perfect draughtsmanship of the amateur's wooden copying press. I have had in use 'another of the same,' which, while being slightly less mechanical in construction, is still as perfect in action, and has the advantage of having the stand ready made, or, at least, handy in most domiciles. Although hailing from the modern Athens, we children of the northern regions of the British Islands are not so far left out in the cold as not to have, as a rule, in the kitchen, a strong wooden-bottom armchair; that forms the stand I use, while Mr. D. Denning is evolving from the depths of his inventive consciousness the more elegant or shapely one to stand in the corner designed for it. The press itself, with its wooden screw, resolves itself into the screw and pressure board. The bar, B, in the illustration, in this case is a bit of birch, tapped to fit the screw, as shown—22 in. long by 3 in. thick and 3 in. wide; two might be strong enough, but that is my size. A strong pin is inserted at the points marking the centres of the arms of the chair, and on the under sides of those a hole is made to receive the two pins. These pins are simply to prevent lateral slipping or sliding, and in this case are of boxwood, but anything will do. The pressure board for the quarto copying-book, in my case, is a flush framed 1½ in. thick, which I happened to have, but any strong piece of timber which will not twist, bend, or give, will do. The attachment of this to the screw is where, I think, this home-made press has the advantage. It is well known that screw nails do not hold well in wood, so to overcome this difficulty, I got a collar turned with a notch made in the screw to receive it, allowing it (the screw) to



Wooden Copying Press.

A, Nut, or Female Screw. B, Bar. C, Circular Catch cut through before being screwed to pressure board.

revolve loosely while working up and down in its nut. Of course, to get it to catch and work, the collar was sawn through before being screwed to the pressure board, as shown in the accompanying tracing from your own woodcut with the necessary alterations."—[You have certainly shown the utmost economy in the construction of your press, but I think Mr. Denning's has a little advantage over yours, although he uses up more material. One slight difficulty suggests itself to me, and that is the shape of the seat of the chair, which ought to exert a pressure on the lower sides of the copying-book precisely equal to that which is exerted by the screw through the pressure board on the upper side of the book. If the seat of your chair is perfectly flat and level, all will be right, of course; but the seat itself, though well adapted for press purposes, can scarcely be comfortable to sit on. I have a wooden armchair on which I sit daily when at work, but the seat itself is slightly hollowed—moulded, in fact, for obvious purposes, and I fear its curved depression would render it unfit for utilisation as the bottom, or *pièce de résistance*, of a copying press.—Ed.]

II.—Questions Answered by Editor and Staff.

Inlaying.—W. H. Dunley.—The Italian and, I believe, also the French mode of inlaying, which is simply fret cutting, is carried out somewhat in this way. Suppose the material is ivory and ebony, two thicknesses of the veneers of each are glued together with paper between; this when dry receives the drawing, which is cut in the usual way; these are separated. The ivory inlaid into the ebony is called *primo*, the ebony into the ivory *secundo*, the latter being considered much inferior. The same principle prevailed, or prevails, with buhl work, in every case a light and a dark material let into each other, so that nothing is lost.

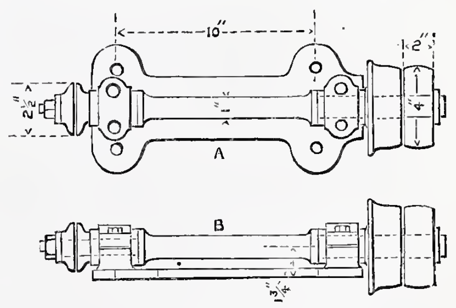
Cupboard Doors.—C. H. J. (*Chelsea*) writes:—"With reference to Mr. David Adamson's article on 'Artistic Furniture,' which appears in Work, in which he gives instructions for making the doors of the overmantel, by halving the styles and rails together and rabbeting the panel in the back, may I suggest the following method, which seems easier for amateurs?—Cut a piece of ½-in. board the length and width of cupboard. Then cut your styles and rails out of ½-in. stuff. Screw the styles on the sides of the board, cut the top and bottom rails in tightly between them, and fix them. Should it be a long cupboard, a middle rail can also be fixed, at the maker's discretion, making it a two-panelled door."—[This mode of making doors is one that is known as "mocking," that is to say, when the effect of panelling is produced by the use of slips of wood, and even mouldings, as you have described.—Ed.]

Wire Thread Fret Saw.—O. F. (*London, N.*) writes:—"The wire fret saw was illustrated in the *Scientific American*—an American paper—some years ago, I think about twelve years."—[Will you kindly try to fix the year in which the article to which you refer appears? Or will any reader who has access to a file of the *Scientific American* take the trouble to make a search for me, and let me know number and date?—Ed.]

Bunsen Battery for Incandescent Lamp.—Electric.—To light up your room of 10 ft. square you should have at least 30 candle-power. This you might get from three 10 c. p. incandescent lamps worked with current from ten quart Bunsen cells arranged in series, the lamps being placed in parallel circuit. The probable cost of each cell would be about 3s. 6d., and the cost of lamps the same, but one can scarcely venture to quote prices here to suit all districts. I do not suppose, however, that you could safely reckon on less than £3 to cover cost of installation. Working expenses extra, for which no estimate can be made. Mr. S. Bottone, Carshalton, Surrey, will give you an exact estimate, and supply you with all necessary materials if you apply to him.—G. E. B.

Leclanché Cells for Incandescent Lamp.—Nulli Cedo.—The thing proposed by you is entirely impracticable. The E. M. F. of a Leclanché cell is 1·40 volts, and it will take at least 50 volts to light your 20 c. p. lamp. You get no advantage in coupling the cells in multiple arc. Even if you used the largest size Leclanché cell for the purpose, it would take at least 36 cells in series to make the lamp glow, and this faint glimmer would only last a few minutes, because the cells so rapidly polarise on constant work. To employ this battery at all on electric light work is like using a tack hammer to forge a ship's anchor. 20 c. p. lamps are also unsuited to electric lighting with current from a battery. Nothing higher than a 10 c. p. lamp should be used. Lamps are easily switched on and off a battery. Cotton-covered copper wire for leads. The cells are charged, then connected to the switch. There is no danger. No danger at all to persons from current generated by batteries used in electric lighting. See replies to other correspondents on electric lighting.—G. E. B.

Sewing Machine Treadle for Circular Saw.—H. W. (*Gateshead*).—You cannot get sufficient power from an ordinary sewing machine treadle and fly-wheel to drive a circular saw through a 1-in. deal. One inch is too thick to be cut without extreme labour, even in a 5-in. lathe with a heavy fly-wheel. Could you not manage to pick up an old treadle and fly-wheel second-hand and rig up a little circular-saw bench? That would be much cheaper than purchasing a saw bench properly fitted. You can buy a saw spindle of any tool maker, price varying with size. A spindle with carriage and bearings for a 15-in. saw costs £6. But you can, if you can work a bit in metal, and get the loan of a lathe, make a spindle for yourself. I enclose a drawing of such a spindle in plan and elevation, with a few leading dimensions suitable for a saw of from 10 in. to 12 in. diameter. The smaller dimensions you can measure from the drawing, as it is to scale. You can make a bench by framing quartering together, and screwing a table upon it. Almost any design will answer the purpose. If you manage to pick up a crank and heavy wheel (it



Spindle for Saw Bench. A, Plan. B, Elevation.

must be as heavy as a 5-in. lathe wheel), and will then give dimensions of it, I will show you how to adapt a table thereto.—J. H.

Steel Straight-edge.—Mechanic.—To make a steel straight-edge 4 ft. long, you must obtain the use of a true surface plate, or true straight-edge, or else you must make two other similar straight-edges in order to get one true. Whatever plan you adopt, you must first rough cut and file your bar of steel to width, and then, before attempting to finish, take out all wind, curvature, or inequality of surface by careful hammering. When this is done, and the faces clean and polished, get one edge as true as possible by filing. If you can test by another straight-edge, or surface plate, well and good. But I judge from your letter that you are dependent on your own resources. Then, in this case, get two strips of dry mahogany to make two other straight-edges, the counterparts of your metal one. I suggest mahogany because it is so much easier to work than metal. If you can get a sale for steel straight-edges, make the two supplementary ones in steel. Take then the strips, and file or plane one edge of each as true as possible. In the absence of a true surface to check by, lay the straight-edges upon a plane face, scribe a fine line by the edge you have filed, then turn the straight-edge over, and try that edge again by the line just scribed. Half the amount of non-coincidence of edge and line measures the amount of inaccuracy present in your straight-edge. This you will reduce, and when, by repeated trial, you think it is true, gauge or scribe the second edge parallel with the first, and file that. Serve all three alike. Now, when you try edge to edge you will certainly find that though two may possibly appear to coincide, they will not coincide with the third, when tried edge to edge. By removing material, therefore, carefully, until all six edges of the three straight-edges are mutually coincident, each to each, you will ensure perfect accuracy, and this without extraneous aid. If you do not require absolute perfection, then two straight-edges will suffice instead of three, provided they are not only tried edge to edge, but end for end. Do not spoil the value of a straight-edge as a parallel strip for purposes of levelling by making one edge rounding, as was shown in the sketch accompanying your letter. No true mechanic would be guilty of such barbarism. All straight-edges should be perfectly parallel.—J. H.

How to Distinguish Steel and Iron.—W. L. W. (*Dublin*).—You ask for "a safe and ready method of knowing good steel from iron or bad steel," because you "find it difficult when buying tools to know that the articles are of good quality." To this I may say that iron emits a comparatively dull sound when struck with a hammer; steel gives forth a very sonorous and musical ring. Polished steel has a much more lustrous appearance than polished iron. These are broad distinctions. But when you ask a "safe and ready method of knowing good steel from bad steel," I can only say that this is entirely a matter for experience, practice, and test. You cannot judge of the temper of steel tools by inspection only; you must make trial of them. For this reason all tools by good makers are "warranted," and will be exchanged if found unsatisfactory. You might expect that a tool which shows a high polish is good, but the best guarantee of quality is the name of a maker of recognised repute, and the paying a good price.—J. H.

Riding Tricycle up Hill.—A NOVICE.—You ask for "information as to the best means to assist rider in ascending hills." Kindly give me the following particulars, and I will endeavour to assist you:—Type of machine; size of driving wheels, and to what speed are they geared; length of crank throw.—C. I.

Wire Thread Fret Saw.—C. R. B. (*Edgbaston*).—This fret saw is not yet in the market, to the best of my knowledge. When it is so, and when I am in possession of sizes and prices in and at which it is made and sold, I will mention both in these pages. I am obliged to you for your good opinion of WORK.

Valuation by Cubical Contents.—READER asks how the above can be obtained in all classes of house property. The answer is simple. To obtain the answer considerably less so—*Experience*. When it is taken into consideration that a house occupying the most space may be of the least cubical value, or that two houses built from the same plans may be so varied in the interior that the value of one shall be 3d. per cube foot and the other 4d., what established rule can decide the difference? House property worth 2½d. per cube foot, when several houses are built together, might cost 3d. if built singly. To obtain these varying prices it is necessary, either from plans or from a building of similar structure, of which the cost is known, to take the cubical contents, and so from one to price the other. The information thus obtained is of little value except for that special class of work. Other class property must be treated in a similar manner. But it may not be possible to compare property in this manner. Just so; there lies a difficulty which experience alone can overcome. Comparison gives a clue, but considerable judgment is necessary before one can properly compare one class of work to another. It is easy to find buildings ranging in value from 2d. to 6d. per cube foot, the different prices depending more on quality than quantity. It is an unsafe method of valuing, and I could quote instances in which mistakes have been made by builders of as much as three hundred in the thousand pounds by using cubical measurement. As well guess at the total value at once as guess at the value per cube foot, and I maintain that cubical valuation is more or less of a guess.—JOACHIM MILLER.

Peripheral Speed of Breast Water Wheels.—X. Y. Z. (*Orkney*).—The peripheral speed of breast water wheels is settled on practical considerations, and is usually set at 6 ft. per second—it should not fall below 4½ ft. or exceed 8 ft. per second. For economical working, the velocity of the feed water entering the wheel should be twice the peripheral velocity, or usually 12 ft. per second. This will require a head of 2¼ ft., therefore the outlet from the penstock should be 2¼ ft. below the surface of the supply. To find the gross power, multiply the number of cubic feet of water passing per second by 62½, and by the vertical height of fall of the water, and divide the product by 550; the quotient will be the gross horse-power, and the available or effective power will be from 6½ to $\frac{8}{10}$ of the gross, according to the design of the wheel. The height of the fall is the vertical distance between the level of the head-water in the penstock and the level at which the buckets of the wheel empty themselves.—F. C.

Taking a Cast after Death.—A. E. (*Liverpool*) will find this a simple matter as compared with casting the face of a living person. The features should be rubbed over with a very little oil. The beard, moustaches, etc. (if any), should be plastered down with soap, and carefully, as any stray hair which may become entangled in the mould will probably be pulled out. Cloths should be tucked under the chin and all round the face as far as the mask is to extend, and closely, that plaster may not run between them and the skin. These, going along the line of the hair, will protect it; or should it be desired to extend the east over any part of the hair, that part must be plastered down with soap. The nostrils should be plugged with a bit of oiled cotton wool. The plaster should be put on carefully with a spoon, not poured on in quantity, or it will overflow the cloths and make a mess. It is better to make the mould in two layers, colouring the inner one as in ordinary waste-moulding. No difficulty will be found in removing the mould if no hairs are left loose to become entangled in it.—N.B. In this place it would be impossible to give full directions for all the processes of ordinary plaster casting, but I have articles on the subject in preparation which may, I trust, by the courtesy of the editor, appear before long in these pages.—M. M.

Printing Estimates.—S. A. C.—I know of no English work which treats of this subject. The Russell and Morgan Printing Company of Cincinnati have compiled a series of tables showing the principles upon which estimates should be based. These tables, which are being reproduced at intervals in the *British and Colonial Printer and Stationer* (Office, 58, Shoe Lane, London), would give you all the information you require.

Smiths' Work.—VULCAN.—I am glad to receive so sensible and so practical a letter as yours, and will do all in my power to aid yourself and all young workers at the forge by suitable papers in WORK. Before this can meet your eye you will have read the first of a series of papers on "Wrought Iron and Steel Girder Work," and I have the first of another series on "Smiths' Work" in type and ready for publication. Much beautiful work is now being done in wrought iron, and I have recently seen candlesticks, ornamental brackets, lecterns, and other articles in hammered iron that afforded abundant proof that the ornamental ironwork of mediæval times is on the eve of revival. I saw also a spray consisting of a full-blown rose and leaves wrought in iron, to look on which was to me a genuine pleasure. I hope one day to follow the Sheet of Repoussé Metal Work given with No. 7 with a sheet of Hammered Iron Ornamental Work.

Hat Making.—W. G. H. (*Stockport*).—You ask for "a course of papers on the manufacture of hats," adding that "it is a trade of which little is known theoretically. If you could see your way to give papers on the preparation and blowing of fur, forming, planking, blocking, curling, finishing, dyeing, trimming, etc., you would convey a boon on the neglected hatters." I must confess that I cannot see my way to do what you ask at present, for there is so much to the front to be dealt with already. Meanwhile, hatters will find much in WORK that will benefit them indirectly at home, if not directly in connection with their trade. If a hatter takes up WORK and studies it from week to week it may be instrumental in giving him many a hint and affording many a suggestion that may be of use to him in his trade.

Printers' Lead Castings.—To judge from your sketches and the description you give of your mould for casting printers' leads, you appear to be on the right track as far as this is concerned. Your trouble is that the metal will not run in the mould. The fault, in all probability, is in your metal; try 24 parts lead, 4 parts antimony, and 1 part tin.

Our Advertising Pages.—E. C. (*North Brixton*).—Suggestions are always welcome; no apology is necessary for them at any time, for they are nearly always of service, and we are always glad to have them. I can only say that if it ever be found possible to meet your wish it will be met.

Comment and Criticism.—P. C. (*Leyton*).—I will not give your letter at length, but will content myself with assuring you that nothing will ever appear in the pages of WORK that will be irrelevant and touching on subjects that are best left alone. I sympathise with you in all you say about—but here I must stop, for obvious reasons. No one can detest flippant dealings with sacred subjects, or "profane and vain babblings, and oppositions of science, falsely so called," more thoroughly than I do.—ED.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Cement Roofing.—X. Y. Z. (*Orkney*) asks:—"Can any practical builder inform me whether cement plaster would do for a roofing material? I mean to nail laths on the rafters, as in inside house plastering, and cover with a coat of cement plaster. Would there be a danger of the plaster cracking or peeling in a storm; and if so, is there no known way of preventing? If practical, this would make a very cheap light roof, and when lined and painted would be very pretty and very suitable for, say, farm steadings. I should much like to know whether it has been tried, and with what success.

Coating for Damp Walls.—R. A. P. wishes to know "the requisite proportions of shellac and methylated spirits on wood naphtha to make a waterproof solution for inside damp walls. How much naphtha to 1 lb. of shellac."

Trade Notes and Memoranda.

AN Heraldic Exhibition is opened at Ghent. The armorial bearings of the early Knights of the Order of the Golden Fleece will form a prominent feature of the show.

THE bridge erected by Lord Burton over the River Trent is 240 ft. long. For the ferry rights at the site a sum of £12,950 had to be paid.

A PUBLIC studio is about to be established in London, under the personal direction of Sir James Linton, P.R.I.

THE piers of the Tay Bridge are founded on silty sand, and consist of two iron cylinders, which are sunk deep, joined together, and filled with concrete masonry. The maximum load is 3 to 3½ tons per square foot. The Paris Exhibition buildings rest on a substratum of stiff clay. Where the gravel was 10 ft. thick, 6,140 lb. per foot was the maximum load allowed; when between 10 ft. and 5 ft. deep, 4,550 lb. was allowed, and the thickness of concrete was increased. When below this depth, piles were driven.

SHEET metal is applied by the Americans to a large number of purposes. One of the more recent adaptations are sheet metal ceiling centre pieces, which can be painted to imitate plaster, or decorated to suit any taste. Lightness and durability are claimed for it.

LECTURING on "Some Newer Modes of Working Sheet Metal," Mr. D. W. Kemp, of Edinburgh, explained recently to the members of the Association of Science and Art that the invention consists in taking advantage to the full of the well-known properties in all ductile metals to flow or stretch under gradual pressure. The improvement claimed over the ordinary methods of hammering, cressing, or spinning might be called flowing, and consists in employing fluid pressure and heat in combination with suitable moulds, the pressure being applied on the sheet metal in such a manner as will force it gradually into the concave or hollow part of a mould, shaped internally to fit the external shape intended to be given.

THE Argentine Republic has a very large foreign trade in proportion to the number of its inhabitants, for the reason that it produces large quantities of raw material, and has, at the same time, very few manufactures. In 1887 the exports and imports amounted to £42,349,840, being equivalent to £9 13s. per inhabitant, against £8 8s. in France, £6 7s. in Germany, £6 in the United States, and £2 4s. in Russia.

WORK

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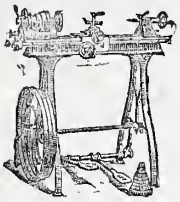

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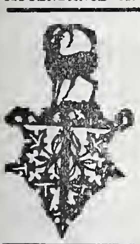

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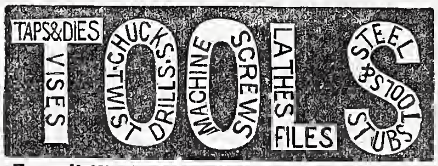

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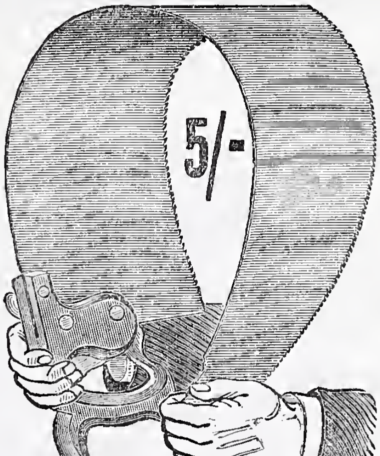

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STUDIES IN WOOD CARVING.

BY FRED MILLER.

I.—TWO CORNERS FOR PICTURE FRAMES.

SINCE the introduction of *carton-pierre*, carved frames have become almost works of the past; but seeing the scope the craftsman has to exhibit his skill in a carved frame, the tyro should certainly try his hand at something of the kind. The two designs given with this number of WORK are very simple in character, and present no difficulties to even beginners in the craft. Fig. A is an adaptation of a tolerably familiar pattern, used in the "bosses" of Gothic wooden roofs. The corner consists of two double leaflets interwoven, and forming the termination of the twisted stem that occupies the rest of the frame. It would be easier when the frame is mitred and glued up to glue an extra piece, say, $\frac{1}{4}$ of an inch or $\frac{3}{8}$ of an inch deep, at each corner, so that the corners are in higher relief than the stems running along the four sides. The four bosses can then be carved out of the pieces glued on, the "grounding out" being taken to the depth of the pieces glued on, and *not* to the depth of the flat upon which the twisted stems lie. The corner is given full size for working, and a tracing should be made, and the four corners might have a little Chinese white brushed over them, and when this is dry, transfer the design of the bosses by means of a hard point and black carbonised transfer paper, to be obtained of any artist's colourman or stationer. Having "grounded out," carve away the leaves as they approach the edges of the bosses, so that the centre is the highest part of the corners, and the edges of the leaves only slightly higher than the thickness of the four pieces you glued on. Let the veining be simple and in the direction of the way of the leaf. Get the contour of the leaves sharp and angular, and let the carving be crisp and executed in a broad, free manner.

The stem running along the sides of the frame should be about $\frac{1}{8}$ of an inch in relief. The length and height must be divided up so that the twist or knob comes at regular intervals. The stem should not be smooth, but have a sort of bark-like surface running the lengthway of the stems. The background would look well if worked over with a punch instead of being left plain.

A

B

Two Corners for Picture Frames. Fig. A.—Adaptation of Gothic Boss. Fig. B.—Hispano-Moresque Arabesque.

Fig. B is adapted from a Hispano-Moresque piece of carving, and is only intended to be like a fret upon the flat. Consequently the grounding out should not be taken deeper than $\frac{1}{8}$ of an inch. Some portions of the design should be lower than the others. Be very careful to get the curves correct, and not broken, as the beauty of these designs is their flowing, interwoven character. The rest of the frame can have the double arabesque running the whole length of the frame, and terminating at each corner.

Such designs as these Moorish arabesques would make good fret work designs, and, in fact, a frame might be decorated in this way by cutting the design out as a fret, and gluing it on the flat. Those who have not yet tried their hand at carving out of the solid, but may have ventured to relieve fret work, which they have executed by a few touches put in here and there, by aid of gouge or chisel, may be led on to wood carving by working in the manner suggested, and venturing to impart a little more relief and variety to their work by means of carving tools proper, without which it is impossible to carry out the simplest carving effectively.

SMITHS' WORK.

BY J. H.

I.—Development of Art of Metal Working—Twofold Division of Subject—Ancient Hammer Work—Copper Work—Bronze Castings—Celts—Ancient Riveting—Iron Working among the Ancient Greeks, Romans, etc.—Iron Manufacture in the Middle Ages—Smelting in Sussex—Casting—Fagoting and Welding—Hot Blast—Processes of Heath, Bessemer, and Siemens.

Having undertaken to write a succession of articles for this magazine upon the work of the smith and of the boiler maker, I propose to preface those articles by a compendious sketch of the general lines of development of the art of metal working. I shall then proceed with my first series on smiths' work, to be followed by a second series on plating and boiler making.

All metal work is readily divisible into two broad classes — cast and hammered. This distinction is sufficient for our purpose, although it does not entirely cover the field, because nearly all malleable iron made by modern processes and all mild steel are cast before they are puddled, hammered, or rolled. Neither does this take account of the method of electrotyping. Both casting and hammering were employed in prehistoric ages, and both methods have continued in use until the present time. It is comparatively easy to produce intricate forms by casting, but the forging of such forms taxes the very highest skill and patience of the craftsman. Most of the specimens of prehistoric art which have been preserved to us are in the form of castings, but the more delicate hammered works are mostly of historic dates, or belong to periods immediately antecedent thereto.

The work of the blacksmith is of comparatively recent origin in human history. Skill in the working of iron dates only from a few centuries before the Christian era. In the Homeric period, iron was a rare metal of great value. One of the prizes at the funeral games of Patroclus was a self-fused mass of iron and iron fit for making arrows. — (Iliad xxiii.) Previous to the introduction of iron, bronze was the metal employed for weapons of war and defence, and for articles of ornament and domestic service. The ancients had acquired very great skill in the composition and use of this alloy, as is attested by the vast number of cutting tools and utensils which have rewarded the researches of archæologists. The origin of the age of bronze is lost in remote antiquity. No hard and fast chronological line separates it from the preceding neolithic or new stone age, when men polished their celts and implements of flint and chert. But the discovery of the use of the metals copper and tin marked a most distinct advance in the history of civilisation; and in this broad sense we are justified in regarding the bronze-using period as a very important age or era in the history of the race. It is considered probable, and in some isolated districts it is a fact, that there was also a period when pure copper, unalloyed with tin, was employed. But as a rule the advantages in increased hardness which were gained by alloying tin with copper were so evident, that in most cases bronze, and not pure copper, was used.

The evidences of a copper age are chiefly found about the Lake Superior district, in North America. Here native copper occurs in great abundance; and here the metal has, in most cases, been hammered, and not cast, though there are exceptions. In the State of Wisconsin alone, upwards of a hundred axes, and spear-heads, and knives formed of pure copper have been found. In Central India, at Gungeria, copper instruments have been found. But it is doubtful if either of these remains is of great antiquity, and they are only instanced as illustrative of the probability of a copper age having, in some cases at least, preceded that of bronze in countries where no direct evidence of such has been discovered. As a matter of fact, nearly all the primitive implements of metal as yet found in the old world are made of alloys of copper and tin.

The composition of the prehistoric bronzes varied extremely. A good bronze mixture, as used by engineers, contains about 88 or 89 of copper to 12 or 11 of tin respectively. Many of the ancient bronzes contained proportions approximating to these, but some contained a much less, some also a much greater proportion of copper. Very considerable traces of lead, nickel, silver, and iron also occur in the early bronzes, the modern art of the purification of copper from the foreign ingredients present in the ores being, of course, unknown to the early smelters.

These castings were made in regular foundries, the remains of which have been found in many districts in England. Moulds, lumps of rough copper in cakes and ingots, worn out and broken implements intended for remelting, gates or runners, cores, etc.—all these have been found in large quantities, so that there is no mystery at all about the method of manufacture of the early implements.

It is, to some extent, matter of conjecture how the metals were cast, but crucibles of clay must have been employed. At Robenhausen, in the old Lake dwellings, such crucibles have been found with small lumps of bronze still sticking in them. The moulds used were made in various materials—loam, sand, stone, and metal. In some moulds the upper portion was left open, in others, closed moulds were used, and hollowed parts of the castings were made of cores of sand or of metal. Spear-heads and celts—chisel-like implements—were cast in divided moulds, whose halves were guided into coincidence by means of dowels on the joint faces, the halves being bound together during casting with thongs, pins for the encircling cords being cast upon the outside of the mould. The metal was poured through holes in the joints.

In the case of socketed chisels, the interior core was formed sometimes of loam, sometimes of metal. This would fit into the upper portion of the mould; and the founders did not always get their cores central any more than they do now, as is evidenced by the thick and thin metal on opposite sides in specimens of castings still in existence.

In no essential did the methods of moulding and casting differ from those carried on at the present day. Yet these relics date from a period long anterior to the Christian era, how long, none can say even approximately; probably, almost certainly, many are from 2,000 to 4,000 years old. Dr. Evans thinks the bronze age began in England some 1,200 or 1,400 years B.C., and that it lasted about a thousand years, but he believes that the knowledge of copper and tin may have much antedated this.

Among the articles fabricated by the early bronze founders were the celts, or typical cutting tools, whose uses were probably multitudinous: long narrow chisels and gouges, sickles, knives, razors, daggers, swords, spear-heads, lance-heads, hammers, shields, helmets, trumpets, bells, pins, bracelets, rings, ear-rings, buttons, caldrons, etc. Some of these were riveted to their handles, and in the case of caldrons and other vessels, the plates of which they were composed, were also united with rivets.

The introduction of iron brought about a revolution in the art of metal working whose ultimate developments are but dimly foreseen, even in our own age. The date of its discovery is lost in obscurity. But we may venture to affirm that it was a metal which was little known at the period of the Homeric poems, and that it was in common use by the second or third century before the Christian era.

The significance of the passage in the "Odyssey" is unmistakable—"As the smith plunges the loud hissing axe into cold water to temper it, for hence is the strength of iron" (ix. 393). The metal was known in ancient Assyria, a few iron articles found by Mr. Layard being quite sufficient to prove that the use of iron was not unknown. A few remains have been exhumed by Mr. Schliemann from the site of ancient Troy. There are abundant evidences of its use in Egypt, probably seven centuries or more before the Christian era. Mr. Fergusson even gives cogent reasons for believing that iron was known in Egypt fifteen centuries before our era, and in the Mediterranean shortly afterwards. And it is certain that the metal has been smelted in the rude Indian furnaces from time immemorial. This summarises nearly all our knowledge of the early use of iron. But when we come to within five or six centuries of our era, the evidences of the age of iron become more abundant.

In the days of Hesiod iron had become very common. The poet gives to Hercules a helmet of steel and a sword of iron; and to Saturn, a steel reaping hook. Some centuries before the time of Herodotus, the manufacture of iron had been practised by the Chalybes, on the shores of the Euxine. Their country was full of iron ore, and covered with forests, from which the charcoal for smelting was obtained. The steel of Sinope was reputed for smiths' and carpenters' tools; that of Laconia for files, drills, and masons' tools; and that of Lydia for files, swords, razors, and knives.

Two or three centuries before the Christian era, iron was in abundant use. The Isumbrian Gauls who fought with Flaminius were discomfited because of the softness of their iron swords, which bent in action. The swords of Noricum, in great repute during the Augustan age, were of iron. Iron is mentioned by Strabo as being among the products of Britain. The Veneti, in the Morbihan, when attacked by Cæsar, had their galleys fastened with nails of iron and moored with chain cables of iron.

The knowledge of steel must have been contemporaneous with that of iron. It is impossible that it should have been otherwise, because in the primitive smelting furnaces, which must have been practically identical with those which are in use in India, Burmah, Africa, and Catalonia, at the present day, the conditions of the reduction of the metal are such that iron or steel is produced almost at the will of the smelter. The nature of the resulting product depends on the temperature, the quantity of charcoal present, and the period of time during which the metal remains in contact with the fuel. Any given grade of malleable iron, steel, or steely iron, can thus be usually produced at the will of the smelter by the regulation of these matters. But it often happens that the product is other than that desired. Or, as in the Catalonian furnaces, every grade will be produced during one and the same smelting, so that the various qualities of metal have to be sorted according to the appearance of their fractured surfaces.

Although the art of casting in bronze was practised in a remote antiquity, yet the majority of the early work in iron appears to have been wrought under the hammer. The making of huge castings is a comparatively modern branch of metal work. The only distinctions made by the ancient and the early mediæval iron workers were those into malleable iron, and steel. Cast iron, though produced in the furnace, was an abnormal product, for which no use could be found. And the malleable iron they made was superior to our best, because it was smelted only with charcoal. Small quantities only were produced at one time, just as in the Hindoo, Burmese, African, and Catalonian furnaces; but the quality was admirably adapted for the best and most delicate smiths' work. Probably the early smiths could not have produced such excellent work as they did if they had been compelled to use our inferior bar iron.

During the Middle Ages, iron in small quantity was produced in England by a rude process of smelting, the ore being simply dug from a pit and transported to the localities where fuel was plentiful for smelting. The best iron was then imported from Spain and Germany. Historical documents prove that iron has been continuously smelted in the French Pyrenees from 1293 A.D.

The revival of the English iron manufacture first took place in Sussex, where the proximity of the iron-stone to the great oak woods had fixed the location of the industry, even in the time of the Roman occupation.

Iron at this time was so precious that, though cannon were cast and forged in the metal, the balls were hewn out of stone. The first cannons cast entire in England were made at Buxted in Sussex, by one Ralph Hogge, in 1543, whose assistant was Peter Baude, a Frenchman, the art of casting guns having been invented in France. Baude afterwards set up in business, and many of his guns, both in brass and iron, are preserved in the Tower. The low state of the art of casting in England at that time is illustrated by the fact that most of the early founders were Flemings and Frenchmen, who, driven by religious persecution to this country, brought their skill with them to the enrichment of England. That this was the revival, and not the creation, of an industry is clear from the fact that many of the old English andirons or fire-dogs date from a period anterior to the fourteenth century.

Toward the close of the reign of Elizabeth, the iron manufacture of Sussex was at its zenith. The fortunes of many great families had been built upon it. Ordnance was now exported. During the reign of James I., about one-half of the iron produced in the country was made in Sussex. But by-and-by the authorities became alarmed at the rapid clearing away of the forests, pit coal not having come into general use for fuel, because of the great prejudice with which it was regarded. An Act was passed in 1581 prohibiting the destruction of timber within fourteen miles of London for the purpose of iron making. New iron works were forbidden to be erected within twenty-two miles of London. These, and similar enactments, caused the emigration of many of the Sussex ironmasters to South Wales and elsewhere. About the middle of the seventeenth century, the civil wars gave another and more serious check to the iron trade in the destruction of the Royalist and royal iron works. By the latter end of the eighteenth century, the whole of the Sussex iron works were closed.

The smelting of iron, an art in which the English had now for so long excelled, was threatened with absolute extinction by the thinning of the forests, and legal restrictions imposed upon the further making of charcoal. In one locality after another the industry suffered, or became extinguished altogether; and iron again, as heretofore, had to be imported from Spain and Germany. In these circumstances the smelting of iron with pit coal occurred to many, and some patents were taken out with that object; but prejudice was strong and the practice unsuccessful. And so things continued until Dud Dudley took out a patent in his father's name, on the 22nd February, 1620, for smelting iron with fuel made from pit coal. The ironmasters of that period feeling, like the silversmiths of Ephesus, that their craft was in danger, pursued Dudley with unremitting hostility, and the civil wars subsequently swept away the fruit of his labour and reduced him to poverty.

To Abraham Darby, the Quaker, who commenced the casting of hollow ware in 1700, and who shortly afterwards opened the Coalbrookdale Works, in Shropshire, the iron trade owes much. Previous to this the hollow ware was imported from Holland. He too had experienced the difficulty of carrying on his work in consequence of the scarcity of timber, and resorted to the use of coke. The business was continued by his sons, then by Reynolds, who married a daughter of one of the Darby's. It was at Coalbrookdale that the reverberatory furnace was invented and first employed, the credit of the invention being due to two foremen, brothers, named Cranege. By its invention the operation of puddling for the making of bar iron was effected better than was possible in the old finery worked with a blast. Then there was the patent of Peter Onions, of Merthyr Tydvil, in 1783, for working the pasty mass of puddled iron about on the end of a rod, collecting it into a lump, and hammering it under the forge hammer.

Finally, Henry Cort, in 1783, patented the method of fagoting the bars of puddled iron, and welding and rolling them into one homogeneous mass. Cort introduced the practice of rolling bar sections in grooved rollers; and generally, he fixed the details of the practice of puddling and rolling as carried on in the present day.

During the period immediately preceding Cort's patents, the iron trade in this country was in such a bad way, chiefly because the ironmasters were debarred from the use of charcoal, and had not yet learnt how to adapt their processes to eliminate the impurities present in the coal and coke, that the Government would not use the wrought iron made in England, and the cast iron was considered rotten. Cort's processes have enriched thousands of ironmasters, but he, in consequence of a most unfortunate partnership, died in poverty, broken in spirit. To his inventions mainly, the Crawshays and the other great ironmasters of the present century owe their enormous fortunes.

On the first day of January, 1760, Dr. Roebuck, a Sheffield man, a physician, and the friend of Watt, opened the famed Carron Works in Stirlingshire. He was a man of large mind and of daring enterprise, but was ruined by the magnitude of his own projects, and died poor and in obscurity.

The black-band ironstone, whose use has quickened so vitally—indeed almost created the industry of iron smelting in Scotland—was discovered by David Mushet, in 1801.

In 1828, Neilson patented the application of hot blast to the smelting of iron. By its introduction a great saving in fuel has been effected, the black-band ironstone utilised, enormous fortunes made in consequence, and industries created.

About the middle of the last century, Huntsman invented the process of fusion of blister steel for the making of homogeneous cast steel, and the methods and details still pursued are, in all essentials, identical with those invented by Huntsman. It is not a little singular that although the method of fusion had long been followed in India in the production of wootz, the practice is so recent in England.

In 1839, Josiah Heath patented the addition of manganese to cast steel, by which the quality is so much improved, that inferior blister steel will yield cast steel of superior soundness and weldability. The addition of manganese is also absolutely essential to the strength and toughness of Bessemer and Siemens' mild steels.

In 1855 Bessemer patented his method of blowing air through melted iron for the production of mild steel. By this process, no less than 7,500,918 tons of steel were produced throughout the world in 1887.

A few years later Siemens invented the open hearth methods, the regenerative furnace and gaseous fuel, by which 1,672,340 tons of steel were made in 1887.

Simultaneously with the development of the Siemens' open hearth process for the manufacture of mild steel, a great revolution has been taking place in the methods of manufacture of malleable iron. The dry puddling process, perfected by Cort, is being rapidly supplanted by the wet puddling, or "pig boiling" process, in which the grey cast iron is melted on the hearth of a reverberatory furnace, in contact with substances rich in oxygen, by which operation the carbon and the foreign elements are oxidised, and the metal rendered malleable. The preliminary cost of refining the grey pig to white is thereby saved.

My summaries in this article have related to *metal*; my next will relate to *men* and their work.

(To be continued.)

ARTISTIC FURNITURE
EASILY MADE AND CHEAPLY PRODUCED.

BY DAVID ADAMSON.

II.—A Screen Secretary.

Uses—Construction—Principal Dimensions—Shaped Brackets—Writing-Flap—How to Fix It—Backboard—Shrinkage of Wood—Interior Fittings—Candle-Sconce—Shaped Bottom Pieces — Castors — Screws and Screwing — Fasteners for Lid — Lock — Lining of Writing - Flap — Mouldings — Flutes—Other Uses.

The little piece of furniture shown in Fig. 1 is distinctly a "fancy" article. It holds no recognised place among the things usually looked upon as necessary in domestic furniture, but is one of that large class of more or less useful and ornamental oddments of the "here-to-day-and-gone-to-morrow" kind. For want of a better name I have called it a screen secretary, fulfilling as it does the purposes of a writing-table and draught- or fire-screen. Perhaps a small writing-desk and shelves, self-supported, would be a better definition, for the screen is merely a necessity of its construction. Still it may be used as the latter article.

Whatever it may be called, however, it is a useful little thing, and ought to be a welcome addition to our home comforts. It occupies little floor space, very little more indeed than an ordinary fire-screen, while for writing at it is at least as handy and convenient as the common davenport. Those who require a large writing-table will, of course, not find it suited to them, though there is no reason why the same principle of construction should not be applied in much larger sizes than those named for the small one about to be described. This will be found useful enough for occasional writing, and its portability is a recommendation. In winter it can be moved near the fire, while in summer it affords a convenient table by the open window. Any amount of ornamentation can be lavished on it, but in accord with the object of these papers it is purposely shown with little or no decoration. Those who wish to add this will readily see that carving on the ends and front of the writing-slope affords a ready means of ornamenting, as does fretwork or the application of marquetry panels. However, plain as it is, and of old packing-case stuff though it may be, if cleanly made and finished with enamel paint, it will form by no means an unsuitable piece of furniture even for a drawing-room. So far as utility is concerned, it will, however, not be out of place in any room, and those who want to give something more than useless knick-knacks to bazaars will find this a very welcome change. Those who have some knowledge of joinery will hardly need any instructions for making such a simple thing, and novices need not despair of turning it out satisfactorily, if they will make good use of the square, and take their time over the work.

For the general principles of the work, I must refer to remarks in a former chapter where the construction of an overmantel is described, and proceed at once to say what may be necessary about the special features of the thing in hand. Fig. 2 shows the front of the contrivance; Fig. 3 the end with the shelves, fall, back, etc., in section, the fall, or writing-flap, being shown shut in both of them. The scale to which Figs. 1 and 2 are drawn is $1\frac{1}{2}$ in. to the foot, so that each $\frac{1}{8}$ in. of them represents one inch in actnal size, or approximately so, for very small dimensions cannot be accurately gauged from diminutive working drawings. Though large enough for illustrative purposes, I strongly once more recommend the maker, before cutting his wood, to set out a full-sized drawing. This need not give more details than are shown on Figs. 2 and 3, where any that would be likely to confuse are purposely omitted.

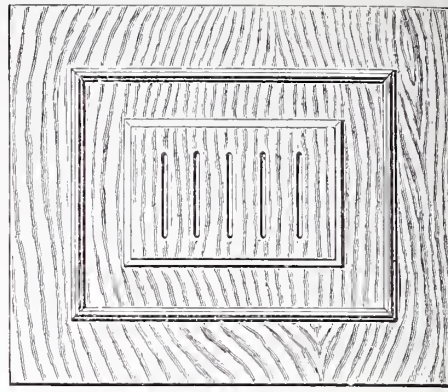
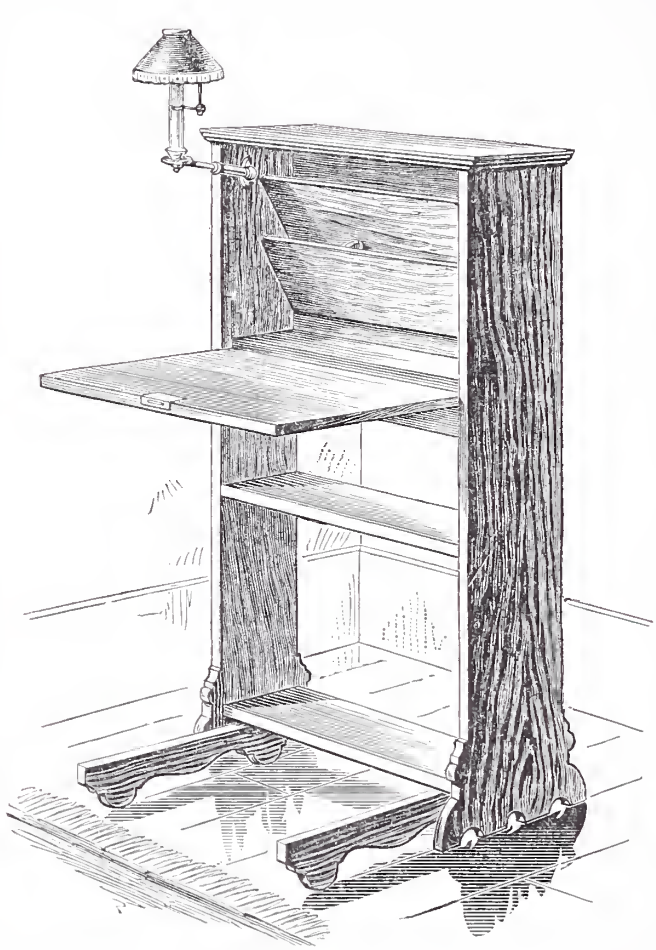


Fig. 9.—Lid with Mouldings and Fluted Panel.



Artistic Furniture. Fig. 1.—A Screen Secretary: Perspective View.

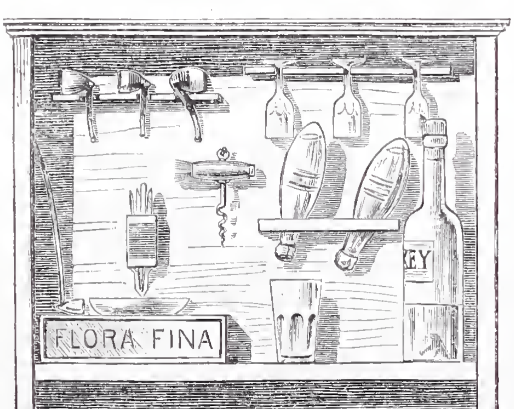


Fig. 11.—Another Arrangement for Interior.

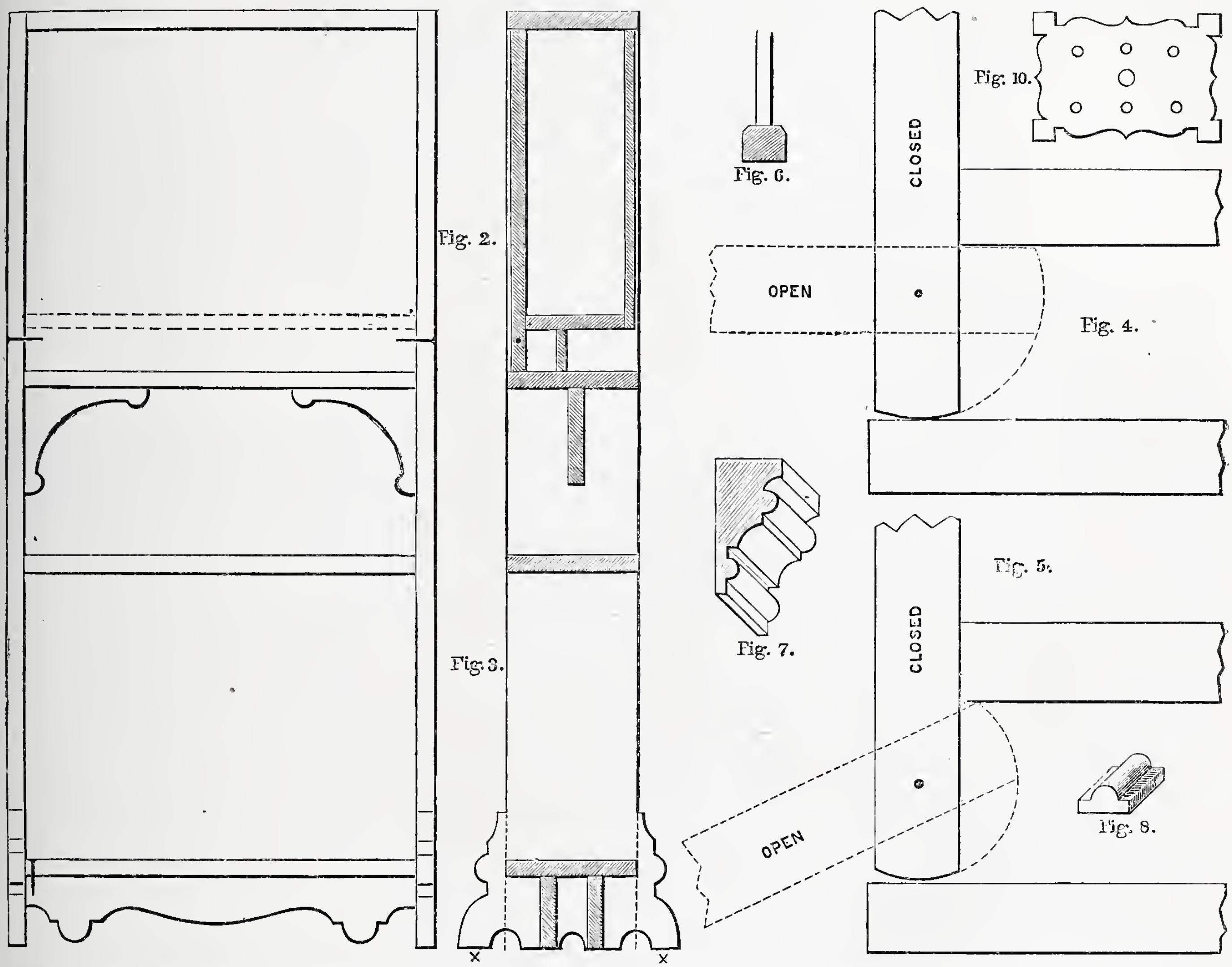
By the drawings we find that the principal dimensions are as follows:—height, 3 ft. 8 in.; width from side to side, 1 ft. 8 in.; depth from back to front, on top, 6 in., and at bottom, 12 in. Taking the thickness of the ends, and, indeed, all the rest of the material, as 1 in., the top piece will be 1 ft. 6 in. long. This, as will be seen from Fig. 2, is nailed within the ends, like the two lower shelves and the bottom of the writing part, all of which must consequently be exactly the same length as the top piece. Three nails in each end of a shelf will be sufficient to hold it.

The two shaped brackets under the shelf at the bottom of the fall will serve to stiffen the work, which, without some such contrivance, might be apt to be strained. They, therefore, not only serve to break the monotony of straight lines, but are placed for a structural object, and should not be omitted, though *on paper* they may seem superfluous.

When this part of the work has been done, the writing-flap may be made to fit accurately into its place, for, as it will have to be made of several pieces, it may be supposed that to save time it has been previously jointed up, and left rather full, so that it might be reduced afterwards to the right size exactly. Though not absolutely necessary, it will be better for the grain of the wood to be from top to bottom instead of across the flap. See that both surfaces are planed as smooth and level as possible, for one will be visible when the flap is closed, and the other is, of course, the desk side. The former must be level for appearance, the latter for comfort's sake, so that any ridges at the joints must be carefully worked down.

Now the hingeing of the front or flap will demand some attention from those who are not accustomed to this kind of work, though, like a good many other matters, it is simple enough when it is understood. In Fig. 2, just below the dotted lines, will be noticed a nail driven through each end into the flap. In Fig. 3 the nail is indicated by a dot in the corresponding part of the drawing. On these nails, or centres —for there is a special kind of hinge for similar positions, known as centre hinges—the flap works. With a flap so hung it is evident that on pulling its top forward the part below the nail swings backward and upward till it is stopped by the narrow shelf indicated by the dotted lines on Fig. 2. Were this shelf not there the flap would fall into an almost vertical position. Recognising this principle, it is merely a matter of adjustment of the relative positions of this shelf and of the centres or hinges to get the writing-flap either level or at any slope that may be most convenient. It will be understood the slope is not variable at will. When once the hinge is fixed, the angle of the board is also, so it will be well to decide on what seems likely to be suitable before fixing either the narrow shelf or the hinges. For all practical purposes, however, the shelf, which really forms the bottom of the desk, may be fixed at the distance shown in the illustrations, above the one below it—viz., about 2 in. By merely placing the hinge more or less distant from the lower edge of the flap, sufficient range of choice can be got.

To make this clearer, Fig. 4 is given, showing the position of hinge, *i.e.*, its centre or pivot when the flap is to be horizontal; and Fig. 5, with a considerable slope. These diagrams, I imagine, are more explicit than any verbal description, and will enable any one to set out the slope for himself. It is only a matter of compasses and measuring, and it will be more beneficial to exercise a little thought than simply to be told to place the hinges at such or such a distance for any particular angle that may be required. If work is to be of any value to the worker in an educational sense—and it may freely be conceded that novices' work is not worth much in any other—it is better to understand the principles than to work only to measure to definite directions. Without a knowledge of principles of his craft no man can become a competent worker, however good he may be at routine work. Hence about this hingeing no precise measurements are given now, but those who want them and cannot work them out for themselves may apply through "Shop" columns. The important matter of the position of the hinge being decided, it must suffice to say that a large screw-nail working freely in the ends and screwed into the flap will do very well as a substitute for the proper centre hinge. The head may be sunk and the hole covered with a small turned button. Those who want to know more about centre hinges may be referred to the articles on Hinges and Hingeing, in Nos. 5 and 7, pages 74 and 103.



Artistic Furniture. Fig. 2.—Front. Fig. 3.—End (Scale, 1½ inches to 1 foot). Figs. 4, 5.—Diagrams showing Mode of Hingeing. Fig. 6.—Section of End, with Block for Castor. Fig. 7.—Moulding, Elliott's Registered Design, No. 1071. Fig. 8.—Moulding, Elliott's Registered Design, No. 1001. Fig. 10.—Shaped Panel.

The board enclosing the back—and by "board" it will be understood that two or more may be jointed to get the necessary width—is fastened to the back edge of the compartment bottom, and underneath the top, through which one or two nails are driven to hold it securely, in addition to one or two through the ends. I am aware that this is not particularly good joinery work, as, unless the back is thoroughly dry, almost baked, in fact, it will, through having no opportunity for play, be apt to split. It may stand, and probably will, if the wood is quite dry. In all joinery theory is one thing and practice another; so it may be some consolation to the amateur to tell him that many thousands of articles of furniture are made every year without any allowance being made for shrinkage or expansion, and that such work, defective though it be, from a purely theoretical point of view, is quite serviceable when the wood is perfectly seasoned and dried before fixing together. All that can be done is to allow some play wherever it may be convenient, and in the present case rabbeting and precise joinery cannot be considered so. In all such circumstances the utmost that can be done is to take care to keep the direction of contraction as limited as possible, which means that the grain of the wood will run across from end to end, not from top to bottom.

I do not know whether I have already said in these articles that wood does not shrink in length, but in width; if I have, the fact being an important one will bear repetition, as the recognition of it will save many a constructive error. For this reason it will generally be found that in good cabinet making the grain of the wood is in the direction of the greatest measurement—viz., length not breadth. As will be seen from Fig. 3, this backboard may be of some thinner material than the rest of the job—½-in. stuff will do very well—and it will also be observed that it is set in a little, that is, the hinder edges of the top and ends project a little beyond its outer surface.

While we are at this part of the work it may be as well to call attention to the interior fittings, which are made of thin wood —¼-in. stuff; but even thinner than this will do. The bottom, which stops the flap, will do very well to hold ink, pens, etc., while the sloping racks will afford storage for note paper, envelopes, etc.; and as requirements will differ, it has been thought best just to indicate the method of utilising the space by a simple arrangement. The ends of the sloping boards are supported on thin slips of wood glued to the ends. The boards then rest on them, and, if necessary, are further secured by a glued block or two behind. Any partitions may be easily fixed without grooving by cutting them neatly and securing with a little glue and a few small brads or needle-points. If preferred, of course the sloping boards may be placed level as shelves, but by having them as shown, larger paper can be kept in them. Those who want something simpler even to keep their papers tidy will, no doubt, be aware that convenient little receptacles may be made by nailing tape across, leaving, of course, the spaces between the nails sufficiently loose for the purpose. The same use may be made of the ends, which are large enough for post-cards and envelopes, while a couple of cup-hooks, screwed into the back, will support a ruler. Indeed, by economising space, and with a little contrivance, it is astonishing how much in the stationery line such a little thing will hold.

The candle-sconce is another suggestion which may be welcome to some. It is merely one of the kind commonly seen on pianos, so that it can be folded inside when the lid is closed. It may occur to some that a sconce, or one at each end outside, would be not only a useful but an ornamental adjunct. If so, there is no reason why they should not gratify their tastes, only to be in harmony with the screen, the sconces should not be over elaborate in design.

Nothing so far has been said about the shaped bottom pieces, by which stability is given. They are merely small pieces cut out and glued to the edges of the ends, as indicated by the dotted lines in Fig. 3. Care must of course be taken that these shaped pieces are of exactly the same thickness as the ends, and also that they are uniform at the bottom, or otherwise the structure will not stand firmly, but rock in an unpleasant manner, when in use. It may seem ridiculous to call attention to this, but the novice, who has never tried it, will probably find the difficulty of "truing" the ends somewhat more difficult than he imagines. It may be done after a fashion, so that there may be no rocking; but this will hardly suffice to satisfy a critical eye, as, in addition, the upright surfaces must be perpendicular. Indeed, if I may so express it, squares, levels, and perpendiculars are the proper signs by which we may know that the work has been thoroughly done. If these are wanting there is something amiss.

Now, the bottom ends, widened as they are, ought to be enough for stability in the screen form, but it will be evident that some additional support will be necessary when the lid is down and being written on. Unless the shelves are loaded with books, or something heavy to counteract the leverage of pressure on the flap, there would probably be an upset. Such a catastrophe could be easily avoided by making the ends wider still at the bottom, but then look at the space they would occupy; and be it remembered, compactness is one of the chief features of this little writing screen. If it is to spread itself over the floor twenty inches or so, whenever it is wanted as much out of the way as possible, well one of its great recommendations is gone. Better have a regular writing-table instead. But we can still get the necessary stability by having hinged supports underneath the bottom board. These are shown extended in Fig. 1. Their shape is shown in Fig. 2, and their relative positions when closed in Fig. 3. They are hinged to the bottom shelf by a large screw driven through each at alternate ends, and as near the ends as convenient. If the screw is driven in from above, as indicated in Fig. 2, the hole in the board should be large enough for it to work freely, not loosely mind, but just enough to let the tighter hold of the thread in the movable piece remain undisturbed. Perhaps the appearance of the screw-head may be deemed objectionable. If so, run the screw in from below, through the thickness of the swinging bracket, and in this case the thread must bite in the shelf, therefore, the hole in the bracket must, in this case, be the larger of the two. It will be seen that the screw acts as a centre hinge, precisely as already indicated for the writing-flap. The ends of the brackets or supports will have to be rounded off to give clearance and allow them to be turned; and if they are cut to exact length, the free end will require a little bevelling off to its inner side; for it will be clear, that if a tight fit, and cut quite square on the end, it will jamb on attempting to move it. When not required for use, these hinged supports are out of the way, and rather ornamental than otherwise in appearance.

Possibly, some may prefer to have the whole thing on castors, so that it may be moved from place to place without lifting. If so, I would only say that "pin" castors should be used. These are so-called to distinguish them from the socket castor, as they have a screw or pin which can be let into the wood. Obviously, a socket into which a leg might be fitted would be unsuitable here. If castors are used—mind, I do not recommend them for this screen—they should be placed as near the ends of the bottom as possible: two to each end, as shown by the × on Fig. 3. Care must be taken that the plate of the castor is not greater in diameter than the thickness of the wood to which it is attached, if appearance be regarded. However, it may not be practicable to manage this, as the wood may be too thin to take a strong enough castor, and a weak, unserviceable one is nothing but a nuisance, whatever piece of furniture it may be on. Some of the "direct bearing" castors are good enough in their way, many of them perfect, till they are tried; but when all is said, there is nothing better for general purposes than the ordinary style, when of good quality and properly fastened, and, of course, sufficiently strong for its work.

In the round plate referred to will be seen some holes. They are for screws to support the central one, and let them be long enough. The little paltry screws, *hammered* into common furniture, are no use at all. If for any reason a castor-plate larger than indicated is advisable, this is how it may be fixed: Along the bottom, underneath the ends, fasten a rail as shown in section, on Fig. 6, and screw the castor into it. The screws will also hold better by this arrangement, as they will not be driven into end grain. Those who do not want castors on the ends may think that they will be a convenience on the hinged supports, and wish to have them there, but beyond giving the hint, any minute instructions can hardly be requisite.

Some sort of fastening will be required to keep the lid up when it is not in use for writing purposes; a spring catch may be used, or if it is desired to keep the contents of the case from prying fingers, a lock. The kind required will be a "till" lock, a space for which must be cut out where shown in Fig. 1. No difficulty should be experienced in doing this with a chisel, the principal caution I would give being, to see that the surface of the back of the lock and that of the writing-lid are equal. The part of the plate through which the bolt works will take care of itself, so far as projecting beyond the wood is concerned, for if it sticks out much, a well-fitting flap could not be closed. On the other hand, do not let it be sunk too deeply, but try and keep the surfaces uniform. A hole will have to be cut in the top for the bolt to catch in. Its exact position may be easily ascertained by smearing a little gas black, or any colour that may be handy, on the top of the bolt, shutting the lid and then turning the key. This will force the bolt against the top, and an imprint will be left just where the space must be cut. Rough and ready perhaps, but a thoroughly good "workshop" way.

But we have supposed the lock to be working without a key-hole. To form these neatly is not easy at first, and the power to do so can only be acquired by practice. The shape of a key-hole is too well known to require any description, and all I would say to the novice at present is this: Cut it as accurately as you can, and if it does not, in the end, look sightly, get a "plate" escutcheon, which is nothing but a small plate of brass, with a hole cut for the key, and screw it in position. The plate will hide any defective shaping of the hole in the wood, and be, in itself, an ornament. The thread escutcheon which is sunk into the key-hole may be used instead, but the other form is better, for the reasons given.

I am compelled for want of space to reserve my remarks on the lining of the writing-flap, mouldings and flutes in panel (Fig. 9), and other uses to which the secretary may be put. One of these is shown in Fig. 11, which I think sufficiently explains itself, and warrants us, almost, in naming the screen so fitted as the "Smoker's Companion." What's in a name? Ah, what! otherwise from appearance of the contents it might be called the teetotaler's *vade mecum*. Liquids to be partaken of medicinally—only—of course.

(*To be continued.*)

A HANDY CASKET FOR COIN COLLECTORS.

BY ONE OF THEMSELVES.

About Coin-keeping—Character of Casket—Dimensions—Joints—Carcass—Base Strips—Feet—Lid—Trays—Sweeping of Coins—How to Keep Coins in Place.

We coin collectors are accustomed to speak of our treasures in the lump as "a Cabinet of Coins," but this does not imply that every one of us keeps his collection in a cabinet, in the strict sense of the word. I for one do not. Granting that a cabinet has its advantages as being the most accessible of receptacles, it has also its objectionable points. Our hoards have an intrinsic value, and are attractive to the too-appreciative burglar; and it is, in my opinion, well to keep them in something which can, when occasion arises, be more easily removed to a place of safety than a cabinet.

My plan, therefore, is to arrange my collections in a sufficient number of handy boxes. During the years that I have made a study of numismatics, I have devised and tried many methods of disposal, and may, therefore, be able to throw out suggestions worth the consideration of my brother collectors. The box—or call it a "casket," the word sounds better, and is, indeed, more appropriate, both in respect of its ornamental shape and of the value of its contents—the casket, then, which I am about to describe is one of a series, and is the outcome of some experience. I think I may claim that three or four of such caskets, when set out to view in a room, are decidedly sightly things, and that they are easily stowed away in some secure and secret nook when safety is an object; also, they have this advantage, they enable one to arrange a greater number of coins in a given space than could well be done in any cabinet. The casket before us, with an internal measurement of only 10 in. by 6 in. by $4\frac{1}{2}$ in., holds, as fitted by me, nine trays, which give a surface of some 540 square inches. This means room for the exhibition of a very considerable number of specimens.

But before speaking of the internal arrangements, it will be well to give such a description of the box itself as will enable any one with a fair knowledge of the handling of carpenters' tools to make it for himself. My own casket, as will be seen from the illustrations, is carved, but made of some ornamental kind of wood the thing would look very well without carving.

A general view of it is given in Fig. 1, and in Fig. 2 is shown the front piece, drawn to half-size. Its dimensions are 11 in. by $4\frac{1}{2}$ in. It is of $\frac{1}{2}$-in. oak, as are also the back and the ends. The back is like the front, only it is not carved. The carving is of that simple kind which is worked almost entirely with the gouge and the dividing-tool, and which, though effective when finished, does not take long in the doing. The end pieces measure 6 in. by $4\frac{1}{2}$ in. No separate illustration of them is given, as the carving is almost identical with that on the front, the only point of difference being that in the ends the conventional foliage on each side of the half circle is a trifle wider.

At each end of the front (Fig. 2) are shown the screws, three in number, which fasten the box together. Probably a professed carpenter would not have been happy unless he had dovetailed these joints. I have enough of the craft to have dovetailed them had I been so inclined. But I knew that I could give abundant strength to my work in the more simple manner, and I chose to have the screws and to make a decorative feature of them. Dovetailing would have interfered with the ornamental character which I wished to give to my corners. The bottom of the box is merely a piece of $\frac{1}{2}$-in. deal, which is screwed to the front, back, and ends. The edges of this are completely hidden by the carved base strips (Fig. 3) which are screwed over them.

I first fitted the carcass of my box together, and having got it to my satisfaction, unscrewed it and worked the carving on front and ends; but it was not till I had put it together for the second and last time that I scolloped out the corners at front and back with a large gouge, as shown in the perspective drawing (Fig. 1), and indicated at the ends of Fig. 2. This scolloping was but the work of a few minutes; it does not weaken the casket, and it adds very much to its ornamental character.

In Fig. 3, a portion of one of the base strips which run along the bottom is drawn at full size. These strips were cut from $\frac{3}{4}$-in. stuff, but worked down so as not to be more than about $\frac{5}{8}$ in. broad and deep. The front and back strips are $12\frac{1}{4}$ in., the end strips $8\frac{1}{4}$ in.—or rather were so originally, for the finishing off at the corners, which is done after they are fixed in place, reduces their length by $\frac{1}{4}$ in. These are fixed to the edge of the bottom by slender screws. The back strip is left uncarved.

One of the feet is seen in profile at Fig. 4, and in plan at Fig. 5; both these figures are of the actual size. The feet are of $\frac{3}{4}$-in. wood, 3 in. long, and $1\frac{1}{2}$ in. wide at their widest part, but decreasing to $\frac{3}{4}$ in. at front. They project at the corners about $\frac{1}{2}$ in. beyond the base strips and 1 in. beyond the box itself, as is indicated by dotted lines in Fig. 5. Each foot is fixed by two screws, one driven upwards into the bottom of the box, and one driven downwards through it. These screws are shown in both the diagrams, and are both on the diagonal line (a, Fig. 5) drawn from the corner of the box.

The lid is cut to overhang the front and ends by $\frac{1}{2}$ in.; it therefore measures 12 in. by $7\frac{1}{2}$ in. It is of $\frac{3}{4}$-in. board, and is, for the sake of appearance, planed down at the edges to $\frac{1}{4}$ in., as seen in the section, Fig. 6. The slight enrichment cut with the gouge along its front and end edges is shown in Fig. 7. The former illustration is half-size, the latter full-size.

It has been mentioned that the internal arrangement for displaying the coins was by a series of trays. The casket is $4\frac{1}{2}$ in. deep, and as it was intended for heavy examples (chiefly tokens), the trays had to be strongly made. Half an inch was allowed for each, which gave nine trays. Had the coins been of a lighter description, as, say, a series of English silver pennies, trays of a slighter build would have sufficed; by allowing $\frac{3}{8}$ in. only for each, room might have been found for twelve trays.

In Fig. 8 is shown a section, to half-size, of one of the trays as actually made. It is of $\frac{1}{6}$-in. deal, ebonised at the edges, and secured by small screws at each end to a narrow strip of hard wood. A slip of coloured leather (b, b, Fig. 8) fixed to the under side of the hard wood by a tack, serves as a handle by which to lift the tray. This tray is strong and simple, and easily made.

My earlier attempts in this direction were not exactly as above. My first trays were made with rims running all round, and the coins were arranged loose in them. Now, if no examples came to one's hands but such as are perfectly distinct and legible, this plan might suffice. But such is not the case. Many pieces there are to which even an expert has to give close and careful study before he can decipher them, and such coins, when once made out and identified, it is desirable to keep distinct, each with its own proper description; or one may have the same work to go through again.

Therefore my later plan has been that shown in Fig. 9, and when this is adopted no sides are needed to the trays. A piece of millboard is cut to fit the tray, and through the board round holes are punched with the gouge, each to serve as a compartment for a coin. Before the millboard is fixed to the tray a sheet of writing paper is pasted over its lower side. This makes a bottom to the compartment, and prevents any danger of thin coins slipping between millboard and tray. Then the board is fastened down with a few neat brass tacks. On the paper at the bottom of the compartment one can write any short needful description of the coin that is to occupy it; and whenever, in those rearrangements which must needs occur in growing collections, a different coin has to be substituted, it is easy to cut out a circular piece of paper, write the new description on it, and paste it into the hole over the old.

It may be objected that the varying sizes of coins will render rearrangements difficult—that the new examples which we wish to place in certain situations may not fit the holes. This may happen, and if it should do so—if a larger hole is absolutely necessary—the millboard, which is only tacked down, can be detached from the tray, a larger hole punched, and a separate piece of paper pasted over it. But in arranging coins, the necessity for keeping all of one reign together, regardless of size and value, does not appear to me to be absolute. A grouping of pieces which do not greatly vary in size may frequently have as much completeness and interest.

Take, for example, our silver pennies. Of these a complete series from the days of the Heptarchy to the present reign may be disposed in compartments $\frac{8}{10}$ in. in diameter; and if the recent pieces do but indifferently fill their holes, the decreased value and importance of the coin is all the more forcibly illustrated. And a most instructive series is one of pennies ranged alone. Through Saxon times the silver penny was all but our only money; it was absolutely so through Norman times. The silver penny of those ages explains to us the now almost unmeaning terms of a "pennyweight," and of a "pound" as applied to value, for down to Edward I. the penny, by the old Tower standard, weighed 24 grains; 20 pennies made an ounce; and 240 pennies a pound of silver, alike by weight and by tale. By modern Troy weight these pennies weighed $22\frac{1}{2}$ grains, from which, by successive curtailments, they had sunk in Elizabeth's reign to the meagre proportions of the "Maundy" penny of to-day—that is, to $7\frac{1}{4}$ grains (Troy). These latter degenerate pennies will fail to fill their holes by some $\frac{3}{10}$ in., which will not, however, involve any very serious loss of space.

Or the eighteenth century tokens, the numbers of which give them an importance in every collection, might be instanced. This prolific coinage was so generally an issue of halfpence, that pieces of other denominations look out of place in it, and may well be—as they have been from some of the most comprehensive collections—culled out to find a place elsewhere. Compartments of $1\frac{1}{4}$ in. diameter will take all these halfpennies.

Similarly, the seventeenth century tokens, issued so abundantly in the few years preceding 1672, are almost exclusively of a small farthing size, and might, with few exceptions, be relegated to uniform holes $\frac{7}{8}$ in. in width.

All coins cannot, however, be made to conform in this respect; and at Fig. 9, one half of the tray given has been divided into uniform $\frac{8}{10}$ in. compartments, and the other into holes of such varying sizes as best economise space. This diagram also shows how the respective trays are numbered.

Caskets of this description have, as the writer has found to his sorrow, one weak point unknown to stationary cabinets. In careless lifting—as for dusting, etc.—coins may be jerked from their places and hopelessly mixed together. This has been remedied by fitting over each tray a second piece of millboard, which, closing upon the holes, keeps every coin in its proper place. Indeed, these shutters, being covered with writing paper, can be turned to very considerable advantage. They are numbered like the trays, and each compartment having also its number, the shutter can be converted into a register of such information about the coins beneath it as is too bulky to be written in the compartments themselves—such as where and when the example was found, how it was obtained, and from whom, the price given for it, etc. I have used one side only for this purpose; the other I have appropriated to such general numismatical memoranda as one desires to be able to refer to easily when looking through a collection—such as, for instance, the reigns in which pieces of the different denominations were first struck, or ceased to be issued, variations in weight under different kings, the rarity or abundance of this or that; and in connection with Roman coins, explanations of the abbreviations used: with other similar matter. These shutters are thus converted into a highly useful adjunct to the collection, and renders it far more valuable if any necessity arises for disposing of it.

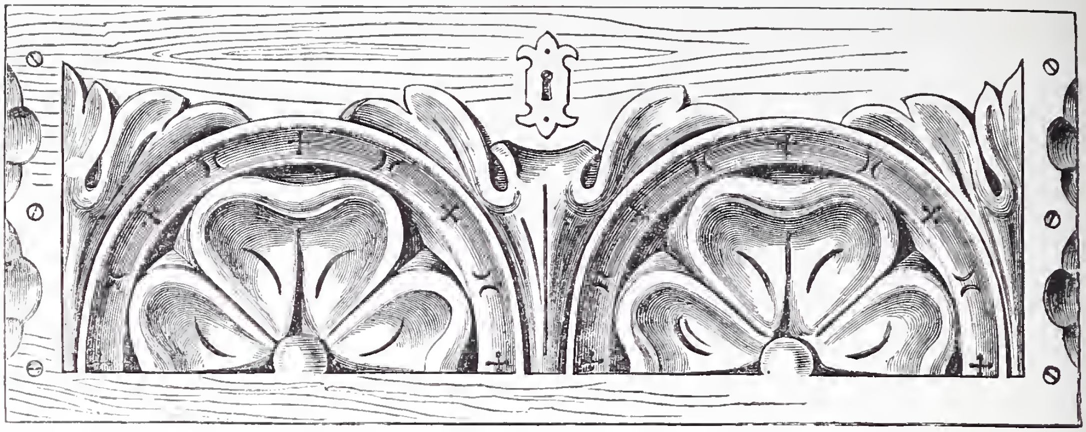


Fig. 2.—Front Board of Casket.

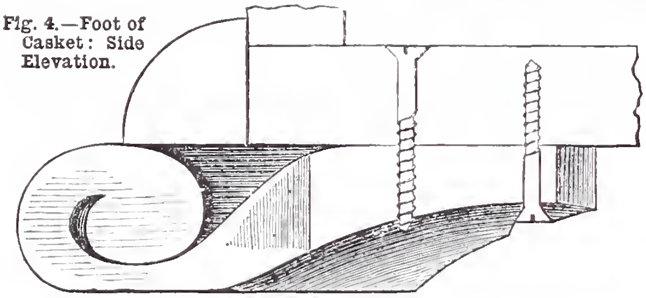


Fig. 4.—Foot of Casket: Side Elevation.

Fig. 3.—Base Strip.

Fig. 7.—Edge of Lid.

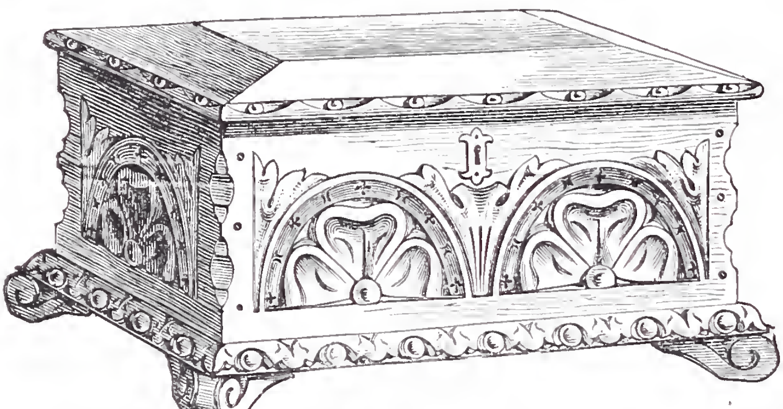


Fig. 1.—Casket for Coins.

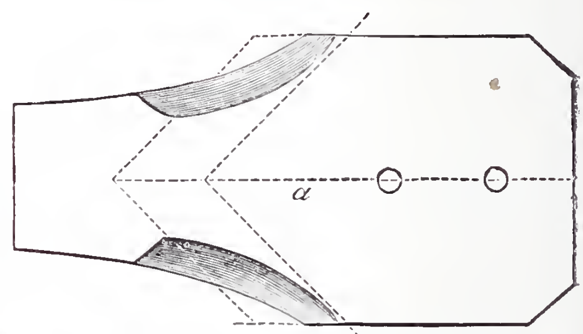


Fig. 5.—Foot of Casket: Plan from above.

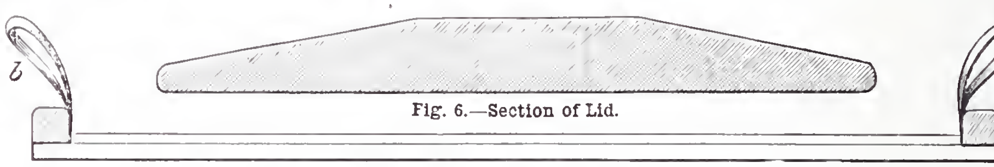
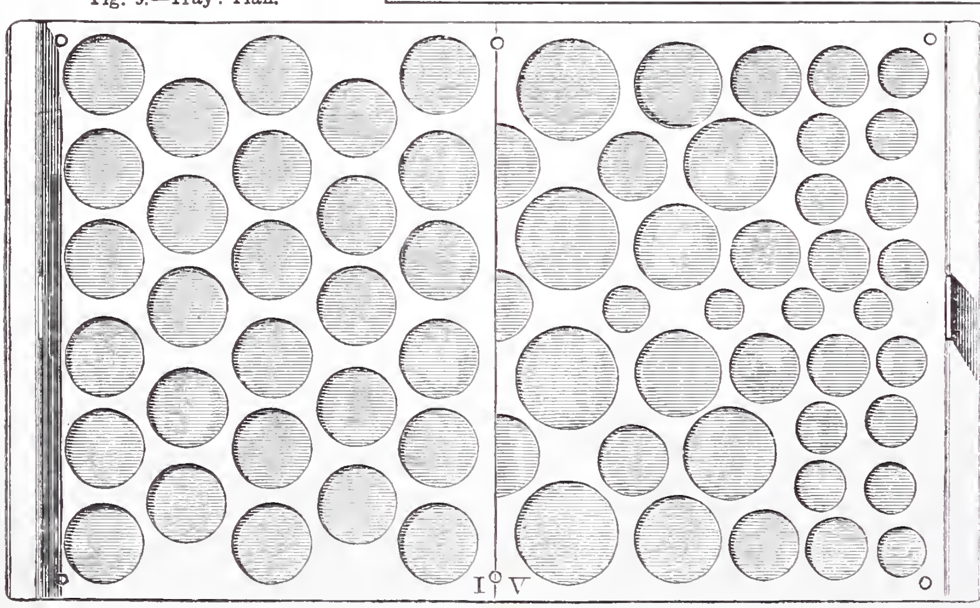


Fig. 6.—Section of Lid.

Fig. 8.—Tray for Coins: Side View.

Fig. 9.—Tray: Plan.



LATHES AND TURNING APPLIANCES.

BY F. A. M.

V.—The Division Plate and Index.

Principles of Division Plate—Simple Appliance—How Powers of Lathe are Augmented—Regulation of Divisions—Material for Plates—Drilling Holes—Peg—Adjustable Index—Table of Divisions—Cost of Drilling.

Those who are acquainted only with plain turning, whether in wood or metal, may well wonder when they see the beautiful regularity with which ornaments and other enrichments are spaced round turned work. The flutes upon a column, for instance, are so correctly spaced, that no inequality can be detected by the finest measurement. The teeth of cogged wheels too—produced with such wonderful accuracy—what kind of apparatus can give so many equal divisions, ending always in a whole number, and never in a half tooth breaking two spaces into one? All this can be done by means of the division plate and index.

Let us suppose that you have turned a stand, and wish to mark the holes for the insertion of six legs or ornaments; or, that you have turned up a blank for a six-sided nut, and you wish to mark six equi-distant lines upon it, to guide you in filing it up. You can, of course, do this rather awkwardly with the dividers; it will take some time, and you will not get the work very exact, besides the trouble of repeating the process for every nut or other object requiring division. But suppose you began by dividing the pulley on the mandrel into six, making a mark at each division, and providing a fixed pointer; or, still further, if you were to drill six small holes at these six divisions, and fix a spring pointer with a little peg that would enter the holes and hold the mandrel fixed at the six angular positions; you would then have constructed a division plate and an index peg, and it could be used to divide any number of circles into six divisions.

I think my readers will understand from these simple examples the principle on which the division plate is constructed, and also be led to see that it is really an important and valuable addition to a lathe; it allows of equally spaced divisions being placed around circular work, enables us to determine and draw angles upon flat surfaces, and, by means of the index, to hold the work fixed whilst we scribe or draw lines upon it, or operate upon it with drills or revolving cutters.

As to scribing or marking lines upon the work, such, for instance, as the six lines which would be drawn upon a circular blank, to guide the workman in producing a hexagonal nut; or, again, in marking the angular divisions on a protractor, something is required to guide the scribing point; the top of the T-rest is indeed sometimes used, but only when accuracy is not required. A very simple appliance is shown at Fig. 16. This is only a flat-rimmed saucer of hard wood, about 3 in. diameter, having a round stalk or pin which fits the socket of the T-rest. If the hole in the T-rest socket be vertical, and at right angles to the lathe bed and the line of centres, then the saucer will provide a support and guide for the scriber seen lying upon it (Fig. 16), which will keep its point in one plane, and enable

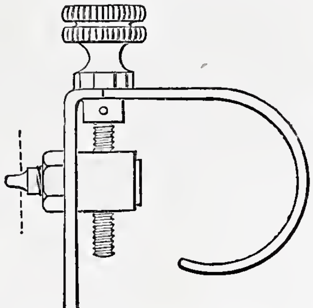


Fig. 21.—Simple Form of Adjustable Index Spring: Side View.

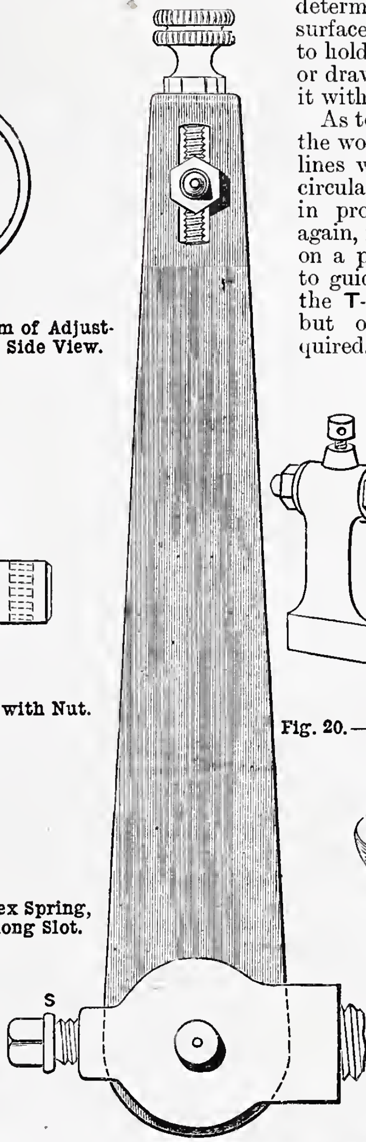


Fig. 22.—Index Spring, Showing Oblong Slot.

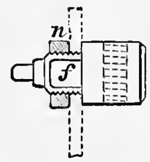


Fig. 23.—Peg with Nut.

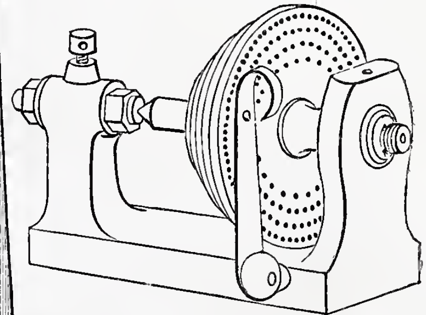


Fig. 20.—Application of Spring to Pulley.

Fig. 18.—Index Spring: Side View.

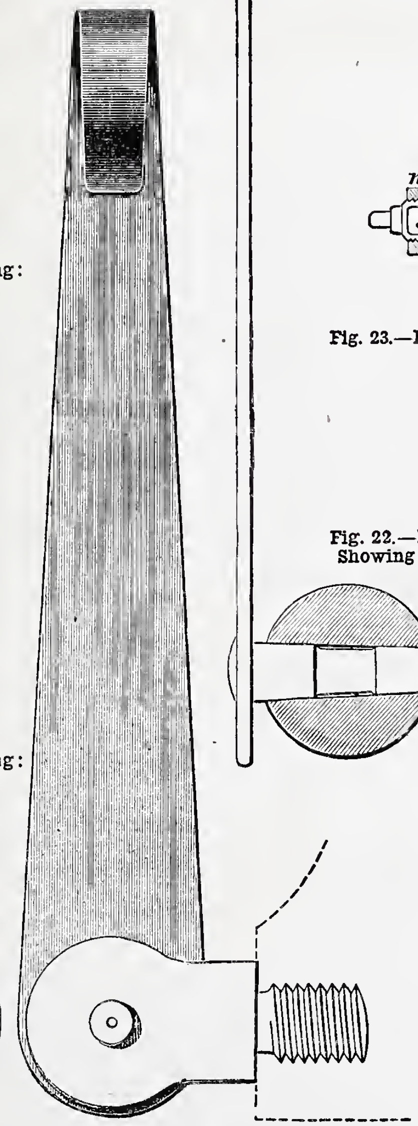


Fig. 19.—Index Spring: Front View.

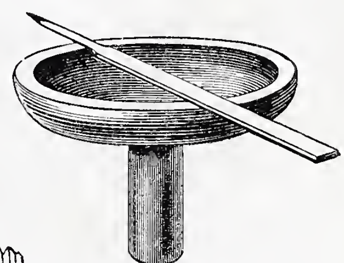


Fig. 16.—Guide for Scribing Point.

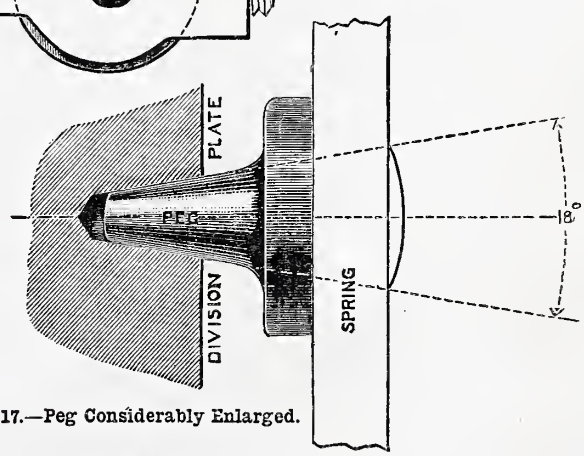


Fig. 17.—Peg Considerably Enlarged.

lines to be struck upon uneven surfaces, if only the scriber point be first adjusted to the exact height of the centres of the lathe. For this kind of work the band is simply thrown off the pulley, and the lathe is at rest. But, when drilling is to be done, or the revolving cutters are to be driven, then the treadle and wheel, not being required to drive the mandrel, are available for driving these by means of the overhead motion. We may consider the *plain* lathe as a machine for revolving work whilst it is being cut by stationary tools held either in the hand or in a slide rest. When, however, we add to a lathe the division plate and index, and the overhead motion, the lathe proper may simply hold the work stationary, whilst the cutting is done by revolving drills and cutters. By revolving the *work only*, circular and flat work can be done; by revolving the *cutting tool*, work of almost any regular shape can be accomplished, and the powers of the lathe are immensely increased. It must, however, be clearly pointed out that a division plate and index *alone* will only serve for marking out work as already explained; if fluting, slot drilling, eccentric cutting, etc., are to be attempted, not only the division plate, but also the overhead motion and the slide rest, are necessary, besides the driller, eccentric cutter, universal cutter, etc., which hold the small revolving tools, and are themselves held in the slide rest, whilst being driven from the overhead.

We will now proceed to consider how many divisions it will be convenient to have, and this will be determined partly by the class of work we intend to do, and partly by the size of the pulley, and the number of rows of holes for which we have room. The larger the pulley, the more holes we can get in; if we are going in for wheel cutting, we shall require rather larger holes than for ornamental turning; but in every case you require to choose those numbers which have the greatest number of divisors; 360 is a most useful number, having more divisors than any other not much greater than itself; and it was for this reason that it was chosen for the number of degrees in a circle. There is some difficulty in getting in so large a number, since the pulley of a 5-in. lathe will not be much more than 7 in. diameter. If we put the centres of the holes only $\frac{1}{16}$ in. apart, and allow $\frac{2}{3}$ of that distance for the hole, and $\frac{1}{3}$ for the space between the holes, we get holes of $\frac{1}{24}$th, and spaces of $\frac{1}{48}$th; then we shall require a circumference of $360 \times \frac{1}{16} = 22\frac{1}{2}$ in., eorresponding to a diameter of a little over 7 in. Such small holes are only fit for ornamental work. If you allow holes of $\frac{1}{16}$ in. and spaces of $\frac{1}{32}$ in. the holes must be $\frac{3}{32}$ in. from centre to centre, then $\frac{3}{32} \times .360 = 33\frac{3}{4}$ in. gives the required circumferenee, and corresponds to a diameter of about $10\frac{3}{4}$ in. of pulley, which would require a height of centres of 7 in. Enough has now been said to show how to reckon what number of holes ean be got into any sized pulley. Holes of $\frac{1}{24}$th are too small for any but the finest work; holes of $\frac{1}{16}$ in. will do for *small* wheel cutting; holes of $\frac{1}{12}$ in. are good for metal work, and will suffice for anything likely to be required of a division plate. In ornamental and other work, it will be necessary to divide the circle into 2, 3, 4, 5, 6, 7, 8, 9, 10, etc., parts; and, therefore, the most useful numbers of holes will be those which can be divided by as many of these numbers as possible, without leaving any remainder. Such numbers can be found by multiplying together two or more of the above numbers. For instance, we may multiply 8 and 9 to get 72 holes, a very good number, since it contains multiples of 2, 3, 4, 6, 8, 9, 12, 18, 24, 36. Here we have all the first-named numbers but 5, 7, and 10. Now 5 is already contained by 10; if then we make up another number by multiplying 7 by 10 to make 70, we get another number of holes, which will allow us to divide the circle by any number up to 10. This will suffice to show how these numbers are chosen, and also that the chief difficulty is with the prime numbers, 1, 3, 5, 7, 11, 13, 17, 19, etc., which are not divisible. The first four of these we have managed to include; the second four are seldom required, except in wheel cutting. It is possible—though probably not worth while—to include them by placing them all in one line, or circle of holes. Beginning from one zero hole, divide the circle first into 11; then beginning from the same zero, divide the *same* circle into 13, then into 14 (for 7), then into 17, and lastly, into 19. If this be done on a $6\frac{1}{2}$-in. circle, with $\frac{1}{16}$-in. holes, they will not clash. It would be well, however, to choose higher numbers than 70 and 72, and we may sometimes have a good many rows. In the ornamental turning lathes by Messrs. Holtzapffel & Company, the numbers chosen are 360, 192, 144, 120, 112, and 96; there is no necessity to have 96 as well as 192, except that it sometimes facilitates the counting; also, many of the chuck wheels are divided into ninety-six divisions, which makes it convenient to have a circle of that number on the pulley. If ornamental turning is the object in view, it is of some importance to adopt these numbers, because, in the books treating of that art, patterns are given with directions for cutting them, which directions could not well be followed upon circles having other numbers. If, therefore, they can be adopted, it is well to do so; but if there be not room for the 360 row, it might be well to substitute a row of 180 (half that number) between 192 and 140, as that would, at any rate, enable the workman to divide a circle into divisions of 2°. If there be room for only three rows of holes, 180, 144, 96, or 180, 96, 84 would do well.

Cast iron is the best material for a division plate, being the most durable, and least likely to be indented or bruised; gun metal is the most usual material, and it shows up the numbers and marks well; yellow brass is too soft for such a purpose. The point of the index peg should be carefully rounded, lest it should scratch the plate.

In many division plates the holes are simply drilled straight in, about $\frac{1}{16}$ in. deep, whilst the peg is slightly coned, so that it only bears upon the mouth or edge of the hole. The holes should be coned to an angle of about 18°, being drilled by a very short and special drill, made to cut upon its sides; the peg must then be turned to the same angle, and should be very short, so that the spring will come up close to the plate. Fig. 17 shows the peg enlarged about six times; Figs. 18 and 19 show the index spring bent round at the top for the finger, the peg being riveted in. At the bottom, a slightly tapered pin is riveted into a second hole, $4\frac{1}{2}$ in. from the first. This tapered pin fits into an iron or steel ball, which is screwed into the base of the headstock, seen dotted in Fig. 19. The shoulder of this ball would have to be gradually turned away until, when screwed up hard, the spring comes upright when the peg is in position, as at Fig. 18. The spring itself will require to be about $\frac{1}{16}$-in. thick, and this arrangement is known as the *plain* index. Its application to the pulley is illustrated in Fig. 20.

Figs. 21, 22, 23, show a very simple form of *adjustable* index. It was made from the plain one just described, by heating the top of the spring, and bending it to the form at Fig. 21. The peg of the plain one was driven out, and two holes were drilled above and two below the original hole into which the peg had been riveted; these five holes were then filed into one oblong slot, as seen at Fig. 22. The new peg, Fig. 23, was then turned and fitted with a nut (n) to bind it fast to the spring, and prevent the slightest possibility of shake. The screwed part had two flats (f) filed, one on each side, so that it would fit rather tightly into the long slot, and could be moved up and down by the screw. A thoroughfare hole was then drilled through the top of the spring, and then, with the tapping sized drill, continued through the body of Fig. 23; then the adjusting screw of steel in one piece, with its milled head, was fitted, and the small retaining collar fixed, and pinned through as close as possible, so as to avoid all looseness. The milled head has its collar divided into about ten divisions, and there is a mark on the spring to correspond, but the explanation of the uses of that addition would too much prolong the present paper. The advantage of the adjusting index as compared with the plain one is considerable. It will often enable the workman to bring his flute, or his tooth (in wheel cutting), or his pattern (in ornamental work), to correspond with a part already finished. The ball in Fig. 22 is slightly different to that at Fig. 19, the screw (s) being added. This screw being fixed when the work of dividing is begun, prevents the possibility of placing the peg in a hole in another row; it fixes the conical fitting in the ball, so that it can no longer act as a hinge.

The zero marks of the circles of holes are placed together, but they are not placed upon a radial line, because then it would be impossible to pass from one circle to another without slightly turning the pulley, or altering the adjusting screw of the index. The zero holes from which each circle counts should be placed upon an arc of a circle struck upon the pulley with the point of the division peg.

The rows of holes should be, at least, $\frac{1}{4}$ in. apart, that there may be room for figures of a visible size, and for the dots, and other marks made opposite every 5th, 4th, or 3rd hole, to assist in the counting, by enabling one to put the index peg in every 5th, 4th, or 3rd hole without making a mistake, which would very likely spoil the work, since nothing looks worse than a false cut.

The table of divisors about to follow any one can make for himself, and the present one can be continued. It would be a good plan to copy it out on a card, varnish it, and keep it by the lathe for reference; or, at any rate, that part of it which corresponds to the numbers of holes in one's own division plate. Eleven convenient numbers have been chosen and written down in the column headed "No. of Holes"; then comes, in a horizontal line, the row of "Divisors," containing every number up to 20, except the primes 11, 13, 17, 19.

Looking along the first horizontal line, underneath the divisors, we find that a circle of 360 can be divided without remainder by twelve of these numbers..

Numbers 240 and 180 come next in value, since they can be divided by eleven of the divisors; 120 by ten; 300 and 144 by nine, etc. 112 and 70 have the fewest, but they contain multiples of 7. It would, however, be necessary to continue the table to make the comparison quite fair.

TABLE OF DIVISIONS.

No. of Holes.	Divisors. 2	3	4	5	6	7	8	9	10	12	14	15	16	18	20
360	180	120	90	72	60	—	45	40	36	30	—	24	—	20	18
300	150	100	75	60	50	—	—	—	30	25	—	20	—	—	15
240	120	80	60	48	40	—	30	—	24	20	—	16	15	—	12
192	96	64	48	—	32	—	24	—	—	16	—	—	12	—	—
180	90	60	45	36	30	—	—	20	18	15	—	12	—	10	9
144	72	48	36	—	24	—	18	16	—	12	—	—	9	8	—
120	60	40	30	24	20	—	15	—	12	10	—	8	—	—	6
112	56	—	28	—	—	16	14	—	—	—	8	—	7	—	—
96	48	32	24	—	16	—	12	—	—	8	—	—	6	—	—
72	36	24	18	—	12	—	9	8	—	6	—	—	—	4	—
70	35	—	—	14	—	10	—	—	7	—	5	—	—	—	—

The cost of drilling a division plate is about six to ten shillings for each row, and a plain index and ball cost about six shillings. By beginning with a worm wheel or segment engine, the writer was able to drill his own division plate, but an account of how this was done must be reserved for another time.

(To be continued.)

NOTES AT THE ARCHITECTURAL AND BUILDING TRADES' EXHIBITION, 1889.

(Continued from page 107.)

An important exhibit, not reviewed in our previous report, was that of Messrs. E. Jacobs & Company, 105, Queen Victoria Street, London, E.C. That firm of engineers and machinists have, for some years past, shown a knowledge of the requirements of wood workers, which gives to the machines produced by them a reliability and practical value which cannot be over estimated. Among the pieces of mechanism sent to represent them at the recent exhibition, a "Panel-planing and thicknessing machine," an "Improved hand feed surface planer," and the "Newington" mortising and boring machine, were, perhaps, the most important. The first named is made in two sizes, to suit various purchasers, the larger size being capable of planing up to 15 in. wide, and from $\frac{1}{4}$ in. to 4 in. in thickness. The timber is fed up to the cutters by two geared top rollers and two bottom friction rollers, the table being easily adjustable, by hand wheel and screw, to admit the thickness of wood required. The knives, being arranged to work spirally, give a shear cut; an improvement of great importance in the execution of good work. The "Improved hand feed surface planer" is intended for use by joiners, builders, cabinet makers, packing-case makers, pattern makers, and, indeed, most other wood-working trades, and contains the latest improvements calculated to perfect the operations of taking timber out of twist, surfacing straight or taper, bevelling, chamfering, squaring up, making glue joints, and a dozen other purposes beside. Of cabinet work and furnishing items the number of exhibits was somewhat small, but, notwithstanding that, some very good things were shown by those who did put in an appearance. Messrs. S. G. Vaughan & Company, 26, Great Eastern Street, E.C., fitted up a stand thoroughly representative of modern taste in furnishing, and the freedom from any taint of the French in their goods was most gratifying to the lover of national art in handicraft. Drawing-room furniture was shown in the richest of rosewood, inlaid with ivory and decorative woods, a mode admitted to be *par excellence* for that apartment; and the free and graceful forms marked out therein, and further embellished by silk brocatelle upholstery, spoke well for the bent of modern taste.

The development of furnishing in the nocturnal apartment was illustrated by a bedroom suite in walnut, and the wardrobe being made with accommodation for writing purposes, after the manner of the old-fashioned secretaire, showed that firm's knowledge of the requirements of to-day.

Another representative of the cabinet-making trade was the firm of Messrs. W. H. Vaughan & Company, 332, 334, Old Street, E.C., who provided a good display of drawing-room, dining-room, and bedroom furniture. Such goods as there is a certain demand for in these times were shown by those makers, and as they were just selected from the ordinary stock kept by them, their capabilities in that direction could be well judged therefrom. A fine sideboard, in walnut, was particularly noticeable, and for those who still adhere to a liking for saddlebag upholstery, Messrs. Vaughan proved themselves to be in a position to suit all tastes in that direction.

Mr. Ferdinand Falet, 10 Gray's Inn Road, W.C., displayed a very attractive variety of wicker furniture; and, for the Spring season, some of their dainty little wicker chairs, dressed up as they are with dhurries and other Oriental materials, would be quite the thing.

Now that the sunny season is approaching, the matter of window blinds assumes some importance, and the variety of those articles shown at the Building Exhibition left little room for complaint. Messrs. S. Mitchell & Son, 32, St. Martin's Lane, Charing Cross, W.C., exhibited their improved "Outside Sun Blinds," and in them offered an admirable solution of the difficulty. The objection that has hitherto been advanced against the majority of outside blinds, viz., the necessity of wood framing with deep facia and side wings with wood jambs and slides, is, by the present invention, entirely removed. The blind in question requires neither wood jambs nor metal grooves, and draws up under about six inches of facia. It travels on iron rods, preserving the convenient form of the Spanish blind, and the hood portion allows of being raised or lowered to any height.

Among those little annoyances which ruffle the temper and yet have long been without remedy, is the difficulty of adjusting the laths of Venetian blinds to any required angle. Messrs. Mitchell have, however, produced an invention bearing upon that question; and, as far as it is possible to judge by a cursory inspection, we should say that it is fully calculated to answer its purpose well.

Another exhibit in the same line of things was that of Mr. Andrew Smith, 57, Ashbourne Grove, East Dulwich, S.E. The speciality which formed the chief attraction of that stand was certainly one of the greatest utility, and may be briefly described as follows:—It consisted of a patent whereby the headpiece generally used in connection with Venetian blinds is rendered unnecessary, being substituted by fittings which, when fixed, enable the blind to be removed and replaced in a few seconds, no side cords being necessary for altering the position of the laths. This is a contrivance which would greatly facilitate all such operations as spring cleaning, and would bring joy to the heart of the cleanly housewife.

Among the most attractive as well as the most sanitary of modern methods of decoration, the utilisation of glazed tiles takes a first place. When we say modern methods, it is, of course, in reference to the recent revival of the art of tile making; for, it is needless to say, tiles were among the first materials employed by the decorative artists of earliest ages. Reference to the existing records and ruins of Pompeii, the Alhambra, Granada, and other such spots, fully establishes their antique pedigree: and as antiquity is, in society, generally considered to be synonymous with respectability, no further argument on their behalf is necessary.

Messrs. E. Smith & Company, Coalville, Leicester, have done much to imbue the manufacture of modern tiles with real artistic feeling, and their display was well worth seeing and studying. Whereas, not so very long ago, it was considered a bold innovation to introduce tiles into a fireplace, now we get them in furniture of all sorts, from wash-stands to flower-stands; and their introduction constitutes a pleasing departure from old methods, forming, as they do, such a pleasant contrast with the various woods with which they are brought into connection.

The greater scope thus given to tile manufacturers has led to the production of designs, colourings, and forms, whose name is legion; and to attempt to describe such a collection as was shown by Messrs. Smith, would be almost as futile as attempting to pourtray a flower garden by mere description. Suffice it to say that terra-cotta, floor tiles, wall tiles, mosaic, hearth tiles, and decorative faïence, were fully represented in their most modern developments.

Mr. H. J. Rust, 353, Battersea Park Road, S.W., showed examples of his mosaic work, and those whose fancy inclines in the direction of that eminently durable and most antique method of decoration would do well to get particulars of his productions. There is, of course, mosaic and mosaic, but that of the maker in question bears the stamp of good workmanship, and has a peculiarly fine surface.

It would be possible, of course, to fill pages with even brief remarks on the many useful and beautiful objects that met the eye in every part of the Exhibition; but to do this would be not only unnecessary, but wearisome to the reader. We shall only encroach on his patience for a limited space in another number, and then bring our "Notes" to a close.

(To be continued.)

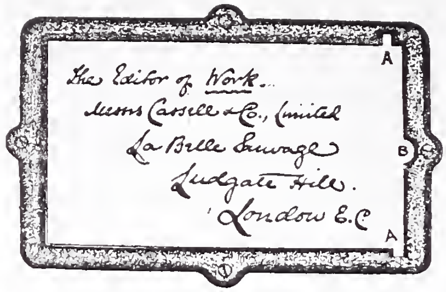
OUR GUIDE TO GOOD THINGS.

39.—Thompson's Improved Address Holder.

Address holders for portmanteaus, etc., and for the names of seat holders in church, made in brass for the most part, are common enough, but the principle has only just now been applied to business purposes in Mr. Thompson's "Improved Address Holder," an illustration of which is given in this page. Between the address holders to which allusion has just been made and Mr. Thompson's invention there is just this difference: that in the former the address card that is inserted may be withdrawn by merely sliding it out through the space left for its introduction between the frame and the wood to which the frame is attached, and may even slip out if the frame could be placed in a position convenient for its escape; but in the latter, the card, when once introduced, is so safely and securely retained that it cannot possibly fall out or work out. The frame, or address holder itself, is made of malleable cast iron neatly japanned, and is pierced with four holes countersunk, for the introduction of screws, by which it may be fixed to crates, boxes, cases, etc., for the transmission of goods and to the ends of barrels, casks, etc. If used for hampers the address holder must be screwed on to a piece of board, and the wood, in its turn, be tied to the hamper. When the frame is fixed, it will be found that its outer edge rests on the board, while there is a space of about $\frac{1}{16}$ inch between the board and the inner edge. The corners of one side of the card on which the address is written are introduced, under the nicks, A. A, in the frame, and the card is pushed on until it has been passed entirely under three sides of the frame. The edge that remains uncovered may then be easily passed under the fourth side, if the card be long enough. A semi-circular indentation will be noticed at B, at which the card may be pushed forward again, and raised by the nail if it be desired to withdraw it. The advantages of the address holder are: the security of the address card, the ease and rapidity with which it can be introduced when once the frame has been screwed on, and the preservation of barrels, boxes, etc., from injury by nails or tacks, to say nothing of its cheapness, durability, and utility. A single sample will be sent to any part of the United Kingdom, post free, for five stamps, by the agents for its sale, Messrs. W. and A. Jarvie, general ironmongers, 200, Parliamentary Road, Glasgow. Net prices, carriage paid, are: 4s. 3d. per dozen, £1 2s. 6d. per half gross, and £1 17s. 6d. per gross.

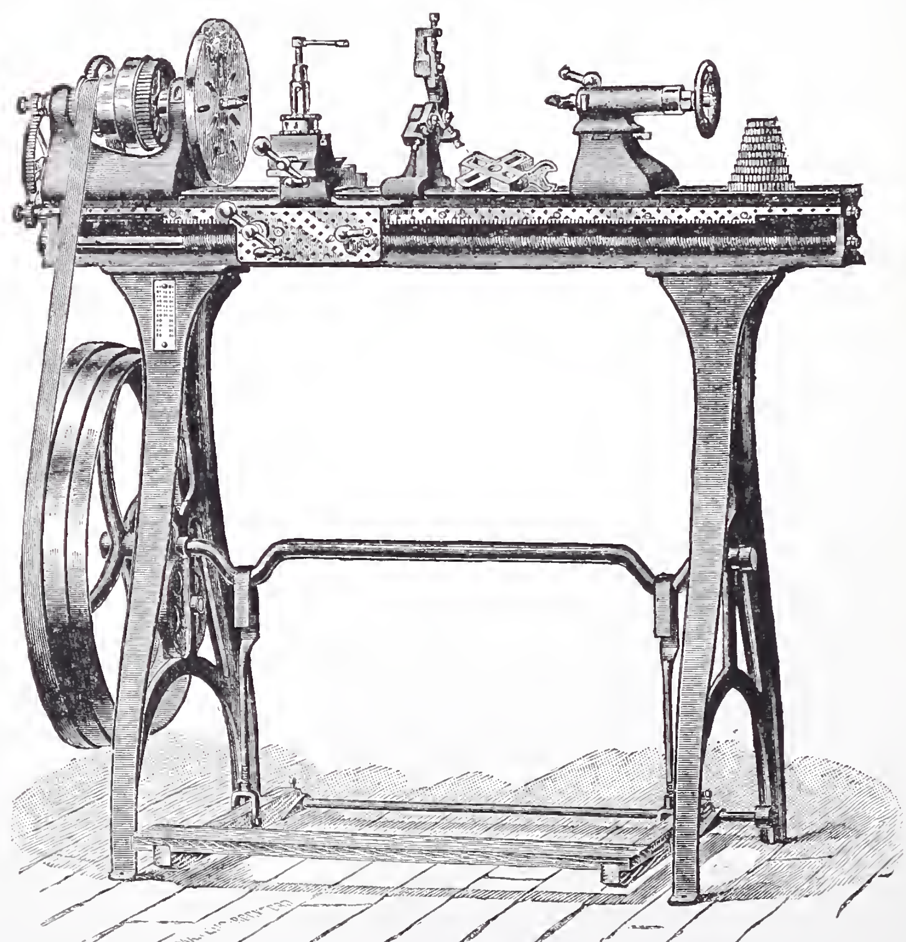
40. — Barnes' Screw-Cutting Foot Lathe, No. 5, with Foot Treadle.

The accompanying cut gives a graphic representation of Barnes' Screw-Cutting Foot Lathe, No. 5, with the ordinary treadle as found in English lathes. It is an American lathe, and is supplied by, and may be seen at the warehouse of, Messrs. Charles Churchill & Co., American importers of tools and machinery, 21, Cross Street,



Thompson's Improved Address Holder.

Finsbury, London, E.C. It differs from Barnes' usual form of lathe in being fitted with the foot treadle instead of the seat for the turner and cranked axle, by which the lathe is driven by the action of the legs in the same manner as a bicycle or tricycle. With regard to dimensions, it is a $5\frac{1}{2}$-in. centre lathe, and $3\frac{1}{4}$ in. over the tool carriage, and is just 34 in. from centre to centre. As may be judged from the illustration, the lathe is substantially built, and to this it may be added, that it is thoroughly well made in every particular. The headstock has a hollow steel spindle that will take a $\frac{7}{16}$-in. rod through its entire length. The boxes are accurately fitted to the spindle, with provision to keep them true and take up wear. The poppet, or "tail stock," as our American cousins style it, can be readily set at any desired point, or be removed altogether from the lathe bed at pleasure, thus leaving the lathe free for face-plate work or chuck work. It can also be set even for turning tapers. The spindles of both headstock and poppet are of steel, with taper holes for the reception of the centres that are positively true; moreover, the poppet centre is self-discharging. The tool carriage, which, as it may be seen, is gibbed to the bed, is a model of convenience and accuracy, and is such that the tool can be set to the work in any position, or at any angle desired, and also to bore a taper hole or turn a ball. All the works are securely protected from chips and dirt, which has the desirable effect of insuring long wear and durability to the most costly and vital parts of the lathe. The gearing that is furnished with the lathe can be combined to cut screws from 4 to 40 per inch. As a screw-cutting lathe, the maker claims that it is complete. All the gearing is cut from solid metal in the best machinery known for gear cutting, and is as true as possible, and works noiselessly. The entire weight of the lathe is 3 cwt. 29 lbs.; its price £22 10s.; a set of eight tools for metal is supplied for 12s. It is unnecessary to enter further into details of construction, for these are self-evident from the illustration.



Barnes' Screw-Cutting Foot Lathe, No. 5, with Foot Treadle.

41.—Winder's Banjos and Banjo Fittings.

Mr. J. G. Winder, Maker and Teacher of the Banjo, 16, Jeffreys Street, Camden Town, London, N.W., has asked me to call attention to his brackets for pulling banjo vellums tight, and has sent me a specimen of them, and a photograph of his "Special Banjos," which, as far as I can judge from the photograph itself, appear to be nicely made and well finished. The bracket sent is certainly well made, as the screws on the threads and nuts are deeply cut, and there is no fear of the screw threads slipping. It is of the best pattern, and is heavily nickel-plated. These are supplied at 6s. 6d. per dozen, but another pattern may be had, also plated, at 3s. 6d. per dozen, and brass brackets at 3s. per dozen. I mention Mr. Winder's specialities with pleasure, as I have reason to believe that a great many workmen like to have a turn at the banjo in leisure half hours, and even make instruments for their own use. It is not always an easy matter to get fittings in small towns and out-of-the-way places, but application to Mr. Winder will soon put an end to any difficulty that may exist.

42.—Pocket Technical Guide, etc., for the Building Trades.

Messrs. Crosby, Lockwood, & Co., 7, Stationers' Hall Court, London, E.C., have recently produced the fifth edition of Mr. A. C. Beaton's "Pocket Technical Guide, Measurer, and Estimator for Builders and Surveyors." This handy little book, which may be stowed away in the waistcoat pocket, contains technical directions for measuring work in all the building trades, with a treatise on the measurement of timber, complete specifications for houses, roads, and drains, and an easy method of estimating the various parts of a building collectively. It has been carefully revised, and prices stated according to the present value of materials and labour. It may be said to be a *multum in parvo vade mecum*, not only for those for whom it is specially intended, but for all house owners and those who are interested in house property. The information given is briefly put, and neither words nor space are wasted.—The Editor.

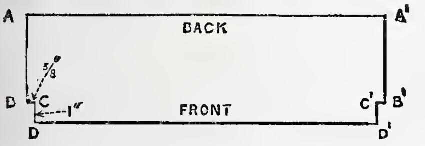
SHOP:

A Corner for Those who Want to Talk It.

**** All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

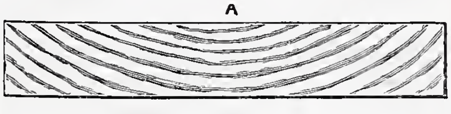
I.—Letters From Correspondents.

A First Attempt.—Kildonan writes:—"In to-day's issue of Work I observe you reply to S. (*Edinburgh*) with reference to definitions, and I think both he and also R. S. C. (*Leeds*) deserved each sharper replies even than those you gave them. You tell S. that 'those who read Work are certainly supposed to know the uses of lathes and tools.' If that is so, sir, then I must apologise for having dared to become a subscriber, for I never handled a tool in my life. Stay; yes I did. When a very little boy I used to watch for hours an old joiner at work, and one day, while the old man was outside arranging his little store of wood, I thought I would try my hand with a plane. I proceeded to *plane the bench!* Rip! went the iron over many an aged nail, and when I looked at the edge its serrated condition told even my childish brain that there would be a row. Stealing softly out, I disappeared, and for months afterwards the sight of the white apron and broad bonnet of old 'Tirly' sent me flying up the nearest cross street with winged speed. That was my apprenticeship. My next venture in the mechanical arts was when a junior telegraphist. Left alone on night duty, I proceeded to 'take down' an ordinary single wound galvanometer, so as to explore its construction, and I shall never forget the fear and trembling with which I awaited the arrival of the superintendent next morning. But this by the way. Galvanometers and more complicated pieces of apparatus have been investigated since then. But I want to tell you what Work has done for me. Lend me your ear, sir—softly—*I'm beginning to build my nest.* Well, No. 2 brought with it Mr. Adamson's overmantel. *She* approved of it. My landlady's husband, a working carpenter, has a bench and a few tools—the greater part are at his employer's yard, where the men have to provide their own kit. I bought a tenon saw, a square (9 in.), a chisel (½ in.), and a claw hammer. There were two planes (well worn) and a gauge on the bench. Having invested 4s. 6d. in nice clean yellow pine, with many misgivings I started. Being on night duty, I had the greater part of the day to myself. I wrought slowly and carefully. In Mr. Adamson's drawings and instructions the shelves and tops are simply held by nails. I was more ambitious. I cut the shelves ⅝ in. longer, and at each end cut out a piece thus (excuse freehand!):—



I made a groove in the uprights ⅜ in. deep, running from the back to within 1 in. of the front, so that the shelves are not dependent on the nails to support any weight placed on them. (B, C, and B', C',=⅜ in.; C, D, and C', D',=1 in.) Knowing that the tops would be hidden by the moulding, I thought I would venture on dovetailing! I succeeded—in nearly splitting one of my uprights!—and they fit tightly enough, though, perhaps, they are not beautiful. The result is that my overmantel will stand the proverbial three removes. Another departure from the design is in the panels of the doors. I got the 'tip' in the same No. (2), in the paper on 'Decorative Work for Panels.' My panels are of zinc, and will be prepared as there directed; when ready *somebody* will paint a floral design on them, probably a bunch of 'lilies of the valley' in the centre. Now, sir, being a very tyro, it must not be supposed that I escaped a mistake or two. *Experientia docet*, and sometimes *does it* (ahem!) with a vengeance. My mistakes have thus far been knocking two corners off the feet of the uprights, and making the groove for the shelf *on the wrong side* of the left-hand middle upright! Being concealed by the frieze, and besides being within the left-hand cupboard, I did not make a new one. There is no weight on the top shelf. With all deference to the designer, I have taken the liberty of putting a back of ⅜-in. stuff, in order the better to protect my looking-glass. For this purpose I have reduced the *shelves* behind in proportion. My back is in three portions, and flush with the edges of the uprights. Although not quite finished, I have got the worst over, and I have taken the liberty of writing you to say that Work has been of some use already to one who is an entire novice, and perhaps to encourage those who are equally ignorant of the use of tools with myself. My 'kit,' as you see, is by no means extensive—one ½-in. chisel doing the whole of the small fittings. I intended to have given you a description of the old lathe used by the old turner referred to at the beginning of my letter. It was driven by a flexible pole fixed to the rafters overhead, with a rope twisted round the object turned, but I have already trespassed too much on your time and patience. I noticed in the 'Technical Educator,' in the papers on the lathe, the writer referred to this old form, which he 'believed' was still in use in some parts of the country, but which he had never seen. I have often had *tops* made by old 'Tirly,' and I know he used the same lathe for over half a century. Should a description of it be interesting to any of your readers, I shall be very glad to try, but, unfortunately, I am no draughtsman, and so cannot give a drawing of it."—[I am glad to give publicity to your letter. You yourself certainly know the uses to which certain tools are put, and have given practical proof thereof. I meant S. (*Edinburgh*) to understand that I saw no necessity when a hammer was mentioned to explain that it is "a tool used for knocking in nails," and occasionally for other purposes into which I need not enter. You certainly need not apologise for having become a subscriber to Work; and I hope it will ever be found week by week to present fresh charms and increased utility to "She" and "Somebody" and yourself, and all others who have determined to pair and build, or rather line their own nests, for I daresay your nest has been already built for you, and you have only the lining to attend to. I will take care that a nice baby's cot is described for you when increase and multiplication begin to take place in the nest, as I trust it will. I will not trouble you for a description of old "Tirly's" pole lathe. You say you are no draughtsman, but at all events your diagram of the shelf was intelligible enough. There is one comfort—you can always fall back on "She" for illustrations to your copy when you write if you continue to distrust your own powers.—Ed.]

Cabinet in Fret Cutting.—Artist in Wood writes:—"I have the plate issued with No. 1 of Work; it is a very good design. I think the pattern proper for fret sawing will do very well for inlaying, and take less time and care than the pattern proper for inlaying, and best for amateurs to try at. The method of inlaying sent by Inlay, and put in 'Shop' in No. 6 of Work, is the one I use for inlaid panels of all kinds; the white holly and ebony should be the thickness of saw-cut veneer. When the holly is in the ebony the waste piece of holly should be taken off and placed at the back, then a piece of paper glued over the front, and the two veneers pressed between two level boards. When dry the waste veneer is taken off with a knife; the inlaid veneer should be placed paper side down on a level board, and scraped with a fine toothing plane; now a piece of ⅜-in. mahogany should be planed level on one side and then toothed. This should be sized with thin glue size and let dry before the inlaid veneer is glued on; the paper on the front side of the veneer may be scraped off with the toothing plane; the natural veins of foliage can be put in by the aid of a grainer. When white wood is used for inlay it is important that flake white be mixed with the glue to prevent it staining the wood; the glue should not be made in an iron kettle—iron will stain all light woods; it will be best to mitre a strip of ⅛-in. boxwood round the edge of the doors to prevent the veneer from being split off when closing the door. If the end grain of wood that is to be veneered on shows any curved marks it is important to know the right side to veneer. For example, supposing the annexed cut to represent the section of a piece of



wood to be veneered, veneer on the side lettered A. To inlay on the method of Mr. J. W. Gleeson-White take four veneers, say, two of dark rosewood and two of satin wood; cut square through all four at once; glue the ground veneers on piece of paper; now dip the cut-out pieces in warm water to expand them, and they fit the ground veneer, and make a good joint. This plan should not be used for a design having so many small pieces in it."

II.—Questions Answered by Editor and Staff.

To Repair Harmonium Bellows, etc.—Woodman.—To prevent a harmonium from getting out of order, it should be kept in a place that is free from damp, and not subject to sudden changes of temperature. Moths do a deal of damage sometimes by destroying the cloth and felt of the action. If there are signs of any, two or three small linen bags should be made, and a piece of camphor about the size of a walnut put into each. These can be fastened by a couple of tacks to the inside of the reed pan (which may be opened by undoing the two hooks at the back of the keys). The jerking of the wind, when playing softly, is most likely caused by the spiral spring under the reservoir being too strong; a weaker one would, probably, improve it. Should this not be the case, unscrew the covered back, and fill the bellows with wind. If there is a sound of wind escaping examine the reservoir and wind trunks for any signs of breakage in the leather. By passing a lighted paper carefully along where the escape is likely to be, it will more easily be discovered, as the flame will be blown out when it comes to it. When the hole is found, glue a piece of leather over it; a piece of old kid glove will do if the appearance is not studied. Should the escape be in the front of the reservoir, it will be necessary to take the bellows out of the case in order to get at it. But before doing this it will be better to make sure that the leak is in the bellows, and not, as is often the case, where the reed pan shuts down on the wad. To prove this, unhook the action at the back, and lift it over. Take out the spiral spring from under the reservoir, and lay some paper over the hole in the top board of the reservoir; press this down tight by means of a book or flat piece of board, so that no wind can escape; then get some one to push up the reservoir, and if the escape of wind is not heard, the leak must be looked for round the wad. This may sometimes be cured by giving a turn to the screw eyes which the hooks fasten into, or by pinching up the wad, so as to soften it. It is possible that the bellows has dropped a little; if this is so, by unhooking and lifting over the action, the bellows will be found to be loose. To remedy this turn the instrument upside down, and drive a small wedge under each end of the supports. You might get a larger bellows in if there is sufficient room, but the present one will, no doubt, be found large enough if it is made wind tight. It is not possible to give any general hints on how to construct a harmonium within the limits of this answer.—G. N.

Plaster Cast from Clay Model.—Moulder (*Limehouse*).—This must be made by the waste-moulding process. Colour the water for inner mould with a few drops of ink, and mix fine plaster to the thickness of cream. With this cover the model to ⅛ in. When hardened, brush clay water as thick as duck pool over it, then lay on outer mould, say ⅜ in. thick, of coarse plaster, embedding iron bars in its outer surface, if the model is large, to give strength. If the model is in the "round" the mould will have to be made in two (or more) pieces, to do which attach a strip of clay edgewise against the model, where the dividing line is to be, to form the limit of the first piece of mould. Cast this, then remove the strip of clay, and brush clay water along the edge of the plaster. After this cast the second piece; the clay water will prevent the pieces sticking together. Remove the clay of the model, well wash the mould with soap and water, and the sooner it is filled the better. Mix fine plaster with plain water for this, pour in, and move mould about to spread it equally. Repeat this till the cast is thick enough; coarse plaster may be used for backing up. When the cast is set the outer mould may be broken off by a few strokes of the mallet and a blunt chisel; the clay water will make it separate from the inner one. The inner mould being of a grey colour from the ink will easily be distinguished from both outer mould and cast, and must be broken off more slowly and carefully. The thorough saturation which the mould has had in cleaning will prevent the cast from sticking too closely to it.—M. M.

Electric Lamp for Bunsen Battery.—G. K.—The small glow lamps used to obtain an electric light from current supplied by the Bunsen battery cannot be made by an amateur. The glass bulb containing the carbon filament is blown by experienced workmen; the filament is inserted in the bulb, all the air is exhausted from this by means of a special air pump, and whilst thus exhausted the neck of the bulb is fused around the wires connected to the carbon filament. Such lamps are sold at 5s. each by all vendors of electrical instruments. See replies to other correspondents on this subject.—G. E. B.

Connecting Electric Bell to Clock, etc.—R. M. D.—Use No. 20 cotton-covered copper wire for the lines. Carry a wire from the bell to the clock, and connect it to the works, or metal frame of the works. Fix a bit of platinum wire to the *wood* frame of the clock close to the dial, so that it can be bent in to touch the hour hand at the hour when you wish to rise. The minute hand must clear this wire. Connect this wire to a line wire leading to the battery; then from the other terminal of the battery lead a wire to the bell. Use two Leclanché or two Gassner cells; these are best for electric bells. Have a separate line from the battery to the door, and from the door back to the bell, then from this back to battery. You will need a contact trigger to the door if you wish the bell to only ring when the door is opened. This will cost 3s. 6d. If you can wait until my articles on Electric Alarums are published, you will learn exactly how to do the job, and will be guided by illustrations. Space cannot be given here in "Shop" to fully explain how to do it, but I hope to show in my articles how to make an electric alarum clock.—G. E. B.

Magneto-Electric Machine.—H. C.—The two inside ends of the coils must be connected together. One of the outside ends is soldered to the spindle which carries the bobbins. The other outside end is soldered to the insulated brass collar outside the bobbins, which forms part of the commutator. If this part is not insulated from the bobbins and the spindle by a collar and plug of ebonite or boxwood, no current will be obtained from the machine. Other causes of failure are badly shaped and fixed commutator, allowing no break at all or a break at the wrong time. The commutator should break contact with the spring just as the ends of the bobbins are passing the poles of the magnet. The spring may be too strong or too weak, the magnet may be weak, or there may be several other causes of failure. One cannot say without seeing and testing the machine. If you do not succeed, write again and tell us how you made the machine.—G. E. B.

Crystoleum Painting.—C. G. (*Lower Edmonton*).—If C. G. S. will look carefully on page 58 he will find his question already answered. In the second paragraph from top I have said, "All this is to be painted in the transparent photo." Need I say again that the photo is pasted to the concave side of the first glass? The first painting is made on the transparent paper, then the second glass is placed in the concave of the first, and the remaining painting is worked on the concave side of this.—O. B.

Sale and Exchange Column.—BERNHARD.—If you look at the last page but two in each number of WORK, you will find that space has been reserved for special advertisements at the foot of the third column. I agree with you that it is very desirable that a "Sale and Exchange" department should be started in WORK, and if it is found that readers have a disposition to support such a department—and this disposition must be evinced by letters and advertisements sent for insertion—it would be started and developed to the very utmost. At present, however, such advertisements must find a place in the page and column indicated, until their numbers render it necessary to give them a place by themselves, and to classify them as (1) "For Purchase;" (2) "For Sale," and (3) "For Exchange."

Soldering.—F. B.—Instructions on the art of soldering will be given in these columns at some future time. The subject is far too large to be properly dealt with in "Shop;" but if you will kindly specify the class of work you wish to solder, we shall have much pleasure in instructing you how to do it.—G. E. B.

Barometer.—F. B.—I may say that some two or three methods are adopted for exhausting barometer tubes of air and filling them with mercury. The most simple is as given here. Get some *pure* mercury, place in a clean Florence flask, and warm up on a sand bath. Clean the barometer tube with a strip of split cane and a bit of wash-leather. Warm the tube gently near the flame of a spirit lamp until it is hot enough all over to be handled without scalding the hand. Then pour the warm mercury into the warm tube in a very fine, thin stream from a lipped vessel through a thin-necked glass funnel. When the tube has been filled with mercury, close the open end with a gloved thumb and shake the mercury up and down the tube until all air bubbles have been expelled, and the clear, bright column of mercury strikes the closed end with a sharp click, thus denoting that there is a perfect vacuum at that end. Warm the tube by holding its closed end *close to*, but not *in*, the flame of the spirit lamp, and turning it round and round in the hands, gradually warming it all along until the open end is reached, then back again until hot enough. Unless these precautions are taken the tube will be liable to crack. Tubes will also crack if cleaned with a *wire* brush or mop. The mercury must be quite pure. By another method the tube is first filled with warm mercury, then heated inch by inch, beginning at the closed end, until the boiling mercury has expelled all the air. This is said to be a risky method for the amateur. Another plan is to warm the tube and invert it mouth downwards in a trough filled with mercury. A small quantity of the metal ascends as the tube cools. The tube is again heated whilst still inverted, and the operation is repeated again and again until the tube is full. All remaining traces of air bubbles are shaken out, as in the method first described.—G. E. B.

Litho Retransfers from Stone.—J. D. (*Perth*). —Take Scotch transfer paper, and damp the back with a sponge. Let it lie for a minute or two, when it will be ready to take an impression from the stone without sticking sufficiently to break the composition in lifting. Roll in the work with retransfer ink (stone to stone), which is sold by dealers in litho sundries, fan the stone till it becomes quite dry, and then pull the impression on the previously damped paper. It will be found to adhere firmly to the stone, and must, therefore, be peeled off slowly. If done with care, impressions from the retransfer will compare favourably with those from the original.

Sheet Metal Working.—J. F. (*Elgin*).—Wood working naturally has had a preponderance at first, because where one man can be found who is competent and willing to write on metal working of any kind, there are at least a score who can write—and write effectively—on wood working. Many subjects in connection with metal working are in preparation, and even in course of issue, as you will have noticed. Arrangements have been made for papers on sheet metal working, and these will soon be commenced.

Picture-Frame Making.—ASHMORE.—I am glad that the instructions to which you allude were of service to you. A paper or two on the mode of making ordinary picture frames from mouldings will be given for the information of yourself and others who are interested in this subject. The article on "Frames à la Mode" was a paper on art in picture frames, and not a practical paper on frame making.

Bogus Advertisements.—It would have been better for your friend's wife to have purchased the necessary tools and materials and have obtained some instruction in the art to which you refer in your letter before she commenced operations. It is not wise to trust to such advertisements as you mention. There is no royal road to wealth; and persons who trust to specious promises—far too specious, in truth, to afford any hope of fulfilment—must expect to lose their money. I do not see how I could "bell the cat" in the matter as you suggest. Papers on the work-bench will be given. Instruction in holding saws, files, chisels, etc., is, I think, scarcely needed.

Litho Bronze Blue.—A LITHOGRAPHER (*West Bromwich*).—The introduction of a little tallow into the ink would, most probably, have overcome the difficulty.

Litho Machine Transfer.—A. C. (*New Barnet*). —The fault, no doubt, lays with your transfer paper. Procure *Scotch transfer* paper; slightly damp same by placing between damp blotting paper and warm stone before laying down transfer upon it.—J. F. W.

Toning Bath for Black Tones.—A. P. (*Stockport*).—The following toning bath will give good black tones, but it must not be used until at least twenty-four hours after mixing:—Chloride of gold, 1 grain; acetate of soda, 30 grains; water (distilled), 10 ounces. Another good one, which must be used half an hour after mixing, is—Chloride of gold, 1 grain; borax, 30 grains; distilled water (hot), 10 ounces. To obtain the best results, the paper should be sensitised by the operator.—T. C. H.

Repairing Jewellery.—J. W. (*Manchester*).—There are two ways of repairing jewellery, soft soldering and hard soldering. Soft soldering is the method employed when the article to be repaired will not stand the heat necessary for hard soldering, such as enamelled articles and rings when broken at the shoulder, and when it is not advisable to take out the stones with which the ring is set. The tools and materials for soft soldering are very simple: a blowpipe, some blowpipe solder, soldering fluid, small file, pair of pliers, and shears. To mend a ring broken at the shoulder with soft solder, cut a plate from thin gold plating or metal the size and shape to fit nicely over part or all of the inside of head and part of shank; tin one side of it, by spreading over it a drop of soldering fluid, and then working in the gas till a small piece of solder laid on it melts and spreads all over. Tin the portions of the ring that the plate is to cover in the same way, using the flame from blowpipe very cautiously; wipe off any superfluous solder from plate and ring, then adjust the plate inside in the required position, hold it there with the pliers, and gently warm with blowpipe flame till solder melts, withdraw flame, and let the ring cool; if any solder has run out at edges it must be scraped off with point of an old three-cornered file; hard soldering is more difficult, and will be dealt with next week. All materials, tools, and stones (real and imitation) for jewellers' use can be bought at King's, 13, St. John's Square, Clerkenwell, London.

Lathe Motive Power.—WOODMAN (*Newcastle-on-Tyne*).—You say you have tried to convert one of Jones's sewing machines into a saw bench, to do grooving and other similar work, but could not get sufficient speed, or enough power, and you want to know how to construct a machine to obtain power and speed for cutting, grooving, and rebating, without such labour at the treadle. Your error lies in trying to put work upon a light piece of mechanism for which it is utterly unsuited. A sewing machine treadle and fly wheel is not designed for cutting wood, therefore it will not absorb and give out sufficient power for that purpose. But you can have no simpler piece of mechanism for such work as you require than the treadle and crank, with fly wheel. The next better plan is to get a heavy driving wheel, and let some one else turn that, and so drive your lathe or saw with a belt, just as turners do in heavy cutting on large lathes. If neither of these methods will suit you, then power must be obtained from an extraneous source, using a motor, a steam engine, gas engine, or water power, as most convenient. I should recommend you to look out for a second-hand treadle and fly wheel at the marine store dealers, and then rig up a framing to suit. In this way you can obtain ample power at small cost, and the labour of driving a heavy crank axle and fly wheel, supposing they are properly pivoted, and the parts well fitted, is comparatively slight.—J. H.

Cost of a Patent.—B. D. (*High Holborn*), in reference to reply given to G. B. B. (*Portsmouth*), writes to say, "The stamp on application for provisional protection is only £1, whilst if the application is 'complete' the stamp is £4." Attention has been already drawn to the oversight in stating the cost of provisional protection to be £1 10s., so there will be no occasion to insert any further letters on this subject.

Advertisements in "Work."—J. E. G. (*Leeds*). —I note your strictures on advertisements in WORK. Your suggestions are noted, and if at any time it is found that they can be adopted, they shall be followed.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Making a Cyclorn.—BON-AMIS asks:—"Could any reader of WORK inform me how to make a cyclorn?"

Joiners' Composition.—F. B. (*Guernsey*) writes:—"The other day I was in a cabinet-maker's workshop, and noticed, after veneering, there were a few defects in the joining, which were immediately filled with a composition which was kept heated for the purpose. This hardened very quickly, and, after being sand-papered, could not be detected. Being an amateur fret worker I took particular notice of this, and I think it would be a great assistance to amateurs to know of this preparation. Will any of your readers kindly give the recipe in 'Shop?'"

Trade Notes and Memoranda.

THE new Calais mail steamer, which has been built for the London, Chatham, and Dover Company, and which will be placed in the service in May, has been named the *Calais Douvres*, after the twin ship of the same name, now to be withdrawn from the service. The new vessel is built entirely of steel, and is divided into nine watertight compartments. It is expected that she will be the fastest cross-channel steamer afloat, and will make the passage easily in an hour. She will be lighted with electricity, incandescent lamps between decks, and are lights for embarkation.

SIR JOHN FOWLER, addressing the students of the Crystal Palace School of Practical Engineering, recently, told them that England was the best place in the world for the engineer to learn his profession, and to get equipped, wheresoever his future might be. By the best equipped men, he meant, not necessarily those with certificates, although these were valuable, but those who had the best general record. He said that India, Canada, Australia, South Africa, and our other colonies and dependencies, offered vast scope for the engineer.

IT is stated in the *Revue Scientifique*, of Paris, that paper of best quality can be made from the stalk of the sugar cane; and the writer suggests introducing the industry into countries where the sugar cane is grown, and where, owing to over production of sugar, the industry is in a languishing condition.

A LARGE terrestrial globe is being constructed for the Paris Exhibition. It will be one-millionth the size of the earth, measuring about 30 metres, or nearly 100 feet in diameter. A millimetre on its surface will represent a kilometre on the surface of the earth. Paris will occupy about one centimetre, and will be a convenient unit for comparison. If this globe were revolved on its axis, a point on the equator moving at the rate of half a millimetre a second would represent the diurnal movement of the earth.

A CORRESPONDENT of the *American Machinist* relates his experience of an experimental working of steam hammers with compressed air. Water power was abundant, and the idea occurred to utilise this in compressing air for operating the hammer. Compressing apparatus and a storage tank were erected, and the air brought about 200 feet through a 2-in. pipe. He says that the hammers worked better than with steam, there was no steam blowing off, and no water dripping.

THE exhibition of the Turners' Company will be held at the Mansion House in October. The competition will be in hand turning of glass, wood and metal, with a special section for amateur turning. Particulars can be obtained of Mr. Edgar Sydney, 4, Hare Court, Temple.

WORK

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WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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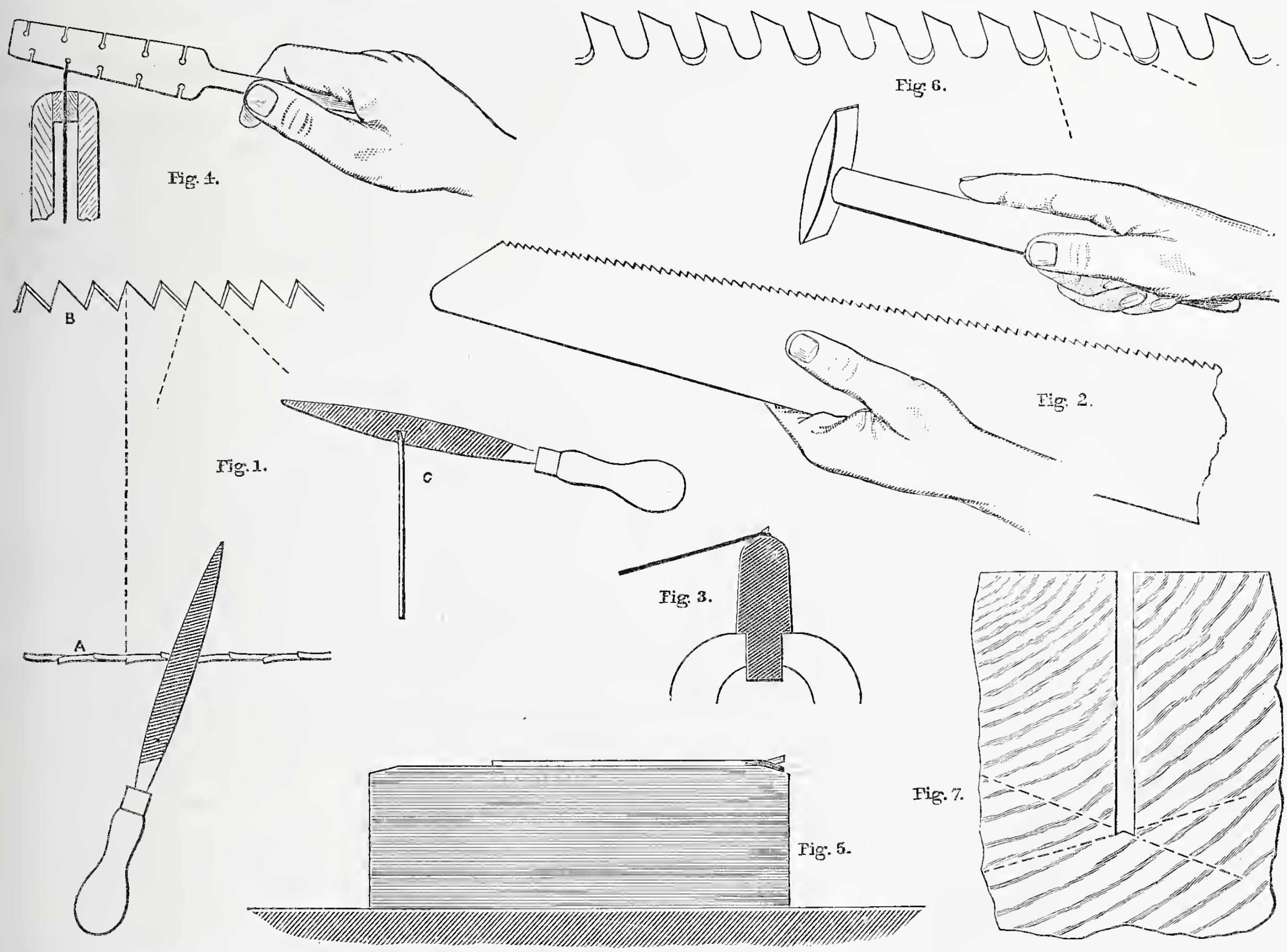


Fig. 1.—Hand-saw Teeth. Fig. 2.—Method of Setting on a Block. Fig. 3.—Section of Setting Block. Fig. 4.—Method of Using Plyer Set. Fig. 5.—Method of Setting by Chamfered Edge. Fig. 6.—Teeth with much "Rake," used for Cutting Soft Woods. Fig. 7.—Saw Kerf, Enlarged.

THE SAW: HOW TO USE IT.

BY J. H.

I.—VARIETIES OF SAW—TYPICAL HAND SAW—TEETH—GAUGE OF BLADE—SAW PLATE—STRESSING OF SAW—FORMATION OF TEETH—SETTING HAND SAW—PLYER SET—SETTING ON BLOCK—SHAPE OF HAND-SAW TEETH—TOPPING TEETH—ANGLE FOR FILE IN SHARPENING HAND SAW.

EVERYBODY uses, or tries to use, this most indispensable tool. But how different is its method of operation in the hands of a skilful or of an unskilful man; or when it is in good trim, or is out of order! So much is involved in the sweet working of saws, the minutest matters have so intimate an influence on their manner of operation, that some remarks on this subject may prove of interest and service to most of my readers.

First, as to the saw itself:—Confining our remarks to those used for wood working, there is first that general class, in its various modifications, of which the hand saw is the type, then the cross-cutting and circular, the back saws, the band and fret saws, and the various kinds used for cutting sweeped work; a whole host; all of which are used to a greater or less extent by amateurs and professional wood workers. Let us look at these *seriatim*.

Taking the hand saw type, we find this includes the hand saw proper, the ripping, half-ripping, and panel saws; all of similar outline, but differing in dimensions, and in form and size of teeth. There is no broad line of distinction between these tools, but they merge one into the other. Yet at the extreme ends it would be impossible to substitute the ripping and panel saws one for the other. The hand saw, however, which is a kind of compromise between extremes, is used indiscriminately for all purposes. What, then, are the characteristics of the typical hand saw?

Its length is from 24 in. to 28 in., being measured on the blade, which corresponds with the maximum range of thrust of which the arm is capable. Its blade is as thin as possible consistently with that amount of rigidity necessary to prevent buckling or doubling of the saw under thrust. The blade tapers in length, a form which is also best calculated to withstand thrusting stress without unduly increasing the mass of metal. The handle completely encloses the hand, so that no muscular effort is required to keep the hand from slipping away from its proper grasp. The teeth are bent to right and left alternately, while their outline is triangular—the cutting angle being very obtuse, and apparently ill-fitted for dividing fibres. Lastly, the teeth are so sharpened that their outer points first enter the wood, and the fibre is divided by a gradually incisive kind of action. Now there is not one of these points that can be neglected with impunity, for they all conduce to the proper operation of the hand saw.

The thickness or "gauge" of the blade is an important matter, because increase in thickness means additional power required to operate it, and also more material wasted in dust. As a rule, select the saw that has the thinnest blade, which will generally be found the most flexible. The Eastern nations carry out this principle to a greater extent than ourselves, by using saws so thin that they cannot be thrust, but are instead drawn towards the workman, and cut only when being thus drawn towards the operator—the rake of the teeth being placed in the reverse direction to that of ours. I do not think this is good in principle, because much greater power can be exercised in a thrusting stroke than in a pulling one, and I have not the slightest doubt that an English carpenter with his hand saw would beat by a great deal a Japanese or Indian sawyer at a trial of results.

Our best English hand saws are not only thin in the blade, but they are tapered from the cutting edge towards the back. To a slight extent, therefore, they clear themselves in the cut, and there is, in consequence, less loss by friction than in the saws of parallel thickness.

One important point in a saw plate is that it must neither show winding, nor buckle. Either defect will cause the saw to "run" in its cut, so that it will be impossible to work to a line, or only possible by exercising constant coercion on the saw in one particular direction. These evils are seldom present in new saws, but they become developed by careless usage, as forcing the saw violently through wet and harsh timber, letting it slip out of the cut, so that the point drops upon the timber while the pressure doubles or bends or otherwise stresses the saw. A saw blade once out of truth is very difficult to put right again; and if an amateur attempts by hammering to restore it to its original condition he generally contrives to indent it with hammer-marks without removing the evil. The best plan always is to take it to a saw-sharpener, who by a skilful direction of blows will generally level the plate, the process being akin to that used in operating sheet metals, the material being slightly thinned out in certain sections relatively to others. But a saw may be so badly buckled that no skill will suffice to make it what it was before buckling. Hence the reason why violent stressing of saws should be avoided.

Since this stressing is most apt to occur in wet and harsh timber in which the saw is moved with difficulty, and in timber for which the form of the saw teeth is not adapted, obviously the principal means by which a saw can be preserved in good working order is by paying particular attention to the manner of the formation of the teeth. This is really the fundamental point, attention to, or neglect of, which makes the principal difference in good or bad results.

The formation of the teeth depends on two matters—first, "set," or the amount of bending given to alternate teeth to right and left of the median line; and the method of sharpening, by which the rake and angles are imparted.

Although the blades of the best saws are thinned slightly towards the back, this by no means obviates the necessity for setting. All wood-working saws without exception have their teeth bent from side to side alternately, in order that the width of the "kerf," or groove made by the teeth, shall be slightly greater than the thickness of the plate, so that the broad surfaces of the latter shall move through the wood with the least amount of friction possible. This set is extremely variable in amount, and is necessarily so varied by reason of the wide difference in the nature of the materials which have to be divided, the extremes being, say, thick, wet, and soft wood, cut across the direction of the grain-fibres; and thin, dry, and hard wood, cut in the direction of the grain-fibres. The hand-saw tooth is not formed for so great extremes as these, but it will nevertheless embrace a very wide range of work.

Fig. 1 A represents about the average quantity of set given to a common hand saw suited for general work; that is, work within the ordinary limits of that done on the bench. This is imparted either on a setting block or by means of some form of saw-set, of which there are many. Fig. 2 shows how a saw is set on a block. The latter is a piece of iron whose section is seen in Fig. 3, and which is clamped in a vice. Upon the rounding edge the saw is held with the left hand at the particular angle required for any definite quantity of set, and the alternate teeth are struck sharply with the narrow-paned setting hammer, held in the right hand. When the alternate teeth which lean in one direction have been so treated, then the saw is reversed end for end, and the opposite alternate teeth struck.

Another common method of setting adopted is that effected by means of the "plyer" set. Here the teeth, instead of being hammered, are gradually bent over, the saw being either held in the left hand, or in the vice the while. (Fig. 4.) Of the two, I much prefer the hammer and block, because the set can be rendered more precise and uniform, and I think the risks of fracturing brittle teeth are diminished. An abrupt setting over of the teeth is also more efficient than a gradual bending from their roots; at least, that is my own opinion. The only objection to the setting block is that in unpractised hands the angle of the saw relatively thereto (see Fig. 3) may possibly be permitted to vary, and the setting, therefore, not be uniform. This, however, is a question of skill, which comes by use. But a good substitute is a block of iron, or even of hard, close-grained wood, having one edge chamfered to the quantity of set required. The saw being laid (Fig. 5) upon this, the set is imparted with the hammer, and the angle of the teeth cannot be other than that precise amount corresponding with the bevel of the edge. If hard wood is used for the block, its grain must run vertically, so that the ends of the fibres shall be opposed to the indenting force of the hammer.

In whatever manner this set is imparted, and whether it be much or little, absolute *uniformity* is of the first importance. A saw with a comparatively small amount of set, if regularly given, will operate better in wet stuff than one whose amount is greater, but given irregularly.

The shape of the hand-saw teeth is shown in Fig. 1 B. It will be noted that the rake of the teeth (*i.e.*, the amount of their leaning forward) is such that there can be no true cutting action. For the teeth to cut truly they would require to be formed with a good deal of rake, as in Fig. 6. But the quantity of rake thus represented would unfit a hand saw for general work. Actually, then, the hand-saw teeth (Fig. 1) are in principle an assemblage of scrapes, and as such they have little penetration. Wedge-like teeth having much penetration, like Fig. 6, would cause much hitching and jarring of the hand to occur, particularly in operating hard wood and in cross cutting. But there is a certain incisive action in Fig. 1 very much akin to, if not identical with, that of the wedge or chisel form, and it is due to the method of sharpening adopted. Looking at Fig. 1, A, B, C, it is seen that the teeth facets are bevelled in both directions, so that they first enter, and divide the material by their extreme outer corners only. To note what would result if such were not the case, imagine the teeth to be sharpened perfectly square across—the saw would then work extremely dead and heavy, and the labour of cutting would be vastly increased, probably more than doubled. But the teeth being bevelled, the action is such that the severance of the fibres takes place in a diagonal direction. This is seen in Fig. 7, showing a saw kerf much enlarged, from which it is evident that the action of the tool has much in common with that of the wood chisel worked diagonally, or the skew-mouthed rebate plane. The fibres are divided in series in the direction of the dotted line, and excessive stress thereby avoided.

Lastly, in order to the most perfect action, all these tooth points must be in line; if they are not, those which are below the rest will be inoperative. Hence, in sharpening, as in setting, perfect uniformity is essential to the best results. Before sharpening, therefore, the teeth are "topped"—that is, the file is run down over the points two or three times in succession, until all are level, and then the sharpening follows, until the blunted tops are just removed and no more. The angles at which the file is held for the common hand saw are shown in plan in Fig. 1 A, and in end view in Fig. 1 C.

(To be continued.)

NOTES FOR ELECTRO-PLATERS.

BY GEORGE EDWINSON BONNEY.

VI.—Anneal, Annealing—Antidotes—Aquafortis.

Anneal, Annealing.—Metals are said to be annealed when they have been heated and cooled in such a manner as to render them softer and more pliable afterwards. The temperature to which a metal must be heated and the method of cooling afterwards differ in each case, and a knowledge of this difference forms a part of the art of annealing. Iron (and all its compounds or alloys) is made hard by heating to a dull red, and cooling it rapidly, as by plunging it in cold water; but when allowed to cool slowly in hot ashes, or enclosed in a metal tube previously heated and surrounded with a bad conductor of heat, it then becomes soft. The hardest steel can thus be made soft enough to be cut with steel tools.

Gold, copper, silver, and some kinds of brass may be annealed by being heated to a dull red, and allowed to cool gradually, or they may be plunged at once into cold water without any apparent effect on the annealed metal. The art of annealing is practised by those workers in metals who draw them into wires or beat them out into thin plates. To anneal gold, silver, and copper anode plates, or strips, heat them to a dull red and cool in water. Tarnished silver plates may be cleaned by cooling them in a dilute solution of potassium cyanide, such as the cyanide dip used in nickel plating. Copper and brass plates may be cleaned by cooling them in a very dilute solution of one part sulphuric acid in forty parts of water. This should be warm to properly clean brass. Where naked wires and strips of copper are used as conductors of electricity, as between battery and bath, or in use as slinging wires, they become brittle with long use, and should, therefore, be carefully annealed occasionally to restore their softness and pliability. Pure copper may be annealed at a low heat. Fine copper wires passing from one conductor to another (as those leading from the poles of a powerful plating dynamo) will become heated by the current and annealed in passing.

It is sometimes necessary to anneal articles of jewellery in the workshop to colour them after being repaired. This should be done cautiously to avoid unsoldering any parts soldered with soft solder. Best silver-soldered goods will stand the annealing and colouring process all right. See notes on *Colouring*. It is probable that the process of annealing changes the positions of the small particles which go to make up a sheet, a bar, or a wire of a metal. What this change is cannot be demonstrated, but probably it is in the direction of an alteration from a crystalline to a fibrous form of structure. Some curious effects are observed in annealing alloys and metals coated with gold or silver. These suffer a permanent change in colour by the annealing process. German silver loses its whitish lustre, and becomes a dirty grey. The kind of brass known as gilding metal loses its gold yellow tint, and becomes coppery. Gilded copper articles lose the pure gold tint, and assume a dark coppery hue. Gilded silver articles assume a brassy yellow tint. Silver-plated copper, and alloys of this metal, are blackened by annealing. If the process of annealing is carried on too far—that is, the metal subjected to too much heat—the discoloration becomes permanent, and the gold or silver coating is said to be "sunk." If not carried too far, the colour can be restored by a judicious course of pickling. Rules, embodying a scale of safe temperature for annealing gilded and silver-plated articles, might be drawn up if we knew the exact thickness of the coatings and the composition of the metal beneath. But the safe line varies with the thickness of the coat of precious metal, and it needs a trained eye to determine by the change in colour when this line is reached. The changes of colour which take place on the surface of metals during the process of annealing are little understood. For instance, if we anneal a piece of copper coated with gold the gold coat disappears, and the surface seems to be composed of an alloy of gold and copper. Is what we see a real alloy of these two metals? If so, the alloy cannot have been obtained by fusion, for the annealing temperature has not been raised to the fusing point of either metal. Has the gold sunk into the surface of the copper? If so, the pores of the copper bar must have opened under the influence of heat and received into their mouths, so to speak, the fine particles of gold which covered them. This seems to be the only tenable explanation. In the alloyed surface the two metals are so intimately mixed in such a fine state of division, as to give it the appearance of a real alloy obtained by fusion, but the intruding grains of copper may be dissolved in an acid pickle, and leave the gold coat in its former pure condition. A similar result follows the annealing of any other plated metal.

Antidotes.—An antidote is a medicine that counteracts the influence of a poison—that is, opposes and neutralises its action. As electro-platers work with deadly poisons, they should be well acquainted with the deadly properties of those poisons and their antidotes. Under the heading of each poisonous substance mentioned in these notes, I have given cautions respecting its use, and directions respecting the selection and application of the proper antidote in case of accident. The general rule respecting the choice of an antidote is as follows:—Choose a substance that will combine at once with the poison and form a compound having no action on animal tissues. Antidotes should be promptly applied, and therefore should be kept at hand in an easily accessible position. *The antidotes to acids* are such alkalies as magnesia, soda, potash, or even chalk, mixed with lukewarm water and swallowed at once. Afterwards take a little milk, or broth, or such vegetable oil as olive oil, or oil of sweet almonds. It will also be safe to take a dose of castor oil in the course of a few hours. *The antidotes to alkalies* are such vegetable acids as vinegar, acetic acid, lime juice, lemon juice, or orange juice diluted with water and taken at once. If neither of these are at hand, ten drops of sulphuric, nitric, or muriatic acid in a wineglass of water may be used instead. After the pain has abated, take a tablespoonful of olive oil. Later on, cleanse the stomach and bowels with a dose of castor oil. *The only safe antidote to poisoning by metallic salts* is an abundance of warm water to be drunk at once so as to cause copious vomiting. If this does not succeed speedily, other means must be employed to cause vomiting, or the stomach-pump must be used. Most metallic salts may be converted into insoluble and inert sulphides by taking a strong dose of milk of sulphur, or flowers of sulphur, but it is best to get them out of the stomach as soon as possible to avoid bad after consequences. Afterwards the stomach may be relieved and comforted by a good egg beat up in a glass of milk.

The antidote to poisoning by cyanide in all its forms is a solution of iron. The common *green* vitriol or protosulphate of iron dissolved in water may be used. But as some time may be lost in preparing this remedy, it will be well to keep always handy some *steel drops*, obtainable at any chemist's shop. Give half a teaspoonful in a wineglassful of water *at once*. Then dash cold water over the head and down the spine of the sufferer. Stimulate the heart's action by giving brandy, either neat or mixed with warm water. As the action of this poison is fearfully quick, prompt action in applying the antidote will be needed to avert fatal consequences. Sal-volatile may be used where brandy is hard to get or unattainable. Liquor ammonia, six drops in a wineglassful of water, will also give relief. *The antidote to acid fumes* is the fumes of ammonia, either from ammonia carbonate or diluted liquor ammonia sprinkled on the floor. *The antidote to ammonia fumes* is the fumes of chloride of lime, or some other fuming chloride; as chlorine combines with ammonia to form sal-ammoniac, and this is simply innocuous. See also notes on *Cyanide of Potassium, Prussic Acid, Poisons, Poisoning*, etc. etc.

Aquafortis.—A name given to commercial nitric acid. It is evidently a word compounded from two Latin words meaning respectively "water" and "strong" to denote this liquid as being a strong water. For further information see note on *Nitric Acid.*

(*To be continued.*)

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

IV.—USE OF GUIDE LINES—THE ALPHABET IN FREEHAND — SKELETON LETTERS—NECESSITY FOR PRACTICE.

I HAVE so far merely considered freehand drawing more or less from a general point of view, but must now direct the pupil's attention as to the best course to pursue in becoming proficient in truthfully and accurately forming and drawing the letters of the alphabet without any mechanical aid whatsoever.

I will afterwards give some directions for the making of various "guide" lines, which are sometimes used as an aid by the sign writer in forming accurately and quickly some of the more difficult letters, such as C, G, S, and &. But I must impress upon the learner how absolutely desirable it is to, first of all, learn to be able to draw all the letters in a bold and workmanlike manner by freehand alone, and using his eye as his guide pure and simple. I may also add that although "guide" lines are all very well in their way, the young student, if he wishes to master this art and become a capable workman, must eschew them altogether in the preliminary stages of his practice. And, be it said, that our best "writers" never make use of these aids to correct drawing, but trust to the eye and hand alone, and that it is by this method that all the best displayed and boldest work is turned out, and which, of course, invariably bears the imprint of the master hand and an artistic eye and mind.

I will admit that occasionally it is next to impossible to construct one's letters properly and truthfully unless they are drawn or formed by mechanical means. Take, for instance, the case of the workman being confined in a very awkward and cramped position, or being up aloft on a frail platform and at a great height, in fact, sufficiently high to unsteady the nerves, and consequently the hand. Again, supposing some very large letters have to be painted on the front or side of a house, and also at a great height; in this case it is almost impossible for the workman to have sufficient room to stand far enough back to occasionally survey his work, and gauge its appearance or detect any imperfections or malformation of letters. Therefore, in such circumstances as these the use of any mechanical aid or guiding lines is perfectly legitimate.

A good many of our most dexterous and expert sign writers seldom chalk their letters out at all, but proceed offhand to write them in with the pencil and colour. And even when they do previously mark their letters out, it is merely in a rough and sketchy manner, and more with the object of properly spacing their letters and filling in the allotted space on the board evenly than anything else; and they very seldom follow their chalk lines in painting the letters, but, on the other hand, let the pencil follow its own inclination.

In commencing to practise drawing the alphabet in freehand, it is better for the learner to first of all draw simple outline letters. For this purpose, then, I here give a sheet of "skeleton" letters (Fig. 27), together with numerals.

It is, perhaps, just as well to draw these on paper with the lead pencil for a while; but, taking it for granted that the learner has been practising hard on the two previous lessons, recourse should soon be had to the blackboard, and once here, the work Therefore, at this stage of our lessons more than any other, the watchword should—in fact, *must*—be *practice*, PRACTICE, PRACTICE. It is far from my wish, of course, to dishearten the pupil; on the contrary, every inducement will be thrown out and encouragement given to the youth about starting in life to adopt and follow this educational, remunerative, and elevating art trade of sign writing, which to some, the writer included, is fascinating to a degree. It is, in fact, my enthusiasm in the subject improves in quality, so will the workman be the better able to see its imperfections, although for the life of him he cannot tell the exact points, perhaps, where the fault lies. But after a bit he will perceive and detect these also, and eventually be able to correct bad lines, and, in their place, render with precise and masterly touch those he has so long desired to obtain. Once, therefore, he has surmounted the somewhat difficult task of forming in shapely and pleasing manner the whole of the letters which our alphabet

Fig. 27.—The Alphabet and Numerals for Freehand Practice.

should proceed with both the chalk and the camel-hair pencil filled with colour.

Now, it takes but very few words to describe this method of procedure for a first attempt upon the alphabet, but as it is the whole groundwork and foundation of letter-forming and letter-painting, it is very important that the student should be very pointedly told, also, that he must completely master this lesson, or, speaking still plainer, be able to form each letter at least in a decent way before he can hope to become a creditable craftsman, and, more important still, earn money by his craft. which induces me to so strongly urge my readers to "stick to it" in this fourth lesson. Do not become disheartened at repeated failures, and "throw it up" altogether. That is not English pluck and doggedness, and failures there must and will be at the commencement, but which repeated practice will slowly but surely overcome. Some letters will be very difficult to form correctly, especially the S and the "short and"—&; but each succeeding effort on the part of the pupil will show some improvement, however slight and imperceptible it might be to the untrained eye. As the work contains, his greatest obstacle on the road to progress is passed, and the rest, it can confidently be said, will come naturally and easy to him, with one possible exception—that of colours and colouring.

Leaving the student at this point to follow the precepts I have just laid down for his guidance and success, I will seek to do no more at present than remind him that the examples given in the accompanying skeleton alphabet are to be drawn by him on a larger scale, as the other freehand exercises that have been already given in these papers.

(*To be continued.*)

HERALDIC CHASING.

BEING HINTS FOR THE ORNAMENTATION OF HARNESS, ETC.

BY OPIFEX.

HERALDIC chasing is the art by which crests, coats of arms, monograms, and various kinds of ornaments, etc., are made in gold, silver, brass, or indeed in any of the ductile metals or alloys.

The subject of this paper is not Heraldry, which is a most interesting subject in itself, and one which well repays the intelligent student, being so intimately connected with the history of our country, and having so many legends of romance and chivalry embalmed within it; but we are only indirectly concerned with it now.

Heraldic chasing presupposes some knowledge of Heraldry, or, at least, the possession of a design prepared by one who possesses it; and my object is to help my brother amateurs to produce articles in this *line*, about the manufacture of which ninety-nine per cent. of us are entirely ignorant.

We will assume, then, that some reader is anxious to have a set of crests for his harness, that he is possessed of sufficient energy to undertake the work himself, and that he is furnished with an accurate drawing of what he desires to produce.

Heraldic chasing is the near relative of repoussé work, in fact, it is its direct offspring, so that those readers who are proficient in that art will have little to learn, and will find that their knowledge has merely to be applied in a groove slightly differing from pure repoussé work.

The tools employed are of the same kind, but generally of a finer make, our subjects being, as a rule, more elaborate in detail and more highly finished than works in repoussé.

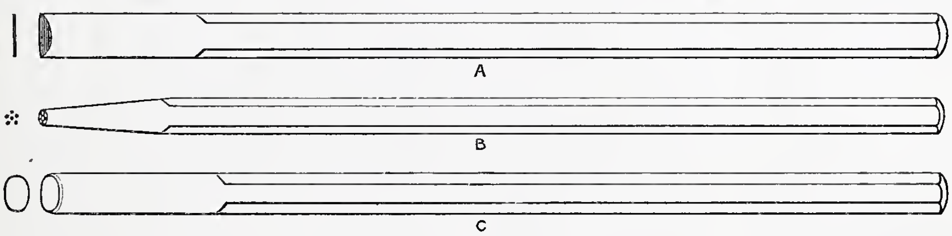


Fig. 2.—A, Tracer No. 1; B, Punch No. 5; C, Relief Punch or Beater No. 7.

Our first example given at Fig. 1 represents a falcon's wings with hooded head, and is a simple crest, easily executed, and the following directions apply to all subjects of a like nature.

There are two methods by which this work may be executed: one very simple and perhaps more suitable for beginners, but *not* the correct or professional method, and therefore not so satisfactory in its results as the other; however, I give it in hope it may induce some one to attempt the work who might shrink from the other and more complicated process.

Whichever method we follow, there are certain special tools and appliances required to make a beginning, which I shall enumerate at the outset.

The necessary tools are:—First a medium-sized chaser's hammer; any small hammer will do in an indifferent sort of way, but the reader is strongly advised to obtain a professional chaser's hammer, at a cost of about half a crown.

Next two tracers—Nos. 1 and 2, as used in repoussé work, $\frac{1}{4}$ in. and $\frac{1}{8}$ in. respectively. (See Fig. 2, A.) These tools should be flat on one side and rounded on the other, the edges being formed by grinding down the *round* side. The advantage of these over other shaped tracers is that curves and straight lines may be traced with them with equal ease, and also a greater degree of *relief* can be obtained by their use. We shall also need two straight tracers (Nos. 3 and 4), $\frac{3}{16}$ in. and $\frac{1}{8}$ in. respectively, ground on both sides; these tools should be *rather* sharp, but smooth at the edge; we also need one $\frac{1}{8}$ in. made quite sharp. These will be sufficient for the present, and I shall describe any others as occasion requires.

The following appliances, etc., are also essential:—Some flour emery and crocus powder, soft rags or cotton waste, sweet oil,

Fig. 1.—Crest: Falcon's Wings with Hooded Head.

Fig. 4.—Section of Crest taken across Centre.

steel wire scratch-brush and sheet of carbon transfer paper, an H.B. pencil, several small files of various shapes, a small soldering iron, some common solder and "killed spirit," a small block of hard wood, say about 6 or 8 in. in diameter, and the same length—a piece of this size cut from a beech bough will suit admirably if the faces are cut parallel and

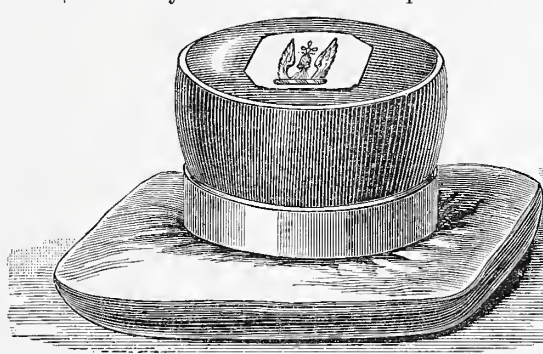


Fig. 3.—Chaser's Bowl, filled with Cement or Pitch.

made tolerably smooth—some $\frac{5}{8}$-in. "cut tacks," a fine bradawl, and last, but most important of all, we require the material to work upon; this must be thin sheet metal, brass, or silver (or gold!), but, "fiat experimentum in corpore vili," which, being interpreted freely, means, "on the present occasion let us experiment in common brass." It is cheap and *not* nasty, and for our present purpose (harness crests) is in much better taste than silver, but this, of course, must depend upon the other mountings; as to thickness, No. 25 gauge brass is what we need.

And now as to method No. 1. Cut a piece of brass about 3 in. by 5 in. or sufficient for two crests, and having made the metal quite flat proceed to cleanse and polish it on both sides, using, first emery and then crocus; or you may polish in any of the other approved methods, as in repoussé work, but the above will suit the subject in hand. Next, wash the brass well in hot water with soda and soap, to remove all grease, and rinse clean and dry. Now scratch-brush one side all over (in the absence of a scratch-brush emery cloth will serve) or scrape the surface with any sharp instrument. The object of this operation is to prepare the back of the work to receive the solder, which, as we shall see, is to be run into the reverse side of the crests.

Next lay the brass upon the block, scratched side down, and with the bradawl make a row of holes all round about an inch apart and a quarter of an inch from the edge; then tack the metal securely down.

We are now ready to transfer the heraldic device to the brass; this is effected by placing a piece of carbon paper upon it. Next place the design upon the carbon paper, and with a sharp pencil go over all the markings carefully; repeat the operation for a second copy; and we should now have two facsimile drawings in black upon the metal. Sprinkle a little French chalk upon the brass, rub gently over the drawings, and all danger of "smudging" will be obviated.

In the case of the present example the transfer may be made direct, but in dealing with crests, monograms, etc., which would be reversed by transferring (such as a lion rampant, etc.), it will, of course, be necessary to prepare a negative design.

The simplest way of doing this is to place a piece of carbon paper upon a hard, smooth surface—a piece of plate glass is best—lay the design upon it, and then go over the drawing with a hard pencil (as above), when a facsimile will appear on the *wrong side* of the design, which may then be transferred to the metal.

And now for the actual work. Taking tool No. 1 or No. 2 in the left hand and hammer in the right, proceed to indent lightly the outside of the design (*i.e.*, leaving out such markings as feathers, crossbars on the "hood," etc., in the example in hand), keeping the flat side of the tool next the design, using No. 1 for all the straighter lines and No. 2 for the smaller curves. When the whole of the outline is thus indented, go over it again, more decidedly this time, repeating the operation until all the lines are indented evenly and as deeply as possible; but this result should be arrived at by frequent rather than violent application of the tool.

Having treated both crests in this way, punch down the brass immediately surrounding the design with No. 5 (see B, Fig. 2), as this will help to raise the figure in higher relief, and also render the after process of cutting out easier.

Employing No. 6, proceed next to cut

through the whole outline as already traced. This process requires care, not striking too heavily, but with just sufficient force to go through the brass.

Of course, it may be necessary to use sharp tools of different sizes and shapes, modifications of No. 6, in cutting out. This, however, must be left to the judgment of the worker, who should always endeavour to cut out the crest, etc., as clearly as possible as regards outline. The operation of cutting out may also be performed with a fine fret saw, as used by jewellers; but this also is a matter for the worker's decision.

So far, as regards No. 1 method; but, as before stated, this is not a satisfactory process, and for this reason—we have not been able to provide for the proper *shaping* of our subject. All has depended on the fact that the untouched brass within the outline has become bulged up by the process of tracing and the use of the matting tool, and we are dependent on the after chasing for form, which in some simple cases may answer well enough; but in order that our work can possess any real artistic merit, some other method must be resorted to by which we shall be enabled to *model* our subject, leaving nothing for the after chasing but details, such as the feather markings in the example before us.

In case my readers are not repoussé workers, it will be necessary here to give directions for carrying out this alternative and more correct process.

Instead of the uncompromising block, which takes no impressions, we must provide ourselves with a chaser's "bowl," *i.e.*, a round basin of cast iron. These are of different sizes and shapes, but such a bowl as that shown at Fig. 3 will suit us best. This is filled with the substance known as chasers' cement, or, more familiarly, "pitch," which is really a mixture of pitch, resin, tallow, and Paris plaster or sand. The pitch should be melted and poured into the bowl until it just overflows, and when almost cold the brass should be heated, *unscratched* or right side rubbed lightly with oil or tallow, and placed next the pitch, pressing gently, so that it shall sink sufficiently to make sure of it adhering to the pitch. The corners of the brass may be turned down with advantage, for further security. When the pitch is almost cold—*i.e.*, when applying the hand to the brass we can feel a suspicion of warmth—the design may be transferred as above, and we are then ready to repoussé, or punch down the metal, so that when it is turned we may have our crests, etc., correctly shaped, and so have a much better subject for chasing than could possibly be obtained by the other method explained above.

The tools required for this are, in the present example, only three in number—Nos. 7, 8, and 9 (see C, Fig. 2).

No. 7 is an oval-shaped relief punch or "beater."

No. 8 an oblong, ½ in. long.

No. 9 a very small "edition" of No. 8.

Using No. 7, the broader portions of the design should be punched down, at first all over to an equal depth, and when by repeated applications the desired degree of relief is obtained, the details of form should be attended to, *e.g.*, the pinions in the present exercise.

It must also be borne in mind that crests should be beaten down to a depth considerably greater than that which would suffice to give correct form. At Fig. 4, I give a section of the crest taken across the centre of the design, which will serve to explain my meaning, by comparing the depth of relief necessary in this work with that which would be sufficient in ordinary repoussé work; the line, A B, representing the level of the metal for crests, and the dotted line, C D, indicating the relief as in repoussé. If this is not attended to, the crests will be much too thin, whilst if my directions are followed, they will stand out well upon the harness and be most effective.

Tool No. 8 will suit best to beat down the crest "wreath," and No. 9 the cord by which the hood is held; both these tools will also be brought into use for the sharper portions of the wing, feathers, etc.

When both crests are treated as above the brass should be removed from the pitch, well cleansed, and washed in hot water with soap and soda.

Next cut out with fret saw as above; or place the metal face upwards upon a block of lead, and cut out with No. 6, etc., in either case using great caution in order to preserve the correct outline of the design. And now we have reached the same point, whichever method we have employed, and the following directions are equally applicable to either.

The crests being cut out, are now placed face down and painted over on the back with "killed spirit" (spirits of salts, in which zinc is dissolved until it will dissolve no more), then with the hot soldering iron let the solder run in, until the crests are just full, care being necessary to avoid allowing the solder to overflow and stick to the right side of the articles; guard against this at first by coating with blacklead and beer, as in plumbing work.

We have now two solid crests, the edges of which are rough and jagged, and the next step is to file them out clear and sharp, using the small files of different shapes to suit the intricacies of the work.

We now arrive at the most important and interesting part of our work, namely, the chasing of the crests. To accomplish this the subject is placed upon the block—a larger one than that described above, say, about 10 in. in diameter and 6 in. deep—which should be placed upon a sand cushion upon a solid bench or table.

Having the original design placed so as to be easily seen, next proceed to indent all the lines exactly as they appear in it, using the tracers described above, and choosing those which suit the different lines, curves, etc., as occasion requires, taking great care to follow the drawing faithfully.

In this operation there is unlimited scope for artistic work, but the worker must depend almost altogether upon himself for success, as it is well-nigh impossible to give more than the most general directions as to chasing. But I may say that a safe rule will be to follow faithfully the markings in an accurately drawn pen-and-ink design, and the result will be found to be satisfactory.

The chasing being finished, the next step is to provide means of attaching the crests to the harness. This is accomplished by fixing short pieces of copper wire to the back in several places, so as to ensure that the crests shall be quite flat and secure. Take a piece of ordinary bell wire, and having made it straight by stretching, rub it well over with fine emery cloth until quite bright; next having a hot soldering iron at hand, dip the end of the wire in killed spirit, and applying it to the part of the crest where it is desired to fix it, hold it perpendicularly, and apply the point of the soldering iron to the solder; the result will be, that the solder melting, the wire will sink down to the brass, and holding it there for a few seconds until the solder sets, the wire will be found perfectly fixed. Now with wire nippers cut off at about three-quarters of an inch, and repeat the operation until a sufficient number of wires are fixed—in the present example five in each crest will be required, one at the point and base of each wing, and one in the lure. See that these wires are perpendicular to the back of the crest, and of equal length; place the crest in position upon the harness, give it a slight pressure, so that the points of the wires shall leave a mark upon the leather, then with a suitable awl pierce the leather where marked; insert the wires, press home, and clinch securely underneath the leather.

ARTISTIC FURNITURE

EASILY MADE AND CHEAPLY PRODUCED.

BY DAVID ADAMSON.

II.—A Screen Secretary.

(*Continued from page* 150. *For Diagrams, see pages* 148, 149.)

Lining of Writing-Flap—Mouldings—Flutes in Panel—Shaped Panel—Other Uses.

The writing-flap may be left plain, or, as it is technically called, unlined, *i.e.*, uncovered. It will, however, be better and more comfortable for writing on to line it either with cloth or leather. The latter is the more usual, but I must say I prefer cloth, as being softer. Leather is all very well when new, but it gets hard, and then one might as well write with nothing between the wood and the sheet of paper. Those who habitually use a blotting-pad will not be affected by either material, and except that custom requires a writing-table top to be covered, they may as well just finish the inside of the lid like the remainder of the work, either painting or staining it. If leather lining is preferred, skiver is generally used, though popularly known as morocco. Skiver, which is a split skin, does just as well, and is much cheaper. It can be got either from an upholsterer or a bookbinder, though the charge from the latter is higher than the former generally. Leather cloth must not be confounded with the real leather, though it too is often used. It is harsher to the touch, and, personally, I do not like it, except where cheapness is the prime consideration. In such a small surface, the difference in cost between any of these materials is very trifling, so the best, either leather or cloth, may as well be chosen. Any fine cloth, such as ordinary tailors' cloth, not "diagonals" or "tweeds," but the sort known, I think, as doeskins, with a smooth surface is suitable, and the colour is only a matter of taste. Dark greens and maroons are those generally used for the purpose, and most upholsterers can supply proper cloth. A "cutting" sufficiently large can easily be got for a very small sum, if the purchaser is not too particular about the colour or shade. Whatever the lining, it must be well fastened to the wood. Glue will do, but paste, strong as used by bookbinders and shoemakers, is better. Smear it on to the wood, not on the lining, rubbing it well and evenly. It may be done with a brush, but a method adopted by upholsterers is this: Wrap up some paste in a fold or two of open meshed canvas (Hessian or scrim) and rub this over the wood. The pressure causes the paste to ooze through the canvas, which retains any lumps there may be through defective mixing. When the surface is ready, the lining is laid on and pressed evenly and firmly down with the hand. Pray don't use a hot iron to expedite matters, especially if the lining is leather or leather cloth, unless its destruction is the object aimed at. If it is a very hot iron, it may be used with every reasonable prospect of perfect success in attaining this end. Properly applied, that is, with pressure of the hand or a cold iron, the paste will be dry in a few hours, when the edges of the lining may be easily trimmed off sharp to the edges of the board. Those who have bookbinders' tools will be able to roll a border, either gilt or blind, along near the edge of the lining, which, especially if leather, will be much improved in appearance thereby. It will be seen that the lining covers the whole surface of the writing-lid, instead of being surrounded by a border of veneer, as is usual in writing-desks and tables, and it is omitted as not only unnecessary, but in such furniture as the present, because, to put the matter in plain words, it is more trouble than it is worth.

So far as real utility is concerned, the thing may be considered finished, but there are certain purely decorative details which may be added; indeed, should be, if we wish to conceal the packing-case origin and crude, though serviceable, construction. It is astonishing what a few mouldings will do, and beginning at the top, let one such as that shown in Fig. 7 (see page 149) be glued and bradded all round. This is one got from Elliott, of Newbury, in whose catalogue it appears as *registered design*, No. 1071. It is very nearly the same thickness as the top board, the edges of which it should just cover, but if it comes at all below, it will not matter except in front. Were it to do so here, action of the lid would be prevented, and the moulding must be either shaved away, if only a small hindrance, or the top edge of the lid may be planed down till it clears the moulding. The bolt of the lock will, probably, still catch, but if not, a thin slip of wood glued to the top, just behind the moulding, thickening up the top equal to the moulding, will be all that is necessary. The corners of the moulding must, of course, be mitred.

Now, the surface of the lid strikes one as being too plain, and a little relief from the flat appearance will be an improvement. A small moulding glued on round the edge will make a great alteration, say Elliott's registered design, No. 1001, Fig. 8, but a more ornamental scheme is given in Fig. 9 (page 148). In it the moulding is shown glued down at a little distance from the edge. The centre is further relieved by a thin bevelled edge board on which flutes are cut. These flutes are merely hollows cut with a gouge, and the only thing it is necessary to say about them is that they should be kept clean and sharp at the edges.

Those who cannot manage to cut the flutes neatly, may not be aware of the pleasing effects which are got by merely shaping the outlines of such applied panelling (which, by-the-way, may strike the critic of art woodwork as being very shocking) and boring a few holes with a centrebit. Such a shaped and perforated panel is shown in Fig. 10, and in connection with it, the well-accepted principle that plainness is not so apt to be unpleasing as over-elaboration in design may be remarked.

What applies to the front may be said equally about the back, though there is no necessity why these two parts should be the same in appearance, *i.e.*, details may vary though some regard should be paid to harmony. It will be noticed that there is a difference in size between the two parts, and it will, undoubtedly, add to the appearance if a moulding, however small, is carried round the whole of the back panel. If desired, the small space behind may be enclosed, but made as shown, it will form a handy receptacle for various odds and ends. The upright shown in section is merely a piece of wood forming, as it were, a back to this opening, to prevent anything interfering with the free action of the lid. If this opening is not desired, of course, it can easily be closed, by bringing the back board or panel down to the bottom, so that it corresponds exactly with the lid in appearance. Both sides will then be uniform in appearance, but there will, of necessity, be some lost space. Even this might be avoided by reducing the width of the bottom till it is no more than is required as a stop for the lid, and utilising the space for a small sunk stationery rack.

This, however, would complicate the work beyond the scope of these directions, and it is hardly too much to say that, were all the ideas for alterations and modifications that may suggest themselves to be mentioned, it would, in a very short time, be found that a totally different piece of furniture, both in design and purpose, had been evolved. Still, one or two hints may not be unwelcome, and may serve to show how this screen can be converted into a still more useful thing. We have, say, a number of drawings, and we want a lock-up place for them; well, nothing easier than to enclose the lower part, that is, the space between the bottom board of all and the shelf. Let the back be fixed like the back of the writing-case, and the front fall down like the writing-flap; only, instead of it being hung with centre hinges, use a couple of ordinary butt hinges. Some may prefer a door opening in the ordinary way, when the interior may be fitted with two or three shelves and serve as a small bookcase. Again, others may like to form the space below the secretarial department into a cupboard, either with a fall-down front, or as suggested with ordinary doors. I have, however, not made the screen with either of these modifications, which are merely suggested as ideas to be worked out by those who may find them useful.

The "creature comforts" phase of utility I have already alluded to, and further reference to it is unnecessary.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

II.—Straightening and Bending Plates and Bars.

Although wherever straightening rolls are available they will be used in preference to hand straightening, yet, as in some circumstances there is not the option, it is necessary for the operative to be acquainted with the manipulation necessary to straighten or level the surface of a plate by hammering; if a plate is merely bent in one direction it is a very simple matter to hammer it out, but if there are bulges in it the process becomes one of greater nicety. The bulge itself must not be touched, as by hammering the metal would become thinner, and therefore rise more; on the contrary, by hammering out the plate all round the bulge more room will be given superficially for the material at that place, and it will thus be drawn out level, the amount of truth of surface attained depending upon the care and ability of the men employed upon the job. Of course it is understood that the plates are straightened cold.

In Fig. 3 is shown in cross section the arrangement of rolls in a plate-bending and straightening machine, for it will serve to curve plates as well as to straighten them. The apparatus is fitted with an upper roller, A, and two lower ones, B, B. These rollers admit of adjustment in relation to the vertical distances apart of their centres, and thus the plate, C C, passing through them becomes straight, or is curved as may be required; the curvature, however, only taking place in the direction in which the plate travels. In some straightening machines a greater number of rollers are used.

There has recently been introduced a machine for levelling very thin plates which should not be overlooked, for in view of the enormously powerful machines now being constructed for various processes of mechanical manipulation, it may follow that machines of this type will be produced powerful enough to deal with ordinary bridge plates. In the apparatus referred to the plates are firmly gripped by each end in powerful jaws, which, being then forced asunder by hydraulic pressure, stretch the plates, and in

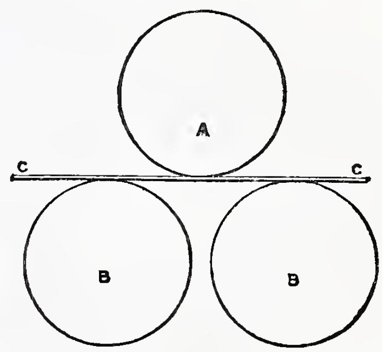


Fig. 3.—Arrangement of Rolls in Plate-Bending and Straightening Machine.

so doing take out any buckles that may have formed in them. In order to stretch the plates a force exceeding the limit of elasticity must be applied, and that for wrought iron is about eight tons to the sectional square inch, so for a plate 24 in. wide by ½ in. thick a pull of about 100 tons would be necessary. So long as no greater force is used than is necessary for the straightening it does not seem probable that the strength of the iron would be reduced by this process.

The bars of various sections, angle, tee, etc., will also require to be straightened, and this may conveniently be effected by pressure in a machine, the principle of which will be understood from the sketch plan shown at Fig. 4. A A is an angle bar, shown broken off, undergoing treatment in the machine; B, B, are properly-shaped blocks, against which the bar, A A, rests; they are solidly fixed to the bed of the machine. C C is a shaft driven by means of a belt on the pulley, D, and there is a fly wheel, H, at the other end to equalise the running. Upon the shaft, C C, is keyed a small toothed wheel or pinion, I, which works in gear with a larger wheel, K, keyed on to a second shaft, L L, upon which is fixed a strong eccentric, E. The revolution of this eccentric, which has a very small throw or stroke, drives forward the block, F, thus pressing upon the bar, A A, between the blocks, B, B; the extent of its action is regulated by raising or lowering the wedge, G, according to the degree to which the bar is bent; this adjustment is worked by hand. The action of this machine is by intermittent pressure for short periods, the bar being shifted as may be required between the

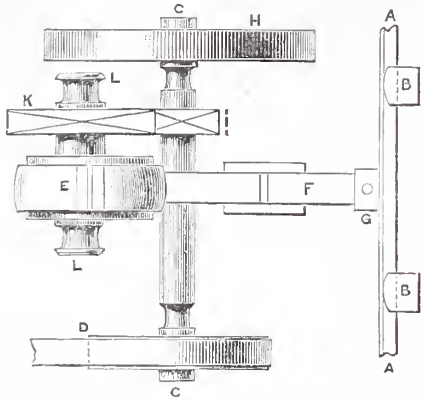


Fig. 4.—Machine for Straightening Angle Bars, T Bars, etc.

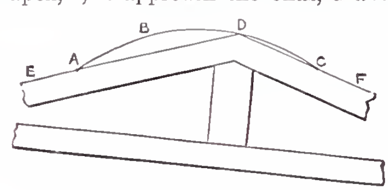
strokes. In the intervals of pressure the necessary momentum to impart it is stored up in the fly wheel, H, which gives it off when the resistance of the bar is met. From this simple form of machine much greater power is obtained, as towards the end of the forward stroke the pressure increases, until if resisted it becomes infinitely great. The bed requires to be very strongly made, its size and proportions being calculated in accordance with the strength of the largest bar it will be capable of taking, and the shafts and other parts must be in proportion, so that if anything breaks it shall be the bar and not the machine.

When angle and tee iron bars have to be curved or bent at an angle, the work must be done hot, as otherwise the normal angles of the sections would open, and in most cases the bars would crack at the root where the two limbs meet, and even when worked hot this opening will occur, and the bars must be hammered or pressed back to their original section. If the bar is made of uniform curvature throughout its length, and the curve is moderate, there will not be any special trouble from this cause, which is most noticeable in sharp bends.

If a number of angle irons are to be bent to a given curve, one is first so shaped, but to a curve so much sharper as to give the required form exactly to the others when bent hot upon it. Any slight opening of the angle can be set down by a few blows from a light hammer. In order to prepare the angle iron mould a template must be made, showing the curve it is to follow, and when of very large radius it cannot well be struck from a centre on the floor used for setting out work, but the arc required can be easily drawn by means of a bevel, the construction and use of which I will now explain. As a rule, all the curves used in girder work can be very closely followed by a series of circular arcs joined together, so if the length of each and its radius are marked upon the drawing, the foreman template maker need have no trouble in setting them out. There are a few simple properties of circles I will now point out, which will make the mode of procedure quite clear and fully explain its principles. In Fig. 5, G I H is a circular arc, of which O is the centre from which it is drawn, and I the centre of the arc. Now if from the points, G and H, two straight lines are drawn to meet each other at any point, P, in the arc, and two others are drawn to meet at some other point, P′, in the same arc, the angles, G P H and G P′ H, will be equal, no matter in what point in the arc the lines meet, so long as they are drawn from G and H respectively. If, then, we join two straight edges together so as to fit this angle, as shown at E D F, and put two pins, A and C, in the floor at a distance equal to G H, and fasten a pencil at the angle, D, then, by sliding the bevel thus made over the floor, keeping the edge, E D, against the pin, A, and the edge, D F, against the pin, C, the pencil at D will be caused to draw an arc of a circle, A B C, of the same radius as G I H. To be able to make this bevel we must know the length, G H, and the rise, Q I. These should both be marked upon the drawings, but very often they are not; then it will be necessary to calculate Q I. It will not do to scale it off the drawing, as any error so arising would be multiplied considerably in the full-sized template. The radius being known, divide it by one of the numbers in Column I. of the following table, selecting such a number as will give as a result a convenient chord length, G H, to work with. To find the rise of the arc in the centre of the chord, G H—that is, the length of Q I—multiply G H by 100, and divide the product by the number in Column II. opposite the divisor chosen from Column I. For example: let the radius be 116 ft.; take 8 as the divisor, then 116 divided by 8 equals 14 ft. 6 in., or 174 in., which is the length taken for G H; this multiplied by 100 is 17,400, and opposite 8 in the table we find the divisor 6,389; dividing 17,400 by this we get $2\frac{11}{16}$ in. for the rise, Q I, in the centre. Lay down the length 14 ft. 6 in. on the floor, putting in a pin at each end, and in its centre square up Q I $2\frac{11}{16}$ in., then G I H will be the angle to which the bevel must be made. The sides, I G, I H, must be prolonged to allow its apex, I, to approach the ends, G and H, without running off the pins. By means of this bevel the template can be made. I must now show how to shape the ends of the templates, so that the curves may be accurately joined at a change of radius. H S is an arc of shorter radius (H T, or S T), joined at H to the arc, G I H. In order that two curves may join without showing any break or distinct angle, the radii at the point of junction must coincide—that is, the shorter radius, H T, must lie upon the longer, H O. All that is required, then, is to mark the radius at each end of the template, then any two such templates being placed end to end, their curved edges will join accurately. The radius of a circular arc is drawn from any point in it as follows:—To draw a radius from the point, N, mark off on each side of it with compasses the equal distances, N K, N L, and from K and L as centres describe two arcs of equal radius, shown crossing each other at M, then a straight line drawn from N through M will be radial; and if two such lines are produced they will meet at the centre, O, of the arc. In order to allow the radial line to be drawn at the end of the arc, the curve must be carried a little further. In this case, N M would be the end of the template.

TABLE.

Col. I.	Col. II.
4	3,184
5	3,984
6	4,785
7	5,586
8	6,389
9	7,194
10	7,968
11	8,810
12	9,569
14	11,173
16	12,179
18	14,054
20	16,000



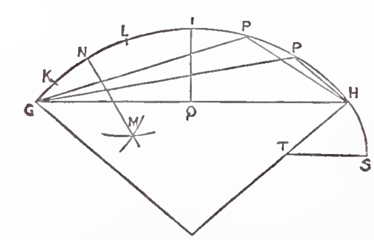


Fig. 5.—Diagram Exhibiting Properties of Circle.

(To be continued.)

THE ORDINARY CHIMNEY BREAST: ITS TASTEFUL TREATMENT AND DECORATION.

The accompanying illustration is a suggestion for the artistic treatment of an ordinary chimney breast.

Nowadays, every young lady of ordinary talent is capable of depicting floral studies accurately and with feeling; it being quite a common thing for our youthful friends to send pictures to the Royal Academy, in many cases, unhappily, without a chance of their works being exhibited. It is a pity that so much meritorious work should be wasted, and it *is* waste both of time and money in the case of most young artists.

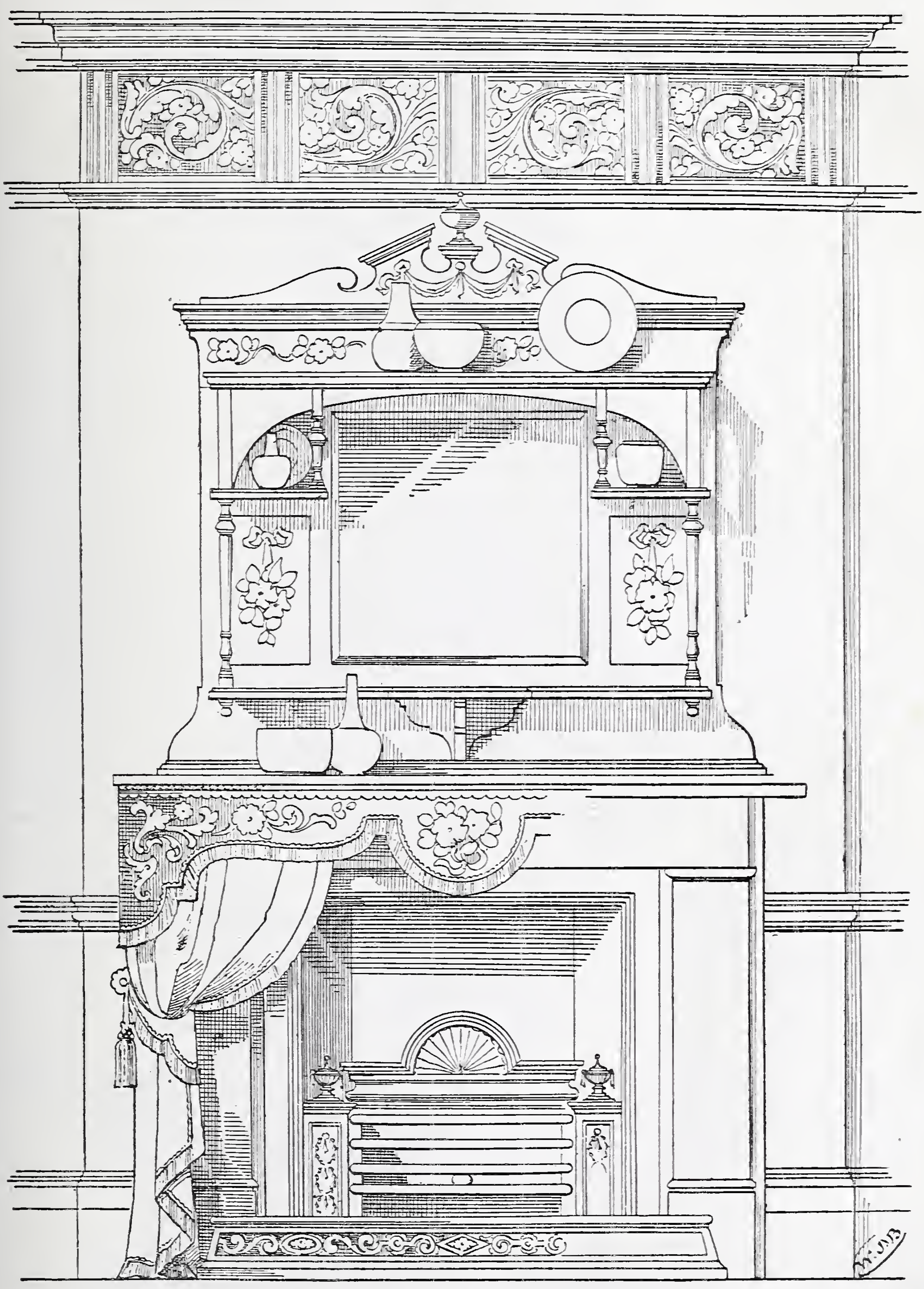
What I would propose to our young friends, as an outlet for their energy and talent, is the artistic decoration of their homes. Many of the flower paintings which are annually turned away from the Academy would form a pleasant relief to the panels of a door or window shutter.

My advice is that, instead of striving vainly for exhibition honours, they should devote a portion of their time and labour to beautifying the home. Why should they not paint the woodwork of their rooms in such delicate tints as egg-blue, terra-cotta, cream, etc., in preference to employing a man who is not an artist, and whose sympathies are not with his work?

The overmantel and chimneypiece shown in our illustration might be treated in plain tints, and then painted by hand in some tasty floral design. To begin with, the overmantel would have to be made in deal or pine, which would not be a very difficult undertaking for any moderately careful workman; then the entire woodwork of the room, including overmantel and chimneypiece, should be painted in one or more tints. A plain moulding would have to be run round the room at a distance of about 18 inches from the ceiling, to separate the frieze from the wall-paper filling, the frieze being either lincrusta-walton, hand-painted canvas, or ordinary paper.

The mantel valance is so simple that any lady could cut it to the required design, and embroider the pattern in crewels or silks. A few yards of gimp and fringe, and two small curtains sliding on a rod attached to mantel-board, complete the decoration of the mantelpiece.

The whole design admits of cheaper treatment than that illustrated; in fact, it is but a suggestion by which, I hope, some of the readers of WORK may be benefited.



Artistic Treatment of the Ordinary Chimney Breast. Frieze in Lincrusta-Walton, or Hand Painted; Wall Paper, Sage Green; Woodwork of Overmantel, Painted White or Cream, with Hand-Painted Panels.

PHOTOGRAPHIC DEVELOPERS.

ADVICE TO BEGINNERS.

BY L. IVOR POOLE.

THE tyro in the art of photography is not long in discovering that not the least of the difficulties which beset him is that of deciding on a formula for his developer. He sees so many of them given in any books to which he refers that it is no wonder he should feel perplexed. First of all he must decide whether he will use pyro, oxalate, or hydroquinone, the new claimant for favour, each of which is strongly recommended for his purpose. Then he must make up his mind on the host of minor details, and failing to do so satisfactorily, he applies to a friend who has made some progress. He will probably then have his doubts set at rest by being told more or less authoritatively that one particular developer is best. Armed with this assurance, he starts development with the formula recommended; some of his negatives turn out satisfactorily, but a good many of them do not. Some of them are flat, some thin, some too dense, and so on. The chief feature in which they exhibit some uniformity is that there is something wrong about most of them. Naturally he is enthusiastic about his hobby. He talks with others about his successes and failures, wants to know the cause of the latter, and how to avoid them in future. Some sympathetic friend is sure to be found willing to aid him and to give the benefit of his counsel. In due course the question of developer comes up. The friend probably remarks that another formula is better; he uses it himself, and perhaps brings out a photograph to show its capability of producing good work. The tyro is eager to try it, and vainly hopes by its aid to have good negatives henceforth, bright and clear, dense where required, quick printing, no stain, half tones and all the other qualities which combine to form a perfect negative. Disillusionment soon comes, for developer No. 2 is no more reliable than the other. Other friends are applied to and with like results. They get good negatives, but the beginner cannot, and so he goes on messing about without making much real progress in the art. He either becomes disgusted with photography or sends his plates to a professional to be developed. In the latter case a fair number of his negatives are satisfactory, and he will have some nice pictures to show. He will, however, know none of the true delights of amateur photography in the same way as the man who begins and finishes the photograph. His share of the work is almost limited to the exposure of the plate, a very necessary operation, but by no means the only one before the negative is finished. Such operators are rather plate exposers than photographers, and it may fairly be assumed that few beginners start with the intention of having the bulk of the work done for them.

This being so, a few words of advice to him who intends "going in for photography" this summer, or any other time, may not be unacceptable from one who *has* gone in for it for some time past. Of course, I have my own pet formulæ for different photographic processes, though they will not be named, not from any desire to withhold them, but simply because to give them might further embarrass the tyro instead of helping him to decide on formulæ for himself. The intention of these remarks is rather to indicate the general principles which should guide him, than to confine him to details.

First of all, let it be distinctly understood that there is no formula which is equally suitable for all purposes and under all circumstances; even if the ingredients admit of almost universal application, their proportions must be modified to get at all times the best results. With the chemical constituents of any developer the mental one of judgment must be largely used. Development is not a merely mechanical process, but is distinctly an art. The chemicals used are simply the tools, and their use may be very clearly demonstrable theoretically up to a certain point, beyond which the intelligence and skill of the operator must in practice carry him forward. Were it possible always to work under precisely the same conditions, such as unvarying activity of light, perfect uniformity in plates, temperature of the weather, etc., then indeed development might be reduced to a mechanical operation. As it is, it is no more so than that of an artist in painting a picture. A right comprehension of this, therefore, will save the tyro some disappointment, even if it does not help him to any great extent in producing a good negative.

Naturally, at first especially, a developer which allows of considerable latitude in time of exposure will be the most useful. A developer which cannot be modified to bring up an under exposed plate, or to restrain an over exposed one, cannot be so satisfactory as another which works fairly well, when used judiciously in either case. As a matter of fact, in the hands of experts there is no developer among those generally employed which does not admit of some latitude in exposure; but some are more easy to work with than others. That which can be most easily manipulated is of course the one which ought to commend itself to the tyro, who, however, must not make the mistake of supposing that with even the best of them in this respect the time of exposure is of no consequence. The best results possible can hardly be got unless the timing has been correct, though trifling errors, which are unavoidable, may be so far corrected that they are hardly discernible afterwards.

As the beginner is almost sure to try a pyro. developer, that is, one in which pyrogallic acid is the active agent, it may be said that he can hardly do better. If he cannot manage with it he is hardly likely to succeed with any.

Now comes the consideration of the particular pyro. developer to be used. The best advice I can give him is to choose a simple formula, consisting of nothing but the active agent, the pyro., a restrainer, usually a bromide, and an accelerator, such as ammonia. These are all that are actually necessary, and by varying their proportions it is possible to do almost anything that can be done in the way of development. Let therefore a start be made with the formula containing the fewest ingredients. By working with them, the novice not only obtains a command over the essential chemicals without them having been modified by the addition of others which, though useful in their way, are not essential, but he learns to appreciate practically the advantages offered by these. He has the rudiments of practical development on which to build his future practice, if he finds it necessary to improve his resulting negatives. He will not be long, for example, before he finds out that a pyro. developer such as described darkens and perhaps stains the negative. Of course, the stains may be removed, but that is hardly the question just now. He may wish to keep his pyro. in solution instead of weighing out and mixing it for each lot of developer, or lots of little matters may suggest themselves to him as being capable of improvement. As similar ideas of improvement have occurred to others, we get the numberless formulæ which have appeared, and however bewildering they may be to the novice, he must remember that each ingredient is advocated for a specific purpose, and in the vast majority of cases has had fair trial before it has passed the bar of photographic public opinion. It is, however, only the expert who can to the full benefit by such refinement, and no expert ever became one who could not do good work with the simplest formula. Though I have spoken of pyro., the same principles will apply to any other developer, as, for instance, the one which is causing so much stir just now in the photographic, or perhaps I should say, in the *amateur* photographic, world, viz., hydroquinone. No opinion is here expressed about the comparative merits of either or between them and other chemicals, whether used as developers, restrainers, or accelerators; but enough has been said to enable the beginner to form some notion of the kind of formula he should start with. He may be further advised not only to start with such a one, but to keep on with it till he has attained proficiency in its use, till he knows positively from experience in what direction he may reasonably require improvement on it. Stick to one developer will be a good rule for him to follow. Its peculiarities become familiar with practice, and by care he can manipulate the developer in a way to produce good results that might at first have seemed impossible. If on the contrary he chops and changes about, first trying one developer and then another, he gives himself no fair opportunity of thoroughly satisfying himself about their good or bad qualities and what they are capable of. He never gets to the bottom of them, and as no two developers require exactly the same treatment, he too hastily assumes that the fault lies in them rather than in his own inexperience. The amateur who makes progress in proficiency, and consequently in the pleasure of practical photography, is he who has learnt well one branch or mode of manipulation before proceeding to others. This, after all, is only common sense, but, as suggested in the opening remarks, the obvious advantages of beginning and continuing with a simple developer do not always occur till time has been wasted and experience gained.

But perhaps the beginner may think this rather confines him, and that were every one to act on the principle of sticking to one developer no progress would be possible. He would rather experiment for himself, and, if he can, add to the general fund of photographic information. Every one knows that the hidden mysteries of nature and art are only divulged by patient investigation, barring the usual exceptions which prove the rule, where they have been discovered by accident; and he is actually recommended to debar himself from any good which might accrue from scientific observation, or from profiting by a lucky accident. They are always possible, you know, and no one has discovered how to photograph in natural colours yet.

Such is by no means the intention of the present remarks, which are written to help the beginner, who will surely not overlook the fact that improvements in any art can hardly emanate from a novice in it. After he has emerged from his novitiate it will be quite time enough for original research to begin, and the more of it the better.

OUR GUIDE TO GOOD THINGS.

43.—Glover's Machinery for Splitting and Bundling Firewood.

Almost everything, except eating, drinking, and sleeping, is done by machinery nowadays, and machines are contrived for the performance of household operations and many kinds of manual labour which our fathers invariably carried out by hand. Even for work of so simple—I might also say, so uninteresting—a character as chopping up firewood, machinery has been devised and patented by Messrs. M. Glover & Co., Potterdale Works, Dewsbury Road, Leeds, by which the work is effected with a certainty and rapidity in every movement which cause a considerable saving of time and labour. There may be some readers possibly who doubt the utility of describing such machines as these as foreign in some degree to the nature and scope of Work, but it must be remembered that every kind of machine is possessed of interest to the mechanic in the first place; secondly, that the illustration and description of machinery are often useful in prompting some inventive brain to the production of other machines of the kind distinguished by greater simplicity, perhaps, and additional power; and, thirdly, that the industry, in aid of which such machines are contrived, must be of far greater extent and importance than would appear at first sight to any one, either to do work of the kind or to see it done by means of the ordinary hand saw and hatchet. More than this, the mention of the machinery here may cause its introduction into union houses and other places where much of this kind of labour is done by aged men, who are far better able to watch and attend to machines of this sort than to apply their fast-fading strength to the performance of the acts of sawing and chopping.

In Fig. 1, the Patent Splitting Machine is shown, which is used for dividing the wood into small pieces, instead of the hatchet or chopping knife, hinged at one extremity to the bench and having a handle at the other. The wood is first cut into pieces or blocks six inches long, as shown to the left of the machine, the grain of the blocks being vertical or running from end to end. They are carried by means of rollers into the machine, and placed under a cross head carrying a heavy chisel, which acts in the same manner as the chisel of a mortising machine, falling on the end grain of the wood, and splitting it cleanly from top to bottom, the grain of the wood being followed in the stroke by the action of an automatic side spring placed in the feeding trough opposite the knife, partly to keep the wood in place, and partly to prevent any undue resistance that might be offered if the wood were held so rigidly in position that it would be absolutely unyielding when split by the chisel. When the strap by which the machine is set in motion is thrown off, the latter is stopped by a brake applied to the wrist pin disc. The size of the pieces into which the blocks are split is regulated by the rate of feed. The sticks as they leave the chisels are carried forward on rollers towards the Bundling Machine, shown in Fig. 2, the rollers acting as a kind of sieve through which all dust and dirt that may be adhering to the sticks fall from them. The sticks, as seen on the right of Fig. 1, are placed on a travelling band in the Bundling Machine, and carried into a box, where they are shaken together and gathered and compressed into round bundles by four formers, the ends having first been brought level by a plunger, which pushes the sticks up to a diaphragm which then withdraws. After compression into bundle form, the mass is forced from the box by another plunger, actuated by a cam, and forced outwards through a tube slightly convergent, and having a spring top in the manner and position shown on the right of Fig. 2. Here they are further tightened up by a band of steel drawn up by strong toggle-joint gearing, and the bundle is then wired by wire held by a clip above, which can be released by a foot lever. The ends of the wire are then twisted by the revolution of the clip, and, the bundle being completed, is pushed out of the machine by the next in order to be wired. Figs. 1 and 2 can be worked separately or in combination. The "Excelsior" Bundling Machine, shown in Fig. 3, is worked by the foot, and is intended for smaller requirements. The lever (7), fixed at the further end by the pin (8) on which it moves, acts by means of the vertical rod (6) passing through the bed or plate (1), secured by bolts to the table on which it is placed, and the toggle joints (4) on the sliding jaw (3), which moves into the fixed jaw (2) in front of it. By these jaws the sticks are compressed into bundle form, and are then wired or tied by hand, after which the bundle is released by the spring (5) below the stand. In this machine there is nothing in the form of ropes, chains, etc., that requires renewing, and time is saved in the rapid release of the bundles, which are made round, level at the ends, and of uniform size, by the action of the machine, which makes the work easy to the operator, and obviates the necessity of close supervision.

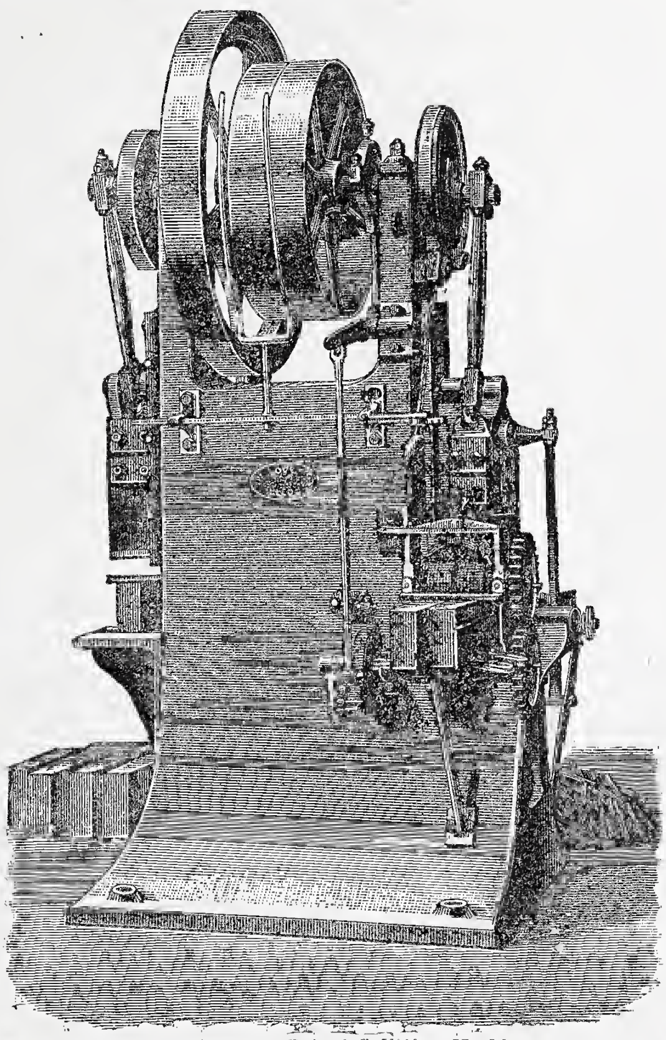


Fig. 1.—Glover's Patent Splitting Machine.

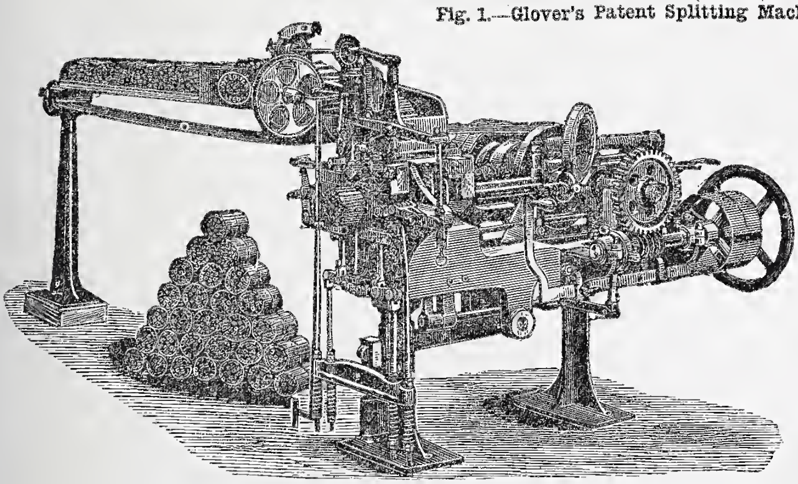


Fig. 2.—Glover's Patent Firewood Bundling Machine.

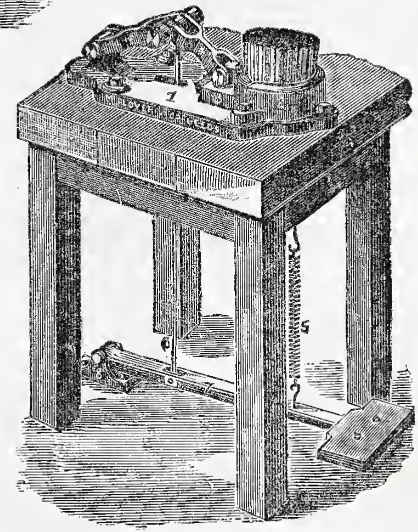


Fig. 3.—"Excelsior" Patent Firewood Bundler.

It seems at first sight somewhat marvellous that machinery of such size, power, intricacy of construction, and value, should be necessary for carrying out such simple operations as splitting and bundling firewood. Its very existence, however, proves the demand that there is in the present day for labour-saving apparatus, even for work of the most ordinary character. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

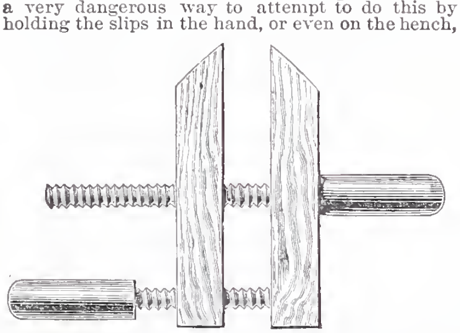
*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Circular-Saw Rigs for the Lathe.—A Foreman Pattern Maker writes:—"As the writer of the article on 'Circular-Saw Rigs for the Lathe,' I have tried to understand the meaning of your correspondent's criticism (G. E., *Camberwell*, p. 78), but in vain. He speaks of 'Fig. 1' as representing 'a superfluous amount of work for small results to an amateur in the screwing or tapping a chuck to obtain a counterpart.' From this I gather that G. E. takes exception to the trouble of cutting the thread in the saw spindle. But the same objection would apply with equal force to the fitting of lathe chucks of any kind. Fig. 3, without the thread, and made square ended for a square hole chuck, and lathe centres, is 'much better adapted,' but 'the square should taper 15°.' Well, I do not attempt to give dimensions, or taper to suit any particular chuck at all, and those who possess square hole chucks can make spindles to suit them. I simply give the general design. Again, 'the saw driven between centres of 60° is the most lasting, and less liable to run out of truth.' I don't see why a chuck like Fig. 1, tapped for the mandrel nose, should run out of truth any more than an ordinary lathe chuck. I know a wood turner who has been using spindles and saws, rigged like Fig. 2, for several years, without their running out of truth. And in the article, I advised steadying one end of the spindle with the poppet centre in cases where the fit of the thread may be imperfect. Besides, your correspondent should remember that a mandrel nose terminates in a collar, which helps to steady the chucks, and minimises the evil due to badly-fitting threads. I do not quite understand why G. E. thinks the table let into the rest socket the best. It certainly has the merit of simplicity, but I prefer Figs. 4 or 7, because they can be fitted with fence."—[The diagrams to which reference is made here will be found in No. 1 of Work, pages 8 and 9.—Ed.]

Metal Ball Making.—A Reader of "Work" writes:—"I should very much like to see an article on sheet metal press work in your valuable Work. It is a subject that does not seem to be very well understood by writers in technical papers generally. I once saw some hollow balls made from one piece of sheet brass, with only a small hole where the metal had been brought round to. I asked in one of our leading mechanical papers what tools and appliances had been used, but could get no answer. And then there are such things as military ornaments, some of which are quite works of art. I hope you will be able to see your way to insert an article on the above subject."—[Probably the balls you mention consisted of two hemispheres moulded by pressure, or produced by a process known as "metal spinning," and then joined edge to edge and neatly brazed or soldered together. Perhaps some reader may be able to give you the information which you failed to get from the quarter indicated, in the form of a letter, etc.; if necessary, a paper describing the means used.—Ed.]

Sharpening Carving Tools.—J. W. B. writes:—"In No. 7 of Work I notice a reply to Tom on the mode of using slips to sharpen carving tools. It is a very dangerous way to attempt to do this by holding the slips in the hand, or even on the bench,

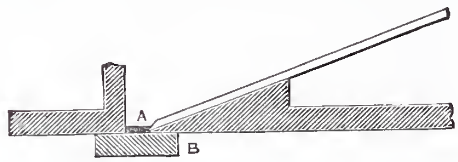


as the tool may slip as well. A much better way is to secure the tool in a hand screw (shown in illustration), and then fix the latter in the bench vice.

A Good Word for Work.—Dulcimer writes:—"I have taken in Work since the commencement of its issue, and have circulated the copies amongst friends, who have almost, without exception, determined to become subscribers. I think no one can do less for a work which will probably have more effect in rendering home healthier and happier than any legislative measure can do. The various ways in which this can be effected need no comment."

"Disgusted Abandonment."—E.C. (*N. Brixton*) writes:—"Buying No. 6 by chance, seeing its hook-binding diagrams, I ordered No. 7, in reasonable expectation of its being concluded or continued *seriatim*, but it is neither so, nor any intimation present or future; so, though it may be imagined a bond of continuance, it may equally end in disgusted abandonment, if one can never reckon on things being *regularly* carried through. Perhaps washing would not be thought work, else there is a new system with solid paraffin used which would be of general interest."—[I hope you are now buying Work regularly, as you ought, and have come on the continuation and conclusion of "Binding made Easy," which duly appeared in No. 9. For my part I think the expectation of continuation of any subject from week to week the reverse of reasonable, for many reasons, the chief of which is that if such a course were rigidly followed, variety would be unattainable. Be assured that nothing once commenced will ever be discontinued, save under circumstances that are not influenced by human control, such as the death of a writer before he has completed his subject, and even in this case another would be sought to gather up the broken threads, and carry out the work. The ladies say—especially those who take it in hand—that washing *is* work, and hard work too. So if you will kindly enlighten those who buy Work—and I believe there are many who do—with an account of the new system, they will be sincerely obliged to you. The fact of your writing shows that there will be no "disgusted abandonment" of Work on your part, but that you are on the look-out for a rejoinder to your remarks. Well, here it is.—Ed.]

Pattern of Plane for Casting.—E. P. W. writes:—"I have read the article on home-made planes, and I think it is my duty to mention that when a pattern is made for a casting, it should not be cut quite through, and there should be a thin piece glued or tacked on to the pattern where the mouth is to be, because it is difficult to have a clean casting when the mouth is cut through, and the part that forms the bed for the iron, being very thin, cools very



quickly, and is sometimes so hard that a file will not touch it. This will prevent it, and there will be no trouble in chipping or grinding the projection off, and then when the casting has been planed or filed up, as the case may be, the mouth will be through, and there will be no trouble. I hope the writer of the article will not be offended, as I do not write this to offend him, but for the benefit of any one that may be following his instructions, and be fixed, as I have been. I speak from experience."

Work's Utility.—F. E. writes:—"As one who has benefited by your Work, I feel constrained to inform you that I too made use of No. 1 (though not the cabinet), but I made one of Mr. Adamson's tables, putting the shaped top on to the shaped stand, which, after being enamelled a pink colour (probably terra-cotta would have been better), I found was a pretty table, acceptable to my employer. I hope you will, in due course, treat of the *Upholstery and Polishing Trades*, in which I am more immediately interested. The articles by Mr. Denning and those on the cutting, etc., of tools, I regard as especially good."—[We are all glad to know that No. 1 of Work has proved genuinely useful to you. I am sure that hundreds of workmen will find it useful in the same way—namely, as a mine from which to quarry ideas. Try the overmantel in No. 2. Upholstery and polishing will be treated in due course.—Ed.]

Tube Saws for Ivory.—F. A. M. writes:—"Many of your readers will envy me when I tell them I have just paid a visit to the workroom of a famous ornamental turner, Rev. C. C. Ellison. Amongst the many interesting things were some tube saws for cutting blocks of ivory into cylinders with the smallest possible amount of waste—a most important object with ivory at its present high price. Those who have read Mr. Evans's book on 'Ornamental Turning' will remember that it contains a description of some bent cutters for use in the spherical slide rest, contrived by Mr. Ellison for cutting a number of hollow half spheres out of a solid one; these tube saws are the complementary tools for similar use where cylinders are concerned. I was first shown a series of ivory cylinders about $\frac{3}{16}$ in. thick, one within the other, and at least 4 in. long, whilst there was only about $\frac{1}{16}$ in. between the internal diameter of one cylinder and the external diameter of the one within it. Evidently a parting tool could not produce such work. A little further on I came upon a set of cylindrical or tube saws, and the secret was revealed. Mr. Ellison procured a set of solid drawn steel tubes from the Credenda Steel Tube Works, Birmingham. The length of the smaller, from 1 in. to 2 in. in diameter, is 6 in.; the larger sizes, from 2 in. to 4 in. diameter, are 9 in. long. These tubes, being too stout, were reduced by turning to about half their original strength, when they became from $\frac{1}{16}$ in. to $\frac{1}{32}$ in. in thickness. The pitch of the teeth, as well as the thickness of the saws, gradually increases with the size, from $\frac{1}{16}$ in. to $\frac{3}{16}$ in. from point to point, and the teeth are set rather upright. The saws are advanced into cut by the back centre, whilst the block of ivory revolves in the lathe. A shouldered cylinder of hard wood is fitted into the hinder end of the saw, which piece of wood has in it a conical hole to receive the point of the back centre. A groove is cut with a parting tool in the face of the work to form an entry for the saw, which must be wet when the material operated upon is ivory, and the saw has to be frequently withdrawn to clear it of cuttings. Mr. Ellison considered the saws could not be so well made by bending round and brazing a saw blade. Perhaps some practical workman who sees this will give an opinion upon it; and possibly some firm of tool makers will be found to undertake the manufacture of such sets of saws, and will tell us what they think they can be supplied for."

Fretwork Cabinet.—Engine Driver writes:—"I feel quite jealous of the honour you have bestowed on T. F. of being the first to use No. 1 presentation plate. I had finished a fretwork cabinet on the 20th, and would have wrote telling you of it, only I had used a cigar box for my fretwork (don't let Mr. White know this). However, I have got a real nice cabinet, and you will please give Mr. White my humble thanks for his beautiful design. I must also thank Mr. White for his 'tip' for ebony staining, and Mr. Denning for his valuable hint for mixing glue. I could never make glue stick until I read his article, and now I think I could make glue that would make an M.P. stick to his promises. I wish you every success, and have to tell you, by the way, that six of my shopmates who have seen my cabinet intend to get Work regularly."

Cabinet in Fretwork.—T. F. (*Willington-on-Tyne*) writes:—"I thought I would just like to write and let you know that I did not allow the little difficulty I met with in commencing to make the first cabinet dishearten me; far from it, for I never allow any sort of fretwork or plain inlaying to be my master, and when first I got sight of the cabinet pattern in No. 1 of Work, I took a great liking to it, for it is the very best I have met with, and as the designer said it was certainly worth doing well. So I thought I should like to let you know the trouble I am going to to make it, as near as possible, a success and a good finish. In the first place I have used up four of the cabinet patterns during my experiments. First I cut out one door $\frac{1}{16}$ in. thick, and filled in with a composition of different colours, using the proper system of indicating colour: red for the flower, yellow for the stem, and green for the leaf, but this did not please me. So then I tried another door, in plane tree, which is white. I cut the pattern all out first, and then I stained the glue quite black, and glued the pieces, and put them all back again, and when it was cleaned up the black glue showed the line of the pattern up something nice, although this was not quite to my taste. So now I am inlaying the three right-hand doors with plane tree laid into a walnut ground, and the three left-hand doors are being inlayed with walnut into a mahogany ground, so I think it is as near to perfection as one could get it. I forgot to say that I tried very thin wood, but it does not bring the pattern out so well as my last experiment, but of course a lot of patience is required, and unless beginners in fretwork or inlayers are not prepared with a lot of patience and time, or if they do not take a delight in the art, they had better not commence it. I have been now twenty-two years at fretwork, and my patience has never once yet run short, although I have many times been weary in it but not of it. Here is a proof of the trouble and time I have been to. I once, while I was in China, made a basket called the stag hunt; it took me many months to finish it, for there were over 1,500 cuts in it, and some of the pieces as small as a pin's head. How many beginners in fretwork are there who would go to the trouble of first cutting that pattern out with his penknife—for I have that pattern still by me—and then paste it on to wood, and then cut it out with his fret saw, making altogether 3,000 cuts, and still have his patience as fresh as ever? I should like some day, sir, if I can find time and you space, to let you know, or rather your readers, how I treat my fret patterns, for I never destroy them; some I have had by me this twenty years, just the originals as I bought them. I have two books full, and they are very nice scrap books to look at. I have never fell across any one in England who treats these patterns as I do, but of course there may be some who do."—[Your patience and perseverance are remarkable, and eminently praiseworthy. By all means let us know how you treat your fret patterns. The knowledge will be useful to many readers.—Ed.]

Something Cheering from Kerry.—Iernus writes:—"Being a subscriber to the *English Mechanic* for some short time back, I happened to see in an issue of that paper of about the 1st March last an advertisement of Work, and seeing that it seemed to be the kind of paper I wanted, I sent to Dublin for a number of it, and it turned out to be indeed all I could desire. So you see the first number of your paper found its way even to 'the wilds of Kerry.' I need not tell you I have continued to get it since, and that I will recommend it to all whom I can. I am sure some articles on speculum grinding, and silvering and telescope making, would be very acceptable to many besides myself. Perhaps Mr. Bonney would be kind enough to give us some articles on telephone making. I must mention with regard to all articles which have appeared in Work up to this that they are all as clearly written and as useful as any one could desire. I may say, in conclusion, that I wish a long and prosperous career for Work."—[Thank you for your good wishes and commendations of Work. I am glad to say that Irishmen are numbered among the contributors to the Magazine as well as among its readers. On my staff are writers of ability and experience on the subject you name, and these will be taken up as soon as opportunity offers. Meanwhile, ask any question in reference to either, or both, of them, and your inquiries shall meet with the best replies that can be given.—ED.]

Touching "Shop."—G. P. B. (*Darlaston*) writes:—"Having taken in WORK from the commencement, and being immensely pleased with it too, I desire to add my little meed of praise to that you have received from so many correspondents. I have been particularly struck with your 'Shop' column, and the courteous manner in which all letters of inquiry on a vast variety of technical questions have been answered week after week. Although I, too, have many questions to ask I refrain for the present, seeing that this week you have more questions to reply to than ever, but before long I shall have to trouble you. In the meantime may WORK go forward and prosper as it deserves to do; the very fact that so many apply to it for advice proves conclusively how much the venture is appreciated, and that a long and useful career is assured."—[I do not know that I deserve your commendation for courtesy in replying to letters of inquiry. I should be sorry to be otherwise than courteous to any man living. It is my belief that it is by kindness in speech and manner that one chiefly obtains influence over others. Believe me when I say that in all I say in WORK or do with respect to it, I am chiefly actuated by a wish to be useful in and to my generation, God permitting. Ask what you will, when you please, and, if possible, an answer shall be forthcoming from one of my staff or myself. Failing this—for we do not pretend to know everything, either individually or collectively—your queries shall be submitted to WORK'S readers at large, in the hope that one or other of them will be wiser than we on the point. It is impossible to put more than a quart into a quart measure, and equally beyond possibility to put more into WORK'S sixteen weekly pages than what they contain at present, having regard to legibility, etc. I suppose WORK will have to grow in superficial area one of these days.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Type: How Made.—ELECTROTYPE.—Types are cast in moulds from type metal, which is a composition of lead, antimony, and tin, in various proportions according to the size of type.

Work on Electricity.—ELECTROTYPE.—Possibly the best work for your purpose will be "Electricity in the Service of Man," edited by Dr. Wormell, now publishing in monthly parts at 6d., and of which three parts are published to the present time.

How to Obtain a Patent.—A. D. (*Bury*).—In the reply to a correspondent to which you refer, £1 10s. was inadvertently or accidentally written for £1. At the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C., a "Circular" may be obtained giving all information on the course to be taken to obtain Patents for Inventions in the United Kingdom. Possibly you will wish at first to obtain provisional protection. This lasts for nine months, and during this time you can be developing your patent with the view of obtaining complete protection at the end of this time. Or you can obtain complete protection at once. If you merely require provisional protection the fee is £1; with another fee of £3 for complete protection at the end of nine months. For complete protection at first the fee is £4. You can obtain the form of application through any money order office at a few days' notice, and by prepayment of value of stamp. At Bury, where you reside, you may obtain the necessary form at once from the head office on application, and payment of fees, for I note that Bury is named in the list of places in the United Kingdom where forms of application are kept on sale. The "Circular" to which I have alluded above, and which is obtainable at the Patent Office, will afford you all other information in detail.

Kit of Carpenters' Tools: its Cost.—COST OF TOOLS.—Anything relating to practical work is worthy of attention in this column; but I am afraid very little in the way of direct answer to your questions can be given. First, it is impossible to say what constitutes a complete outfit. If you make a "hobby" of your tools you may run to any cost you like; and, on the other hand, you may get a very fair assortment for general work for a very few pounds. At the most, the outlay at any one time is not heavy, if you go the right way about it, just adding a tool as you find it advisable, or as opportunity occurs for getting what seems likely to be useful. The quantity and style of tools also depend a good deal on the class of work to which you devote yourself, and whether you have one or two good-natured shopmates who are willing now and again to lend a youngster some out-of-the-way tool he may not possess. In many shops no tools at all would be required at "just starting," for the simple reason that the work is almost confined to attending to, and waiting on, the men; but you may, I think, take it for granted that for the first twelve months a sovereign would well cover your outlay for tools. Much, however, would depend on what your employer or foreman might consider necessary, and this you can always ascertain before being engaged. If you go "on trial" for, say, a month, you would not probably be expected to possess any tools during the probationary period. You will thus see the difficulty of giving you definite answers, but what I have said will, no doubt, be of assistance to you.—D. A.

Practical Method for obtaining the Bevels of a Bevelled Hopper or Box.—X. Y. Z. (*Orkney*).—The reason that this question presents some difficulty to the average mechanic or amateur is because the sides are not at right angles or upright with the top or bottom, as the case may be, but bevelled. If the angles of the box or hopper were square, it would be simple enough, and all that would be necessary would be to set a bevel or square to the bevels or joints required. Fig. 1 given herewith represents the section of one side

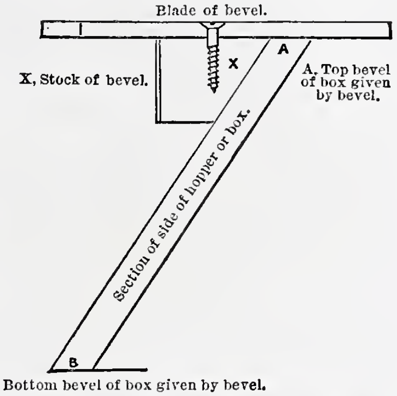


Fig. 1.—Section of Side of Bevelled Hopper or Box.

of a bevelled hopper or box, and all that is necessary is to make a simple wooden bevel, with one side of the stock bevelled, as shown at X, to the splay required, and set the blade of bevel to the necessary angle, as if the sides of box were upright with the bevelled side of stock against the work (always setting angle of blade of bevel from the square or upright side, which is marked darker in the diagram). Fig. 2 represents the plan of bevel,

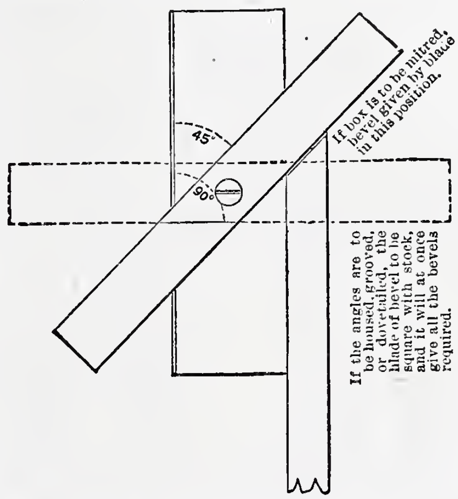


Fig. 2.—Rough Sketch of Bevel, for giving at once all the Bevels required for making Bevelled Hopper, Box, or Splayed Window Linings, etc.

with the blade set to an angle of 45°, or, practically speaking, a mitre, and shows the method of applying same to mark the mitre of angle—that is, if the hopper or box is to be mitred. If the angles are to be dovetailed, housed, or grooved, the blade must be set to an angle of 90°, or square, just the same in all respects as if the hopper were square, with the one exception that one side of the stock of bevel is splayed to suit the splay of hopper required. Fig. 3 shows the method of cutting out

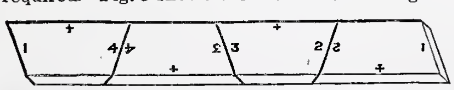


Fig. 3.—Showing Method of Cutting out Sides of Box to save Material.

the sides to save waste of material, and it will then be seen that after cutting and turning two alternate pieces upside down the angles will coincide. Of course, if the angles are not to be mitred, allowance must be made at each cut for overlapping. If X. Y. Z., after getting his stuff to the proper width, first bevels the top and bottom of his sides (the position of bevel, in Fig. 1, determines these bevels), and then marks the splays required, as Fig. 3, he will, on applying the bevel, at once see the simplicity of this method. The same rule also gives the bevels for the angles of splayed window linings, and that much-discussed problem—the bevels of a washing tub.—E. D.

Preparing and Polishing Wood.—G. W. (*Bermondsey*).—A series of articles on this subject will appear in due course; but, pending their publication, I shall be happy to help you in this column if you will let me have particulars of what you want to know. It would be of the very greatest assistance if you and other inquirers would state the kind of wood and the style of finish desired, as at present to answer the question fully would require a complete treatise. For example, I do not know whether your things are pine to be stained to imitate some superior wood; then whether they are to be polished or varnished, or whether they are of wood—say mahogany—to be finished bright or dull, darkened, or natural colours, etc. If you will write again I shall be pleased to tell you, as you are quite right in supposing that I am prepared to help workers; but, of course, before I can do so, it is necessary I should know as many particulars as possible. With these in hand, you may depend on getting reliable directions.—D. A.

What to Do, and How to Do it.—W. H. M.—You say, "I am in the Post Office, and have a lot of spare time on my hands, and feel that that time is absolutely wasted, having next to nothing to do; so what I have long desired is to learn something about joinery and carpentering, and I wish I could get to know some carpenter or master from whom I could obtain some knowledge in return for any services I could render." From this I gather that you are a letter carrier, and have spare time between the deliveries that you wish to utilise. If I am wrong, forgive the incorrectness of the inference; but reading between the lines of your letter, I am led to this conclusion. Well, you seem to be possessed of a little ready money as well as spare time, and if this be so, spend a guinea or two with some friendly carpenter that you may learn how to hold, use, and sharpen your tools, and go through all the preliminary exercise in carpentry, in which, however, you can only attain perfection by practice. You will subsequently find it has been a guinea or two well spent. As to tools, buy good ones. You will often pick up excellent tools at the unredeemed pledges' shops—the pawnbrokers—and even the marine store dealers'—otherwise known as "rag and bone shops." Never mind if they look a little the worse for wear; an hour or two spent in furbishing them up, cleaning, polishing, and refitting, will work wonders, like old Time, and lend quite a new aspect to things that looked dingy, battered, and next to useless. A little money goes a long way in second-hand tools, and by care in selecting and buying, you will soon gather together a very decent kit. Buy anything that is cheap and worth having, whether you want it immediately or not. Everything, don't you know, is useful once in seven years, and I am sure this applies particularly and especially to tools, for I never yet bought a tool that did not come in handy at one time or another. Once I bought a capital hardwood bevel for 2d. that I use to this day. Having got a few tools—a hand saw, tenon saw, rule, square hammer, jack plane, smoothing plane, half a dozen chisels, and some bradawls and gimlets of different sizes, are indispensable—and having learnt how to handle them, look out for a few jobs in repairing, and make for sale some of the pretty things that are described and illustrated in WORK—such as the Summer Fitment for the Fireplace, in No. 9. If you are a letter carrier, as I suppose you to be, have some cards printed when you are skilful enough to work in a workmanlike manner, and leave them at houses where you are in the habit of calling; you will soon get a connection. And if you are a householder, and have a handy window, put a few things in it on sale—such as a gipsy or fancy table, two or three brackets, and other pieces of work that are likely to take the fancy of those who have money to spare and spend. Very simple instructions on lathe making will soon appear, from the pen of a "born lathe maker."

Wood Engraving.—T. O'C. (*Plumstead*).—You say:—"I have a fair knowledge of drawing, and in order to make that knowledge marketable, I want to work it up so as to draw for the various illustrated weeklies—to become an artist on the staff, not an occasional contributor." To become "an artist on the staff" you must be possessed of a decided talent for drawing; and if you can really draw well, you might submit some sketches to some of the powers that be on the illustrated papers. At the same time, I must warn you that there are many others on the same trail as yourself—prospecting for happy hunting grounds in this direction. To be an artist, you need not be practically acquainted with wood cutting and engraving, but it is decidedly of advantage to an engraver to be able to draw. I am not acquainted with any good book on wood engraving, but I think I may venture to say there is one on the road, which, I trust, will find publicity in WORK. I am sorry I cannot give you better advice than to first catch your editor of an illustrated paper with inducements and enticements in the form of well-executed and taking sketches. This is the hardest part of the business, as you will find, but having landed your editor, the rest is comparatively easy.

Upholstery.—A. S. (*Edinburgh*).—Complete and thorough instruction will be given on this subject in WORK, as well as on all things that are more or less directly connected with it.

Glue-Paste.—J. G. (*Stanningley*).—Paste mixed with glue—*i.e.*, glue dissolved in the hot water when adding it to the flour—will be found sufficient, as glue for so large a surface is difficult to manage.

Bronze Powder.—I. G. W. H. (*Uxbridge Road*).—Hughes & Kimber, West Harding Street, Fetter Lane, supply the bronze powders in every shade and quality.—J. G. G.-W.

Bunsen Battery.—ENGINEER writes to point out a clerical error in the second article on the Bunsen battery. On p. 22, second column, near the bottom, instead of "·08 volt," read ·08 ohm. Thank you for your kindly criticism. It was merely a slip of the pen, as you will observe by comparing it with the calculations just below the line in which it occurs.—G. E. B.

Model Making.—BABY MODEL MAKER.—I must answer one question by another. What kind of model do you require? Of what do you wish to have a model? Model making covers a tolerably wide field, and although I have nothing whatever to urge against model making, I cannot help thinking that what is now appearing will prove of equal assistance to yourself—a youth of fifteen, in the first six months of your apprenticeship—and your fellow-apprentices. You say you think WORK "ought to centre more on wood and metal working and trades. Such topics as (Bunsen) electric batteries, painting photographs, and electro-plating, are rather out of the proper sphere and mission of WORK, and are only interesting to a very small portion of the readers, while to the large majority of wood and metal workers it is of no use." It is not probable that everything that appears in the pages of WORK will be equally welcome to every reader; but I may say, that on the principle that everybody is somebody's darling, or ought to be, so every pursuit is somebody's hobby. Take up one of the subjects that you look on as being of no use to you and make it your hobby. It will widen your experience, and, perhaps, some day, when you may least expect it, it will prove of positive use to you in the money-earning point of view.

Index to Numbers of Work.—INDEX.—I am obliged to you for your suggestion, which is noted for adoption, if it be found necessary at any future time. As each number of WORK consists of separate papers of some length, and not of a number of short paragraphs, "a condensed index of the contents of the number" seems scarcely requisite. Mostly each article is headed with a brief synopsis of its contents, which is indirectly an index to its subdivisions.

Composition for Raised Ornament.—H. S. F. (*Worcester*).—If the ornament is only to be slightly raised on the card, etc., for the display of gilding or bronzing, a raising composition is sold for the purpose by artists' colourmen, or one may be made by mixing whiting, flake white, and gold size. If the card or paper be quite smooth, roughen it a little with the edge of a knife, and the composition will stick. Paint it on with a camel-hair brush, which should be kept well filled at the point to flow properly; the composition should be as thick as treacle. Successive coats, with intervening dryings, can be laid on till high enough. It makes a good ground for gilding upon. If the relief is to be considerable, and on wood, etc., it may be well to satisfy the grain of the wood with linseed oil, to prime it with linseed oil and whiting, and to model the ornament on in a putty composition (whiting and linseed oil). Flake white added to this will make it set harder, but it is poisonous. A better composition for modelling ornaments for fancy articles is said to be plaster of Paris, with 2 per cent. of powdered althea root. This can be worked upon for an hour, after which it sets as hard as ivory; but more difficulty might be found in making this stick to the board.—M. M.

Advertisements in Work.—R. G.—Your suggestions shall receive attention, and shall be adopted if possible.

Organ Building.—R. B. (*Salford*).—The subject of American organ building will be taken up first, and that of making pianos. I do not think it likely that instructions will be given for making a barrel organ.

Artificial Legs.—BERNHARD.—I must draw the line somewhere, and I think I must draw it in one direction at artificial limbs, legs, arms, and eyes as well. The only man I know whom I could ask to write on the subject is Mr. James Gillingham, of Chard, a specialist of the highest order on this branch of manual and mechanical work, and he is far too busy at all times to put pen to paper. It may be that this may meet the eye of some one who is suffering, or who has friends suffering, from loss of limb, spinal complaint, distortion of any kind, etc. All such as these I strongly recommend to send for Mr. Gillingham's book, which will show in how many remarkable cases he has been most helpful and most successful.

Model Steamship Construction.—M. M. (*Glasgow*).—I will not pledge myself to a series of articles on this subject, but I may say that papers are in preparation on a steam launch, which will afford instructions on the method to be followed in building such a vessel from beginning to finish.

Sounding Board of Dulcimer.—DULCIMER writes:—"I should feel obliged if you would inform me of the proper dimensions for the sounding board of a dulcimer of twenty-one notes, eighty-four strings. Of course the frame would be on the same angle. I think a description of such an instrument would be welcomed by many subscribers, as it is easy to make and to play when made."—[If any writer likes to send in a paper on the construction of the dulcimer on approval I shall be glad to receive it.—ED.]

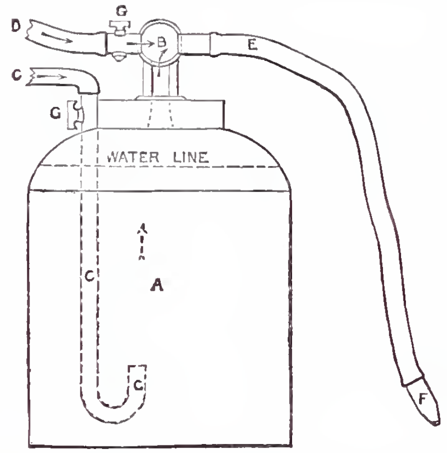
III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Polishing Oak Floors.—H. N. (*Bexley Heath*) asks, "How to polish oak floors that have been polished before. He has tried beeswax and turpentine, but that does not answer very well."

Fretwork Patterns.—W. E. M. sends two sheets from a fretwork pattern book, and is desirous to know who may be the publishers of the book, as he is anxious to get the book itself, regardless of expense. He is told that it is an American publication. If any reader can give the desired information will he kindly do so? The patterns sent to me are on sheets 14 in. × 11 in.; they are printed in black on white. Plate 2 (thus numbered) is a photo frame, with imitation door covering photo opening on hinges on one side. The door is fret sawn, and so is the gable-shaped finial with which the frame is surmounted. On each side of the top is a spray, the outline of which is shown on the frame in white dots. Fittings for supports of frame are also given. Plate 15 gives nine small patterns, embodying the adventures of a man and his donkey and donkey cart. The man comes to grief at first; but at last, by the advice of a passer-by, he puts the donkey into the cart—a proceeding which, apparently, causes trouble to both the bipeds. Perhaps this description of the particular plates may lead to the identification of the book itself.—ED.

Refrigerator.—URGENT writes:—"Being a reader of your excellent paper, and seeing you are willing to give advice to amateurs, I would take it as a favour if you would answer the following: *How to construct a refrigerator*, or ice chest, to keep meat, fish, etc., during hot weather. I have been asked to make one by a friend; the space I have is 7 ft. long, 3 ft. broad, and 3 ft. high, and also to use the top as a counter. There is also a descent for drainage, if wanted."—[This subject is thrown open to all constructors of refrigerators, and doubtless a paper on the subject from a practical man will soon be forthcoming.—ED.]

Oxyhydrogen Blowpipe.—T. W. B. (*Barnsley*) writes:—"I enclose a sketch of an oxyhydrogen blowpipe which I have devised, although I have never seen one. I enclose it for your inspection. Kindly answer me through 'Shop,' and say if you think it will be a 'workable' and 'safe' instrument. In the sketch, A is a tin chamber containing



water through which the hydrogen gas bubbles up from the pipe, C, into the chamber, B, where it mixes with the oxygen from the pipe, D, and passes immediately to the burner, F. G, G, are stop taps."—[I have given a half-size reproduction of your sketch, which was full-size, and I leave it to readers who are skilled in this matter to determine if your blowpipe be in every respect that which you hope it is.—ED.]

Wood Colouring.—"OX GALL" writes:—"I have made an overmantel in deal, and I want to know how to stain it a very dark colour in imitation of old black oak; also how could the dull polish seen on such wood be simulated with as little labour as might be consistant with a good effect."

French Polishing.—T. A. (*Belfast*) asks for "some information on the different methods of polishing wood, French polishing, wax polishing, etc. I French polish my fretwork as well as I can, having oiled the wood with linseed oil first, but invariably after a time the oil comes through the polish and spoils the work. I would like to know what preparation I should use to prevent its doing so."

Glaze for Finishing French Polishing.—W. H. B. (*Redditch*) writes:—"Could you tell me, through your valuable paper, WORK, a good receipt for making glaze for finishing off French polishing?"

Photo Colouring.—EXPECTANT (*Hull*) writes:—"I am an amateur artist (or, rather, try to be), and your articles on Crystoleum Painting and Sign Writing have interested me considerably. I should esteem it a favour if some one would kindly inform me whether photographs can be successfully coloured with water colours; and, if so, what is the best method, as I have often tried to colour them same as ordinary paper, but always failed."

Trade Notes and Memoranda.

SUGAR has been recently recommended by an Italian engineer as an anti-incrustation agent for steam boilers. In a boiler containing 126 tubes, the use of 2 kilos. (about 4·4 lbs.) of sugar per week had the effect of so far reducing incrustation, that at the end of four months only a very thin scale was formed, which was easily removed.

SOME of the remarks made by Mr. Sanders in his recent lecture on "Wood Carving" at the theatre of the Albert Hall are well worth perusal. He told his audience that carving should never detract from the use of the object, or weaken its construction. To construct decoration, instead of to decorate construction, is one of the greatest crimes an architect can commit. The use of glass paper is most mischievous, for it obliterates the mark of the tools, taking away all life and vigour, and leaving nothing but an inert mass of dulness behind. He said he looked forward to the day when the State would provide an institute for the carver, furnished with the best examples of ancient and modern woodwork, a reference library, and a staff of duly qualified masters, for construction, design, and carving, assisted by the advice of the great artists of the day.

AN enormous block of coal has been cut at the Abercarne Colliery as a specimen of the Welsh mining industry for the Paris Exhibition. It measures 7 ft. 6 in. high by 5 ft. 6 in. wide by 3 ft. 6 in. deep, and weighs 5 tons 10 cwt. It was hauled about a mile through the workings to the pit shaft. Five other blocks, each weighing 2 tons, will accompany it.

A PAPER read at a recent meeting of the International Society of Electricians in Paris contains the following items:—The total cost of the Exhibition to the French Government and town of Paris is estimated at about £2,000,000. There are, in round numbers, 50,000 exhibitors, each of whom will spend on an average £120, representing an additional outlay of £6,000,000. The number of hours during which the public will have access to the Exhibition is 2,520, making the cost of the Exhibition per hour about £3,000. The total electric lighting of the Exhibition is estimated to be equal to that of about $1\frac{1}{2}$ million candles.

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WORK

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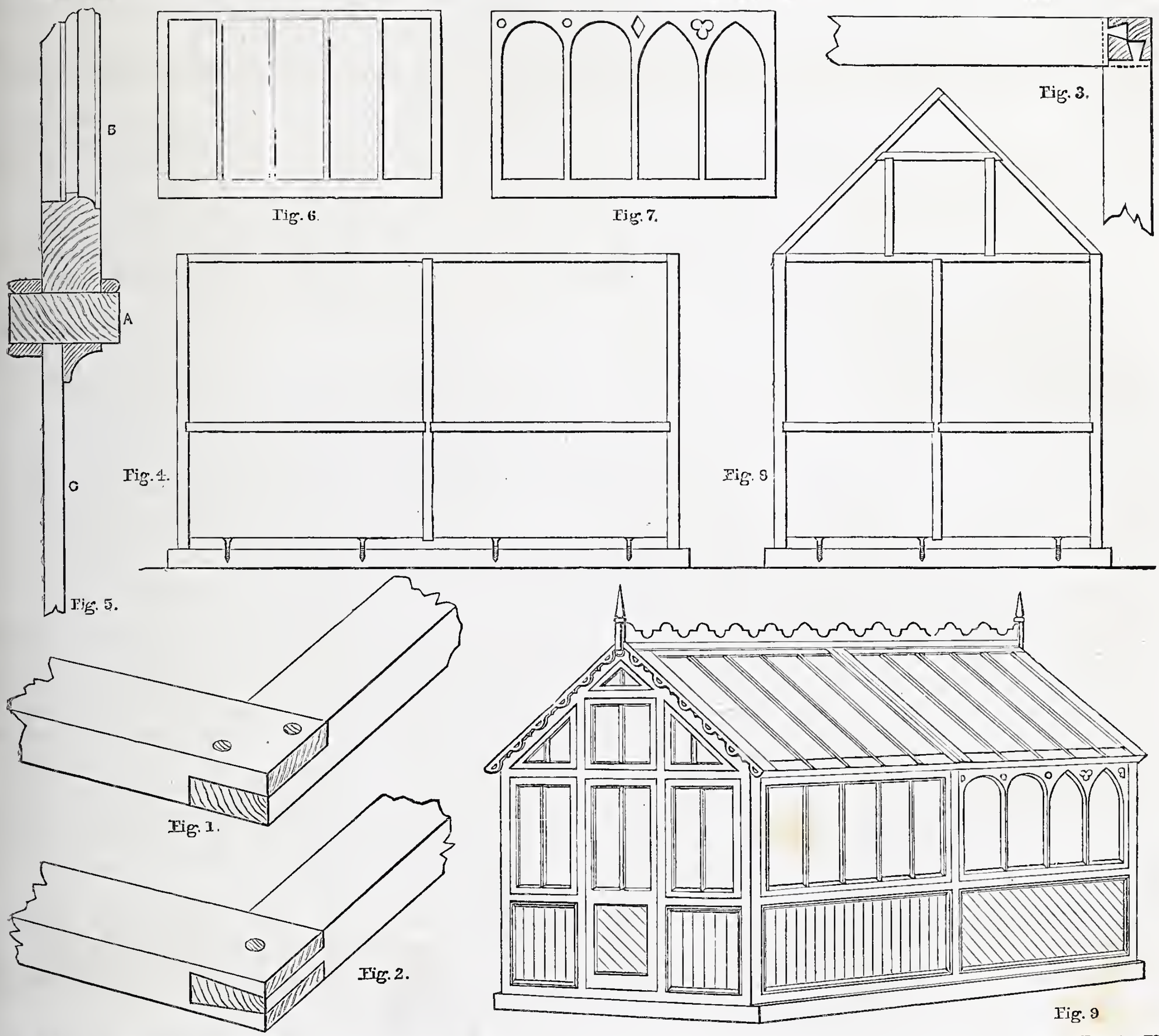


The Tenant's Greenhouse. Fig. 1.—Mode of Halving Sill. Fig. 2.—Mode of Dovetailing Sill. Fig. 3.—Mode of Joining Rails to Posts. Fig. 4.—Elevation of Side Framing. Fig. 5.—Section of Belt Rail (A), Sash (B), and Matchboarding (C). Fig. 6.—Sash for Upper Part of House. Fig. 7.—Alternative Method of Cutting Sash Heads. Fig. 8.—Elevation of Closed End. Fig. 9.—The Greenhouse Complete.

THE TENANT'S GREENHOUSE.

UNATTACHED TO THE SOIL AND REMOVABLE AT PLEASURE.

BY GEORGE LEBRUN.

PREPARATION OF GROUND—FRAME OR SILL—FRAMING OF HOUSE—BELT RAILS—FILLETS—SASHES IN ALTERNATIVE FORMS—VENTILATOR—END OF HOUSE—APPEARANCE WHEN COMPLETE.

THE possessor of a piece of garden ground, who is fond of cultivating choice flowers, often finds himself wishing for the addition of a greenhouse, in which he may rear those delicate plants that to leave in the open air, exposed to the many changes of our variable climate, would soon kill. Doubtless, many do erect a small conservatory, and find much delight in its possession, while, if the house and garden are their own property, it adds considerably to their value. But there are plenty of less fortunate individuals who simply rent their houses from year to year, or even from month to month; and although the erection in their garden of a small greenhouse might not be very costly, still the knowledge that, upon their removing to other premises, the landlord would step in and claim it as his property, often acts as a deterrent, and so the luxury is foregone, and they have to content themselves with what flowers they can manage to rear in the open air.

Now, without entering into the merits, or the justice, of this right of the landlord to claim all erections put up by the tenant that are fixed *in* the ground, I propose to show how a greenhouse may be built *on* the ground, and so, in a legal sense, may be removed in the same way that a barrel or box could be taken away if only left lying in the garden; that is, I mean to say that it will simply lie on the ground in the same manner as the barrel or box, and be in no way fixed to it. Further, as the several pieces and sections of the building will be held together by means of screws, it may, I think, with every right be considered a "tenant's fixture," and be taken down, removed, and re-erected in the new garden.

The particular greenhouse for which the design, details, and sizes are given, will be 12 ft. by 8 ft.; this is a very suitable size for a small garden, and does not cost much for material, while those whose requirements or aspirations demand a larger size can easily increase the dimensions, the manner of construction remaining the same.

Firstly, then, the ground on which the house is to be put up must be laid off and nicely levelled; then four 7-in. by 5-in. battens, two of which are 12 ft. 3 in. and two 8 ft. 3 in. in length, are taken and joined at the four corners by halving them into each other, as in Fig. 1. Two holes, 1 in. in diameter, are bored down through the halved parts at each corner, and oak pins, fitting tightly, driven through them.

You have now a frame 12 ft. 3 in. by 8 ft. 3 in. There is no need to plane up any of this framing, but, after cutting off the ends of the oak pins that project from the corner holes, it should receive a good coating of coal tar. This frame forms the sill or foundation of the house, the upper part of which rests upon and is fixed to it. The frame I have described can now be put in its final position *on* the ground previously levelled up, care being taken to get it perfectly square by measuring diagonally across from corner to corner, after the manner of squaring a sash. There is an alternative method of joining the ends of the sill that may be adopted; it is shown at Fig. 2; the corners are dovetailed, and a single pin driven through to prevent slipping. This mode of joining is the best, but entails some extra care and labour.

For the framing of the house four posts are required 7 ft. long by 4 in. square; also four rails for the sides 11 ft. 8 in. by 4 in. by 2 in., four rails for the ends 7 ft. 8 in., and five upright pieces 6 ft. 9 in., all of the same width and thickness as the side rails. The dimensions given are the *exact* sizes when squared up and finished, so that allowance must be made for cutting when procuring the wood. The top and bottom rails are dovetailed into the posts in the manner shown in Fig. 3, and secured with two long screws in each end. One upright piece is put in the centre of each side, one in the centre of the closed end, and two in the front end, 2 ft. apart, to serve as door frames. The upright pieces are cheeked ½ in. into the top and bottom rails, and are also secured by screws put in on the angle. Fig. 4 is an elevation of the framing of one side, showing the manner of attaching it to the sill by means of 5-in. wood screw bolts, the heads of which must be sunk flush with the surface of the wood. Pieces of the same scantling as the rails are now put in at a height of three feet from the upper side of the sill; they are halved and screwed in the same manner as the uprights, and, for the sake of clearness, I will term these pieces the "belt rails" when I have occasion to speak of them in the course of my description.

Fillets 1 in. wide and ⅝ in. thick are now put round all the openings on the inner side. These fillets should have a bead run on the edge, and be mitred at the corners, so as to form a better finish to the inside of the house than if they were left plain; these fillets may be put on with ordinary nails. ⅝ in. matchboarding is now cut into lengths to fit between the bottom and belt rails, and put in its place *without nailing*, and a moulding, mitred to fit the opening, put round the outside, and fastened in with screws; this keeps the matchboarding firmly in its place and allows of easy removal. Narrow matchboarding (about 3 in.) should be used, and, if thought necessary, two bars can be nailed along the inside at top and bottom so that the whole of the pieces come out like panels. The boarding can either be put in upright or diagonally, the latter having the nicest appearance. Fig. 5 shows the various details in section.

The upper openings are filled in with sashes, made to fit, and secured as shown in Fig. 5. The stiles and lintels are of 2½-in. by 2-in. stuff, the soles 3½ in. by 2 in., and the sash bars 1 in. by 2 in. These sashes can either be made square as in Fig. 6, or, if a little extra labour is of no moment, may be made of an ornamental character by putting in a deep lintel and cutting out either circular or Gothic tops, in which case the moulding and glass cheek will require to be worked by hand; this and the sawing out is best done after the sash is glued and cramped together. (Fig. 7.) The piece of dead wood between the panes can be lightened by cutting a trefoil or other ornament out of ⅜-in. wood, and putting it on the top rail between the openings. The closed end of the house is filled in in exactly the same manner as the sides, and the upper part for the support of the roof is framed up by two pieces of 4-in. by 2-in. wood, dovetailed together at the apex, and let into the tops of the corner posts at their lower ends. A square opening is formed with 4-in. by 2-in. stuff, in which an opening sash is hung on pivots, and the triangular openings at the top and sides are filled in with sashes made to fit them. The construction of the end is shown in detail at Fig. 8, which is an elevation of the end framing.

In Fig. 9 a perspective view of the greenhouse, when completed, is shown with alternative methods of making the sashes. I shall allude to this illustration in a future paper, in which I shall speak of it more fully. I give it here, however, as most of those who wish to erect such a structure will wish to see what it will look like, even before commencing operations.

I have described a house technically known as a "span roof" house, partly because a correspondent has asked for instructions for erecting such a structure, and partly because it is better fitted for the requirements of a tenant than a "lean-to" greenhouse, which in ninety-nine cases out of a hundred is reared against the wall of another building, and has not in reality a back of its own. Should any one, however, wish to put up such a greenhouse on his own premises he has simply to nail a wall-plate to the wall to take the upper ends of the rafters and sash bars, and provide for ventilation by a lifting light in the roof. If he wishes to put up a removable "lean-to" on another's premises he must put a back to it.

(To be continued.)

ON CUTTING REBATES.

BY DAVID DENNING.

If the question, what kind of plane should be used to form rebates or rabbets with? were asked of two men, both workers in wood, but one of them a carpenter and the other a cabinet maker, the answers would probably differ. The carpenter would probably say a fillister, the cabinet maker a rabbet plane; perhaps going a step further, each would say the other was making a mistake. The inference which might naturally occur to the mind of the non-technical from such different opinions would be that either tool might be used, or that neither of the men knew what he was talking about. Parodoxical as it may seem, both these inferences are correct, for either the rabbet plane or the fillister may be used in making any ordinary rebate, and the man stating that one or other tool should be used exclusively, could certainly know very little of the work to be done by the other.

How then does it happen, it may be fairly and properly asked, that two men, both presumably skilful in their own departments of joinery, one the cabinet making and the other the building, use different tools to effect the same result? The answer is simply because each finds the tool he advocates is the best for his own purposes. Ask a cabinet maker why he prefers a rabbet plane, and he will at once say that it is better for the comparatively small work he is generally employed in making. It is to the fillister what the smoothing is to the jack plane. Even the joiner will at once acknowledge that if a finely-finished rebate is wanted, the rabbet plane may be used with advantage, but only after the fillister has done its share of the work. The cabinet maker, on the other hand, will object to using the fillister at all, unless, indeed, on exceptional pieces of work or from personal idiosyncrasy. He will state that any advantages which may exist in the fillister are rendered useless from the amount of labour required to force the cutter in front of the iron through hard wood—a piece of Spanish mahogany, for example. He is not far wrong, for though it would be incorrect to say that a rabbet could not be cut with a fillister—the side fillister in ordinary cases preferably—in hard wood no sensible man would voluntarily choose the tool which induces the greatest amount of fatigue when another would answer his purpose as well or better. In soft wood, such as the builder mostly uses, the fillister cuts well enough.

But, says this individual, only just look at the convenience of being able to "set" the fillister to any gauge, and the fence to serve as a guide; the rabbet plane is destitute of these, and with it the work cannot be so well done. What is there to keep the plane straight?

Well, skill assuredly counts for a good deal. If a man has been in the habit of working without a fence, he does not feel the need of it so much as another who has been trained to depend on it. Of course, a line to work must be marked in some way, with an ordinary gauge, for instance, or, where extreme accuracy is not required, by drawing with a pencil. Careful manipulation does the rest. As for the actual details, such as the mode of holding the plane and the use of accessory tools, they vary. One man will use the plough to form a groove to the required depth, another will be content with cutting gauge and chisel to remove a little of the waste wood before taking up the rabbet plane, while a third will simply rely on his fingers. Each, if he be intolerant of other ideas than his own, will claim his own method as the best, and doubtless it will be for him; but if he be a man of liberal mind he will at once say that there is no absolute best, and that it altogether depends on the custom of the worker.

It is rarely indeed that a good practical artisan, who has arrived at the years of discretion, has not found out which is the most convenient way for himself personally to use the ordinary tools of his craft. He may go to the length of telling youngsters who ask him which way he finds best, or even in friendly chat will discuss with others equally as competent as himself the pros and cons of various methods, but as for saying that every other but his own must be wrong—well, to do so would not reflect credit on his intelligence, but it might, and very likely would, be very strong presumptive evidence that his work would be that of a "duffer." Not that even such workers are not useful sometimes, so if any of them read these lines, and feel inclined to take umbrage, perhaps they will kindly remember that the word is used in a Pickwickian sense, and that they are frequently to be thoroughly relied on for doing whatever they have been accustomed to do—turning the grindstone, for instance, to the entire satisfaction of all concerned.

But, it may be inquired, do no workers fall into bad habits in their methods? do they invariably choose the best for their particular purpose? To answer this fully it would be necessary to consider many points in detail; but without by any means suggesting that absolute perfection exists in any workshop, professional or amateur, it may safely be conceded that most mechanics have a very fair idea of what suits them best. The cabinet maker and the carpenter can therefore very well agree to differ on cutting rabbets and the proper tools to use, remembering that to find fault with each other simply shows imperfect knowledge of the requirements of both trades, however competent one may be to express an opinion about his own. "Eh, mon, it's a graat peety that we canna a' think alike; but ah'll no change ma ain opeenion for that o' ony ither body." "Ma ain opeenion" is that it is at any rate rash to condemn other methods or tools if we do not know the reasons for them being used; and that occasionally, very occasionally, the least little bit of toleration of other people's mode of working might be better than none at all, or wholesale condemnation.

BURGLAR ALARUMS:

How to Make, Work, and Maintain.

BY GEORGE EDWINSON BONNEY.

INTRODUCTION — ELECTRIC ALARUMS — HOW TO CHOOSE AN ELECTRIC BELL—HOW TO MAKE THE ELECTRIC BELL—THE WOOD BASE—THE METAL FRAME—THE MAGNETS—THE CORES OF THE MAGNET.

How truly delightful it would be if all honest people could dwell together secure from alarm from burglars, in an Arcadia where bolts and bars and locks were not needed, because "thieves do not break in and steal!" Such a state of security cannot be attained in "happy England" by persons holding portable property, for thieves are ever on the alert to enter an unlocked and unlatched door or climb through an open window to relieve the honest householder of his worldly goods. Because of this failure on the part of dishonest neighbours to recognise the law of *meum et tuum*, the honest man is compelled to live in an atmosphere of suspicion, and secure his property under the safeguard of locks and bolts in safes and strong rooms. Those of my readers who have read the "Real Detective Stories," by William Henderson, in CASSELL'S SATURDAY JOURNAL, must know how the thieving fraternity make light work of locks and window fastenings when they have decided to "crack a crib," *i.e.*, break into a house. Locks that cannot be easily picked fail to securely fasten doors when these are under the persuasive influence of the burglar's boxwood and steel wedges, and window fastenings spring back readily as they feel the thin blade of the thief's knife. Not a winter passes over our heads without leaving a long newspaper record of the doings of Bill Sikes and his "pals" in town and country wherever their fancy may lead them. A hand-to-hand encounter with an alert burglar, wide-awake and armed with a steel jemmy, whilst you are just newly aroused and can only defend yourself with the pillow, is not at all a pleasant surprise in the middle of the night. A loaded revolver under the pillow has been suggested as a remedy, but the remedy seems to me to be only one remove from the disease, for burglars now arm themselves with revolvers, and it is the man who gets the first shot who is likely to win at the game of bedroom duels. Revolvers are also dangerous tools to have about a house, or, indeed, anywhere else, for they have an unpleasant knack of going off just when you least expect them to do so, and at such times some friend is sure to get in the way of the bullet.

We want to be apprised of the thief's intentions before he walks, unannounced, into our bedrooms, and we want to receive warning of his operations before he has cleared out all the valuables in the lower rooms. Dogs have been tried, but a dog, however faithful, may not be proof against the bribe of a poisoned bait. Many amusing tales have been told of amateur burglar alarums and their failures; of tea-trays and fire-irons clashing together whilst puss, in her zeal, pounced on the thievish mouse; of torrents of shot making an unearthly din in a milk-pail in the dead watches of the night, because the plug of the pouch had been set too loose: and sundry other futile attempts to set automatic sentinels.

All such failures should now be relegated to the dark ages before the invention of electric bells: there is not any excuse in the present day, on the part of well-to-do householders, for leaving their premises unguarded. For a few shillings, not exceeding one per cent. of the value of the property to be protected, a thorough system of electric alarums may be set up in any house, and these generally scare the thieves away ere they can effect an entrance, whilst they arouse the soundest sleepers to take part in the defence. Electric alarums, properly fixed, are also so certain in their action that they do not give false alarms, nor do they fail to give an alarm should a thief *attempt* to open a door or window guarded by them. They also serve a useful purpose in detecting an open door or unfastened window when all should be closed at night, and it goes without saying that they also prevent the lambs of the house straying from the fold when all the inmates should be wrapped in sleep.

Such a system I hope to fully describe and illustrate in this first paper of the series and succeeding articles.

Electric Alarums.—Electric alarum systems have one feature in common. An electric bell of the continuous ringing type is placed in communication with springs, so inserted in the doors or windows to be guarded as to be kept from ringing the bell when all is secure, but to spring into instant action when an attempt is made to open a door or window. The first necessary article is, therefore, a bell of the right type, and this may be bought at prices varying from 4s. up to 25s., according to quality and size, or it may be made by any man accustomed to the use of tools in metal working. Electric bells vary very much in quality and type. A badly-made bell is dear at any price, for any purpose, but is specially objectionable when set as a sentinel. If badly-wound magnets are employed, and leaky connections are made, it will ruin the best of batteries, and failure will be put down to an exhausted battery. If hard or badly-annealed iron is used in the magnets, the armature will stick close to them on the first contact, and fail to ring the bell. If badly-fitted screws are employed, or badly-constructed contacts are used, or the metal parts improperly fixed to the wooden base, the bell may cease to act just when most required, and effectiveness is sacrificed to false economy. Even as the ship was lost for lack of the proverbial "ha'porth" of tar, and for want of a nail the horse was lost, so a house may be lost for want of a proper bell.

How to Choose an Electric Bell.—As so much importance attaches to the bell, I will here show the good and bad points of electric bells as a guide to their choice. If a bell mounted on a metal frame with a wood base is chosen (and some of the best bells are so made), see that it is made of teak or mahogany, or some such wood not easily warped by changes in the moisture and temperature of the air. If the base is of iron or brass, or the bell is of the Jensen pattern, see that the contact pillar is well insulated from the metal work with collars of ebonite above and below, and that the connecting screws are similarly insulated. See that the set screw has good threads, is well fitted, and is provided with a good lock-nut. If this part is defective, the armature spring will work out of contact under the jarring action to which it is subjected. Have the bell set a-ringing, and then try to stop it by placing the forefinger lightly on the armature; if this sticks to the magnet in any way, and does not readily recover itself, reject the bell, for the iron of the magnet is, doubtless, unannealed. A good electric bell magnet should attract iron filings when the current is passing through its coils, but should drop them the instant the current is interrupted. The set screw should be tipped with platinum, and this tip should be in contact with a speck of platinum soldered or riveted to the armature spring. Get the vendor to guarantee these parts to be of platinum, as German silver or aluminium is sometimes fraudulently substituted. A drop of nitric acid from the tip of a glass rod will turn German silver green, and a drop of hydrochloric acid, applied in the same way, will dissolve aluminium, whilst these acids, separately, have no effect on platinum.

Specially made bells for alarums, fitted with automatic relays, are now sold by respectable dealers in most large towns. If these cannot be obtained, the next best will be a good 3-in. bell of the vibrating or trembling type. Single stroke bells are useless for this purpose. A fairly good 3-in. bell costs 10s. 6d., and the same with automatic relay from 17s. to 18s.

How to Make the Electric Bell.—I have received so many grateful testimonials from working men who have made electric bells from my instructions, that I begin to think almost any man can make such a bell if he has the means at his command to get the tools and materials. It should be understood, however, that there are grades of makers as well as grades of bells. The man who buys materials and sets men to work for him in making bells claims to be a maker of electric bells, although he may not know how to put the parts together. Another man buys the various parts, and, putting them together, says he has made an electric bell. Who will dispute his claim? The various parts were not an entire bell until he put them together. It is to such a would-be maker of electric bells I now write. To each and to all I would say, make as many parts of the bell out of the raw material as you can; only a stickler for originality will go to the extent of exacting such a strict adherence to the letter as to require a maker to cut his own wood, cast his own metal, draw the wire, and cover it with silk spun by himself. Very few, if any, makers of electric bells draw the wire and cover it, or cast the gongs, as this is better and more cheaply done by persons who make it their business.

The Wood Base.—The first requisite for an electric burglar alarm bell is a piece of wood for the base. If the base is for a plain 3-in. bell, select a piece of sound well-seasoned teak or mahogany 8 in. by $4\frac{1}{4}$ in. by $\frac{7}{8}$ in. If the base has to carry a relay in addition to the bell, the wood should be two inches longer. Plane both sides smooth, then cut the planed wood to the form shown in Fig. 1, and bevel the edges on the face of the base. Fill in the grain of the face and edges, and French polish them in the usual manner.

The Metal Frame.—The next requisite is a metal frame to hold the magnet, armature, contact post, and bell pillar. This may be of sheet iron, sheet brass, sheet copper, or even stout sheet tin cut to the form shown in Fig. 2. Or it may be cast in this form in brass, gun metal, or iron. The dimensions are, from A to B $5\frac{1}{4}$ in., from C to D 3 in. As the main use of this frame is to hold all the parts together, and not allow them to be shifted in their relative positions to each other by changes of temperature and jarring motion in the bell itself, the frame may have other forms and be equally useful. Some of these are shown at Figs. 2, 3, 4, and 5. The reference letters in each figure correspond with each other. B shows the hole for the foot and tang of the bell pillar; P, the hole for the foot and tang of set and contact screw pillar; S, the lug or turned-up angle to which the armature spring is fastened; and M, the position of the magnets. The position of the magnet bobbins is shown in Figs. 4 and 5 by dotted lines. The yokes of the magnet cores are, in these forms, made separate from the base plate, and fixed to it afterwards by studs or set screws.

The Magnets.—The next articles to engage our attention are the magnets. These are made up in three parts:—1, the cores; 2, the bobbins or reels; 3, the wire. The following table, from Mr. S. R. Bottone's book on Electric Bells, will show at a glance the relative sizes of these parts for several different sizes of bells:—

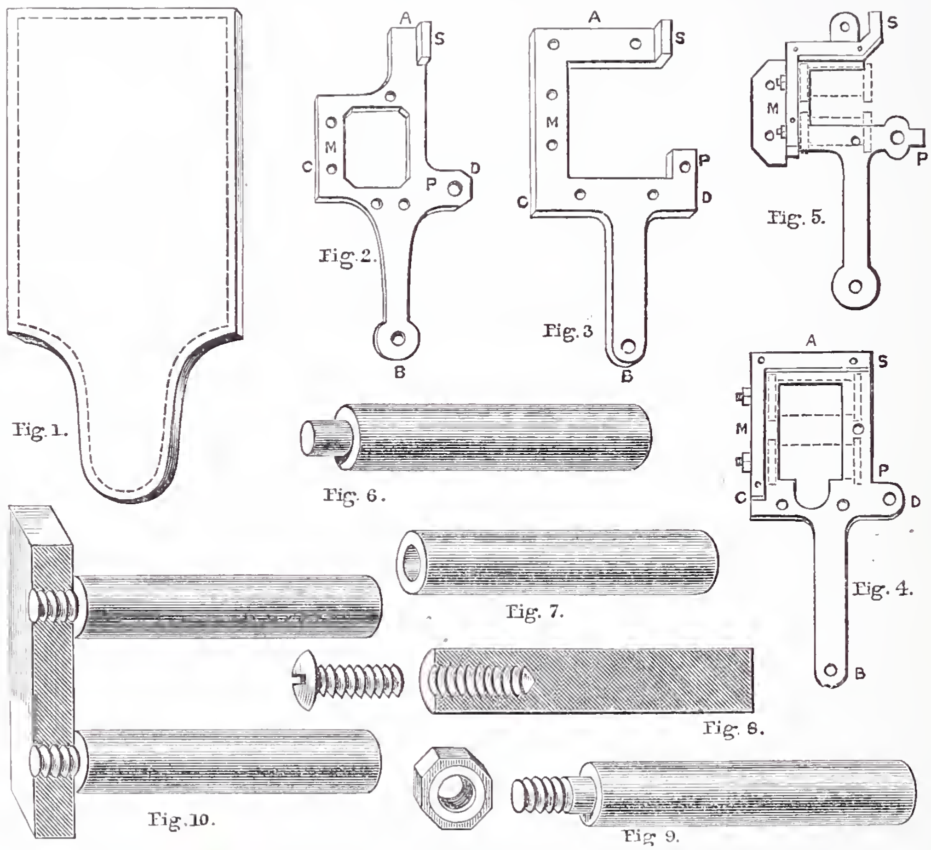


Fig. 1.—Form of Wood Base for Electric Bell. Figs. 2, 3, 4, 5.—Some Forms of Metal Bases for Electric Bells. Fig. 6.—Core of Magnet with End turned for rivetting to Yoke. Fig. 7.—Core of Magnet with End bored and tapped. Fig. 8.—Section of same, showing Screw Stud. Fig. 9.—Core of Magnet with End turned and screwed to receive a Nut. Fig. 10.—Magnet Cores turned and screwed into Yoke.

PROPORTIONATE PARTS OF MAGNETS.

Diameter of Bell.	Length of Magnet Cores.	Diameter of Magnet Cores.	Length of Bobbin.	Diameter of Bobbin Head.	B. W. G. of Wire on Bobbin.
Inches.	Inches.	Inches.	Inches.	Inches.	
$2\frac{1}{2}$	2	$\frac{5}{16}$	$1\frac{3}{4}$	$\frac{3}{4}$	24
3	$2\frac{1}{4}$	$\frac{3}{8}$	2	$\frac{7}{8}$	24
$3\frac{1}{2}$	$2\frac{1}{2}$	$\frac{7}{16}$	$2\frac{1}{4}$	1	22
4	$2\frac{3}{4}$	$\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{8}$	22
5	$3\frac{1}{4}$	$\frac{5}{8}$	3	$1\frac{3}{8}$	18
6	$3\frac{3}{4}$	$\frac{3}{4}$	$3\frac{1}{2}$	$1\frac{5}{8}$	16
7	$4\frac{1}{4}$	$\frac{7}{8}$	4	$1\frac{7}{8}$	16
8	$4\frac{3}{4}$	1	$4\frac{1}{2}$	$2\frac{1}{8}$	14
9	$5\frac{1}{4}$	$1\frac{1}{8}$	5	$2\frac{3}{8}$	14

The Cores of the Magnet.—The cores must be made of good tough iron rod (Swedish iron is recommended). The length given in the above table allows for the ends being turned down and screwed to receive the nuts which hold them in the yoke. Some makers dispense with nuts, and secure the cores to the yoke with screwed studs entering the cores. If this plan is adopted the ends of the cores must be drilled and tapped to receive the studs, and it will not be necessary to cut the pieces of iron so long as when they are to be fastened by nuts. However tough and good the iron may be, it must be annealed to make it quite soft after the cores have been cut off. If the cores are made of hard iron, or are imperfectly annealed, they will retain some magnetic influence over the armature after contact is broken. Iron cores are annealed by heating them to a blood-red tint in a good fire, covering fire and cores with hot ashes and allowing all to cool down gradually for some ten or twelve hours before disturbing the iron.

After they are annealed, the back end of each must be turned down to form a tang with shoulder to fit in the yoke, and the front ends filed level and smooth to form faces for the armature. If the iron rod is quite round and smooth the cores need not be turned, but the roundness and smoothness should be seen to, so that the cores may fit the bobbins of the coils, for it is most important that the wood of the bobbins should lie close to the cores.

If the cores are to be riveted to the yoke, this must next be done. If they are to be attached by nuts, the tangs must be screwed and the nuts tapped to fit them. If they are to be fastened by screws or studs, the holes must be drilled and tapped to receive the studs. At any rate, all this must be done before the bobbins are made, and wound with wire. In Figs. 6, 7, 8, 9, 10, I show several ways of attaching the cores to the yoke, but I consider the neatest and best to be either Fig. 7 or Fig. 10.

Before bringing this paper to a close, I may remind the readers of WORK that prevention is better than cure, and that it is better to frustrate Mr. William Sikes's amiable intentions towards your belongings and yourself, if need be, by fitting a house with alarums that cannot fail to herald his approach and declare his presence, than to have to calm down scares, or, perhaps, plug bullet holes in body or limbs. Moreover, prevention is the cure itself, for if burglars could be treated wherever they went to an experience of this, the veritable "burglar's horror," they would be compelled in self-defence to betake themselves to honest ways.

(*To be continued.*)

SOME LESSONS FROM AN OLD BUREAU.

BY DAVID ADAMSON.

(*Continued from page* 116.)

II.—Insides of Drawers—Cutting Out—Gluing and Dowelling—After Jointing Up—Hints on Dovetailing—Fitting Drawers—Inner Top and Rails—Antique Furniture—Facing Slips.

At the end of the preceding paper I made mention of the "insides" of the lower drawers. If I were writing for professional workmen only, I need not say anything as to what is implied by this term. I must not forget, however, that I am writing for amateur workmen as well, and as some of them may not understand what is meant by "insides" of drawers, I may explain that the sides (or ends), back, and bottom of a drawer are often thus designated. Thus, in speaking of a chest of drawers—which is very much akin to the bureau—it is perfectly well understood when it is said to have "pine insides" or "mahogany insides," that the drawers themselves are made of the wood specified. Where pine is not considered good enough, ash insides are commonly used with oak, and mahogany with walnut or mahogany work. There is no hard-and-fast rule on the matter; but by accepting and adopting trade customs—where they are not prejudicial to durability—the amateur artisan may to a great extent avoid the "amateurish" character which so frequently betrays itself to the experienced eye. His work may be equally serviceable, but, as a general matter, it is not well for him to depart from the methods which are found the best by practical workers, unless he has some good reason to do so. This is far from saying that improvements are not to be made, nor recognised when made, either in tools or methods; but as a rule, if there is anything good in them, they are the outcome of study and thought, prompted by such experience as the amateur can hardly expect to have. These remarks may seem hard on amateurs and beginners, but I trust those who may be inclined to resent them will consider they are given in a friendly spirit by way of enabling those who wish to do so to turn out work in the best possible style.

But with regard to the "insides:" if pine is to be discarded for these parts, it is only necessary to read Nos. 32 to 36, both inclusive, as being of the wood preferred to it. By the way, referring to mahogany for these parts—and I may say that, personally, I like this wood even with oak—it is not to be supposed that choice wood is necessary. Cheap baywood is quite good enough; but the reminder that mahogany insides are often made of *cedar* may be of service. The cedar used for such purposes is the kind of which cigar boxes are made, and must not be confounded with what is commonly called pencil cedar. It is easily worked, and is a most suitable material for "mahogany" insides. Perhaps the mention of pencil cedar may suggest to the would-be maker of the bureau that the small drawer insides might be made of it. It is a nice delicate wood for the purpose; but the fact must not be overlooked that the oil contained in it, and on which its fragrance depends, is sometimes apt to discolour note-paper, etc., left long in drawers made from it. Moth, however, object to cedar (pencil), so that there are advantages attaching to its use, and any materials subject to the attacks of these little destroyers placed in cedar may be regarded as secure from their ravages. When the wood is finally decided on for the various parts, the bureau may be proceeded with.

The first thing is to cut them out to the sizes ascertained from the working drawing and list. It is hardly likely that the stuff will be wide enough in the plank to allow of such parts as the ends and large drawer bottoms being got in single pieces, and they must be jointed up. Do this, to get the necessary width, before smoothing the stuff—that is to say, while it is still rough. Thin parts, such as drawer bottoms, will merely require gluing together, but the ends should be dowelled as well. It can hardly be necessary to explain the operation of dowelling, as it is presumed that, before attempting to make a piece of furniture such as this bureau, the rudiments of joinery will have been mastered; but as it is just possible some may be stuck by not knowing what dowelling means, the hindrance may be removed by referring them to an ordinary extending dining-table. If they will open this out and look, they will find that on the inner end of one of the halves there are a few round pegs, which, when the table is closed up, fit into corresponding holes in the other half. These pegs are dowels to all intents and purposes, but they are only glued at one end. Put similar pegs, glued all over, between two boards, also with their edges glued, and we have what is known as the "dowel joint," a full description of which has already been given. Gluing the boards together might do, but dowelling, when properly done, makes the joint stronger. Another part that may require jointing up, in order to get the necessary width, is No. 3—the table-top. If the part under the pigeon-holes is pine (which is suggested merely to save cost of material), a join will certainly be necessary, and it will be well to see that it is so made that it will be out of sight—viz., a little back under the superstructure. In connection with the top, another small economy may be practised without detriment to the work, though it is almost a "bull" to say this, as, if the work were to suffer through any niggardliness in the use of material, it could hardly be called economy. Wood costs money in proportion to its thickness, and a ¾-in. or even ½-in. piece of oak will do very well for the part under consideration. If, however, it is of this thickness, the front edge must be lined up to improve its appearance, and also to allow of the lid being made a proper thickness—½ in. would not be enough for this, and, as will be seen later on, the lid, and, at any rate, the front of the part to which it is hinged, should be of the same thickness.

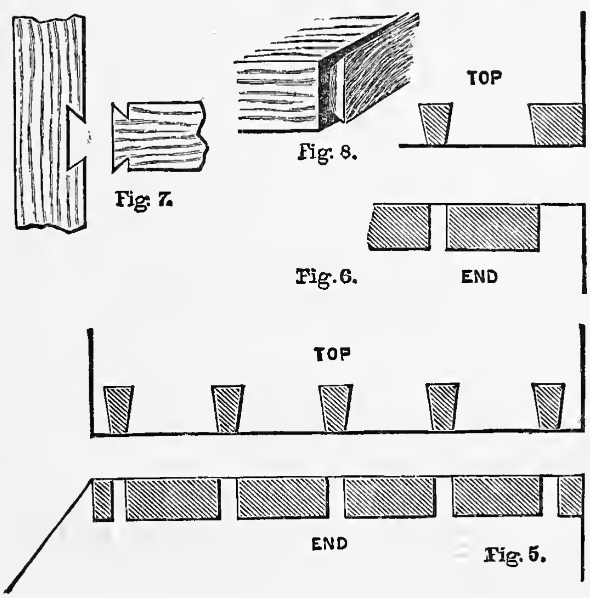


Fig. 5.—Dovetailed End of Top. Fig. 6.—Ends and Back: Top Corner. Fig. 7.—Joint for Drawer Bearer. Fig. 8.—End for Drawer Bearer.

In Fig. 3, the piece thickening up the front edge is indicated, though it will be understood it is not necessary if the top is made of 1-in. stuff; in fact, it would only be a hindrance unless the lid were made thicker too. After jointing up any pieces it will be well to let them stand by for a day or so in a dry warm place for the joint to set firm, before using them roughly. The next proceeding may be to plane up and smooth the ends and top (No. 2), after which they and the bottom may be put together. The method of fastening them is by dovetailing. In the bureau we are working from the plain dovetail is used, but as this shows the end grain of the top on the ends, and of the ends on top (see Fig. 5), in which the shaded portions represent end grain, it may be objected to by some who like the neater-looking appearance of the mitred dovetail joint. This, however, is rather difficult of construction, and as an explanation of the method of making it would almost require an article by itself, more need be said about it. One thing, however, may be said in favour of the plain dovetail: that is, it is stronger than the other, and if it is neatly made, there is no real reason why it should be regarded as unsightly. It is primitive rather than objectionable in appearance. Do not fall into the common mistake of making the pins or dovetails—*i.e.*, the pieces of the ends which fit into the spaces cut into the top—too thin, under the idea that they look better when they taper away almost to nothing. In such a case as the present they will look paltry if they are less than ½ in., and may be larger still with advantage. The number of dovetails shown is five, but there is no necessity for adhering to this.

It occurs to me that a bureau would not suffer in appearance by having the pins and sockets equal, but this is merely a matter of opinion which the maker must decide for himself. To some, the last pin, the one nearest the back, may appear a little objectionable, and that it would be all the better for being a little further from the edge, or even omitted altogether, and the end carried up as shown in Fig. 6. At any rate, if this plan is adopted there will not be the same risk of splitting the top that there might be in the other if the pin happened to be fitted into its socket with too much force or unevenly. A very little reflection will show why. Not that such an untoward event would happen in the hands of a skilful worker, but as it might with others it will be as well to avoid the risk, especially as the second method is at least equally good joinery. The bottom should be manipulated in the same way, and should be left projecting a trifle in front—say ¼ in.; if a little more it will not matter, as any surplus can easily be planed away afterwards. These pieces, the ends, top and bottom, should only be fixed together dry as yet, *i.e.*, without any glue. If the dovetailing has been properly done they will hold solidly enough when they are wanted to be together. It will be noticed that the ends cannot be forced outwards from the top and bottom, but that any pressure laterally binds the parts more firmly together, owing to the wedge-like spread of the dovetails. It is of the utmost importance that the greatest care should be taken to fit the top, bottom, and end pieces perfectly square and true, otherwise it will be impossible to fit the drawers correctly, so that they may run smoothly and easily. All corners must be right angles, and the width at the back and front be exactly the same. If there is any doubt about getting them so, let the ends slope a trifle, and it should be but the merest trifle, outwards towards the back. I almost hesitate to say this in case any one should mistake the intention and purposely try to make the back wider than the front. This should not be done. The aim ought to be to get the ends perfectly parallel, so that the space at back and front may be equal, but as this would be perfect adjustment, which it would be almost unreasonable to expect except at the hands of the most expert, the caution is given that any excess in size should be towards the back. Indeed, as a rule, the best workers make drawer carcases in this manner.

Perhaps a few words of explanation may be of service, for what applies to this applies equally in all similar cases, and it is just as well to know the "reason why." It will be remembered that drawers are intended to be fitted into this space. Now, just consider how these would run, or rather how they would stick, if, being properly made—that is to say, of an equal width in front and behind—they were forced into places too narrow for them. Of course, wood not being a sufficiently compressible substance, to squeeze the drawers into a space less in size than themselves they would have to be made to fit. This might be managed by making them out of the square, which certainly is not satisfactory, or the fronts would have to be made no larger than the backs, which is hardly an improvement. Mind, I do not say that the drawers would be altogether unserviceable, for if this were so, many a comparative novice might be discouraged from attempting the work. No; they would probably be serviceable drawers, but they would not run easily and smoothly; in other words, they would fit badly, besides being unsightly. Now, if the ends of the carcase spread ever so little outwards to the back, the drawer fronts may be fitted tightly to the front, and the drawers being fairly made, they will run firmly and smoothly without either jambing or wobbling. This is the result to be aimed at, but there are various degrees of excellence between the drawer that fits almost air-tight and yet moves easily, to the drawer that requires a most carefully equalised pull or push to move it. We all know the latter—don't we?—the drawer that starts so easily, but so soon sticks fast, and won't move further till it has been pushed and pulled, first at one end and then at the other. Such are not nice, but they are not worthless; so if all the drawers in the new bureau won't work as they should, do not be unduly despondent. A drawer is not the easiest thing in joinery to make, and if you only get them to run moderately well, be satisfied; but try to do better next time.

In making the bureau, the next thing may be to fit the inner top and rails, or bearers between the drawers, as in addition to the drawing, we have now the ends set up to guide us. It will be noticed that the drawers are graduated in depth, the two short drawers, immediately under the top, being the shallowest, and the bottom one the deepest. The spaces must be accurately set out on the ends, lines representing the thickness of the rails being drawn across their inner sides. The rails are fixed into the ends by dovetail joints, but if this is considered too much labour, a very serviceable plan is simply to dowel them, or even to use the mortise and tenon joint. The best way is, however, undoubtedly to dovetail them. There are several ways of going about this, or rather modifications, but I don't know that any are better than that in the old bureau. The dovetail is cut at each end of the rails right across, and fits into a correspondingly shaped groove in the end pieces (Fig 7). It is obvious that these rails must be pushed in either from the back or from the front till they are in position, and equally obvious that it will be simpler to do so from the front. Now, if they were pushed back till their edges and those of the ends lie flush, it, the dovetail, would show, and it is to hide this that the facing slips mentioned in the remarks column against No. 1 in the wood list are required. Some may prefer that the dovetails should show, and there is no reason why they should not be visible, if they are made as they should be, neatly.

There are, indeed, I may say, critics of woodwork who go the length of saying that it is bad form to hide or conceal any detail of construction. They prefer that methods of construction should proclaim themselves. Of course, those who think so have no need of the facing slips, but I think these will be an improvement. But perhaps it may be said by some who admire the style of joinery that would show all the construction, "because it is so honest, you know," that any concealment is a modern innovation to hide bad work. Truly, if they are correct, there is very little indeed now made that is good. Is it, however, the fact, that to cover up joints, and, by so doing, improve the appearance of a piece of furniture, is an indication of "scamped" work? I say, and so will any one who is acquainted with fair modern woodwork, most emphatically, No! Our ideas of good finish have enabled us to improve on old forms, good enough in their way, but, after all, somewhat rough and crude. It may, however, freely be conceded that it is not the primary object of a piece of furniture to proclaim every detail of its construction to those who are only superficially acquainted with joinery. Perhaps this is where the difficulty is felt by more than one of those who affect to despise modern work, and would have us return to antiquated construction. They can understand the latter, but the former requires more knowledge than they possess. Yes, my theoretical friends, that's the reason for most of your ecstasy over pinned-through joints and other barbarities. I yield to none of you in my admiration of good sound work, but there is no reason why elegance of finish should not be added to it. If it is thought that the slips are not an improvement, do not use them, but it may be said they are on the bureau which is described. As it, to all appearances, dates from the end of last century, and it is certainly not less than eighty years old, in copying it, even the most enthusiastic admirer of our great-grandfathers' work won't be doing violence to his principles. As eighty to one hundred years ago may not seem sufficiently remote to entitle the bureau to be called "old," I may say that the age of articles of furniture is often very much exaggerated in popular ideas by those who have not studied the subject. For example—and it is only one of several similar which have come under my notice—a sofa was once shown me which its owner stated was made during the reign of Henry VIII. Unfortunately for the accuracy of this date, the sofa was made of *mahogany*, and the style of the work showed it to have been made some years after the time "when George the Third was King." Yes, an ordinary piece of furniture which was made a hundred years ago may fairly be called "old"—not antique, perhaps, but still old. Very little furniture, indeed, is as much as 300 years old. The cabinet-making industry was not an extensive one in those days; such as it was, it ran principally into chests. One or two of them may be useful and interesting, but they are apt to become monotonous if one wants to furnish a room with genuine Elizabethan stuff, even though one might be fortunate enough to pick up a settle, a cabinet, and a chair or two to correspond. Sideboards, easy chairs, and the hundreds of convenient forms of furniture now so common, had then no existence.

But, through this digression, the bureau is being temporarily overlooked. We were at the rails, about which it only remains to be said, that if facing slips are to be fixed to the ends, due allowance must be made for them. Perhaps it will save trouble to decide on the exact thickness of these slips at the present stage. They are nominally ¼ in. thick, and must be the exact thickness of the ends in width. Well, whatever the thickness of the slips, cut away just so much from the dovetails on the front edges of the rails so that, when all is fitted up, these and the front of the facing slips will be quite flush. Fig. 8 shows the end of dovetail cut away. The lowest bearer, the one immediately above the bottom board, need not be fastened in so elaborate a manner, but may be simply cut to fit within the ends and lie on the board, to which it can be fastened by a few screws. The effect of this rail is to thicken the bottom board at the front; and the reason why the board was not to be trimmed off flush with the ends may now be perceived, though it will be still more obvious, a little later on, when we come to consider the plinth.

(To be continued.)

PAPIER-MÂCHÉ.

How to Mould It, and how To Ornament it.

BY SYLVANUS WARD.

III.—Decoration—Materials and Appliances—Japanning—Pearl Inlaying—Gilding—Dead Gilding—Designs for Dead Gilding—Raising Composition for Dead Gold—Working Fret Patterns in Gold.

Materials and Appliances.—Of these the most important required for the decoration of papier-mâché are:—

Black japan varnish, which is dark and thick like treacle. It is inexpensive, and is bought by the gallon (price 3s. 3d. to 3d. 6d.) at such shops as Thornley's, 6, Snow Hill, Birmingham. Copal varnish costs from 10s. to 16s. per gallon. Japanners' gold size costs 9s. per gallon. Ordinary tube oil colours, brunswick black, turpentine. Gold leaf, deep and pale; silver leaf, bronze powder of different colours. Also gold powder, if the worker thinks that he can afford so costly an appliance; but as it costs some £5 per ounce, and bronze 10d. only, most persons will content themselves with the humbler substitute, notwithstanding the greater and more permanent brilliancy of the gold.

Pearl, for inlaying. Of this there are three standard kinds:—1. White pearl. 2. Scotch or snail pearl. 3. Aurora pearl. The white is obtained from the shell of the large pearl muscle, the same from which pearl buttons are made. It was the first kind used, and was originally very costly. This is to be procured in the largest pieces, and is, therefore, employed in inlaying on a large scale, as in the squares of chess boards, etc. It has less iridescence than the other varieties, and is lower in price. Snail pearl has a pleasing blush, and colours nicely varied. It is to be had in fairly large pieces. Aurora pearl is obtained from a univalve, auriform shell. It is of finely varied colour, but the pieces are comparatively small. There is also a fourth variety, which has a beautiful iridescence, green being the prevailing hue, but it is less apt than the other three to be sound and reliable. The pearl shells are reduced to flakes by grinding by persons who make it their business to prepare them for inlayers. Pearl may also be procured from these persons stamped out into certain stock forms, such as discs, diamonds, stars, roses, vine leaves, shamrock leaves, bells, etc. These will be in snail or aurora, white not being showy enough for such small matters. By judicious combination, pleasing designs may be formed from these stock shapes. Pearl is purchased by the ounce.

Brushes—a thin sable, an inch long, for fine and moderately thin lines, known to japanners as an "etcher;" also a somewhat thicker sable, half an inch long, known as a "sprigger." In selecting a brush it should be held up to the light, and the thumb nail pressed against the bottom of the hair; this, if the brush is a good one, will cause the top to spread out evenly, and the ends of the hairs will alike be fine. If many thick, blunt hairs appear, reject the brush; if there are only two or three thick hairs they may be removed with the points of a sharp pair of scissors. Wet the brush (the colourman usually has a cup of water at hand for that purpose), and see if it then comes to a good point. Sometimes a brush, otherwise satisfactory, may appear to have too fine a point, owing to one or two hairs projecting beyond the others. This defect may be corrected by laying it on any flat piece of wood, and carefully removing so much of the hair as causes the weakness with a keen penknife.—[N.B. The above remarks may be useful not only to papier-mâché decorators, but to others who use fine brushes.] A camel-hair pencil of the same size as the "sprigger" will also be needed for "pencil varnishing." For laying the transparent varnish over larger surfaces one of the broad, flat, camel-hair brushes sold as "varnishing brushes" should be had; one at about 9d. will suffice. A large round brush will also be wanted for japanning, that is, for laying on the black varnish.

Pumice-stone, rotten-stone, hard and soft, whiting, and a little olive oil, will also be wanted for polishing. Most, if not all, of these requisites may be obtained at the shop above mentioned.

Japanning. — The article being taken from the linseed oil bath is set on a tray to dry, and when oil no longer appears on its surface, a coating of black japan varnish may be brushed over it. Such an article as a vase or a spill cup may be japanned all over at once, but a flat thing, like a tray, after japanning on one side needs to be dried before the varnish is put on the other side. The stove, or oven, in which it is placed should be slightly warmer for this than for drying paste. When dry the coating has to be, to some extent, removed by scraping with a plane iron drawn backwards. So much of the varnish has to be taken off as will remove all gloss, and so much left as will form a ground for after processes.

Should a hollow show itself at this stage it must be filled up with paper dust and black varnish (a mixture technically known as "bomption"), drying it, and scraping it level. In japanning, the worker is tolerably sure to blacken his fingers freely, but the varnish may be readily cleaned off with tar spirit.

If pearl inlaying is intended the papier-mâché is now ready for the first stages of that process, but as the art of japanning can be most clearly described by going straight on with it to the end, we will consider the article under treatment to be intended for gold and colour decoration only, and deal with pearl inlaying later on.

Such, then, being the case, the use of the black varnish has to be continued, drying after each coat, and rubbing down all knots and air bubbles with pumice-stone before the succeeding coat is laid on. Three coats are usually sufficient. To prepare the last coat for decoration it should, after the usual pumicing down, receive an extra rubbing with picked (the finer) pieces of pumice-stone. It has then to receive a still further smoothing by being thoroughly rubbed over with a large bob made of rag, and what is technically known as "sand," that is, pumice-stone pounded very fine in a mortar, and applied wet. After this comes a rubbing with wet, crushed rotten-stone, applied with a smaller rag bob, which application must be continued till all cuts and scratches left by the pumice-stone are rubbed out. If *dead* gilding is to be employed the surface is now ready for it.

If, however, as we will assume, *bright* gilding is to be used, the surface which has now been thoroughly *smoothed* has also to be *polished*. This must be done by rubbing with the palm of the hand and finely powdered *dry* rotten-stone, and afterwards in the same way with whiting, and just a spot of olive oil after this. Care must be taken that there is no grit in the whiting, or it will make scratches. A soft, flat palm gives the best polish, and if properly done a most brilliant jet-black surface will be the result. We now have the proper surface for *bright* gilding.

The different stages of the work at which it is proper to apply pearl, dead gold, and bright gold, have now been shown, and I may next proceed to describe those processes.

Pearl Inlaying.—When this art was first introduced the practice was to cover the required surface of the pearl flake with some acid-resisting paint, such as asphaltum, and then to bite out the form with acid, a process patented by Jennens & Bettridge, of Birmingham, but it was afterwards found that the pearl might be cut. Rectangular forms are best cut with a sharp knife, such as that used by shoemakers for leather, which has been converted into a fine saw by drawing it against a file. Simple curved forms may be cut with scissors; soaking the pearl in water makes it cut more easily, and lessens the danger of breakage. For cutting intricate forms, a very delicate and minute fret saw must be used. Formerly, it was usual as a means of preventing breakage whilst sawing to glue the pearl to a sheet of thin metal, but the later practice has been to glue several flakes together, sometimes as many as six, and to saw through them all at once. The flakes are afterwards separated by soaking in hot water. If the cutting is not quite accurate, any little inequality can be concealed at a later stage of the work with black paint.

Pearl may be used in several different ways—for covering the entire surface, for diapers and set patterns, for forming buildings, for giving brilliancy and richness to fruit and flower subjects, to the wings and breasts of birds, to insects, etc. In all these it is employed in combination with more or less painting or gilding, or both.

To cover the entire surface with pearl is a simple mechanical matter, demanding only neatness and accuracy. It is easy to lay out the ground in lozenges or other rectilinear spaces, as in Fig. 22, and to cut the flakes of pearl to fit them, variety being attained by placing white and snail alternately, or, if the figure should not exceed a square half-inch or so, aurora also may be employed, the pieces of this pearl being too small for larger patterns. On a flat surface this is simple work, but if it has to be carried over any slight curvature it becomes difficult, and will be best accomplished by cutting the pearl into strips; even then it may not be found easy to make good joints. Before laying the pearl in place, japanners' gold size has to be spread over the surface to fix it. The black-lead lines drawn to indicate the pattern will show through the size.

Fig. 22 gives a design for this "solid" pearl inlaying, in which the size of the component spaces is so considered as to allow the employment of all the different kinds of pearl. The letters, W., S., A., and G., indicate those for white, snail, aurora, and green, respectively. The dotted lines show where the larger spaces may be subdivided if desired without injury to the effect of the design; and it is well to remember that pearl lies flatter and better in small pieces than in large ones.

Diapers and set patterns, made with stock or other forms in pearl, require to be first laid out with black-lead lines. A design of this character is shown in Fig. 23. In this the strips of pearl forming the border would be cut with the roughened knife mentioned above. The other pieces of pearl are common stock forms. The dotted lines represent lines drawn in black lead, on which to arrange the diaper.

In inlaying for flowers, fruit, etc., a solid piece of pearl is laid where the flower or other object will come, and the exact form left to be made out afterwards in the painting, which will be with transparent colours.

In blocking out buildings in pearl, more care is desirable. It is well so to arrange the joinings of the pieces as to make them fall in places where they will be least seen—as, say, along the perpendicular lines at the corners of the structure, the horizontal ones at cornices, string courses, etc. In Fig. 24 the black lines show where the joinings ought to fall, and if further joinings should be found necessary, the dotted lines indicate where others might be carried with little injury to the effect of the work. The narrow ragged strip at bottom of the tower shows how scrap strips from the sawing-knife operation may be made of use.

After the pearl has been put upon the sized surface, the article should be placed in the stove for the night; the gold size will take rather longer in drying under the pearl than where exposed. As the flakes are often not absolutely flat, it is probable that in the morning one may occasionally be found to have "sprung." If so, work a little paste into the hollow beneath it with the finger, and put a weight upon it. But in doing this, be careful not to let any superfluous paste remain round the edge of the pearl, or it will cause the varnish, which will afterwards be laid on, to crack. After half an hour in a coolish stove, the "spring" will be found to be set and firm.

When the pearl is fixed, another coat of the black varnish has to be applied to the entire surface, covering pearl and all, and, after stoving and drying, this has to be pumiced down till the pearl is cleared. Then the worker has to varnish again, and so to repeat the operations till japan and pearl present a perfectly level surface. Three coats will generally do this, but something will depend on the thickness of the pearl; white pearl, which is thick, will require more than the thinner aurora. Where two kinds of pearl are used together, the thicker may be filed down, or, in the later processes, be pumiced down, to bring it flush with the thinner; but this, by-the-bye, will be at the risk of some of its brilliancy.

A level surface having been reached, it has to be smoothed and polished as above described, just as if there were no pearl. If *dead* gold has to be used with the pearl, it can, as already mentioned, be applied after smoothing and before polishing, though it can be also applied upon the polished ground. If *bright* gold, this *must* be laid on after polishing. We will suppose both smoothing and polishing to be done, so that we shall now see the pearl shining out from a brilliant jet-black ground, to all appearance a perfect example of inlaying, though, as we have seen, the process by which this effect has been reached cannot accurately be called inlaying at all.

When pearl and gold come in close contact, the gilding must be done before the pearl is finished. For convenience of description, however, it will be desirable that finishing the pearl should first be

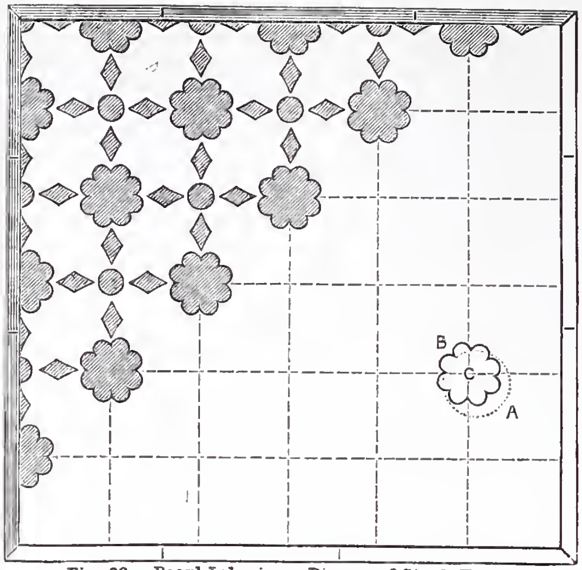


Fig. 23.—Pearl Inlaying: Diaper of Stock Forms.

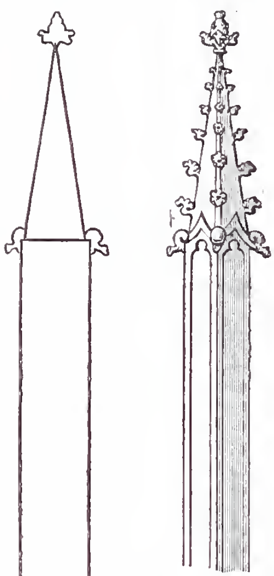


Fig. 25.—Use of Pearl Colour.

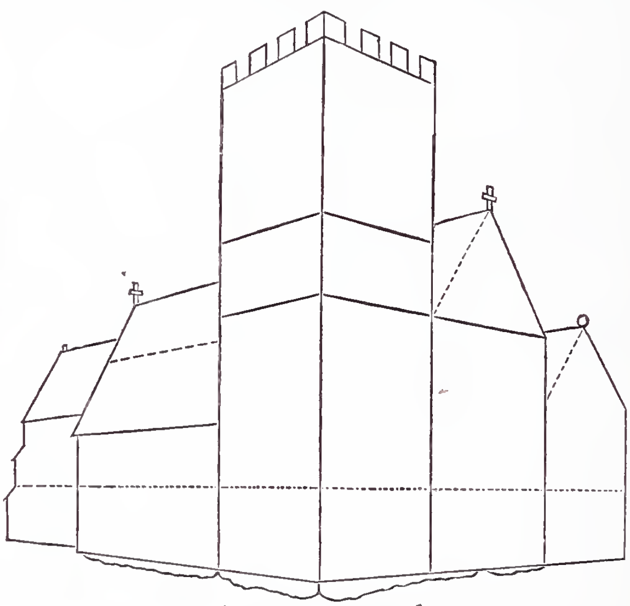
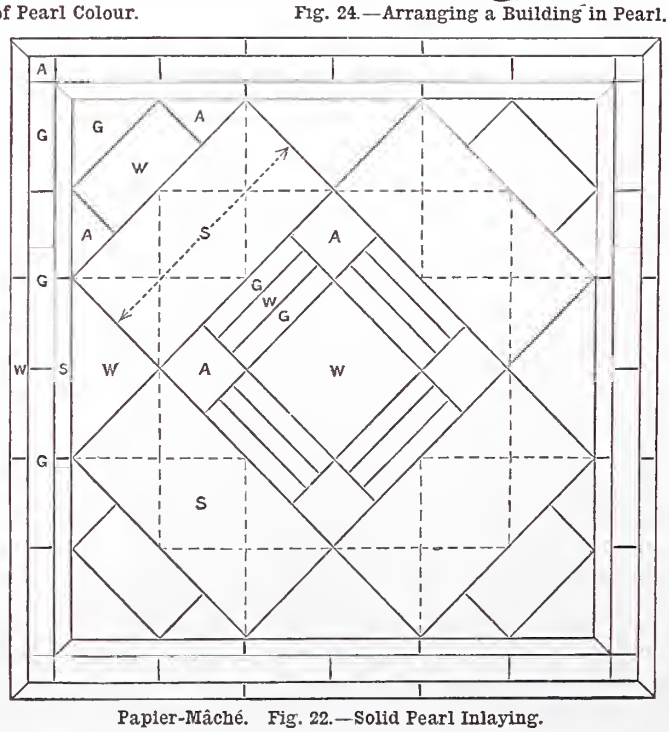


Fig. 24.—Arranging a Building in Pearl.



Papier-Mâché. Fig. 22.—Solid Pearl Inlaying.

spoken of. If any little flaw appear in the pearl, or if it should have been worn through in any part in the pumicing, the fault will have to be repaired by touching with what is known as "mending" or pearl colour; this is a mixture of flake white, crimson lake, a little black, and a little blue. It is important to remember this mixture, as in all cases of pearl inlaying it will probably be wanted.

This "pearl" or "mending" colour will also be necessary in painting buildings, since, in them, the joinings of the pearl have to be hidden, and there are often little projections, such as those made by crockets and finials in Gothic buildings, which it is not possible to cut out in pearl, and which, therefore, have to be painted in this colour. At Fig 25 we have a pinnacle: A, shows the plain outline laid in with pearl; B, shows how its crockets and finial have afterwards been added in mending colour. If, however, such details should be of any appreciable size, little pieces of "scrap pearl," *i.e.*, the odd pieces which break off in cutting, may be laid in to form them, and afterwards be brought to the required shape with colour. And it may be mentioned that there are other ways in which "scrap pearl" may be found useful in decoration, of which I may have occasion to speak later on.

It will sometimes be found that, during some of the stovings to which the work is subjected, a pearl form may have slipped somewhat from its place. This will probably be owing to too great a flush of gold size beneath it, which has been temporarily softened in the stove. Such an accident is indicated by the dotted circle at C, Fig 23. There is no way of actually restoring the pearl to its place. What has to be done is to block out with black, as at A, that part of the pearl which has passed its proper limits, and to add with pearl colour so much of the form as is wanting at B. If this is neatly done the defect will escape any ordinary scrutiny. All little slips of this nature are to be corrected in the same manner.

When the entire surface is covered with pearl, a mere line, generally of white paint, drawn neatly over the joinings, is all the finishing required. Some diapers and set patterns will perhaps need nothing more to render them sufficiently decorative than the mere correcting of irregularities of outline with black paint (vegetable black). Others will need more work. In such patterns, for instance, it is often desirable to connect small forms by thin lines of

Papier-Mâché. Fig. 26.—Simple Design in Dead Gold.

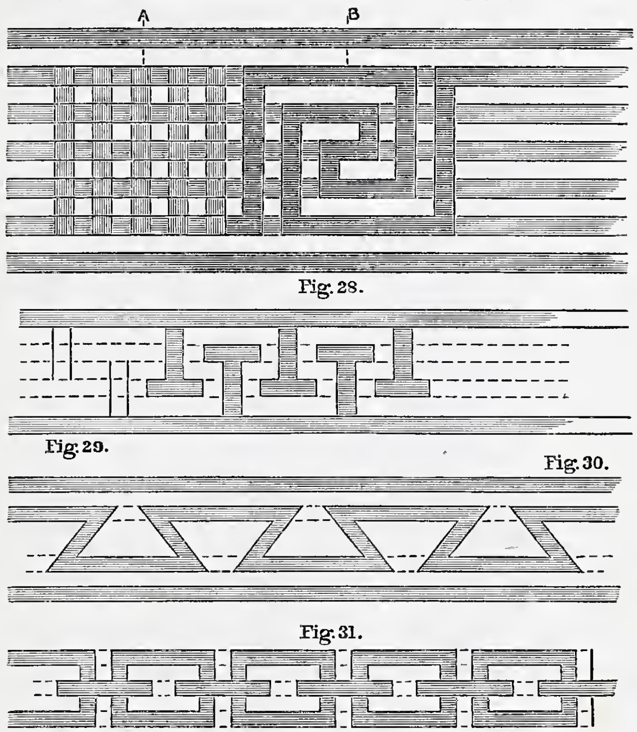
earl. Now thin nes cannot well e cut; it is neces- ry to make the rips of pearl mewhat broader han is desirable r effect, but they an now be light- ned and made to ok thin by draw- g a black line long the middle f each.

Some description f the methods of ainting and finish- ng buildings, flow- rs, figures, etc., on earl, will need to e given, but this vill, for sufficient reasons, best be deferred ill the more elementary processes of gilding ave been dealt with.

Gilding.—The gold leaf used on papier- nâché is the same as that employed by gilders generally. It is of two colours, deep and pale, the latter owing its lighter hue to an alloy of silver. Gold leaf is purchased n books of 24 leaves, 3 inches square, and costs from 1s. 2d. to 1s. 6d. per book. There is beside these a green gold which might be used as a variety; it is, however, more in favour in France than with us, being rarely seen in this country. A cheap substitute for gold leaf is Dutch metal, which is sometimes used in inferior japanning work, and which may be bought at 2d. or 3d. a book.

Dead Gilding.—It has been mentioned above that the proper surface for *dead* gilding is that before the polishing with hard rotten-stone and whiting. It is indeed possible to do dead gilding upon the polished surface, but chrome yellow or some similar colour has then to be mixed with the gold size to enable the worker to see what he is doing; and as this tends to weaken the size it is undesirable, unless the nature of the work requires it, as is the case when bright and dead gold are intermixed.

The design should first be drawn on paper and transferred to the papier-mâché by pouncing—that is, by pricking holes along the lines and dusting whiting through; no more whiting should, however, be used than is necessary, or it will make the outline ragged. The design is then to be pencilled with a sable brush in japanners' gold size. The gold leaf is to be laid on when the size has so far dried as to be merely "tacky," which will be in from one to three hours, as the size may be quicker or slower. To hasten drying the sized article may be held to the fire and then let cool again; to retard drying it may be put in a cool place, also a drop of poppy oil mixed with the size causes it to dry less quickly. A gilder's "tip" can be used if the worker is accustomed to one, and can apply gold more readily in that way than any other; if not, as the surfaces to be dealt with are all comparatively flat, most persons prefer to cut the book of leaf into convenient pieces, and to lay on the gold with the paper of the book. The leaf has to be pressed down in the usual way with a little ball of cotton wool, and superfluous gold dusted off with the same. Should any gold adhere in wrong places, as for instance to the ground, owing to a little greasiness from a finger touch, it may be removed with the wetted corner of a silk handkerchief.



Papier-Mâché. Fig. 28.—Method of Gilding Greek Key. Figs. 29, 30. —Method of Gilding Frets. Fig. 31.—Method of Gilding Chain Fret.

If, as in the design for dead gilding in Fig. 26, both deep and pale gold are used, the processes of pencilling, laying on the gold, and drying have to be gone through *separately* for each colour. The deep gold being of the most importance is generally applied first.

A day or two is sufficient to dry gilding, or less time in a stove of low temperature, and it has then to be protected by varnish. If the gilding covers but a small part of the surface, it has to be pencilled over with transparent varnish—usually copal—care being taken to put as little as possible on the black japan beyond the gold. The japan will not polish so well where the varnish goes. Nevertheless, if the gilding covers a great part of the surface, it is usual to go over the whole with the broad varnishing brush. If a loose hair from the brush should get entangled in the varnish, it should at once be removed and the place smoothed over.

If, however (as is the case in the designs for dead gilding, Figs. 26 and 27), the effect depends less or more upon "cutting-up" with black lines, this work must be done before varnishing; so also must any correction of outline which may be required. It should be borne in mind, however, that in this latter particular as little as possible should be left to need correction, for the black paint now applied will never equal the depth of the black japan. The paint to be used may be ordinary tube colour (vegetable black) mixed with varnish. The older plan was to grind the colour in turpentine and then add varnish; this cost more trouble, but it dried more quickly.

When the varnish over the gilding is thoroughly dry, the whole surface has to be polished. It has first to undergo a slight rubbing with the bob and soft, wet, rotten-stone, and afterwards one with the hard, dry, rotten-stone, whiting, and a spot of oil, as already

Papier-Mâché. Fig. 27.—Border in Dead Gold.

directed. This is, indeed, the method of finishing all decoration on papier-mâché, as will be noted more particularly farther on.

Fig. 26 is a simple pattern in deep and pale dead gold from old japan work. In this it will be seen that the gilded forms are very little "cut up" by lines of paint—the cutting up being confined to the fibres of the leaves and a single line up each petal of the flowers. The thin stem work, the leaves, and the centres of the flowers are in deep gold; the petals of the flowers, the balls, and the thick portion of the stem are in pale gold. The little shading seen is in wash black.

Fig. 27, also from old japan work, is a running pattern in dead gold, for the edge of a tray or any similar use. In this, the cutting up is much more elaborate. The border lines, as well as the stems, leaves, and centres of flowers, are in this design in deep gold; whilst the petals of flowers are in pale gold. The shading, as before, is in wash black.

Raising Composition for Dead Gilding.—In old japan work it will be observed that some parts are occasionally considerably raised above the general ground, as in such objects as the bodies of butterflies, the front petals of flowers, etc. To effect this, a mixture must be made of whiting, flake white, and gold size, of somewhat greater density than treacle. With this the form to be raised has to be painted in with a camel-hair brush, care being taken to keep the brush well charged at the point, so that the composition may the more readily flow upon the surface of the papier-mâché. This raised work has to be dried, and if necessary pumiced a little to correct roughness. It may then be sized and gilded in the ordinary way. This work must be done on a dead, not on a polished, surface, since on the former alone will it properly take hold, and it is always used in connection with *dead* gold.

Working Fret Patterns in Gold.—Both in old oriental and in English work, we not uncommonly meet with varieties of the "fret" ornament in gold, used as borders, and when so used always looking well. In the East, where time and labour are of little value, designs of this class are pencilled in line by line, but English japanners have adopted a shorter method. For instance, the "Greek Key," Fig. 28, is produced by the worker first drawing a series of lines (in this case seven, inclusive of the two border lines) with his pencil and gold size. He then crosses the five central ones with other lines at right angles, as shown at A. The whole has then to be gilded at a single operation, and the parts of the lines not needed for the pattern, as shown by the dotted lines at B, are afterwards blacked out. By this same process of lining and blacking out the different frets shown in Figs. 29, 30, and 31, with many others, may also be produced.

The way in which to draw these long horizontal lines accurately is by holding the hair pencil in the usual manner, but at the same time placing the third finger against the straight edge of the article under decoration. This steadies the hand, and by this means the required number of parallel lines may be drawn slowly and firmly. To do such work satisfactorily demands some skill in the use of the pencil; with practice, however, it may be done with precision and rapidity. These directions are, of course, supposed to apply to working frets in dead gold. In bright gold (of which I shall next have to speak), frets may, however, be worked in the same manner, except that, instead of blacking out, the superfluous gold will then have to be removed with a wetted box point.

(*To be continued.*)

NOTES AT THE ARCHITECTURAL AND BUILDING TRADES' EXHIBITION, 1889.

(*Continued from page* 155.)

MANY an individual, nowadays, when looking at the mantel with which his dining- or drawing-room is embellished, rests fully content in the conviction that the said mantel is marble, and that of an exceptional quality too. Such a display as that set up by Messrs. Corfield & Morgan, Tredegarville, Cardiff, would, however, be to those confiding individuals what is vulgarly called an "eye opener," for there were to be seen various productions in enamelled slate, which it would need an expert connoisseur to distinguish from marble itself. If people are determined to have the beauty of marble, and yet cannot afford the price for the real material, Messrs. Corfield & Morgan's enamelled slate offers itself as a remarkable substitute; and for those whose means will go to the genuine article, that firm are in a position to fulfil any commission entrusted to them.

The display of marble chimneypieces, enamelled slate chimneypieces, tiled stoves and hearths, iron mantelpieces, overmantels, and other goods of that description which bore the name of Messrs. Betts, 33, York Street, London Road, S.E., was most comprehensive in its way, and several of the designs shown by that firm gave pleasing evidence of the great strides made in that section of the hardware trade of late years.

An interesting novelty, and one which is likely to make its way in the market, was shown by the Ambrose Patent Bedstead Company, 16, Newgate Street, E.C. As the style and title of the company indicates, the invention is named the "Ambrose" patent bedstead, and it possesses many advantages of really genuine value. One of the chief objections urged against the old wooden bedsteads was the difficulty of keeping them clean, but many people have refused to adopt iron ones, in consequence of their more hard and ungraceful appearance. It is just this aspect of the matter which has been adopted by the inventor of the "Ambrose" bed, and we must say that the result of his cogitations may be looked upon as a most "happy medium." This new invention is introduced with the object of supplying a bedstead which, while perfectly free from the objectious met with in the old wooden ones, at the same time combines the comfort and elegance found in them with the cleanliness, durability, and cheapness of those made of brass or iron. The head and foot are composed of various woods, turned, carved, or otherwise decorated, while the frame and laths are entirely of metal, thereby ensuring the utmost freedom from anything objectionable. Owing to the extensive adoptiou of metal bedsteads of late years, the woodworker has been debarred from exercising his talents on that indispensable article of furniture. But, by this new invention, the cabinet maker would once again have an opportunity to make the bedstead "a thing of beauty and a joy for ever;" and even if it were only for that reason, the "Ambrose" bed should receive the heartiest welcome from all who have to use such an article.

The decoration of glass is a field which has enticed many inventors, and numerous are the methods by which plain glass may now be so manipulated as to rival stained glass more or less successfully. It is to Messrs. T. Baillie & Co., 187, Wardour Street, W., that we owe the latest invention in that direction, and the examples which they had on show at the Agricultural Hall proved conclusively that the "Valère" translucid enamelled glass, as their production is styled, will constitute a formidable rival to other materials of a like description. The novelty of this patent rests in the fact that the enamel is translucid, rendering both sides of the glass decorative, so that windows, screens, etc., display a rich effect on whichever side the light plays. At night, when illuminated by artificial light, the effect is specially charming, as the enamels appear translucid from the outside, while from the interior they have exactly the appearance of opaque enamels. The beauty of the tints and the variety of treatments which these enamels permit of place them very high, and they would be particularly valuable for such purposes as heraldic decorations on windows and in other similar associations.

Other exhibits were, of course, to be seen in large numbers, but those chosen for notice herein have been fairly representative, and with them we must conclude this necessarily brief report.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

STRAIGHTENING AND BENDING PLATES AND BARS.

PLATES which are required to be finished with curved edges may be ordered from the rolling mill of the most convenient shape from which to cut it out, but its edges will have to be straight lines, though its corners need not necessarily be square. Although plates ordered to special forms will cost a little more than ordinary rectangular plates, yet where the waste in the bridge yard would otherwise be large and extra labour required, it is the most economical course to pursue.

The curve to which the edge of the plate is to be formed having been accurately marked upon it, as much of the superfluous material as is convenient is taken off in a shearing machine, and the edge finished with a chipping chisel.

There is a point in connection with the setting out of bridge plates to which the attention of the operative must be directed, otherwise he may get wrong. Girders in single spans are usually made with a slight rise or camber (about 1 inch for each 40 feet of span), the object of which is that when loaded they shall not "sag," or deflect below horizontal lines drawn from end to end of each girder. Commonly the girder is drawn as straight and parallel, and a note made of the camber to be given. This, then, must be arranged for in setting out the work for the yard. The girder, instead of being straight, will be a segment of a ring of very large radius, and the top flange being of larger radius than the bottom, it will be longer in the same proportion. The web plates will therefore be wider at the top than at the bottom; but the deviation from a straight line of the theoretical edges of the web plates will not be sufficient to necessitate their being made curved in practice. The rise due to camber being given for the whole length of girder, the exact radius of the bottom flange is found from the following rule :—Divide three times the square of the length in feet by twice the rise at centre in inches, and add one-twenty-fourth of the rise. This last addition is, however, so very small compared with the rest that it may be neglected in practice. The rule will then stand thus :—To find the radius in feet of the bottom flange, divide three times the square of the length in feet by twice the rise at centre in inches. Should any fraction occur, take the next whole number above it. For example :—Let a girder be required 108 ft. long and 9 ft. deep, cambered to give a rise of $2\frac{1}{2}$ in. in the centre. One hundred and eight multiplied by itself, 108, gives its square, 11,664, which multiplied by three is equal to 34,992; this divided by twice $2\frac{1}{2}$—5, gives 6,998$\frac{2}{5}$, so 6,999 ft. will be taken as the radius of the bottom flange; the radius of the top flange will be 9 ft. more, or 7,008 ft., and in the same ratio will be the bottom and top edges of the web plates. Let the web plates be 4 ft. wide at the bottom; then by proportion, as 6,999 is to 7,008. so 4 ft. is to 4 ft. $\frac{1}{16}$ in.

(To be continued.)

OUR GUIDE TO GOOD THINGS.

44.—The "Line and Design" Series of Art Drawing Copies.

Prompted by a desire to show that a foundation in design can be laid as soon as a student can use the pencil freely, Mr. Donald W. Robertson, Head Master of the School of Art, Walsall, has produced the "Line and Design" Series of Art Drawing Copies, a well-conceived and carefully-executed collection of copies which deserve attention in all schools where drawing is taught, and from all persons whose vocation it is to teach drawing, as being eminently suggestive of the means by which drawing lessons may be made even more interesting and attractive than they are under the ordinary *régime* of instruction in this most important art. It is a desirable thing, no doubt, to reproduce, with pen or pencil on paper, any form, whether regular or irregular, that may be set before the student, but it is still more desirable for him to find the disposition of certain straight lines and points, which are at first drawn as guide marks, gradually grow, as I may say, by the addition of a few more lines, straight and curved, into a design or pattern, which is at once symmetrical and satisfactory alike to eye and mind. Mr. Robertson has been successful in producing a series of copies that will well pave the way for original design for any student who is conscientious in his work and desirous of rising above the dead level of the mere copyist. Additional interest has been lent to them by the introduction of colour in flat washes, which serve to bring out the patterns and impart to them a distinctness and individuality that no drawing in simple outline in black or white, or *vice versâ*, could ever possess. The examples in the series are intended for pupils preparing to pass the Second Grade Examination in Freehand Drawing of the Science and Art Department. Directions for drawing and colouring are appended to each example. Good designs for monograms are included in the series, whose London publishers are Messrs. Simpkin, Marshall, and Co., Stationers' Hall Court.

45.—The "Monarch" Play Chair.

Many a boy, and girl too, for the matter of that, will welcome the addition of the "Monarch" Play Chair to the furniture of the nursery. There are many combination tools in existence in which, by various adjuncts and contrivances, one thing is made to serve the purpose of many, but although I have been permitted to learn that even the hard and unyielding carpenter's bench may be converted into a comfortable if not luxurious bed, I have never yet met with a chair that was so chameleon-like in its constitution, and variable in its capacity, as the chair which is distinguished above its fellows by the proud title of "Monarch." For this capital play chair it is

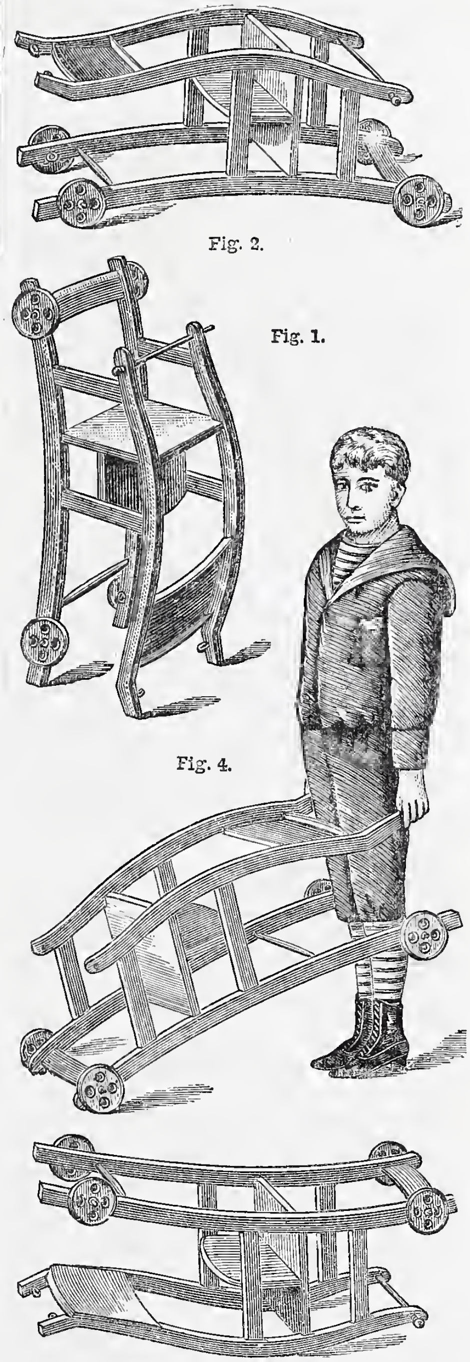


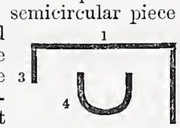
Fig. 2. Fig. 1. Fig. 4. Fig. 3.

The "Monarch" Play Chair. Shown in Fig. 1 as a Table Chair; in Fig. 2 as a Cart with Play Table; in Fig. 3 as a Rocker or Sleigh; and in Fig. 4 as a Wheelbarrow.

claimed by its inventor and patentee, Mr. Thomas R. Weston, 61, Hampton Park, Bristol, that it is "convertible into a cart, stool, rocker, table chair, play table, wheelbarrow, sleigh, enclosure, go cart, and, when carried by two persons, into a sedan chair, and when attached to ropes into a boat-swing." Some of its phases are shown in the accompanying illustrations, in which it appears erect in Fig. 1 as a table chair, or rather as a chair in which a child may sit at table securely pinned in by the rail or bar in front. Put it on its back, and, by the aid of the four small wheels attached thereto, this Proteus of a chair becomes a cart with a play table, as in Fig. 2, the seat of the cart being furnished by a board attached at right angles to the underside of that which serves as its seat when used as a table chair, and the play table, that part of the front which served as a rest for the child's feet when sitting in it at table. Put it on the ground once again on its front part, and it becomes a rocker or sleigh, in which a child can sit and rock itself or be rocked according to circumstances. This last transformation is shown in Fig. 3, and in Fig. 4 it appears how, by taking hold of the ends of the top to the left, as it is shown in Fig. 2, and tilting it on the wheels to the right, it may be converted into a wheelbarrow, though, I fear, the boy who is using it as such in the illustration would find difficulty in occupying it as a table chair. Among the good points of this piece of toy furniture, are its attractive appearance, its strength, its excellent finish in the best style of workmanship, the absence of any movable parts, the front rail excepted, to get out of order, to get lost. or to injure the child, and that any child can alter the arrangements at pleasure by simply turning the chair about into the various positions. The price is 15s. It may be obtained at all cabinet makers and toy warehouses. The wholesale manufacturers are Messrs. James Cox and Son, High Wycombe, Bucks.

46.—The "Era" Printer.

To use the words of its inventor and manufacturer, Mr. Fred. J. Bowditch, 5, Waldo Road, College Park, Kensal Green, London, W., the "Era" Printer "prints anything;" and so it really does, although that "anything" must be taken *cum grano*, as meaning not everything, but any letter or figure that it may be desired to print by its aid. It is an invention which supersedes stencil plates for marking and numbering bags or boxes, and printing window tickets and brief notices, being useful, in short, for any purpose where bold lettering is essential. Thus it will be found desirable for all offices, warehouses, shops, timber and builders' yards, and all places in which lettering is sometimes required, being inexpensive to buy, always ready at hand, and practically indestructible. The means for printing are contained in a small box, and consist of a stamp, a bottle of ink, and a brush for spreading the ink on the ink pad attached to the front of the box, which falls forward on lifting the cover. It is the stamp only which requires any comment and explanation. On taking it up, it presents the appearance of a short stick of composition with a flat piece of india-rubber at one end, and a semicircular piece at the other. The end and sides of the flat piece are shaped as shown in the margin at 1, 2, and 3, imprinting three straight strokes of different lengths.



The semicircular piece is of the shape shown at 4. By these forms, either used singly or in combination, any letter of the alphabet or numeral can be printed. Thus No. 1 will print I, M, N, V, W, X, each letter being formed by one, two, three, or four impressions of No. 1. Again, A, E, F, H, L, T, are formed by combinations of Nos. 1 and 3; K, Y, Z, of Nos. 1 and 2; P, B, of Nos. 1 and 4; R, of Nos. 1, 2, and 4; J, U, of Nos. 2 and 4; C, O, Q, G, of Nos. 3 and 4; S, D, of Nos. 1, 3, and 4. Of the numerals, 1 and 2 are formed by combinations of Nos. 1, 2, and 4; 3, of Nos. 3 and 4; 4, by No. 1 alone; 5, of Nos. 2 and 4; 6, by No. 4 only; 7, by Nos. 1 and 2; 8 and 9, by No. 4 only; and O, by Nos. 3 and 4. I think sufficient has been said to show the ingenuity and utility of the invention, and that it is applicable for all lettering for which stencil plates are now used, although the results may not be so neat and regular as the impressions by means of plate and brush. The stamps are made in different sizes to suit different purposes, and range from about $\frac{1}{2}$ in. to 2 in., as regards size of letters. The set for stamping 1-in. letters is supplied by the inventor, post free, for 1s. 3d.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

What a Glasgow Man Thinks of Work.—W. C. T. (*Glasgow*) writes:—"I am very glad that (as the *Glasgow Herald* says) you have made a bit with Work. It deserves to be a success. It was just needed by fellows who job at home like myself. I think that if you have loose covers on the weekly numbers they would help to keep them clean, for the Work weeklies get dirty on the outside with our dirty hands, being black squadders, and that does not look well in a bound volume. The covers could be made to pay by advertisements."—[I am obliged to you for your letter, and the notice of the patent darning weaver. Your suggestion with regard to wrappers for the weekly numbers is a good one; but it would not prevent the pages from being soiled by turning them over while reading. To keep the outside fairly clean, make a loose cover of pasteboard as recommended in "Binding Made Easy," Nos. 6 and 9, and put four or five strings along the back, inside from top to bottom, to take as many weekly numbers.—Ed.]

Cabinet in Fretwork.—Buhl writes:—"I have been waiting to see if there were any among your readers of Work that had undertaken the making of the inlaid cabinet; and, if so, to read what their experience was, because it is an almost impossible pattern for 'amateurs;' a professional would not think of executing it, being too much labour for little effect. A 'marqueterie cutter's' mode of operation would be to trace the pattern given upon strong tracing paper, then perforating it with a fine needle, from which he pounces several patterns. He then takes his ground woods—say four (it is generally four they cut)—and gums a pattern on one of them, and then four coloured veneers, of whatever colour the ornament is to be, and gums his ornaments on to one of them; a piece of greasy paper will be put between the first and second veneers of each packet, and then pinned up separate. He will now make a saw, then start cutting his ornaments, laying them out in a tray as he does so; having cut the ornament, he proceeds to cut the grounds. Having done that, and having no shading to do among the ornaments, he will put them together, when they will fit as near as possible to air-tight. Now fancy an 'amateur' following the instructions of the 'designer' in a pattern like that, by using a shop saw, and cutting 'buhl,' or one into the other, fashion; he would either break all his groundworks, or lose his ornaments in space; in the one you would have no saw kerf, in the other you get hardly anything else. I could not resist writing on the above subject, as it is a line in which I have been engaged for some considerable time, in all its branches—the 'cutting,' 'engraving,' and 'designing,' in the principal 'London' West-end firms. Accept my best wishes for Work."—[I am pleased to have your letter, as it gives evidence of the interest taken by men of every trade in Work, and of their readiness to assist by instruction, reproof, caution, etc.—all of which we ask for and desire. You will learn from other letters on this subject that amateurs have managed the work, and got through the cutting of the design, although it is certainly elaborate, as you say. Will you send me some of your own designs to look at? for, in the case of Work, it is always a selection, and, therefore, a survival, of the fittest; and if your designs surpass those of the "designer" of the "Cabinet in Fret Cutting," both he and I would be glad to find you numbered among the contributors to Work.—Ed.]

A Good Word for Work.—J. L. (*Elgin*) writes:—"I have taken Work since its commencement, and am much pleased with it; and having the 'Technical Educator' complete, I should be fairly well instructed by it. You will, no doubt, receive so many advices and hints how to conduct the 'paper,' as, if followed, would only leave you as a machine to be moved at will, and I have no intention of adding an infliction in this way. Everything can't appear at once, as we impatient patrons would like; and, while adding my congratulations on such a good start, would merely suggest that thoroughly reliable papers on such subjects as forging, brazing, and soldering, would interest not a few. How few can practically treat the various grades of steel when such a thing as welding is necessary? and being practical myself, know the value of such information."—[Thank you for your good wishes. I do indeed receive much advice, and many hints. Well, I read all, and I am truly thankful for the kindly endeavours that are made to lead me in the path in which each individual writer thinks I ought to go, but I pursue the even tenor of my way, imagining, vainly enough, perhaps, that I know my own business best. There was a man once who called his wife an *obstinata mulier*, putting something else before *obstinata*, which I omit for propriety's sake. He only meant, poor fellow! to say that she was an obstinate woman, which, possibly, she was, and he relieved his feelings in Latin, trusting that his little outburst would thus escape notice. The woman kicked, however, and said she wasn't going to be called an obstinate mule by any man living, and certainly not by her husband. It may save much trouble if I allow at once that I am a very obstinate mule myself, but that I do not in the least mind being called so, with any word by way of prefix that may be preferred.—Ed.]

Hints to Amateurs.—M. A. writes:—"Being interested in amateur work, especially what I deem the most useful branch—viz., carpentry, joinery, etc.—I hail with satisfaction the appearance of your journal. The hints to amateurs in a recent number were very good, but in my opinion just left off where they should have continued. The great difficulty with all amateurs is not how to mix glue, to saw a straight line, etc., but to make a good joint; and this, I think, is a point that should be thoroughly set out in your journal, together with the explanation and diagrams illustrative of the various kinds of joints, and the explanation of the technical terms used, etc. etc. Such matters are easily enough learned in the workshop, but it is only the very few who can obtain such help; and, moreover, as they are unwilling or unable to invest in expensive books, they look to obtain the information in your valuable journal."—[In reply to your remarks on this subject, first let me say that I am in complete accord with you in considering carpentry and joinery as one of the most useful branches of manual labour to which an amateur workman can turn his hand. Gluing-up and ability to make a straight saw cut are matters which require practice, I can assure you, and it is as necessary to give instructions on such points as these as on other things mentioned in your letter. If you can make and use glue in a proper way yourself, and can rip down a board from end to end, holding the saw so truly that the saw cut is straight throughout, and the edges thereof at right angles to the surface of the board, you are well advanced on the road to excellence as a carpenter. Let me ask you, when you are sawing through a plank lengthways, and wish to do the work as truly as possible, how you test your progress and ascertain that you are not bearing on the saw so as to drive it out of a truly vertical plane (supposing the board to be truly horizontal) either one way or the other. It is a very simple matter, and, doubtless, you know all about it, but—if you do not, you will agree with me that it is even desirable to show, as you put it, "how to saw a straight line." Well, as to "jointing boards," papers on this very important branch of carpentry are already in the printer's hands, and are being translated—if I may use the expression—into type. With regard to the explanation of technical terms, whenever any term that may not be perfectly intelligible—as, for example, "bolection" moulding—is used, the meaning will be given; but it is possible that there may be many omissions in this respect, for the simple reason that writers who are thoroughly conversant with the subject often forget that those for whom they are writing are not so well informed on minor points and technical terms as themselves. But when any term is used that is not readily understood, a few lines pointing out the difficulty will always meet a ready response in "Shop," which will tend at once to dissipate any cloud of mystery that may appear to hang about it.—Ed.]

A Vote of Thanks.—S. D. writes:—"If Mr. Adamson would derive any pleasure from the knowledge of the fact that he has been the means of encouraging some youthful amateur to push his endeavours to a successful end, I consider, out of common gratitude and justice, he deserves to have that satisfaction. From his design I have made an overmantel; but instead of using waste timber, such as packing cases and the like, or even tea chests, I have gone to considerable expense in buying the best white pine and mahogany. It is, in my estimation, false economy to utilise that timber for such purposes. The damage done to planes and utensils and the increased amount of labour necessary quite neutralise any advantage that might be gained in the first cost. But of course that is a matter for individual consideration. Mr. Adamson was very successful in introducing his design to the readers of Work in an attractive form, and I beg most heartily and sincerely to thank him for being the cause of my possessing a really handsome piece of home-made furniture."—[You will notice that your letter has been translated into long hand. Shorthand has its advantages, I know; but my education was sadly neglected in that particular branch, and your letter, as it was, was thrown away upon me. However, I can generally manage to get on the other side of anything, whether shorthand or trade secrets, or anything else that may happen to be somewhat cloudy. But I trust that no one else will follow your example, because if it is done to any extent, I shall have to provide myself with a special shorthand clerk, which will be to me an expensive luxury.—Ed.]

About Work.—D. T. D. (*Cardiff*) writes:—"I desire to supplement what so many of your readers have already said as to the value and worth of your able production, Work. I need not say how useful I find it in my recreative moments. Being engaged all day with a great deal of arduous brain work, you can understand my appreciation of amateur's work, therefore my high appreciation of the articles in your able edited publication. I wish your every effort every possible success. There is one thing I should like to suggest if you will allow me, and that is, that a wrapper be put around Work, in order that the advertisements may not be bound up with the readable matter. Doubtless that has already engaged your attention, and I have no doubt that your enterprising firm will, when the publication is better known, accede to the wishes of your readers in this direction."

Asking for More.—T. J. H. (*Trowbridge*) writes:—"For many years past I have taken in all of your publications that have come within reach of the average workman's pocket, but the most tantalising is your latest, Work. Why, it's like feeding a lot of donkeys with one oat at a time, and making each donkey wait for his turn to get the oat. Could you not double or treble the thickness (I would not increase the size of the pages) of Work, and charge us 2d. or 3d. for it, and so enable yourselves to give us a few articles on other subjects? I am sure the readers of Work would not object to double the information (for a start) at 2d., at the same time putting an end to the 'crowding out.' Alas! if you had to buy instead of sell Work you would not object to its being issued in a spare or advertisement cover. If you lived (as I do) in a country town, and saw your favourite Work, with other papers, thrown out of a train (like a lot of fish guts at Billingsgate) into the dirt on the railway platform, well, perhaps you would not swear, but you might think some very strong words that will not appear in your 'Encyclopædic Dictionary.' I should like to see the opinions of fellow readers of our Work on these points."

Tea-Chest Wood.—G. W. M. (*Westbourne Park*) writes:—"Both Barrington and yourself are right with regard to old tea chests. Being in the grocery trade I am always on the look out for anything useful in the way of old boxes. The tea chests sent over by the Chinese are almost useless for anything but firewood, but those sent over with Assam, Ceylon, and Indian teas, can often be put to good purpose. Assam, and sometimes Indian, tea chests are made of teak, the boards being from ½ in. to ⅜ in. thick, and from 6 in. to 9 in. wide. The Ceylon chests are made of a rather soft reddish wood, not unlike Spanish mahogany when the grain is good, but much lighter, the boards sometimes being as much as 12 in. and 14 in. wide. Another useful box is the American bacon box. These boxes are made to hold five sides of bacon, being made of inch pine about 3½ ft. long by 2 ft. 6 in. deep, and 1 ft. 6 in. wide. The boards used vary in width; from two to four are used for the sides, but the tops and bottoms are usually in one piece. They can be obtained at most wholesale cheesemongers at from 1s. to 1s. 6d. each."—[I have used the American bacon boxes with good effect for fencing and ornamental work in the form of plant boxes, for what I term "wall gardening." The boxes in which honey, lobsters, Swiss milk, etc., are sent to this country, I have often utilised as plant protectors, converting them into small frames by cutting sides and front to the proper slope, and then making a light to cover the top. It is surprising to find how much can be done with boxes that are generally considered as being fit only for firewood.—Ed.]

About Work.—J. P. A. writes:—"After reading a prospectus setting forth the great amount of information and practical instruction to be got out of Work, I immediately ordered it. But I was greatly disappointed, for I find it almost useless to practical men, although it may be otherwise with clerks and such like, who want to put off their time by a little wood spoiling or something else. But I am a practical cabinet maker and joiner with my bread to earn, which is as much as I can do, without wasting my time making such useless trifles as you give such full instructions about. But to be more particular. You take up a great deal of valuable space (I say valuable not because it is valuable, but because I think it might be made so) in giving instructions about making such things as iron trying planes; but where is the man who having need hasn't got one? or if he hasn't he can buy one a great deal cheaper than he could make one, or he could make one without any need for instructions. Another large space wasted is that on hinges, and how to fix them. How can you take up space with such trifles when you say you have so much waiting? In your 'Guide to Good Things' you only describe the stock of two firms, and then only unimportant things, or if important, things which working men know just as well as yourselves. Very few would want such a thing as a Lukin lathe. The last number is now in my hand, and in it one of the designs for a lattice-work blind is very bad—in fact it could hardly be made as shown. In your 'Guide to Good Things' you describe a circular saw which you say will cut 4-in. stuff. Well, I have seen a good many treadle saws, but I have only seen one that has been worked at all after the first week or two; the rest have invariably been thrown on one side. This is one made by the master (my father), which we have had *in constant use* for about two years, and it is more used now than ever it was. Don't think I am prejudiced because you may think I had a hand in making it. I would describe it, as it is made on an entirely new principle; it has never got out of order, although it has only been made of odds and ends, only the saws being bought, all the other parts have been made out of whatever was handiest; but the inventor is seriously thinking of patenting it. Some day you may perhaps find room for an illustration in your 'Guide to Good Things,' as it has nothing in common with any I have yet seen. Of course it is easier to find faults than to mend them, but by way of suggestion I think it would be better if you followed rather more in the steps, or rather in advance, of the 'Technical Educator,' with a few such papers as Dr. Dresser's 'Principles of Design,' or Prof. Church on 'Colour,' or 'Building Construction,' or such papers as 'Electricity' in Dr. Lardner's

'Cyclopædia,' or other papers in the same series, and gave a few good drawings for *carving* or illustrations of *good old or new furniture* or good inventions, with a few papers on such a thing as handrailing. You talk of a practical man taking pupils for a short time; a short time will do the pupils little good, and certainly will do the rest of your readers much less. I have Jeay's book on handrailing before me. I think this makes it simple enough, but the majority of joiners will not consult a book, whereas they will often follow the instruction of a journal. The 'Cabinet Maker and Art Furnisher,' though cheaper, has much more information than WORK. I hope you will accept this criticism in the spirit it is written, and if you cannot altogether make such sweeping changes, at least do what you can, or else before long you won't be able to number a practical man in your subscribers. P.S.—I can supply your correspondent with as many Elizabethan twists as he likes, finished, direct from the lathe."—[Your strictures are sufficiently answered by other letters in this number without any rejoinder on my part.—ED.]

About Work.—H. C. F. (*Great Bedwyn*) writes:—"I must take this opportunity of telling you how pleased I am with WORK; it is a paper which has been much wanted, and to such as me (a country joiner) will prove a great boon, as the classes in towns are beyond my reach. I have already the pleasure of supplying three monthly parts, and each of these customers speak very highly and hopefully of this practical and useful publication."

Plans and Specifications of Buildings.—AJAX (*Huddersfield*) writes:—"In reference to the introduction of *plans, specifications*, etc., into your much valued WORK, I think myself, *coupled* with the opinions of fellow subscribers, that it would be of decided interest, and the means of a large circulation, and would not fail to please all generally."

How Work is appreciated.—H. G. writes:—"I am very pleased to tell you that I shall have each volume of WORK bound, because I know it will be the means of assisting my children in gaining a technical education. Success to yourself and WORK."

Lacquering.—FAL writes:—"Some of the readers of WORK who go in for repoussé work may be glad to know that the silico enamel sold by all dealers in cycling requisites is a first-rate thing for superseding lacquer. It flows as ready as water over the brass plate, and as no heat is required all the difficulty which the use of lacquer involves is avoided."

Muzzle for Ferrets.—FAL writes:—"The plan described by OPIFEX is good, but it has the disadvantage of requiring a separate muzzle for each ferret, as their heads differ a good deal in size. The ferret, also, will be apt to hurt his jaws if he works too energetically, as the projecting pin will catch against the sides of the top when he and the rabbit are at close quarters; this, of course, has a tendency to make him slack. The best plan I ever met with for 'coping' ferrets was taught me by a warrener in Warwickshire, many long years ago. I used it for twenty years on a large manor, where we killed from 1,000 to 1,500 couple annually, and found the ferrets would work quite as well 'coped' as they did when free. All that is required is a piece of tape and a little soft twine. The tape should be tied round the ferret's neck, so as to form a collar, and should be kept on permanently. When required for work make a single knot in the centre of a piece of twine, but do not have it taut. Open the ferret's mouth by pressing the sides of the jaws, and then slip the loop of the knot over the canine teeth in the lower jaw, and draw the knot close; bring the two ends over the nose, and make a double knot, slip one end of the twine through the collar, and knot both ends together. It requires a little practice to get the right tension in the knots; if they are too taut the twine will hurt the ferret, if too slack he will get his claws in the twine, and pull it off. I can cope a ferret by this method in less than half the time it has taken me to describe how to do it."

Bookshelves.—SCOTO-IRISH writes:—"I have just been turning over the pages of your interesting paper, which I hailed with delight when the first number was published. The subjects treated, so far, don't give me a chance to exercise my spare moments upon, as they are rather intricate for me, or require tools that I don't possess; but I live in hope that ere long my patience will be rewarded by seeing some article that will specially interest me. What I should particularly desire to see described in your journal is an article on how to construct a plain, substantial bookcase, free from turning or fretwork, but which might be made with the aid of a saw, plane, and chisel. I am sure I don't stand alone in my desires. I had a request from a friend in Scotland if I could furnish him with a design for same. I purpose making a start shortly to try and make a case to hold my books, but if I get any encouragement from you I will hold it over until such times as an article may appear, that may go beyond the appearance of a *packing case or box* in its construction."—[A paper entitled "Some Rational Bookshelves" will shortly appear, which, I think, will please you and meet your requirements in every way. Certainly no pains will be spared to render both the text and the diagrams so explanatory that any one able to handle a tool need not long be without a useful bookshelf.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Photographic Apparatus.—W. W. (*Devonport*).—Articles will appear in WORK describing the construction and use of cameras and all kinds of photographic apparatus, with such details as you ask for.—T. C. H.

Half-Plate Camera.—J. R. (*Hebden Bridge*).—See answer to W. W. (*Devonport*) above.

Adjustable Callipers.—E. B. (*Manchester*).—As you say you "have tried most tool shops in Manchester and failed to get" these useful appliances, you had better send to Messrs. R. Melhuish & Sons, 85 and 87, Fetter Lane, London, E.C., who have them on sale.

Wood Carving and Carving Tools.—P. P.—You give your name only, and no address, so I am unable to write to you on the subject of your letter, as I should have done. If you will send me a set of your tools and accompaniments, with specimens of carved work and instructions supplied to your customers, I shall be better able to judge of their utility. If they are up to the mark, I will notice them in "Our Guide to Good Things." When next you write to me on this subject do not omit your address. Every one who writes, under his or her own name, should give address, not for publication, but to enable me to communicate with them direct, if there be any necessity for it, as in your case.

Hatchet.—J. P. (*Gt. Keyne*).—To make a hatchet, procure a piece of flat iron of the best Staffordshire quality—say, Lord Ward's—and file it down to the shape in Fig. 1. If the head has to be steel-faced,

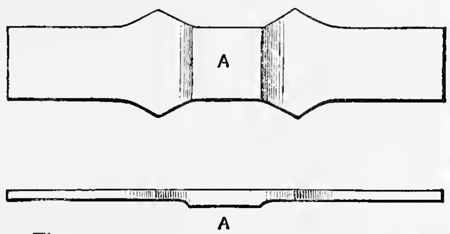
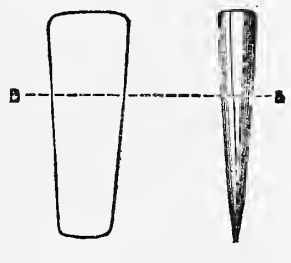


Fig. 1.



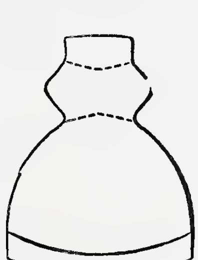


Fig. 3.

Fig. 2.

SECTION B–B

weld a piece of steel on at A. Make a wrought iron mandrel, like Fig. 2, bend the strip around this to form the eye of the hatchet, and weld to complete the eye, but leaving the tails apart. Insert a strip of steel between the inner faces of the tail portions so bent over below the eye. Then weld the whole together, and draw out under the hammer, and flatten both lengthways and sideways to form the blade, Fig. 3. When finishing the eye, the taper mandrel is entered from both sides, so that the eye is smaller in the centre than at the outsides. This is necessary in order to prevent it from slipping off the handle after wedging. Shear steel, or double shear steel, should be used for the edge. To temper, heat the hatchet to a low red, and partly quench in water. Then take out and allow the heat to go back to a light purple, or plum colour; then quench until entirely cold. Leave the forged edge a fair thickness for grinding away.

Cost of Patent.—P. T. S. (*Sheffield*).—The statement referred to was a clerical error. The Government stamp of £1 on depositing the provisional specification secures protection for nine months. If you intend to proceed with the application you must within that period deposit a final specification, the stamp in this case being £3, and the papers obtainable, the same as for the provisional specification, on application. Two months are then allowed to elapse to afford opportunity to any desiring to oppose the sealing of the patent. After that period you can obtain the sealed patent on application. Until the patent is actually sealed you should observe secrecy in regard to your invention.—F. C.

Weight of Fly Wheel.—F. W. M. (*North Brixton*).—There is a great deal involved in such a question as this. There are several rules based upon cases in practice; but since conditions vary, the rules are not applicable to all cases. Perhaps the best is one of Molesworth's:—

$$W = \frac{\cdot 6366 \, P \, S \, C}{D}\left(\frac{N}{60}\right)$$

where P=pressure on piston, in tons; S=stroke of engine, in feet; D=mean diameter of rim, in feet; N=number of revolutions per minute; C=constant, varying from 3 to 4 in ordinary engines, and rising to 6 when great uniformity is required; and W=weight of fly-wheel rim, in tons.

Another rule, which does not take account of piston speed, is

$$W = \frac{P \, S}{45 \, D}$$

where W=weight of rim, in cwts.; D=mean diameter of rim, in feet; P=total average pressure on piston, in lbs.; and S=stroke, in feet.

The principle, however, is as follows:—An engine would, in the absence of the fly-wheel, run at varying velocities at each single stroke, due to the ever varying nature of the forces operating on the crank pin. The governor regulates the admission of steam to the cylinder, and so determines the *mean* speed at which the engine is to run. But the fly wheel regulates its degree of *steadiness* under the continual fluctuations of velocity to which it is subjected. In marine engines with cranks at right angles, the motion of the paddle wheels, or of the screw and its shaft, tends to equalise the motion of the engines. In locomotives the weight of the engine has the same effect. In hand engines the fly wheel is necessary to absorb energy when that is in excess, while it gives out some of this store of accumulated energy again when the power of the engine diminishes, and thus maintains equable motion. The fly wheel is in effect a falling body—that is, its accumulated energy is correctly calculated as though it were a body falling perpendicularly and gathering energy as the square of its velocity. The weight of the rim alone is taken account of. Knowing piston area, speed, and steam pressure, it is easy to calculate the amount of power given out by the engine at every stroke. It is necessary, however, to assume some arbitrary relationship between the stored-up energy in the fly wheel and the power of a single stroke. It must be more than that given out in a single stroke, but the precise relationship will have to be settled by existing conditions. A slow running engine will require a greater reserve of energy than a fast running one. Engines badly balanced require a heavier wheel than those whose balancing is perfect. Some machinery is thrown into and out of action more frequently than other kinds, thus subjecting the engine to extremes of stress. A variation of speed permissible in some machinery would be injurious to the motion of others. Usually the reserve of energy of the fly wheel is estimated as being equal to that given out in six single strokes of the engine—that is, equal to area of piston × pressure per square inch × 4 to 6 single strokes, the result being in foot-pounds. A mean diameter is assumed for the fly wheel as most convenient—say, length of stroke × 3 or 4. From the number of revolutions of the engine per minute the velocity of the fly-wheel rim of a given diameter can be calculated in feet per second. Having found this velocity, the height from which a body must fall by gravity to acquire such velocity is estimated. The energy in foot-pounds of the number of single strokes first taken or assumed is then divided by this height, and the quotient is the weight in pounds which the rim of the fly wheel must have in order to possess a quantity of energy equal to 6 single strokes of the piston. By this method, a cylinder 6 in. in diameter, 10 in. stroke, with 40lbs. of steam, would, assuming 6 strokes, work out thus:—

$$6 \text{ in.}^2 \times \cdot 7854 \times 40 \times 6 = 6768 \text{ foot-pounds.}$$

Assuming 200 revolutions per minute, and fly wheel 3 ft. 4 in. mean diameter, then—

$$3 \text{ ft. } 4 \text{ in.} \times 3\cdot 1416 \times 200 = 2094 \text{ feet per minute, or } 34\cdot 9 \text{ feet per second.}$$

To find the height from which a body must fall to acquire this velocity, square the velocity in feet per second and divide by 64·4=18·9 feet. The energy given out by 6 single strokes divided by this is the weight of the fly-wheel rim in pounds, thus:—

$$\frac{6768}{18\cdot 9} = 358 \text{ lbs.}$$

This weight may be disposed in any sectional form about the mean radius of the rim.—F. C.

Violin Tools.—J. W. (*Battersea*).—I am not acquainted with a tool bearing the name you give ("fillitere"), nor do I see the use of it. Veneers may be reduced to any desired thickness with a five-toothed veneer plane. If you are desirous to make purfling—which may be bought very cheaply—you might do as follows:—Cut two strips of dyed veneer and one strip of white two inches wide,; glue the white piece and one black piece together; when set, plane the white side to the thickness you want, and then glue on the other black piece. These being dry, the sheet should be planed, so that both blacks are the same thickness; and the whole sheet is $\frac{1}{16}$ in. thick. Plane one edge true, on the shooting board, and with a sharp knife and steel straightedge divide into strips of $\frac{1}{32}$ of an inch. Please specify the particular tools you require.—B.

Wooden Copying Press.—You ask me to "minutely describe how to make the wooden screw and threaded block through which the screw revolves" for the wooden copying press described in WORK No. 2 (p. 27). The screw is first turned in a lathe, and then cut with a box and tap; and to describe the process as you ask would be practically useless to you. Mr. Denning tells you that in making his press he used "a discarded bench screw." I recommend you to do the same; but if you do not happen to have one, and cannot get one elsewhere, go to any dealer in tools, and buy a wooden bench screw. It will cost you about 1s. 6d. or 2s.

Papier-Mâché Pulp.—W. H. (*Dover*).—Without fuller information it is not easy to say why W. H. should have failed to make his pulp set properly. Possibly he may not have used enough pressure to expel superfluous moisture, or his paper may have contained saccharine matter, or his paste may have been too thin, or the flour used may have been what is called "self-raising." The glue paste is made by boiling flour and glue with water, and this has, after boiling, to be most thoroughly and intimately mixed with the pulp. A subsequent boiling might make the incorporation more complete, but would otherwise be immaterial. The mixture must be a thick mass before any attempt is made to mould it. In modelling in pulp (*i.e.*, building up forms in it with the spatula), only a little should be added in a day, and then dried. For trade purposes, considerable heat (stoving) is used in drying. A mixture of pulp with the above-described paste, when properly freed from moisture, can scarcely help setting into a solid mass. Glue alone would serve, as in the composition for stopping holes in wood; but when used on a large scale would be liable to crack, which the paste is not.—S. W.

Casting from Life.—J. E. S. (*Stoke Newington*).—Casting a hand or foot is simple when one side only has to be moulded. Take the hand; the back only to be shown. Rub a very little olive oil over the skin, place it palm downwards on a cloth so arranged as to fill up the hollows beneath as far as possible, and pour on the plaster. When this is set (say, in five minutes), the cloth may be pulled away, and the mould eased with a knife where necessary to let the fingers be drawn out. Well rinse the mould with clean water, and it is ready for making the cast, either in plaster or wax. If both back and palm are to be moulded, bury half of the hand in sand, mould it, turn it, and clean sand from edges of mould, which brush over with clay and water to prevent the two pieces of the mould adhering. Make second half of mould, remove the hand, and tie the two pieces tightly together before filling. To the second query of J. E. S. we would reply that articles, with illustrations, fully explaining the whole art and mystery of plaster-casting, are in preparation, and will soon appear in WORK.—M. M.

Lathe for Wood Turning.—F. S. (*Crewe*).—In reply to your queries:—(1) A conical mandrel fitting is best for wood turning, because the friction is less than parallel fittings. (2) No advantage whatever, unless you have corresponding block to raise the headstock. (3) This is a grave question on a common lathe; it is essential first to have front of headstock planed square with bed or bearer; then to have a casting (brass will do) to form base-ring for adjustment of oval. The cost of a trustworthy chuck to produce ovals of from 1 in. to 12 in. would be more than the value of an ordinary wood-turner's lathe. F. S. should try his hand at plain turning. First reach the first rung of the ladder before mounting the top.—G. E.

Overhead Motions.—J. E. J. (*Portsmouth*) writes:—"Referring to the valuable articles now appearing in WORK concerning lathes and turning appliances, and more particularly the portion dealing with 'Overhead Motions,' will you kindly point out the objections to the accompanying arrangement which I propose adopting, and which appears much simpler and easier to make than any shown in your last number? I ask your advice on this subject as your contributor recommends amateurs to be cautious in adopting ideas of their own in preference to those generally approved by our best makers."—From a practical point of view there is scarcely any objection to the form of overhead which you have sketched. As a cheap rig-up it is a very good substitute for the more expensive, and only slightly more efficient, pieces of apparatus shown in p. 92 of WORK, and with a few very slight modifications in design it will answer your purposes as well as those. First, for the wooden supports which you show at the left-hand end of the lathe-bed I think I should substitute iron—either parallel rectangular bars, between which the horizontal bar for the guide pulleys would be pivoted; or a single stout bar forked at the upper end to embrace the horizontal one, similarly pivoted. Then, instead of fastening these bars to the top of the lathe-bed, I would bring them down past the end and attach them to the standard. It is not clear how you intend to adjust the pulleys to suit the position of slide rest, as the centres of the pulleys in your sketch correspond with the longitudinal axis of the horizontal bar. I would suggest making a light casting to slide along the bar, to be pinched in any position with a set screw. From an eye in the bottom end of this casting I would suspend the guide pulleys by means of cord, so that they should be free to revolve on their spindles, and to turn into any required position to suit the drill spindle in the slide rest. This would be better than having the pulley spindles rigidly fixed in the horizontal bar. With these slight modifications your overhead will prove a good and efficient one.—J. H.

Bronze Powder and Frames.—G. A. (*Sheffield*).—Fig. 17 is described in second column of p. 74. The bronze powder at 6d. an ounce is hardly likely to last. Hughes and Kimber, of Fetter Lane, E.C., keep many qualities at various prices. I confess I do not quite understand your query. You say "Fig. 1 is mentioned as making a beautiful panel, but no mention is made of any frame; the same of Fig. 17." The latter I have referred to above, and the former is described on p. 72.—J. G.-W.

Printing Machine.—H. C. F. (*Great Bedwyn*).—The wooden copying press described in WORK No. 2 (p. 27) would not do for a hand printing press, in which the impression should be given by the action of a lever. Your letter shows that you are very much in the dark with regard to everything relating to printing, especially when you say that among your difficulties are, "how to fix the type, and how to use it when fixed." To attempt to give you the necessary instructions through "Shop" would be useless. You shall be shown how to make a small press, and do a little elementary work in printing, in some papers devoted to a consideration of the subject by a practical printer who is also a good woodworker.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Etching Names on Cutlery.—J. W. C. (*Walkley*) writes:—"Can you, or any correspondent, please tell me how to do it; or can you give me the name of a book that will give full instructions? I am told I shall want a small copperplate printing press, and I have to print the name I want to etch on a small slip of paper with a special kind of ink, and then use some transferring process. I should be very thankful to get full particulars of etching, as it is very much used in Sheffield trades."

Composition for Covering Pipes.—R. A. P. (*London*) says, "I should feel much obliged if a reader could give me a recipe for a composition for covering pipes to keep them from frost."

Machine for Current of Air.—BELLOWS (*Gloucester*) asks, "How a machine, to answer the purpose of an ordinary household bellows, should be constructed in order that it may be worked by a rotary motion, and give a constant current of air instead of an intermittent one."

Cleaning Oil Paintings.—L. S. (*Lower Broughton*) writes:—"I have an oil painting which has got very dirty, and should be glad if some one will inform me, through 'Shop,' how I could effectively clean it without injuring the figure."

Organ-Builders' Tools.—W. P. (*Grantham*) says:—"I want you to tell me where I can get the best list of piano and organ builders' tools, as I want several. I have got Mr. Melhuish's list, and I find tools for every trade marked, but none mentioned for the above, being an organ builder."

Chuck for Frame Turning.—R. C. H. asks:—"Would any reader of your valuable paper enlighten me on the subject of an eccentric chuck for turning oval frames and handles, and favour with drawing of same; or state where such can be obtained, and also what is the price?"

Joints in Indiarubber.—W. P. (*Grangetown*) writes:—"Will any kind reader tell me how the joints in bicycle tyres are made, also how to vulcanise indiarubber?"

A Pronged Ring.—BATTLEMORE writes:—"I want a malleable cast-iron ring with three prongs 1 in. diameter and $\frac{3}{32}$ in. thick. I might require them made in quantities of thousands. Can any reader give me the name of a good firm who could make them at a reasonable price?"

Moulded Indiarubber.—OSLEK writes:—"I want a piece of circular-moulded indiarubber 1 in. diameter and $\frac{3}{8}$ in. thick. Could any correspondent tell me where I could get them manufactured at a reasonable rate?"

Facsimile by Electro Process.—ELECTROTYPE asks, "How may I obtain a facsimile of a letter in relief for letterpress printing by the electro process?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Etching on Steel.—P. J. E. (*Hackney*) writes in reply to EXCELSIOR (see page 125):—"Seeing that you want to know how to etch on steel, I beg to submit the following receipt:—First clean your steel, and then dip it into hot white wax; then let it stand till it is hard, then dig again, and let it stand till hard as before; then take a needle, or anything with a sharp point, and draw your subject on the wax. After this use the following solution:—Pyroligneous acid, 5 parts; alcohol, 1 part; nitric acid, 1 part. Mix the first two, then add the nitric acid, pouring the preparation over the plates where the traces of the picture are. Let it stand till it has eaten sufficient depth, then wash the plate in cold water, dry it, and place it near a fire till all the wax is melted off."

Model Beam Engine.—ELECTRO writes in reply to W. J. P. (see page 125):—"I am at present making a model beam engine $1\frac{1}{2}$-in. bore, 2-in. stroke, and got a very good sectional drawing of the engine, full size, from Mr. R. Thompson, engineer, Church, near Accrington, and also the whole of the metal, and brass castings of same, at a very reasonable price."

Trade Notes and Memoranda.

A FOUNTAIN, fourteen yards in diameter and eleven yards high, ornaments the base of the Eiffel Tower. At the top are eleven figures. Six of them form a central group; and five lower down represent Europe, Asia, Africa, America, and Australia.

THE plant employed on the works of the Manchester Ship Canal is now worth more than three-fifths of a million sterling. By about the end of June there will be 20,000 men employed. Nearly one-third of the total excavation (reckoned at 47,000,000 cubic yards) has been finished.

TELEGRAPH poles are preserved in Norway by boring a hole about 2 ft. deep into the ground, and plugging coarse crystals of sulphate of copper around the wood. The wood absorbs the chemical, becoming of a greenish hue. This is said to be a perfect preservative, but requires occasional renewal.

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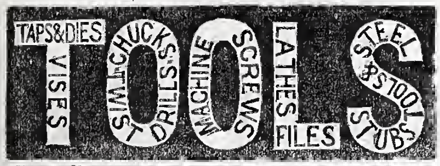

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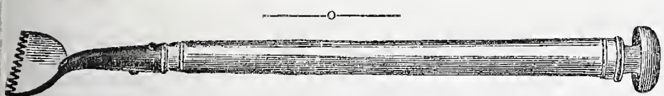

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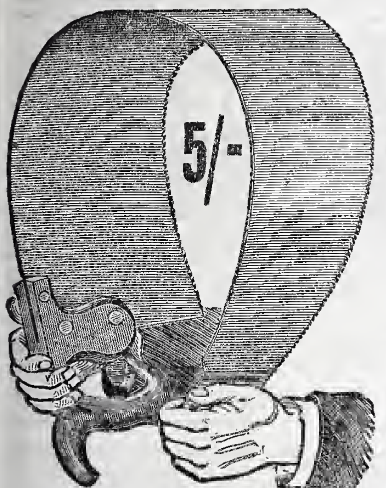

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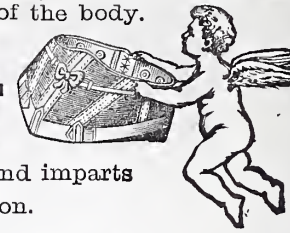

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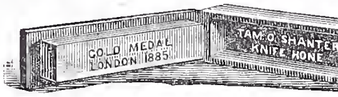

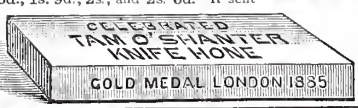

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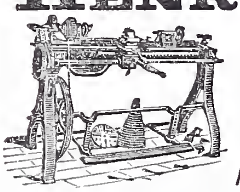

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 13.] SATURDAY, JUNE 15, 1889. [PRICE ONE PENNY.

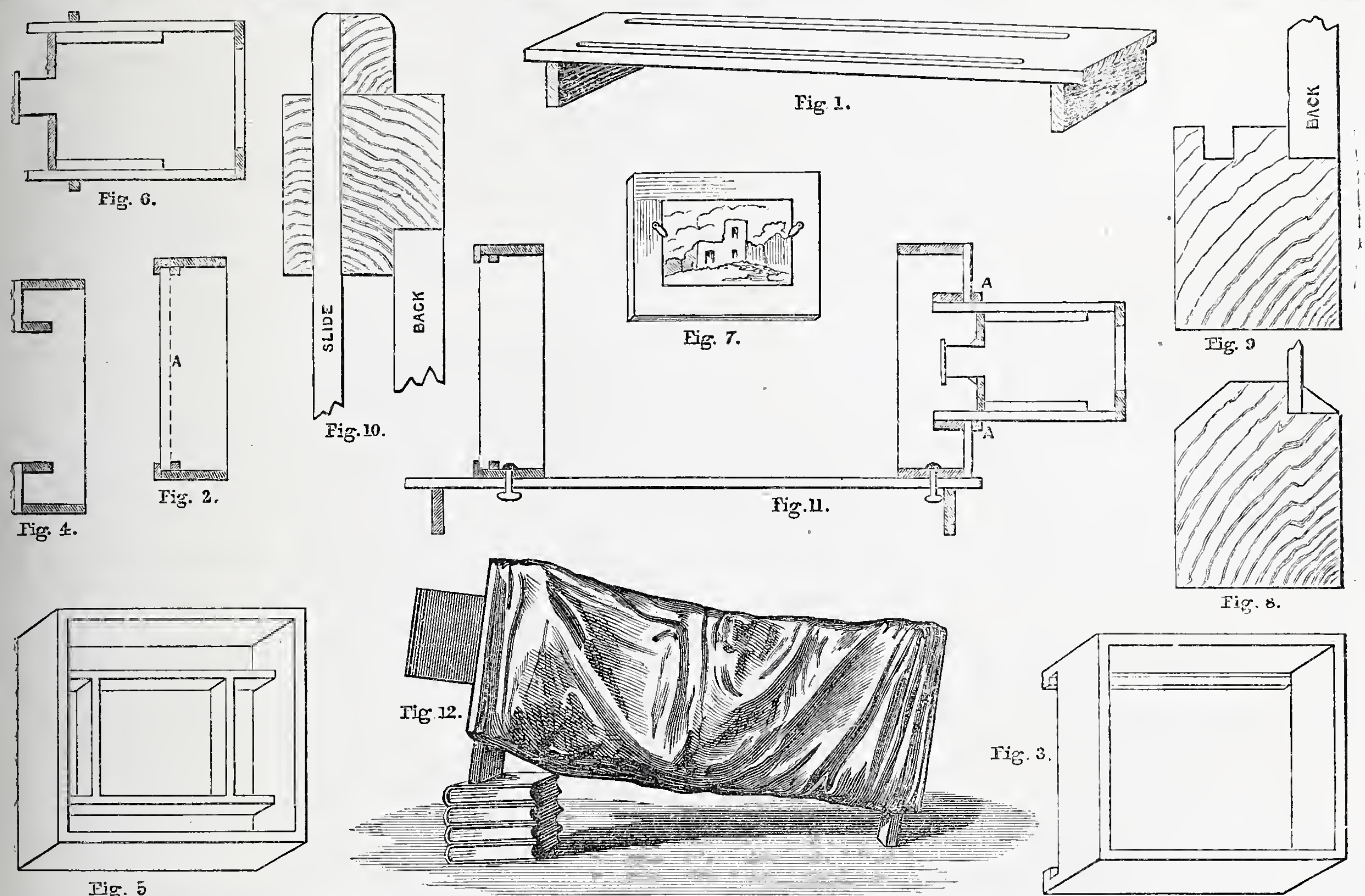


Fig. 1.—Baseboard, Perspective View, showing Elevation also. Fig. 2.—Camera Back: Section. Fig. 3.—Ditto: Elevation. Fig. 4.—Camera Front: Section. Fig. 5.—Interior of ditto: Elevation. Fig. 6.—Sliding Box for Front of Camera: Section. Fig. 7.—Carrier for Negative. Fig. 8.—Ground Glass Frame: Section. Fig. 9.—Dark Slide Framing: Section. Fig. 10.—Top End of Dark Slide. Fig. 11.—Camera Complete: Section. Fig. 12.—Camera in Position for Enlarging.

A CHEAP ENLARGING CAMERA.

BY G. LE BRUN.

INTRODUCTION—MATERIALS—CAPACITY OF CAMERA—BASEBOARD—BACK AND FRONT—BOX—GROUND GLASS AND DARK SLIDE—SILESIA CLOTH—INTERIOR—HINTS FOR WORKING—USE OF MAGNESIUM LIGHT—RULING GROUND GLASS—ADJUSTMENT OF PARTS OF CAMERA.

ALMOST every amateur photographer, whose kit consists of a quarter or half-plate set, after a time feels a yearning for larger pictures than he can produce with his apparatus; for, however artistic and beautiful his pictures may appear when mounted on cards, or in the album, they are too small for wall decoration, and could scarcely repay the expense of framing, being completely dwarfed when hung beside larger works. Now the great majority of amateurs are workers of small sizes, and of this majority the greater number are tied to size, more on account of expense than from choice; while the difficulty of getting a suitable room that can be darkened for the purpose of daylight enlarging, and the high cost of enlarging apparatus for artificial light, render the practice of this part of their chosen art out of the question.

Now, I have "been there;" I could only utilise a room for enlarging that had two very large windows, and a fanlight over the door; I tried the blocking out of daylight by making frames to fit the windows and covering them with brown paper. But, oh! the valuable time I lost in the attempt, and the stuffing of dusters, etc., into crevices to shut out straggling rays that would force their way in, till I found the game not worth the candle. Then, as my purse was unequal to the purchasing of an enlarging camera, I set my wits to work and devised the simple apparatus that I will endeavour to describe in this paper. When made, I found the process of enlarging easy and pleasant, and a most engrossing pastime.

The materials required are not expensive, the entire cost of the whole being under five shillings. The construction is easy, and quite within the powers of the merest tyro in carpentry who can handle a few simple tools, while the results are equal to any that can be got from apparatus costing many pounds; and the amateur who devotes a little time and perseverance to its construction will find himself the happy possessor of a useful appliance, and be able to decorate his walls with capital enlargements from his small negatives.

The particular apparatus I describe is made to enlarge up to $12\frac{1}{2}$ in. by $10\frac{1}{2}$ in., and of course to take any smaller size, but the size can be increased to suit individual requirements, the principle of construction remaining the same.

Referring to the accompanying drawings, Fig. 1 represents the baseboard, which is 3 ft. in length, 11 in. wide, and 1 in. thick; a piece of 1-in. wood, 4 in. wide, is screwed on the under side at each end to serve as supports, and also to prevent any tendency to warp; two slits, $\frac{3}{8}$ in. wide, are cut 1 in. from and parallel to each edge of the board; these slits extend from within 3 in. of one end to 9 in. of the other end, and are for the screw bolts securing the back and front of the apparatus to slide in.

The back and front of the camera, as I suppose we should call it, are made of pine 4 in. wide and $\frac{5}{8}$ in. thick, their outside size being 15 in. by $13\frac{1}{2}$ in. The back is shown in section in Fig. 2, with the fillets for holding the dark slide, one of which is put on the edge, the other on the inside. Of course it will be noticed that one end of the back must be kept $\frac{7}{8}$ in. narrower than the sides and other end to allow of the insertion of the slide; this is indicated by the dotted line, A, in Fig. 2. Fig. 3 shows the back of the camera complete.

Now for the front, which is shown in section at Fig. 4, and in elevation at Fig. 5. It is somewhat more complicated than the back, as an opening has to be arranged for to allow the box carrying the lens to be attached, and the front side has to be closed in. By referring to the figure it will be seen that two pieces of wood run right across between the ends, and they again have two pieces between them, thus forming an opening the size of which is 9 in. by $7\frac{1}{2}$ in., which must be exactly in the centre of the front; the slips of wood used for this purpose are 2 in. wide and $\frac{1}{2}$ in. thick; the spaces between them and the sides of the front are covered in with pieces of $\frac{1}{2}$-in. wood, leaving the opening clear.

A box must now be made to fit the opening tightly, the length of which is 9 in.; it is made of $\frac{1}{2}$-in. wood, and, when finished and fitted to its place, should have a small fillet put round the outside to prevent any light entering through the joint (A, Fig. 11). This box has no ends, and another box must be made to slide easily within it; this inner box is only 5 in. long, and is closed in one end, in which a hole is cut, and small fillets are put on the outside to allow of the insertion of the sliding front of your small camera and its lens, and, when fitted, which should be done as correctly as possible, a piece of black velvet is glued round the open end of the box so as to make it tight when in position. Fig. 6 shows these boxes in section with the negative carrier on the end of the larger one. This negative carrier is a piece of wood fitted to one end of the larger box, and having a hole cut in the centre of it large enough to carry the negative: of course, if you are going to enlarge from both quarter and half-plate negatives, you will have to make two carriers, one for each size. The hole must be cut with a small rebate of about $\frac{1}{8}$ in. to hold the negative, which is held in its place by two small turn buttons as shown in Fig. 7; the carrier itself is held in position by a hook and eye on each side.

Two pairs of $2\frac{1}{2}$-in. screw bolts with thumb nuts must be got; a pair of these are put in the bottoms of the back and front of the camera to coincide with the slits in the baseboard; small washers should be put on each screw bolt so as to prevent the nut destroying the wood on the underside of the baseboard when screwed up.

A ground glass back and a dark slide are now to be made; they are shown in section in Figs. 8 and 9 in full size. The back of the dark slide is made of wood $\frac{5}{16}$ in. thick, while the sliding front is simply a piece of thick millboard. I use millboard in preference to wood, as it is not so liable to warp; a piece of wood is glued across the top of the slide so that when it is closed no light can enter through the joint. (Fig. 10.) The ground glass being put in the frame and neatly puttied in, the camera is complete, so far as the woodwork is concerned, and can be put together, when it presents the appearance shown in section in Fig. 11.

Four yards of black silesia cloth are now bought (costing about sixpence per yard); this is doubled and sewed along the edges, then the ends are sewn together, and you have a bag with open ends; slip this bag over the front and back of the apparatus to serve in lieu of bellows, securing it by tying with tapes round the camera, put in your lens, and you are ready for enlarging.

The paper is secured in the dark slide with a drawing pin at each corner, and, as there is plenty of room between the back and the front of the slide, glass plates or opals can be manipulated, securing them in the same way as the paper.

The inside of all the woodwork must be stained a dead black; this is best accomplished by coating it with a mixture of lamp black and turpentine, adding a few drops of terebene to ensure drying. The whole of the outside wood I stained and varnished to represent mahogany. Instead of using silesia cloth, workers with plenty of spare time can of course make a bellows, but the labour entailed is great and the job messy; while the cloth bag is easily made and serves every purpose.

In focussing, slide the back of the camera only, keeping the front rigidly fixed in position; when the picture is sharp on the ground glass secure the back by means of the thumbscrews. To facilitate focussing I have drawn lines $\frac{1}{4}$ in. apart at right angles across the baseboard; these lines serve to guide the worker, as when once he has focussed a particular size of picture by marking the line at which the back was, he will have no trouble next time in finding the focus for that particular size.

When working with this camera I generally put it on a table close up to the window, and raise the front of it by placing a few books underneath, so that it may point towards the sky, and obviate the risk of getting a few stray chimney pots or tree tops in the picture that are not in the negative; when thus used the whole apparatus looks like Fig. 12.

As all the parts separate, it is easy to pack the camera away on a shelf or in any odd corner, and, as the trouble of putting it together is small, it is always ready when wanted. It has also the additional advantage that its use is not confined to daylight. I have got some very fine enlargements on Ilford rapid paper at night by placing a piece of white tissue paper in front of the negative and burning 18 in. of magnesium wire at 6 in. distance, waving it slowly in front of the negative so as to diffuse the light equally over the picture.

I would suggest that the ground glass be ruled with lines corresponding to the various sizes of paper, and the inside of the dark slide with exactly similar lines, so that when a picture is focussed on the glass the paper can be put in the slide in exactly the right position, and thus obviate the danger of getting only about two-thirds of the picture on the paper, as I did several times before adopting the lines. Care must also be taken that the back and front of the camera stand perfectly perpendicular on the baseboard, and also parallel to each other, as if they do not distortion and fuzziness will be the result. I say nothing about the *modus operandi* of enlarging, as that can be found in any elementary book on photography.

I have no doubt if any photographic enthusiast makes and uses a camera of this simple description he will be thoroughly satisfied with the work he can do with it, and the ease with which it can be used, while its inexpensiveness will commend it to all who have large aspirations and small purses, as is most unfortunately the case with the writer.

CYANOTYPES OR BLUE PHOTOGRAPHS.

BY L. IVOR POOLE.

THE Cyanotype—or, more familiarly, the blue process—although not for a moment comparable with the ordinary silver or other A1 methods of producing photographic prints, so far as highly finished pictures are concerned, has, nevertheless, so many good qualities, that many who waste a good deal of time with more complicated processes might well bestow a small amount of attention on it with satisfactory results.

The preparation of the paper is extremely easy, and the cost small. No toning is required, and the fixation is effected by simply washing the print in water. The process is most useful for copying fretwork and other designs, these being used as negatives from which to print; and it is perhaps better adapted for such work than for the production of photographic pictures as these are ordinarily understood. Still, for many photographs, the effect of the blue colour is decidedly pleasing. The technical defects may be briefly stated to consist in the difficulty of obtaining half tones, and in the loss of detail, though this latter depends a good deal on the kind of paper and the manner in which it is coated or rendered sensitive. It is, however, not my purpose so much to give complications of the simple process, although finer results might be obtained, as to give such directions as will be of service to the vast majority of those who want a cheap and easy means of sun printing.

The chemicals required are only two in number, viz., ammonio-citrate of iron, and ferri-cyanide of potassium ($K_6F_{e2}C_{12}N_{12}$), or, as it is sometimes called — the *red* prussiate of potash, to emphasise the difference between it and ferro-cyanide of potassium ($K_4F_eC_6N_63H_2O$), the yellow prussiate, which is of no use for the purpose. Both the iron and potash preparations are to be obtained through any druggist; but the red prussiate, not being used medicinally, may not be so familiar as the yellow prussiate to the ordinary chemist. It is to this cause the want of success sometimes complained of with the blue printing process may possibly be attributed—one prussiate having been used instead of the other.

An ounce of each will be ample to sensitise a large quantity of paper, and as they are both very cheap it will scarcely be worth while to purchase in smaller quantities. Great care, however, must be used with the prussiate, as it is a most deadly poison, and should never be carelessly left lying about, or where it might be mistaken for something harmless.

Whatever the quantity, the proportions are as follows:—Four parts of water to one part of each chemical, thus—1 oz. ammonia citrate, 4 oz. water; 1 oz. prussiate, 4 oz. water. The chemicals are readily soluble in water, so there will be no difficulty about this part of the preparation. The solutions should be made and kept separately, as there is then little or no risk of their becoming useless as they will do if mixed, unless they are carefully excluded from light. Some directions state that they should be mixed, and kept so ready for use; but I can see no advantage from doing so, unless that sometimes it may be more convenient to have one bottle than two. Even when unmixed, it will be just as well to keep the solutions in a dark place, though I have never found that a moderate amount of light does them any harm. Immediately before using—that is, applying them to the paper—equal quantities of each solution should be mixed, and not exposed to any strong daylight. It is not necessary to work in the ordinary photographic dark-room—that is, one illuminated only by ruby or orange light. It will be quite safe to use a moderate amount of gas or candle-light; or, in the daytime, to partially darken the room by drawing the curtains to or the blind down.

The mixture should not be effected till the paper is ready waiting to be coated.

A good deal has been said, and may be said, about the kind of paper best suited for the cyanotype process. For ordinary reproductions there is, however, no occasion whatever to be very fastidious about its make or quality, as any that is non-absorbent will answer. Naturally more care will be given if a print of a picture is wanted than if it is merely a design for fret cutting. I have frequently used ordinary writing paper and found it do very well. The better the paper, or perhaps it will be more correct to say, the harder and finer its texture, the better the print will be. The kind known, I think, as bank post, which is hard without much sizing, is perhaps the best. Of course, when pictorial effect is aimed at, paper free from water marks should be used.

A very small quantity of the liquid is required to sensitise the paper, on which it should be painted rather than rubbed in. Some advocate that the paper should be damped first, but this is not necessary. It prevents the paper curling up when the sensitising solutions are applied, but otherwise it only complicates the process.

The paper may be sensitised by either floating on the solution or by painting it on. A sponge may be used, but I prefer a large-sized camel-hair brush—one such as is used for damping the pages of press-copying books—to any other kind. The brush should be washed out directly afterwards, and may then be used for its ordinary purpose without suffering any injury.

Some small amount of care will be required to get the solution evenly spread over the paper, which, when coated, should be laid by in the dark to dry. It will, if protected from light, keep for a considerable time, though it does not improve, and on that account more should not be prepared than is likely to be used within a limited period. The fresher it is, the more quickly it prints, and the purer will be the high lights or white parts of the picture.

The exposure is made in an ordinary printing frame, and will be much longer than for silver prints, say from five or ten minutes in a bright sun with quick-printing negative, to several hours. The brighter the light, the more brilliant will be the picture, of course, provided that the exposure has not been unduly prolonged; as, if so, the high lights, instead of being pure white, will be tinted with blue. A bold, "plucky" negative gives the best results, while from a thin one it is hardly worth while taking a blue print.

The exposure must be prolonged till the darkest parts assume a greyish metallic appearance, the middle tones being decidedly a dark, but by no means a brilliant, blue; while the high lights remain much as they were originally, viz.: greenish hue, much lighter than any of the other portions of the print. Perhaps the best way for a novice to note the different colours, will be to lay a piece of the paper uncovered in the sun, and note the changes which take place. There will then be no difficulty in recognising the final depth to which the print should go. It will be understood that the image becomes visible, though detail is to a great extent lost.

To complete the print it is only necessary to wash it thoroughly in water till this runs off clear without any yellow tinge. So long as there is any yellow in the water which drips from the print, washing must be continued. The most convenient way to wash the prints is to hold them under the tap and let the water flow over them. This part of the process does not take more than a few minutes, during which the unfixed chemicals are washed away, leaving the high lights perfectly white and the remainder of the picture in shades, down to deep intense blue in the darkest shadows.

In conclusion, I may say that I have found that by holding the print under a tap of hot water the clearing and fixing are much expedited, the print being developed with an almost startling rapidity, which, in the case of an ordinary negative, would more than suggest over-exposure.

A "CHEVAL SCREEN" ESCRITOIRE.*

BY J. W. GLEESON-WHITE.

THERE are divers attributes required of furniture. One man I know always cries out for "stable" fittings. He does not mean, I find, that he wishes racks and mangers in his drawing-room, but that his upholstery should be of a rigid and monumental character. At once I must confess that the piece of furniture herein to be described would hardly meet his requirements; yet the original cabinet which supplied the motive of this combined screen and escritoire, was, at least, a hundred years old, possibly more. If our construction lasts out the century—not this century, but the hundred years from date—it will, probably, outlive our reputation, most likely our very memory. The individual who writes, and the one who is now kindly reading it, will most probably be entirely gone from human knowledge by 1989. If only space allowed, this theme would be a much more tempting subject to display one's newly acquired odds and ends of information, furbish up one's old stock of trite aphorisms, and moralise vaguely and generally, like the leading article of a sensational daily on New Year's Eve.

This piece of joinery is of somewhat ambitious order; it should not follow a rabbit-hutch, the ordinary first work of the youthful carpenter, unless the rabbit-hutch was a *very* good one. And if the tool chest is limited to a sort of hammer, a saw that makes excursions upon erratic anatomical deeds of daring in the back kitchen, and a bradawl that frequently (eager to do a little more than is required of it) attempts to fulfil the purpose of the nail, by staying firmly in its hole and parting company with its handle—the work had better not be attempted. This great triad of amateur tools must not be too lightly spoken of; they do a lot of mischief, and little good (like most of us), in the course of a year. Even as Mrs. Partington's mop, that was excellent for a puddle, but of doubtful good to drive back the encroaching waves of the Atlantic, these tools may be left to those whom they satisfy. But for the skilled amateur, whose work, by reason of special tools, ample time, and general good taste, is often quite equal to the very best professional work, there is no hidden mystery in this cabinet, which demands only good work of ordinary joinery: no angles fitted on Euclidian, unlikely, radiating lines; no curved work or elaborately-wrought turnery; only ordinary mortise and tenon, dovetail and mitre; yet since its purpose is for "my lady's chamber," it must be finished just as neatly as the craftsman is able to do it.

One point, I own, is doubtful: whether it would be trustworthy when in use, or whether, by a simple arrangement suggested in Fig. 3, it would not be needful to provide more support for the weight of the arms of the writer on its desk. Of course, it might be screwed to the floor; since it is a bric-à-brac what-not as well its movability is unimportant, and a single screw at each foot would not seriously affect the carpet, nor make it an awkward fixture in "spring cleaning." Of course, the legs might project more; perhaps that is the simplest way to overcome the difficulty; but in the original, so far as a hurried inspection serves, the general dimensions were about those given here, certainly not more spread out at the base.

The whole character of the design being somewhat Japanese, I would suggest either a red lacquer-like finish, or if that be too *outré*, and its alternative, black and gold, is impracticable or disliked, then, walnut holly, with satin or other light wood for the panels, might be adopted. The panels of the door and escritoire top, as suggested, are for inlaid work; better still, of real lacquer. Shops for the sale of Oriental goods have often damaged tea-trays that are procurable cheaply and cut up well for this purpose, or panels finished on purpose for ultimate framing. Painted decoration would also be in keeping, or the panels might be left plain. The design given is less a working drawing (although it is intended to fulfil that purpose) than a suggestion for a motive, to be varied according to the needs or will of the maker.

The whole piece of furniture should be neatly backed, either in panelled wood or with painted design; or finished by some fluted silk or other textile fabric; the idea of the structure being that it stands out, away from a wall, and showing all its sides.

Space is a valuable commodity; next to time perhaps the most in demand. Time and space are mighty words to deal with,

* When the same idea occurs to two different writers, and both make use of it according to their respective idiosyncrasies, the second in the field is set down by the charitable as a plagiarist. In Mr. Gleeson-White's "Cheval Screen Escritoire" readers will note a marvellous resemblance to Mr. Adamson's "Screen Secretary." Yet in neither case was one of them the outcome of the other. The "Screen Secretary" is followed by the "Cheval Screen Escritoire" to show how in all cases bent of mind influences treatment.—ED.

and a suggestion to save either sounds more like a motive for a sermon than for WORK; yet, if we can save either, or both, we will risk the allusion.

I see no reason why a duplicate, as it were, of the front, minus the secretaire itself, or a neat set of shelves for books, should not be added; this would, of course, make the thickness double, but (if a bookcase) at once remove any doubt as to its stability, and give additional use to the whole thing.

I should like to explain the making of this escritoire in words, but I have done so in diagram so exhaustively (at least, so it seems to me, if exhausting and exhaustive are synonymous), that I feel like an orator talking against time, and trying to lengthen out ten minutes more when he has already said all he had to say.

The whole framework should be, as far as possible, made to fit in one construction, that is, the main shelves and uprights should all fix together, so that they may hold in their place without a nail. I mean the sort of letter-H arrangements should fit like the divisions of a drawer for birds' eggs—I forget if there is a technical term for this process—the shelf that projects on either side being one piece, bracing the two main supports, and, if possible, being fitted to the two inner supports in like fashion. But it is hopeless to put this into words; if you cannot see what I mean by the diagrams, I can only regret having not been more clear in the drawing, and will readily supply the required information in "Shop."

The lining at the back of the shelves is intended to be covered with Japanese gold leather paper or a dark plush, to set off the china and other bric-à-brac.

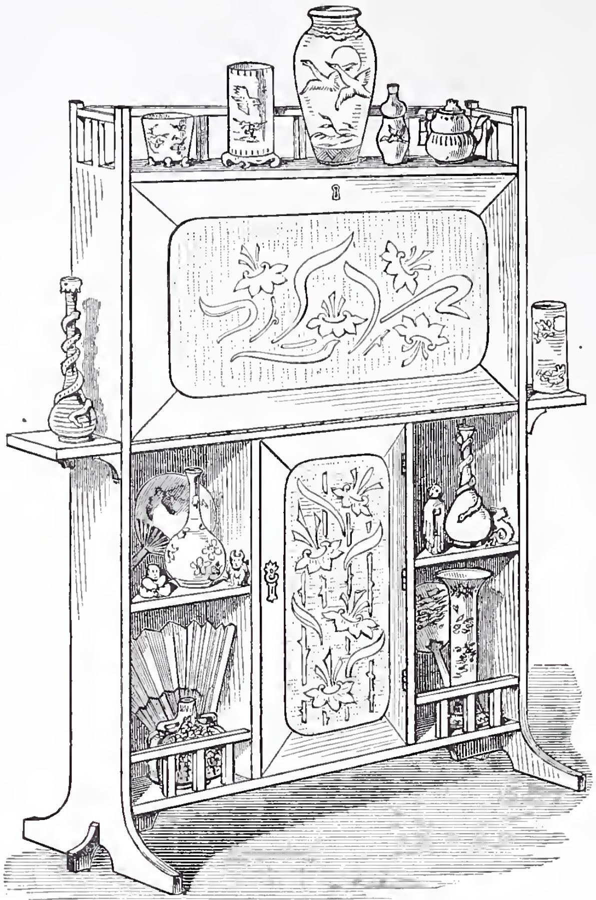


Fig. 2.—The Cheval Screen Escritoire with Cupboard and Shelves below.

If the edges of the shelves can be reeded, so much the better; if they can be inlaid, better still. If in place of the simple rail, which would look well in lacquer finish, but not in any other, a turned balustrade is preferred, all the Japanese ornaments should go, and a more formal pattern be chosen for the panels—such as Adams or Sheraton used so often.

The original escritoire charmed me—it was of inlaid wood, and had an arched top and cupboards enclosing all its space; whether, in attempting improvements, I have spoilt the idea, I cannot say.

I need say nothing about Fig. 1, which, as I have said, explains itself. In Fig. 2 the central space below is converted into a cupboard. The panel of the door and of the flap above may be hand painted or fitted with lincrusta walton.

Figure 3 shows a variation from the same main lines, but with fretwork introduced for the cupboard doors, and (although not shown in the sketch) has panels in the fall-down top, which forms the writing-desk.

To conclude, I would reiterate the advice to depart entirely from the model, if wished; but, if so, do it consistently. A mixture of styles is unbearable; *no* style is bearable; any style, if adhered to, is good of its sort, but a mixed style is generally as contemptible as the word mongrel, which fitly describes it.

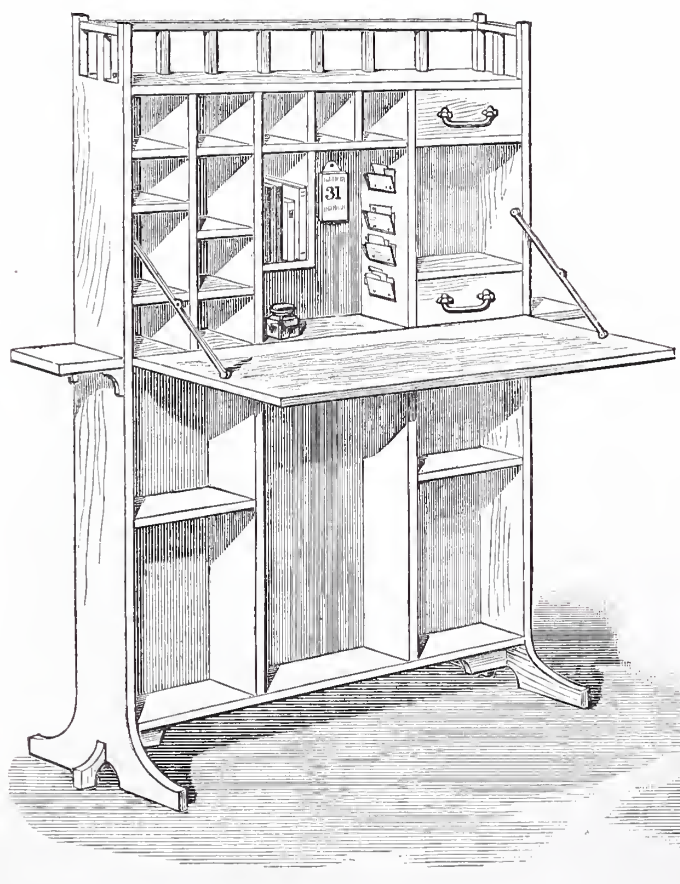


Fig. 1.—The Cheval Screen Escritoire in its Simplest Form.

Fig. 3.—The Cheval Screen Escritoire with Four Cupboards below.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

(*Continued from page* 164.)

Analysis of Formation of Letters of the Alphabet.

Let us now, in our intervals of rest from practice, consider together the letters of the alphabet as they stand in relation to the sign writer and his work, for which purpose I distribute them into five divisions, for the sake of clearness and the proper understanding of the subject.

The easiest letters to form are those, of course, which consist wholly of straight lines, or, more properly speaking, of parallel lines at right angles to each other. These letters are shown in Fig. 28. This drawing brings us to another class of letter, viz., the sans-seriff order, which are given here in outline only. In forming letters, no given rule can be followed as to their general construction and symmetry, and for this reason — letters may be of an average width and length, or they may be "elongated" or "extended," and consequently the width between all parallel lines vary accordingly. Referring to Fig. 28 and the letters E and F, I would point out that the middle *members* (this is a technical expression used in the trade, and indicates each individual portion of which the letter is constructed, or "built up" with) should never be quite so long as the outside ones. They may be nearly so, but should never be less than one-half as long as the other members. The letter H has one horizontal member exactly in the middle of the two uprights. This should be of the same width or thickness as the rest of the letter. Mr. Ellis A. Davidson, in his book on "House Painting," and in the chapter devoted to sign writing, argues that the middle member of the H should be thinner than the horizontals in other letters; but this, although having learnt much from his book, I entirely disagree with—in fact, his own drawing disproves the theory, which, I may say, is not followed by practical men. It is one weak point in an otherwise excellent book. The other three letters are some of the easiest to form, and require no further remarks other than that the top member of the T should always be equally distributed on each side of the upright.

Fig. 29 shows the only three letters which are composed of slanting or oblique lines. The first, V, is not a difficult letter to form, care being taken not to give it an appearance of falling or leaning on either side, and to allow each arm or member to slant at the same angle. W, the next letter, resembles two V's joined together; it must not, however, be so wide as two V's would be if they were actually joined, or it will give a very unsightly appearance to the whole word of which it is a part. The average width of the W should be about half as wide again as the letter F or N. That is, of course, for letters of normal dimensions, as elongated and extended letters are not at present under consideration. The X is generally formed in a rectangle, and the upper triangle of the two, formed by the members crossing each other, should be a little smaller than the lower one, but very slightly so. The lower portion, however, must never be the smaller of the two, or the letter will look ugly and top-heavy.

The letters which are formed of vertical, horizontal, and oblique lines combined with each other are given in Fig. 30. The A is simply a V inverted with the addition of a cross member. This should be nearer the bottom than the top, as shown in the drawings. The K is a somewhat difficult letter to draw to give it a pretty appearance. There are various ways of drawing it, which depend greatly on individual taste; the one given here, however, is that which is generally accepted as the true style, at least for all plain lettering. The M is, of course, a wider letter than the N, but the middle member should not be shortened, as we sometimes see it, but allowed to come right down to the base line. Some writers have compared this letter to the letter V, supported on each side by two perpendiculars, the outer lines of the V starting from about the middle of the top of each of the vertical members. This is a very good description of the letter. The way to draw the N is to make the perpendicular lines equal in width, and then to draw the oblique one from the innermost angles. The letter Y is fashioned after a V, but supported on a single leg or stem, and Z is formed within a rectangle. We next come to letters made up of both straight and curved lines (Fig. 31). The B and the R are very similar in construction, the only difference being that in one case the lower member curves inwards and in the other it curves outwards. In B the lower curve should always be slightly fuller than the upper one; it is thus prevented from having a top-heavy appearance, and looks altogether more solid. The D consists of a perpendicular and one full curve, the P of a perpendicular and a half-full curve, the J a perpendicular with a curved base, and the U a curved base continued into two perpendiculars. I have purposely left the five most difficult letters to the last, and these consist entirely of curved lines (Fig. 32). It

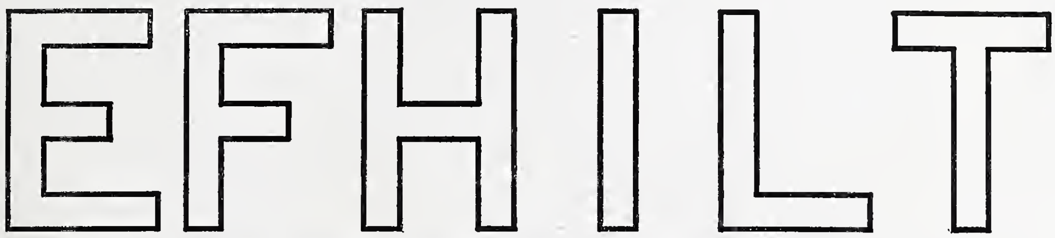


Fig. 28.—Letters Formed of Parallel Lines at Right Angles to each other.

Fig. 29.—Letters Formed Entirely of Oblique Lines.

Fig. 30.—Letters Formed with Combined Vertical, Horizontal, and Oblique Lines.

Fig. 31.—Letters Formed with Combined Straight and Curved Lines.

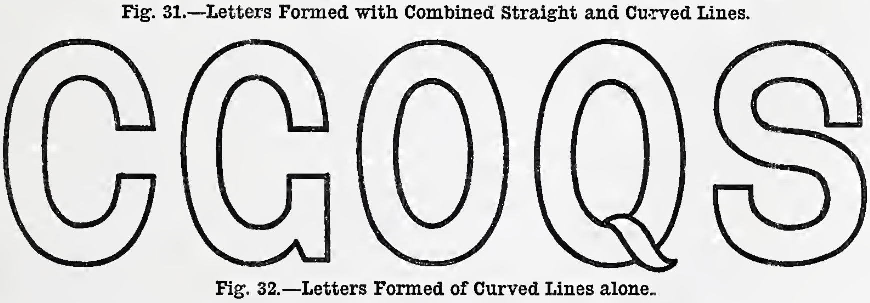


Fig. 32.—Letters Formed of Curved Lines alone.

should here be pointed ont that the O is the foundation or base upon which is constructed the C, G, and Q, and that the O should be a perfect ellipse. The S is the most difficult letter for a novice to draw, bnt if he has been assidnonsly practising the freehand lessons, he should soon be able to give it a graceful rendering without any extraneons aid. Having so far eschewed any reference to the mechanical ways of drawing letters, it would be out of place to give any directions here for treating the S in this manner; suffice it to say, therefore, that the letter should be contained within a parallelogram, and that it should have a proportionate appearance throughout. Of conrse, if the learner so wishes, he can at once adopt certain guide lines for the correct drawing of this letter, but it is uot recommended, for—to quote a well-known authority—"if the eye be not trained to a correct perception and an accurate discrimination, and if the hand has not, as the result of experience, the power of exact definition and precise demonstration, the ultimate result will be indefinite and unsatisfactory."

SMITHS' WORK.

BY J. H.

(*Continued from page* 147.)

POSITION OF THE SMITH IN ANCIENT NATIONS—FORGING OF ARMOUR—ARTISTIC METAL WORK OF MEDIÆVAL TIMES—CASTINGS IN METAL AND BRONZE—HAMMERED METAL WORK—CANDELABRUM IN MILAN CATHEDRAL—FITTINGS OF DOORS AND GATES—CAUSES OF MANY-SIDEDNESS OF OLD ARTISTS—INFLUENCE OF RELIGION.

THE smith was far and away the most important craftsman of ancient and mediæval times. It is only since the modern perfecting of the processes of casting, and because of the introduction of machines for the simplification of many of the operations of smiths' work, and also because of the very small demand for high artistic work in malleable iron, that the smith has fallen into a position among craftsmen inferior to that which he formerly occupied. From the periods of sacred and ancient history, down through the mediæval ages, in the wildest aud most turbulent times of crusade and chivalry, and in the ages of faith, the smith was the artificer whose services were in constant request by king and court, knight and pope, bishop and priest.

In ancient times one of the greatest evils by which a conquered people could be afflicted was the deprivation of their smiths.

When the Philistines conquered Judea they captured the smiths, "lest the Hebrews make them swords and spears." And the Israelites then "went down to the Philistines to sharpen every man his share, and his coulter, and his axe, and his mattock."—1 Sam. xiii. 19, 20.

When Jerusalem was taken by the Babylonians, they adopted the policy of carrying away the smiths captive to Babylou (2 Kings xxiv. 16).

Cyrus, after the conquest of the Lydians, ordered that no weapons of war should be kept in their possession.

In the peace which Porsena granted to the Romans he stipulated that no iron was to be forged, save for purposes of agriculture.

In the old chronicles and romances the smith figures as a conspicuous and important individual. As a maker of swords and armour, or forger of chain and plate mail, he was of the highest value in turbulent times.

The Romans worked and smelted the iron ores of this country extensively. Their cinder heaps have been found in North Derbyshire, North Yorkshire, Northamptonshire, in the Forest of Dean, in South Wales, Sussex, and other districts, and the smith was a mighty man both in the armies and in private dwellings.

In Anglo-Saxon times the smith was treated as an officer of the highest rank, and took precedence of the maker of mead and of the physician. In the ancient Welsh Court he sat near the king and queen, next the domestic chaplain.

Weland the Saxon Vulcan was a smith who is reputed to have forged the sword "Galatin" of Sir Gawain, and "Joyeuse" of Charlemagne. Among the Northern nations traditions of magic swords, the work of the smiths, long lingered.

William of Normandy brought over smiths and farriers with him to Britain, and the coat of arms of the earldom of Ferrers long consisted of horseshoes. It may be uoted that William I. introduced the practice of shoeing into this country. The ancieuts did not shoe their horses. The horseshoe came to be regarded with a certain kind of reverence, and horseshoes were hung on church doors to propitiate St. Martin, the patron saint of those who travel on horseback.

Edward III., it is said, sent to the Forest of Dean for smiths to act as engineers for the royal army at the siege of Berwick.

Iu Edward III.'s reigu the pots, spits, and frying pans of the royal kitchen were classed among his majesty's jewels.

Readers of "Waverley" will call to mind Andrea de Ferrara, a great smith in Highland story. He is said to have worked iu a dark cellar, the better to observe the colour necessary for the tempering of his blades. He could temper a sword so that by bending, the point might touch the hilt and spring back uninjured. Patten describes these swords as "all notably broad and thin, universally made to slice, and of such exceeding good temper that, as I never saw any so good, I think it hard to devise better."

The forging of armour was a most important section of the smith's work, and in course of time became a separate craft. So late as the year 1690 the workmen armourers of London presented a petition to Parliament, complaining that their trade was well-nigh ruined. As a matter of fact, the use of armour nearly died out with the Commonwealth.

Armour was used by the Anglo-Saxons, but the Normans employed it more extensively than did the conquered people, elaborating it until they became clothed *cap-à-pie,* and their steeds were largely encased also in armour.

Some of the aucient armour in the Tower is well worthy of close study. Helmets aud visors, breastplates, gauntlets, greaves, and so forth, are marvellous specimens of handwork—everything so thin and light, yet so strong withal. The chain mail is the older, having been superseded by the plate armour in the fourteenth century. The art appears to have reached its height about the time of Henry VIII.; witness that monarch's suit in the Tower which was presented him by the Emperor Maximilian. The armour of this period was sometimes fluted, ribbed, engraved, damascened, russeted, and otherwise ornamented. As indicative of the importance of the art of the smith in the mediæval period, during which its ascendancy was supreme, we note that in 1282 there were seventy-two forges leased from the Crown by iron smelters in the Forest of Dean alone. No marvel that the name of Smith or Smythe is so common. And the Scotch have their Gowans or Cowans, the Germans their Schmidts, the Italians their Fabri, the French their Le Febres or Le Fevres. There are also the Nasmyths, the Arrowsmiths, Goldsmiths, blacksmiths, whitesmiths, etc.

But the demands of the men-at-arms by no means occupied the whole time, or exhausted the skill of the smiths of the Middle Ages. There were arts of peace as well as of war, and there were the vast demands of the wealthy and ubiqnitous Chnrch. Craftsmen and artists—and the terms were often synonymous—vied with one another in rendering her service. The labours of workers not only iu iron, but also in brass, copper, and the precious metals, were pressed into her service.

Byzantium early became a great centre for the production of artistic metal work. From thence the art spread, in the ninth and tenth centuries, to the Rhenish provinces of Germany, to Italy, and Western Enrope. Bronze doors, altars, candelabra, and other ecclesiastical adornments commanded the highest skill of the Middle Ages; and untold wealth was expended on these works in bronze, copper, iron, gold, and silver. Of these, some were cast, some were hammered.

Cast iron is not suited for fine work, neither taking very minute impression of lines, nor capable of being worked into such delicate tracery as wrought iron, copper, and brass. Cast iron also requires to be so proportioned that the relative masses of adjacent portions shall not be very dissimilar, else shriukage stresses will be set up that are apt to cause fracture. Cast iron cannot be made of such extreme tenuity as wrought metal and brass. For these reasons, thongh it answers many of the purposes of the engineer most admirably, it was not used to any exteut worth naming, scarcely at all, in fact, by the mediæval workman. The common use of cast iron as a structural material only dates from the sixteenth century, when the process of smelting by pit coal instead of by charcoal was introduced.

The greatest refinement in the art of casting in bronze appears to have been attained by the great Italian artists. The method, as described by the Florentine artist Cellini, is as follows:—The figure was first roughly modelled in clay to a size very slightly smaller than the casting. Over this was laid a skin or thickness of wax, representing the thickness of the intended casting. A moulder will recognise in this the counterpart of the "thickness" on a loam pattern. The perfect figure of the cast was imparted to this wax with modelling tools, all the fine lines, expressions, etc., so perfect, as to leave little for after touching-up. Then a mixture composed of clay, pounded brick, and fine ashes, made with water to the consisteuce of cream, was applied with a brush, completely filling every interstice, and afterwards this was enclosed in a substantial body of clay, and the whole banded with iron hoops. Then the mass was baked in an oven, and the wax melted and escaped through holes left for the purpose. Rods of bronze passing from the outer mass to the inner core maintained the thickness of the interspace left by the melted wax constant, and into this space the metal was poured. After the removal of the baked clay the casting only required touching up.

But much of the old metal work was hammered as we now do repoussé work. The sheet metal was laid upon a bed of cement, composed of pitch and pounded brick, and the design was beaten into relief with hammers and punches, the pitch yielding, and so preventing fracture of the metal, however great its tenuity. This method was practised by the Assyrians and Greeks, as well as by the mediæval artists. The gates of Shalmaneser II. date from 859—824 B.C., and the Siris bronzes by Greek artists, both of which are in the British Museum, and are fine examples of repoussé work. In the latter the heads of the figures, though standing out life-like, and little thicker than paper, have been nowhere broken by the punch.

The great candelabrum in Milan Cathedral is a wonderful work of art, and dates from the twelfth century. It is fourteen feet high, has seven branehes, and is supported on four winged dragons. Even the minutest details of this work are finished with all the care that can be bestowed on the most delicate bit of jewellery. There is a plaster cast of this at South Kensington.

In the thirteenth and fourteenth centuries wrought iron came into general use for screens for chapels and tombs, and grilles for windows. It is impossible in this paper to so much as mention the greatest works of this character. Florence is rich in these precious antiquities, true works of art in which the skill of the smith is made to embody the creation of the artist, in which the boldest design and the most delicate imitations of nature harmonise, works which have been the wonder and despair of succeeding generations. The Italian smiths were famous for their skill, so too were the English, and specimens of their handiwork are to be seen at South Kensington.

Even the hinges of the doors which remain from mediæval times are true works of art and craftsmanship. The earliest English hinges date from about the tenth century, soon after the Conquest. They are stiff and cramped. Specimens occur on the west door of Woking Church, and at Compton, Berks. But in the Early English style they become very much elaborated and ornamented. The hinges on the refectory door of Merton College, Oxford, date from the fourteenth century.

Other specimens of door hinges occur at Radford Abbey, at Nottingham, Butleigh Church, in Somerset, Rouen Cathedral, St. George's Chapel, in Windsor, the doors of the Chapter House, York Minster, the south door of Durham Cathedral, and other localities.

In all the mediæval works, whether hinges, screens, gates, or cathedrals, there is the same grandeur of conception and beauty and perfection of execution, which inspire us with astonishment, reverence, and delight.

We marvel much at the many-sidedness of the old artists and the mediæval craftsmen. We wonder that men could master so much and so thoroughly like Leonardo da Vinci, mechanician, engineer, sculptor, artist, and man of science; Michael Angelo, painter, sculptor, architect; Quentin Matsys, blacksmith and artist, and others whose names will occur to the mind; and we attribute it to the small extent of ground which was covered by any single art or science in those periods as compared with the present. But this is not by any means the whole of the truth. If we have gathered a greater array of facts and details, the men of those times had grasped the broad ideal, underlying and encircling the practice of their craft, and they were not slaves to a little section of the same. Trades were not divided into sections, each man making the fractional part of a pin, of a garment, or of a machine, as is the case with us. The present division of labour, so profitable as a money-making system, so ruinous and depressing to the individual, did not then exist.

Those who have given attention to the history of the craft guilds of the Middle Ages are not at a loss to understand why the artisans of that period reached so high a degree of excellence in workmanship. As voluntary associations of brotherhood for mutual interest and protection, these guilds date under various aspects from early Anglo-Saxon times, probably even earlier. (The Blacksmiths' Company was incorporated in 1325.) They were strengthened by the most powerful sanctions of morality and religion, and solemn rite and ceremony. In the periods of their supremacy, every craftsman was compelled to belong to his proper guild, which exercised the most despotic power, usually for good, over him. No person was admitted a member who had not served a regular apprenticeship, the admission of whom was generally done in a solemn manner either at the Town Hall or at the guild meeting. The apprentice formed a portion of the family of his master, who was compelled to teach him his craft, and was held responsible for his morals. The regulations of the guilds were such that neither inferior materials nor bad work was permitted. As yet there was no division into capitalists and workmen, for most craftsmen shortly became masters and took apprentices. The guild statutes before the fourteenth century do not even mention the workmen, and it is not till about the middle of that century that regulations concerning them, as distinguished from their masters, were necessary.

Nor must we forget the influence of religion on the mediæval craftsmen. The Church was the principal patron of the arts and handicrafts. The great cathedrals and churches, with their altars and tombs, absorbed the best work of their time. Wealth there was in abundance to pay for the labour of years, whether that labour was engaged with the body of the building itself or on its adornments. The Church was the supreme power in society, overshadowing and overawing the kings and ministers, the warriors and the burgesses. The guilds, too, had their patron saints; they set up painted windows, erected altars, distributed alms, and went in solemn procession to church. Though such relations are ousted from nineteenth century industrial life, they, nevertheless, were a most vital factor in the mediæval period.

(*To be continued.*)

PANELS FOR WOOD CARVING.

BY FRED MILLER.

(*Continued from page* 145.)

The Plum, the Blackberry, and the Wild Rose.

All craftsmen should desire to design their own work, for it is not only more interesting to carry out the ideas that have emanated from one's own brain, but there is every likelihood that the work itself will be more spirited if the hand of the cunning worker is used to express his own ideas. I cannot do better, therefore, than offer a few suggestions on "designing for wood carving."

The three designs that accompany this paper are based on familiar forms, the larger panel (Fig. 1) showing the plum, and the smaller panels (Figs. 2 and 3) the common bramble or blackberry and the wild rose. I have purposely chosen familiar plants, because I want my readers to go to nature for themselves, and get the inspiration that is always to be derived from a study of nature direct from the fountain head. Every craftsman should make a point of drawing plant form whenever he has an opportunity, for all design is based on an intelligent study of plants. Draw any plant rather than none, but exercise your faculty of selection, and study particularly those plants which are what designers term "ornamentally suggestive," for a form like the bramble is full of suggestion, almost all its features giving the craftsman "opportunities." The leaf itself, made up of five small leaves growing from a common stalk, is most adaptable, and can be rendered effectively in wood. Then the way the leaves articulate from the stem in what is termed a "whorl," or around the stem on the principle of a spiral, is a point to be noticed. The stem, again, with the spines is an ornamental feature, and one that can be, and should be, made much of. In the panel it will be noticed that I have introduced a flower and buds as well as fruit, in order to enforce practically the axiom that every suggestion should be made the most of by the craftsman, and as the flower is seen at the same time as the fruit, such a trait should be utilised and insisted upon. The fruit, again, with its numerous little beads or "drupes," is most effective in carving, as the surface being broken up, catches the light, and casts numerous shadows, which give brilliancy and relief to work, and prevent any tendency to tameness.

The skill in wood carving is seen in the way the surface is broken up or "thrown about," as carvers say. In other words, it depends for its effect on some forms being prominent and receiving light and others being kept back and producing shadows. The throwing about can less easily be studied in a sketch than in modelling in clay, for one is more occupied in disposing the various forms, filling out the space, and arranging "lines" than in studying it as a piece of carving. I have endeavoured to suggest by light and shade which parts should be prominent and which should be kept back, but in actually carrying out the design many modifications would doubtless present themselves. Many wood carvers model the design roughly in clay, and work from this rather than from the design on paper, and undoubtedly a more accurate estimate of the finished work can be thus obtained than by the most elaborate of pencilled drawings. But this is a branch of the subject which must be treated on another occasion.

To return to the designing. To make the best use of plant form, it is necessary to draw the plant many times, until one is thoroughly imbued with its spirit and knows all its salient features by heart. For in designing you do not want to think of any one particular specimen you have on some occasion seen, but your object is to put into your design the characteristics of the plant, and not the adventitious and individual peculiarities of some *one* specimen. And to get freedom as a designer one must be able to depend largely upon recollection (the stores of a well-stocked memory accumulated by patient and thoughtful observation), rather than upon reference to fragments. The planning and disposition of the main lines of the design should, at all events, be studied apart from any individual specimens; for if one has recourse to such data, the design is apt to be local and petty instead of general and dignified. In other words, the letter instead of the spirit will be found in your work when the recollection is not largely depended upon.

A designer has to first of all dispose his forms so that they occupy the space without crowding it, and the skeleton of the design should have balance, proportion, and grace—qualities which largely reside in the designer's inner consciousness: for you may have made a most excellent drawing of a bramble, and yet utterly fail to adapt a portion of it to occupying a particular space agreeably, or in such a way as shall give the beholder the feeling that the bramble filling out the panel was designed for that space, and that alone, and could not have been employed elsewhere.

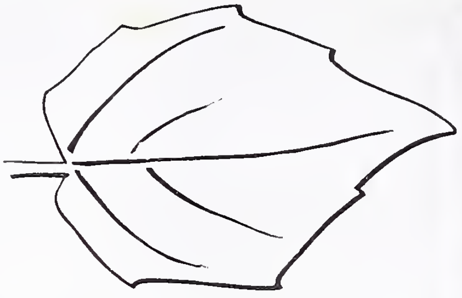
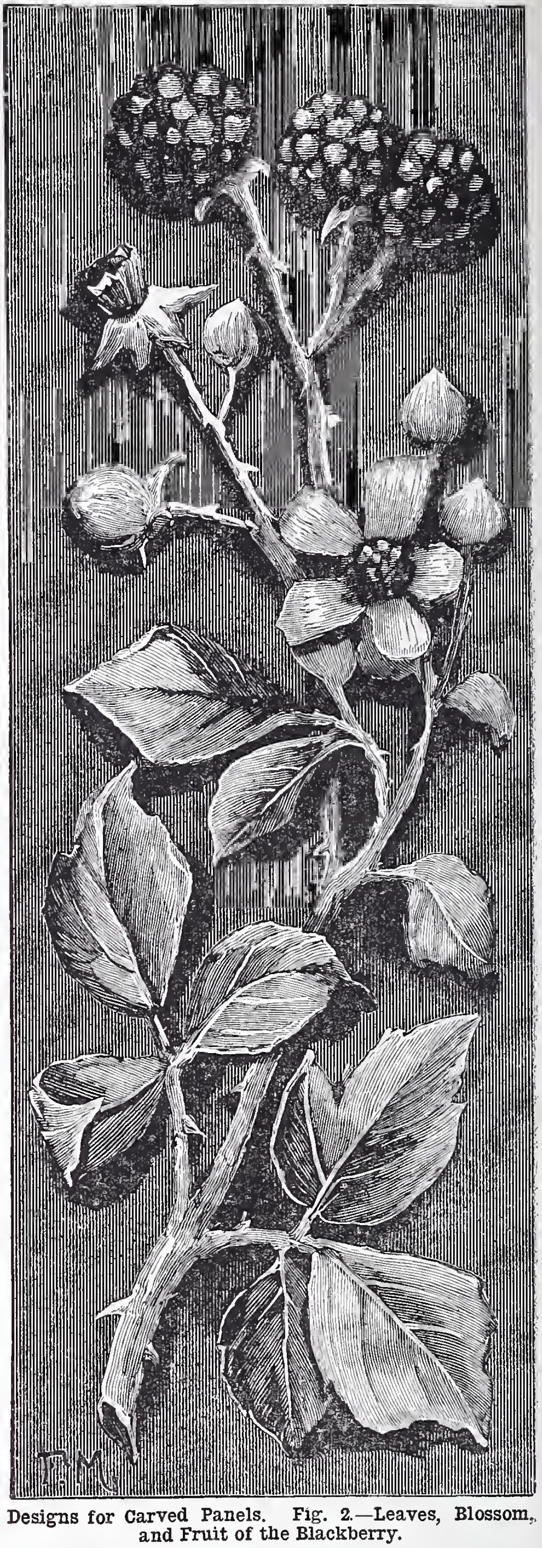


Fig. 4.—Angularity in Leaf Form to be followed in Wood Carving.

Designs for Carved Panels. Fig. 3.—Foliage and Fruit (Hips) of the Wild Rose.

Then the capabilities of your material and the possibilities of your craft have to be considered. Remember always that you are not, as a wax modeller does, imitating a piece of bramble in wood, but are carving a *design* suggested by the bramble. A great deal must perforce be generalised, for if we think a moment it is evident we cannot cut all the stamens in the centre of the flowers, or make the spines on the stem as sharp as they are in reality, or put every vein in the leaves. But we can *hint* that the stem is set with excrescences we call thorns, and can suggest that the leaves are veined in one way and not another, and that the stamens are many. We shall be truer by our generalising than we should be if we attempted to reproduce all we know to be there if we look for it, for then we should fail, owing to the impossibility of carrying out such a task, whereas we can entirely succeed if we only attempt to suggest the marked peculiarities or individuality of the bramble. We must draw what appears—what strikes the eye when we look intelligently at an object—and not what we know from previous study to be there; and this rule applies with even greater force to the work of the chisel.



Designs for Carved Panels. Fig. 2.—Leaves, Blossom, and Fruit of the Blackberry.

Start with the main stems, and get these placed so that they form either agreeable curves or "nervous" angles with each other. At the same time put down your leading features, as the plums in centre panel, for the objects being

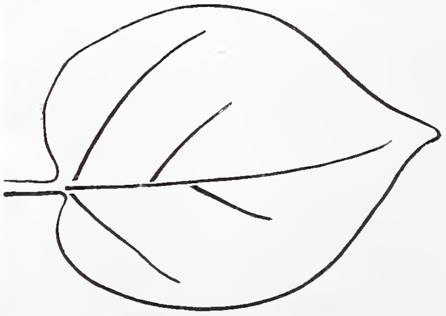
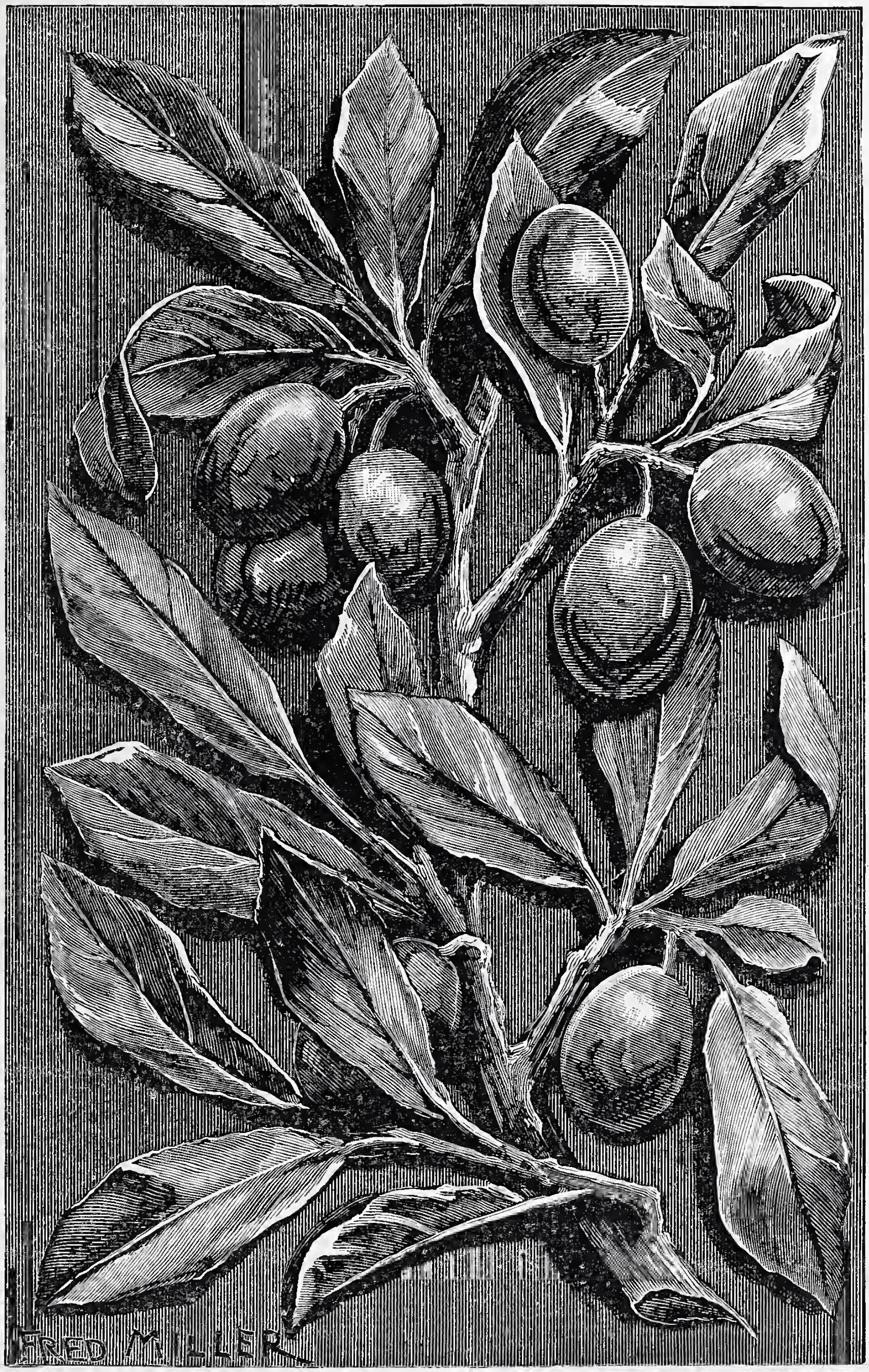


Fig. 5.—Rounded Outline in Leaf Form to be avoided in Wood Carving.

prominent must be thoughtfully arranged so that they do not (*a*) all come in one place and leave the rest of the space vacant, and (*b*) fall one under the other in perpendicular lines, but are spread about, so that if we drew lines from one point to another we should make a series of triangles instead of squares. Having roughly fixed upon the position of stems and fruit, we can now think of the leaves. These want most carefully arranging, and many considerations step in. We must not have too many leaves — not nearly as many, in fact, as we might find on a piece of plum, for we want to keep our design simple. Then some leaves can fall over the fruit and stems, for the stems should here and there be broken up by leaves or fruit, to take away the look of *stalkiness*. As we proceed with our design we shall modify some of the features already indicated, for second thoughts are often the better. It stands to reason that as all forms have a relation to each other, the introduction of a leaf or fruit may cause us to slightly modify the disposition of some particular piece of stem, though adhering generally to our first suggestion. Thus you see a design is gradually built up or put to pieces like a puzzle, and not set down as a whole, complete in all its details from the outset.

In carrying out the three designs, an enlarged drawing should be made the size you intend to carve them — say three times larger than their dimensions in Work, or fully the natural size. The enlargement should then be transferred to the wood, or pasted down upon it if you do not require the design again. The depth of the "grounding out" (taking out the background) depends upon the thickness of your wood; but I would advise those workers who are still novices not to attempt too much relief. Keep the design as a low relief, for the carving or "throwing about" is *the* difficult part of the work, and the more relief you attempt so are your difficulties increased. I should be disposed to tiy the designs not more than half an inch in depth; even three-eighths would be sufficient. The "grounding out" is much more difficult the deeper it is taken into the wood, and at the outset the general difficulties are quite enough to overcome, without courting others. It is much better, I hold, to succeed in a humble way than egregiously fail by over ambition; and I always make a point whenever I have taught to put a very moderate programme before my pupil, and direct my assistance to enabling him to overcome such difficulties as arise, so that succeeding with a moderately simple piece of work, he is emboldened and encouraged to go from more to more.



Designs for Carved Panels. Fig. 1.—Plum.

My remarks, as well as the designs themselves, are intended for those who have had some practice in wood carving; but in another number of Work I will take the reader back to preliminaries, and begin *de novo*.

One word more. I spoke just now of the stems making *nervous* angles with each other. A design is said to be "nervous" when there is vigour, crispness, angularity in it — qualities, in short, the reverse of tameness. Now, getting the work *angular* is what gives work its nervous quality. Instead of the edges of leaves being round or continuous, they should be in a series of angles (as in Fig. 4), and not rounded (as in Fig. 5). Examine leaves for yourself, and you will notice that nature is full of angles. The leaves break vigorously from the stems, and the stems again form most beautiful angles with each other. "Round" lines are always a sign of want of skill, and are sure to produce a feeling of insipidity and feebleness. Do not be afraid of letting your chisel show itself in your work. Good wood carving looks as though the craftsman had executed his work by a series of well-directed bold cuts rather than a number of nerveless timid ones.

I see that I have mentioned the need of an enlarged drawing if you wish to reproduce the designs on a larger scale than that in which they are given in the engravings, but I have said nothing about the method to be followed in enlarging, which some readers possibly may not know. Suppose you wish to produce a copy of Fig. 3 *twice* its size (that is to say in linear dimensions, for the area covered will be *four* times the area of the original), divide the drawing into squares $\frac{1}{2}$ inch each way by drawing lines across it and from top to bottom at intervals of $\frac{1}{2}$ inch. Then rule a piece of paper in the same way with lines one inch apart, and having done this copy the outline, square for square, on the paper thus prepared. You will thus get a true and exact enlargement.

ARMATURES AND ASSAYING.

BY GEORGE EDWINSON BONNEY.

AQUA REGIA—ARMATURE—ARSENIC—ARSENIOUS ACID—ASSAY: ASSAYING—ASSAYING FOR GOLD BY THE DRY WAY.

Aqua Regia.—A mixture of nitric and hydrochloric acid has long been known by this name. This also is a compound of two Latin words meaning "royal water." The name was probably derived from its well-known property of being able to dissolve gold, the royal metal. The usual mixture of the two acids employed to dissolve gold is composed of hydrochloric acid three parts by measure, to nitric acid one part by measure. The both acids should be pure, and only mixed just before they are required, as the mixture will not keep good for any length of time. Even when enclosed in a glass-stoppered bottle it is liable to be decomposed and cause a separation of chlorine from the other constituents. A druggist related to me a short time ago a little experience of his illustrative of this property. A careless assistant mixed some aqua regia, put it in a glass-stoppered bottle, tied the stopper down to prevent any escape of chlorine, and placed the bottle, with other drugs, near the shop window. Shortly afterwards the sun shone strongly on that window, and then there was an explosion, which not only shattered the aqua regia bottle, but also several other bottles around it, and filled the shop with suffocating fumes. Aqua regia will dissolve platinum, but more slowly than it dissolves gold. On some other metals it acts more strongly than any single acid, but on silver it has scarcely any action, owing to formation of the insoluble chloride of silver which forms a crust on the metal, and protects it from further action.

Armature.—A name given to the iron keeper of a permanent magnet. It is also applied to that part of a dynamo-electric machine which is rotated within the influence of the field magnets. In the greater number of those machines, the armature is made to revolve within the field, or magnetic influence of the magnets, but there are some exceptions in which the magnets are caused to revolve and the armature is stationary. Revolving armatures and fixed field magnets have the merit of adding stability to the machine and steadiness to its running and the output of the current. Each inventor of a new dynamo-electric machine appears to have adopted a special form of armature, hence we have as many forms of armature as there are inventors of machines. The armatures of dynamo-electric machines are generally furnished with iron cores, around which the insulated copper wires are wound. Machines have been constructed without iron cores by Messrs. Siemens, Ferranti, & Thompson. In those machines a looped or zigzag band of copper is attached to a brass spider, mounted on a spindle, and forms the armature Armatures are divided by Sir W. Thompson into four types:—

"(1) *Ring armatures*, in which the coils are grouped upon a ring whose principal axis of symmetry is its axis of rotation also.

"(2) *Drum armatures*, in which the coils are wound longitudinally over the surface of a drum or cylinder.

"(3) *Pole armatures*, having coils wound on separate poles projecting radially all round the periphery of a disc or central hub.

"(4) *Disc armatures*, in which the coils are flattened against a disc."

Of these it is as well to say that examples of the first type are furnished by the machines of Gramme, Schuckert, Gülcher, and Brush. Examples of the second type are found in the Siemens (Alteneck), Edison, Weston, and Elphinstone-Vincent machines. Examples of the third type may be seen in the dynamos of Allan, Elmore, and Lontin. There are few useful examples of the fourth type, but several combine the first with this, as where flat rings, or discs, are used side by side. When solid iron is employed for an armature core, it abstracts a portion of the electric current from the machine, and this is employed in heating the iron. The current thus abstracted, forms what is called eddy currents in the iron, and causes the machine to become hot. Iron armatures should, therefore, be built up of thin sheet iron discs, or plates, or hoop iron, each piece of iron being insulated from its neighbour by varnished paper or calico. The armature coils should be of pure copper wire, well insulated with cotton steeped in paraffin, and the wires should be as short and thick as is consistent with the requisite E.M.F. without driving the machine at an excessive rate of speed. For further information, see notes on *Dynamos, Electric Machines*, etc.

Arsenic.—Chemical Symbol, As. A crystalline and very brittle metal of a steel-grey colour and high metallic lustre which readily tarnishes in the air. It is found combined with sulphur in the ores of several metals, and as an arsenide with iron, nickel, and cobalt. When these ores are roasted, the arsenic in them combines with oxygen, and forms crude arsenious acid. This is purified by sublimation, and roasted with charcoal in a retort where the arsenic is reduced to its metallic state. The combining or atomic weight of arsenic is 75. It readily combines with oxygen on being heated, and is converted into arsenious acid. Heated in a retort, it volatilises without fusion. Arsenic may be made to combine with metals, and the alloy thus formed bears a close resemblance to that of an alloy of the same metal with phosphorus. The general effect of its presence in a metal is to increase its hardness and lessen its conductivity. Impure copper is sometimes contaminated with arsenic.

Arsenious acid, named also *white arsenic*, and *white oxide of arsenic*.—Chemical symbol, As_2O_3. Molecular weight 197·8. This is the only compound of arsenic used by the electro-plater. Professor Fownes says of it:—"It is a heavy, white, glassy-looking substance. When freshly prepared it is often transparent, but by keeping becomes opaque, at the same time slightly diminishing in density, and acquiring a greater degree of solubility in water." Boiling water will dissolve arsenious acid in the proportion of 11·5 parts acid to 100 parts of water, but 8·5 parts of the acid is thrown down when the solution cools. Agitated in cold water, even less acid is dissolved. These solutions will redden litmus paper. Alkaline solutions dissolve it freely, forming arsenides with the alkali. It is easily soluble in hot hydrochloric acid. The vapour of the acid is colourless and inodorous. "The acid has a feeble, sweetish, and astringent flavour, and *is a most fearful poison.*"

A solution of arsenious acid in water may be easily detected by the following methods:—

1. Add a solution of silver nitrate. At first there will be no precipitate, or merely a slight cloudiness in the solution. On adding a little alkaline solution or a drop of liquor ammonia, a yellow precipitate of arsenide of silver will be formed. This precipitate is soluble in an excess of ammonia, and also in nitric acid.

2. Add a solution of sulphate of copper. This gives no precipitate until a little alkali is added, when a yellow-green precipitate (Scheele's green) is formed. This is also soluble in excess of ammonia.

3. A slip of copper foil boiled in the liquid suspected to contain arsenic, will become whitened if the liquid has been previously acidulated with hydrochloric acid.

There is no simple antidote for arsenical poisoning, but calcined magnesia mixed with water will give relief. Death may be averted by the timely use of the stomach pump, and remedial agents prescribed by a competent medical man. See also notes on *Poisons, and Poisoning.*

Assay: Assaying.—An analysis of metals, notably those denominated precious metals, with a view to determine their purity. The apparatus necessary to conduct assaying operations is too costly to be within the reach of electro-platers working in a small way of business. But all large firms engaged in the manufacture of goods in which large quantities of gold and silver are used, should have means at hand for assaying the goods. Only a mere outline of the process can be given here. Full information can be obtained in Mitchell's "Manual of Assaying." Assaying for gold and silver is performed in the dry way by the use of suitable furnaces and crucibles, or in the wet way by the use of acids and certain chemical re-agents.

Assaying for Gold by the dry way.—First of all weigh out a sample of the metal to be assayed in a delicate balance capable of indicating to 100th of a grain. The sample should be some easily divisible part of the pound troy or the pound avoirdupois, just as the answer may be required, or it may be some aliquot part of 100 grains. If it is suspected to contain more than one-fourth of its weight of gold, it must be fused with enough silver or copper to bring the proportions to exactly 1 part gold to 3 parts alloy. The bead of metal thus obtained must now be flattened out to a thin disc, or rolled to a thin riband and annealed. It is then placed in a thin glass flask, or beaker, or in a porcelain capsule, together with 2 parts pure nitric acid to 1 part of distilled water, and heated over a sand bath until all ebullition has ceased and the hot liquid ceases to give off bubbles of orange-coloured nitrous oxide. The acid solution of copper and silver must then be poured off into another beaker, and the finely divided gold dust or sponge of gold well washed with distilled water ejected from a wash bottle. Finally, the gold must be washed into a small porcelain crucible or into a cornet pot, dried, and fused to cause coherence of its particles. It may then be accurately weighed, and the proportion of gold calculated.

It is not possible for me to complete my Notes on Assaying in this number, and I must therefore postpone to the next paper the further consideration of gold and silver assays in the dry way, as well as the assays or analysis of metals that are known to contain silver. The subject is one of considerable importance as well as interest, and therefore deserves and demands attention. I shall not detain the reader long with this subject, and I shall then pass on rapidly to other topics which have been kept waiting through sheer inability to give greater instalments at a time.

OUR GUIDE TO GOOD THINGS.

47.—Steel Calliper Gauge.

In Fig. 1 in this page is shown, full size, a very handy little instrument for machinists and tool makers, manufactured by Mr. Chesterman, of Sheffield, and sold by all dealers in tools and hardware merchants throughout the United Kingdom. Beautifully made, accurately divided, and exquisitely finished, it demands the attention, and should be in the possession, of every workman of the trades for which it is chiefly intended. The Steel Calliper Gauge is made in four varieties, distinguished by the divisions marked on them, each variety being made 3 in., 4 in., and 6 in. in length. The four sorts are known by numbers stamped on the instruments to facilitate distinction, the numbers being 1400, 1401, 1402, and 1403. They are sold, the 3 in. at 5s., the 4 in. at 5s. 6d., and the 6 in. at 6s., in all varieties except No. 1401, the prices of whose three sizes are 6s., 6s. 6d., and 7s. respectively. It will be useful to say that No. 1400, as shown in the illustration, is divided, the inches into 32nds, and centimetres into millimetres and halves. In 1401 the metric divisions are the same, but inches are subdivided into 32nds, 48ths, and 50ths. In 1403, divided for inches only, the subdivisions are into 32nds and 50ths. No. 1402 differs from the rest, in having inches and circumference measure shown upon it, of which the former is divided into 32nds and the latter into 16ths. The particular use of this gauge is that if the diameter be known and the movable arm adjusted thereto, the upper end of the arm will also indicate the circumference in inches, and *vice versâ;* if the circumference be known the diameter may be read off the scale by adjustment of the movable arm. The construction of the instruments may be seen from the illustration. A flat steel bar, which is carefully graduated, is set on the fixed arm of the Calliper Gauge at right angles to it. On the bar slides the movable leg, kept in position by a projecting arm at the bottom and a spring at the top. At the top there is always a binding screw by which the movable arm may be held in place and rendered as rigid as the other.

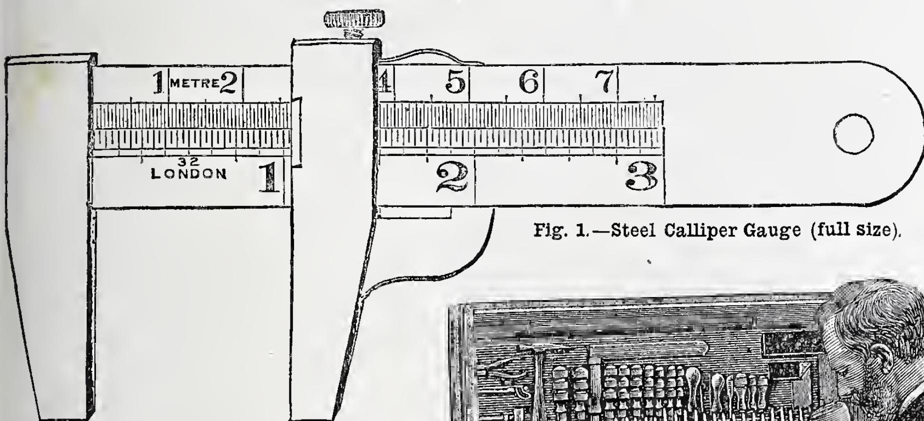


Fig. 1.—Steel Calliper Gauge (full size).

48.—Barrett's Improved Combination Roller Gauge.

This capital tool is an importation from the United States, in which it was patented barely a year ago. It is manufactured by Mr. C. E. Jennings, 79 and 81, Reade Street, New York, the maker of the well-known Jennings' Twist Bits. Its nature may be seen from the illustration of it given in Fig. 2, which is just half size. It consists of three parts, and is composed entirely of metal, the head being of superior grey iron, and the beams of Bessemer steel finely polished and nickel-plated throughout. The head is octagonal at top, as shown in Fig. 3, and circular below. It is pierced with two holes in which the beams work, the latter being secured, when adjusted, by binding screws, which appear clearly enough in Fig. 2. The larger beam is 8 in. long, and is graduated throughout its length in inches and 32nds of an inch. The smaller beam is 4 in. long. In place of a spur or point, rolls of the finest steel are used, bevelled to a fine edge, hardened and revolving on the shank of hardened steel screws, enabling them to run over cross-grain, knots, and rough surfaces with perfect ease and accuracy, making a nicely-finished, easy, and perfect working tool. It may be used both as a mortise gauge and as a marking gauge, but when it is used in the latter capacity the head or roller of the shorter beam must be dropped into the recess made for its reception in the plate, and shown to the right in Fig. 4. It is a nice tool to handle, and much superior to the ordinary wood gauges. It is only recently on the market in this country yet, and its price is 9s. 6d. post free.

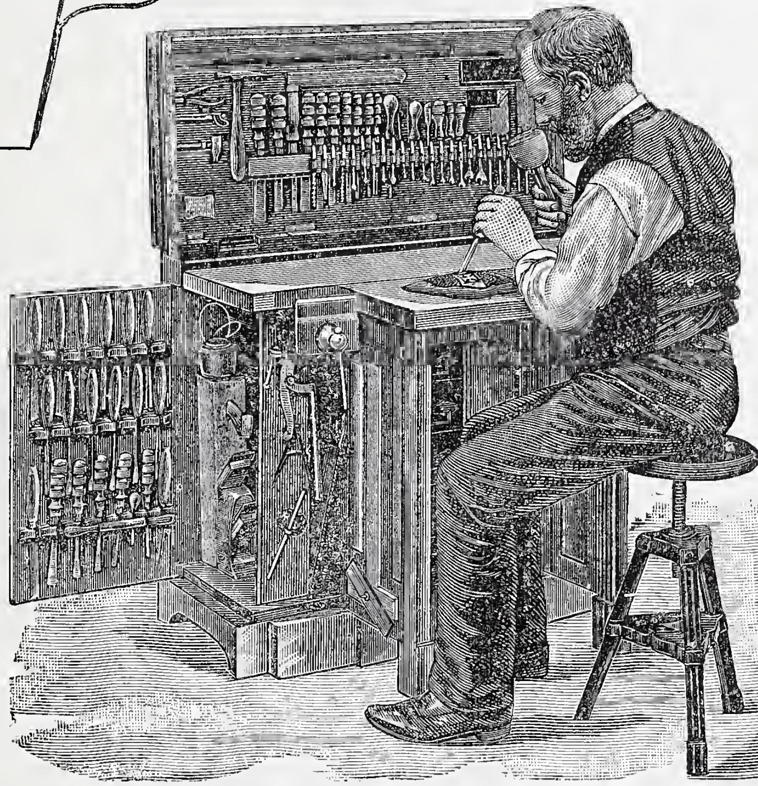


Fig. 4.—Melhuish's Tool Cabinet and Wood Carver's Bench Combined.

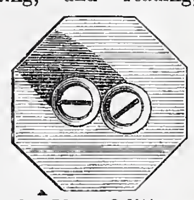


Fig. 3.—Plan of ditto seen from above (half size).

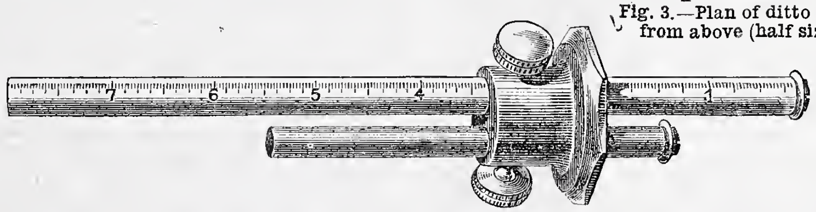


Fig. 2.—Barrett's Improved Combination Roller Gauge (half size).

49.—Patent Combination Tool: Joinery and Carving Work-Bench Cabinet.

In No. 6 I drew attention to this Cabinet in its primary form, and alluded to certain modifications which were about to be made in it by the inventors and patentees, Messrs. R. Melhuish and Sons, 85 and 87, Fetter Lane, E.C. The Cabinet may now be had in its alternative form, as represented in the illustration given in Fig. 4, fitted with tools complete, for £25 8s. The alterations and improvements effected are these. The lower drawers, which came to the front in the first form, have been reduced in width and recessed, giving more space for the workman when standing in front of the bench at work. The front of each side of the Cabinet opens outwards on hinges as shown, travelling on surface rollers under bearers, thus by direct bearing forming a solid and perfectly rigid support for an addition to the work bench in the form of a stout, well-made board, which is attached to the longer part of the bench by dowels. To this the supports are bolted by flush bolts of peculiar arrangement, which, being fixed by springs, remain unmovable, and are free entirely from the vibration which would be caused in ordinary bolts by percussion occasioned by the use of hammer or mallet on the bench above. This carving board, as it is called, when not in use, is stored away in a recess shown in the engraving, just under the joiner's vice, which it fills to a nicety, its width and length corresponding to the depth and height of the Cabinet. It can be utilised for carving, as shown by the operator at work, who is represented seated on a convenient revolving stool resembling a music stool, but of stronger make, whose height may be regulated at pleasure. In the carving board are two holes, bushed and surrounded with plates flush with the bench. In these, nicely made holdfasts may be inserted to hold work in process of carving. These holes are further utilised for the reception of a brass stand for a drawing board, which may be inserted in either hole and moved in any direction, thus giving facilities for drawing, painting, and reading, by using the board as a reading stand. The transition of the drawing board from a horizontal to a vertical position, or any angle between, is effected by a rack and pinion attached to the T plate screwed to the under surface of the drawing board, and actuated by a large milled head attached to the rack. It is difficult to imagine a more convenient piece of furniture for an all-round man who likes to use tools of all kinds, pen and brush alike, but is somewhat limited for space for the using. The drawing board is stored when not in use in a recess contrived for its reception at the back of the Cabinet, entered from the right-hand side.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Circular Saws Running out of Truth.—A. R. (*Scorrier*) writes:—(1) "In perusing the pages of Work from time to time, I hope to derive some benefit from queries answered and letters written by practical workmen, who are kindly invited by the Editor to give such information relating to their trade as may be in their power to give. And as we live by each other, I think it is the duty of all readers of Work to do what they can to instruct their fellow readers, and at the same time be the means of helping to make Work a most interesting and valuable paper. Therefore, the few remarks I may make on circular saws I hope will be of benefit to those interested in the same, and any question asked through 'Shop' on saws for general work I shall be pleased to answer to the best of my ability. There are many reasons why circular saws deviate from a true path; I will endeavour to give some of the principal reasons. First there should be plenty of power to drive the saw or saws a regular speed; if power is limited, the saw will be merely dragged through the timber, and not driven through as it should be, consequently the saw soon gets dull and requires sharpening often; if worked dull saw plate will be strained or buckled, and it will commence to run out of truth. (2) In driving saws from 24 in. diameter and upward, the distance between centres should not be less than 16 ft., nor more than 24 ft. or 25 ft.; if the belt is short the tension has to be great, consequently the bearings become hot, the heat is conveyed to the centre of the saw, and it will bulge and run out of truth; if the belt is too long it will sag, and the bearings soon begin to cut, and the same results follow. (3) Belts should not be less in width than one-seventh the diameter of saw, and pulleys on saw spindle not less in diameter than one-third the diameter of saw. (4) A bearing should be near the pulleys on spindle to take the pulley belt, so as to prevent vibration of saw spindle; should it vibrate it will be conveyed to the saw, and undue friction will be set up; after a short time the saw gets buckled, and runs out of truth. (5) Bearings of saw spindle should fit very nice, and end play should be avoided. (6) The collar washers should be slightly concaved, or the saw will bulge or dish, and run out of truth. (7) The saw should be properly packed; the proper packing of a circular saw is of great importance, and various are the opinions of men on this point; but my experience is that if a saw is evenly hammered it should be packed a little warm at the centre, and the warmth decreased toward the rim, where, when running, it should be quite cool; this will allow for the extra friction which will be going on at and near the rim of saw, the speed being much greater than at the centre. (8) All timber, before presented to the saw, should be properly bedded, or made perfectly steady by some means. How often do we see a man with a piece of round, rough timber, as much as he can lift, trying to push it against a circular saw, and quite unable to keep it steady: the man with fear, as he knows there is danger attached to it. He pushes the piece a few inches, and the saw brings up the belt and slips over the pulley. The saw being freed the work is again commenced, and after a while the cut is got through, and the saw will tell it has not been rightly treated, as it knocks about in a fearful manner, and if you should put the back of your fingers against the saw plate you will find it scalding hot; this heat is caused by undue friction set up by the timber not being steady, and as the friction increases the saw runs out of truth, and at last becomes crippled. The rack bench as well is often used for cutting round timber, with nothing to keep it steady but its own weight, and sometimes a little of the ends sawn off, which, in many cases, spoils the timber of certain work; all such timber should be so clamped as to keep it perfectly steady, and it would, to a great extent, prevent saws from getting crippled, and from running out of truth. (9) The speed of the saw is an important point; should the tool be driven too fast it becomes pliant and runs untrue. The following will be found to be a good speed, if saws are of proper gauge, from 8,000 to 9,000 ft. per minute, at the point of saw teeth; and for hard wood generally, such as elm, ash, etc., a speed of about 6,000 ft. at point of saw teeth. Circular saws kept in good order and properly worked will do good work at the above speeds. (10) The saw should not fit light on spindle nor on steady pin; should heat be conveyed to the centre of saw, it will bind on saw spindle, and the saw will run out of truth. (11) How often do we see a circular saw enter a log of timber, and the sawyer go to the other end of the log, and with pinching bar move the log transversely, the other end of the log acting as a lever on the front of the saw; consequently the saw draws thick or thin, as the term is. The cause of the saw drawing is often put to the bad sharpening and irregular setting of the saw. This moving of the timber, after the saw has entered it, should, by all means, be avoided. If the timber is not in position, it should be brought back and freed from the saw before being moved in any direction. (12) Timber deeper than the saw will reach should not be sawn when the saw is buried. It is impossible to see whether the saw is running true or not, and the plank being sawn off cannot be spread as it should be, so as to prevent friction on the saw plate, which is sure to be great near the rim of saw; consequently the saw gets winding, and gives an amount of trouble to the sawyer by running out of truth, also to the man that has to sharpen the saws. (13) The most essential point is the sharpening of the saws. Unless a circular saw is properly sharpened it will soon become crippled and run out of truth; men vary greatly in opinion on the sharpening of saws. I am of opinion that no man is perfect in the work of saw sharpening, especially of circular saws, and I calculate within the past eighteen years I have sharpened more circular saws than any two men in the county in which I live, and feel I am far from perfect, and that a deal of practice is required. There should be a certain angle for each class of work, and only by practice can we know the best angle to give saw teeth to suit the work it has to do. A frame saw may be put into the sharpening machine, and the emery wheel set to a certain angle, so as to give the teeth their proper rake, and if the saw is used only in one class of wood, we will say soft wood generally. The wheel, when once set, will do at the same angle as long as the saw is being worked; but this is not the case with the circular saw, though many so-called saw sharpeners think it will do. When I go into a works, and see a man put, we will say, a saw 50 in. in diameter in the sharpening machine, and set the wheel to a certain angle, afterwards take another saw much less in diameter, and commence with wheel at the same angle, I am at once convinced he is not the right man for the place—that he does not know his work. If the saw teeth are to be sharpened to an angle of 65° to 70°, it is impossible to give the same angle to a saw of 30 in. diameter as one of 50 in. diameter. Keeping the wheel at the same angle in the smaller saw, the teeth would be much more acute, and not at all adapted for the work. The best rake, as far as my experience teaches me, for teeth of circular saws for soft wood, generally, is to an angle of from 70° to 75°, and bevel of front and top of teeth about 65°; and for hard wood, generally, rake 80° to 85° bevel of front, and top of teeth 75° to 80° in cutting very soft wood. The angles may be more acute than the above, but for general work good work can be done at the above angles. Again, the setting of circular saws is of great importance. If the set is too much more power is required; if not enough the saw will not free itself, and will get overheated. A saw 24 in. in diameter for general work, from two to three gauges set, or about the 36th part of an inch, the set to be increased as the diameter of saw is greater; practice alone will teach the amount required. Again, some are in favour of setting circular saws with hammer, and to a sharp angle, such setting gives a rough surface to the work, and more power will be required to drive the saw. For fine surface work I prefer a hand set, and for thick saws one with two handles, setting the teeth a little curved, and gauging every tooth with a gauge made of a thin piece of steel, saws set as above. If saw plate is true, the saw will cut very clean, providing it is perfectly round. Much more might be said on sharpening and working of circular saws, but some of your readers who are not interested in the above may think I am intruding on valuable space. However, I hope many of your readers may be benefited by remarks I have made, and, if adhered to, saws will not require hammering until so reduced in diameter as to require regrinding, after which they will be as good as new if done by a good maker."

Die Chuck.—H. J. N. (*Malvern Wells*) writes:—"I have had your first issue of Work, and I think it a very useful book for amateurs, etc.; they can see the issue of tools, machines, etc., and it also gives good instruction. Your dog chuck which you have illustrated is very useful and simple. I have much pleasure in submitting a method of making a die chuck, and I should be pleased for you to put it into Work, if you think it worth doing so. The method I propose is to get a disc of hard wood, oak, elm, mahogany, or beech, and turn it down in the lathe to about 8 in. diameter. To make it screw firm on the nose of mandrel, it is best to get a piece of iron of suitable size square in shape, and drill it in each corner, and countersink for screws, then let the plate in flush at the back of wood disc, and screw it tight home with four short wood screws, having first tapped it to size of nose; this ought to hold it firmly, if the plate let in be of sufficient thickness to allow three or four good threads being cut. Now, to proceed with the chuck, go to a blacksmith's and get a disc of iron ¼ in. thick and just over 8 in. in diameter cut; the reason for having it a little over the size of wood disc is to allow for it being turned down to same size. Get it drilled, as marked in Fig 1, and countersunk for head of wood, screws to lie flush with surface. Now get two pieces of V-shaped iron about 6 in. long, or if not obtainable get flat, and file carefully up to shape shown in Fig. 2, which is an end view of chuck, showing V irons fastened on. If you have a large-size old square file, put it in the fire and get it to a full red, and put it on the ground to cool. When cool, cut off two pieces the same length and size, and file up clean and smooth; these are to be the dies. If you have fastened V irons on the face plate as they should be, that is, an equal distance apart from the centre of face plate, and parallel to each other, you can file your pieces of old square file to fit. They should fit tight, but also slide between V bars without binding. The shape they should be filed to I have shown at A, Fig. 2. The V-shaped irons should be drilled for screws to fasten them down by; about four screw holes each for wood screws is sufficient. They should be countersunk. You will also have to drill holes in the iron disc for the screws to pass through into the wood. This you can easily do, first getting the irons true on disc as mentioned before, and then mark for drilling. The next thing to do is to get two pieces of iron about 1 in. wide by ½ in. thick, and file them up to shape shown in Fig. 3. The hole in the centre having been tapped for pins, the two screws in the feet must have corresponding holes in the iron disc, so as to bring the hole with thread exactly in the centre between V irons at each end. These plates, fastened down with screws through feet and through hole in metal disc into the wood, ought to stand a good deal of strain; they should be opposite one another at each end of bars. Now to make the pins to screw through hole in each plate to slide the steel dies, you will want two pieces of iron of suitable length and size the same size; then cut thread on them same size as the thread in plates, and drill

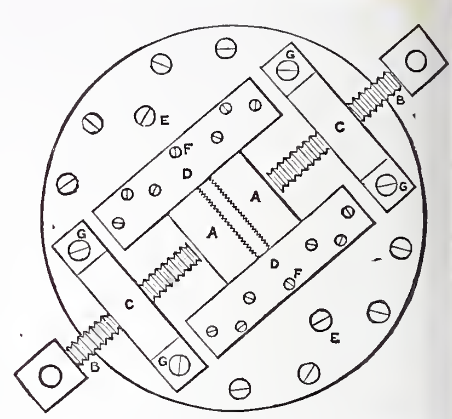


Fig. 1.—Die Chuck, One-fourth Size, Complete.

A, A, Dies in position. B, B, Capstan Screws, Male Threads. C, C, Plates with Female Threads. D, D, V-shaped Bars. E, E, Wood Screws through Iron Disc into Wood: Head countersunk. F, F, Wood Screws through V-shaped Bars and Disc into Wood. G, G, Wood Screws through Screw Plates and Disc into Wood.

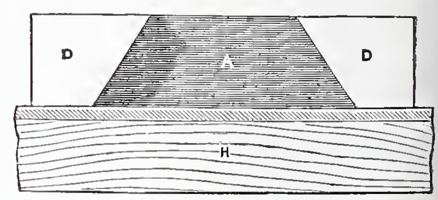


Fig. 2.—View of Chuck Edgeways.

This diagram shows shape of Parallel V Bars (D, D,) for Dies (A) to slide in; also showing Iron (I) and Wood (H) Discs in Section. Not to Scale.

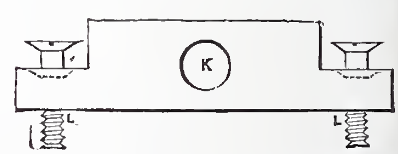


Fig. 3.—Shape of Iron Plates (C, C, in Fig. 1) for Capstan Screws to work through.

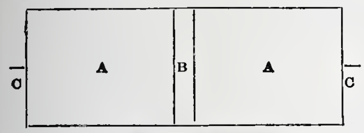
K, Threaded Hole for Male Screw. L, L, Wood Screws through ends of Plate and Iron Disc into Wood: Head countersunk.

hole through the end to insert rod, to screw them in and out. Before putting dies in you will want to harden them. The way to do so is to heat them to a full red, and drop them in cold water. If you find them too brittle you can easily let them down by heating a bar of iron red, and placing them on till they take a straw or violet colour, and then drop them into a tin of linseed oil, and let them cool out. The dies should be cut with a three square file along the faces that come next to the work before hardening, or those faces may be left rough when filing up and fitting. As this is optional the maker may please himself. Now put the dies in and screw the plates on at each end, and put a bar between dies and screw up with pins, and you will find that you have a chuck that will hold if proper care and time have been executed, and I hope those who make it will take that trouble, as it will repay them. I have made a few rough drawings of the parts, and, as I have said, if you think it worth putting in Work I shall be pleased for you to do so."

Building Construction.—W. P. (*St. John's Wood*) writes:—"In reply to your request regarding plans and specification, as a consistent reader of Work, if you can see your way clear to assist your readers in this too much neglected study, you will confer a lasting blessing upon a large number, and greatly help others to understand what they need when building."

Building Construction.—A. E. D. (*Westcombe Park*) writes:—"Being a subscriber, and feeling greatly interested in the several articles that have appeared in WORK since its commencement, I am sure the proposition of opening out a course of instruction in building construction, as regards modern dwelling houses, would be highly satisfactory for the merits of WORK, and also meet with a great deal of approval by its numerous readers. The foundation you set forth for the treatment of drawings, etc., as a course of assistance to all interested is a remarkably good one—as you say, beginning with the cottager's dwelling, town and country, and so gradually advancing till you get to the more superior villa residences or mansions, which would be valuable information for the educated as well as the uneducated in such matters. I think, as an inducement to secure the co-operation of the readers generally, and so receive a fuller outcome of what we want, it would be well to introduce prize competitions, say, once a month; it would, I am sure, create a closer tie between the practical as well as the theoretical, and be an inducement to maintain WORK as a useful paper in the building trade, where it is, no doubt, having an increased circulation. I conclude with best wishes for your highly valuable paper."

Portfolio for Weekly Numbers of Work.—SCOTO-IRISH writes:—"Will you allow me to give a suggestion for the preservation of the weekly numbers of WORK, or any other weekly publication? I do not like to see my literature soiled, particularly if I wish to bind it in volumes. So I got a straw board—strong paste or millboard will do better—I cut board in two, slightly larger than a page of WORK, then glued a strip of cloth on boards, forming a back about 2 in. wide, as per annexed diagram,



Portfolio for Weekly Numbers of Work.

A, A, Sides of Millboard. B, Back of Cloth. C, C, Ribbon.

and fastened a bit of ribbon to the outside of each board, with which you can tie boards together after placing weekly part within. If desired, I will send instructions how to make a blotting folio or pad."—[You can send these if you like.—ED.]

Utility of Work.—JOINER writes:—"I beg to add my testimony to the immense value of your paper. I have showed it to many of my fellow workmen—some of whom are subscribers—and they all agree with me that WORK is the best and most useful paper of its kind that has as yet been published. It is a paper which claims the attention of every right-thinking and right-acting man, whether he be a professional mechanic of whatever trade, or a man of independent means, who takes up any craft merely as a hobby."

Patents for Inventions.—P. J. (*Royston*) writes:—"I think working men will appreciate your kindly offer which you made to W. J. P. in No. 8. There is a great number of working men who have inventive genius, which is lost through not having the wherewith to patent their inventions. I would suggest that a subscription be got up in WORK for the purpose of helping those who cannot help themselves. I am sure, sir, if any working man got help through that means and prospered thereby, he would not forget those who helped him."

Gold Leaf.—PAINTER writes:—"I notice in 'Tips for Tyros,' by OPIFEX, in No. 8 of WORK, that a book of gold leaf, which is quite good enough for such purposes, can be bought for 6d. Having had some little experience as a painter and decorator, I feel bound to say that if you want work to stand, it must have something better than so-called gold, at 6d. per book. The best material is much the cheapest. For this work buy a book of 'transfer gold' at any good oil and colour shop. It will cost about 1s. 3d. The gold is already transferred on loose leaves which interleave the book, and only needs to be lifted or drawn out, and then cut up as needed. In winter, use quick-drying gold size; in summer, use slow-drying gold size. The gloss is almost sufficient to hold it."

Utility of Work.—AJAX writes:—"Being a constant reader of the SATURDAY JOURNAL, it was with pleasure that I saw the announcement of your new publication, WORK—not so much for the hints it is likely to give me regarding my own trade (cabinet making), as the information I may get from it respecting other trades. I shall put each number carefully away, so that my son, who is now ten years old, may have the benefit of them when he is older."

Elizabethan Twist in Lathe.—C. C. E. writes:—"Permit me to make a slight correction. I did not say that an Elizabethan twist cannot be cut in a lathe (I believe a lathe might readily be constructed to cut one, at any rate, in hard woods and ivory), but that I do not believe there is any lathe in existence by which they can be produced. You ask why, if a spiral groove can be cut, cannot the sharp edge of the groove be removed, and the twist finished without rasp or file? No doubt it can, and by apparatus too complicated to describe, very fairly be done; but if you will go to your lathe and try to make a convex curve die into a concave without a break, you will soon realise the difficulty, and, justly proud if you succeed, will yet have to confess that it is not in the range of practical mechanics. During a hunt of some thirty years I have met many such men as you describe, and with precisely the same result. The lathe which produced the twist is always somewhere else, and you can never 'run it to ground.' Lathe-users, not generally lathe-makers, are the men to assist us in difficulties. It is one thing to make a piano, but quite another to play upon it. And pig-headed though I may appear, I am of the same opinion still, 'that there is not any lathe in existence by which a true Elizabethan twist can be produced,' and I shall be very glad indeed to be proved wrong."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Papier-Mâché for Outdoor Work.—"PAPIER-MÂCHÉ" (*Burnley*).—Outdoor ornamental work, such as for palisades, can be made from paper pulp, and the moulds used would be of cast iron. Thoroughly japanned, such work would resist weather alone for a considerable length of time. But exposed as it must be, it could scarcely escape accidental injuries, which, letting in the damp, would ruin it. On the whole, cast iron would be both cheaper and better. Pulp on a large scale would be more cheaply bought than made. Messrs. Rubery & Evans, of Birmingham, used formerly to supply it, and probably do still.—S. W.

Tools for Repoussé Work.—W. E. S. (*Oldham*).—These may be obtained of Gawthorp, 16, Long Acre, London, who also supplies all materials necessary, and makes the special cement referred to in the article. The simplest method of transferring design to metal is to place a sheet of carbon paper between the design and the metal (the *black* side being in touch with the metal), then trace over the whole of the design with a blunt steel point, and the design will be found in black upon the metal. Scratch this in with a sharp steel point to avoid rubbing out. To smear the metal with turpentine, and allow it to dry before tracing with carbon paper, or drawing with lead pencil, is a good tip.

Electrotyping with Bunsen Battery.—ELECTRIC.—The Bunsen battery is not suited to this work, because its E.M.F.—that is, the intensity or pressure of the current—is too high to produce *tough* copper. I should say that you get a good tough deposit from your 3-gallon Smee. If you wish to increase the rate of the deposit, add more cells as the deposit spreads, and connect each cell to the work by a separate wire; 60 square inches of copper plate $\frac{1}{8}$ in. in thickness will weigh about 29 lbs. Copper is deposited at the rate of 17 grs. per hour for each ampère of current passed through the solution. It will take 50 ampères of current per hour to deposit 60 square inches of copper $\frac{1}{8}$ in. thick in 10 days, and this cannot be obtained from a single-cell 3-gallon Smee. Are you sure as to the dimensions of your electrotype? An eighth of an inch is thick for an electro.—G. E. B.

Tea-Chest Wood.—BARRINGTON.—Thank you for the specimen of tea-chest wood sent to me. It is a very decent kind of wood for working up into articles for home use, as you said, and I am glad to have had it brought under my notice. It is possible the chests came from India, for all tea-chests I have seen from China are made of thin hard wood that will split at the slightest provocation. There will be no chance of discussing the subjects to which you allude in the pages of WORK. They are strictly tabooed; so your mind may rest relieved of any apprehension of squabbles over well-gnawed bones of contention, that no really reasonable man would care to discuss.

Tea-Chest Wood.—J. S. W. (*Norwood*).—I am obliged to you for the sample of Indian tea-chest wood sent, which, as you say, "is not at all a bad-looking wood—in fact, very much like black walnut." I append the rest of your letter, which conveys much useful information, and runs as follows:—"I have seen numbers of chests of the same kind at Cooper Cooper's, King William Street (London Bridge), and they could be procured at any large tea merchants. I remember seeing an article not long ago, but I quite forget where, by a gentleman in India, in which he said that Indian, and particularly Ceylon, tea-chests were often made of quite valuable woods. He had come across one himself made of a beautiful spice wood, which he had had made up into some article by a native workman, and which was well worth it. The sample I send is part of a chest from North India. I am delighted with WORK. I have recommended several friends to take it, with success."

Hand-Loom Weaving.—G. O. (*Sheffield*).—I trust a beginning will soon be made in this direction with a spinning wheel and a simple loom. It is desirable, in dealing with such a subject as this, to begin at the beginning, and these preliminary papers will be most useful in the colonies—Manitoba, for example, where they have plenty of wool and no machinery for working it up into yarn and cloth.

Binding Screws and Clamps for Battery.—A. A. (*Grantown-on-Spey*).—These may be bought of any dealer in electric wares. The price of the binding screws for the zincs should not exceed 8d. each; the clamps may cost from 1s. to 1s. 6d. each, according to width of jaw, ranging from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. If you cannot get them at Inverness or Perth, you may have them sent by post from Messrs. H. Dale & Co., 26, Ludgate Hill, London, E.C.—G. E. B.

Carbons for Bunsen Battery.—M. I. (*Horsham*).—Your perseverance in trying to make carbons for the Bunsen battery is very creditable, and if this alone could command success it would certainly be assured. Every man to his trade, and this must be gained by experience. Carbon moulding and baking is a trade by itself, and there are several little wrinkles in this, as in all other trades, not revealed to outsiders such as myself. I believe, however, that the coke must be ground to fine dust, and this mixed with fine dust of *caking* coal. The mixture is then pressed into a strong iron mould of the shape required for the carbon, and heated strongly in a furnace. The baked mass is found to be porous (as your carbons were) when the mould is opened. The porous mass is soaked in gas-tar or in sugar syrup, and again heated in the mould. This process is repeated until the carbon block has acquired the necessary solidity. If you still intend to persevere in trying to make the carbon blocks, I hope this will help you. But why try to make carbons for this, or for the single-fluid bichromate battery, when you can get carbon plates $\frac{1}{4}$ in. thick for about 1d. per square inch?—G. E. B.

Electric Lighting by Accumulators on a Small Scale.—YORKSHIRE.—(1) To estimate the capabilities of an accumulator for electric lighting, calculate each square foot of positive surface plates to yield six amperes of current per hour. Find out the resistance of the lamps, and calculate one pair of elements, or 1 cell=2 volts, to each 2 ohms of resistance, including that of the connecting wires. As 10 c. p. lamps vary in their resistance, I cannot say what would be the resistance of five of these. If we put it at 20 ohms each, and the five are arranged in series, we shall get a total resistance, including the leads, of, perhaps, 102 ohms; this will require an E.M.F. of 102 volts, obtainable from 51 cells arranged in series. If the plates in the cells are each 1 square foot, the battery will probably furnish light to this number of lamps for five hours. By using a battery with plates having an area of 5 square feet, and coupling the lamps in parallel, eleven cells will furnish the same light for five hours. (2) The second part of your query contains an almost impracticable demand. Of course it is possible to connect a motor to a sewing machine, and to cause the motor to generate a current capable of charging an accumulator by reversing its action and treading the other way. But who would undertake to devote himself to such drudgery? You would have to exert 20 per cent. more power during five hours to charge the accumulators than would be required to work the machine itself by the foot! When an accumulator is charged, the bubbles of gas shift over to the opposite plate, and the cell discharges itself, if not disconnected from the machine. (3) A secondary battery, *i.e.*, an accumulator, will work a sewing-machine motor very well. The chromic acid battery is said to be the next best for the purpose, and is generally used when primary batteries are employed for this purpose.—G. E. B.

Sale and Exchange Column.—F. J. B. (*Kensal Green*).—I note your reply to F. T. (*Bristol*), relative to a Sale and Exchange column in WORK. I think it would be very popular, and shall be glad to give it my support.

Address.—JACK PLANE.—We cannot give you the address you ask for, as we have not got it on record.

Bicycle Making.—W. E. (*Kirkcaldy*).—This is a subject for winter work. It would be impossible to give instructions which would enable bicyclists to make their own machines for use this summer, which is already upon us.

Harp Making.—G. L. (*Sheffield*).—Your request shall not be forgotten, but it is impossible to enter upon the subject at present.

Enamelled Paper Letters.—J. W. (*Bradford*).—Enamelled adhesive waterproof advertising paper letters and figures, ornamentations, etc. etc., may be had from the sole and original manufacturers, S. H. Beit & Co., 4, Hyde Street, New Oxford Street, W., who will forward price list and sample sheet on enclosing stamp for postage.—N.B. The nearest on their sheets to samples sent is No. 20 $\frac{3}{4}$ in., which is a very near match.—H. L. B.

Photographic Camera.—G. L. (*Sheffield*).—Instructions for making a camera will be given shortly.

How to Make a Wardian Case.—W. P. (*Southport*).—An article on this subject will appear shortly.

French Polishing.—T. W. (*Leek*).—Articles on this subject will be commenced very shortly.

Electric Motors, etc.—J. S. (*Orkney*).—Articles upon all these are in preparation, and will appear in due time.

Treadle Fret Saw, etc.—E. G. (*Malvern Link*).—A member of my staff, who is an accomplished fret sawyer, has this subject in hand.

A Patent: Its Cost and How to Get It.—A. M. (*Birmingham*).—If you have not read reply on this subject to P. T. S. (*Sheffield*) in No. 12, p. 189, please do so, as you will find in it a sufficient answer to your query. You can get the £1 form for application for provisional protection at the chief post office in Birmingham.

Mixing Colours.—C. S. B. (*Glasgow*).—Papers on house painting and decoration will appear shortly, and in these the subject of mixing colours will be carefully considered.

Sign Writing and Lettering.—H. C. (*Camden Town*).—We have some more of these papers, and their publication has been resumed, as you will have seen before this meets your eye.

Magic Lantern Slide Painting.—T. A. G. (*Stratford*).—This subject will be treated in due time, but the present season is scarcely the right opportunity for me to commence it.

Greenhouse.—Signalman.—You will have seen in No. 12 of Work instructions for building such a greenhouse as you want. Do not hesitate to ask me anything about gardening and garden appliances, for gardening is one of my hobbies, though I have very little time to indulge in it, as you may suppose. You say you have made three handlights. It will interest you, then, to know that I hope soon to be able to tell you about an entirely new thing in this kind of appliance which I have been testing for some time, and find to be a most useful article.

Fret Machine.—Joiner (*Glasgow*).—The subject has my attention. I quite agree with you as to its utility; but you, as a canny Scot, will know that everything can't be first. Thanks, all the same, for the suggestion. Meanwhile, you do not say whether you have a lathe or not to which you fit an arrangement for fret cutting.—D. A.

Finishing Fretwork.—M. C. (*Nottingham*).—French polish decidedly, rather than varnish. Polish the wood in the usual manner before cutting, or, if the fret is already made, polish without using any filling.—D. A.

Plane for Cutting Rebate.—A. D. (*Canonbury*).—You say there is a "mistake in thinking, or, rather, saying, that a rabbet plane is used for the purpose of making a rabbet or rebate," and that "the plane used is either a sash fillister or side fillister, according to the work that is being done. A rabbet plane is only used for reducing a rabbet or anything similar, if required in fitting the work together. It is a mistake that most writers on woodwork fall into unless they are in the trade." I cannot agree with your remarks about this. In making up such work as that described, few cabinet makers would use any but the rabbet plane. It would be simply a waste of time to set the fillister if only a single article were being made, and be quite contrary to custom to do so. In the joinery or building trades the tools you name are no doubt preferable, as you say, "according to the work being done." Even in cabinet work the side fillister is sometimes useful, though not generally; and it may astonish you to hear that many cabinet makers with a good stock of tools do not possess one. The other, as far as I am aware, is never, or but rarely, used by cabinet makers. You have, I fear, yet to learn that in different trades, or branches of the same trade, different tools are used. Because one man prefers to use one in preference to another, it does not follow that it is a "mistake." Writers on the construction of furniture, if they know what they are writing about, certainly will very often fall into what you are pleased to call a mistake, especially when they are "in the trade" (cabinet making), as the writer of the article you refer to is, and has been for many years.—D. A.

Paper Replicas of Relievo Subjects.—G. M. (*Calvine*).—The reliefs referred to in "'Tips' for Tyros," April 6th, are issued in series of twelve each by MM. Monrocq Fres., 3, Rue Suger, Paris. Series D are classical heads. I am sorry I cannot give a definite address where they are retailed in this country, but try Messrs. Gawthorp, 16, Long Acre, London. I shall be happy to send querist a specimen, should he desire it.—Opifex.

French Polishing.—E. B. (*Lymington*).—Unless you are acquainted with the process of French polishing generally, it is impossible in a short space to give such an explanation as is likely to be of service to you. If you want to know how to polish any particular wood, let me know, and I will direct you; but your present question is far too general to be answered in this column. Briefly, the process consists in coating the wood with a film of lac, which, dissolved in spirits, is the principal ingredient of French polish. This is rubbed in till the spirit has evaporated and a bright surface is obtained. In some woods it is necessary to fill the grain with filling, and the colour is generally improved by oiling. Both filling and oiling are generally done, and light wood is often stained.—D. A.

Joints and Cabinet.—R. M. W. (*Burnley*).—Don't apologise for troubling me. Letters such as yours are not regarded in that light. The desire is to make Work useful, so that practicable suggestions and encouragement are always welcome and cheering. I am glad you, among others, have found the friendly hints to amateur woodworkers helpful. Mr. Denning, to whom your thanks have been conveyed, has papers on both the joints you name in preparation, as well as other topics of a similar character, all of which, no doubt, you will find of assistance, and your "sincere hope" is cordially re-echoed. The cabinet—by which, if I am right in thinking you mean the piece of furniture commonly known among cabinet makers as a nest of drawers—will have attention at an early date. In case you do not understand what a nest of drawers is, I may say it is a kind of square-cornered pedestal fitted with drawers only. These run from side to side, and are usually secured by one lock fitted on a hinged style to the right of them. If this is not the kind of thing, let me know, and I will see what can be done to meet your wants. In any case, I think I may safely promise that sooner or later a description of whatever the piece of furniture you wish to make will appear in Work. Why not send me a rough sketch or diagram of the article? No matter how roughly drawn, a sketch often shows more plainly than any description what is really required; and when the subject seems likely to be of general utility, you may be sure that arrangements will be made for a paper on it. I am pleased to hear you are making one of the tables described in No. 1, and I trust it will come up to your expectations. Thanks for your good wishes.—D. B.

Tin-Plate Working.—W. H. F.—A thoroughly competent man has this subject in hand, and his papers, I trust, will soon be commenced. By all means give the readers of Work the benefit of your experience by "talking 'Shop'" whenever you feel inclined to do so, and by writing papers on any particular subjects connected with your trade which seem to you to require elucidation. You are right in saying, "I think if greater help were given by those well up in their respective trades, we should have a healthier body of workers, and the country at large would be greatly benefited by it." Yes, there is nothing like mutual assistance; like mercy—

"It is twice blessed;
It blesseth him that gives and him that takes."

By helping one another through the medium of Work, workmen will be able to do much to improve the quality of work done throughout the kingdom and the empire at large, and to foster that enthusiasm in one's work without which no work, be it what it may, is thoroughly and effectively done. Enthusiasm is the very soul of work, the begetter of success, and no man can hope to produce, create, or make or do anything approaching to excellence unless he enters heart and soul into his labour, and has pride in, and respect for, the work of hand or brain.

Papier-Mâché Boat.—S. T. (*Shepherd's Bush*) does not state whether this is intended as a mere model, or toy, or as a boat for actual use. A toy boat in papier-mâché will stand water, and last a long time, with only ordinary japanning. If, however, it is to be left swimming on the water much, it will be well to give it a couple of coats (nail-heads, if any, and all) of boiled linseed oil before japanning. If the boat projected is for actual use, S. T. is warned that papier-mâché is a material highly sensitive to changes of temperature; that all copal varnish, which would, when thus used, be liable to crack, should be avoided, and that wooden ribs would be necessary. For this purpose two or three coatings of the boiled oil, before japanning, would be desirable. Any injury should at once be stopped with the paper-dust and japan varnish compositions, and the whole re-japanned. It is doubtful whether the grey paper expressly made for the papier-mâché trade is still in the market; but any paper warehouse could supply a porous paper of medium weight proper for the purpose.—S. W.

Book on Plumbing.—A. H. (*Gosport*).—Buchan's "Text Book of Plumbing," 3s. 6d., Lockwood and Co., is the only one I know. Hellyer's "Plumber and Sanitary Houses," 4th edition, 10s. 6d., Batsford, is a good book, but I cannot say whether it gives what you require.

Wood for Violin Making.—Fiddler (*Highbury*).—I do not know of any one (beyond the wholesale dealers) who makes a business of selling violin wood; but if Fiddler experiences any difficulty in getting what he requires he can be supplied from my own stock.—B.

Government Patent Office.—W. R. (*Hulme*).—The Government Patent Office, to which specifications of patents must be sent, is the Great Seal Patent Office, Southampton Buildings, Chancery Lane, London, E.C. You can obtain stamped forms for patent purposes at provincial post-offices.—F. C.

III.—Questions Submitted to Correspondents.

Resilvering Looking-glasses.—R. C. (*Bingley*) says:—"Being a subscriber to your valuable paper since its commencement, I venture to ask you, or any of your numerous subscribers, if you could inform me how to resilver looking-glasses, trusting you will excuse my encroachment on your time and space."

Making a Xylophone, or Dulcimer.—Correspondent writes:—"Could you, or some musical correspondent, give me a few hints on the construction of the xylophone or wooden dulcimer? What is the best sort of wood for the purpose, and where can I get it? Do you know of any information, article, or papers on the subject?"

Resilvering Glass.—J. S. (*Taunton*) wishes to know what the solution or mordant may be that is poured on the glass in this process after it has been washed with pure whiting and putty-powder and distilled water. He also asks where he may be able to obtain it. Further, he wishes to know the right shape and proper material for the leather squeegle, which is used to wipe over the glass, and remove the surplus solution, after another solution of nitrate of silver has been poured over the glass, and the silver precipitated by the action of the mordant on the second solution.

Trade Notes and Memoranda.

Sir John Lubbock recently laid the foundation stone of the Battersea Free Library.

During the course of the present exhibition at Paris, no less than sixty-nine International Congresses will meet under Government patronage, besides others of a non-official character.

Another, though less brilliant, illustration of the happy union of scientific with commercial pursuits is afforded by the career of the late Mr. R. S. Newall, of Gateshead. He was the pioneer of wire rope manufacture, and the earlier submarine telegraph cables were turned out from his works at Gateshead. The 1850 cable between Dover and Calais; the Holyhead, 1852; the Dover and Ostend, 1853; the Black Sea, 1855; the Red Sea, 1859, were made by his firm. He was devoted to astronomical pursuits, and had a 25-in. repeating telescope made by Cooke, of York, which, shortly before his death, he presented to the University of Cambridge. He was an F.R.S. and an F.R.A.S., was twice mayor of Gateshead, and had been requested to fill the same office during the present year, on the occasion of the visit of the British Association to Newcastle.

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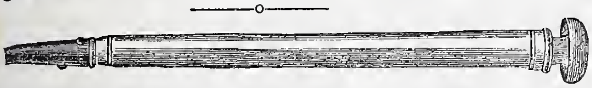

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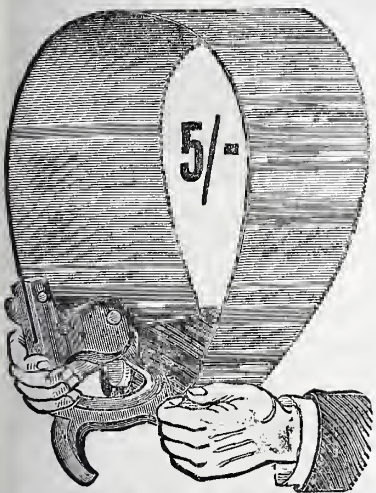

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WORK

An Illustrated Magazine of Practice and Theory

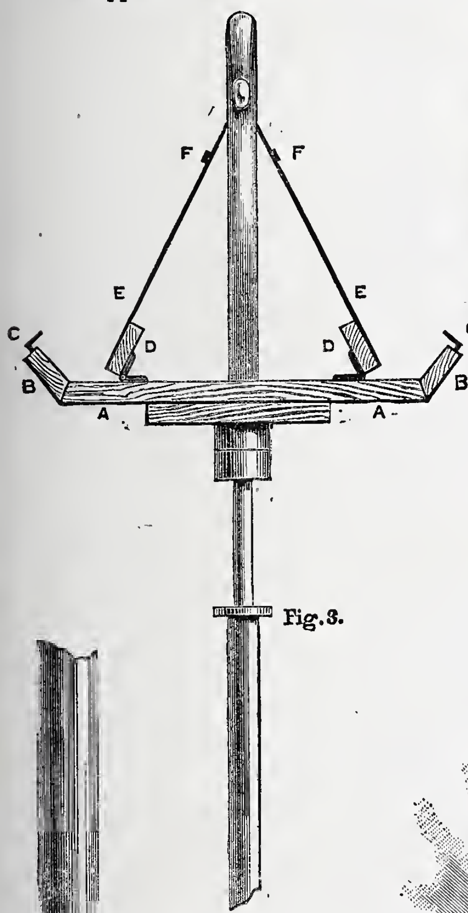
FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

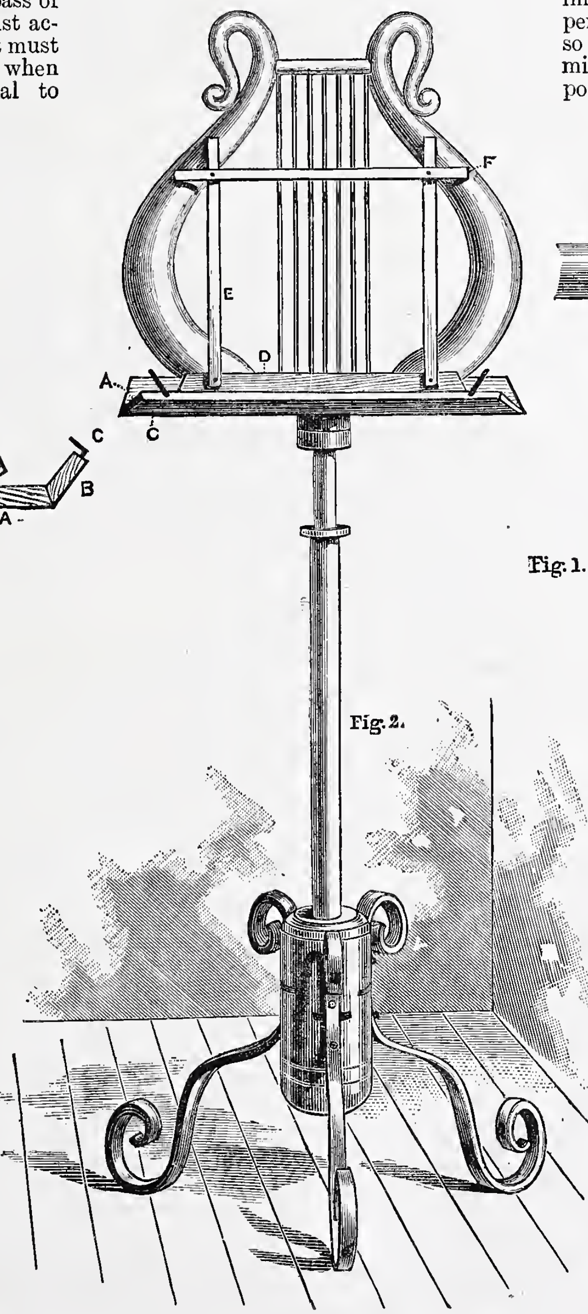
VOL. I.—No. 14.] SATURDAY, JUNE 22, 1889. [PRICE ONE PENNY.

MY DOUBLE MUSIC STAND; HOW I MADE IT.

BY O. B.

I WANTED a music stand, but beyond the conditions I required it to fulfil I knew very little indeed. The conditions were these: First, it must be well within the compass of an amateur to make; secondly, it must accommodate two performers; thirdly, it must be adjustable in height; and, lastly, when made its appearance must be equal to parlour society. I cast about in my mind for a type to work by, but I could remember having seen nothing that just met my needs. The only stands that I was familiar with were the portable folding umbrella-like arrangements and the heavy reading-desk form; but these did not suit me. I required one handsomer than the first, and less cumbersome than the last. So there was nothing for it but thinking the subject out for myself; consequently, donning my studying cap and finding refuge in my studying chair, I began to work, when slowly and phantom-like there arose the image of the stand I wanted. Snatching my pencil I hurriedly sketched its features, and so the more firmly impressed it on my mind; then at my leisure, by the wonderful powers which even the humblest workman





Music Stand. Fig. 1.—Side of Music Rest (half size). Fig. 2.—Stand Complete. Fig. 3.—Side View of Rest. Fig. 4.—End of Sliding Rod in Tube. Lettering in Figs. 2 and 3 is merely intended to show correspondence of parts in each diagram.

possesses, I, by slow degrees, materialised the idea and produced the thought in concrete form. The illustration (Fig. 2) will give a general idea of the stand. It so fully meets all my requirements that I have thought that perhaps others who are both mechanical and musical in their tastes would be glad to get a hint.

I found in working, however, that had I obtained a hint here and there I might have done better and have saved some trouble, and with that view before me I write this article.

As it will be seen, the music rest is somewhat in the form of the conventional lyre. One side (Fig. 1) should be struck out on a piece of cartridge paper the exact size, and then be cut out as a template. If one has practised freehand drawing no difficulty will be experienced; but for those not so experienced I have drawn the side to scale one half size, so by simply doubling the squares any one can draw it full size.

Plane up a piece of mahogany $1\frac{1}{4}$ in. thick, and lay the template on it, and carefully mark it out on the wood. Now, when I got as far as that I was puzzled to know how I should cut wood so thick to the shape. My tools were not very numerous, and I seemed to have nothing more likely to do it with than a fret saw. Consulting a practical man, he said he should just use such tools as he had, and that nothing would answer better than cutting a line of holes with a brace and bit. I was surprised to find how simple my difficulty now became; in a few minutes the two sides were cut roughly to form. With a chisel, spokeshave, and file, the wood should be brought down to the line; let them be worked together that the curves may be alike. Carefully mark where the bar at the top is to be placed, and with a half-inch centrebit bore a hole in each; be sure that the centre of the holes coincides. Draw a line $\frac{1}{4}$ in. each side the hole; up to this line the edges must be rounded off, whilst the one inch containing the hole must be left square; the reason of this will be seen further on. Before the limbs are rounded off, the tenon at the foot must be cut; great care must be observed here, as if they are not alike the lyre will not be true. The base must be 16 in. × 10 in. × $\frac{3}{4}$ in. Draw a central line and mark the place of mortises. When the sides are put in position they must be both perpendicular and in line with each other.

For the top bar, turn down a piece of wood with a pin at each end to fit the holes in the top of the standard. See that the shoulders of the pins are quite square. The sides of this bar must be planed off so that in section it is oval. Glue and pin the bar in its place. The portion of wood at the hole which was left square is now to be cut away to match the top bar; by this means we shall have a neat joint. I overlooked this, and consequently the finish at this part is not so neat as I should like it to be. Our mistakes are not altogether failures, if by them others are taught wisdom.

The distance between the standards, both top and bottom, is exactly 3 inches. Seven holes must be bored or drilled $\frac{1}{2}$ in. apart in the bar and base, sufficiently large to take small brass rods. I made mine of the stoutest brass wire I could get, say about $\frac{1}{8}$ in. Care here too must be observed that the rods stand equidistant and perpendicular. The holes must not be drilled through the bar, but must be put through the base, so that the rods may be pushed up. After we have fitted the parts together, but before the standards are glued in their places, the base must be finished. Cut two pieces of wood the exact length and thickness of the base and $1\frac{1}{2}$ in. wide. The edges of these must be planed off at a small angle, as shown in Fig. 3.

To make a good joint the shooting plane must be sharp and finely set. Perhaps it would pay many an amateur to get the shooting done by a joiner. Take four pieces of the brass rod 3 in. long; flatten down one end for about an inch so as to make it wider and thinner than the other part; file out the hammer marks and polish; on the other end cut a screw thread; now bend them at right angles, and screw them into the edge of the base. They are for the purpose of clipping the music on the stand as on a piano. The edges and corners of the base can now be rounded off, the standards glued in, and all worked off with fine glass paper.

Turn two pieces of wood, one to receive the top of the support or leg with a pin turned on it to enter a block; the other as shown to receive the other part of the leg and the feet. Boring the holes so that the whole thing shall stand perpendicular will, perhaps, be the most difficult part of the whole business.

Feeling this, I took mine, after having turned them, to a joiner. It looked all right whilst he was doing it, but when the thing was put together it was like the tower of Pisa. I turned it now one way and then another, and got it to look true when one was facing the stand, and tried to persuade myself it did not matter for falling over a little in the other direction; in fact, I almost think I went so far as to persuade myself it looked very well. But try as I could *I knew* it was not upright, and that it *ought* to be, so I had no peace of mind until I took it to pieces and rectified it. It is well, I think, to let *ought* rule, not only in the moral, but in the mechanical world. To rectify the matter I did what should have been done before—bored from the opposite end, then, with the humble appliance of a red-hot kitchen poker, I managed to make the hole true.

The leg I made as follows:—

I procured 2 feet of 1-in. brass tube, or, rather, iron covered with brass, and 2 ft. of $\frac{3}{4}$-in. ditto. To make a neat finish to the lower portion, I took a short length, say $1\frac{1}{2}$ inch of brass tube that would fit into it, and turned down one end true. I then soldered this to a disc of brass just a little larger in diameter than the leg; this I put in the lathe and finished off with a central hole to receive the smaller length of the leg. Out of $\frac{1}{8}$ sheet brass I cut a strip 8 in. × $\frac{1}{2}$ in., and bent it in two in the centre and bellied so as to act against the inside of the larger tube. This is fixed to the tube by a pin (Fig. 4). I find in practice that it is quite sufficient to support any weight likely to be placed upon it in the way of music, and is for many reasons, I think, better than having a screw to press against the sliding rod. From a smith I procured three iron scrolls for legs as shown; these are fastened by two screws. If two lugs or ears are welded to the scroll between the screw holes, curved to fit the wooden boss, it will render the legs much more firm. I have shown such ears in the illustrations.

We shall now need a rack for the music to rest against.

Two pieces of wood 11 in. × $1\frac{1}{4}$ in. must be fastened to the base by small hinges; two pieces of wood 9 in. × $\frac{3}{4}$ in. × $\frac{1}{8}$ in. must be riveted to each, with a similar bar riveted to the top. Care must be taken that the distance between the rivet holes in the top bar and in the hinged flap must be exactly the same. The stand is now complete with the exception of painting the feet and polishing the woodwork. When this is done it will be found to be a most useful and even elegant adjunct to a musical home.

"LINING UP."

WITH A FEW CONSIDERATIONS ON ART AND ITS TEACHERS.

MEANING OF "LINED-UP" TOP — LEGITIMACY OF CONSTRUCTION—PRACTICE AND THEORY—WHY PRACTICAL WORKMEN LOOK COLDLY ON THEORISTS—ART OVERDONE—WEAKNESS OF SOME ART DESIGNS—THE WORKMAN AS A JUDGE OF ART PRINCIPLES.

THE meaning of a "lined-up" top is too well known among cabinet makers to require any explanation to any craftsman; but to the amateur, or even the professional critic of woodwork, who, in too many cases, is merely a theoretical individual, neither the technical expression nor the work involved may be understood. Perhaps it should also be added that the amateur critic, even though he be one who poses as a teacher of art principles in books (mostly published at his own expense), will probably denounce lined-up tops as a sham, and therefore to be eschewed by all honest workers. His argument in the main would run somewhat thus:—The effect of lining up being apparently to give thickness to the wooden slab, to make the top of a sideboard, a chest of drawers, or other piece of furniture look thicker than it really is, the operation must be deprecated.

Now, were lining up resorted to with the intention of even tacitly implying that a top so finished is throughout of equal thickness, no justification of the practice could be urged. It would evidently be a dishonest construction contrived for the express purpose of deception. I would, however, ask if those who have the slightest practical knowledge of the subject could possibly be deceived by any lining up, however cunningly it might be done. It can be understood that a person who, in ignorance, jumped to the conclusion that a top is the same thickness as on the moulded edge, and afterwards found out his mistake, might be disposed to imagine that the intention of the worker had been deceptive. Should he, however, on that account blame the artisan or the manufacturer? No; I would rather put it, that owing to his limited knowledge he is merely a living exemplification of the motto, "*Honi soit qui mal y pense.*" He imagined a wrong thing, and therefore concluded that the worker—I refer not only to the artisan who actually manipulated the wood, but to the designer or draughtsman, as the case may be—was actuated with a reprehensible desire to produce something which should convey a false impression. To those who are acquainted with joinery or woodwork in its minor and finer branches, such as furniture making, as distinguished from building and architectural construction, the idea that lining up could be regarded in any other than a decorative detail is so preposterous that it verges on absurdity.

But it may be urged that the foregoing remarks have nothing to do with the practical work of lining up, and that in making them theory has received undue attention. I should be sorry for this, as I conceive that theory is a necessary part of any good worker's technical education. Practical men are met on all sides by theoretical objections to their methods of working, by teachers who, without in any way disparaging or impugning their good intentions, are too often singularly deficient in practical training. I do not now so much refer to manipulative skill as to those numerous considerations by which every man who earns his living by his work, *i.e.*, professionals as distinguished from amateurs, must be influenced. I would ask all artisans engaged in any artistic craft, if it is not because of the neglect or ignorance of the circumstances under which things are made, that many writers on art applied to manufactures fail to produce a good effect; nay, I will even go further and say, that they hinder the spread of technical education and the study of applied art. They excite a feeling of antagonism in the minds of those they would teach by assumption of superior knowledge. They may be acquainted with art principles in the abstract, and so far they are deserving of respect, but when they, at the same time, make statements which every craftsman knows to be incorrect about mere mechanical details, the inference too naturally follows, that the man who holds forth on art and craft knows no more about the one than the other. His influence is gone, and instead of benefit being derived from his acquaintance with and exposition of art principles, harm is done, if not by an outspoken protest, at least by a dogged sullenness which will not listen to anything bearing on art. Now this should not be. It is a lamentable state of affairs, but is it not true? Why is it that the craftsman does not respond so freely as those who wish to, and doubtless can teach him much, would like? Why are the efforts, often, I must confess, put forth in all sincerity, not responded to with more cordiality? Is it because the artisan—please note I do not use the word "working man" or "mechanic," but artisan, the artist worker—is so sunken that he will not learn? or is it that he imagines he has nothing to learn beyond the "bread and cheese" portion of his trade? Truly, one not acquainted with the workers, the artisans, the designers, the employers of artistic skill, might excusably think so, if only the utterances of the professional æsthete be regarded. I unhesitatingly say, that were our would-be teachers a little more familiar with the every-day requirements of practical work, with its demands, with its commercial considerations, and if they would regard these when endeavouring to raise the standard of our artistic productions, they would have no reason to complain of having the cold shoulder turned to them. Is that not so, my brother working men, fellow craftsmen, even though we may work in different departments? Would any one of us object to learn from any source whatever anything that could improve our manufactures? I venture to say no; but we are not inclined to learn from any one who dogmatises on art, and at the same time shows his ignorance of practical work, or what I have called the mechanical details of work. Can we do anything but laugh at the art professor who wants to lecture to craftsmen, not boys at school, but grown-up men who must *work*, not play, and because they won't attend his *afternoon* classes thinks them apathetic? The professor in question might have got men to listen to him had he suggested *evening* lectures, but even then surely it would be more charitable to suppose that though the spirit is willing the flesh is weak, and that men do get too tired to listen to theory after working all day, instead of charging them with indifference to refining influences. If they did an honest day's work, doing that which their hands found to do with all their might, surely that was better than listening to "art" talk, most of it, without doubt, very incomprehensible. We, who have any practical experience of the exigencies of work, know too well that the real cause why artistic productions are not more common is not because the worker will not or cannot take the necessary pains, but because the public, *i.e.*, the purchasers, will not encourage them. No, they will sneer at the modern worker, advise him, but they will not pay a fair price for good honest work, and none are greater sinners in this respect than the so-called patrons of art. This may seem a serious charge, but I would ask any artistic tradesman if it is not unfortunately too true. Let him put his best work into any preliminary design, and how often is he not mortified by the huckstering spirit that shows itself in the patron. This, however, is by the way.

No one recognises more readily than I do that both the worker and the theoretical exponent of art occupy legitimate places in the sphere of labour, and it is much to be regretted that they do not sink, if possible, their differences with the view to acting more in harmony. The workers have to some extent been benefited by the teachings of the professors and writings of those who have opportunity of becoming students of art, though not of applied art, but their efforts have been dwarfed by their having failed to grasp the conditions under which things are made. Art is just now the fashion, and is being done to death; attention to art is very well in its way, but in urging its claims many who are enthusiasts, either from love of it or for monetary considerations, are tending to produce a revulsion against it among our actual workers, upon whom after all its application principally depends. Let them take a friendly word of warning, and not cause these to loathe the very name of art by their insistence on it as being the end and aim of every manufactured article.

Surely, a thing, whatever it may be, of any artistic merit should not proclaim the art or artifice by which it is vulgarly recognised as an artistic production. If we look at the stilted affected designs which one sees occasionally bearing the names of leaders of public opinion on art, the bewildered student, who with an intuitive perception that truth and honesty of purpose are the true principles on which art is founded, may well be disposed to think the contrary.

Now all this may seem dreadfully "Philistine" and to proclaim the outer barbarian, but artisans in whatever craft I ask you is it not time that we should have our say in the world of art? The literary art student, or, if he prefers it, art worker, has, from circumstances which need not be enlarged on, hitherto almost alone had the ear of the public, but now that we have WORK, a real technical journal not devoted to any one branch of labour, and in which professional and amateur meet on common ground, it will be our own fault if, however feeble our pens, we do not give forth our opinions. We, whatever our trade or craft, have opportunities of being familiar with its practical side, and to give the British worker his due, he is not so deficient in intelligence as to be necessarily one whit behind the theorist in true perception of art principles and their application to his own special avocations.

On these grounds I have, therefore, ventured to digress to some extent from the practical consideration of "lining up," and I can only hope that none of the foregoing remarks will be in any way misconstrued to mean that due attention should not be given to art in relation to manufactures, only it must be done in a manner consistent with common sense.

(*To be continued.*)

THE TENANT'S GREENHOUSE.

UNATTACHED TO THE SOIL AND REMOVABLE AT PLEASURE.

BY GEORGE LE BRUN.

FRONT END OF HOUSE—DOOR—RIDGE BOARD—ROOF SASHES—FINIAL—IRON STAYS—FLOOR—SHELVES OR STANDS FOR PLANTS—DISPOSAL OF RAIN-WATER—PIT FOR SURPLUS WATER.

THE front end of the house is put together in a similar manner to the back (as described in the previous paper), but two upright pieces are required, and they are placed at a sufficient distance apart to admit of a door 2 ft. wide being hung between them. This door is lined with matchboards in the lower panel to correspond with the rest of the house; the upper part is filled in with glass, a sash bar dividing it into two panes. The door stiles are cut away above the belt rail to a width of $2\frac{1}{2}$ in. in the usual glass-door manner. The wood for the door should be $1\frac{1}{2}$ in. thick, and a suitable width would be 4 in. for the stiles and top rail, and 7 in. for the belt and bottom rails. The door is best hung to open outwards, as it is then out of the way when attending to the plants. Fig. 10 shows the framing of the front end, in the square opening of which, above the door, a fanlight is hung on pivots.

A ridge board is now put on of 7-in. by $2\frac{1}{2}$-in. wood; it must be bevelled on the top edge to the rake of the roof, and, when in position, project the thickness of the roof sashes above the framing of the house ends. It is secured by means of iron plates, two at each end, screwed on as shown in Fig. 11. A fillet 1 in. square is put along the entire length of the ridge board on each side for the sash ends to rest on. (A, in Fig. 11.)

The roof sashes come next. They are made in four sections, two for each side, and project two inches over each end of the house, and the same distance over the sides; the four end stiles must therefore be 6 in. wide. The inner stiles may be $3\frac{1}{2}$ in. wide; they are grooved on the upper side to allow of the water running off, and so preventing leakage to the inside; a bead covers the joint, and projects midway over these grooves. This mode of jointing is shown at Fig. 12.

The finishing of the ridge is given at Fig. 13, and a design for cutting an ornamental ridge board of a simple and easy design at Fig. 14, Fig. 15 being an alternative design for the same purpose, which, however, is far better fitted to be cut in zinc than in wood. A finial is placed at each end of the ridge to form a finish; it may be of any design to suit the builder, from a simple piece of turned work to an elaborate octagonal, a design for which is given at Fig. 16.

Two iron rods are put across the house in the inside, about 4 ft. from each end, one end of the rod having a snap head and washer, the other a nut and washer to allow of tightening up. These rods are best put through the top rails of the framing; they prevent any tendency of the sides to spread from the outward thrust of the roof, and they can be utilised to hang pots or baskets from.

The house being put together, the inside demands our attention, and the first call upon it is the floor. Now we will eschew wood, it holds water and rots easily, and utilise whatever may be most handy in the way of concrete slabs, slate, or cement; in any case we will require joists, or sleepers rather, of 5-in. by 2-in. wood, cut to fit between the sides of the sill, and levelled down so as to come even with the top side of it. If concrete slabs are used for the floor, the sleepers must be put at sufficient distances apart in order that the edges of the slabs may rest evenly upon them; while, slight fall towards the closed end of the house, from which end of the gutter a pipe, $1\frac{1}{4}$ in. diameter, is taken inside (by boring the end sash stile), and led into a tank or cistern underneath the table. This tank will have a tap from which to draw a supply of water when required, and an overflow pipe to carry off surplus water, and so prevent any chance of flooding the house in the event of a very heavy rainfall. This overflow pipe should be 2 in. in diameter, and may be led into the nearest drain, or, if that is inconvenient, a large hole may be dug in the garden and filled with broken bricks to within a little of the surface; over the bricks lay a few boards, and level up with earth. The overflow pipe should be dug in the earth about 4 ft. deep and 30 in. in diameter. The pit should be filled up to about half its depth with brickbats thrown loosely in one on the other. On this some brushwood should be thrown to prevent the entrance of the earth, with which the pit is filled up, and a 2-in. drain pipe should be set in the earth extending from the surface of the ground to the brickwork. The free end of the overflow pipe should be introduced into the drain pipe, and the mouth of the latter closed round the pipe with cement or some other suitable material.

Pits made and filled in this manner are most effectual for carrying off surplus water,

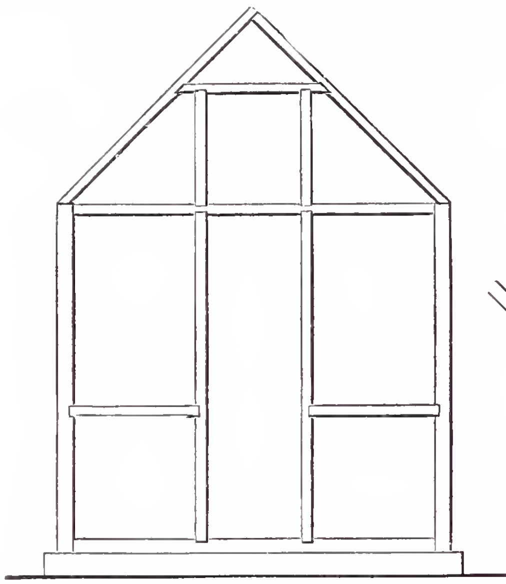


Fig. 10.

Fig. 14.

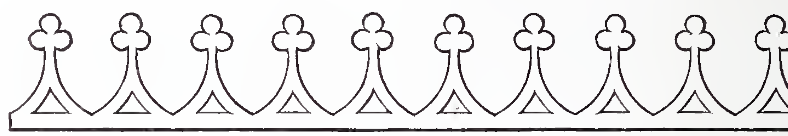


Fig. 15.

Fig. 16.

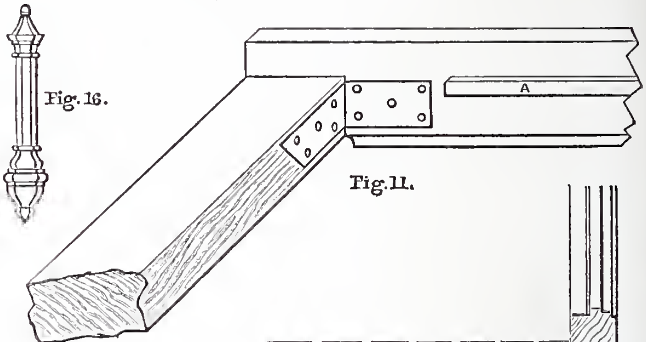


Fig. 11.

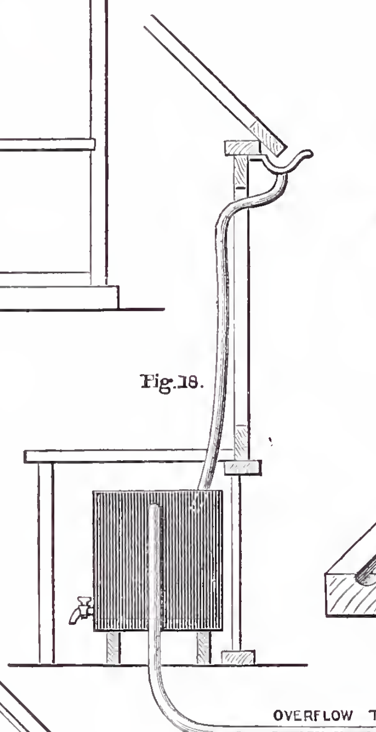


Fig. 18.

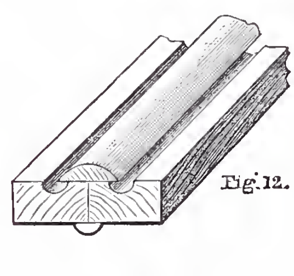


Fig. 12.

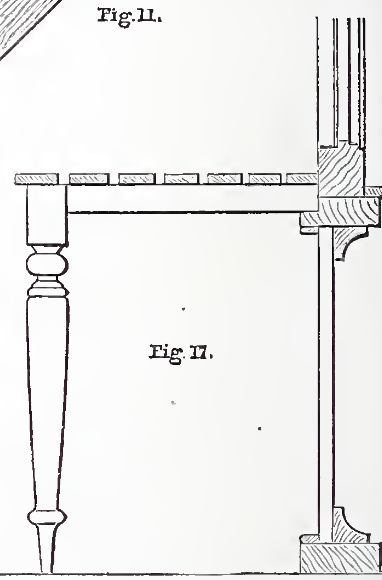


Fig. 17.

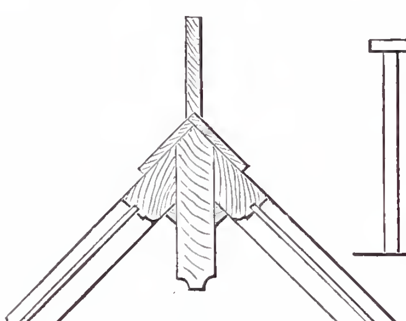


Fig. 13.

Fig. 10.—Elevation of Framing of Front End. Fig. 11.—Mode of Putting on Ridge Board. Fig. 12.—Details of Joint of Roof Sashes. Fig. 13.—Details of Ridge in Section. Fig. 14.—Cut-out Ridge Board. Fig. 15.—Alternative ditto. Fig. 16.—Octagonal Finial for End of Ridge. Fig. 17.—Details of Inside Shelves. Fig. 18.—Section showing Cistern for Rain-water with Mode of Collecting and Disposing of Overflow.

if a cement floor be decided upon, rough slates or boards can be utilised to form a bearing for it, and the sleepers put in accordingly.

The width of the greenhouse (8 ft.) allows of shelves for plants nearly 3 ft. wide along either side, and the mode of supporting these tables is given at Fig. 17. One leg only is used, the inner end of the support, or table rail, resting on the belt rail of the house, into which it is checked and screwed. The shelves are spanned with 3-in. by 1-in. stuff about 1 in. apart.

Instead of allowing the rain-water from the roof to run off on to the ground and go to waste, it can be utilised for watering the plants with, and so we will run a neat zinc gutter along each side of the roof, having a may then be led into this hole, which will absorb all the surplus water that is likely to reach it. A sketch of this cistern arrangement is given in Fig. 18, in which only the pipe from one gutter is shown; the pipe from the other gutter is taken inside the house in the same way, brought down under the table, and led under the belt rail of the framing across the end of the house to the tank. A large tub or barrel can be used instead of a square tank if it is found to be handier. The overflow pipe must be led under the house before the floor is laid down, or it may be taken out through the end if that method suits best; in fact, many minor alterations can be made to suit individual tastes.

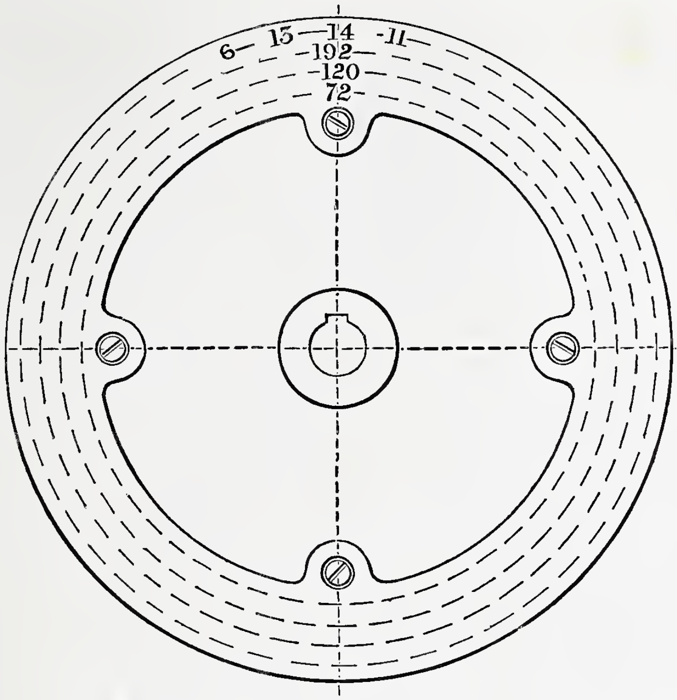
To get rid of the surplus water, a pit and by the interior arrangement described water for the plants is always at hand except in very dry seasons, when showers are few and far between, and any dirt or annoyance from drip round the house is utterly prevented.

LATHES AND TURNING APPLIANCES.

BY F. A. M.

VI.—The Worm Wheel and Tangent Screw.

When wheel cutting is to be done by means of the division plate, it will often be found that the required number of teeth cannot be produced by means of any of the circles at command. Clockmakers' dividing engines, which have large horizontal division plates, on which are drilled a large number of circles, may contain every number that is at all likely to be required in clockwork, but the 5-in. lathe pulley cannot well contain more than six or seven circles; and if the table given with the paper on the division plate be examined, it will be seen that none of the eleven circles of holes given there can be divided by the prime numbers 11, 13, 17, 19; yet this table is only carried up to 20. Had it been continued still further, many other numbers would have been found which would not go exactly into any of the eleven circles of holes; and therefore it would have been difficult, with these numbers only at command, to cut wheels having 11, 13, 17, 19, etc., teeth. The worm and wheel about to be described may be considered a universal dividing engine, inasmuch as that, with a little contrivance, it will cut any number of teeth whatever.



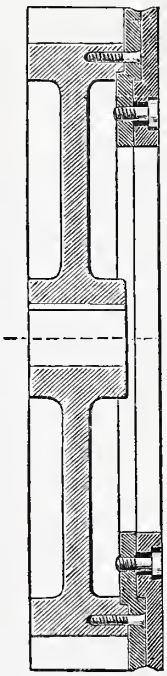


Fig. 26.—Worm Wheel and Gear Wheel: Front View. Fig. 27.—Ditto: Section.

In ornamental turning it will not be necessary to go beyond the powers of the division plate to find an unusual number. Yet the worm and wheel, otherwise called the tangent screw movement, with segment stops, is of as much importance as in metal work, because it provides for a very slow movement of the mandrel, and also enables the workman to confine this movement between two circular stops, called segment stops, so that he can drill or cut out only part of a circle. Fig. 24 will give an idea of the way in which the tangent screw and worm wheel is generally arranged upon the ornamental turning lathe, where there is no back gear. There is a circular fitting upon the small end of the pulley, accurately turned, and the worm wheel has a shallow recess which fits upon this, and then the two are fixed by screws put in from the left. The tangent screw is underneath, and it is turned by the upper one of the two square heads seen. The lower square commands an eccentric, by means of which the frame carrying the screw can be raised, so that the screw will gear with the wheel, or can be lowered out of the way when the band is in use.

The writer's lathe is fitted with back gear, which made it inconvenient to attach the worm wheel as in Fig. 24; also the bolt upon the face of the large gear wheel (by means of which this wheel and the pulley are caused to revolve together) does not clamp them immovably, and might even come to allow a little shake between the pulley and wheel. It was therefore necessary to attach the worm wheel to the large gear wheel in front of the pulley (see Fig. 25). The worm wheel cannot well be less than ⅝ in. thick, and there may be some difficulty in getting it in; but it will certainly

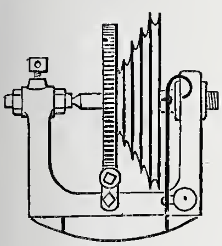


Fig. 24.

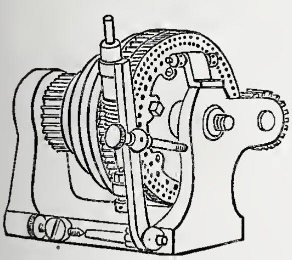


Fig. 25.

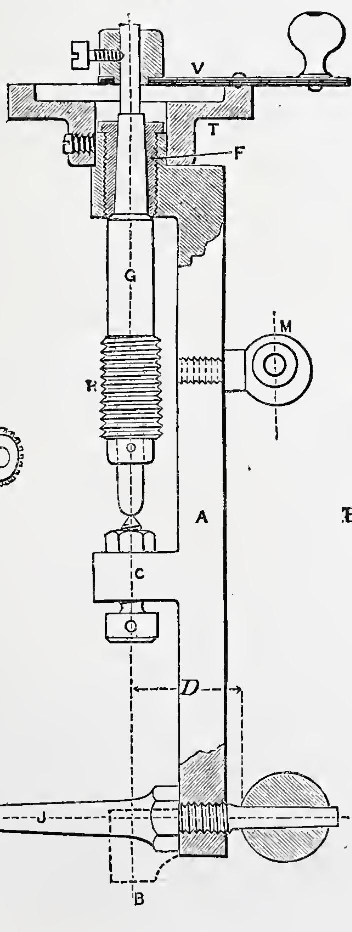


Fig. 28.

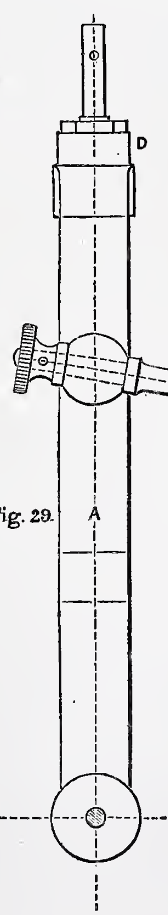


Fig. 29.

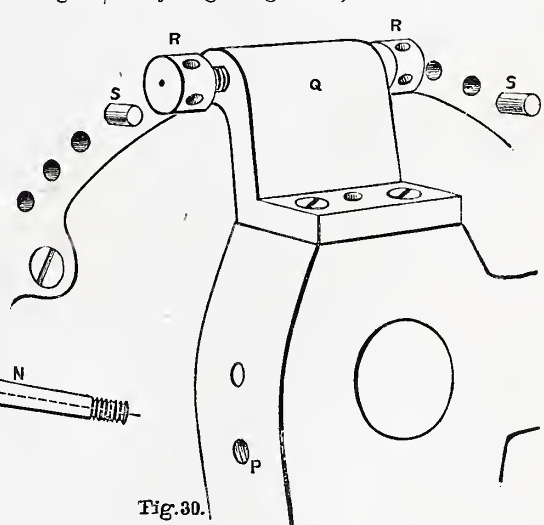


Fig. 30.

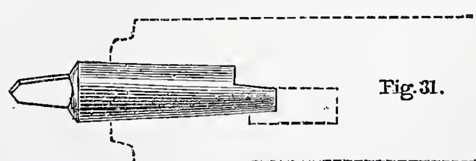


Fig. 31.

Fig. 24.—Arrangement of Tangent Screw and Worm Wheel. Fig. 25.—Attachment of Worm Wheel to Large Gear Wheel of Pulley. Fig. 28.—Tangent Screw and Frame: Side View. Fig. 29.—Ditto: Front View. Fig. 30.—Segment Stop and Pins Enlarged. Fig. 31.—Drill Enlarged.

be impossible to get the tangent screw in beneath it. However, its frame can be easily fitted into the ball of the index peg, which will suit very well, since they will not both be used at once. Besides, it will be very easily removed and put away for safety when not wanted.

It would be difficult to fit such a worm wheel into one's own lathe without a second lathe to work with. It would be still more difficult to cut the teeth of the worm wheel perfectly. The amateur is not advised to attempt that part of the work; he may have a worm wheel fitted and cut for about 50s. He can then correct it himself, make the tangent screw and frame, and then, by means of the worm wheel, he can drill the front as a division plate. This is the work now about to be described, not, however, with quite so much detail as the former paper contained, since no one should attempt such a piece of work who is not already something of a workman.

Figs. 26 and 27 are a front view and section of the front gear wheel of a 5-in. back-geared lathe, showing how the worm wheel was attached. The worm wheel is 7 in. in diameter, and the ring is rather less than 1 in. wide. (It would have given room for plainer figures if it had been $1\frac{1}{4}$ in. wide.) There are four rows of holes. The *first* is $6\frac{5}{8}$ in. diameter, and it has holes which divide it into 6, 11, 13, and 14 equal parts. Six is contained in the other circles, but it is often required, and is easier to pick out quickly in this circle. Every hole of the 6, except the zero or starting hole, is marked with a (6), so that it is easy to pass from one to another. Every hole of the 11 divisions is marked (11), and every hole of the 13 but the first (13); every hole of the 14 divisions (14). The first or zero hole is not marked, as it is easy to pick that out, and from it to divide the circle into 2, 3, 6, by the 6 divisions; 7 or 14 by the 14; and 11 and 13 besides. Thus you only have to keep to the holes marked 11 for 11 divisions, or to those marked 13 for 13, etc.

All the holes are about $\frac{1}{12}$ in. in diameter, so that it would not have been possible to divide still further the same circle into 17 and 19 without the holes clashing, *i.e.*, cutting one into another in certain places. The *second* row of holes contains 192, which contains multiples of 8 and 12; also it is twice 96, and it is much used in "double counting." The figures 192 are stamped over the zero mark of this row, and numbers are placed at every 12 holes, dots above (or outside) the holes at every third, and inside opposite every fourth hole. The circle is $6\frac{1}{4}$ in. diameter. The *third* row has 120 holes, chiefly useful because it enables one to divide the circle into 5, 10, 20, etc., divisions. It is therefore figured at every twelfth, and has a dot opposite every sixth and third hole. This circle is $5\frac{5}{8}$ in. diameter. The *fourth* and last circle contains 72 large holes, about $\frac{1}{5}$ in. in diameter and $\frac{3}{8}$ in. deep. These are intended to hold the segment stops—little steel pegs which fit the holes, and project from the plate about $\frac{3}{8}$ in., so as to meet and be arrested by the head of adjustable fixed screws, and so confine the revolution of the mandrel within certain limits. There is, however, a short shoulder upon the index peg (described before, see Fig. 6, page 92), which fits into these large holes, and allows of their being used in connection with the index, which is useful, because 72 contains 9 and 18, which the others do not. It is marked at every eighth and fourth hole.

Looking at Fig. 4, it will be seen that the worm wheel is made as two flat rings, which are screwed together by four cheese-headed screws passing through four lugs or ears inside the rings. The first ring is strongly riveted by six rivets to the gear wheel, after having been carefully fitted to the circular fitting. It has itself a circular fitting, into which the second half of the plate must fit very exactly. The four screws are, however, purposely fitted with a slight amount of play in the plain holes, so that they shall not control the set of the second plate upon the first half. It is, however, confined by the circular fitting, which ensures the two halves remaining rigidly concentric. The gear wheel, with the worm wheel attached, should now be chucked perfectly true in a wheel-cutting engine, and the edge cut with 240 teeth, inclined to an angle of 2°, which will leave them very nearly 11 to the inch, the pitch of a $\frac{5}{8}$ Whitworth bolt. At this point the amateur may take the work in hand himself.

First take out the four screws, turn the front plate half round, and replace them, taking care to examine the fit or correspondence of the teeth all the way round; when this correspondence is as near as possible, fix the screws, and then you will see how near to truth your worm wheel is. Dividing engines are not perfect; of course, too, it is very easy to chuck the worm wheel a little out of truth, which would cause the teeth to be closer together on one side than on the other; and you will very likely find a tooth edge projecting $\frac{1}{50}$ in. in one direction one side, and $\frac{1}{50}$ in. in the opposite direction on the other side of the wheel. Observe carefully whether you have "split the difference;" if not, release the four screws, and do so.

Here it may be pointed out that as one object of the four screws is to enable one to fix the outer plate in four different positions upon the inner so as to equalise any error in the spacing of the teeth, it is necessary that the number of teeth chosen should be a multiple of (*i.e.*, divisible by) four: for instance—had we to deal with seventy teeth we might have turned the plate half round and found the teeth correspond, but if we had turned it one quarter round, their edges would have been "at sixes and sevens."

The tangent screw or worm, with its frame, will now be described as seen in detail in Figs. 28 and 29, its application to the headstock appearing at Fig. 25. A is the frame, a casting of brass, cast with a projection, B, shown dotted at the lower end of Fig. 28, intended to aid in the chucking, and cut off as soon as the turning is finished. File up the back or straight flat side of the casting, then measure the distance, *D*, on your lathe from side of ball to centre of worm wheel, subtracting $\frac{1}{8}$ in. from that distance, scribe the height of the centre of tangent screw on both ends of the casting as it lies on the flat back, and also on the lug, C, Fig. 28; now file up one side of the casting, and, laying it on that side, scribe across these lines to get the centres for the screw and for turning and boring the piece. Punch and bore centres at both ends, put the work in the lathe with B against the running centre, and turn up the neck, D, Fig. 29; round the shoulder, substitute the boring collar for the back centre, and bore and screw the hole for the coned bearing, F; now drill the hole at C for $\frac{1}{4}$-in. Whitworth screw, putting the drill in through the collar on to the punched mark made where the scriber marks cross. This is to ensure the hole at C being in line with the spindle when fitted into F. Take the piece out of the lathe, cut off the projection, B, and tap the hole at C from that end. Now turn the coned bearing, F, of brass, not forgetting the short conical shoulder, which is quite essential. Turn up the spindle, G, fit F upon it, at first tightly, so that you can turn up the outside of F, and thread it; or it may be driven on another mandrel; or, better still, the neck, D, might be cast so much longer that the piece, F, might be turned there, bored out, screwed, and cut off, and then the part, A, screwed to fit it. Make two long ferrules, H, to fit into G; both should be threaded alike with eleven threads to the inch and both of cast steel, one of these to have oblique grooves filed out to form it into a kind of hub; it is then hardened and used to equalise the teeth of the worm wheel and bring them to fit the plain screw. Make the small centre screw and nut at C and harden its point; turn the piece, J, of steel, fit the point into the index ball, and fit it into the frame with a $\frac{3}{8}$-in. screw. The piece, K, screws into the base of the headstock just like the ball, and through it goes a $\frac{1}{4}$-in. screw with a milled head and pointed end, which takes into J and ensures that the frame shall be held firmly and without shake; the piece, K, should be far enough away to allow J to pass it when the frame is taken out of the ball, otherwise K would have to be removed every time. Now make the ball, M, so that the screwed end of N shall come opposite the casting of the headstock, where the $\frac{1}{4}$-in. tapped hole, P, Fig 30, is bored to receive it; see also Fig. 25. It is by means of the milled head on the screw, N, that the frame with the tangent screw it carries is brought into close contact with the worm wheel, or released so that it can be turned down or taken out altogether. At Fig. 30 are seen the segment stops, S, S, in the innermost row, consisting of large holes. At Q is seen a forging firmly screwed upon the top of the headstock; it leans backward so as nearly to touch the face of the division plate, and it carries two capstan-headed screws, R, R, easily adjusted, against which the segment stops abut: the piece, Q, is not in the way, and remains where it is even when not in use.

We now come to the most interesting part of the apparatus. The top of the frame and spindle, G, rise clear of the worm wheel, and enable us to fit a large collar, T, of which there are several, on to the circular fitting D, which keeps it concentric with the spindle; these collars have small binding screws to fix them in any position. On the upper end of the spindle, G, goes a spring handle, V, secured by a binding screw; the arm of V is made of a bit of the blade of a hand saw, and the square hole at the large end is riveted firmly into the boss; there is a little steel rounded pin riveted into the middle of the blade just over the edge of the cup-shaped collar, which pin acts, in fact, like a short index peg, for it can drop into shallow holes in the edge so that the handle can receive one or more turns exactly, or half a turn, one-third, one-fifth, etc., or one and one half, two and one third, etc. etc. By slightly lifting the little knob-handle as it is turned, the spring bends enough to allow the little peg to pass without touching. Make any number of these collars you think you may require, say five; fit each on to D, turn it up, and divide the edge by drilling 5, 7, 11, 12, 13 shallow holes, one row in each collar; provide each collar with a fixing screw, and lay them aside.

To equalise the teeth of the worm wheel, drive the hardened ferrule, H, upon the spindle, and fix a small pulley upon the upper end of the spindle, so that you can drive it from the overhead motion, then bring up to cut by turning the screw, N, and take care that the mandrel is quite free to revolve, as it must do, while the cutting is done. Continue cutting till the mandrel has made several revolutions and till the teeth of the worm wheel are touched almost all over; then take out the four screws, turn outer plate half round, and repeat the cutting; then return to the first position and cut again, then to second position, till the teeth coincide in both. After this turn plate one quarter round and continue the process till the teeth correspond in all four positions; be patient here, and persevere, for a week if necessary, and when you have got it right you will have made a most valuable addition to your lathe.

Now the holes of the division plate may be drilled upon the front of the worm wheel. A drilling spindle and overhead motion will be required, also a slide rest. Make a very short drill, which should be turned up *in its own drilling spindle* to an angle of about 18°; it need not project more than $\frac{1}{4}$ in., so as to be as stiff as possible. The drill is shown enlarged at Fig. 31; it is flat, point of the usual form, but sides bevelled off with the file, then hardened and sharpened on an oil-stone; try it on a spare bit of brass, and when it cuts perfectly be very careful not to break it till the whole of the work is done. You will require a second and larger drill made to a sharper angle for the larger holes. The small holes may be $\frac{1}{8}$ in. deep and $\frac{1}{12}$th diameter at the mouth. There must be a stop on the slide rest to regulate the depth, so that each hole will be of the same size and depth.

The principle on which the divisions are obtained must now be explained. If between every hole the tangent screw were given one turn, then, since the worm wheel has 240 teeth, and at every turn of the handle the screw passes one tooth, therefore we should divide the circle into 240 divisions, and the last turn would cause the drill point to drop again into the first hole. Evidently, if between each hole we gave the screw 2, 3, 4, 5 turns, we should get $\frac{240}{2}$, $\frac{240}{3}$, $\frac{240}{4}$, $\frac{240}{5}$ numbers of holes=120, 80, 60, 48 holes; on the other hand, if we give $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ turns, we get

$$\frac{240}{\frac{1}{2}},\ \frac{240}{\frac{1}{3}},\ \frac{240}{\frac{1}{4}},\ \frac{240}{\frac{1}{5}},\ = 480,\ 720,\ 960,\ 1{,}200$$

holes. Therefore, whatever number of holes or divisions you wish for, divide 240 by that number, and you get the turns or part of a turn of the handle of the tangent screw which you must make between each cut.

Applying this rule to the numbers chosen for our division plate (see p. 153), we have

$$\frac{240}{72}=3\tfrac{1}{3};\ \frac{240}{120}=2;\ \frac{240}{192}=1\tfrac{1}{4};\ \frac{240}{14}=17\tfrac{1}{7};$$

$$\frac{240}{13}=18\tfrac{6}{13};\ \frac{240}{11}=21\tfrac{9}{11};\ \frac{240}{6}=40;$$

so that to divide the inner circle into 72 we must between each hole give the tangent screw $3\frac{1}{3}$ turns, and the use of the divided collars becomes apparent.

In the same manner the tabular statement just given shows the number of turns that must be given to the tangent screw between each hole in order to divide the inner circle into 120, 192, 14, 13, 11, and 6. I have endeavoured to make the explanation as clear and complete as possible, and I do not see how it could well be made plainer; still, if any reader fails to understand anything that has been advanced, I will endeavour to give him fuller information through "Shop."

The following table shows how many turns are required for any number up to 50:—

Divisions.	Turns.	Divisions.	Turns.	Divisions.	Turns.	Divisions.	Turns.
2	120	15	16	28	$8\frac{4}{7}$	41	$5\frac{35}{41}$
3	80	16	15	29	$8\frac{8}{29}$	42	$5\frac{5}{7}$
4	60	17	$14\frac{2}{17}$	30	8	43	$5\frac{25}{43}$
5	48	18	$13\frac{1}{3}$	31	$7\frac{23}{31}$	44	$5\frac{5}{11}$
6	40	19	$12\frac{12}{19}$	32	$7\frac{1}{2}$	45	$5\frac{1}{3}$
7	$34\frac{2}{7}$	20	12	33	$7\frac{3}{11}$	46	$5\frac{5}{23}$
8	30	21	$11\frac{3}{7}$	34	$7\frac{1}{17}$	47	$5\frac{5}{47}$
9	$26\frac{2}{3}$	22	$10\frac{10}{11}$	35	$6\frac{6}{7}$	48	5
10	24	23	$10\frac{10}{23}$	36	$6\frac{2}{3}$	49	$4\frac{44}{49}$
11	$21\frac{9}{11}$	24	10	37	$6\frac{18}{37}$	50	$4\frac{4}{5}$
12	20	25	$9\frac{3}{5}$	38	$6\frac{6}{19}$		
13	$18\frac{6}{13}$	26	$9\frac{3}{13}$	39	$6\frac{2}{13}$		
14	$17\frac{1}{7}$	27	$8\frac{24}{27}$	40	6		

Remembering that our collars are divided into 5, 7, 11, 12, 13 divisions, and looking through the fractions in the list, we find we could divide into any of these numbers except 17, 19, 23, 27, 29, 31, 34, 37, 38, 41, 43, 46, 47, 49. Now, although these numbers, and those others which would be discovered to be beyond our range if the list were continued, might, very likely, never be required; yet these, and, in fact, any number whatever, can be obtained by a little trouble. Take, for instance, 239 divisions, one short of 240; here it would be necessary to give between each cut $\frac{240}{239}$ turns, that is, one whole turn and $\frac{1}{239}$th of a turn. This is an extreme case, but it could be managed by making or buying a paper scale having on it 239 divisions of about $\frac{1}{32}$ in. in length, so that the length of the strip would be some 8 or 9 in., the circumference of about 3 in. Take the dividers set to about $\frac{1}{32}$ in., and step them along the edge of a piece of paper, cut off the strip when you have made 239 marks, and your strip should be about 8 in. long. Now prepare a collar of hard wood, fit it upon D, and then carefully reduce its external diameter, till the strip will just meet round the edge; fix it there with fine pins or tacks (gum might alter its length). Now between every cut make one whole revolution and one division. By carrying the divisions on to the upper surface, and making a mark on each one as it is used, mistakes may be avoided. The general rule would be, divide 240 by the number of divisions required, reduce the fraction if possible, let the collar be divided into a number of divisions equal to the denominator, and count between every cut as many of these divisions as you have units in the numerator.

The apparatus just described will divide into as many divisions as are likely to be required with great convenience, and, with a little trouble and contrivance, it will divide into any number whatever. It will serve also to give a very slow motion by hand to the mandrel, which is often of great use. It is often quicker to use than the division plate, since one turn of the handle, two turns, or three, or one and a half, for 240, 120, 80, 160 divisions, can be given more quickly than the index peg can be moved, and with less chance of error. The tangent screw must, of course, be held close up, so that there can be no possibility of shake between it and the wheel, and then the work will proceed with certainty and despatch.

I have now put my readers who are given to lathe work in possession of much information on Lathes and Turning Appliances that, I trust, will be useful to them; and here I shall stop, for the present at all events, leaving other appliances for consideration, if required, at some future period.

JAPANESE MOTIVES FOR FRET CUTTING, STENCILS, AND SIMILAR PURPOSES.

Illustrated from Native Books.

BY J. W. GLEESON-WHITE.

II.—Of Flower and Insect Forms.

In the former chapter of this paper enough was said of the general laws of Japanese art, but little of the possibility of using it upon English articles; and yet this is a very pertinent aspect, for while there are objects that may be embellished with direct copies of Japanese ornament, others are so emphatically European in their shape and purpose that the Eastern decoration fails to combine with them, but tells distinctly as applied ornament, that might be removed with no great loss to the article so treated. For example: a modern coal box, spatter Japanese birds all over it as you will, looks always what it is; yet in such an extreme case I think a little modification of the accepted shape might bring the discordant qualities into harmony.

In woodwork—more particularly the subject to-day—we notice that the Japanese almost entirely eschew our conventional mouldings, prefer square posts to turned ones, are content to let a square rod end with a simply cut-off finish, not always longing for a little knob to decorate it. They know eminently where to leave off, and in all art the best artists have recognised the value of this critical quality.

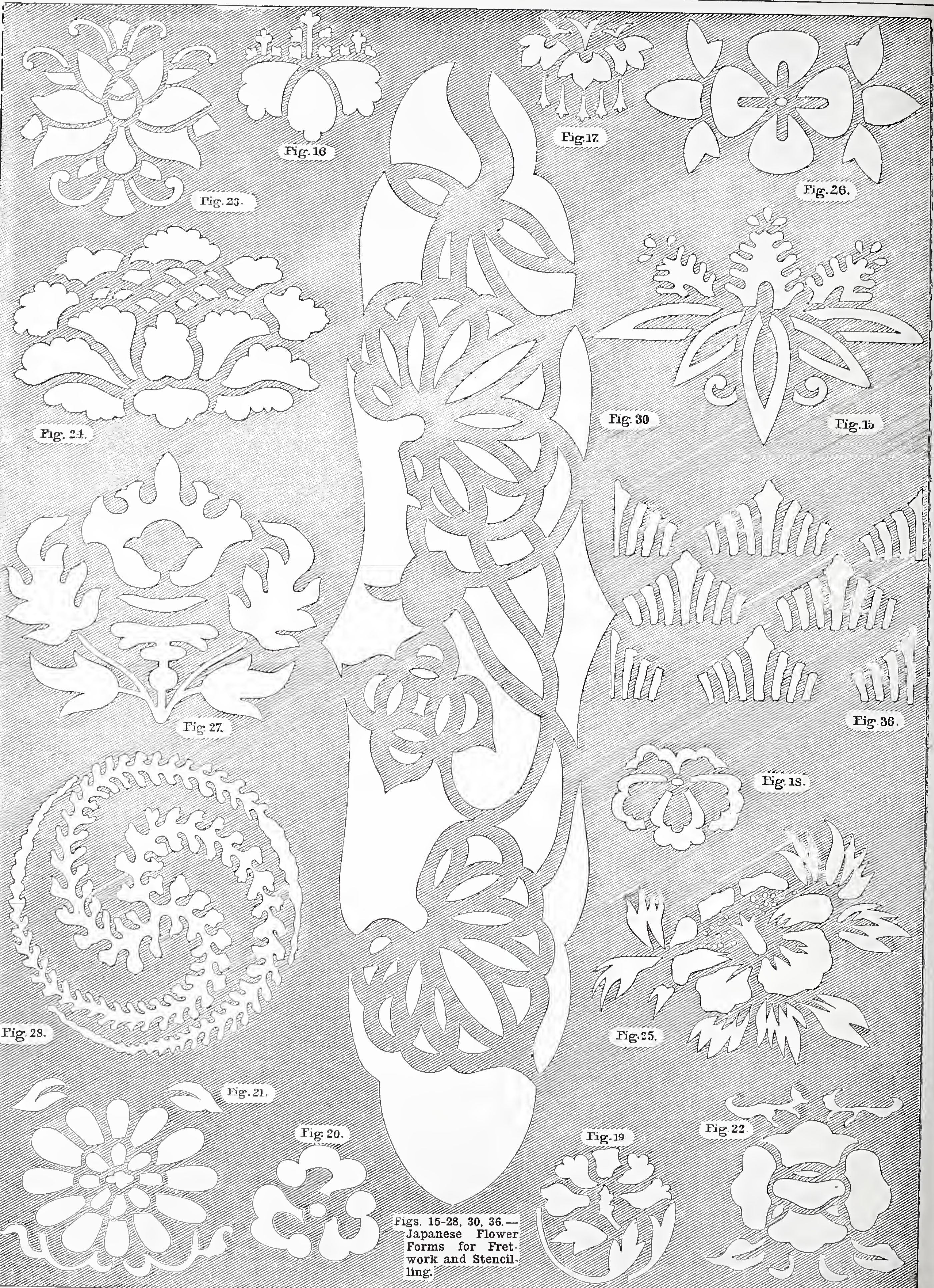
Suppression and reticence serve to display the beauty of the rest. If you lavish ornament on every part, like much modern Indian carving, the whole thing becomes a mere excrescence, and kills itself.

The value of an undecorated portion to give repose and breadth to the whole work, be it a palace or penwiper, is a quality worth trying for, and more truly artistic than any other, be it what it may.

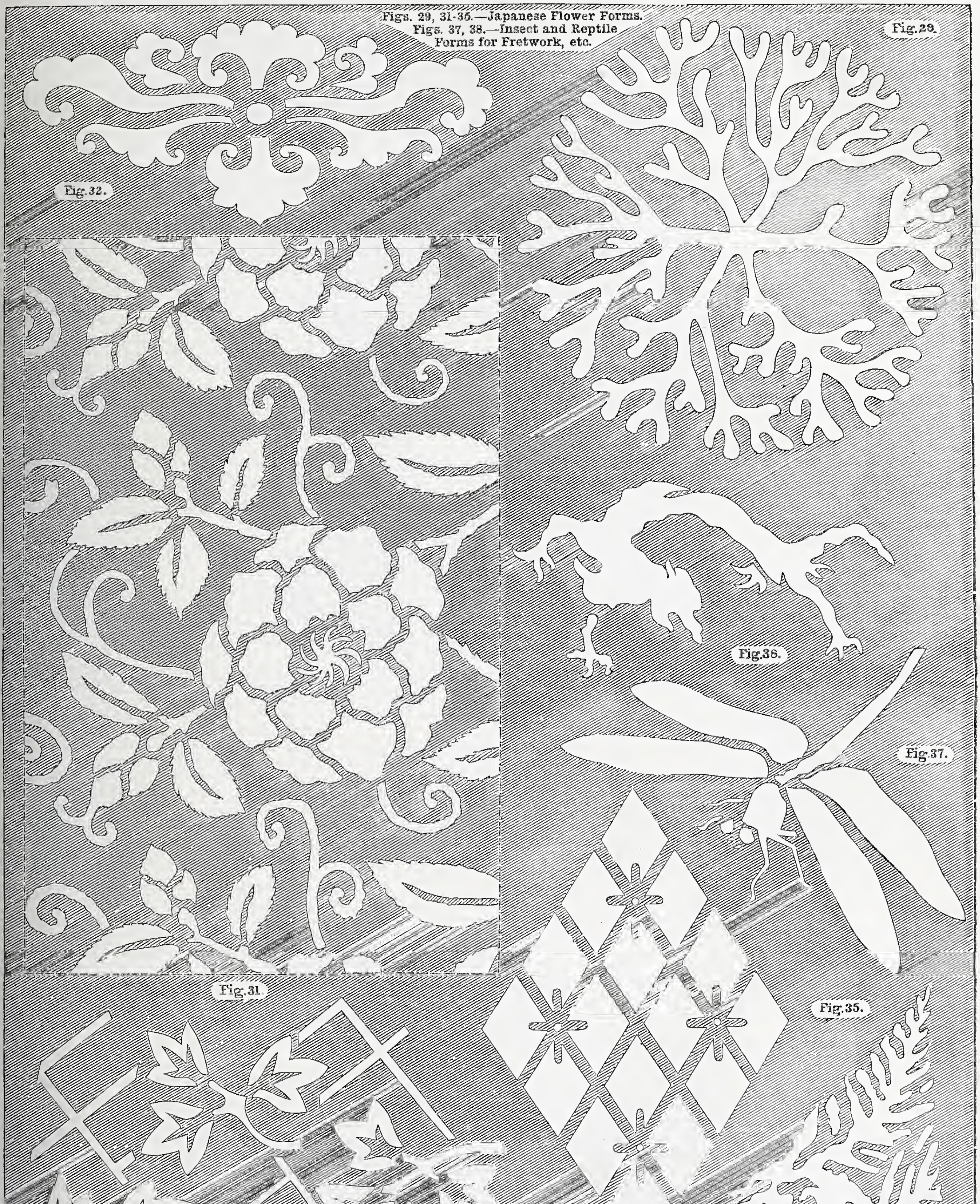
For the designs here shown are the piquant spots that decorate the mere construction, and to be of value must be used liberally, but with great care against excess. Of the two extremes, poverty of ornament is, on the whole, better than exuberance. A thing plain to meanness is less wearisome than overloaded with meretricious gewgaws. The tendency of late has been to exceed the bounds of good taste by ever-increasing mass of details. In many of our modern restaurants and hotels we groan for a square inch of plain restful surface. Floor, furniture, walls, ceiling, are all alike a mass of design, may be good in itself, but as different from really beautiful decoration as a meadow sprinkled with wild flowers is to a bedded-out lawn. This frugality of the use of ornament allows the thing introduced to be of better quality. It is better to have a square yard of fine carving than a square mile of machine-made pattern. Better to have just two or three masses of careful design to emphasise certain portions of the work than a cheaper style lavishly spread all over it.

One more point is needful to reiterate, namely, the distinction between ornament and picture. And this is a fault the Japanese rarely make. They are pre-eminently decorative artists, and realise the importance of the distinction. In no aspect of the craze for the imitation of Japanese style has the difference between the true and the false been more apparent.

Because the Japanese artist suggests a picture upon his panel, and only suggests it, too often the European workman has



Figs. 15-28, 30, 36.—Japanese Flower Forms for Fretwork and Stencilling.



Figs. 29, 31-35.—Japanese Flower Forms. Figs. 37, 38.—Insect and Reptile Forms for Fretwork, etc.

corrected what he took to be the result of mere incapacity of the Eastern craftsman, and translated the merely indicated background to a veritable landscape. But pictures are entirely distinct from decoration. Flatness is a valuable quality in conventional treatment of architectural spaces, distance an equally valuable one in a picture, and neither can interchange without detriment.

In these floral forms to-day it is instructive to note how carefully the Japanese artist has avoided pictorial representation of his subject. He has suggested all the salient points of the growth and shape of the plant, or been satisfied with a mere hint of the actual flower, but he has never tried to make it a picture.

Notice the floral ideas expressed in Figs. 15 to 31, especially the imperial crest of the Mikado, the horse-chestnut treated conventionally in Figs. 15 and 16; this beautiful object is perfectly suggested, and yet it becomes a conventional ornament, entirely decorative in itself. In Figs. 17 to 19, and 21 to 31, other flowers and leaves are expressed in similar way. Fig. 31 is an all-over design, capable of infinite extension to cover the required space. The amount of labour in a square foot of this pattern would be great, much more than in a square foot of American-Greeco-Gothic-Japanese-tag-rag-and-bobtail pattern. But the result would be also unlike. In one case a bit of good, if to some extent mechanical, art; in the other a monstrosity not worth having. Fig. 37 is a perfectly rational treatment of three simple leaves, but their geometrical arrangement makes the whole circle a masterpiece of design, easy and without effort, cut with no change of the fret saw; decorative either near or at a distance, it embodies all the good qualities of the art of design. Fig. 36 is a pattern almost meaningless in itself, yet repeated over a surface it becomes very telling in its effect. Of similar class is Fig. 35. If repeated it would be best to do it in chequer fashion, leaving alternate blank spaces the size of three sixteen smaller diamonds, thus saving the work, and gaining the larger decorative effect, the advice to secure which has already been repeated *ad nauseam* in this article. Fig. 34 is another all-over pattern, but the Japanese do not cover all the surface with such a design, as English use has it, but break up the mass by irregular portions of plain surface, vastly heightening the scheme of the whole.

And now, having noted down thirty-eight themes, how can they be best used?

For stencil plates they may be copied bodily. It is hardly needful to explain the way to cut these; but a very ingenious method, of Japanese origin, has been shown to me lately.

All stencil users know how often the bars left to strengthen the thin paper mar the design, so that in many cases the brush has to be used afterwards to fill up the breaks in the pattern caused by these said bars.

The Japanese solve this difficulty by cutting the stencil in two thicknesses of stiff but thin paper, then laying a network of the finest thread, as fine as hair, between the two papers. These being fixed together, the brush plays freely through the spaces of the net, which is of wide mesh in proportion to its size. Thus the sweep of the long line is kept, with no loss of strength in the stencil plate itself, and economy of future labour, since the one process completes the decoration.

For fretwork, there is no limit to the use of these motives; later on I hope to give working drawings of various structures adorned in this fashion, for this true fret cutting is worthy to be termed the classical method of its use. It appeals not to schoolboys or carpenters merely, but to artists. There is no reason why fretwork, properly used, should not rank among the minor arts. But to secure such a position it must be done without thought of the labour, and with care above that usually devoted to it. After many years of designing ordinary patterns, I should not like to maintain definitely that in this cut-out pattern the sole future is to be found; but I do hold distinctly, that much of the ordinary work is misapplied labour, and that if the pastime is doomed to remain only a pastime, it will be because of the low quality of its design. By this I do not, for one instant, say all designs produced are bad designs, but, as a rule, they are poorly adapted for use, and weaken the material under the pretence of beautifying it, making it less serviceable, less lasting, and, too often, in no way decorate the complete work, only ornament its several parts, and those in inadequate fashion. An inch of good decoration is better than a yard of poor ornament. A blot-book cover (to take an instance), with one of these Japanese designs worked carefully for its sole adornment, would be a thousand times better than many of the dozens of existing designs for that purpose; and as I am responsible for far more of these than perhaps my readers guess, such a statement comes at least unbiassed, and with the strength of a confession from one who has sinned even more than those to whom he is preaching.

Feeling strongly that a new future would be possible for fretwork if higher art were brought to bear on its designs, I have welcomed gladly this opportunity of showing one way to attain such a result. Here is good art and true, albeit it is foreign, and art of unusual style, in these thirty-eight examples.

For stencil work, these designs may be used to ornament panels, whether disposed as corner ornaments or centres, or produced in seeming irregularity over the surface at intervals. Nor need they all be worked in solid heavy colour; the Japanese obtain beautiful effects by shading off the colour in their stencil work, just as in their block printing they procure a result that is more akin to clever painting than printing, by this expedient of breaking into the European monotony of solid equal tint.

It may be said, to work successfully in this way needs the instinct of an artist. But every reader of WORK has more or less of that quality, if he would but make up his mind to use it. We have had artistic periods as a nation, and if now we can only encourage the individual to express himself individually, to cease to be a mere unit in a complex machine, there is hope for a new revival of genuine art. For art is not to be found in museums or picture galleries alone; when the cottage has a perception of beauty, seeking no mere prettiness, but a fit and seemly decoration, however simple it may be, that really beautifies its object, without in any way making it less useful or less serviceable, then the good day will be not far off.

The curse of the day is that each school, while proclaiming its own idols, disparages others. The Japanese lover will not love his hobby the less if he recognises the beauty of Flaxman's ornament, if he can appreciate Raphael's arabesques in the Vatican, and love and admire the attributes of periods directly opposed to his favourite Oriental models.

If those who look upon Japanese art as childish and barbaric, who think its worship a sign of degradation and decadence, are thereby impelled to revive their own admired styles, and diffuse new spirit and vitality into the well-worn mechanical repetitions of classic and later ornaments, well and good. But he loveth best who loveth well all things, both great and small; and the man who appreciates the value of a Japanese trifle at its true worth, will be better able to estimate the noble grandeur of those Elgin marbles we talk about so often aud gaze at so seldom.

Above all, "clear your minds of cant." This seems an aphorism far away from our title, yet cant is as easy to acquire in decoration as theology; and because I like Japanese, there is no reason why you, my reader, should not hold it contemptible! The danger is, that people follow each other blindly, adopt a new thing because it is new or popular, and degrade themselves in the attempt to assimulate hastily an indigestible thing that needs some amount of previous acquaintance and study.

To-day the would-be art lover has only too much at his disposal, and in the multitude of good things to see and read, is apt to lose his head and try all round. For the absolute canons of good taste and good art are familiar to us all, yet because they are so often insisted upon they fail to move us, and we let trivial things seduce us from our allegiance.

This paper has been a desultory one, and I fear irrelevant in its rambling digressions, but the study of a living school of design brings in every page painful memories of our own shortcomings; and if, in a paper like this one, that reaches so many, chance words inspire a "mute inglorious Milton" to try for himself, not to follow the advice here, but to strike out manfully by study of nature, to embody new features of design and new aspects of decoration, that one good, however problematical, must be pleaded to outweigh the tediousness of so long a chat upon and around and about—mostly the two latter—the subject of this paper.

And to hark back to our heading. As it is only by the study of the best work of others that all our work improves, and as in fretwork I know of no more worthy instances of good design than some of those here presented to our readers, to whom they will probably come for the first time, this grain of truth must be held in every way responsible for the verbiage in which it has been expressed.

"TIPS" FOR TYROS.

BY OPIFEX.

QUICK-DRYING FLAT OR DEAD BLACK.

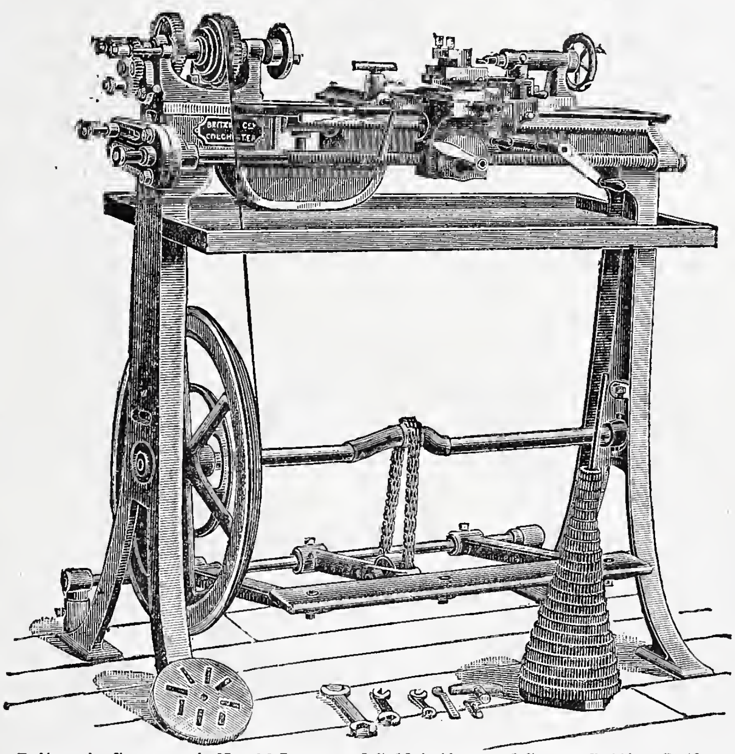
A GOOD "flat" or "dead" black which will dry in half an hour may be thus compounded:—Quarter lb. "drop" black; half pint of turpentine; a wine-glassful of black japan, well ground, aud mixed with stone and muller, or with a pestle and mortar.

This is most useful for ironwork to be japanned, as "black japan" is really a brown varnish, and requires a black ground. Articles of wood, furniture, panels, etc., when blackened with this mixture, if rubbed smartly with a cloth, assume a true ebony surface, which, in combination with gilding, is most effective.

OUR GUIDE TO GOOD THINGS.

50.—Britannia Company's No. 14 New and Improved Self-acting and Screw-cutting Lathe.

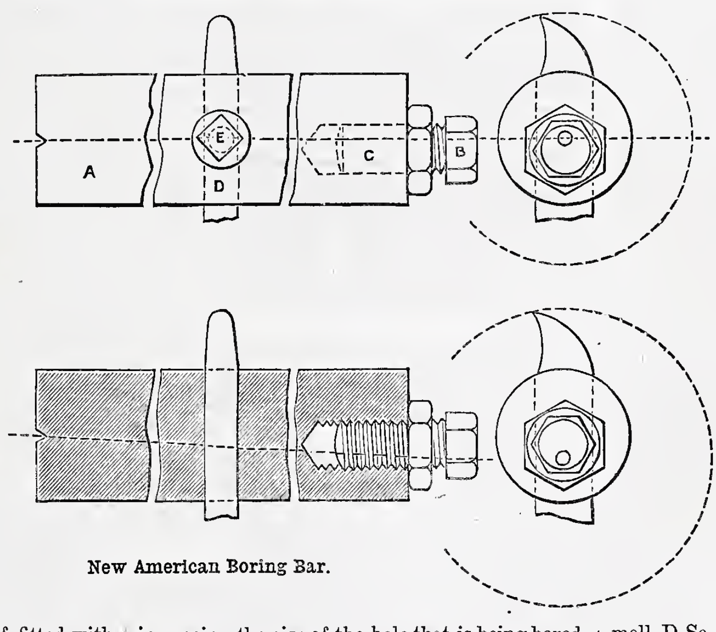
This is a well-made, compact, handy machine for amateurs, as well calculated for their purposes as the No. 16 Self-acting Sliding and Screw-cutting Lathe is for the workman to whose notice it may be fairly recommended. Similar in purpose to the No. 16 lathe, but in every respect smaller and less powerful, the No. 14 lathe is of new design of $3\frac{1}{2}$ in. centre and 3 ft. 6 in. gap bed. It will admit 25 in. between centres, $5\frac{1}{4}$ in. diameter over saddle, 7 in. over bed, and $14\frac{1}{4}$ in. in the gap. The fixed headstock is well made, with back gearing hard steel mandrel, conical neck, adjusting cone at back end to take up wear and running in hardened steel collars, three speed cone pulley for gut band, and fitted with reverting gear to cut right or left hand screws. The poppet head has a steel cylindrical mandrel, a left-hand square thread traverse screw, and bright turned hand wheel; the centres are of best steel, cone fitted. The saddle is strongly made, with flush top and T grooves for boring, well scraped and fitted to bed, with adjustable strip to take up wear, and carries a compound slide rest of modern design, swivelling and graduated to turn swivelling tool holder at any angle. The bed is of cast iron with V edges, all machine planed, 3 ft. 6 in. long, $4\frac{3}{4}$ in. on face, $3\frac{3}{4}$ in. deep, with gap 5 in. wide and $3\frac{3}{4}$ in. deep, with bridge piece properly fitted. The leading screw is of steel, accurately cut $\frac{1}{4}$ in. pitch and 1 in. diameter, with double gun-metal nuts, disengaging by eccentric motion, and the saddle is fitted with rack and pinion for quick return motion. The standards are A-shaped, and of cast iron, the top faces being planed; the bottom surface of the bed is also planed and bolted firmly to the standards. The crank shaft and treadle shaft run in self-adjusting swivelling bearings. The latter is made with three cast-iron arms and bright turned shaft, and connected with the crank shaft, which is also bright turned, by anti-friction cham and roller. The driving wheel is 24 in. in diameter, bright turned, with three top speeds and a small speed for slow motion. A polished tool tray is neatly fitted between the standards, extending back and front to hold tools, small work, etc. The lathe has a full set of twenty-two change wheels, fourteen pitch, $\frac{5}{8}$ in. face, face and catch plates, eccentric hand rest and two T's, spanners, keys, etc. The height from floor to centre is 3 ft. 8 in.; the approximate weight is 430 lbs. The price complete, as shown in the illustration, is £18 18s., or £19 19s. if fitted with cone speed and driving wheel with flat belt. If required for ornamental turning, as amateurs' lathes usually are, an overhead motion is supplied for £5 5s., making £25 4s. the total price if sent out with all the appliances named.



Britannia Company's No. 14 Improved Self-Acting and Screw-Cutting Lathe.

51.—New American Boring Bar.

As attention has been already called to various means for boring small cylinders in the pages of Work, it is desirable to introduce here, for the benefit of engineers, a brief notice and illustration of a new American boring bar of ingenious construction which has been recently described and figured in the *American Machinist*. It consists of the bar, A, in the end of which is the bolt, B, put in, as will be noticed, about $\frac{3}{16}$ in. out of centre. In the head of the bolt there is, as shown, a centre coinciding with that of the bar. The bolt enters into C, a chamber in the head of the bar which is threaded for its reception. By turning the bolt, therefore, a certain amount of eccentricity can be given to the cutter, D, for the purpose of gradually increasing the size of the hole that is being bored. The method is more accurate than the usual one of tapping the cutter outwards with the hammer. The amount of eccentricity given to the bolt may in most cases be less than $\frac{3}{16}$ in.; it would seldom be required more. A check nut, shown in the illustration, prevents spontaneous movement of the bolt during turning; E, in the upper illustration, is the set screw, by which the cutter, D, is pinched. To save trouble, I may as well say at once that I am not aware that the boring bar to which attention has been directed is to be purchased in the United Kingdom.



New American Boring Bar.

52.—The Boomerang: How to Make it and Throw it.

Any one who is at all curious on this subject may satisfy his curiosity by procuring a booklet, thus entitled, written, and, I presume, published by Mr. Alfred E. Beddow, 17, Cardigan Road, Richmond Hill. The boomerang is one of the weapons of the natives of Australia, and two kinds are used, one in war, which, when thrown, does not return to the owner, and the other in the chase and native games, which, after proceeding to the mark, will change the direction of its flight and return and fall at the feet of the thrower. Mr. Beddow first very clearly describes the mysteries of its manufacture, illustrating the method to be followed by carefully executed diagrams, and he then describes the mode of throwing it. He says that it has taken him several years of study and hundreds of experiments to acquire the information imparted in his pamphlet, and that any one wishing to make this singular weapon satisfactorily, without the aid of any instructions, would have to go through the same course.

53.—Calvert's Catalogue of Books on Practical and Scientific Subjects.

Many of us are frequently in want of a text-book on some practical or scientific subject, and find considerable difficulty in putting our hand on what we want. However, Mr. John Calvert, 99, Great Jackson Street, Manchester, has issued for 6d. a selected list of books on practical and scientific subjects, from the catalogues of all publishers, compiled by the editor of "Calvert's Mechanics' Almanack," a well-known and valuable annual. The list includes works on architecture and building; arts and sciences; bridge and ship building; civil engineering; decorating; education; gardening and agriculture; iron and steel manufacture; marine, mechanical, railway and sanitary engineering; mining and founding; navigation; textile manufactures; various tables and data; and miscellaneous trades and manufactures. Appended to the catalogue is a list of drawing instruments, revised to the present date. The entire catalogue is divided into sections, under each of which kindred or allied subjects are grouped together. As the catalogue cannot fail to be useful to the possessor, it should be found on the bookshelves of every workman, whether amateur or professional.

54.—Practical Mechanics.

This work forms one of the series issued under the general title of "Manuals of Technology" published by Messrs. Cassell & Company, Limited, La Belle Sauvage, Ludgate Hill, E.C., and edited by Prof. Ayrton, F.R.S., and Richard Wormell, D.Sc., M.A. The author is Mr. John Perry, M.E., Professor of Mechanical Engineering and Applied Mathematics at the City and Guilds of London Technical College, Finsbury. Its object is to put before non-mathematical readers a method of studying mechanics, that is to say, to afford an easier road to the acquirement of a knowledge of this subject than that which must be travelled by those who take up the ordinary mathematical text-books. It is written in clear and simple language, and is well illustrated by effective diagrams. It is a book that should be acquired by all young readers of Work. Its price is 3s. 6d.—The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

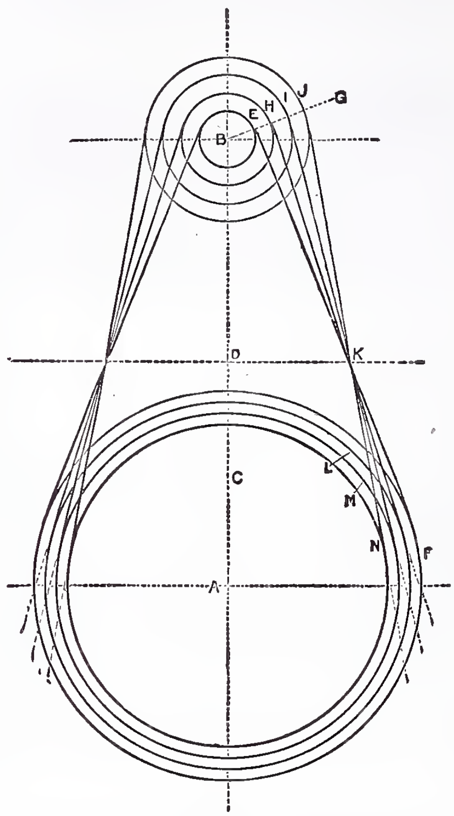
Building Construction. — PRACTICE AND THEORY BUILDING TRADES writes :—"Seeing your suggestion in 'Shop,' *re* plans, etc., for buildings, I write to say that I have been waiting for papers on this subject, and think that it cannot fail to interest a large portion of your subscribers. I think it would be well to bear in mind the fact that very few men would actually build from plans given in WORK, without structural alterations in a more or less degree, and so materials, modes, and appliances would be the principal part of the subject. I hope I shall soon see papers on this subject in WORK. I think stone masonry (monumental and building) is a subject which ought to have an early place in WORK, and I feel sure that a few papers on stone carving and letter cutting would interest many of your subscribers."

Small Cottage Construction.—J. R. G. (*Perth*) writes :—"I have taken in your paper since the commencement, and beg to state that my friends and myself are highly satisfied with it. It is undoubtedly the best paper published of its kind, and being so very moderate in price, many (who otherwise are debarred from purchasing more expensive books on different subjects) will welcome it. I myself have gained much valuable and useful information from its pages, and as I intend to build a little cottage some day in the country, I eagerly look forward to the sketches of cottages which I hope you will publish soon. I wish you (and the paper of course) every success, and trust I have not taken up too much of your valuable time."

Words from a Workman.—R. H. (*Preston*) writes :—"I have received the first monthly part of WORK, which I am very well pleased with indeed. Its style of composition, and construction generally, show that skill and talent are engaged upon it. A work of this description ought to have been out years ago; though never too late, it's none too soon. I wish you every success, and so will thousands of readers of Messrs. Cassell's publications, who know as well as I do that nothing ever emanated from La Belle Sauvage Yard but what was sound and good. I am sure it will prove beneficial, not only to the amateurs, but to the artisan that depends upon his skill for his daily bread. There must be a large demand for this work when it becomes more generally known, for I myself never knew of its existence before I saw the first monthly part exposed for sale. After reading the contents on the wrapper, through the window, and the name at the bottom, I had no hesitancy in becoming a subscriber. Any workman refusing to take a work relating to his business, stands as an obstacle to his further progress, and without progression he is left behind. But there are some very fair workmen who would feel affronted if another showed him a better method of proceeding with his work. A man of this sort considers himself perfect, and further improvement unnecessary. Granted he is perfect up to the present time (to-day); but is he the same to-morrow? To-morrow some inventor may bring out his idea that has taken years to develop, which may ruin his perfection, and send him to seek another employment. The old hand-loom weaver, in his happy (to-day) contentment, never thought of the morrow that brought out the steam-loom, and scattered him like chaff before the wind to seek any labouring job that was offered him. The same with the old millwright, with his square shafts and square-toothed wheels, before Watt and other geniuses were born. You will still find at the present day some remnant of the earlier craftsman in a few smiths' shops in the country, puffing at his asthmatical bellows, and using tools of the rudest description. What may be expected, be works for a low wage—not as much as a striker will get in a good shop—and where the competent average smith comes, he has to take a 'back seat.' I am particularly interested in this artificer, and shall have something more to say about him hereafter. Years ago I had the good fortune to invest a penny in a weekly periodical. It was the best pennyworth I ever got, for it not only gave me a thirst for knowledge, but it gave me the highest wage paid in any shop I have worked in, and that was the first issue of Cassell's 'Popular Educator.' That well-invested penny has given me constant employment without once being discharged, or loss of one single hour out of work for over twenty years. Had I never spent a penny on an instructive paper, I should undoubtedly be now receiving a less wage, less respected, and like many that never read, be paying the penalty by taking a 'back seat.' There are, nevertheless, a few good workmen with a very inferior education receiving the same wage as an intelligent workman, but with this difference: should a vacancy occur for a foreman, one is prepared, the other is not. And, moreover, if the uneducated workman can make a stand with his better-learned fellow workman, what would he have been if he had studied the same as they? Competition, and thousands of inventors working silently on something to astonish the world, make a man's trade like the fashions; there is always something coming out new."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Proportion of Fly Wheel.—J. P. A. (*Walthamstow*).—To obtain the diameters of the steps of the driving cone, set out the centres, A, B, of the lathe spindle and driving crank, and connect them with the vertical centre line, C. Bisect C at D, and draw D at right angles therewith. Draw the smallest cone, E, and decide on the largest diameter of the fly wheel, F, and draw and connect the two



with the line, E, F. Draw E, G, at right angles with E, F; draw your remaining cone steps, H, I, J, and draw lines tangential therewith, that is, on the line, B G, to cut the line, D, in the same point, K, and prolong. Circles struck concentric with F, and touching these lines, will be the correct diameters of the speed-pulley steps, L, M, N. I may add that this should be done to full size, as a very slight inaccuracy in setting out will vitiate results.—J. H.

Ticket Buckram for Easy Bookbinding (H. R. W., *Chiswick*) is procurable at every draper's I have tried. John Barker and Co., of High Street, Kensington, quote it at 8¾d. per yard 36 in. wide, who sell also the *vegetable parchment*, 20 in. × 30 in., from 9d. the dozen sheets. Whitcley's quote it at similar prices, but I have not their estimate at hand. It is quite possible that the thick parchment used would be at least double the price of that quoted. I have given 3d. and 4d. a sheet for it.—E. B. S.

Clockmaking.—F. H. M. (*Liverpool*).—I note your wish for instructions on the making of a clock and the supply of parts of a clock in the same manner as the castings of parts of lathes, steam engines, etc., are sent out. I will see what can be done to satisfy you.

Clockmaking and Shoemaking.—J. S.—See preceding reply with regard to clockmaking. I cannot say anything about shoemaking at present.

Zinco Process.—D. T. D. (*Cardiff*).—This process is engaging the attention of a contributor, who will write a paper or two on the subject.

Boiler Making.—E. J. (*Llandaff*).—WORK is a magazine intended, God permitting, to run on, like Tennyson's brook, "for ever," as wise men understand these words. There is no intention whatever of completing it in so many numbers or parts. You will have seen that "Smiths' Work" and "Wrought Iron and Steel Girder Work" have been commenced. "Boiler Making" is on the way, and special papers are in preparation on the construction of a steam launch and a half-horse power steam engine and a boiler suitable for it.

Jewellery Jobbing.—G. H. Y. (*Southwark*).—Solutions will be found in any text-book, but I can give no certificate as to their merits. I never use them. I sell the solutions with instructions on bottle; gold, 1s.; silver, 9d.; but as I do not make it I cannot say what it is. My own opinion of all processes without a battery is that very little dependence can be placed upon them; this is only an opinion, *not* the result of experience. Hard soldering requires more care and skill, because, as a rule, the temperature at which the solder runs is very near that at which the metal to be soldered will melt. It is quite impossible, in the limits of an answer, to deal with the subject thoroughly; so that only a simple example can be given to repair a ring broken at the back of the shank—that is, the point farthest away from the head, in the majority of cases. This can be soldered without drawing the stones, but care will be required. The two surfaces to be joined must be made clean by slightly filing, and then adjusted so that they press against each other. If this cannot be done without, the ring must be tied round with soft iron wire, called binding wire, and sold for that purpose of any thickness required. Then rub a piece of borax down with water on a piece of slate till you get a mixture about the thickness of cream, and with a small camel's-hair brush paint the part to be joined with the borax. Do this carefully, as you must remember that wherever the borax is put the solder will flow. The solder used is of a little lower quality than the article to be joined, and can be bought ready made to suit any kind of work; but for the majority of cases you will find it easier and safer to use a good silver solder. Of course, the joint will show white, but being very small it is not of much consequence, and can be gilt over; and in soldering cheap gold jewellery the quality is often so poor that it will not stand the heat necessary to flush gold solder. The solder is bought in thin sheets, and the surface should be cleaned by slightly scraping with the scraper or rubbing with a piece of glass-paper; then cut the solder up into little squares, the smaller the better, and, taking up one of these little squares with the point of the camel's-hair pencil, lay it carefully on the joint to be soldered. Lay as many as you think will be required, then gently warm the solder and the ring with blowpipe flame, first laying the ring on a piece of charcoal; the borax will dry and hold the solder in position. Heat should then be gradually increased until the solder melts and flushes into the join. The article to be soldered should always be heated on each side of the joint a little way, and then a sharp blow right on to the solder will usually cause it to flush and make a good joint. The solder left on the edges should be filed off when cool, and the ring polished with threads and crocus and rouge; or it may be finished by gilding; if much borax is left about the join put the ring while hot into a pickle of sulphuric acid 1 part, water 10 parts. This will dissolve the flux and clean the ring. Of course, this cannot be done when there are any stones in it that would be damaged by the acid.—J. W. K.

Brown Bronze Colours.—L. V. (*Norwich*).—I do not know the particular powder to which you allude, but the following give brown bronze colours: —Sal-ammoniac, ¾ oz.; carbonate of potash, 1½ dr.; vinegar, 1 quart. Apply with a sponge, and repeat several times until the proper tint is obtained. Or 5 dr. of nitrate of iron in 1 pint of water. This will give every shade to black. Chocolate colour can be obtained by steeping iron wire in nitric acid (aquafortis) for a quarter of an hour before dipping the brass. Florentine bronze: dissolve arsenious acid (arsenic) in hydrochloric acid, and apply. Or dissolve corrosive sublimate in acetic acid.—J. H.

Silver-Steel Hand Saw.—JOINER.—When I noticed this saw I gave the address of the manufacturers, Messrs. Spear and Jackson, Ætna Works, Sheffield. If you write to them they will tell you the name and address of any retail dealer in London or your own immediate neighbourhood where you may purchase one. Doubtless, you may obtain any variety of saw, whether rip saw, hand saw, panel saw, or tenon saw, in the same material, of Messrs. Spears and Jackson. The panel saw, I can easily imagine, would be more particularly useful to you. Saws shaped as the one described are called "skew-backed" saws. The American saw to which you refer was, without doubt, one made by Henry Disston & Sons. They are excellent saws, but I think you will find the English ones to be as good. I am told that Disston himself is an Englishman, and once worked for a Sheffield firm before he settled on the other side of the Atlantic. I cannot vouch for the correctness of the statement, but merely mention it to you as it was told to me.

Violin Necks.—WREN (*Glasgow*).—There are three ways in which a violin neck should be tested as to its being in right position, viz., by looking up to back joint, which should be in line with the centre ridge of the head; along the edges of the back, with which the eyes of the scroll should be in line, and also down the finger-board to the bottom nut. When fixed, the neck should project quarter of an inch above the belly. Instructions for bending ribs will be given in the papers on violin making, which will, I trust, soon appear. The price you quote (4d.) is a very reasonable one indeed for violin cramps. You would, no doubt, entertain the same opinion if you were to take the trouble of sawing up, turning, screwing, and tapping them. Your other "hobby" is certainly a novelty. It is a pleasure to be able to give information to so old a subscriber to Cassell & Co's. publications.—B.

Silvering and Gilding Solutions. — T. F. (*Manchester Square, W.*).—The best silver-plating solution is that made with the double cyanide of silver and potassium in distilled water. Dissolve nitrate of silver in distilled water, and add a solution of cyanide to throw down all the silver as silver cyanide. Wash this two or three times, and then dissolve with a strong solution of cyanide of potassium in distilled water. The best gold solution is made in a similar way from a neutral solution of gold terchloride. A weakly-charged Bunsen battery may be used, but it is not so good for this work as a Daniell or Smee. Further details will be given in my "Notes for Electro-platers," under the heads of "Gilding and Silvering Solutions." Information respecting the best batteries is already in the Editor's hands.—G. E. B.

Magneto Machine.—H. C. (*Newcastle*).—The two inside ends of the wire coils should be connected together. One of the two remaining ends should be connected to the insulated spindle of the coils, whilst the other is conneeted to the commutator or break. The braided wire from one of the handles must be attached to the frame of the machine, this being in connection with the coil spindle. The braid from the other handle must be connected to the insulated break-spring. No. 25 silk-covered wire is too large to give a sharp shock; No. 34 or No. 36 would give sharper shocks.—G. E. B.

Battery for Medical Coil.—BERNHARD.—This correspondent has made a medical coil after directions given by Mr. J. N. Urquhart, in *Design and Work.* You have given the wrong date; the article was published in Vol. IX., pp. 206-207, and first issued on September 11th, 1880, not 1881, as stated by you. If you have any difficulty in working this coil I would advise you to look up some correspondence on the subject between the author and "Diogenes" in Vol. X. of the same periodical. You do right in connecting the left-hand binding screw of the primary to the wire leading from carbon of battery. The coil may be worked with a small (½-pint size) bichromate, but a larger cell would give steadier and better results. 1. Carbons 3 in. × 2 in. exposed to the solution in cell. 2. Dissolve 3 ounces of bichromate of potash in hot rain-water, and add 3 ounces of sulphuric acid. 3. The carbons should not be further apart from the zincs than half an inch. 4. You will learn much respecting suitable electrodes from a pamphlet on the subject (price 4d.) from Messrs. F. Gent & Co., Faraday Works, Leicester. For replies to your last query, see correspondence above referred to in *Design and Work.*—G. E. B.

Glass for Aquarium.—TYRO (*Wheatley*).—The glass best suited to your aquarium is what is known in the trade as "32-oz." You do not, however, give the depth, which is the most important point in determining the strength of glass required, as the pressure of water upon the sides, etc., is as to its height and not to its bulk. For cementing the glass in, take 1 lb. of ordinary putty, ½ lb. of red lead, and thoroughly knead the two together into a soft mass with gold size rather thinner than ordinary putty. When of the right consisteney it should leave the hands without sticking. The wooden pillars should be given a coat of varnish before glazing; the edges of the glass where the putty will touch should be smeared with gold size to ensure perfect adhesion. An article embodying a design for a handsome aquarium is in hand, and will shortly be published.—C. M. W.

Moulding of Vulcanite in Dentistry.—BERNHARD.—The moulding of vulcanite is done in plaster casts secured in metal cases. It requires a heat of not less than 315° Fahrenheit, continued from 75 to 90 minutes, this being a pressure of about 85 lbs. to the inch. I do not see that an amateur could safely undertake it in any home-made boiler. Those I use are tested to 130 lbs. pressure; hence, in twenty years' practice, I have had no accident. In metals such as gold, platinum, etc., amateurs who can use a blowpipe might do very well.—R. B. [It will not be possible to give articles in WORK on making false teeth and all that appertain thereto. R. B. is kind enough to say that BERNHARD may write to him on the subject, if he wishes to do so. If BERNHARD, therefore, will send real name and address I will give him R. B.'s address.—ED.].

Mitre Box for Picture Framing.—SCOTO-IRISH.—You will see perspective view, plan, and section of a mitre box in No. 3 of WORK (p. 37), and instructions for making it in the same number (p. 35), in Mr. Adamson's second paper on "Artistic Furniture."

Treatment of Gold Rings after Soldering.—DEAN FOREST.—Referring to AUROLECTRIC'S reply to your query in WORK No. 8 (p. 125), he omits to say that the surplus solder has to be filed off and the joint regulated with the file, and the hammer too, perhaps. It would never do to gild or polish rings direct from soldering, except for the penny ones sold on hawkers' stalls. In properly-made gold articles such a way of finishing would never be allowed.—S.

Bureau Bedstead.—H. G.—It is not possible to satisfy your inquiry in "Shop," but a short paper shall be given showing the mode of procedure to be followed in making this piece of furniture.

Telescope Making.—J. G. (*Cambuslang*).—It will require a long series of papers to deal with telescope making, and we have so many subjects on hand at present that its treatment must be postponed for some future time.—ED.

Boxes with Sloping Sides.—W. K. S. (*Errol*).—Your inquiry is answered in the preceding reply to X. Y. Z. (*Orkney*), page 173. If there is anything in it that you do not perfectly comprehend, write again. The contents of future numbers will show you that your wishes and requests have been anticipated.

Bookbinding Materials.—ANXIOUS ONE (*Bingley*).—1. The proper size to be used for finishing cloth and leather work is glaire, *i.e.*, the white of fresh hens' eggs. They should be beaten up until the whole mass is converted into a snow-white, dry-looking froth, and allowed to stand for some time. The froth will entirely subside, and leave a clear liquid as thin as water. If not wanted for immediate use the beating can be dispensed with. Put it into a bottle, with a drop or two of vinegar for each egg. Cloth-bound books require only one coat of glaire; use a sponge, and apply lightly over the whole of the back or side of the book to be lettered. A little water may be added to the glaire with advantage; it will prevent the cloth getting streaked. For leather work use the glaire full strength. Apply to the parts to be gilded only, using a camel-hair pencil or sponge according as the surface is large or small. Two coats must be given, allowing the first to dry thoroughly before applying the second. Size prepared and used as directed with good solid gold, and the tools heated to the proper degree, should make the books shine like a new sovereign. 2. For collecting the surplus gold leaf a gold rag should be used, and not that soft messy composition which some finishers make and use (often dishonestly). A gold rag is a square piece of close unbleached calico with oil sprinkled over and well rubbed into it. If any gold leaf still adheres after using the gold rag it is cleaned off with a piece of pure bottle rubber. If the rag is properly used there will be little need for rubber, but it is best to have a bit, and the little pieces are picked off before the fall, and kept in a small box in the cushion drawer. The best marbling size is made by dissolving gum tragacanth in soft water; beat it well up with a bunch of birch or small canes, and strain through a hair sieve. In all cases use vegetable colours, as mineral colours are too heavy, and will not float on the size. Marbling colours are sold ready prepared, and it is not worth while preparing one's own as they are so cheap. However, in mixing marbling colours a stone slab and muller will be required for grinding. Put a little dry colour on the stone, and a paring of beeswax; mix it up with soft water, using a palette knife; then, with the muller, grind until it has become as fine and smooth as flour paste. Scrape it off the stone, put it in a small cup, and mix with water and a few drops of gall to make it spread when thrown in the trough. The colour intended for the top will work better if two or three drops of spirits of wine or linseed oil are mixed up with it. Keep the surface of the size free from bubbles and froth while marbling, and scrape the surplus colour off after each dipping.—G. C.

Bamboo Cane and Black Stain.—O. P. Q. (*Bow*).—Bamboos may be bent without danger of splitting by heating them at the parts to be bent over a gas flame or spirit lamp, taking care, of course, not to let the cane burn while doing so. The desired result may also be got by steaming the part. Mr. F. Westbury, 183, Great Dover Street, S.E., and Messrs. Benjamin & Co., 167, Great Dover Street, are dealers in all sorts of bamboos. The former quotes for retail as well as wholesale quantities; the latter may do so as well, but not having received any reply to an inquiry addressed to them I cannot say. I have bought bamboos from Mr. Brandenburg, Queen Street, Finsbury, E.C., and have always found him very obliging and painstaking in selection. I am not, however, sure that he is still there. If not, you will probably do better by purchasing such small lots as you are likely to require from bamboo workers instead of going to the large wholesale dealers. Messrs. W. T. Ellmore & Sons, 16, City Road, E.C., will probably oblige you with any bamboos you want. I have an article in preparation which will be helpful to you and other bamboo workers. Residing as you do in London, you will find it far more satisfactory to buy black stain ready made than to prepare it yourself, almost, if not quite, as cheap, and certainly better. However, if you wish to try, boil some logwood chips in water till all the colour is extracted from them; mix this with some vinegar in which pieces of iron or steel filings have lain for a time; copperas and water, instead of vinegar and iron, are recommended by some. Concentrate and apply to the wood till the necessary depth of tone is reached. Pine is not a good wood to ebonise or stain black. The subsequent polish or varnish should have a little gas black mixed with it.—D. A.

Transfer from Half-tone Negative, etc.—W. L. (*Newton-le-Willows*).—In making a transfer from a half-tone negative it is absolutely necessary to give a grain to the stone or zinc plate. This is obtained by a variety of methods; a very popular one is the use of a photograph of network or lines interposed between the negative and the sensitive film, which breaks up the image into minute dots or lines. Another plan is to cause reticulation by applying a solution of tannic acid to the bichromated gelatine film. Gum water may be made by dissolving about twenty-five grains of gum arabic in an ounce of water, and strain; this is applied with a soft sponge. Success, however, depends principally on the skilfulness of the worker rather than on the materials used. Consult any good handbook on photo-mechanical printing.—E. D.

Photographic Sketch Portraits.—W. J. F. (*Edinburgh*) will find a half-plate camera, with a lens of not less than 8 inches back focus, suitable; but a lens of much longer focus is to be preferred. This would, of course, require a camera of corresponding length, with a necessary increase in expense. The use of short focus lenses necessitate a less distance between the sitter and the camera, causing more or less distortion of the image. The other appliances are the same as for ordinary photography, and consist of measures, weights, dishes, printing frame, sensitised paper, and chemicals, with a non-actinic light to work in.—E. D.

Etching on Zinc.—P. J. (*Royston*).—A paper on etching on zinc, for printing purposes, is in preparation.

Limelight Lantern.—LANTERN (*Dartmouth*).—A set of signals may be easily arranged between lecturer and exhibitor, and carried out by means of simple electric apparatus. If you take off the gong of an electric bell, the armature will merely buzz when the push button is pressed; and this buzzing noise may be used as a signal. A Morse sounder may also be used for the same purpose, giving out a ticking or tapping sound when the key is struck. A cheap bell, battery, wire, and push will cost about 9s. Either Messrs. H. Dale & Co., 26, Ludgate Hill, or Messrs. Mayfield, Cobb, & Co., 41, Queen Victoria Street, E.C., will quote you prices for materials. As I do not clearly understand what you mean when you ask for "a pattern or dimensions of a good strong slide carrier," kindly ask again, and explain your wants more fully.—G. E. B.

Toning without Gold.—HALF PLATE (*Manchester*).—The results, as shown by your photos, are, as you suggest, not satisfactory; but from the look of the prints, I do not think this can altogether be attributed to the toning bath, as they appear to have been produced from very poor negatives. Of course, to get the best results with lead or any other toning bath, the prints must be good originally, and to get these good negatives are necessary. This, to a great extent, will supply the explanation you ask for. Never having obtained such bad results myself with lead toning, the rest is more or less surmise; but as I presume you are quite a beginner in photography, I give you, as a brother amateur, my opinions. From No. 1 having been so deeply printed it is almost a wonder you got anything discernible. It, as well as Nos. 2 and 3, was left far too long in the bath, and I think a good deal of the dirty look about them may be attributed to the too prolonged action of hypo, or possibly to insufficient washing. No. 4 is the best in tone, which is decidedly of a purple hue, and bears out the remark of the muddiness of the others being due to hypo, as the white in it is purer than in any of them. These, you say, were in all night, except No. 5, but even it was soaking in hypo for a couple of hours, or double the time for No. 4. This is decidedly the best of the lot, and to produce it you have apparently kept more closely to the instructions than you have done for the others. The colour of No. 5 is not nearly so good, in my opinion, but the print is clearer, though taken, apparently, from a desperately thin negative. There are no high lights to be seen. Judging from the stains on the back of it, I am afraid you are not a very clean operator; and no doubt you know chemical cleanliness is a very important matter in photography. I am pleased to give you these hints, but I scarcely think you would have got better results with any toning bath, unless closer attention were paid to the matters referred to. Your attempts with regard to lead toning seem to have been more of the nature of original experiments than an adherence to instructions, so that these are hardly to be blamed. You will remember lead toning was not suggested as being superior to gold; but for all that, far better results are to be got than shown in your specimens, and I hope in future you will meet with more success. Yes; camera making will receive attention.—L. J. P.

Polishing Desk.—J. T. (*London*).—Without knowing exactly wherein your difficulty in obtaining the desired polish lies, I may not be able to help you to overcome it. It would be of the greatest possible assistance in enabling questions about polishing to be answered satisfactorily, if inquirers would be kind enough to state wood and other particulars of any article they wish to finish, and, as in your case, if they would state clearly their *modus operandi.* One could then often tell the reason of failure, and what should be done. Without knowing more than I do, it is impossible, without writing a complete treatise on French polishing, which, of course, is out of the question in "Shop," to help you so fully as I should like; but perhaps the following outline of the process may be of some assistance:—Oil the work by rubbing in raw linseed oil; let it stand a sufficient time to dry in, say a day or two; then fill the grain of the wood with some filler, such as whitening, moistened with a little turps, and tinted to correspond with the colour of the wood. Clean off superfluous filling; body in with French polish, using rubber of cotton wool enclosed in a soft rag covering. Rub equally all over the surface till the wood absorbs no more polish and a fair amount of gloss is obtained, though the general appearance may be smeary. The final polish must be obtained by "spiriting off" the work, that is, continuing the rubbing and using a little spirit only on the rubber. Simple as this process reads, you may have made a dozen mistakes, any one of which would be fatal to a good result; so if you still cannot manage write more fully, and you may rely on my best efforts to help you.—D. A.

Choice of Lathe and Fret Saw.—J. H. S. (*Romsey*).—You ask whether it would be better for you to get the Britannia Company's No. 1 patent lathe and fret saw combined, or their No. 3 lathe and the separate fret saw appliance. The answer may be very much a matter of opinion. With

No. 1 you would have the best fret saw and a very small lathe; with No. 3 you would have a better lathe of more capacity and a less advantageous fret saw. I say less advantageous, because it would not have a vertical stroke. As for myself, I should certainly prefer the better lathe. A still better plan would be to have two separate machines. Have the No. 8 fret saw to begin with, and use that for a year or so; then get a lathe, and learn to turn. It is better to take up one thing at a time, and to have separate machines each perfect of their kind.—F. A. M.

Enamelling Fretwork.—CREAMY (*Gravesend*).—Of course, you can hardly expect your work to look "first-rate" when compared with the things you refer to, as you must remember they are finished by experts, while you, I presume, have not had much experience. Not knowing exactly what you have done, or wherein the work is unsatisfactory, I can only advise you in a general way. To begin with, the wood must be well smoothed; then, as it is soft, it would be well to size it, for which very thin glue will do. If this raises the grain, rub down again with very fine glass paper; this will prevent the paint being dull in parts while bright in others, though two coats of paint will have the same effect. Finally, apply the paint thinly and evenly, in more than one coat, if necessary, letting each be quite hard before another is added. If you still cannot manage, write again, and say what is amiss.—D. A.

Casting from Wood Carving.—F. S. (*Bethnal Green*).—We doubt if F. S. can find any way of moulding from wood carving more simple and harmless than by a "clay squeeze." Roll up a ball of thoroughly well-tempered modelling clay, soft enough to be completely plastic, but not so soft as to be in any way sticky, and squeeze it on the woodwork. If the carving is larger than can conveniently be taken at one squeeze, two or more may be used and fitted together before being employed as moulds. This will not give undercutting; if that has to be shown an "elastic mould" will be necessary. It is thus made:—Best gelatine, 1 lb.; beeswax, ½ oz.; water, ¼ pint, boiled together in a glue pot, and poured on warm, but not boiling. In either case the carving should be oiled before moulding.—M. M.

How to Judge Woods.—W. A. (*Leytonstone*).—The information you ask would take up a page of WORK to answer. Write to J. & W. Ryder, 11, Bartholomew Close, E.C., for their work on "Timber and Trees," by T. Laslett, 8s. 11d., post free.—A. J. H.

A Seeker.—(*Pontypool*).—Your way will be to write to Mr. Bolas, Central Institution, City and Guilds of London Institute, London, E.C., and ask him if his lectures will be published, enclosing a stamped envelope for reply.—F. J. C.

Pressure in Boiler.—LANKY TOM.—The pressure at the bottom of the boiler is in excess of that at the top by the weight of the water in it; the steam between the surface of the water and the top of the boiler presses equally upwards and downwards; therefore, for the pressure on the bottom the weight of the water must be added to the pressure of the steam. The feed-pipe is placed low down in the boiler in order that the feed water may enter at the coolest place, and fall naturally into the circulation.—F. C.

Reduction of Power by Pulleys.—LANKY TOM.—Your gearing is not described with sufficient clearness for us to answer your question. A sketch would be more satisfactory.—F. C.

Registration.—D. McR. (*Inverness*).—Register the "name" as a trade-mark.—F. C.

Window Fastener.—L. A. R. (*Mile End Road*).—The cost of provisional protection is £1, if you send your application direct to the Patent Office; but in your case you should certainly employ a patent agent, for your invention may be anticipated, and in any case the specification should be drawn by an experienced man.—F. C.

Gas Regulator.—R. M. C. (*Glasgow*).—Your contrivance is ingenious, but I do not think it would be financially successful as a patent. The fixing and unfixing are against its adoption. Thanks for the sketches.—F. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Barbotine Work in Gutta Percha.—PADDY MURPHY (*London, S. W.*) writes:—"Will some reader of WORK be so good as to afford me in 'Shop' some hints regarding the making of imitation barbotine work in gutta percha? What implements, paints, etc., are required for the work, where procurable, etc. etc.?"

Instruction in Wood Engraving.—TOM, who lives at Islington, desires to know where he may obtain practical instruction in wood engraving.

Tobacco-pipe Making.—SMOKE wishes to know if there is a good book to be got on the subject of tobacco-pipe making, giving full instructions with prices of materials.

Bevelled Cog Wheels.—POTTER asks:—"Where could I get a cheap pair of mitre cogs (*i.e.*, bevelled cog wheels?")

Gripping with the Vice.—CROSS-CUT writes:—"I sometimes want to grip in a front bench vice a piece of veneer against the edge of the bench, and also to grip a shutter or door edgeways with the same vice. How is it to be done in an instant by a cheap and simple vice for a strong wood bench?"

Marbling Washstand Tops.—W. H. J. (*Stratford*) writes:—"I should esteem it a great favour if any reader could give me some information as to a quick method of marbling common washstand tops, as I often have them to do at a short notice."

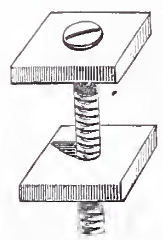
Bevels for Stair Rails.—CONE asks:—"What form of square or of bevel, different to the ordinary square and bevel, is used in trying the square or bevel faces and joints of staircase hand-rails?"

Steel.—PALL MALL says:—"Can you inform me how steel is blued for ornamental purposes for decoration of swords, etc.—namely, court swords, navy dirks, and other weapons? I only know of one firm where this kind of work is done, that is a German firm in Solingen, and if you, or any of our correspondents can inform me, I shall be much obliged."

Hand Circular Saw Bench.—G. H. L. (*Hull*) writes:—"An amateur who is desirous of making a circular saw bench (to be turned by hand) would be greatly obliged if any of your readers could give him a little information on the subject. Could I get sufficient power to cut 1 to 2-in. boards? If any of our friends could give me details how to construct a bench and the fixing of the saw, bushes, etc., I shall esteem it a great favour. My own idea is to fix the hand and wheel on the end of spindle; but I am afraid to venture this for fear I should spoil the spindle, and the whole not act."

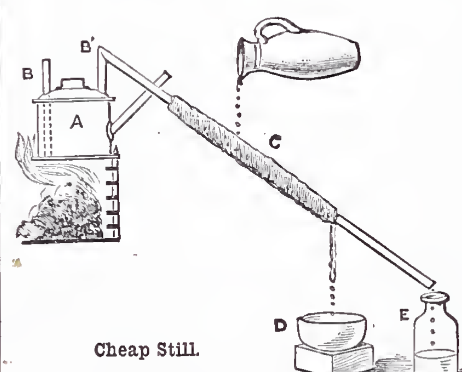
IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Violin Cramps.—J. G. (*Edinburgh*) writes in reply to E. P. W. (see page 125):—"In WORK No. 8, I observe E. P. W.'s inquiry as to violin cramps. The following is a very cheap method of making these, and gives satisfactory results:—Suppose two dozen cramps are wanted—which is about the usual number required in violin making—let him cut up a piece of ½-in. hard wood into forty-eight pieces, 2 in. square, then get twenty-four screw nails, say, 3½ or 4 in. long, and insert them up to the heads in twenty-four of the pieces; in the other twenty-four pieces, the hole must be sufficient only to allow the screws to work. The bottom piece can then be screwed up and down as required, while the other remains stationary. This drawing explains the process."



Cramp.

Cheap Still.—H. B. S. (*Liverpool*) writes in reply to BARRINGTON:—"Get a medium-sized tinplate saucepan, and bore two holes in the lid, each about 1 in. in diameter; if you can solder yourself (if not a tinman will do it for you), get a piece of tinplate tubing that will just pass through the holes; cut a piece long enough to reach to the bottom of the pan, and 2 or 3 inches through the lid when the latter is on; solder this in, so that it will nearly touch the bottom of the pan; get a longer piece of the same tubing, bent at a slight angle as shown; this will have to be done by soldering two pieces together; solder this into the other hole, only just allowing the tube to pass through the lid; when this is done solder on the lid. Your still is now ready. Put a funnel into the short tube, and pour water into it until the still is three-quarters full. Now put it on the fire, wrap a piece of tow or cotton round the long tube, allowing it to hang down a little; keep pouring water on during distillation, and it will run off into a basin at the loose end; it will be well, however, to grease the tube all round just below the cotton. Put a clean bottle at the end of the tube to collect the distilled water, and throw away the first portion that collects; the rest will be almost as pure as you can get it. If the condensing cloth is not sufficient, write, and I will describe a proper condensing arrangement."



Cheap Still.

A, Saucepan; B, B', Pin Tubes; C, Tow; D, Basin; E, Glass Bottle as Receiver.

Trade Notes and Memoranda.

THE question of the feasibility of telephonic communication between the postal authorities of London and Paris is under investigation.

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	Feet.
The Eiffel Tower	984
The Obelisk, Washington	522
The Cathedral, Rouen	492
The Great Pyramid, Ghizeh ...	478
St. Stephen's, Vienna	452
St. Peter's, Rome	432
St. Paul's, London	420
The Panthcon, Paris...	259
The Monument, London	213

It is a remarkable fact, illustrative of the perfection attained in modern engineering works, that all the rivet holes were drilled before the work was brought to the ground, and not a single hole was allowed to be drilled, punched, or drifted in place. If we compare this structure with our own Forth Bridge—which stupendous work appears to interest few, except engineers—we shall see cause for a little self-gratulation. The amount of wrought iron used in the construction of the famous tower is about 6,500 tons; but the last quarterly report on the Forth Bridge by Major Marindin records a total of 39,000 tons of steel as having been fixed up to that date (Feb. 28). When the bridge is complete the total will be about 50,000 tons. In addition to this, 628,000 cubic feet of granite have been already set, besides 113,500 cubic feet of rubble, masonry, and concrete work built. In this herculean task an army of men, whose number averages 3,250 per diem, have been engaged.

WORK

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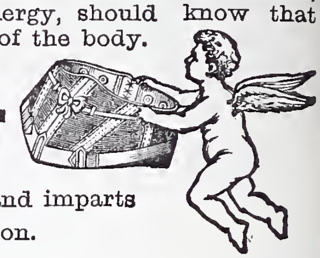

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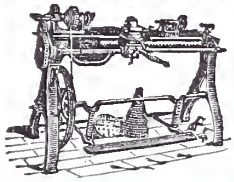

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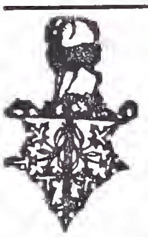

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 15.] SATURDAY, JUNE 29, 1889. [PRICE ONE PENNY.

PIT-FRAME FOR WHEEL MAKING.

BY PETER WILLIAMSON.

A WHEEL-FRAME or pit is a necessity to a wheelwright's or coachbuilder's shop. How a wheeler could make a wheel without this indispensable article it would not be easy to imagine. There are three differently made frames, but all are nearly similar in appearance, the only difference being the way in which they are fitted up. The primitive frame was, indeed (as its name implies), a pit-frame, and is still, I believe, used in some parts of the country yet. It is something similar to a sawyer's sawing-pit, only, of course, very narrow. A pit was dug 5 ft. long by 1 ft. wide, and 1 ft. deep; four posts were driven in, and the top was made exactly the same as the one I am going to describe 2 ft. high from the ground.

But this pit being a fixture in the shop or yard, it took up too much room, so, therefore, it has given way to a more convenient one, which I will describe, and show you how to make one exactly the same as I have, and on which I have made hundreds of wheels. It can be carried about by two men, and when not in use and there is no room to spare in the shop, it can be put outside in the yard, as I have kept mine out in all weathers, in summer and winter; and it appears to be as strong (although it is not painted) as it was when first I made it years ago.

The top of the frame which I have has apparently been the trunk of an ash sawn in two, as the under part and sides are just a little round, where the bark has been peeled off. I merely mention this to show that the top only is required to be straight and square, and also the sides a little, but, if the top be all of one width, so much the better.

In the first place we shall require two long lengths of ash or deal. If of ash, it should be $3\frac{1}{2}$ in. thick; if deal, 4 in. thick. These two pieces must be 6 ft. 4 in. long, 7 in. wide, and $3\frac{1}{2}$ in. thick; two swords 2 ft. by 3 in. by $1\frac{1}{8}$ in. of ash or oak; four legs, $2\frac{1}{2}$ ft. high by $2\frac{3}{4}$ in. square, also of oak or ash. These measurements are just as I have measured, so that you must allow for sawing and planing. Get your jack plane and smooth the two large pieces at the top and sides, also your swords. Then lay your large pieces or top on your bench both together in a line, put your swords upon the top, about 3 in. from each end of the large pieces, and mark with pencil each side of sword on the frame top.

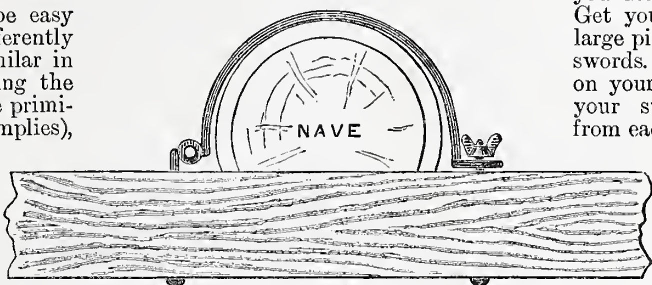


Fig. 3.

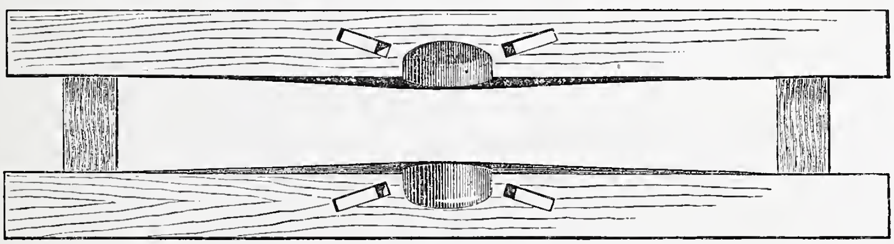


Fig. 1.

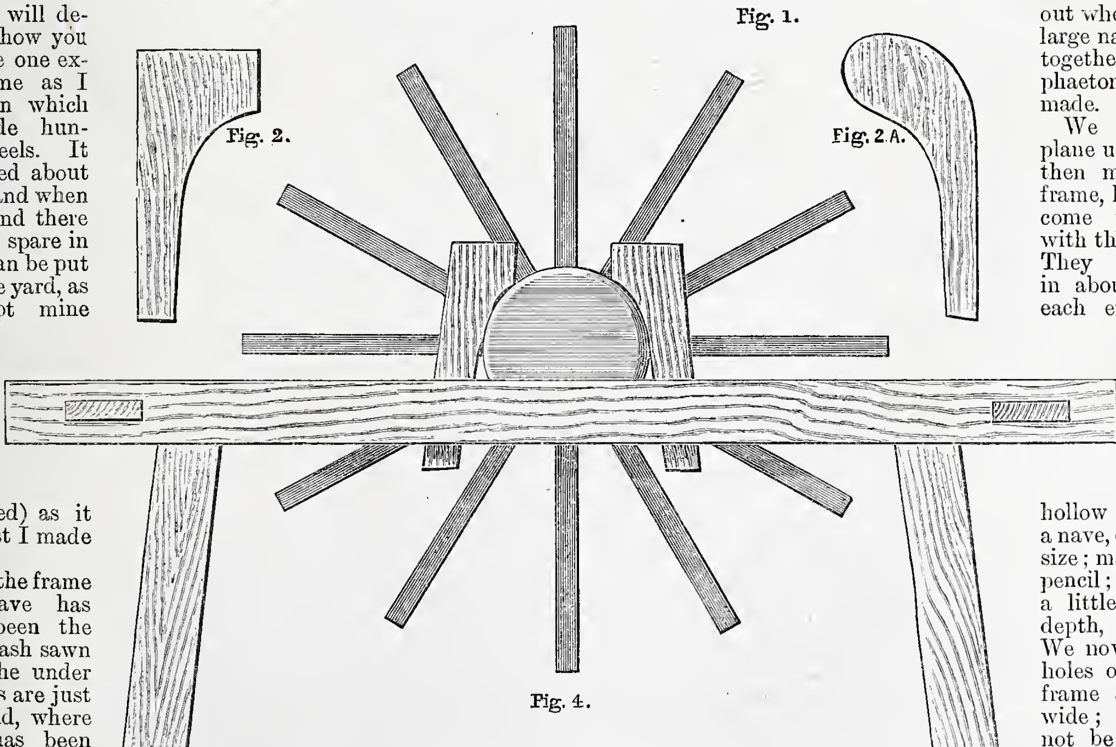


Fig. 2.

Fig. 2 A.

Fig. 4.

Fig. 1.—Plan of Top of Pit-Frame showing Mortises for Holdfasts. Figs. 2, 2a.—Wooden Holdfasts to hold Nave. Fig. 3.—Nave held on Frame with Iron Holdfast. Fig. 4.—Front Elevation of Pit-Frame, with Nave and Spokes in Position.

We now get the large piece and square down the sides from the pencil line. When we have served all the four sides alike, we set our gauge and mark for the mortise. This mortise must be 3 in. by $1\frac{1}{8}$ in. wide: bore first with $\frac{3}{4}$ in. bit, then mortise out with a sharp paring chisel. Knock in your swords; do not fit them in slack, and they must not be fastened in the frame, as it sometimes has to be drawn out when mortising a large nave, or pushed together when a small phaeton wheel is being made.

We now roughly plane up the four legs, then mortise in the frame, letting the legs come through level with the top of frame. They are mortised in about 15 in. from each end of frame. You will see that the legs stand out all round. Now find the centre of frame, and hollow it out; or get a nave, one of medium size; mark round with pencil; hollow this out a little at its lowest depth, say $1\frac{1}{4}$ inch. We now mortise four holes on the top of frame 3 in. by 1 in. wide; these must not be in a straight line, but slanting as Fig. 1. The space between the mortises must be $6\frac{1}{2}$ in. : these mortises are to be fitted with four holdfasts, as in Fig. 2, or 2A. These are of ash, the size of them being 20 in. long, full $\frac{3}{4}$ in. thick, $2\frac{1}{4}$ in. wide at the foot, getting thicker and wider at the top. Instead of these holdfasts, some wheelers have an iron band or hinged clamp which fits half way over the nave to hold it fast in its place whilst it is being mortised. At one end there is a thumb-screw which, when unfastened, allows the nave to be turned round. These iron holdfasts (Fig. 3) are fixed where the fret or hoop will be when in its place on the nave.

The pit-frame which I have been describing, and which is shown in Fig. 4, is, I think, the one which is most approved of, as the wheeler can get at the wheel all round. The third kind of frame is made exactly like Fig. 4, only half of it being fixed to the wheeler's bench. It is a piece of deal or hard wood, 6 or 7 ft. long, with two legs mortised into the top of frame. This half of frame must be quite level with top of bench. Two swords are then fixed upon the top of bench and frame. A 2-in. slot 1 in. from each end of sword is mortised for thumb-screws to work in, or holes can be bored in the sword every inch or so to allow the screws to be put in to tighten and keep the frame together. Two holes are mortised in the bench, and also a little wood hollowed out, to bed the back end of nave. This kind of a pit-frame certainly is a very convenient one, as it does not take up much room, and when not in use can be put at one side until again required.

SMITHS' WORK.

BY J. H.

(*Continued from page* 199.)

CAUSES OF LACK OF TALENT, ETC.—MISTAKES IN EDUCATION—LOWEST POINT OF SMITHS' WORK RENAISSANCE OF MECHANICS—AGE OF MACHINERY—CAPITAL AND LABOUR.

ONE main cause, as I think, of our lack of talent and originality in conception and execution is that our common methods of training do not sufficiently *educate*—draw out the latent faculty of the mind. Our training is imitative rather than originative ; it is mechanical, not creative. There is such a thing as mechanism of the intellect as well as of the hands. Instead of training the inventive faculties and encouraging the plastic minds of the young to follow the bent of their own individual genius, we give to them set tasks, too often destitute of animating life, divorced from ideals, and say in effect, "Learn these ; do these things, and you will become educated." But cramming with undigested and disjointed facts is not the way to evolve and nurture genius, art, beauty, and perfection in design and work. After centuries of pedagogy we are, so it seems to me, to learn the whole art and mystery of education over again. Interest, devotion, originality, must be awakened, fostered, and developed ere we shall behold the revivification of the fair ideals whose loss we unfeignedly deplore. Only in this way can the crushing effects of the use of machinery, and of the consequent division of labour into petty, paltry sections, be eliminated ; and only in this manner can the ruin of the old craftsmen be retrieved. In this lies much of the value of such journals as WORK and those of kindred character. Their mission is to awake brighter ambitions and aims than those at present existing, and to teach men those principles which underlie the practice of their crafts, and which in the modern workshop are not made a necessary part and parcel of their training.

I think we may regard the eighteenth century as being the nadir of industrial skill. The old race of craftsmen had mostly become extinct, the new race had not yet arisen. Hand-work had been neglected, machine-work was not come to the birth. The inventions of the last century demanded an excellence of workmanship which it was impossible to procure by any means. Bramah, Maudsley, Holtzapffel, and other contemporaries were in their infancy. Watt, writing to Dr. Roebuck, says: "You ask what is the principal hindrance in erecting engines? It is always the smith-work." His first cylinder was made by a white-smith, of hammered iron soldered together ; but having used quicksilver to keep the cylinder air-tight, it dropped through the inequalities into the interior, and "played the devil with the solder." Yet, inefficient though the whitesmith was, Watt could ill spare him, and we find him writing to Dr. Roebuck almost in despair, saying, "My old white iron man is dead," feeling his loss to be almost irreparable.

Watt continually complained of the failure of his engines through "villainous bad workmanship." Writing once to Dr. Small respecting a cylinder 18 in. diameter, he said at the worst place the long diameter exceeded the short by *only* $\frac{3}{8}$ in. Brunel could not for a long time get mechanics sufficiently skilful to construct his block-making machines.

But the great mechanicians of the eighteenth and nineteenth centuries have by their inventions completely revolutionised the character of our mechanical industries. Bramah, Maudsley, Penn, Clement, Nasmyth, Roberts, Fairbairn, and Whitworth are names to be held in everlasting honour They are the creators of the Renaissance of mechanics, names familiar to the cultured workmen as household words. Yet although we live in the Renaissance of mechanical skill, it is not skill of the same character as that which gave a lustre to the early and mediæval Christian centuries. The skill we boast of now is of an essentially different kind from that whose loss we deplore. We live in an age of machinery. With machinery there has come division of labour, perfection, and cheapness, at the sacrifice of individuality and of real artistic skill. The artist is crushed beneath the wheels of the car of our modern Juggernaut, the great god Mammon. A workman who sought conscientiously to emulate the old craftsmen would be undersold in the market, and starve by reason of the rage for cheapness.

The cause, therefore, of the decay of artistic craft lies deep down in the foundations of our social life. Master and man, with their living personal relations, have yielded place to "capital" and "labour," with their cold impersonalities. How much is involved in that ! In the great and silent revolution that has taken place, the artist craftsman, member of a proud guild, has given place to the mere "hand," the unionist, whose watchwords are the "three eights." Capital accumulates enormous fortunes; labour shuffles wearily through its tasks, and longs for the sound of the last bell ; capital has become synonymous with a proud abstraction ; labour is a portion of a huge machine by which capital is created. Labour is divorced alike from both wealth and art. The beauty of ideality has departed from every-day tasks ; and life's work is brutish without ideal, ambition, and glimpses of the spiritual and intellectual.

THE SAW: HOW TO USE IT.

BY J. H.

(*Continued from page* 162.)

TROUBLES IN SAWING—SAW STICKING IN WE WOOD—DIFFICULTY WITH HARD THIN WOO —SPECIAL SAWS FOR SPECIAL WORK—TENO SAW—DOVETAIL SAW—CROSS-CUT SAW- LINING OUT—TIMBER FOR CUTTING—ATTITUD IN SAWING WITH HAND SAW—ANGLE OF SA —KEEPING SAW UPRIGHT—REMEDY FOR EVIL —HOW TO USE TENON SAW.

HAVING now clear ideas respecting th proper form of tooth for the common han saw, we can presently pursue our subjec further, taking examples from the saws o other types. But first let us note the metho of action of the hand saw.

If we try to cut down a piece of we plank with a hand saw, we shall encounte great labour and difficulty in doing so. I we attempt to cut across the grain—that is transversely to the direction of the fibre —the difficulty will be much increased and if the stuff is of considerable thicknes the saw will stick fast, so that it will b impossible to move it in its kerf. If w attempt to use the same saw on thin an hard wood we shall meet with trouble o another character. The teeth will hitch i the wood, the saw will sway too loosely an freely in the kerf, and, if we cut across th grain, the timber will become broken o spalted out. Obviously, therefore, different materials require different forms of sa teeth, and the teeth of the hand saw ar only a kind of compromise between extrem forms, in order to enable the saw to do work of an average range.

There are two reasons why the saw stick in soft wet wood. One is that the kerf is not wide enough, the other is that the saw-dust cannot get away with sufficient rapidity. Hence the remedy is to increase the set and to enlarge the spacing, which means an increase of the pitch or centres of the teeth, with a consequent increase in the sizes of the teeth themselves.

The principal reason why the hand saw does not operate sweetly in hard thin wood is because there is too much set, and, in a lesser degree, because the teeth are too coarse and too wedge-like in form. Hence, diminish the set and spacing, and alter the rake. In hand saws which are used exclusively for soft or for hard woods, these modifications are made, a kind of intuitive knowledge begotten of experience and observation guiding the workman in the selection of the forms best adapted for any class of materials. When the limits of average work are passed, special saws are used, one saw being kept for ripping and another for cross cutting, each being of a different and distinctly marked type from the other. Then, again, according as a man works habitually in soft or in hard woods will the forms of these be slightly different. Fig. 8 shows the average forms of teeth of ripping saws used exclusively for cutting soft wood with the grain ; Fig. 9 those for hand saws for general use on hard wood ; Fig. 10 those of cross-cutting hand saws used chiefly on planks and boards of soft wood. In Fig. 8 the teeth are of an acute wedge-like form, having much penetrative power, and the teeth are so pitched that there is ample space between them to receive and carry away the coarse, fluffy sawdust. In Fig. 9 the teeth faces are set back, having little penetrative power, while there is yet sufficient interspace for the fine powdery dust removed from hard wood. In Fig. 10 the teeth are also set back, in order not to hitch in the grain fibres, and the amount of set is so large that the kerf is made sufficiently wide for the saw to pass freely between the severed and roughened-up fibres of the end grain.

Should any one question the effect of these apparently minute differences in form and set of teeth, let him try to cross cut any wood, soft or hard, with the ripping saw (Fig. 8), or to rip soft wood with the cross cut (Fig. 10). In the first case the saw would hitch perpetually, causing painful jar to the hands, and finally refuse to penetrate beyond a certain depth. In the second the labour to be expended would be excessive, and the saw would wobble about in a kerf of unnecessary width.

The remarks which apply in the main to saws of the hand-saw type will also apply in principle to all other forms. But in some the differences are more marked than in others.

The common tenon saw has more or less both of set and rake, according to the material upon which it is chiefly used. Usually it is set and sharpened in a medium or average style for general bench use. But according to the character of the

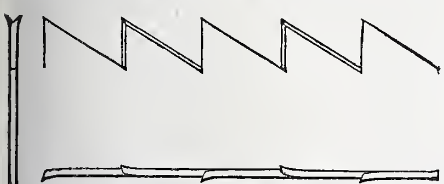


Fig. 8.—Teeth of Ripping Saw.

Fig. 9.—Teeth of Hand Saw for Hard Wood.

Fig. 10.—Teeth of Hand Saw for Cross Cutting.

work mainly done the size of the saw selected is from the 12-in. or 14-in. "tenon," to the 6-in. or 8-in. "dovetail," the teeth in the latter case being so fine that the thinnest wood and the most delicate joints can be cut without risk of tearing out the grain. In the large frame, pit, and circular saws, the tooth forms are often very much gulleted, to afford ample clearance space for the escape of the dust, while the angles, rake, and set are subject to much variation with the different qualities of timber operated on. In the two-handled "cross cut" the teeth are modified to cut in both directions, a form which is improved upon in the saws with M teeth.

A saw that is set and sharpened to be best adapted for its special work is much easier to use than one not so suitably adapted thereto. But, beyond this, there is art involved in the correct use of any saw, and the following notes thereon may be of service.

First, as to lining out. The chalk line, pencil, and scribe are variously used for the marking of the lines by which the saw is guided. The first-named is used for long pieces of timber, the second for ordinary and roughly approximate work, the third for the most accurate sawing.

In the first case a piece of fine cord is whitened with a lump of chalk, and being strained taut between two points whose positions are marked to correspond with the terminations of the line of cut, the chalk line is lifted vertically at or near the central portion, and being suddenly released, transfers to the timber a portion of the chalk, so marking a perfectly straight and fine line upon the timber, which thus furnishes a correct guide to the saw.

In the second, the pencil is used to mark lines for rough sawing, as when cutting short lengths from board, or cross cutting boards or planks.

In the third, lines are marked with the timber scribe, as in squaring the ends of planed stuff and in marking dovetails and tenons. The saw may then be made to cut close outside the scribed line, allowing just sufficient margin of material to be removed with the plane; or the saw may pass right along the scribed line, as in cutting dovetails and tenons, no after-finish being required. In either case the scribed line is preferable to the pencil-marked one, because the cutting can be done much more accurately in the first case than in the last. Also, when the end of a piece of timber has to be squared with the plane, there is, besides the greater accuracy, much less risk of spalting or breaking out of the grain occurring with scribed lines than with pencil-marked lines. In the case of planed ends, a careful workman will also contrive to saw extremely close to the scribed lines, in order to diminish as much as possible the labour of planing.

When cutting with the hand saw there is a certain orthodox kind of attitude generally assumed. The workman stands alongside the stuff, laid upon low sawing stools or trestles, steadying the board, if light, with his right knee, holding the saw in his right hand at an angle of about 65°, and steadying the edge of the board near the saw with his left hand. This position is, on the whole, the best, though many men are skilful in the use of the saw in another fashion. Sitting on the board, they hold the tool with both hands, in an approximately vertical position, and cut rapidly towards themselves, moving backwards with the advance of the saw. The general practice is, however, that first named, and is that in which the greatest power can be exerted and the most accurate sawing done.

The angle of about 65° at which the saw is held is also that which is best on the whole. If the saw is much more inclined, it cannot be advanced so rapidly through the wood; if much less inclined, the workman is forced to assume a somewhat constrained, bending-over kind of position, and the guidance is scarcely so good. Young apprentices usually err at the beginning by giving too much inclination to the saw.

Another point equally important is to keep the saw plumb in a direction transversely to the direction of the cut. Here the tendency is unconsciously to pull the saw towards oneself, causing the cut edge to become other than at right angles with the face of the board; and the canting over is usually not even uniform in unskilful cutting, but varies at every few inches, so that when the edges have to be planed, the timber may probably not hold up to the required width. Then, again, the cut will become wavy in the direction of its length, rendering a moderate allowance for planing insufficient.

The only remedy for these evils is care and practice at the commencement of sawing. The eye should be cast down the blade in order to judge whether or no it is plumb over the line. The attention must be specially directed to this point during the first few strokes of the saw, since to begin right is half the battle. A saw having an excess of set is more difficult of initial guidance than one having a proper amount.

When the saw has once fairly started the cut to a distance equal to the width of, say, its own blade, the risk of departure from linear accuracy is diminished. But even then the tool is apt to "run" by reason of momentary inattention, or by reason of a faulty setting or sharpening of the teeth more to one side than the other, and then the saw will have to be gradually and gently coerced into the right path, slight pressure and twist being imparted from the handle during cutting.

In ordinary sawing the workman bends over the board, not, however, in a too constrained position; and though the strokes of the saw are properly given to the full range permitted by its length, the workman does not sway his body to the same extent as the saw, which would be extremely tiresome, but directs the strokes mainly from the shoulder. The more free and unconstrained the attitude, the greater will be the amount of work got through.

Speaking generally, it will be found that the angle 65° given as the average angle for sawing will be varied with advantage in different materials. Of course, workmen do not measure the angle. I only give it as an approximate guide for beginners, who usually go wrong here. In thick stuff it will be found that there is advantage gained by keeping the saw slightly nearer the vertical, and in cutting thin stuff it may be slightly more inclined. In thin stuff the kerf affords less guidance to the saw than in deep stuff, and the wood is more likely to break out, especially in cross cutting. Hence the reason for the greater inclination.

The tenon saws are generally used at a very slight inclination only with the line of cut often almost parallel; there is then little risk of broken edges. A panel saw will cut much more rapidly than a tenon saw, and should be used in preference for cross cutting of ends and shoulders in quantity; and with fine teeth uniformly set and sharpened, there is practically no risk of broken edges.

After skill in the use of the hand saw and cognate types, facility in that of the smaller saws follows as a matter of course. Similar principles apply to each; matters of set, rake, sharpening, and guidance are pretty much alike, whether we use the large saws or the smaller bow, compass, or keyhole saws, and the principles of operation are alike in all.

THE TENANT'S GREENHOUSE.

UNATTACHED TO THE SOIL AND REMOVABLE AT PLEASURE.

BY GEORGE LE BRUN.

(*Continued from page* 212.)

Completion of Structure—Barge Boards at Ends—Alterations in Details—Filling up with Brickwork—Boarding Filled with Sawdust — Ventilation by Fanlights in Ends — Roof Ventilation — Ornamental Cresting for Ridge—Concealment of Sill —Stop Chamfering of Posts—Greenhouse on Flat Roof.

With the completion of the work, as described in the previous papers, the house is finished, at least, so far as the joiner's work is concerned, and only requires glazing and painting to fit it for the reception of the plants. It presents the appearance shown at Fig. 9 (see No. 12, p. 177), in which the alternative method of diagonal match-boards and Gothic-headed sashes are shown.

To further improve and ornament the structure, barge boards may be put on the ends, and their addition will much improve and beautify the greenhouse, while the extra labour involved is but little. A simple design for barge boards is given at Fig. 19, while Figs. 20 and 21 are of a more ornamental nature. There are many minor alterations in the details of construction that may be made to suit particular requirements, or as the fancy of the builder may dictate; as, for instance, instead of lining the lower part of the house with wood, bricks may be used to fill in with, in which case the sole and belt rails would require to be the width of the bricks used, and would

also be made in the roof if desired, and hinged at the upper end, but this is not so desirable, as there is a certain amount of difficulty in keeping roof openings water-tight, and, if ventilation is wanted high up, the end fanlights will serve every useful purpose.

Roof ventilation can be had, however, in a very simple manner, as will be seen on referring to Fig. 25, which gives a section of the roof, in which an opening board running the entire length of the roof is shown. For convenience in lifting, this board may be sawn across in the middle, and should have cross ends grooved on to prevent warping. In this style of construction it will be seen that the roof sashes do not come up to the ridge board (the stiles had better be kept the full length to afford a support for the ends of the ventilating board); they are kept about 5 in. short, and rest upon rafters, of which there should be three on each side of the house, one under the joint of the sashes, the other two at equal distances from it and the ends of the structure.

the sill lifted and knocked asunder, and the whole packed on a waggon and carried off, the garden ground remaining without so much as a stakehole in it, excepting, always, the drain pool two feet below the surface.

Two minor details I might draw attention to: the outer corners of the corner posts would be much improved by stop chamfering, or rounding; and it would also be advisable to bevel off the outer top edges of the top rails of the side framing for, say, 1 in., so as to allow the roof sashes to have a better hold. These things are not absolutely essential, but are desirable.

There are many houses in London, and other places, that have anterooms, kitchens, etc., projecting in the rear, and having flat roofs, often covered with asphalt or cement. On such a roof as this the greenhouse could be erected, and entrance to it be had either from a window or by means of a trap stair or even by a staircase or steps placed without if there were no means of access from within. In such a position the possession of it would be doubly desirable to the town resident who often has to content himself with a

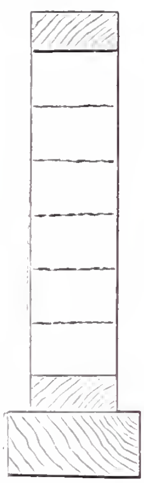


Fig. 22.

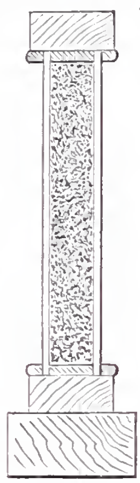


Fig. 23.

Fig. 22.—Alternative Mode of Filling in between Sill and Sashes with Brickwork.
Fig. 23.—Alternative Method of Using Double Boarding and Filling with Sawdust.

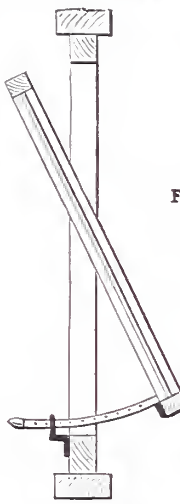
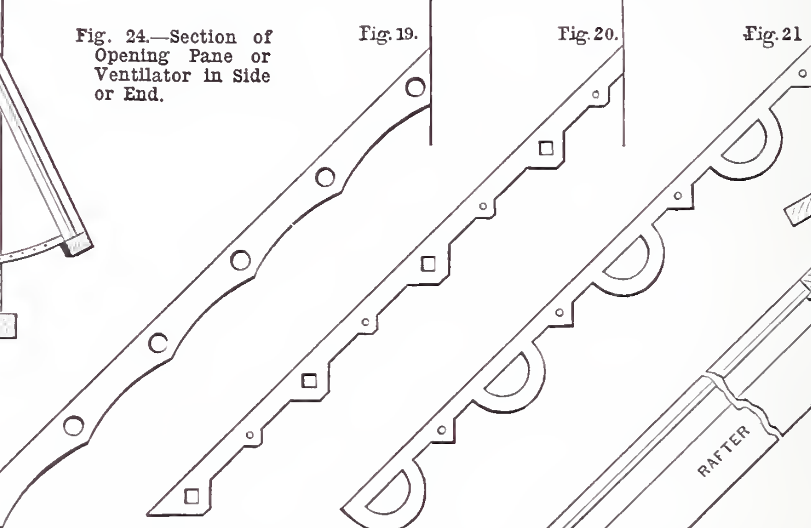


Fig. 24.—Section of Opening Pane or Ventilator in Side or End.



Figs. 19, 20, 21.—Designs for Barge Boards at Ends.

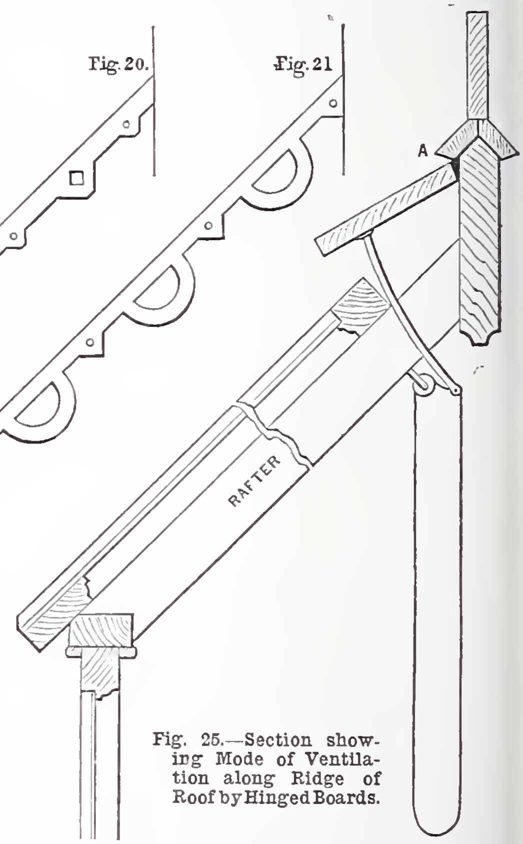


Fig. 25.—Section showing Mode of Ventilation along Ridge of Roof by Hinged Boards.

appear in section as in Fig. 22. Brickwork is certainly more conducive to the preservation of heat than wooden lining, and, in case that artificial heating were resorted to, would be very serviceable; but, then, bricks are not so handy in the event of a removal, so that another method might be had recourse to if heat were wanted, and the use of brickwork was objectionable. A double lining of wood could be put on, and the space between filled in with sawdust, or other material, in which case the details would be as in Fig. 23; both the inner and outer lining taking the form of panels, and being secured by screws only.

As to the opening of the fanlights in the ends, there are some florists who object to that mode of ventilation, and who prefer to have the opening panes at the sides of the house. In this case the alteration in structure is obvious; fix the square sashes in the ends, and make a pane in each of the side sashes to open. For this purpose two thicker sash bars must be put in to carry the opening pane (say $1\frac{1}{2}$ in. thick), which will be hung on pivots in the style of Fig. 24; keep the pivots nearer the top than the bottom, and put on an iron strap with holes in it to catch on a pin, as shown, so that the window can be opened and kept in position as wanted. Opening panes can

The ventilating board is hinged at A, and is opened and shut by means of a cord and pulley worked from below. Rain-water is prevented from entering at the hinged joint by a narrow board nailed on top of the ridge-board, the under edge of which is bevelled as shown in the drawing. The ornamental ridge is put on top of this board and covers the joint of it and its fellow on the other side.

The wooden sill on which the greenhouse rests can have the earth loosely banked up against it to hide its roughness, while the part at the door can either form a step upwards from the garden level, or the approach to it may be gradually raised so as to do away with the step entirely. There are many little details that will suggest themselves to any one who constructs a house of this kind, and the imperfections of the one described, though many, may be smoothed away. My aim has been to fix my attention more on the fact that the house must be removable at will, and so out of the power of the landlord to seize as a fixture, and at the same time be tolerably easy of construction, rather than that it should be perfect in either design or proportion. This aim I think I have accomplished, as every part can be unscrewed and taken separate,

paved backyard and a few pots of flowers, as by its aid he would be able to cultivate choice plants and enjoy his gardening hobby to a much greater extent than he could hope for without the aid of some such easily erected structure.

The amusement to be obtained from a small greenhouse, to say nothing of the profit, is considerable, and no man who can manage to put one up, however poor in general appearance it may be, should be without one. In a house with a good southern exposure, cucumbers may be grown readily, and the vines trained along the sash bars, or better, on wires a little below the sash bars or rafters. Tomatoes may also be grown to please the eye, first of all with the rich hue, deep scarlet or amber, as the case may be, of the clustering fruit, and then the palate, either cooked or in the form of salad.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

(*Continued from page* 187.)

SMITHING, PLANING, PUNCHING, DRILLING.

IN some classes of girder work there is a great deal of smithing to be done in cranking angle and T irons, and joggling their

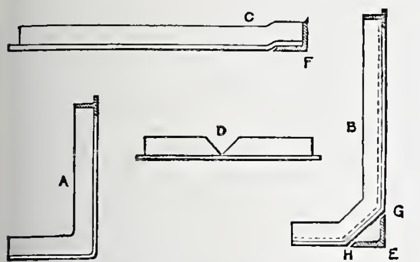


Fig. 6.—Principal Forms of Ends of Angle Bars, T Bars, etc.

ends, and there are two principal methods in use for effecting this: drawing the bars over a block by the hammer, and forming them in dies actuated by hydraulic pressure. In both cases the material is worked at a red heat, the temperature being lower for steel than for iron. In Fig. 6 are shown the principal forms to which the ends of T and angle bars are shaped; A shows one bent at right angles, frequently used in connecting cross girders to the webs of main girders; B is a cranked end used for stiffeners, which are riveted to both the web and flanges of plate girders; the cranking allows them to clear the longitudinal angle irons of the main girders. Such an angle iron is shown in section at E in the position it would occupy in the main girder. At C is an end of a bar joggled to pass on to the limb of an angle iron, on the same plate as that to which it is riveted itself. In some cases the bar ends have to be skewed, or bent sideways as well as vertically, but such forms should always be avoided where possible. To make the square bend, A, it is necessary to cut out a V-shaped piece as shown at D, then the bar is bent and the cut limb welded together again. A weld is always objectionable, doubts as to its soundness being very apt to arise, but in this case it cannot be avoided.

The whole difficulty in welding is in keeping the surfaces to be joined clear of scale and other extraneous matter, which might get closed up in the weld and so cause a flaw, which, being hidden, would escape detection. By the recently introduced methods of welding by the heat derived from gas, a greater degree of certainty as to the soundness of the welds produced should be created, and more satisfactory results still may accrue from electrical welding, if it proves easy of manipulation in the every-day routine of a workshop. In such operations as that of welding, the results of experiments specially made scarcely form any criterion of practical utility, especially where the piece-work system is in force. In the electrical welding, moreover, there must be an element of danger, from the magnitude of the currents necessary to produce a welding heat.

In making the square bend, A, there should be practically no alteration in the length of the bar, but in drawing the end over a block to form the cranked end, B, there will occur some lengthening, more or less considerable, according to the temperature at which it is worked, and the aptitude of the smith working it. In order to save waste, the bar should be cut off to such a length as will, when bent, be of the required dimensions. I have found in average work that it is about right to measure the drawing or template just clear of the root of the angle or T iron, as shown by the dotted line on bar, B. If the iron is very deep on the web, it may become necessary to cut and weld the bar even in making the crank end, B. In such cases it is better, instead of making the two distinct bends, to curve the bar uniformly from G to H; in this way none of the metal is lost; it goes in thickening the web of the T iron. In the joggled end, C, there is no element of difficulty; the bar requires slightly upsetting and then hammering down to shape, and a little extra length must be allowed in cutting off the bar for the joggle. The ends of the bars will require to be trimmed off square after they are worked, and for this about a quarter of an inch at each end is sufficient.

A much more satisfactory job is made by using hydraulic pressure to make these bends; then the bars are not lengthened, and therefore not thinned, but the slight excess of metal goes to thicken the web and make the bar stiffer at the bend, and, therefore, stronger for its particular duty in maintaining unaltered the angles of the parts of

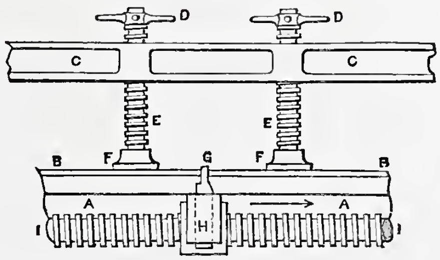


Fig. 7.—Front View of Plate Edge Planing Machine.

the girder to which it is riveted with each other. The fact that this thickening must take place, must be borne in mind during the preparation of the dies, and the requisite room allowed for it, otherwise they will not work. Another considerable advantage that is secured by the hydraulic method of making these knees, is that they are all turned out exactly alike—a result not to be hoped for with hand labour—and, therefore, the uniformity of the work is ensured, and the true bearing of all the stiffeners will materially aid in securing the rigidity of the structure. It may here be mentioned that in hand-bent bars the angle irons will be more troublesome than the tees, on account of their always tending to open out at the bend.

We must now follow our work to the machine shop, where the various parts are to be brought to their correct sizes and made to fit properly together. The planing of the plate edges and ends will first receive our attention. The plate-edge planing machine differs very materially from the planing machines of the engine shops, inasmuch as in the latter the bed of the machine—on which the work is fixed—moves while the cutting tool is at rest, but in the former the reverse is the case. Fig. 7 is a front view of a plate-edge planing machine, shown broken off, as they are made of considerable lengths in order to allow the edges of long plates to be planed throughout without having to shift and refix them on the bed of the machine, an operation of the greatest delicacy to ensure a straight edge throughout the length of the plate. A A is the bed of the machine upon which the plate to be planed, B B, is firmly held down by the heads, F, F, of the screws, E, E. These screws are adjusted by the cross handles, D, D, and work in threads cut in the longitudinal beam, C C. G is the cutting tool carried in the tool box, H, which is driven by a strong square-threaded screw, I I. The machine is fitted with an automatic tumbler to reverse the motion of the screw at the termination of a cut.

The plates having been planed on both edges, a number, of the same width, may be laid together and fixed on the end planing machine, and their ends all planed at one operation by a milling tool, which is essentially a revolving cutter working at right angles to the length of the machine bed. The revolving cutters as formerly made were far from being perfect, but during the past ten years very great advances have been made in the appurtenances of milling machines, and very good work is now turned out by them. In recent years, also, emery wheels have come into use, more especially on the continent, for finishing off certain parts such as the ends of cross braces and other parts that require to be accurately fitting at the joints, but I do not much incline towards their use.

The plates having been planed, or otherwise shaped, the making of the rivet holes comes next. If they are plain punched they will probably require some rymering, but with this I shall deal subsequently, merely pausing here to point out the disadvantage of using rymers under these circumstances. It is very important to get a clean hole so that the bearing of the rivet may be uniform, and to obtain this a tool with an accurate cutting edge must be employed, and the edge of an ordinary rymer is not a cutting but a scraping edge, the angle of its cutting edge being not less than 90°. The use of such a tool must tend to bulge the plate.

When the rivet holes are drilled, as in the best class of work, multiple drilling machines are used, and several plates may be drilled together, thus ensuring the exact coincidence of the rivet holes with one another, and abolishing the necessity of

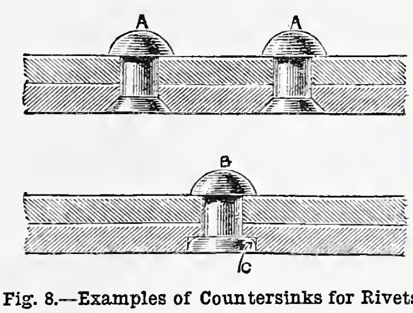


Fig. 8.—Examples of Countersinks for Rivets.

rymering out the holes afterwards; the only treatment the drilled holes require is the removal of the sharp rises around them, which might tend to start a crack under the rivet head during the cooling and contraction of the rivet.

The drills used should be carefully made with true cutting edges, the preference being given to what are known as twist drills, which, besides having true cutting edges, run very steadily, and, therefore, do good work, the chatter which occurs with scraping drills being avoided. I have referred to the difference in widths between the top and bottom of the web plates, caused by the practice of cambering girders; this will necessarily cause a difference of pitch between the top and bottom rows of rivets, unless the whole difference is taken up in the end pitches of each plate, which is certainly not so convenient as running a uniform pitch the whole length of the girder. The having to break pitch in certain places on the longitudinal angle irons has a tendency to lead to mistakes, and in any case it precludes the changing place of angle irons if it should be desired to alter the position of the joints for convenience of carriage or any other reason. Of course I know that all these points of detail should be definitely settled before the work is sent into the yard, but I also know from experience that it not unfrequently happens that a great many alterations are made during the progress of construction, and it is therefore advisable to be as far as possible prepared for any emergency that may arise. In the example taken, it was found that to give the requisite camber, the plates which were four feet wide at the bottom had a top width of 4 ft. $\frac{1}{16}$ in. At 4 in. pitch the number of rivets in the bottom edge would be twelve, and the same number should be put in the top edge, the pitch being found by taking a line 4 ft. $\frac{1}{16}$ in. and dividing it up into twelve parts with the compasses. When riveted girders rest upon plane bearings, it is necessary to sink the heads of the rivets in the plate on the side in contact with the bearings; therefore, in such positions, the rivet holes have to be countersunk as shown at A, in section, Fig. 8. The countersinks should be cleanly made with drills or rosebits, and where the thickness of the plate will allow, it should not be less in depth than one-third the diameter of the rivet, but it should not exceed one-half the thickness of the plate. Could the rivets be properly closed, a square sink, as shown at B, would be preferable, as it would give the rivet head a better hold upon the plates, but the sharp corner, C, running round the rivet would not get filled in. I am inclined to think that, at the hands of designers, the rivets do not receive the amount of consideration to which they are entitled. The whole safety of a structure depends upon its joints, and the most careful and elaborate calculations of main sections will be wasted if not followed up by correctly proportioning and placing the rivets. The strains to which rivets are subjected depend upon their positions; thus, if a load is held by a member hanging on the head of a rivet, the tendency is to pull the rivet asunder, or to strip the head off it. If the rivet is holding two plates together which are acted on by forces in the direction of their length, the effort will be to slide one plate upon the other and shear the rivet through the body or crush it by compression. When the rivet is intended to resist the first kind of strain, it is evident the head should be of sufficient thickness to afford as much strength against stripping off as its body does to tearing across. The stripping off of the head will evidently be a shearing strain, and the surface acted upon will be the circumference of the rivet multiplied by the thickness of the head. The surface resisting tearing is the cross sectional area of the rivet. The working strengths are for iron in shearing, 4 tons per square inch of sectional area; and for tensile strain, 5 tons. The cross sectional area is equal to the square of the diameter multiplied by 11 and divided by 14; and the stripping area is equal to the thickness of head multiplied by the diameter of the rivet and by 22 and divided by 7. These two sums being equal would give equal areas of resistance, in which case the thickness of the head would be one quarter of the diameter of the rivet; but the resistance to stripping is only four-fifths of that to tension, so one-fourth must be added to the stripping area, thus making the least thickness of the head equal to five-sixteenths the diameter of the rivet, and it is better practice to make it at least three-eighths the diameter. Now, in regard to the second kind of joint, the resistance to compression is the same as that to shearing, so the bearing area of the rivet in its hole should be equal to its cross sectional area. The bearing area measured square to the line of strain will be the diameter of the rivet multiplied by the thickness of the plate, and to this must be equal the square of the diameter multiplied by 11 and divided by 14, when the diameter of the rivet will be equal to the thickness of the plate multiplied by 14 and divided by 11.

THE PREPARATION OF PLATING SOLUTIONS.

BY F. W. MASON, CONSULTING ELECTRICIAN AND CHEMIST.

Classification—Gold Solution—Silver Solution—Platinum Plating—Copper Solution—Lead Solution—Nickel Solution—Brass Solution.

In the preparation of these, as most platers are aware, too much care cannot be given. Plating solutions may be roughly divided into two classes:—First, those of the rare or precious metals, as gold, silver, and platinum; second, those of the coarse or common metals, as copper, zinc, etc. Before proceeding further, it may not be out of place to state that all figures employed throughout this article are the results of practical experience, and not the mere figures attained by a few experiments. I will, first of all, give the preparation of solutions of the rare metals, as these are of the most consequence, and likewise the most frequent in use.

Gold Solution.—First in order let us consider the gold (*aurum*) solution, which is best made up to the strength of 8 dwt. to the gallon. To make it, proceed as follows: Take 8 dwt. of fine gold and put it in a porcelain dish of about 40 oz. capacity—an enamelled saucepan will do if this is not attainable—then pour upon this, gently, about 4 oz. of aqua regia (which is a mixture of hydrochloric and nitric acid, used in the proportion of two of the former to one of the latter), then gently heat the vessel containing the gold and aqua regia over a Bunsen burner — this to accelerate the chemical action. When the gold is dissolved, pour the solution of chloride of gold into another similar vessel and evaporate the acid off; a red mass will be the attainment thereby. If too much heat is used the gold will be reduced to the metallic state; if this should be the case, add a little more aqua regia to re-dissolve, and then re-evaporate. When the acid has been driven off, add to the resultant chloride of gold about one pint of distilled water, or failing this, use water that has been vigorously boiled and filtered. If, when the chloride of gold is added to the water, there exists a white precipitate, the chloride of gold solution should be carefully poured off it, and this precipitate is chloride of silver; it should never, on any account, be allowed to get into the gilding solution. Then to the solution of chloride of gold, a strong solution of cyanide of potassium should be added (this need not be of any specific strength); the result of this additiou of cyanide of potassium to the chloride of gold is a brown precipitate of cyanide of gold. The solution of cyanide should be carefully added, so that a drop at last should have no effect upon the clear solution. If you add too much cyanide, you will re-dissolve the cyanide of gold. This cyanide of gold should be allowed to stand for about fifteen minutes, and then the clear liquor poured off; the precipitate should then be washed two or three times with distilled water. This is done as follows: A quantity of distilled water is poured upon the precipitate; this is then allowed to settle and the water run off; this is done two or three times, as before stated. When the cyanide of gold is sufficiently washed, a solution of strong cyanide of potassium is added to dissolve it. When the gold cyanide is dissolved, a quantity of the solution of cyanide of potassium is added to it to form free cyanide. This is essential in the working of the solution; then a sufficient quantity of distilled water is added to make up to one gallon. This solution must be worked with a pure gold anode, and a battery power of two Bunsens, holding about a pint and a half each. If the solution works a bit slowly, a little fresh cyanide should be added, but you must be careful not to add too much, or the work will have a foxy colour. The solution must also be worked at a temperature of 125° Fahr. to 135° Fahr., with a solution same strength as above, and worked at a temperature of 132° Fahr., and two quart Bunsens the colour of the work has been first-class, far better than with other heats and strengths of solutions and currents.

Silver Solution.—This is prepared somewhat similar to the gold solution. Take 1 oz. of fine silver, and add to it about 3 oz. of nitric acid (this should be in a porcelain dish); stand this in a warm place; the silver is soon dissolved. As soon as the red fumes given off during the chemical process have ceased the silver is dissolved; the acid is then evaporated off, and the nitrate of silver treated exactly as the chloride of gold was treated. The solution is made up to one gallon, to be worked with a silver anode and two Bunsen cells, the same size as those used for the gilding. If the work is wanted to be of a bright colour, it can be obtained by the use of a little bisulphuret of carbon added to the solution; the way it should be added is as follows:—Take about half a Winchester of the silver solution and add to it 3½ F. oz. of bisulphuret of carbon; cork the Winchester and well shake it, and allow it to stand for a quarter of an hour, then shake again and allow it to stand. This should be very cautiously used; it should be added to the plating solution at the rate of 2 oz. per gallon of plating solution. This gives a bright, lustrous appearance to the work.

Platinum Plating.—This is generally done by means of a solution of bichloride of platinum ($PtCl_2$). Perchloride is the same as bichloride. This bichloride is prepared by dissolving the metallic platinum in aqua regia (equal mixture of nitric and hydrochloric acids). I myself prefer to use two parts of hydrochloric to one part of nitric acid. When the platinum is dissolved the reddish solution is evaporated down to a syrup, then re-dissolved in hydrochloric acid, and evaporated down to a syrup again. This is then cooled; it then solidifies to a solid mass. Care should be taken that the solution is not overheated in evaporating it down; as, if this is done, it will be found that the plating solution will be almost worthless. I myself also prefer (in the making of the bichloride) to use old platinum crucible lids in preference to new, or platinum wire. This old platinum, before being dissolved, should be boiled for about ten minutes in nitric acid, and afterwards dipped in a strong hot solution of caustic potash, washed, dipped again in nitric acid, and afterwards rewashed in distilled water; the platinum is then dissolved. If the platinum does not dissolve pretty quickly the application of a little heat will soon hasten it; I generally find, myself, that the solution requires a little heat. For the plating process I prefer to use a solution of the double salt of chloride of sodium and platinum, prepared by dissolving 268·4 parts of bichloride of platinum in distilled water containing 58·5 parts of chloride of sodium (common salt); to this add 55·96 parts of caustic potash. The solution should be made up so that it contains 400 grains of platinum in two quarts of water. Throughout these experiments distilled water was used; failing to obtain this my readers should use water that has been boiled for awhile and then filtered.

The following are the figures I employ for my bath:—Bichloride of platinum, 400 grains; chloride of sodium (common salt), 87·183 grains; caustic potash, 83·420 grains; distilled water, 2 quarts. The decimals can be rejected, and the whole numbers taken without any serious inconvenience. With this strength of solution I prefer to use a small anode and a weak current—about two Bunsens are the best. This current will, I think, be a little too strong; if so it should be regulated to the proper intensity by means of the ordinary plater's resistance board; the current I employ is 2·22 volts. This gives a very fair reguline deposit, far better than with any other strength of battery current employed; the article does not require much moving about in the bath, nor does it require (except in some cases) a very high temperature; between 65° and 70° Fahr. is very good. But a few words regarding the treatment of the articles themselves that are to be platinised. I cannot lay too much stress on having them scrupulously clean; in fact, experience proves to me that the cleaner they are the better the deposit takes place. For my method I use the ordinary acid dips, and then boil them in a strong solution of caustic potash, and then well wash them in distilled water, and then immerse them immediately in the bath. The only drawback to platinum plating is its troublesome working, which can be overcome by using the proportions named.

Having described the preparation of the rare solutions of gold, silver, and platinum, I will now proceed with the common metals, copper, lead, nickel, and brass.

Copper Solution.—First, we will take that of copper, as this is the preparation most frequently used. Take of copper sulphate 1 lb., dissolve this in boiling water, add 9 oz. of strong sulphuric acid, and add water to make up to one gallon; work with two Bunsens and large copper anode. Watt, in his book, prefers to use a little arsenious acid added to this solution, but I do not think that there is any absolute need for it.

Lead Solution.—One pound of acetate of lead in one gallon of water, and adding cyanide of potassium to precipitate the lead as lead cyanide, and then adding enough cyanide to re-dissolve this, and also to form free cyanide. Work with a pure lead anode and two Bunsens; but this has hardly ever been a commercial success, it has been mostly tried as an experiment.

Nickel Solution.—This is usually made of the double salt of nickel and ammonia. This should be made up to the strength of 15 oz. of the double salt to the gallon. Prepare the salt as follows (I believe this process was first invented by Mr. Unwin):—Take of nickel 14 oz., dissolve it in three parts of strong nitric acid and one part of strong sulphuric acid, and four parts water. When dissolved, which is known by the fumes (caused by chemical action) ceasing, add a little hot water and filter; the deep green liquid obtained is a strong solution of nickel sulphate. Then make up a strong solution of ammonium sulphate. This is done by dissolving 4 lb. of the salt in a gallon of water, then mix about half of this with the sulphate of nickel and make up with water to one gallon; work with a pure nickel anode and three Bunsens.

Brass Solution.—This is best done by the following solution:—Acetate of copper, 2 oz.; potash, 2 lb.; sulphate of zinc, 5 oz.; liquid ammonia, 1½ pint; cyanide of potassium, 4 oz. Dissolve the acetate of copper in a quart and a half of water, add half the ammonia, then dissolve the sulphate of zinc in two quarts of water at 190° Fahr. When the zinc is dissolved add the other half of the ammonia to it. This should be well stirred for a few minutes, then dissolve the potash in two quarts of water, and, lastly, dissolve the cyanide of potassium in another quart of water. Then add the solution of copper to the zinc solution, then the cyanide, and then the potash. Stir well, and allow solution to stand for two hours, then make up solution to 3½ gallons. Work with a milled brass anode (which should be well cleaned before immersion) and three Bunsen cells. A little ammonia and cyanide may be added when the solution works slowly. Watt, in his book, prefers to use a small amount of arsenious acid to the solution. If added, it should be at the rate of ¾ oz. to six gallons.

As before stated, these solutions must be prepared with care, cleanliness in the manipulation of the solutions, both in making and working, being strictly adhered to. If this is seen to, I have not the least doubt that success will follow, as all solutions given have been tested by long practical experience. Any information or advice any one may require, I shall be pleased to give.

SOME RATIONAL BOOKSHELVES.

WITH A FEW COMMON-SENSE HINTS ABOUT BOOKSHELVES GENERALLY.

BY MARK MALLETT.

MODE OF CONSTRUCTION—CAPACITY OF BOOKCASE—DIMENSIONS—ARRANGEMENT FOR VARIOUS SIZES OF BOOKS—SIDEBOARD IN CENTRE—MIRRORS AT BACK—CORNICE, FRIEZE, ETC.—MATERIAL MOST SUITABLE—EBONISING—PROTECTION FROM DUST—SHELVES, FIXED AND MOVABLE—"BRIDGE" FOR SHELVES—PROTECTION OF EDGES OF BOOKS—PRECAUTIONS AGAINST DAMP.

THE construction of bookshelves is a matter on which a little more common sense might often be brought to bear with advantage. Notwithstanding that books vary as much in breadth as in height, we see but little allowance made for that fact, and, as a rule, the shelves occupied by small books project into our rooms and take up space in a way that is quite needless; besides which the uniform projection from the wall of an ordinary bookcase of any considerable size renders it a heavy and disagreeable piece of furniture to the eye. The plan adopted by the writer, and which he now has to submit, is based on the rational old principle of making a big hole for the cat and a little hole for the kitten—a wide projection, that is, for the great folios, and a narrow projection for the octavos and all the smaller fry of volumes; he claims, also, some other advantages for his shelves, of which mention will be made in due course.

The bookcase shown in elevation in Fig. 1 is intended to accommodate some 700 volumes. An elevation of it has been given rather than a perspective view, because the former, being to scale, is available as a working drawing; yet it must be admitted that it does not do justice to the piece of furniture, artistically considered. Thus drawn it looks square and flat, which the thing itself does not look. In the actual thing the wings projecting in the upper part disguise the fact that the top is bounded by a straight line; the ranges of books are agreeably broken by the bright looking-glass in the middle; whilst the broad shelf beneath it, and the projecting centre of the lower part, convey anything but an idea of flatness.

Fig. 2 is a vertical section on the line, A B, of the above elevation, and Fig. 3 a second section through the centre of the shelves on the line, C D. Fig. 4 gives the central shelf (E, Fig. 1) as it might be seen on its lower side, with sections of the uprights which support the lower shelves; and Fig. 5 gives the upper side of this shelf, with the uprights of the upper portion. These five illustrations are on a scale of ¾ in. to the foot; the set of shelves being 9 ft. long by 6 ft. 4 in. high—that is, 3 ft. 6 in. to top of the wide central shelf, and 2 ft. 10 in. above. That damp—the old enemy who "foxes" books—may be the better avoided, the lowest shelf is kept 3 in. above the floor line.

In a collection of books the average numbers of the different sizes can be pretty accurately guessed, and the spaces for them are arranged accordingly. In the lower portion the central compartment is for *folios.* It is but narrow—only a foot in width—and has but two shelves, for not many folios fall to the lot of any ordinary reader of these days. That it should be narrow there is a second reason: folios are of great weight, and the bearings of a shelf that carries them should not be far apart. This compartment has a depth of 13 in. The lower shelf is some 18 in. high — high enough, that is, to hold *Blackie's Imperial Atlas,* or bound volumes of the *Graphic* or *Illustrated London News.* Ordinary human beings cannot be supposed to have bigger books; if they have they must provide special houses for them. The second shelf is 16 in. high, and above is a recess, 7 in. in height, intended as a receptacle for newspapers, etc.

On each side of this are compartments 15 in. wide, and having a depth of 11 in., which is ample for *quartos.* The six shelves in these are from 12¾ in. to 14 in. high.

But the great majority of our modern books are *octavos,* and to them (including smaller books) all the remaining space is apportioned. In the lower portion the compartments are 8 in. deep for the larger books of this class, while in the upper part they are only 6 in. deep; but that suffices for the lesser octavos, and for still smaller sizes. These compartments are 30 in. wide, and the sixteen shelves range from $10\frac{1}{2}$ in. to 6 in. high; the wings which hold them interfere but little with the space in the room, since at bottom they project but $8\frac{1}{2}$ in. from the wall, and in the upper part no more than $6\frac{1}{2}$ in.

Figs. 4 and 5, as well as affording horizontal sections of the lower and upper portions of the case, illustrate the peculiar shape of the central shelf (E, Fig. 1), which rests on the tops of the lower uprights. As it overhangs the uprights by an inch at each end, it is 9 ft. 2 in. long, and its breadth at the middle is 16 in., a width which allows it to serve as a kind of sideboard, which may be turned to useful or to ornamental purposes, or to both. Had the writer wished to show his design in an attractive rather than in a practical form, he would have represented some æsthetic pieces of crockery as ranged on this shelf and reflected in the glass behind them, but he leaves this to the imagination of his readers.

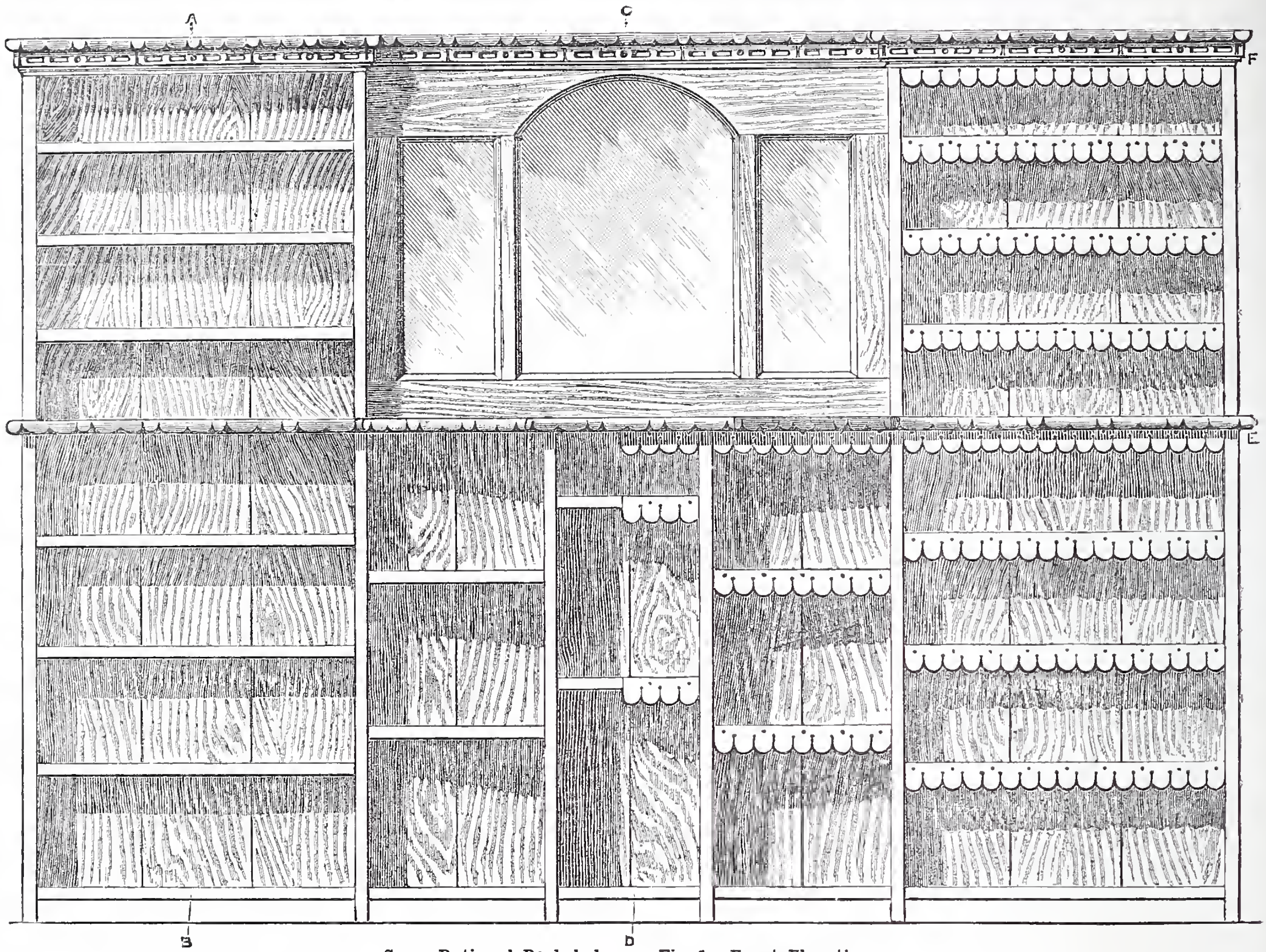
In a set of shelves built by the writer on this model, an old Vauxhall glass, with its characteristic gold frame, has been used. But all who may wish to work on the same lines may not have such a glass to their hands, and, therefore, in the present drawings three panels of ordinary looking-glass have been shown, as introduced. They are fixed in a very simple manner. The whole of the shelves are backed with $\frac{1}{2}$-in. matchboarding; this is continued over the space occupied by the glass, and to it the two horizontal and four vertical strips of $\frac{3}{4}$-in. wood, which form a frame to the panels, are screwed, the glass itself being held in place by a narrow strip of gold moulding fastened with needle points.

The cornice (F, Fig. 1), which, of course, runs along the ends of the wings as well as along the whole front, is, as shown in the elevation, relieved by a little simple gouge work, which is so simple that it can scarcely need a separate diagram for any one who would be likely to work it out. But most persons will probably consider this decoration, as well as the enrichment along the front edge of the central shelf, superfluous; and in the full-size section of this cornice (Fig. 6) the frieze, G, is left plain, and merely an ordinary moulded beading, H, is placed upon it, whilst I is a gilt beading. This and the other gold beadings are introduced on the supposition that the woodwork generally is ebonised, in which case a little gold will have an excellent effect, whilst it adds but a few pence to the cost.

With a view to ebonising, inch pine is recommended for the uprights, and $\frac{3}{4}$-in. pine for the shelves, etc.; the whole is backed, as has been already mentioned, with $\frac{1}{2}$-in. matchboarding. The top and bottom portions are made separately for convenience of removal, etc., the former being kept in place on the latter by four dowels driven into the central shelf, which fit into holes in the four uprights of the top. It is better to fit the work together with screws before ebonising the wood; then to take it to pieces, to brush it over with a strong, hot decoction of logwood, and afterwards with iron dissolved in vinegar. The boards can be kept from warping by letting them dry under sufficient weights. They have to be polished with beeswax and turpentine melted together; little wax and plenty of good hard rubbing is the secret of getting a good polish.

For the protection of the tops of the books from dust nothing looks so well as the stamped and gilded strips of leather, sold for the purpose, nailed along the front edges of the shelves. These are, however, costly, and one half of the elevation, Fig. 1, is shown as finished with a cheaper substitute in the shape of American leather cloth. With ebonised wood cloth of a dark green colour looks best, and the strips should be deeply cut between the scollops, as in Fig. 7, to allow of the easy taking out and replacement of books. The strips are fixed to the shelves with brass nails. The scollops may be quickly cut by laying the cloth on a lump of lead and cutting with a gouge of proper size.

The shelves in this design are not made adjustable, being screwed down to small strips, which, in their turn, are screwed across the uprights. So far as the experience of the writer goes, unless in a very solidly-built bookcase, adjustable shelves involve more loss in the shape of strength than gain in the shape of convenience. As has been already observed, the proportion of volumes of different sizes in a collection can be pretty accurately calculated, and no great difficulty will be found in providing sufficient accommodation for those of each size. Any arrangement



Some Rational Bookshelves. Fig. 1.—Front Elevation.

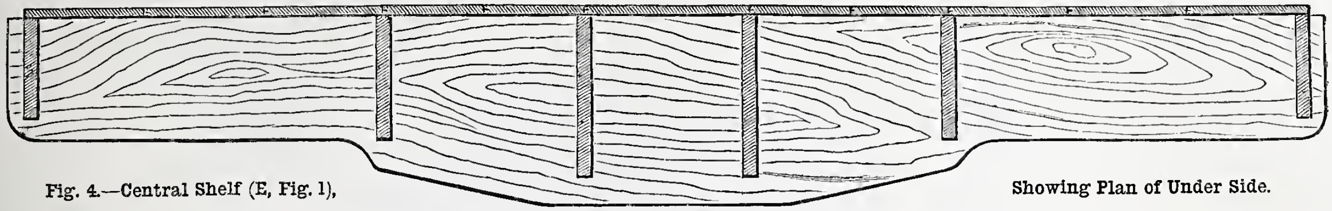


Fig. 4.—Central Shelf (E, Fig. 1), Showing Plan of Under Side.

for rendering shelves adjustable must do one of two things—it must either weaken the upright, or it must lessen the space for books. Yet, as some persons have a decided objection to fixed shelves, it may be well to mention one or two plans for supporting those that are movable. Perhaps as good as any of these is the double rack, Fig. 8. In this the movable slip, K, gives a firm support to the end of shelf, L, which has to be cut to fit upon it. This, of course, takes from the space for books a quantity equal to the thickness of the racks and slip, which can scarcely be less than a quarter of an inch. A slip of wood, near the ends of which are two projecting wooden pegs or pins of metal, made to fit into corresponding shallow holes in the upright, will save space, but it is less firm than the above plan; it is, however, to be preferred to the pair of short, stout, separate movable pegs which we sometimes see employed to carry a shelf end.

Whenever in fitting the non-adjustable shelves a want of proper books for the large compartments is found, and small books have instead to be placed in them, there is an easy method of obviating any unseemly gap between the tops of these small volumes and the dust strip. This is by nailing together three pieces of board in the manner shown in Fig. 9, and thus making a "bridge" of the length of the shelf. Its front edges should be coloured like the woodwork generally, and it will look better if fitted with a dust strip It can be made to bring the heads of the books placed upon it to any required height, whilst the space beneath will be useful for lie-down books, small portfolios, or magazines. If the height to be "bridged" is considerable, two low bridges, one placed upon the other, will be found better than one high one, as the two lie-down shelves will be much more handy than one. Such bridges are knocked together in a few minutes.

Heavy books of reference, which are frequently taken down from the shelves, are apt to suffer from rubbing on the lower edges of their covers. Hence in some elaborately-fitted libraries the shelves intended for such works are padded and leather covered. A cheaper and simpler method of protection has been found by the writer to work well; that is to give the shelf a covering of baize, or some such stuff, and above it one of smooth American leather cloth. This, though not so enduring as leather, causes even less friction, and consequent wear, of the book edges, and will last for very many years.

Whenever there is the slightest suspicion that the wall against which bookshelves are to be placed is not dry, it is always well to leave a space behind the back of the bookcase for the air to circulate freely. If there is cause for any fear beyond a suspicion, it is better, instead of matchboarding, to make the back of zinc. The cost will be much the same, and if the shelves are non-adjustable the zinc can be nailed to the back edge of every shelf. The front side will need to be brushed over with brunswick black, when it will go very well with the ebonised wood. Damp is a cruel enemy to books, and many a good collection is ruined as regards pecuniary value by not guarding against it. Simple precautions like those named above are, therefore, well worth attending to.

Everybody nowadays has books of one kind or another, since works of the highest class, that take rank as English classics, have been brought within the reach, even of those who can afford an outlay of no more than a few pence weekly on mental food in the form of books, by the issue of such works as "Cassell's National Library," in which the best works of the best writers are issued at a merely nominal price. But books, like other objects of utility, require a place to and for themselves, whether the collection be large or small. If large, the bookshelves described will afford a suitable abiding place. If small, the arrangement and spacing of the shelves may be taken advantage of for the construction of smaller

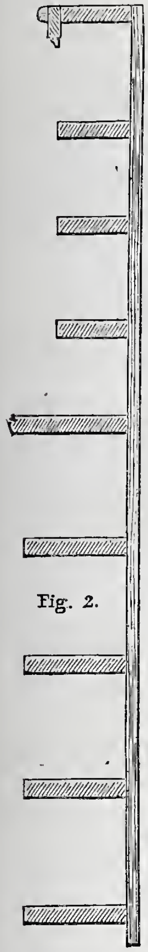


Fig. 2.

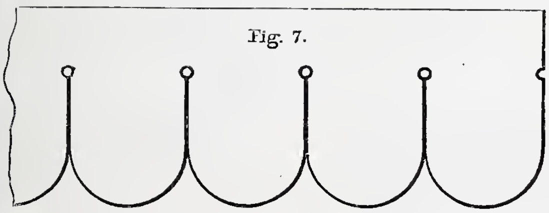


Fig. 7.

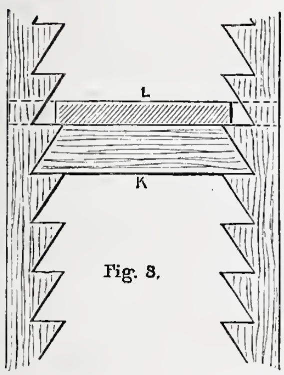


Fig. 8.

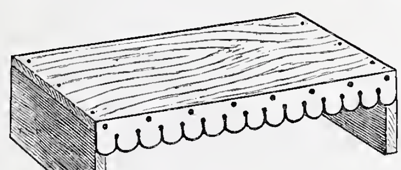


Fig. 9.

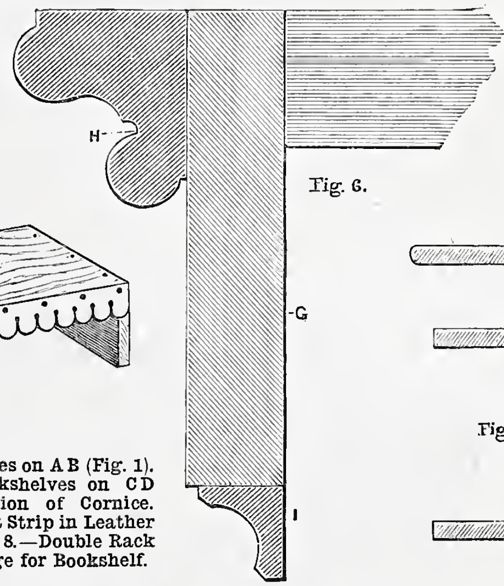


Fig. 6.

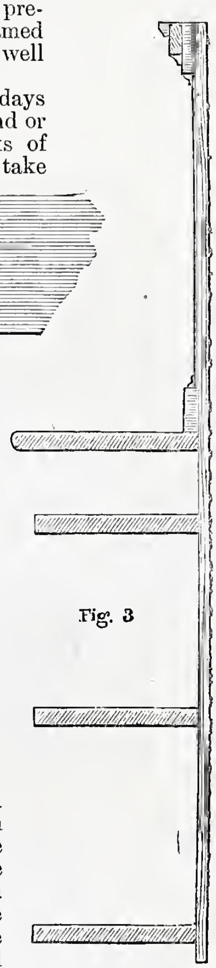


Fig. 3

Fig. 2.—Section of Bookshelves on A B (Fig. 1). Fig. 3.—Section of Bookshelves on C D (Fig. 1). Fig. 6.—Section of Cornice. Fig. 7.—Pattern for Dust Strip in Leather or American Cloth. Fig. 8.—Double Rack for Shelf. Fig. 9.—Bridge for Bookshelf.

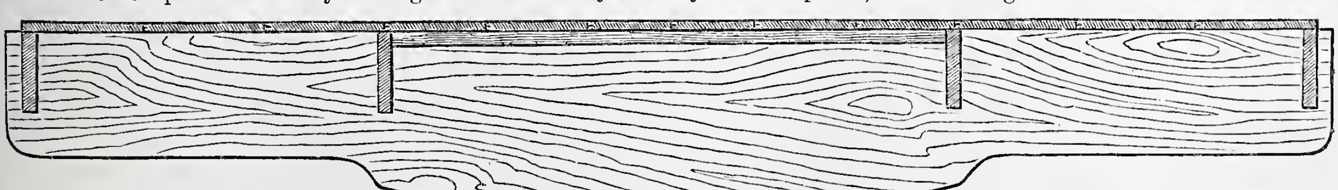


Fig. 5.—Central Shelf (E, Fig. 1), Showing Plan of Upper Side.

sets, which may be better adapted to the space at command and the number of books to be housed, so to speak: for example, the central compartment, with simple modifications, might be used for a recess, which might be appropriated to any of the numerous purposes for which recesses of this kind are often welcomed. There is no reason, indeed, why it should not be turned into a cupboard by the addition of a door, for it is not every one who requires the space for folio volumes, or who would care to go to the expense of binding the illustrated papers of the day.

"LINING UP."

WITH A FEW CONSIDERATIONS ON ART AND ITS TEACHERS.

(*Continued from page* 211.)

METHOD NECESSARY TO PROGRESS—LINING OF TOP OF TOILET TABLE—RELIABLE MODE OF PROCEDURE—GAUGE LINES AS GUIDES—BRADS ON LINES AS STOPS—HOLES FOR SCREWS—LINING OF BACK—ATTACHMENT BY SCREWS—SECURITY AGAINST "GOING."

IT must have occurred to every observer of work in progress how much time may be saved by a little method in the way the various operations are performed. One man will take half the time another requires to get exactly the same result, although they may both apparently be equally busy. The one who gets through with whatever he has in hand first does not seem to go about it hurriedly, nor does the other seem to dawdle and waste time. Why is it? Simply because one works by method, using the accumulated stores of experience, while the slower one does not, possibly only because he may not have done the particular piece of work so frequently that he is able to grasp all the facts in connection with it. The man who is constantly at one class of work acquires a manipulative skill which not only causes admiration in the onlooker, but conveys lessons which it is unwise to disregard.

Some such thoughts passed through my mind while standing beside a cabinet-maker's bench while a small toilet table top was being lined up. Not that there was anything novel in the way it was done. Every one who has been much in a cabinet-maker's workshop must have seen it often, if not precisely in the same manner, at least only differing according to the individual ideas of the worker. Having said this, it will be almost needless to explain that the following directions do not pretend to cover the whole subject of lining up. For instance, the vexed question of direction of the grain on the end lining is not alluded to, at least, not more than by inference. The aim is more to put on record, for the benefit of all whom it may concern, a reliable method of lining up, than to advocate a new one. Those who have followed any other method—or rather let me say have become skilful in other details of manipulation, and have found the result satisfactory—have no occasion to change their style of working. If, however, they find any hints in these directions which will be of benefit to them, so much the better for themselves and their work. I can answer for it that those who follow the course now laid down will have no reason to complain that time is lost, nor that the work when done is not reliable. In the latter respect, I refer to its freedom from liability to split, even if the wood be not thoroughly dry, or from the contraction and expansion which all woods, however dry they may be, are more or less subject to under varying conditions of the atmosphere.

On the bench let us suppose the unlined top lies, bottom upwards, properly squared, and cut exactly to size. The linings are to be set back from the edge, say, ½ in., the distance, of course, depending to some extent on the mouldings which are to be subsequently worked. Whatever the distance, however, run a pencil or gauge line of some kind as a guide to plant the linings down by along the front and two ends. The lining pieces will be of, roughly speaking, 3-in. width. One of them—that for the front—must be cut with mitred ends of exactly the required length; the other two only require one end of each to be mitred, and may be left a trifle full. If they project at the back they can easily be trimmed down afterwards. The front piece is to be glued down, and to regulate its edge to the guide line is certainly possible, but if a couple of brads or wire nails are driven in on the line, one near each end, they will serve as a stop for the front edge of the lining. It is only necessary then to put the piece, after it has been glued, on the top, pressing it both against this and the nails, to ensure its being absolutely in its right place. It is almost impossible for it to slip while the hand screws are being applied, and awkward fumbling to get it truly placed is avoided. As quickly as may be, the hand screws, which have been lying conveniently near, are applied.

If the nails as guides are serviceable for the front piece, they are equally so for the others; but, of course, none but the veriest tyro would in ordinary work think of gluing these to the top. They must be nailed on, or to put the matter more definitely, be screwed down. Very likely there may be some who, when they read this, think that it is not necessary to tell them how to drive the screws in. All they have to do is to bore a hole through the linings into the top and screw up. Quite so; that is all, and experienced workers will know the proper way to act in the circumstances; others will act as if instead of joining two pieces the screws were being used in one piece of solid wood. They will make the hole of the same diameter both in the lining and in the top, *i.e.*, the same bit or gimlet will be used throughout. The result may be satisfactory in the long run, but the chances are very much against it being so. No; if the work is to be reliable, the natural play of the top piece must be allowed for. On a narrow top it is not great, and provision may be made for it by boring the holes in the linings sufficiently large for the neck or plain part of the screw to fit quite loosely in them. The holes may, indeed, take the form of an oblong slot, but it is seldom necessary that so much precaution should be taken, and if not necessary time is wasted in forming them.

Let the hole be as large as it well can be; that is to say, just so that the head of the screw shall not be able to pass through it. Now it will probably occur to most workers that the holes can be bored through both pieces of lining at the same time with greater economy than through each separately. The size of the screws has necessarily been determined beforehand. Then take one of the pieces and lay it down in its proper place. Holding it firmly against the guide nails or pins with one hand, make the holes with a proper-sized gimlet for the screws into the top, taking care not to bore them through, a mishap which can easily be avoided by keeping the fingers underneath as the boring proceeds. Touch the mitred end with glue, place in position firmly, and screw up. A hand screw should be placed so that it grips the three pieces, top, front, and one end at the mitre.

The other end, of course, is treated in precisely the same manner, the hand screws being left on till it is judged safe to remove them, which will be when the glue has set.

The guide nails can be removed at any time after the pieces have been planted on.

There is still another piece of lining to be considered, viz., that at the back. It is cut with square ends, so that it lies within the two end linings, between which it should fit exactly, especially if the back is ever exposed to view, as it frequently is in dressing tables placed in a window. If the back of the job is to be against a wall, precision is not so necessary, though even then slovenly fitting should be avoided. The back edges of the top and the lining here will, in the vast majority of cases, be better if flush than if arranged with the top to overhang.

The back strip of lining may either be glued or screwed, according to the way the top is fastened to the stand or whatever it is to form part of. A moment's consideration will show the reason why. If the top is screwed or blocked down at back and front so firmly by the linings at these parts as to be bound and immovable, the provision which has been made by leaving the side linings free to allow of play in the top will be completely nullified—that is, supposing the back and front linings are both glued to the top. The conclusion, therefore, is that the back lining should be fastened to the top with screws, and that these should fit loosely at the necks; or, that if glue is used, the necks of the screws fastening the lined-up top to the job must fit loosely. To sum up about this part, it may be said that though the experienced worker may safely be left to decide for himself which course to pursue in any given case, the novice can hardly err by using screws instead of glue, always remembering that if screws are used to attach the lined-up top to the work, they must not penetrate beyond the lining into the top itself, unless their necks fit loosely. Enough has now been said to show how a lined-up top may almost to a certainty be insured against "going," which, for the benefit of those who do not understand the word in its technical sense, may be told is merely short for "going wrong." The grand secret to avoid this in lined-up tops the reader either is already aware from his own experience, or will have gathered from the foregoing instructions, is not to "bind" the top, but let it have free scope for natural play.

In describing the practice or way of going to work that ought to be followed, I have endeavoured to combine theory with it as far as possible, by showing, or at all events trying to show, the reason for taking each step in sequence in the operation from first to last.

OUR GUIDE TO GOOD THINGS.

55.—SYER'S JOINER'S CRAMP.

IN the present number of WORK I am enabled to call attention to some of the specialities of Messrs. Thomas I. Syer & Co., engineers, tool and work-bench makers, 45, Wilson Street, London, E.C., and I have all the more pleasure in doing this because it gives me an opportunity of saying that Mr. Thomas I. Syer himself is the principal of the Finsbury School of Practical Amateur Mechanics, whose workshops are in Finsbury Square Buildings, Chiswell Street, E.C., where classes are formed with the view of imparting practical instruction in elementary carpentry, cabinet work, wood carving and engraving, plain and ornamental wood turning, and metal working. Mr. Syer will also form classes for French polishing, upholstery, and fret cutting, as may be required, and will send prospectuses with terms and all particulars to any applicants. Private tuition is also given at any hour of the day in carpentry, cabinet making, turning, and carving. Mr. Syer is assisted in the several classes by competent instructors. The next term will commence in October, 1889, and I believe I am correct in saying that the class-rooms will then be found at 45, Wilson Street, Finsbury, E.C., Messrs. Syer & Co.'s new house of business. To return from this digression to

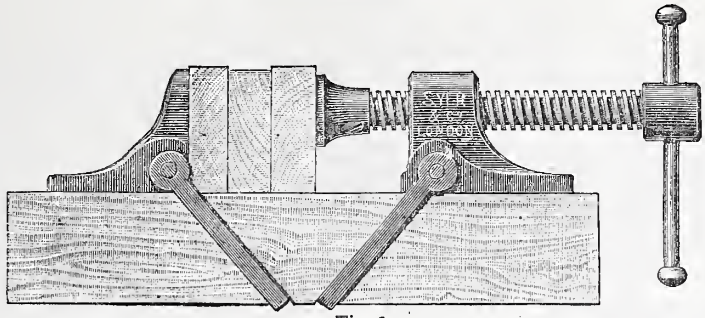


Fig. 1.

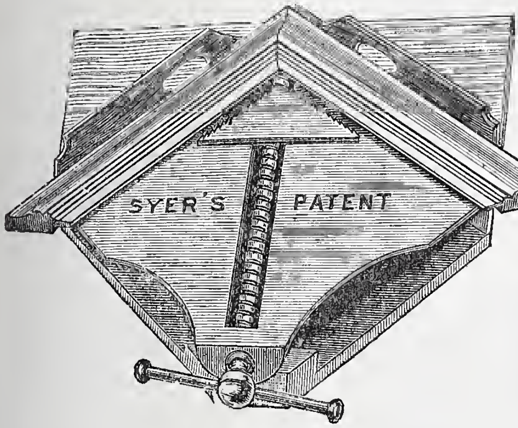


Fig. 2.

the joiner's cramp. The nature of this appliance will be understood from Fig. 1. It comprises a pair of metal heads made in three sizes:—No. 1, to fit over 3-in. by $1\frac{1}{2}$-in. wood bars, and capable of being used up to a length of 6 ft.; No. 2, to fit over 4-in. by $2\frac{1}{2}$-in. bars, and effective to a length of from 10 ft. to 12 ft.; and No. 3, to fit over $5\frac{1}{2}$-in. by 3-in. bars, and effective up to any length that the strain of the timber will stand—that is to say, speaking approximately, up to from 20 ft. to 24 ft. These are much used now by builders for very large work, as they are light and can be easily packed with the carpenter's kit. The prices of the three sizes—Nos. 1, 2, and 3—are respectively 8s. 6d., 11s. 6d., and 16s. 6d. per pair.

56.—Syer's Patent Universal Mitre Cramp.

This excellent appliance, useful alike to picture-frame makers, cabinet makers, and joiners, will secure any mitred joint true. Its principle is clearly shown by the illustration in Fig. 2. The cramp itself is first secured to the table or bench by G cramps or hand screws, and then the ends of two of the pieces that are to form the frame are planed up, if necessary, after being sawn or otherwise cut, and the pieces placed in the cramp as shown. The handle at the bottom of the cut is then turned, and by the action of the screw the triangular plate is pushed forward against the rebate of the moulding. The pressure of the plate is sufficient to close the joint and hold the adjacent pieces firmly enough to allow the nails to be inserted. It will be noticed that the pieces are held by the plate against the sides of the cramp, which do not approach each other so closely as to prevent the insertion of the nails. These cramps are sold at 21s. each, on wood stand; and at 23s. 6d., on well-finished stands of mahogany or oak.

57.—Syer's Patent Bench Knife or Back Stop.

The action of the Knife or Back Stop is shown in Fig. 3, which is placed in position on the bench, a pin on the other side of the plate and not seen in the illustration being dropped into

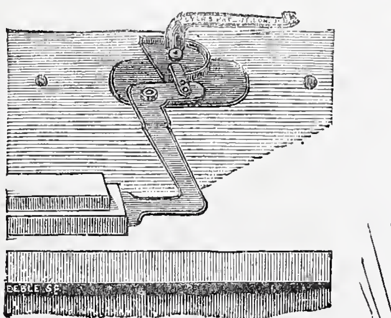


Fig. 3.

one of a series of holes made in the bench for its reception. The handle, which in this appliance is horizontal instead of vertical, as in the old pattern, is then pressed or pulled, and the bench knife is then pressed with force against anything that it is required to hold, the piece of wood, or whatever else it may be, being placed between the bench stop and the bench knife. These bench knives are sold at 3s. 6d. each.

58.—Brown's Patent Tool-Grinding Rest.

The Patent Tool-grinding Rest in Fig. 4 is suited for use on either hand or foot or power stones. As in the other appliances, the construction is apparent in the illustration. Two angle pieces of metal are fixed to the support or trough of the grindstone on opposite sides. Each of these carries a slotted arm, fixed to it by a fly nut. To the arms another iron framing is attached by the same means, and on the inclined piece in the centre of the framing the tool is supported during grinding. The slope can be fixed at any required angle, and the same slope can be easily obtained after examining the edge of the tool being ground, which cannot be guaranteed when tools are held by the hand only. It is made for and can be attached to any grindstone, wood or iron; and any person, however inexperienced, can use it. The price for wood trough and for stones up to 4 in. thick is 10s. 6d.; for iron troughs and stones of same width, 12s. 6d. A clamp for gripping tool on rest is supplied for 2s. 6d., in addition to the prices named.

59.—Syer's Registered Portable Work Bench.

This handy bench, which is illustrated in Fig. 5, is constructed in such a manner that it may be taken to pieces and quickly put together again with an ordinary spanner. The supports are of metal, which imparts extreme rigidity to the bench when all the parts are bolted together. The top is of deal, and is, in the bench illustrated, 6 ft. long and 22 in. wide, but other sizes may be had if desired. It is firmly bolted together from side to side, which prevents warping. The height is 30 in., and the bench at this height and size of top already mentioned is supplied at £3 12s., but 1s. extra is charged for every additional inch in

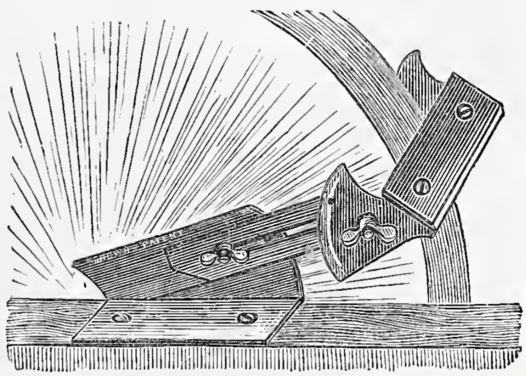


Fig. 4.

height. It is fitted with an instantaneous grip vice of the B pattern, with improved loose handle. With this vice, by a single movement, the wood can be immediately gripped and as speedily released. In front will be noticed a vertical board pierced to take pegs to support boards when in the vice. The bench is further fitted with a screw-rising wood stop of improved pattern, which can be easily raised or lowered to the required distance, and with the patent bench knife, already noticed, for which a series of holes is bored in the top to admit of its application to wood of any length. A strip of wood is shown in position on the bench between the bench stop and the bench knife.

The Editor.

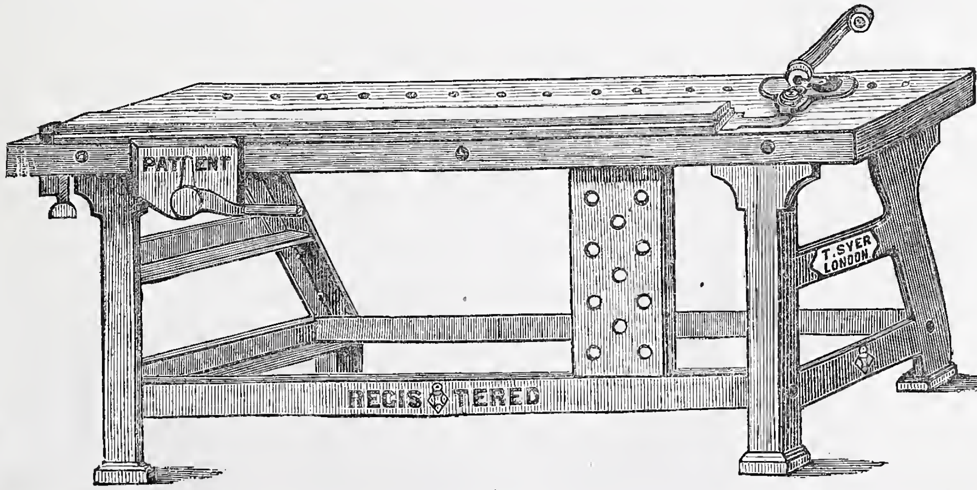


Fig. 5.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Work.—S. H. E. (*Plymouth*) writes:—"As a workman I desire to thank you for the production of WORK. I believe that it supplies a long-felt want, and, therefore, I wish it all success. There are several features about it which are quite unique, two of which I may mention. One is its scope—treating, as it does, of all kinds of work done by man; and the other is its thoroughness of treatment of each individual subject, even down to the most minute details."

Subjects in Work.—SCRIPTOR writes:—"I beg to congratulate you on the success of your paper. It is a great favourite in this district, and most helpful."—[I am glad to hear this, especially as you write from Ireland.—ED.]

"I trust you will be able to give a few papers on the construction of good, honest furniture; not the gimcracks which find so much favour with a certain section of the community, under the name of artistic. What I want is good strong chairs and tables—such as are to be bought in shops. A sideboard is on the *tapis* just now."—[Furniture, plain and strong, and, I trust, not altogether ugly by reason of its plainness and strength, will not be neglected; but our "artistic" furniture is by no means to be classed with gimcracks.—ED.]

"Why is it that engine boilers are never described in magazines like WORK? Are they too difficult for amateurs to attempt, or is it dangerous for the stoker afterwards? If so, I think you might set up an insurance office for those who come near amateur boilers, and then it would be all right."—[You must make terms with some accident company for a policy of insurance, especially as a contributor has an engine boiler in hand.—ED.]

"French polishing would also be very acceptable to me."—[You shall have it.—ED.]

"Kindly remember, Mr. Editor, that I do not wish to have a few years of WORK suddenly published in one number for my special edification. These are merely suggestions, and I will wait for them with what patience I can; in the meantime giving place to more worthy readers. I will do what I can, however, to perpetuate your magazine, lest it should come to a sudden smash, and so deprive me of one of my pleasures on Thursday mornings."—[WORK is so firm on its legs that there is no fear of your Thursday morning pleasures being brought to an end by a burst up, unless the engine boiler happens to go that way.—ED.]

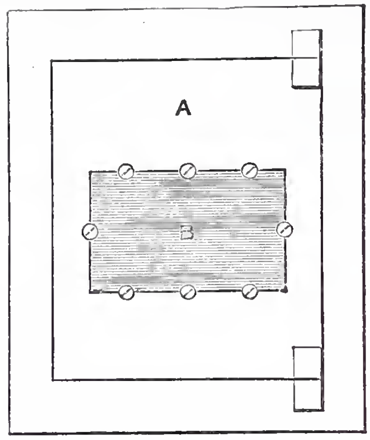
"When writing to friends I enclose one of your prospectuses, which I think a good plan. I am afraid they sometimes think I am an agent for its sale, which I am not."—[No, but being enthusiastic you do as much real good as any agent, and help the agents themselves. Please go on sending prospectuses.—ED.]

Wire Thread Fret Saw.—H. J. (*Shepherd's Bush*) writes:—"In accordance with your request in your appreciated paper, I have this day searched the indices of 26 vols. of the *Scientific American* at the Patent Office—viz., from 1870 to 1882—*re* the wire thread saw, and fail to see any mention of it. Perhaps O. F. could give a little more definite information as to the date he saw the article."—[I am truly obliged to you for taking so much trouble, and regret you should have had so much labour to no purpose. Possibly it may be mentioned in the *Scientific American* under some other name.—ED.]

Suggestions for Work.—H. J. (*Shepherd's Bush*) writes:—"I am very pleased to have such an organ on behalf of work as you are bringing out—such a thing being well needed; but I should be far better pleased, and I have no doubt many others would, if some of your correspondents would bear in mind that your title is WORK, *pure* and *simple*, neither for amateurs, professionals, nor apprentices; and frame their articles in a more simple matter-of-fact style, catering neither for one class nor the other, but for *workers* as a whole."

Home-Made Power Machine.—H. J. (*Shepherd's Bush*) writes:—"If you can see your way at any time to grant such, I would like to see an article (or series) on a *home-made* foot power machine that could be adapted to circular and scroll sawing, boring (wood), say, up to 1 in. in diameter; sawing, say, 3 in. or 4 in. of hard wood; and that could also be used for drilling and polishing metal, turning, etc. It seems to me that with different attachments all could be utilised with the same motive power (and which I would suggest, with its frame, should be described first, followed by its more important adjuncts in due order), though, of course, not all at once. An edge former or shaper might also be included—in fact, a sort of 'general joiner' for both wood and metal to a certain extent. Timber is cheap, and a handy man might rig up a machine at odd times that would, perhaps, turn out work to vie with a more highly finished affair costing £20 or £30 or more, and which he may never have if he has to wait till he can save up enough to pay cash down. I would also be glad to avail myself of J. H.'s kind offer and ask for a supplement to his valuable articles on home-made tools, describing how to make a metal smoothing plane with wood sole or base, as wood does not hang to the surface like iron, and therefore works easier; and if some means of adjusting the iron with a screw instead of by hammer, without infringing on other patents, so much the better."

Safes and Safe Locks.—INQUIRER (*Hull*) says:—"I am a whitesmith and locksmith by trade, and it often happens that some one has lost his safe key, and requires his safe opened and a new key. We used at one time to drill a hole through the door just where the bolt head of the lever lock comes, and force the bolt back; or, failing this, drill the head of the bolt clean away, and the door opens easy enough then; but now they are made with a hardened steel plate immediately behind the door, which we cannot drill; and the last one we did, we had to find the edge of the steel plate and drill it completely out, which, of course, means a new plate and a piece fitting in the door, which we fixed in its place by putting screws between the joints thus:—



I have taken WORK every week, and enjoy the 'Shop' corner very much; and I believe you are ever ready to help a young hand where you can; and what I want to ask your readers is, can they tell me a better way of opening a safe than the one described? The shop in which I work I served my apprenticeship, and there is only my master and I at work, and therefore I have had no opportunity of seeing any other man's ideas; and I should feel deeply indebted to you or any one who could tell me a good method of opening the safe. Also, I am told that in London they make safe keys to any key sent to them, which we do not do here in Hull, as we always take the lock off. Is there any book published that would give me any information on this subject?"

Another Encouraged One.—A. W. (*Liverpool*) writes:—"I had the good fortune to come across your excellent publication the first week it was issued, and have hailed every succeeding number with increased interest. This fact may surprise you when I say that I have never been a workman, either professional or amateur, circumstances, 'when I was much younger,' having turned my career into a channel which nowadays offers little inducement in the matter of remunerative occupation. I will tell you how I account for the interest I take in WORK. From my youth upwards I have always been fond of reading, and subjects connected with science, the arts, etc., were always the most attractive, among my first speculations in the way of books being Cassell's first series of Popular and Technical Educators; these, supplemented by evening classes in physics, mechanics, etc., whetted my appetite considerably. I have also visited workshops of various kinds, and always tried to learn something of tools, etc., when I could get the chance. You will see, therefore, that the foundation of my interest in WORK is not altogether built on sand. Now, the advent of WORK has raised a new hope within me—it has revived the latent yearning of years to be of more use to myself and those dependent on me; and I believe firmly that it will put me in the right direction. Your subjects are so clearly explained and illustrated that the average common-sense man can hardly fail to comprehend them. The advice and encouragement in which your journal abounds seem specially intended for such as myself; therefore I have ventured to address you at such length. Your reply, however, to H. D. (*Bury, Lanc.*), No. 6 issue, gives me a hope that I am not trespassing too much on your kindness. I also notice with particular satisfaction your reply ('New Inventions') to W. J. P., No. 8 issue; the position described is much the same as my own. I have had ideas from time to time which may or may not have been of value, but lack of means to develop them has always put the damper on. Your sympathetic remarks, however, to W. J. P. come like a gleam of sunshine. Some months ago I completed an idea in connection with domestic ventilation. I have not been able to learn, so far, whether my idea has been anticipated; therefore the principle and application of the appliance I shall submit is original to the best of my knowledge. With your kind permission I shall send a rough model with explanations when I hear from you, through WORK or otherwise. If through WORK, address A. W. Kirkdale, Liverpool. I am afraid this communication is too lengthy to merit your attention. In any future correspondence, however, I promise to confine my remarks to the subject in hand."

A Subscriber's Testimony.—C. S. (*Radford*) writes:—"I might say in passing I am highly pleased with your WORK. I waited for No. 1 with some impatience, and I consider it a long-felt want. It has come up fully to my expectations, and I wish it every success, which I am sure it deserves. I am doing some fretwork, and am going to compete at an industrial exhibition. I had so much on hand, I am sorry I had not time to make your cabinet for it."

Building Construction.—G. S. R. (*Tewkesbury*) writes:—"In reply to your request for the opinions of your readers, *re* plans, etc., for building, may I urge you with all my heart to carry out this suggestion? I know of others in my own profession who are placed as I am—that is, anxious and able to get their own house, but not able to meet with just what we want ready built. For months I have been thinking out and drawing plans for a residence—two-storey, with seven or eight rooms—and have drawn and redrawn them, as improvements came to me, but am still not satisfied. Now your splendid paper is just what I want in this direction. Its excellent articles on panelled walls and ceilings helped me greatly, and I intend having part at least of my new home left in the rough from the bricklayer's hands, so far as walls are concerned, and decorating by your valuable suggestions. In this connection may I ask whether a ceiling so treated would, or would not, look darker and heavier than the ordinary sort? Also, may I trouble you for your advice on this point? If the wall panels could be so made as to be covered with a sheet of glass, which should be kept in place by a removable fillet, would it look well or be bad taste to fill each panel with some picture, say a mount with photos, or a scene, etc.? If in accordance with good taste, I can see many developments of this idea. If you have room to reply, kindly do so to my initials. In conclusion, let me very heartily thank you for WORK. I can't say all I think of it, but if you knew how I treasure each number, and eagerly look for each new one, you would tell how truly valuable I feel it. On the completion of a volume, could you not prepare suitable covers for binding the numbers in? I intend having mine bound and preserved as one of my most valued books. When is the new kaleidoscope to be described?"—[The ceiling would of necessity look a little "darker and heavier" than the ordinary flat whitened expanse so called, because shadows would be cast by the beams or *quasi* beams. The description of the new kaleidoscope will appear shortly.—ED.]

Dyeing Osiers.—P. W. S. (*Poplar*) writes:—"On page 78 your conjecture that aniline dyes may be used for dyeing osiers is correct. That plan is preferred to staining for the more vivid colours."

Building Construction.—PLUMSTEAD writes:—"With very great pleasure I have read in 'Shop' of your last issue of WORK, in reference to plans, etc., for building, and would be extremely thankful to you to take up the same. I am about to lease a piece of ground of 40 rods, and want to superintend the building of a four-roomed house myself thereon with 15 ft. frontage. Seeing you would like to have the mind of your readers, I have ventured to write you. I am sure I have the same views as your correspondent: that according to the past and the valuable help WORK has been to me, your information would be most valuable."

Sale and Exchange Column.—CONSTANT READER (*Bristol*) writes:—"I think that all amateur workmen should be obliged to you for publishing WORK. I have got several men to take it in, and they are very pleased with it. I think if you would open an exchange column for readers it would pay you, and I hope you will shortly bring out a cheap way of electric bell-making for house purposes."

Japanese Fretwork, etc.—WAITING writes:—"I congratulate you on bringing out such a useful and interesting little paper as WORK. A teacher by profession, I spend a deal of my spare time in a workshop in the winter time, and in the summer I turn to brush and pencil. I have amused myself for the past five or six summers with water colours, but this year, with the return of the swallow, I began to try painting in oils. I find paints, brushes, and canvas rather heavy, having a very limited income, and have tried to make my own canvases. I cannot get a smooth surface, and it struck me I could get to know through WORK how the thing is done. I make a frame, stretch the canvas over it, size it, and then give it a coat or two of ordinary paint, but it does not turn out so well as bought ones, and I think I am perhaps wrong somewhere. If you would be good enough to give me this information through your paper, it may also help some other struggler. I hope you will soon bring out an article on painting. I am watching for it. I intend trying some of your fretwork patterns next winter. I like the Japanese patterns very much. The cornice design was beyond me. I haven't tools enough. I wanted one, but got three yards of tapestry, a length of felt moulding to go along the top, and cut some corner pieces in fretwork, which I covered with gold leaf, and made a capital one."—[Instructions on house painting will be given, but not on painting in oils for landscapes, figures, etc., as there are so many good text-books already in existence on this subject. You will find the Japanese patterns for fretwork, etc., very suggestive and useful. You have managed to make an attractive temporary cornice, but I am afraid you will not find it very durable.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Overhead Motion.—H. E. W.—If you have a fly wheel of 24 in. with a V groove I should recommend the overhead described in No. 8 of WORK; but if not, you might adopt that illustrated at Fig. 6, p. 92. The main shaft of the overhead may be about 1 in. in diameter, or ¾ in. if of steel. The drum is made of wood with brass caps at each end; it is built up like a barrel, and need not be more than 12 in. long to fix anywhere on the shaft; it may be 6 or 8 in. in diameter. The standards are of cast iron of elliptic section; the triangular section tie-bar at the top takes the thrust of the centre screws on which the main shaft turns, and it checks the fall of the weight if the band comes off. Weight may be about 4 in. in diameter. The overhead of the London Lathe and Tool Company, to be illustrated shortly, is a very good one. Adopt whichever of the three you like, and you will do well.—F. A. M.

Fret Cutting.—J. M. (*Perth*).—Trace the pattern with ink on ordinary tracing paper, and paste it on the wood; this avoids injury to the design itself, and is easier to work from. But if your knowledge of fret cutting is so slight I should not recommend the design referred to for some time yet.—J. G.-W.

Egyptian Trellis Work.—H. C. T. (*Newcastle-on-Tyne*).—I know of no firm in London selling this class of work. There is no great variety of pattern in the trellis work; the Egyptian is satisfied, as a rule, to repeat the same pattern continually. I have, I fancy, as many specimens of the work as are made; but, on looking round, I really do not think I have three distinctly different patterns. Variety is produced by the introduction of pillars alternating with the stars, the shape of the beads, etc., and the different colours of the woods used. The drawing you send is the staple pattern. I have, in papers about to appear in WORK, produced all the varieties of detail I have seen. The art is in the grouping of the patterns and in the designs of the brackets, etc., into which it is introduced. I hope, in the series of papers, to satisfy such inquirers as yourself. I am glad that my contribution has been the means of causing an interest in WORK. I am sending specimen copies to brothers in India, Australia, Demerara, and Yorkshire, all of which will, I hope, lead to new subscribers joining, as I shall ask each brother to show it to any likely friends. The fact of your doing work for a London firm in your own northern town would seem to prove that there is no firm in London who have taken up this style of work.—C. H. O.

[To this I may add that a caterer for furniture makers to whom I was speaking of the Egyptian trellis work the other day as a means of ornamentation that might be used with advantage in a variety of ways, threw, or tried to throw, cold water on the notion by saying that this kind of thing had been overdone in London, and that people were wearying of it. I still think, however, as I thought before the *douche* was applied. Having the principle of the work, it is possible to apply it in any number of forms by pressing differently shaped blocks and spindles into the service. For example, take a number of equilateral triangles as blocks, and connect these flat blocks by turned spindles, and see what a quaint but highly-effective trellis you will get, especially for outdoor work, for which this kind of ornamentation is very suitable, and a great improvement on the crossed lattice of every-day carpentry. If any of the readers of WORK, in making experiments in quest of patterns, hit on any combination of a striking and effective character I trust they will send their designs for publication.—ED.]

"Turning for Amateurs."—H. P. (*Canterbury*).—This elementary work, suitable for beginners, by the Rev. James Lukin, to which reference was made in No. 4, p. 51, is published and sold by the Britannia Company, Colchester.

Organ Building.—E.—In the papers on American Organ Building that are now in preparation everything that is of importance in the trade will be touched on, and made perfectly clear to the beginner.

Obtaining Patent.—J. S. (*Bristol*).—In making application for a patent it will be necessary for you to give your own name and address, and not to apply under an assumed name.

Brass-capped Bradawl.—D. W. M. (*Cork*).—These bradawls are supplied, carriage free, at 3s. per dozen, assorted.

Soda Water Machines.—W. H. C. (*Belfast*).—There is no intention at present of touching on the manufacture of machinery used in the preparation of aërated waters. Should it appear, however, that there is a widely spread demand for the description of such machinery, an effort would be made to meet it. I have said all I can say with regard to the advertisement pages in WORK, and can only repeat that if it be found possible to meet the wishes of yourself and many others with respect to these it shall be done.

Cleaner. — OIL. — The best oil for clocks or watches that I know—and I have now had eighteen years in the trade—is Kelley's, to be had of Grimshaw & Co., 33, Goswell Road, Clerkenwell, London, E.C., 1s. a bottle; or, I believe, by the box of a dozen, cheaper. State if clock or watch when ordering; it does not thicken, like most oils, after a few months. If unable to get it, I will gladly do so for you.—A. B. C.

Photographic Camera Making.—TRENCH.—This will not be neglected, but I think you will agree with me that this is best brought forward in the winter season, when photographers who can use tools can be at work for the ensuing spring and summer.

Tightening Chair Backs.—TRENCH.—Send a sketch of the kind of chair whose back has gone wrong, and show clearly what is amiss with it, and you shall have help. If directions are given in the dark, it is possible that they may in no way apply to the damage in your chairs. In asking advice in repairs it is always needful that the general build of the patient and symptoms, whether of fracture or of general debility, should be set clearly before the chair-doctor.

Column for Beginners.—TRENCH.—You want to get a knowledge of the first principles of carpentry rather than to have papers on making boxes, trays, and things of that sort. You will learn more by making the overmantel and secretary already described than in turning out a few simple things, for, after all, the sawing, planing, and putting together are the same in the one case as the other, or very nearly so. And in making your first article, pay a carpenter to show you how to use and sharpen your tools; you will find it money well spent. Nevertheless, your desire for a few small things shall not be forgotten.

Division Plate.—H. E. W.—You wish to fit one to your 5-in. lathe with back-gear, which has a wheel of only 5 in. in diameter; you say there is no room on the gear wheel, but that the wheel might have been 2 in. larger. I must conclude, then, that you are cramped sideways. I had a plate fitted in a similar situation by cutting away the casting of the headstock with the chisel, and so got in a division plate $\frac{3}{16}$ in. thick, made as a ring, so that the nut for securing the pulley to gear wheel could still be reached; a recess, or rabbet, was turned in the inner edge of the rim of the gear wheel, and the plate, or rather, ring, was turned to fit, and secured by rivets, which came between the rows of holes so as not to interfere. If you cannot possibly get your plate in thus, perhaps you could mount it on the tail end of mandrel, provided it comes through at the back of the headstock. As to the size and numbers of the holes, shape of division peg, etc., I think you will soon see an article on the subject. If you mean by "striking out" that you think you can set out the holes by compasses, I don't think you can make a division plate worth having that way.—F. A. M.

Wrought Iron and Steel Girder Work.—FEN MON.—You express a hope that the papers on this subject will be discontinued, because "there are plenty of journals devoted to the iron trade that better suit it, while more of the ornamental, the arts, and sciences seem more congenial to WORK." Yes; but how about the readers who ask for and like papers on the subject? It is impossible to ignore any subject because some are found who do not take an interest in it. Moreover, papers devoted to the iron trade are trade papers, and are purchased by masters and not by the men, and they do not enter so thoroughly into the construction, and explain the why and the wherefore of matters as completely and intelligibly to the young workman as the writer of these papers does. WORK is intended to be a good paper all round for masters and men, but more especially to enable workmen to get at the theory of their own trades through the practice described. To produce a paper that shall be equally interesting in all its parts to everybody is morally impossible, for nobody exists who has not his or her preference or proclivity both in work and play; so the next best thing is to endeavour to make a paper that is intended for all as interesting as possible to the majority of the readers. And if you are in the minority one week, you will be pretty safe to be in the majority the week after.

Patent.—AMATEUR (*New Southgate*). — To obtain a patent for your invention you must apply for it upon the prescribed forms at the Patent Office. These forms include a declaration, to be signed by the inventor, that he is the "first and true inventor," and the two other forms upon which the duplicate specifications must be commenced. These specifications must fully explain the meaning and the intention of the inventor, and be accompanied by sheets of drawings, when required, also in duplicate, and executed in Indian ink, with a very black line; and the specification must refer to these drawings, which are taken together to indicate the invention. No ambiguous language must be used, and the specification must commence with a *title*, and conclude with a distinct claim or claims, upon which the patent must stand. A provisional protection for an invention can be obtained which extends to nine months, when the specification need not be so full as for the patent, and no drawing is required. The English and French patents are quite distinct and separate matters, the only connecting-link being that, according to a law known as "the Convention," an English patentee has six months' priority should be elect to apply for a French patent. In the matter of foreign patents it is advisable to consult a patent agent.—R. & C.

Polishing and Soldering Aluminium. — ROUGE BUFF (*Battersea*).—Finished goods made of aluminium are polished on a dolly, or mop, revolved in a lathe, and charged with crocus; then finished with Sheffield lime, much in the same way as nickel. The dolly is made with soft linen or calico rags. The following white solders are said to be used for soldering pure aluminium:—(1) Aluminium, 20 parts; zinc, 80 parts. (2) Aluminium, 10 parts; grain tin, 90 parts. (3) Zinc, 5 parts; tin, 2 parts; lead, 1 part. The surfaces to be soldered must be scraped clean, and solid paraffin used as a flux. The following coloured solders are said to be used for soldering aluminium bronze: Hard.—Gold, 88·88; silver, 4·68; copper, 6·44 parts. Medium.—Gold, 54·40; silver, 28·60; copper, 18·00 parts. Soft.—Gold, 14·30; silver, 57·10; copper, 14·30; brass, 14·30 parts. The brass for this last solder is to be made of copper 70 parts and tin 30 parts.—G. E. B.

Electric Bell Battery.—SUPPLEMENT.—The Bunsen battery is altogether unsuitable for electric bell work. The Leclanché has been the battery in general use for this work for several years past. The Gassner dry battery deserves all the praise you may have heard about it. The cells are 4s. 6d. and 5s. each, obtainable in London from Messrs. Mayfield, Cobb, & Co., 41, Queen Victoria Street, E.C.; and in Leicester from Messrs. T. Gent & Co., Faraday Works, Braunstone Gate. An illustrated series of articles on electric bells is now in course of preparation for WORK.—G. E. B.

Bamboo Dealers.—BAMBOO (*Wolverhampton*).—F. Westbury and Benjamin & Co., Great Dover Street; Brandenburg, Queen Street, Finsbury; Ellmore & Sons, City Road—all in London—are dealers in bamboos. See answer to O. P. Q. in No. 14. I do not understand the part of your question asking how to order, I can only say it must be done in the same manner as any other business transaction, either personally or by letter.—D. A.

Oil in Planes.—J. B. (*Rochdale*).—You cannot get the oil out without spoiling them, or at least running great risk of doing so. The blocks are purposely oiled, both in order to improve them for working and to preserve the wood in perfect condition, so that I am at a loss to understand why you want to eliminate it. Few, if any, practical mechanics would regard a wooden smoothing plane as complete till it had been saturated with oil, a very common plan being to fill the hole with oil, after stopping it on the face, and leave it till absorbed. If the planes you wish to free from oil are new, and you find them too greasy to handle pleasantly, remember that time will effect the cure. I have said this to show the folly of trying to eliminate the oil; but if you are still determined to try you might keep the planes in a warm place to cause them to "sweat."—D. A.

Lettering Backs of Books.—J. S. (*Barnsley*). Assuming that your books are leather bound, beat the white of an egg and a few drops of vinegar to a froth; let stand some hours, and then draw off the clear glaire. Damp back of book with vinegar; when dry, give two coats of glaire; dry again, and place gold leaf carefully upon portions to be printed. Heat your letter stamps just so hot that water will not fizz, and apply with steady, firm pressure. Remove surplus gold with cotton wool.—OPIFEX.

Cleaning and Repolishing Dirty Tables.—HAIRDRESSER (*Great Dunmow*).—So much depends on the condition of the tables that one would almost require to see them before expressing a decided opinion on the best way to clean them; but I trust the following hints may be useful to you:—If the dirt and grease are merely superficial, and the wood has a fair amount of French polish on it, you cannot do better than make use of cleanser and reviver in one, composed of the following ingredients—vinegar, linseed oil, and glaze, or a small quantity of French polish. The exact proportions are not important; but, to guide you, say one pennyworth of each of the two first to half a pint of glaze, or half that quantity of French polish. A little of this cheap mixture goes a long way. Use it with a rag, and as often as you like, but continue the rubbing till the surface of the wood is glossy and dry. If the things have not been French polished, but merely oiled or waxed, you may wash them with warm water and soap; but don't saturate the wood. You must afterwards, when quite dry, either polish with a mixture of wax and turps or with French polish. The former is made by melting wax and adding turpentine, so that the mixture, when cold, is of a workable consistency. Use it sparingly, with an unlimited quantity of "elbow-grease." For French polishing proceed exactly as if the work were new, but unless you have some knowledge of the subject, you are hardly likely to make a good job with this finish. To tell you how to do so in the best manner for the various woods you name would require a page or two of WORK; but if you will tell me any one you particularly want to polish, I will direct you with pleasure. I may tell you that papers on French polishing will appear in due course. If the dirt and grease are thoroughly ingrained, the only way will be to plane or scrape off the surface till the clean wood is reached; but if any of your table tops are veneered be careful what you do, or you will go through the veneer.—D. A.

Column Support in Building.—THANKFUL (*Cinderford*).—The request made by a reader of WORK, under the *nom de plume* THANKFUL, is, I think, in part scarcely suitable for the paper. I take it that WORK is intended as a medium for general information; the main question involved in this query becomes personal. For general information I give the following figures, taken at random from various churches, giving the heights from floor to wall plate, the span of arch between nave and aisle, the height of columns and the diameter of columns, and, to a certain extent, must leave you to decide whether the arch you mention is supported by a column of sufficient strength or not:—

	Height to wall-plate.	Span of arch.	Height of column.	Diameter of column.
	ft. in.	ft. in.	ft. in.	ft. in.
1 ..	56 0	11 6	12 0	3 0
2 ..	36 6	22 6	7 0	3 6
3 ..	45 0	7 6	14 6	1 6
4 ..	34 0	11 0	11 0	1 9
5 ..	35 0	16 0	9 6	2 0
6 ..	42 0	12 6	10 9	2 6
7 ..	48 0	16 0	13 0	3 0
8 ..	47 0	14 0	13 0	3 0
9 ..	63 0	15 0	17 0	3 0
10 ..	33 0	13 0	16 0	2 6
11 ..	34 0	10 0	10 0	2 4

In the case you allude to the idea is, I suppose, to avoid creating too many or too ponderous obstructions in the structure, which must of necessity prevent some of the congregation from obtaining a general view. I can conceive of no other reason. From the above figures you will see that the column you mention has a diameter equal to No. 3, whilst the span is 16 ft. 9 in. as against 7 ft. 6 in. Strength of construction is made subservient to expediency; this is a mistake, certainly, in buildings which, like Shakespeare, are not for a time, but for all time. Personally, I should not run so close to possible danger; structural strength and stability should take first not second place. In answer to your second request, if the architect you employed has, to the best of his knowledge, fulfilled his part of the contract, how can you expect him to pay for an alteration you deem requisite, but which he, by his action, plainly does not? You must first prove a fault to exist. He evidently considers the building strong enough, for no sensible man would risk his reputation and practice by running a risk of which he was fully aware; and the collapse of a building under such circumstances must, in ninety-nine out of a hundred cases, mean collapse of business also. Nevertheless, he may, from want of sufficient data, make a mistake the result of which would be disastrous. The builder is in no way responsible for the work beyond fulfilling the scheduled requirements. The probabilities are that those who desire the alterations must also pay the piper.—J. M.

Binding Covers for Work.—W. S. W. (*Hunningley*).—A binding case will be prepared by the publishers of Work to contain a year's numbers, and the price of it will be about 1s. 3d.

Joiners' Composition.—There may be many in use, but the best I have tried is quite waterproof, and sets at once as hard as hard wood. It is called "choucha," and may be bought at Deed's leather warehouse, High Street, Bloomsbury, London. I think it is about 2d. or 4d. per ounce. It seems to be a mixture of gutta percha and shellac. I have used it in cabinet work, or to repair fractures. It is warmed over flame or by heat, and applied with a palette knife very thinly spread. Better also heat the parts to be joined.—J. C. K.

Plumbing Examinations.—J. G. (*Brighton*).—To answer fully the questions asked by J. G. would effectually destroy the chief object of these examinations, which are meant to test the capacity of candidates who wish to be enrolled as registered plumbers. My advice to J. G. is to apply to the clerk to the Plumbers' Company, No. 1, Adelaide Buildings, London Bridge, E.C., for the printed form furnished by the company to all plumbers who desire to be registered. This form contains all needful preliminary information.—G. S.

Painting on Zinc.—W. G. (*Brixton*).—I have painted on zinc both for indoor and outdoor decorative work, and would advise that for either the zinc should first be rubbed over or scoured with dry sandstone or grit, to create a roughness to hold the paint. For my indoor work (which I find stand remarkably well) I have used tube oil colours worked up with gum dammer varnish as a medium. The latter I prepare by dissolving the gum in turps and straining through muslin. A "dammar varnish" is sold which is probably much the same as mine. I have not found work thus done either peel off or blister. It is more difficult to make outdoor work stand than indoor. Some done by me seven years since without roughening the zinc and with gold size only as a medium has almost perished. The sun, and not rain or frost, is our worst enemy. I find that metallic colours, such as flake white, stand best. For merely useful outdoor work, such as spouting, the zinc is best *not* painted.—C. C. C. [As regards sizes and prices of rough articles in papier-mâché, W. G. is referred to Messrs. McCallum & Hodson, Summer Row, Birmingham.—S. W.]

Index to Work.—R. H. P. (*Broadstairs*).—Certainly an index will be issued at the completion of each volume of Work.

More Talk than Work.—Da Capo.—You ask if there is not more talk than work in Work. Assuredly not! How could you possibly learn any trade or art if your instructor held his tongue, and did nothing more than look at you and point and draw diagrams? In all teaching conveyed by the medium of paper, type, and ink, it is necessary to be as explicit as possible, even though the tuition given sometimes assumes the form of a lecture.

French Polishing.—A Constant Reader of "Work."—Information on French polishing will be given at no distant date.

III.—Questions Submitted to Correspondents.

E. M. (*Madrid*) writes:—"If you know of a practical book on the treatment of ivory, mother-of-pearl, tortoiseshell, and similar materials for such work as fan making, be kind enough to mention it and possible particulars in 'Shop.'"

Water Power.—J. L. (*London, W.*) says:—"Will any reader oblige by explaining in Work the reason why a turbine is of more power with the same amount of water available than an overshot or back-shot water-wheel? I can scarce understand its action."

Flour Paste Souring.—J. R. (*Skerries*) writes:—"Would any reader of Work kindly inform me of some means for keeping flour paste from souring and getting bad, so as to enable me to keep it on my office desk for use, instead of gum?"

IV.—Questions Answered by Correspondents.

Polishing Oak Floors.—D. A. writes in reply to H. N. (*Bexley Heath*), see page 174:—"Beeswax and turps, if properly applied, give a good polish, but not so brilliant as varnish. Probably the cause of failure is an insufficient application of elbow grease and a too liberal use of the wax polish. If a bright polish is wanted, use brown oak varnish."

Wood Colouring.—D. D. writes in reply to Ox Gall (see page 174):—"Take vandyke brown, ½ lb., ammonia, ½ pint. Mix and reduce with water."

Glaze for Finishing French Polishing.—D. D. writes in reply to W. H. B. (see page 174):—"Put 2 oz. of benzoin into ½ pint of methylated spirits. When the gum is dissolved strain through muslin."

French Polishing.—G. B. P. (*Birmingham*) writes in reply to T. A. (*Belfast*), see page 174:—"You should always varnish your fretwork, using no oil whatever, as the latter would work out in time. I polish my wood in the flat before cutting out, and then touch up with the brush. If you would let me know fully what you want to know, I would (with our editor's kind permission) let you know with pleasure, either privately or through Work. Editor has my address."

Solidifying Petroleum Oil.—H. B. S. (*Liverpool*) writes in reply to W. H. (*Liverpool*), page 110:—"It is not possible to solidify common commercial petroleum oil."

Solidifying Petroleum Oil.—P. W. S. (*Poplar*) writes:—"If W. H. (*Liverpool*) will name the purpose to which the solidified oil is to be put, I can help him, either in 'Shop' or privately." [Will W. H. (*Liverpool*) kindly notify if he desires the assistance offered by P. W. S. (*Poplar*), and in which way?—Ed.]

Joiner's Composition.—J. M. (*Louth*) writes:—"In answer to question by F. B. (*Guernsey*), page 158, I shall be very pleased to give him the receipt for which he asked, as follows:—Equal parts of beeswax and resin coloured with red ochre to suit the work. Red ochre for mahogany, brown umber for walnut; white wax use for ash, and other light woods. F. B. will have to be careful how he uses the red ochre, as a small quantity goes a long way; better melt the beeswax and resin, and add ochre to suit the job. Being a practical cabinet maker myself, shall be pleased to answer such correspondents as F. B. as far as lays in my power, not only because I am very pleased with Work, but because I am pleased to help any one that is anxious to improve himself. I, myself, am very pleased with 'Tips for Tyros,' the tip about picture-frame corners being very useful to me. I hope you will have a great success with Work, etc."

Etching on Steel.—Fen Mon writes, in reference to the reply given to Excelsior by G. E. B., in No. 8, page 125, under this heading:—"The powder Excelsior means will be, I have not the slightest doubt, sulphate of copper, commonly known as blue stone or blue vitriol. This, when dissolved in water, particularly if acid is present, will itself dissolve out iron or steel, and deposit in its place, as a spongy brown crust, metallic copper. The equation, leaving out the *water* of solution and crystallisation, is—

$$\left\{ \begin{array}{l} Cu\,SO_4 \quad + Fe \quad = Fe\,SO_4 \quad\quad + Cu \\ \text{Cop. Sulph.} + \text{Iron} = \text{Iron Sulphate} + \text{Copper.} \end{array} \right\}$$

Excelsior would get better results if, instead of soap, which is liable to dissolve away with water in fine parts, he heated the steel moderately, and rubbed it over with beeswax. Etchers have, instead, a complicated mixture for a novice to make. Then, with a sharp pointer or pen, be sure to expose the metal. If, when it has stood by, Excelsior does not think he has cut deep enough, before he takes off his wax he may change his solution for fresh, as it will only act so long as there is $Cu\,SO_4$ left in it. If he wants to etch other metals as well, nitric acid is best, as it will attack almost all metals, gold and platinum, etc., being about the only exceptions; but it is not a nice acid to use, staining the hands, and besides, very noxious fumes arise from it. I hope this will explain matters to the satisfaction of Excelsior."

Fretwork Patterns.—F. C. (*Cheadle*) writes in reply to W. E. M. (see page 174):—"Seeing in Work for June 1st an inquiry asking where the work on fretwork alluded to in that publication can be got, I have got the work, and have succeeded in getting some very pleasing patterns from it. It is published by Adams and Bishop, successors to Henry T. Williams, 46, Beekman Street, New York, price 50 cents. The copy that I have was bought at Messrs. Gleave and Sons, Oldham Street, Manchester.

Trade Notes and Memoranda.

The new battleships for the navy, eight in number, will each carry 4,550 tons of armour, whose maximum thickness will be 18 in. The principal armament will consist in each vessel of four 67-ton breechloading guns, having a calibre of 13½ in., and firing a shot of 1,250 lbs. weight, with a charge of 630 lbs. of powder. Besides these, each ship contains a secondary armament of ten 6-in. quick-firing guns, besides several smaller ones. We have it on the authority of Lord Armstrong that these 6-in. guns will pierce the armour of most of the warships now afloat.

A new line of railway between Liverpool and Manchester was opened on the 1st of June. There are already two lines, the Cheshire and the North-Western, connecting those cities, so that some rivalry may be anticipated. The new route runs from Victoria Station, Manchester, through Pendleton and Atherton, and passes just outside Wigan to join the present Lancashire and Yorkshire line from Wigan to Liverpool at Pemberton. Its total length will be 35 miles against 34 miles by the Cheshire line, and 31½ miles by the London and North-Western.

A paper on "The Origin of Bronze" was read at a recent meeting of the Paris Academy of Sciences by M. Berthelot. The author analysed specimens of metal from a statuette from Tello in Mesopotamia, and from the sceptre of the Egyptian King Pepi I., sixth dynasty, both dating back to about 4,000 B.C., and found them to be pure copper. He, therefore, argues the existence of a copper age between that of stone and of bronze, and thinks the latter is not more than fifty or sixty centuries old.

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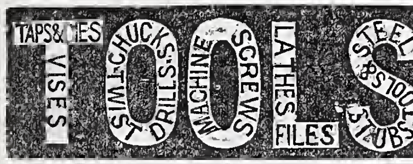

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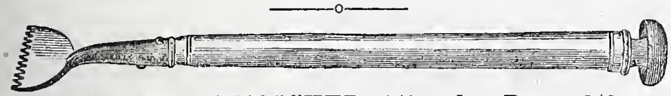

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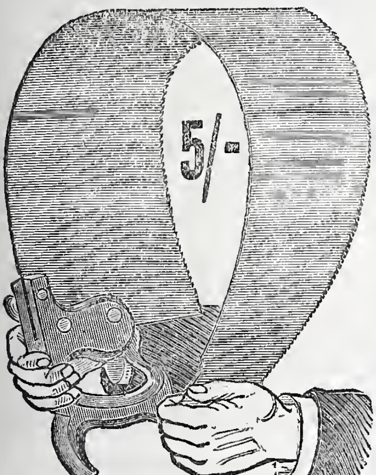

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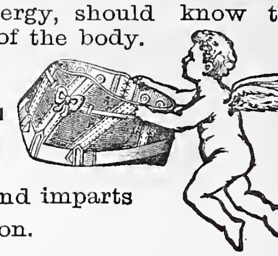

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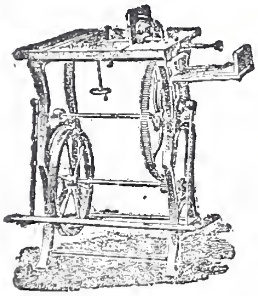

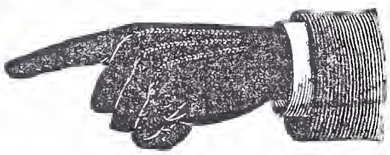

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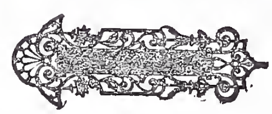

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 16.] SATURDAY, JULY 6, 1889. [Price One Penny.

AN ORNAMENTAL CLOCK CASE AND BRACKET.

BY J. H. MOODY.

Prefatory Remarks — Working Drawing — Demolishing Old Clock—New Top Piece —False Styles—Reconstruction.

The possession of ample means enables a man to indulge without stint in the purchase of things that are costly and massive, and to fill his house with articles that are pleasing and beautiful; but lack of the needful not only compels him to stifle his acquisitive longing, but sometimes induces him to resign himself to surroundings, the ugliness of which his impecuniosity renders him powerless to alter.

My readers will understand that I do not argue that apathetic satisfaction, amidst lack of beauty, is a natural consequence when a man's means are scanty; indeed, there are notable exceptions to be seen in frequent creditable efforts at decoration in humble domiciles; and some, also, that are even possessed of a high order of excellence; but if the efforts are only crude in execution and vague in design, as the work of an untutored savage, they are still to be commended for the good intention they manifest, and because they are evidence of a desire for a better state of things.

Now, it seems to me that it is part of the mission of Work to direct and order all these faltering well-meant efforts by showing how they may achieve good result; and they who are capable of good work may take counsel also; for even as it is said that everybody has something yet to learn, so it may be said that a man must be exacting indeed if he fail to find something to interest him in this magazine, or very undiscerning if he fail to perceive profit in the perusal of its pages.

It is quite possible for a man to attain mechanical skill if he earnestly strive for it; and if at the same time he apply himself to improvement in artistic ability, the time will not be far distant when the power to produce beautiful objects will be within his grasp; and if those objects be neither massive nor costly, I venture to say that their inspection will give pleasure, and likewise a vast amount of satisfaction to their constructor.

Fig. 1.—Ornamental Clock Case in Front Elevation (half full size).

But lest I be charged with misappropriation of space, I must hasten to introduce my subject, and it is imperative that I should quit the character of mentor and become for the nonce the aspirant who has accomplished a few easy jobs with *éclat*. Being big in the possession of a small stock of good tools, I looked around me, anxious, like another Alexander, for other jobs to conquer. I was, however, not long without work to do, and plenty of it—work wherein my proficiency would be tried. Here are one or two among the list:—An overmantel—to depose the one which had long done duty, and whose worn gilding had long been an eyesore—was my great ambition; then my books were becoming dilapidated for lack of shelves or case; the wife also suggests that a few brackets as receptacles for her treasures in the way of china would look well and assist in the embellishment of the walls of our best room. For my own part, I thought that sundry articles of domestic use might be improved and transformed in a way to suit modern ideas, and accordingly I gave preference to the following:—Among my belongings there was a clock that was a good servant in the household, and I determined that I would provide it with a case more important and ornamental than the insignificant one provided for it by its maker.

A description of this clock as it stood before alteration will give my readers some notion of the work I undertook, and will not tax space very considerably. The movement was a very ordinary brass one with pendulum, and the case was little more than a box with a plinth at front and sides, in which channels were cut to carry the bottom; the top was a flat piece of wood rounded on edge and bradded on; there was also a mitred framed door with glass panels; and the dial was printed on zinc plate. Altogether, my clock was such an one as our American cousins send away in shiploads.

The reader may express wonder that I took trouble over so paltry an article; but, as I have said, the clock had always kept steady time, and that, I apprehend, is as much as a clock, whatsoever its worth may be, is expected to do.

The ornamental case which forms my subject was the result of my deliberation, and when I took occasion to look about me for something to guide me, I could see no example in the clockmakers' windows to assist me. The inevitable marble clocks, said to be models of Pompeian relics or of Grecian temples, were too grand for me, and palled by their repetition. I turned then to the neat clocks in tastefully-designed wooden cases for relief; but their turned pillars and railed galleries did not quite satisfy me. At last I took my cue from some architectural detail, and I developed a very pretty cottage porch to suit my purpose. This is shown in Fig. 1.

The design for a new case being thus arranged, the first step was the making of a full-sized drawing of it. This enabled me the better to conceive how to alter my old friend's appearance, and I began work in earnest by demolishing the construction of the old case. This operation was performed with great care, in order that the severance of parts might be effected without abrasion or splinters; and my reason for preserving the parts from damage will, I think, be perceived, as the wisdom of such a course was apparent to me. When I came to review my clock's requirements, I saw that the same full allotment of width and height for length of pendulum and unwinding of spring were demanded in the new case as the old one had provided; and when the time came for reconstruction, my labours were greatly reduced, as much of the old work was used over again.

The old case thus, by disintegration, thoroughly lost its identity, and the *débris* remaining was examined as to how far the fragments might be adapted to contribute towards the building of the new design. Certain of the pieces, I found, were inapplicable; for instance, the old top piece not being large enough to provide the overhanging eaves, it was condemned, and a larger piece made; the door also was discarded as having no local habitation under new conditions. Among sundry other alterations, the doorway, which extended the whole width of the case, was narrowed by first planing the side pieces sufficiently to take away rebates that I found upon them; I then affixed false styles upon each side piece, to bring the aperture of the doorway within proper bounds. These styles also formed the backing for the two ornamental pillars. Planing the sides of course made them narrower, consequently it was necessary to plane away the side pieces of the plinth to match; and, that being done, the reconstruction was proceeded with. With slight alterations here and there, and a trifle of humouring, the case was soon ready for the attachment of ornament; and I must not omit to mention the cutting away of the front plinth for the top step, and for the setting back of the lower parts of the pillars, which also were cut with laps to bring their surfaces into close contact with the styles. In putting together, I ensured firm attachment of one part to another by using screws. I also used glue wherever its application would be attended by good results.

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Retrospective—Advantages of Changing Box—Dimensions—Materials—Stopping Light—Window—Holes for Hands—Hole in Front of Box—Sleeves for Hands and Head—Hooks for Lid, etc.—Eyes—Mode of Using Box—Preparing Plates—Utilisation of Box.

Now that summer is once more upon us, and hosts of photographic cyclists will be taking to the road with their wiry steeds and cameras, some description of an arrangement which I found of use may not be unacceptable to those readers of Work who are riders, though I can no longer call myself one of them. Still, remembering the glorious spins and occasional inglorious spills, the Saturday afternoon runs with their accompanying teas at the famous "Old Salisbury," or other well-known hostelry, I am one with them at heart. As I write how old memories come back: the sixteen assembled in the "Upper Chamber," which sounds better than "Attic," of Ironmonger Lane, there to settle the cycling affairs of the nation, or make as near an approach thereto as circumstances permitted. Portly, pleasant Tod, ably supported by dear old Sheppee, with the General, "Lord" Algy Darnley, Caledonian Craw, and others, who though "lost to sight are to memory dear." Then there's the Phairson with his celebrated song of "The Cat," Nairn (I wonder if he remembers his first ride up Muswell Hill on a sociable ?), MacCandlish, Lowe, "Sigma," and the rest of the cycling pressmen—ah! mentioning them reminds me of our "only Editor," him of the C. T. C. But to dwell on these reminiscences won't do; no further progress would be made than sometimes happened at, ahem, a council meeting of the N. C. U.; so mount and away, no more delaying at "Tally-ho Corner."

The changing box about to be described would be rather too cumbrous to be carried with ease on a bicycle, but on a tricycle I have taken it about without inconvenience. I do not say that it is more convenient than taking a number of dark slides with one on a ride, but on tour I have found it very useful, and at home it is hardly less so, when one wants to change a plate without going into the dark room. On occasion plates have been developed in it, though the space is rather too confined for comfort. Perhaps, to sum up its advantages, it may be said that it is very easily made, and that though not so good as some other forms of changing box, it is very inexpensive.

In size, it is 1 ft. 2 in. long by 9 in. wide by 10 in. deep, which I have found quite sufficient for changing quarter-plates. It is made of pine about ¼ in. thick, the various parts being fastened together with screws. The lid is hinged on to the top, or, as it becomes when the box is in use, the front. To prevent any light getting in round the edges of the box at the lid, these are lined on the inside with thick felt, just projecting above them. By this means a light tight joint is made without any difficulty. About the middle of the top piece a square hole measuring rather less each way, say, about ½ in., than a quarter-plate is cut. Round the edges of this hole a rabbet or recess is cut, within which a quarter-plate lies. This plate serves as the window for the box, and, it is almost needless to say, the light through it must be rendered non-actinic. This I managed by merely pasting some of the orange-coloured paper used by photographers over both sides of the glass, and subsequently oiling it to render it less opaque. The glass was then let into the rabbet, which, it should be stated, is on the inside of the lid, and not deeper than just enough to hold the glass. It will thus be seen that this is a good deal below the level of the outside of the lid, and is, therefore, to some extent, protected from injury. Without some other covering, it might seem likely to be frequently broken, and this objection has sometimes been made to it. All I can say to this is that the glass in mine has not once been broken, though I have used the box more or less for some years. Of course I have taken care of it, and protected it from rough usage. The glass is fixed in by tape glued both to it and the surrounding wood. This, I am bound to say, gave way once or twice, though it probably would not if the tape had been sufficiently wide. To prevent mishaps of this kind, I subsequently took a piece of calico, with a hole in it about the size of that in the top, and glued it down instead of the tape. This has been perfectly satisfactory.

In each end I cut a round hole to admit the hands. To suit me these holes are about 5 in. diameter, from which it may be inferred that No. 6 "kids" don't fit me, but in any case the holes should be quite large enough to admit the hand freely and allow of the sleeve-encompassed arms being moved about. These holes were cut with a fret saw, the pieces removed being kept and used subsequently as covers. This renders it almost unnecessary to say that when cutting them, the tilting table of the machine was adjusted so as to form bevelled edges. The thickness of the saw makes the covers fit in rather too loosely, a fault which is easily got over, however, by gluing slips of paper on the edges. By this means the covers may be made to fit perfectly, without any great skill in joinery.

On the front of the box a similar hole, but oval and measuring about 7 in. by 4½ in., is cut, the piece removed being also utilised as a cover. Through the holes in the ends the hands are passed to work inside the box, while the other one admits of what is done being seen. This latter is not absolutely necessary, as with a little practice it is quite possible to do what is wanted without the assistance of the eyes, though generally it is more convenient to use them. Of course, to prevent any light entering by these holes while plates are being changed, it is necessary to close them without in any way interfering with freedom of action. This may be easily managed by forming three sleeves or tubes of some flexible material, and I doubt if anything is more suitable than black holland and the "canary" coloured fabric sold by photographic dealers. A layer of each of these is used to form the sleeves, or, to express it differently, each sleeve is made of double material, one being black and the other the canary fabric. In diameter these sleeves, at one end at any rate, are rather larger than the holes they are to be fitted to. At the other end the size is not of so much consequence, provided that those for the arms admit the hands easily, and that the other one fits on the operator's head, or, rather, on his face. This latter may require some explanation, and I do not know that I can do better than state that the face is put in it and looks through it, as it were through a tunnel, into the interior of the box. The head sleeve passes under the chin, over the ears and the top of the head. To keep it in close, and also to prevent it slipping off, the edges are bound with a piece of braid-elastic. The outer ends of the arm pieces are also bound in a similar way, so that on the hands being passed through they closely grip the wrists, without, however, being so tight as to impede circulation. The elastic I have on my box is about 1 in. wide. The ring or garter of elastic is, of course, smaller than the full size of the diameter of the sleeves, which are what I think ladies call "gathered;" but this, no doubt, is part of the making, which will hardly be undertaken by men, and any member of the gentle sex will know how to do what is required without being told if the object is explained. In my own case it was so, and I can only hope others may be similarly fortunate, because I am quite unequal to the task of explaining the mysteries of the needle.

The other ends of the sleeves are fastened to the inside of the box with small tacks, so that when the covers are on they are not visible. The tacks should be pretty close together, and it is to allow of the sleeves being properly nailed down that it has been stated they should be a little wider than the holes. The length of the sleeves is not of much consequence: in my box, those for the arms are about 6 in., and that for the head about 1 ft. long.

To keep the lid close and the covers on when required I used nothing but small wire hooks. Something neater might be adopted, but they have served their purpose, and, by making them myself, I was able to get them just what I considered of a suitable size without any trouble. Four hooks are employed to secure each cover, and six for the lid, that is, two in front and two on each side. The hooks themselves are merely pieces of brass wire bent, with one end forming an eye or ring, through which a small screw nail is passed. To catch the hook over, the "eyes" are short round-headed screw nails. By first fastening the hooks, the exact position of these screws can easily be obtained; and if, at any time, the wire does not catch properly on them, a slight bend soon puts everything right. In this respect they are, perhaps, better than hooks bought ready prepared, as these might not be capable of such ready adjustment. In case any one does not understand the nature of these fastenings, it may be said that the side hooks shown in page 217 of Melhuish's catalogue will do admirably, the smallest size being preferable to the larger ones. Whatever sort are used, however, great care should be taken that they keep the lid close down to the box. As a matter of fact, however, it is seldom necessary to open the lid, as anything to be put in or taken out of the box can easily be passed through one or other of the sleeves. When the box has been stained black inside it is ready for use, but, of course, the appearance is much improved by staining and varnishing the outside.

The way of using the box may be explained as follows:—It is placed with the head sleeve upwards, the lid, containing the ruby window, away from the operator. The sleeves being drawn out, that for the head is first pulled over the face, and then the arms passed through their respective holes. To get the first arm through is not difficult, as the other hand can assist, but the other is more troublesome at first, though, with a little attention, it can soon be managed. Both hands being inside the box, and the eyes looking down into it, it will be found that the operations of undoing plate boxes, wrapping them up again, and all the movements incidental to changing plates, can be performed with the greatest ease. I have, however, found that plates were sometimes injured by the moisture of the breath, but having called attention to the liability to this mishap, it is not necessary to say more than that it can be avoided by not placing the face too close to the plate. Since I found out why the plates were injured it has not occurred. Naturally, owing to the confined space, the atmosphere soon becomes unpleasantly warm and close, but no great inconvenience need be incurred on this score.

In connection with this box, I may mention that I found it a great convenience to prepare the plates in pairs beforehand by putting them together with a piece of black paper between each. A small "dab" of gum or paste on the back of each plate kept them in contact with the paper, so that in changing, instead of having two separate plates with the loose backing to manipulate, there was practically only one. I may go a little further, and say that, by taking this precaution, I have changed many plates when out riding in a mackintosh legging for dark room. An elastic garter was slipped over each end of this, and the plates changed without looking at them. This, however, is only by the way, as it has nothing whatever to do with the construction of a changing box, any more than the mention of other kinds or of portable dark rooms.

The box described will hold camera besides other odds and ends, including the tourist's wardrobe when on tour, provided his impedimenta are not great, as they seldom need be for a few days' run, even though they consist of more than a comb and tooth-brush, and possibly a clean collar or two. When being carried about, the covers, which fit over the holes, hardly allow the box to be distinguished from an ordinary plain one.

Thus our box may be made useful in more ways than one, a desirable thing in these times, when so many things are "contrived a double debt to pay," and combination tools in which one article is made to do duty for three or four are so freely offered as an attraction to all workers on a small scale. And I do not think that many will be found who will quarrel with its adaptability on this score.

It is possible that some few, on reading the description that has been given above, and realising the fact that but little skill and labour are required in its construction, and that there is nothing about it to justify its introduction under some high sounding name, will ask why the subject has been brought under consideration at all. I trust, however, that in this case the result will justify the means, for it has been described in the hope that it may be as useful to cyclists and others as it was to the writer when he was one of "the sixteen"; for though, as already stated, no longer a rider, not the days "o' lang syne" nor "the auld acquaintance" are forgotten.

So "here's a hand my trusty frien',
And gie's a hand o' thine,
For auld lang syne."

A BLOCK PLANE AND PLANE WITH LEVER ADJUSTMENT.

BY A FOREMAN PATTERN MAKER.

A Word in Season—Shell of Block Plane—Patterns—Metal and Wooden Boss—Screw—Qualities of Shop Planes—Pin as Fulcrum for Lever—Lever Fittings—Cutting Iron—Merits of Wooden and Iron Planes—Metal Plate on Sole of Wooden Plane.

I have noticed once or twice in "Shop" expressions very nearly amounting to strictures with reference to instructions given on the methods to be followed in making certain tools at home, when the tools that are described may be purchased of most hardware merchants and dealers in tools. Others again show as much desire as others evince disinclination for papers such as I am now about to write, and declare that the information that they derive from them is alike useful and welcome. Doubtless there is much to be said on both sides, inasmuch as some have neither time nor inclination to do anything of the kind for themselves, and others are better pleased to use anything that has cost them both time and trouble to make better than the best of its kind that can be purchased at the tool shops. I think myself, however, that the time spent in reading the article is by no means lost, nor the space that is taken up by it in the magazine to be regarded as wasted, for due comprehension of the construction of a tool invariably leads up to better ability to use it. It is far from likely that every reader can find equal satisfaction or benefit from the perusal of every paper, but it is possible to rest contented even with that which may not be immediately profitable to himself when he remembers their importance and utility to others.

Figs. 1 and 2 represent in plan and section the shell of a block plane, which is made either in iron or in gun metal, in various sizes, and under various modifications. It is, however, only worth the trouble of making when not of very small size; useful dimensions would average from 6 in. to 8 in. in length.

I do not show the plane complete, because the wedge and screw are precisely like those shown in Fig. 3, and the same description will apply to both. The latter, Fig. 3, shows a very neat little plane with a lever adjustment for the setting of the iron, and one that can be made without much difficulty. These are to be bought in the shops, but any one possessing a moderate degree of skill in metal working can make two or three of different dimensions for home use.

In each case construct the patterns exactly like their castings, except, that in Fig. 3, the little socketed recess in the piece A will be left to be afterwards drilled and countersunk, as also will the small holes at B and C. Lest the very thin sides should become rammed inwards or outwards by the moulder, plane up a temporary bridge of wood to just fit between the sides. This will preserve their parallelism, and when the sand is rammed sufficiently around the sides the moulder will remove it, and complete the work without risk of getting the sides away from their correct positions.

In Fig. 2 a common wood screw is cast in the metal boss, B, to receive the circular wooden boss, C, which is struck with the hammer in order to release the iron. The pattern of the arched lever, D, Fig. 3, will be cut from a bit of hard close-grained wood, also like its casting. A pattern is also made for the screw, E, whose head is milled in the lathe. If made in gun metal the screw and head may be in one piece; if formed in cast iron the screw should be cast into the head. That portion of the screw around which the milled head is cast is made angular, square, or otherwise, to prevent it from working slack with use.

The planes sold in the shops are almost always cast in iron. But the iron is of a specially soft and tough quality such as cannot be always procured in ordinary foundries. In such cases it is much better to use gun metal which will not easily fracture. In such light castings the cost is very little in excess of iron because the labour counts for more than the metal. In any case I should have the lever, D, made in gun metal; even when made of good iron, these levers will often break when a slight excess of pressure is imparted in turning the screw for tightening the iron. I should also have the screw and milled head cast in one in gun metal, rather than cast the screw into the milled head, the screw being apt to work loose in its casting in the course of time.

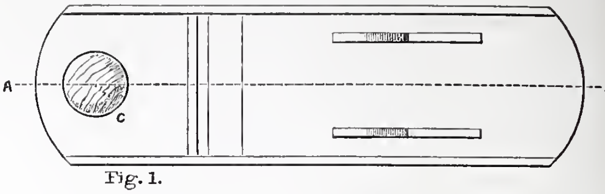
When cast, file the faces, and drill the various holes required.

A pin is made to bridge across the casting at B in order to afford the necessary fulcrum for the lever. This is riveted in holes which are slightly countersunk.

For the lever fittings in Fig. 3, get a bit of steel bent round, and file it to the outlines in F, Fig. 3, and Fig. 4, filing out also the recess through which the lever, G, operates. Drill the holes, C, H; prepare the lever, G, Figs. 3 and 4; pivot it in place, and then pass the pin, C, through, which attaches the rocking lever, F, to the plane.

The assistance of a smith must be obtained for the cutting iron, Fig. 5, which will be ground to size and serrated while yet untempered. These serrations, as well as those on the rocking piece, will have to be done very carefully and regularly. They number about five or six to the ⅛ in., and are sunk to about $\frac{1}{32}$ below the level of the under face of the plane iron.

To cut these serrations, get a cold chisel of the same width, and ground slightly keener than the ordinary chisel. Lay the iron on a piece of metal, and, holding the chisel transversely at right angles with the edge of the iron, strike it a smart but dead blow. That will not only indent the metal, but will raise a burr or ridge formed by the displaced metal. This ridge will guide the chisel for the next blow, and so on in succession like file cutting. If the chisel becomes only slightly dulled, re-grind. It will be as well to practise the cutting first on a bit of wrought iron or steel before tackling the actual plane iron. A shorter but otherwise similar series of serrations will be cut upon the top of the rocking piece, Fig. 4, and care must be taken that they are both at right angles, and at the proper pitch or distance, as otherwise they will not enter and mutually coincide.



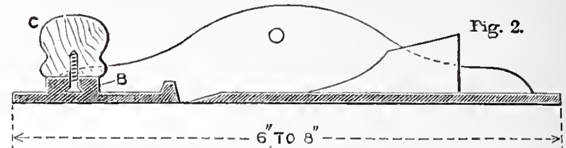


Fig. 1.—Casting for Block Plane. Fig. 2.—Section through A A.

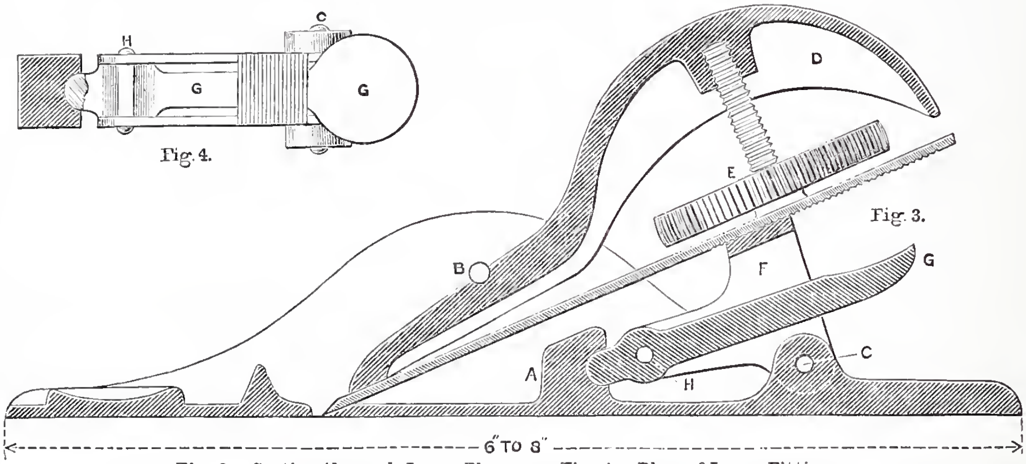


Fig. 3.—Section through Lever Plane. Fig. 4.—Plan of Lever Fittings.

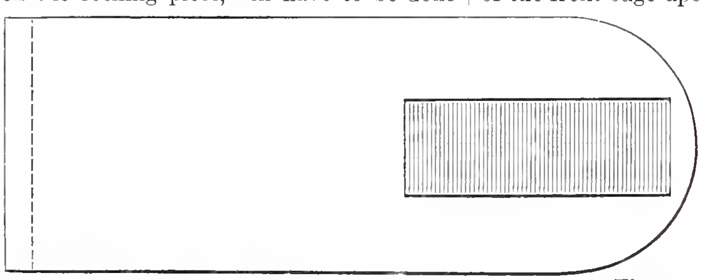
The only fitting about the lever is that involved in the coincidence of the groove, Fig. 3 B, Fig. 6 A, with the pin, and that of the front edge upon the iron.

When the iron is set approximately flush with the face of the plane, the milled wheel, E, is turned, tightening the iron. Then by the simple movement of the lever, C, upwards the iron is thrust forward, increasing the thickness of shaving: by its movement downwards the iron is drawn back for removing finer shavings. Thus no hammer is ever used on the plane.

A great deal of difference of opinion exists respecting the relative merits of wooden and of iron planes. The reason is not far to seek. Many of the planes sold are such utter rubbish that they will not stand ordinary wear and tear. A broken wedge, due to an extra turn of the screw, and a broken body due to a fall, are not unfrequent accidents. The reason is that they are too often made of the commonest cast iron; and so a tool having good inherent qualities has been consequently brought into some disrepute. But this certainly does not apply to the best iron planes, although, even in these, more care is necessary than in those of wood. An amateur also making his own planes will see to it that good metal is put into them, or will have them cast in brass. For the best indoor bench work, as cabinet making, joinery, pattern making, etc., iron planes have their own special value. Speaking of the writer's own trade, he would deem it quite exceptional to find a workman destitute of at least two or three metal planes. One of the advantages of these tools consists in their weight, another in the greater rigidity of metal over wood, by virtue of which they readily remove fine shavings and operate on cross-grained timber; another is that the sole does not become worn out of truth so rapidly as wood, and lastly they are not affected by heat or moisture. For the lighter and best classes of work, therefore, and for some special purposes, these planes are of service, and I have preferred to describe the making of planes of metal rather than those of wood, because the latter, as a rule, do not offer the same difficulties to amateurs and workmen as the former.

Sometimes a compromise is made in the case of wooden smoothing planes by screwing a plate of metal to the wooden sole, but this has obviously only a limited application.

Referring once more to the manufacture of home-made tools, it is, of course, infinitely easier for the majority of men to work in wood than in metal; and it is this facility in wood working, as compared with dealing with metal, that inclines most men to work in the former rather than in the latter. This, however, should not altogether tend to induce men to discard metal for wood because the former happens to be more intractable.



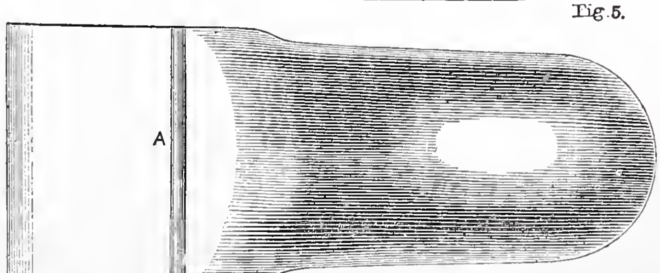


Fig. 5.—Cutting Iron. Fig. 6.—Plan of Lever.

SOME LESSONS FROM AN OLD BUREAU.

BY DAVID ADAMSON.

(*Continued from page* 182.)

ATTACHMENT OF TOP PIECE AND END—MORTISE AND TENON—GROOVE ACROSS ENDS—"RAGGLING" PLANE—FITTING TOGETHER—SUPPORTS FOR ENDS OF DRAWERS—KEEPING RUNNERS IN POSITION—INFLUENCE OF ATMOSPHERIC CHANGES ON WOOD—POLLARD OAK—SPLITTING OF OLD WOOD—DUST BOARDS—THEIR PREPARATION AND FITTING—LID BEARERS—THEIR FITTING.

No special instructions have yet been given regarding the attachment of the top piece (No. 3) to the ends, and it merits a few remarks.

The difficulty of cutting dovetails all along the ends of it and the grooves to match will no doubt have been anticipated while fitting the rails. To manage them neatly will likely tax all the skill of the amateur, while the longer spaces to be fitted to each other in the top will probably be more than he can accomplish. A loosely-made joint—that is to say, the one in which the dovetail slides in so that it does not fit tightly to its groove, is comparatively easy, but then the efficacy of the joint is largely nullified. Rather than have a badly-made joint of this description, it will be better, besides being simpler to construct, to take advantage of the ordinary mortise and tenon, being careful, of course, that the mortises are not cut through the ends. This must not be regarded as a makeshift, suggested by the supposed incapacity of the amateur, for it is a legitimate method, and one that would probably be adopted by the great majority of competent artisans in similar constructions. Many of them also use the same joint, the tenon, for the rails. The top, of course, ought, when the ends are cramped up and the tenons driven home, to fit closely up to the ends of the bureau, but it will probably be found more satisfactory to house each end of the top in a groove cut right across the ends. These grooves need not be deep; in fact, they should not be more than sufficient just to allow the top to enter them. Those who do not mind expense may cut the grooves with a plane constructed for the express purpose of cutting grooves across the grain. It is one not often found in even professional workers' outfits, and as there may be some who do not know that such a tool, though it is not a new one, exists, mention is made of it here. It is called a "trenching" plane, though possibly it is known by other names as well. In "Auld Reekie" it would probably be recognised more quickly if inquired after as a "raggling" plane. In its absence the groove, however, can readily be cut by ordinary tools, a chisel or two, used with care, being all that are absolutely necessary.

Mention has been made of the top being of thin wood, lined up in front of the desired thickness, but special instructions will scarcely be needed after what has been said about the bottom rail, which, if one may so call it, was a reversed lining up. When all the parts mentioned so far have been prepared, it will be as well to fit them together to see that everything is correct, but do not use any glue yet, as they will have to be pulled apart again. We have, as yet, only got bearers or supports for the drawers in front, but there must be other pieces from back to front to support the ends of the drawers, and on which they may slide backwards and forwards. The small upright divisions between the two top drawers, and between these and the lid bearers, should be fitted before proceeding further. They may best be fixed by tenoning them and cutting mortises in the top and in the rail below. The centre division needs no remark about its position, as it may be supposed that any one will be able to ascertain this without being told how; but about the others, those which are between the drawers and the bearers (No. 30),* there may be some hesitancy. The space between them and the inner sides of the ends should be just the thickness of the pieces (No. 30), so it will be as well to have these ready planed up, in order that it may be ascertained to a nicety, or else to keep the space small and plane down the bearers to fit, which is, perhaps, if anything, the better plan. I daresay it will be understood that these bearers are to work backwards and forwards like a drawer, so the importance of fitting them properly will be recognised at once. The pieces now required will be Nos. 31 and 37. The former must be fitted into grooves—say, ⅛ in. deep, running from behind the bearers to the back of the ends. They should be attached to the bearers by a tenon. But Fig. 9 will explain the construction better than any mere verbal description. A is the end of the bureau, B a drawer bearer, and C a drawer runner. These runners must be exactly the same thickness as the bearers to which they are attached, otherwise the drawers will not fit accurately however well they may be made. Not only must they be of the same thickness, but their upper and under surfaces must be level with those of the rails. Now, when all this has been done, it will be seen that the ends and fronts of the drawers will be supported, but some means must be employed to keep the runners in position. The grooves certainly prevent them from falling down when the weight of the drawers is on them, and the joint connecting them with the rails may be enough to keep them from shifting; but they will be further held in place by the boards, which next claim attention. But why not glue them to the ends, thinks the novice, for that, surely, would be strong enough, and save a lot of labour. Yes; certainly it would be *strong* enough, and at first sight it might seem a very feasible method, but a little consideration will show why it is not suitable. As this is one of those details of construction in which inexperienced workers are apt to go astray in their anxiety to glue up and screw up every part to the utmost of rigidity—I don't allude specially to amateurs only here—a few remarks may not be amiss by way of explanation. All wood is more or less susceptible to atmospheric changes. It swells in a moist atmosphere, contracts in a dry—not to any great extent, perhaps, but still appreciably, however well seasoned it may be, the balance of movement being towards shrinkage or contraction for a very considerable time, unless the wood has been thoroughly dried before working up. I allude, of course, principally to interior domestic fittings, not to wood out of doors, where, naturally, the changes are much more apparent. Watch a wooden gate or door, for example. During a long protracted season of dry weather it shrinks so much that it fits quite loosely. When winter comes, or a long spell of wet, cold weather, the same door could do very well with a shaving or two off it. Precisely similar changes, though in a modified degree, occur in all woods, and this natural play must be allowed for and provided against, or it will result in unpleasant consequences. Fortunately the difficulty of contending against it is greatly reduced by the fact that the movement is only lateral, not lengthwise—that is, a plank will only shrink in width, while its length remains the same. It is, perhaps, strictly speaking, not quite correct to say that wood does not contract or expand in length, but the alterations are so slight that, practically, they need not be taken into account. Take a very common instance of shrinkage in wood, viz., the machine-made imported door of a modern medium-class house, put up by that adept in meretricious work, the speculative builder. Look at the gaps between the parts, and remember they all arise from the rails and styles having become narrower, not shorter than they were originally cut, through shrinkage. The same action takes place in the unseen parts, such as the tenons, so that general ricketiness is the result. Now, in fitting the drawer runners to the bureau, it will be seen that their grain runs across that of the sides of the bureau. These sides are almost certain to expand and contract, but the runners will remain of their original length. Well, if the two are glued together, no play is permitted to the ends, which, in that case, are almost sure to split, so great is the tensile property of wood. If, on the other hand, the construction is such that they can expand or contract, the alteration being equally diffused over the width, no harm will ensue, and the slight alterations will pass unnoticed.

I have said that some woods are more uncertain in their action than others, and while we are on this subject I may say that oak, especially the variety known as "pollard," is one with which considerable allowance must be made. It may be some satisfaction to know that action can be largely stopped by stopping the grain up, as is done by polishing. But, say some, surely all this could be prevented by the use of properly seasoned timber. If this

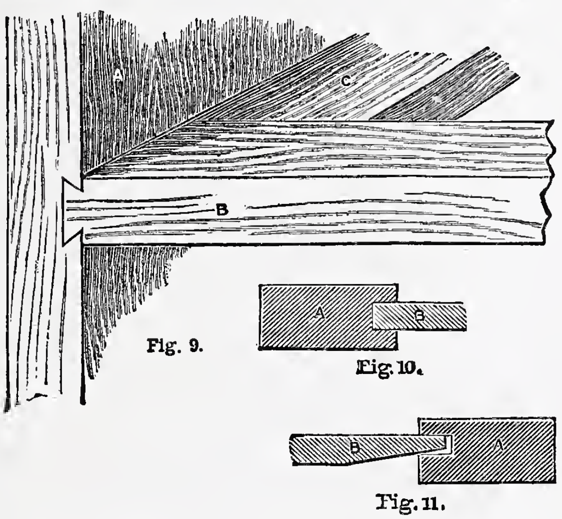


Fig. 9. Fig. 10. Fig. 11.

Fig. 9.—End Bearer and Runner. Figs. 10 and 11.—Fittings of Dust Board.

* For references to all numbers as above, see "List of Pieces of Timber required in Construction of Bureau," page 115.

were correct all cabinet makers would be delighted with the information, but, unfortunately, it is not more reliable than a good many more opinions of the same type. One who knows anything about the subject would not be surprised at the person making such a remark asking why a mahogany slab, 6 ft. wide, could not be made without a join. I would just like to ask those who have such great faith in old work and thorough seasoning, how it happened that one of the ends of the old bureau, which we are taking these ideas from, split from top to bottom, so lately as a couple of years ago. It could not be because the wood was unseasoned, so the explanation must be sought elsewhere. It is simply this. The bureau had been, for some time previously, in a cold, damp place, which had swelled the wood. It was removed to a room continually warm and dry. The wood consequently contracted and cracked, the immediate cause of the crack being a piece of wood fixed across improperly, and so preventing equal contraction.

I have been induced to dwell at some length on this, because it is rather an important lesson to be learned from our old bureau. Having noted it, the fixing of the runners may be proceeded with in the greater confidence of increased knowledge, and as the same principle applies in all similar construction, acquaintance with it will prevent many errors. Perhaps it may ere this have dawned on the reader that the intention of this article is not solely to teach how a bureau may be made, but that useful lessons in joinery may be gathered from it. The same principles are found in all good woodwork, and those that are correct in one piece of furniture are equally so in others. Details may, and must, vary, but the rules of construction do not. Why do I say this? Simply to help the amateur to devise and construct for himself without being obliged merely to copy or to follow minute instructions, giving him every detail of what to do without reasons. In short, the desire is that this article may be educational, leading the worker to think for himself, not simply to "cram" him. Even should he not be desirous of making, it will, at least, give him some ideas how to recognise and appreciate sound, reliable work, and to distinguish between that which is false and that which is correct. I speak now only of constructive not of ornamental details, for as sound construction is, or ought to be, the primary consideration, merely decorative effects must be left for future consideration. May I here say that if I omit to make any point of importance clear to novices, I shall be most happy to do what I can to rectify the defect by answering questions which the Editor may see fit to insert in "Shop."

The fact that wood does not shrink in length is taken advantage of in fixing the thin pieces, sometimes technically known as "dust boards," in such a way that they hold the drawer slides firmly in their places. These boards are sometimes omitted between drawers, and in that case the only way to fix the slides is to run a nail on the slant through their ends into the main piece, and it is just as well to adopt this plan even with dust boards. This still allows a certain amount of play in the end pieces, limited in extent, but generally enough. If the nails were driven straight through at frequent intervals the desired object would be nullified. In the specification these dust boards are given as ½ in. thick, but this thickness is by no means important, for if more easily obtained ¼-in. stuff will do equally well. Whatever the thickness a groove must be ploughed along the inner sides of the runners, and continued in the same line along the back edge of the bearers. Fig. 10 shows what is meant. The drawing is given in section, A being the runner or bearer, as the case may be, and B the thin board. It will readily be seen that on the thin board being pushed home into this groove, the runners are firmly held against the ends without risk of shifting, and that a very slight fastening is necessary. When finally putting all the parts together the dust boards may be fastened to the bearers with glue, but not to the drawer slides, in the grooves of which they are free to expand or contract without splitting. It is not meant that they should be loose, for unless they are immoderately tight, any reasonable degree of close fitting will not make them split. These boards, it may be stated, need not run to within a few inches of the back, but it makes a better job for them to go fairly close, and the same applies to the runners. To save unnecessary labour in planing over the whole surface of somewhat thick but otherwise suitable board to make it fit in any given groove that it may be most convenient to plough, the edge only may be planed to a bevel as shown in Fig. 11.

In another respect besides this method is advantageous. The board need not be so exactly cut to length, for the bevel-shaped edge acts as a wedge, and if at all fairly fitted tends to keep the slides firmly pressed against the ends. We have only to follow out the reasons why the dust boards are useful, so far as keeping the slides in position is concerned, to see that instead of nails driven in as previously suggested, a narrow strip, say, some 2 or 3 in. wide, driven into the runners at the back only would answer every purpose. Now, the plane called a "plough," used to cut grooves of this kind, very likely is not found in the possession of the worker, and though undoubtedly a most useful tool, it may be dispensed with in the present case by those who don't care to get it. The cutting gauge, with a little manipulation, will cut the sides of the grooves, and the waste wood between them may be removed by a small chisel. It is astonishing what may be done by the aid of simple tools used with dexterity, for though improvements may be very convenient, it by no means follows that they are necessary. In the present case the chisel may be regarded as a plane without the wooden stock, which serves to keep the blade in one relative position to the piece being cut, and at the same time by not allowing more than a thin shaving to be removed at a time prevents any tearing up. Bearing this in mind it will be seen that the proper way to hold the chisel is with the bevel underneath, and to be careful not to dig it too far into the wood. When the work is fitted up at this stage it will be noted if the lid bearers are put in that though they slide backwards and forwards, they are only prevented from lateral movements, on one side of each, by the ends. The small upright division separating each from the drawer next it is the only thing to prevent them being springy or strained inwards, and this is hardly sufficient, unless, indeed, the divisions have been made much wider than named. Instead of making this unduly wide, another plan will be found to answer better, and it is this. Immediately behind each division, and of exactly the same thickness, fix down with glue or screws to the runner a piece of wood—width not important, but ¾ in. or 1 in. will do very well—extending nearly to the back. Against this guide, on opposite sides of course, both the lid bearers and the drawer will slide, and any side shake in either of them be prevented. A similar guide will also be required between the two drawers, with the addition of a slide on which they may run, for it will be seen that the board is lower than the front rail, and there is nothing on which the inner ends of the drawers can rest. Now, there are several ways of fitting this part, but one can hardly do better than follow that adopted in the old bureau.

First of all a piece some 2 in. wide, wide enough to let the drawers rest on it, must be made just so thick that, when it is on the dust board, its upper surface will be flush with that of the bearer. Another piece, the counterpart of those separating the lid bearers from the drawers, will also be required to keep the drawers apart, and prevent them from being strained towards each other. Now, bearing in mind what was said about the play of wood, it will be quite clear that it will not do to glue the centre runner to the dust board, so that some means must be used which, while sufficiently efficacious in keeping the construction securely together, takes into account the properties of the material of which it is formed. Well, we have all that is desired in the method now proposed. Cut a tenon on one end of the piece that is to rest on the runner, and a corresponding mortise in the back of the upright division (the centre one), so that when the joint is complete, there shall be just the thickness of the runner between the dust board and the piece which is tenoned. Glue or nail the runner to this piece, put the tenon in the mortise, but not quite up to the shoulder, and then near the back run a brad through the runner into the board below it and we have all that is necessary. This, though possibly not the most common way, is thoroughly good; and it has the great merit, especially to the amateur, of being very simple, besides which, it is, as I have said, that taken by the maker of the old bureau. Proceeding from the top row of drawers to the bottom one, it will be seen that drawer runners or slides must be fitted there at the ends, for the front bearer is higher than the bottom board. Of course, the slides must be on a level with it, and it will suffice to fasten them with a touch of glue in front and a brad behind. Strictly speaking, this ought to be through a slot cut lengthwise in the runners, for similar reasons to those already given, when speaking of the properties of wood; but practically the brad driven in towards the back is generally found sufficient, and it is no use increasing labour for the sake of theory.

GOLD AND SILVER ASSAYS, ETC.

BY GEORGE EDWINSON BONNEY.

GOLD AND SILVER ASSAYS IN DRY WAY—ASSAYS OF METALS CONTAINING SILVER—ATOMS—ATOMIC WEIGHTS—TABLE OF ATOMIC WEIGHTS.

In concluding my last paper on matters of interest and importance to electro-platers, I intimated that it was impossible for me to complete in page 202 the subject of Assaying on which I had entered. I now resume my notes on this process.

Gold and Silver Assays in the dry way are more difficult, and they require the use of a muffle furnace. Those manufactured by Thomas Fletcher, of Warrington, give every satisfaction. The sample is weighed as for a gold assay, and the copper or other alloy is extracted from the gold and silver by cupellation in the muffle furnace. The weighed sample is wrapped in twelve times its weight of pure lead foil, and placed on a boneash cupel in the furnace. Here it is first melted with the pure lead, and then the molten lead is oxidised by admitting air to the muffle. The boneash of the cupel absorbs the liquid lead oxide, and with it the oxides of any oxidisable metals present in the sample, leaving on the cupel a bead of pure gold and silver. This bead is first weighed to ascertain how much of the combined metals it contains, then the silver and gold is parted in acid as for a gold assay, and the pure gold remaining is accurately weighed. By deducting the weight of gold from the weight of the bead left on the cupel, the weight of silver is ascertained, and the sum total of gold and silver, deducted from the weight of the sample, will show the remainder to be copper or some oxidisable alloy. Boneash cupels are small cups or crucibles made of boneash damped and compressed to the requisite form and consistence in a steel mould, then dried and baked. *Silver assays in a dry way* are performed in a similar manner by cupellation in a muffle furnace. A small portion of the silver of a sample is carried over with the oxidised metals on the cupel, and is lost. The ratio of this loss is ascertained by placing a check sample made up with a known weight of silver and copper on a cupel in the furnace with the samples to be assayed. As the silver in this sample is accurately weighed both before and after the process, the difference between these must represent the loss of silver during cupellation, not only on this but also the other samples cupelled with it.

Assays or Analysis of metals known to contain silver may be performed in the wet way. A weighed sample, as in other assays, is first dissolved in dilute nitric acid, and the solution thus obtained is evaporated until all the free acid has been driven off. The residue is then dissolved in distilled water in a large beaker, and to this is added a solution of common salt as long as a precipitate is formed. When this ceases, the quantity of salt solution used is accurately noted, and as this solution is made up of a known weight of salt in a known quantity of water, the exact weight of salt used to precipitate all the silver in a sample can be ascertained to a nicety. Knowing that the chlorine in a salt solution combines with silver in the proportion of 35·37 parts of chlorine to 107·66 parts of silver, we can easily calculate the weight of silver in a given sample of an alloy. This would seem to be a perfect method of assaying samples of silver alloys, but there are sources of loss and probable errors in this as in others. It is not easy to ascertain exactly when enough salt solution has been used, even when dropped from a burette. The addition of a solution of common salt (chloride of sodium) to a solution of nitrate of silver throws down the silver as a chloride, and leaves nitrate of sodium to form in the liquid, and this is able to dissolve some of the silver chloride, thus causing an unascertainable loss. The presence of silver in the supernatant liquid can always be ascertained by adding to it a drop of a solution of chromate of potassium, when if any silver be present it is thrown down in the form of a blood-red precipitate of silver chromate.

Atoms.—"Matter is made up of small indivisible portions which are called *atoms.* These atoms do not all possess the same weights, but the relation between their weights is represented by that of the combining weights of the elements; thus the atom of oxygen is taken to be sixteen times as heavy as the atom of hydrogen, and the weights of the atoms of nitrogen and oxygen as fourteen to sixteen." (Roscoe.) This law of combining weights was first enunciated by a chemist named John Dalton, who further based on this law the conclusion that chemical compounds must contain their constituents in the combining proportions, or in multiples of them, and in no intermediate proportion. For example—gold will combine with chlorine as a monochloride, that is, one equivalent of gold (196·2 atoms) added to one equivalent of chlorine (35·37 atoms) making a molecule of the molecular weight of 231·39 atoms. It will also combine with chlorine as a terchloride, consisting of one equivalent of gold (196·2 atoms) to three equivalents of chlorine ($35·37 \times 3 =$ 106·11 atoms), making a molecule of the molecular weight 302·13 atoms. But gold does not combine with any other proportion of chlorine.

Atomic Weights.—The following table of the atomic or combining weights of the more common and useful elements will show at a glance their value.

TABLE OF ATOMIC WEIGHTS.

Name.	*Symbol.*	*Atomic Weight.*	*Name.*	*Symbol.*	*Atomic Weight.*
Aluminium	Al.	27·3.	Lead	Pb.	206·4.
Antimony. .	Sb.	122·0.	Lithium . . .	Li.	7·01.
Arsenic . . .	As.	74·9.	Magnesium	Mg.	23·94.
Barium . . .	Ba.	136·8.	Manganese .	Mn.	54·8.
Bismuth . .	Bi.	210·0.	Mercury. . .	Hg.	199·8.
Boron	B.	11·0.	Nickel	Ni.	58·6.
Bromine . .	Br.	79·75.	Nitrogen . .	N.	14.01.
Cadmium . .	Cd.	111·6.	Osmium . . .	Os.	198·6.
Calcium . . .	Ca.	39·9.	Oxygen . . .	O.	15·96.
Carbon . . .	C.	11·97.	Palladium .	Pd.	106·2.
Chlorine . .	Cl.	35·37.	Phosphorus	P.	30·96.
Chromium .	Cr.	52·4.	Platinum . .	Pt.	196·7.
Cobalt	Co.	58·6.	Potassium .	K.	39·04.
Copper . . .	Cu.	63·0.	Silver	Ag.	107·66.
Fluorine . .	F.	19·1.	Silicon . . .	Si.	28·0.
Gold	Au.	196·2.	Sodium . . .	Na.	22·99.
Hydrogen . .	H.	1·0.	Sulphur . . .	S.	31·98.
Iodine	I.	126·53.	Tin	Tn.	117·8.
Iridium . . .	Ir.	196·7.	Tungsten . .	W.	184·0.
Iron	Fe.	55·9.	Zinc	Zn.	64·9.

Some of the rare elements are omitted from this table, but may be found in Roscoe's text-book of chemistry. In calculating the combining weights of elements, it is usual to take round numbers instead of the exact decimals, thus:—Silver, 108; gold, 196, etc. For further information, see notes on *Combining Weights, Equivalents, Molecular Weights, Valency,* etc. etc.

SOME RUSTIC CARPENTRY.

BY ARTHUR YORKE.

RUSTIC CARPENTRY SPECIALLY FITTED FOR GARDEN PURPOSES — WOODS SUITED TO RUSTIC WORK—LARCH—A RUSTIC GARDEN ENTRANCE —OAK FOR GARDEN CARPENTRY—THREE ADDITIONAL DESIGNS FOR RUSTIC FENCES — A SECOND GARDEN ARCH ON TWO PILLARS ONLY.

THERE are few of those who have gardens and who work in them who do not more or less dabble in some sort of garden carpentry. Unlike indoor work it demands no nice skill and no varied assortment of tools. Carpentry for the garden is everybody's work, whence it may reasonably be inferred that what I have to say about it, by pen and pencil, will have everybody's attention.

The description of carpentry of which I shall have more especially to speak is that known as rustic work; that, namely, which uses its materials in a natural state, and in that state endeavours to make them decorative. For this, as I take it, is the only style really suitable for garden purposes. Our sense of good taste points out that in our gardens all things ought to be in harmony with and suggestive of nature. Glass, metal, paint, which are suggestive only of the shop and of artificial life, we feel to be out of place. Anything of the nature of a greenhouse—whatever efforts may be made to render it ornamental—never appears to a cultivated eye as otherwise than ugly; whilst the rustic summer-house, with its wooden walls covered with natural bark, its low roof of thatch, and its decorations of moss and fir cones, gives unmixed satisfaction. And this style, whilst the most desirable in which to work, is at the same time the least costly and the most simple.

In the course of these papers I hope to do some service to my fellow-workers by pointing out, so far as I can, what is good taste in garden decorations of this class; by supplying designs, or what may furnish hints to them in designing, and by giving some little practical information with regard to material and construction. I shall hope before I finish to deal with a variety of summer-houses, seats, fences, and similar matters.

There is scarcely any kind of wood which may come to hand in a natural state which is not available for rustic work, though some sorts lend themselves to our purpose more readily than others. In most country districts one has generally a wide choice of materials, and not much more than a firewood price to pay for them; some little trouble has, however, to be taken to look out for and to secure them, as they are not like sawn deals, always to be found in stock at the timber yard, and bought at any time they may be wanted.

The example of rustic work shown in Fig. 11 will look and be best if constructed in larch only. Of all our common English woods this may be said to be most valuable for rustic purposes. Its straight growth specially fits it for the carrying out of decorative designs; it is enduring, lasting longer in exposed situations than any other ordinary wood—heart of oak only excepted—and wearing, perhaps, ten times longer than those portions of the oak which are available for garden purposes; and it is plentiful, for larch plantations now abound in most districts, and when they are thinned the rustic carpenter should look out for his supply. The larch poles grown in thick plantations are better for our purposes than such as grow singly, they taper more gradually and have fewer branches. The larch is a most accommodating tree, flourishing, apparently, almost as well in an old stone quarry or a disused clay pit as in the richest of soils, so it is no wonder that it is largely planted. The wood of spruce and other firs which have the same symmetrical growth may do almost as well for our work as regards appearance, but they do not last like the larch.

There are many modest gardens to which a fence and wicket entrance, like that shown in Fig. 11, might be found pleasing and appropriate; and it would be cheap even though a professed carpenter had to be engaged to construct it. But it is a point in favour of my rustic design that the owner, if he can use a saw and a hammer, and likes such amusement, can just as well put it up for himself. Rustic work looks none the worse because the workmanship may be rough; and I flatter myself that no great knowledge will be needed to understand my designs. I have done my best to make them simple, and purpose to give full explanations.

The general view, Fig. 11, is as nearly as may be drawn to a scale of ½ in. to the foot; the details shown in Figs. 4, 9, 3 are, for the sake of clearness, on a larger scale, ¾ in. to the foot, so that the exact dimensions of every part may be easily ascertained. The arch rises to a total height of 6 ft. 8 in.; its width from centre to centre of the side pillars is 3 ft. 6 in. The pillars, exclusive of tenons at their tops, show a height above ground of 5 ft., but another 2 ft. is supposed to be buried in the ground where it is rammed in with stones and earth like a gate post. The builder will, of course, set them upright by a plummet, and if he takes off the bark from those parts which go into the ground, and gives them a good coating of gas tar, he will find them last longer.

Rustic work, in a general way, is merely nailed together, but in the design before us the pillars are supposed to be mortised into the pieces which rest on their tops, the bars of the gate into the head and hinge tree, and the rails of the fence into the fencing posts. Fig. 1 shows how the shoulders of tenons are sawn so as to make them fit best to the rounded wood. But if this work is taken in hand by any non-professional, who does not feel himself equal to making mortises, he may make a joining, which will neither be quite so strong nor quite so well looking, by cutting each piece something in the manner indicated in Fig. 2, and driving a nail.

In Fig. 3 that side of the gate is shown to which the upright palings are nailed, but it should be noted that on the opposite side the diagonal pieces, A and B, must not be made of short lengths merely going from bar to bar, but must be in one length from top to bottom; they are not for ornament only, but act as braces, and are necessary to give the gate its required strength.

In the example of fencing shown in Fig. 11,

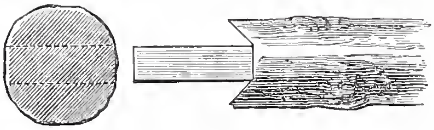


Fig. 1.—Rustic Mortise and Tenon.

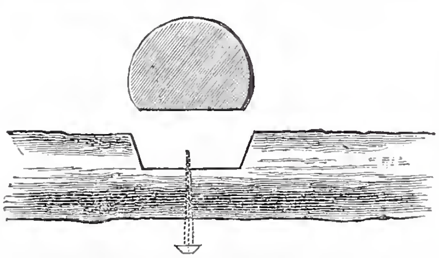


Fig. 2.—Rail and Post cut to Nail.

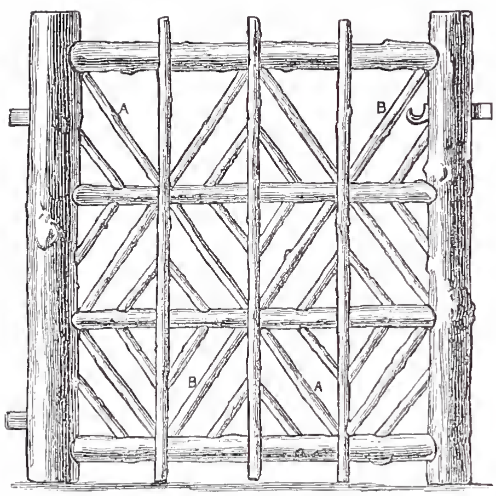


Fig. 3.—Rustic Gate.
(Scale, ¾ in. to 1 ft.)

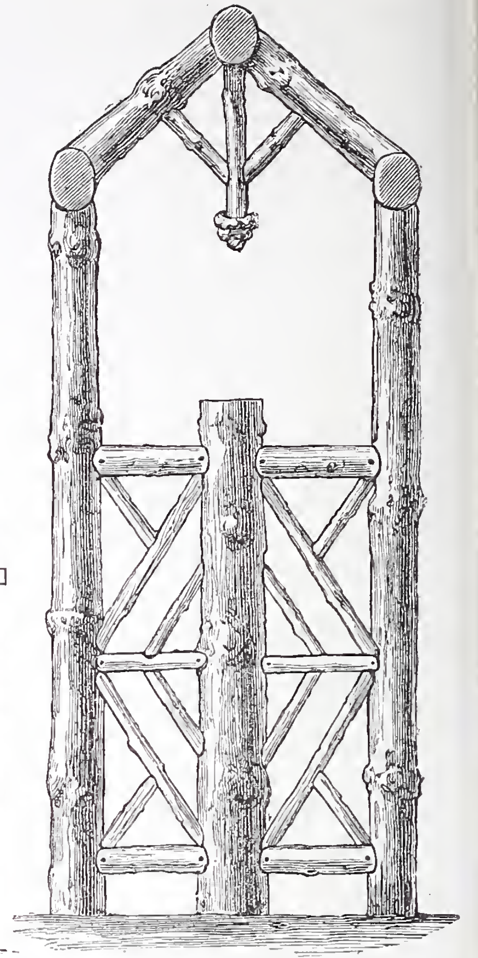
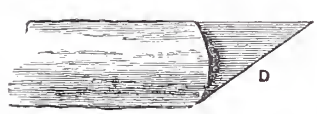
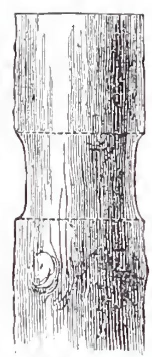


Fig. 4.—Side of Arch.
(Scale, ¾ in. to 1 ft.)





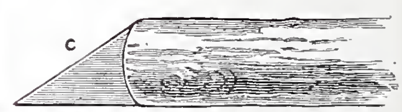


Fig. 5.—Rail Ends cut meet in Mortise.

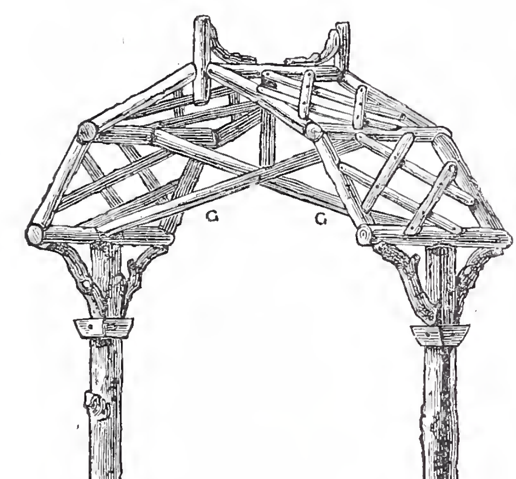


Fig. 6.—Garden Arch with Two Pillars only.
(Scale, ½ in. to 1 ft.)

the posts are set 7 ft. 6 in. apart. This is a short distance; fencing posts are frequently set at wider distances up to 10 ft.; in Figs. 7, 8, 10, they are drawn as 8 ft. apart. These posts, as also the gate posts, need to be set as deep in the earth as the pillars. Fig. 5 illustrates the manner in which the tenons of the rails fit together in the mortises of the posts. The end, C, is, of course, adjusted to the mortise before the post is fixed, the end, D, afterwards. The stuck, E, Fig. 8, which is let into the earth with a crowbar and then nailed to the rails, prevents the latter from having any motion in the mortises.

The smaller stuff, of which the palings and the lighter work generally are made, should properly be of larch as well as the heavier pieces, not only for the sake of appearance, but that the whole may wear together. With care such stuff may be provided from the tops and branches of the larger poles, and from the thinnings of young plantations. In the example before us, Fig. 11, the palings are nailed about 5 in. distant from centre to centre, and will exclude most small animals, but if special protection is desired against chickens, etc., the number of palings may be doubled, shorter palings, to rise about 1 in. above the centre rail, being nailed alternately with the present ones. The fence would then look a trifle heavier, but would keep out anything bigger than a sparrow.

The superiority of such a fence as the above to those in rustic work which we ordinarily see is very considerable. Those common in this country are almost invariably made of oak "bangles" set, as nearly as may be, to cross each other diagonally. Oak bangles, it may be explained, are the smaller branches of the oak, and as we get them they have been stripped of their bark for the uses of the tanner. Their knotted and twisted forms render them picturesque, and they have, therefore, a decided value for the rustic carpenter. But for fencing purposes they are not satisfactory; their crooked and uncertain growth forbids them being worked to any regular design; it also renders difficult the arrangement of them at such set intervals as will effectually exclude animals, but their worst point is that when exposed they decay very quickly. This is always a serious disadvantage, and especially so when, as is often the case, the rustic fence is intended as a support for roses or other climbers; for by the time the climbers are so grown as to be ornamental, the fence is apt to fall to pieces.

Possibly the reader has an idea that among English woods oak is pre-eminent for its powers of endurance. If so, he is in the main right; but the part of oak which lasts for centuries is the heart—that central growth which is always separated from the bark by a ring of softer and lighter timber known as "sap." Few kinds of wood rot more quickly than sap of oak. The smaller branches have little or no heart; they are nearly all sap, and hence their rapid decay. They last best in the dry, but even there they are more subject to suffer from grub than any wood of the fir kind. One point in their favour is, however, that they are cheap; for if not used for rustic work, their only value is for firewood.

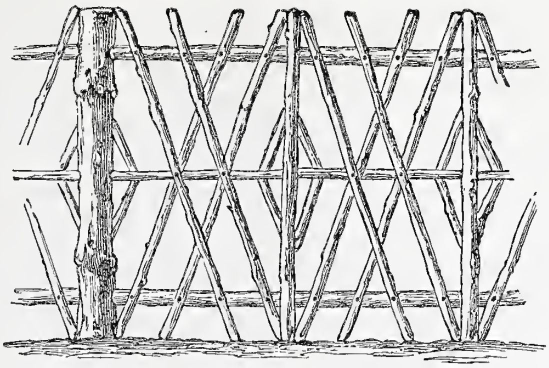


Fig. 7.—Rustic Fence in Rough Larch.

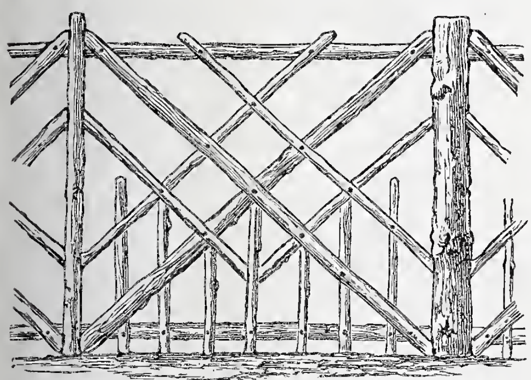


Fig. 8.

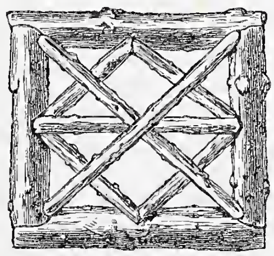


Fig. 9.—Panel of Arch.

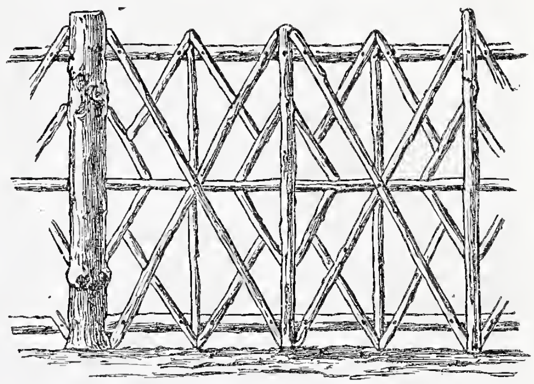


Fig. 10.

Figs. 8, 10.—Rustic Fences in Rough Larch.

Our larch fence will outlast two or three successive ones of oak bangles; as a safeguard it can be made more secure, and in appearance it will be more artistic. The arrangement of the stuff in ornamental patterns may be varied almost endlessly. In Figs. 7, 8, and 10, three additional designs are given (on the $\frac{1}{2}$-in. scale), and these will doubtless suggest still more varieties to the ingenious reader.

Fig. 6 is a second design for an arch, which may, if preferred, be made to take the place of that in Fig. 11 at an entrance. The two pillars, by which it is supported, might well carry such a gate as that in the last-named diagram, as any extra strain thus placed upon them would be compensated by the support given by the rails on either side. It would, however, be desirable to retain the bottom stucks (F, F, Fig. 6), since the weight of the upper part of the arch being considerable, it might, if not accurately balanced, tend to pull the structure out of the perpendicular if deprived of these supports. This arch in its upper part is, it will be observed, strongly tied together by the braces, G, G. This arch is on the same scale as Fig. 11 ($\frac{1}{2}$ in. to foot). It is the same width as the one there given, and 7 ft. 6 in. high.

In Fig. 11, every portion of the arch, with the very trifling exception of the apple-tree knots, with which the lower ends of the pendants are finished, is of larch; but in Fig. 6 are half a dozen pieces of some other wood, namely, in the struts at the tops of the pillars, and in the ties which connect the two pinnacles with the top of the ridge piece. In these a curved form is more pleasing than a straight one, and bits of apple tree have therefore been introduced.

Either arch will also do equally well for use within the garden to span a path and serve as a support for climbers, and will, I flatter myself, look effective in such a position. It is possible that some one may object that the wooden arch thus contrived and made has not the light appearance of, and takes up more room than, the light arches of iron now much used, in which the sides are made of substantial wire—or thin bar iron as I may almost call it—fitted to feet of some width terminating in spikes that enter the ground, and give stability to the structure when placed in position. The standards thus made are connected by trellis work of wire which fills the interval between them. In a trim town garden where everything is prim and rectangular, and laid out with line and rule, the iron arch may be preferred as a support for the roses or other climbing plants that are trained to its sides and top. In the country garden, however, the rustic arch will be more in keeping with the surroundings, and harmonise more effectively with the masses of old-fashioned flowers, long established favourites, that have not yet been sent into exile to make room for the contrasted colours of modern gardening, in which fragrance invariably gives place to brilliancy. With these few plain instructions a pleasant employment is introduced to those of our readers who enjoy garden woodwork.

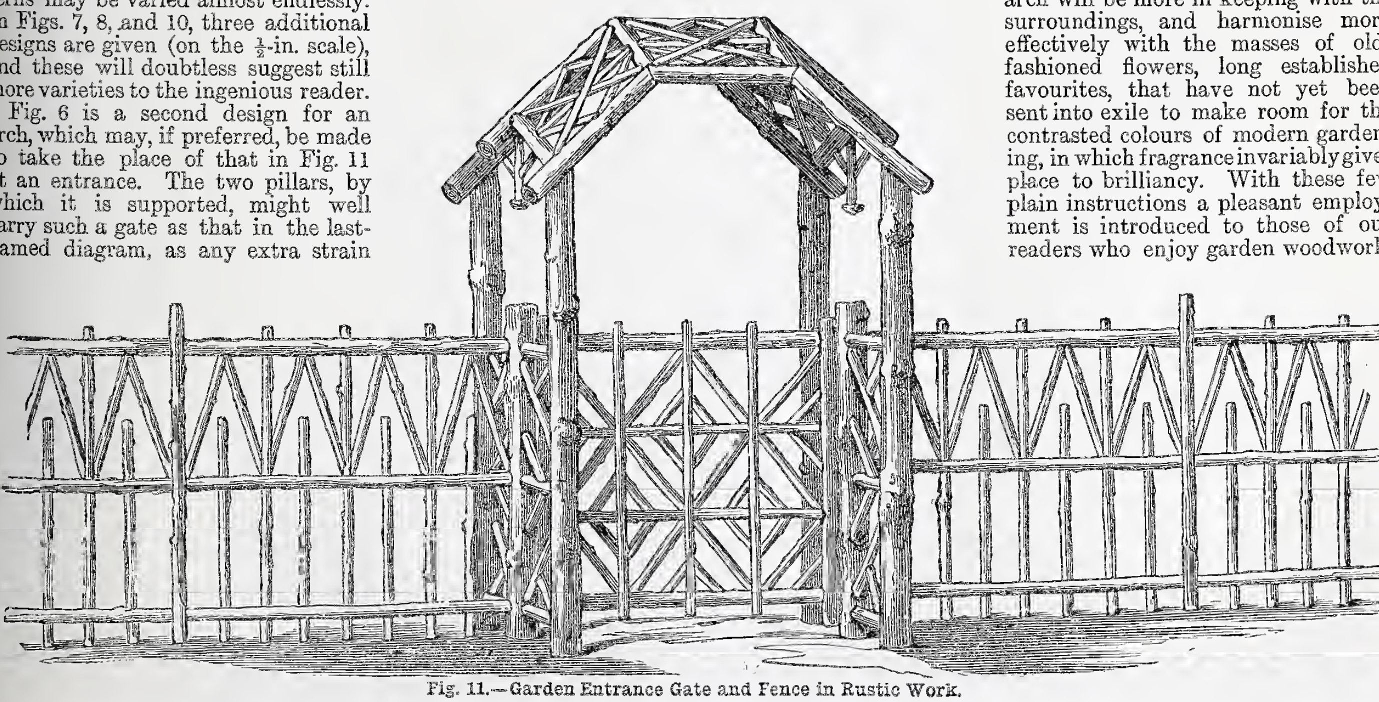


Fig. 11.—Garden Entrance Gate and Fence in Rustic Work.

JOINTING UP—FOR "'PRENTICE HANDS."

BY DAVID ADAMSON.

Plain Glued Joints.

Anything new? perhaps you may ask on reading the heading, and I have pleasure in at once telling you — No. So, therefore, good people who know all about it, your valuable time need not be further taken up with the present subject. I am addressing myself to novices, and not to experts. I can teach the former something, perhaps, but not the latter just now; and if any of these should grudge the space given to those who are, as it were, just feeling their way, will they, the said experts, kindly remember their own early days, and be generous to those who do not even know how to join two boards together?

Now, of course, as far as mere joining goes, boards may be joined together in many ways, the simplest being, perhaps, by laying one on top of the other and nailing them together. This method is seldom, if ever, required, and if the novice should ever have occasion to use it, the manipulation must be left to his native ingenuity. Not to make a long preamble and run through all the joints used in wood working, or from the multiplicity of them, as it is commonly called "joinery," let me say that I purpose confining myself to attaching boards by their edges so as to obtain any required width.

This work is what is known in many places as "jointing up." I say many places because terms are often only of local use, and an expression that may be perfectly well understood in one district, may convey no meaning in another part of the country. Still, I think "jointing up" is sufficiently understood to warrant its being used to express the kind of joint which is the subject of explanation, and, for aught I know to the contrary, it may be the general term all over England. Be that as it may, I do not think I have ever known a practical cabinet maker who did not know what was meant by it.

Possibly some — only those, however, who have never tried it—may fancy that any one can glue two boards together, and that directions may be superfluous. There can be few who are not physically capable of "jointing up," but the novice will find that he has a good deal to learn before he can do so satisfactorily, that is to say, satisfactorily to those who are able to distinguish between good and bad workmanship. So far as a few general directions can do so, I hope his difficulties may be diminished. Verbal instruction is, however, only of use to indicate to him how he should proceed, and it stands to reason if not practically applied will be useless. It cannot give the manual dexterity, and this is not to be acquired without care.

Just to show clearly and distinctly what a perfect joint is, or let me say rather, a perfectly fitted joint, let us compare two of a different quality. In one we see the line of the joint quite easily. There is no mistaking it for most of its length. There is a dark line, thicker in some places than in others, from end to end of the join. In some places it is interrupted every here and there for an inch or two, or, perhaps, even more; all the glue seems to have been pressed out. These places where the glue is not visible are the only ones at which the joint is thorough. Further, on examining the board, we find that instead of being perfectly flat there is an angle at the joint. Very slight if you like, but quite perceptible if a straightedge be laid across.

Now let us turn to the other piece which has been jointed. But stop, you say; for has it been jointed, or is it not one single piece? No line is discernible anywhere, but let us look closely and we shall find that the grain of the wood is stopped short off along a certain imaginary line; the figure seems abruptly broken, not only on one side of this line, but on both. That is all; there is nothing more to indicate a joint, and as the surface stands, as with such a good—I had almost written *invisible*—joint it is almost sure to, the test of the straightedge, it may be regarded as being an exact and perfect fit.

With such nicety and exactness, indeed, can an expert joiner or cabinet maker work, that with some woods the joint is only to be recognised by noticing the figure. True, an amateur craftsman can hardly expect to reach this standard, but the novice will know what his aim should be, and by a little attention to the method of working he will be in a better position to make a good joint than the man who goes about it anyhow. Let us take the plain glued joint first of all, and when this is considered go on to the stronger and more serviceable dowelled joint, as well as that formed by ploughing and tongueing.

The plain joint is serviceable enough for thin wood, say for anything under half-inch thick, and in certain situations for material of any substance. When practicable, however—that is, when the wood is thick enough—the novice will find it safer not to depend on plain glued surfaces only. With thin stuff, however, he must do so, as there is no room for dowels.

In any form whatever of "jointing up" the same general principle of working must be observed, so we will begin at the beginning, remembering that the object is to get one wide board formed by connecting several, or it may be only two pieces. Let us suppose the planks are quite in the rough. The first idea that occurs to the tyro will probably be the necessity of smoothing two of the edges so that they may come in close contact with each other.

But here occurs the question—are the edges to be planed, or are the boards to be got nice and smooth first? Assuming my position as instructor for the novice (I hope some of my readers may favour by reversing the position as far as any craft they are connected with is concerned), let me say that this must depend on circumstances. If the boards when joined will be too wide and cumbersome to smooth, then do so before they are joined; but if the width will not be great, say not over two feet, it will be better to plane them when they are together.

Should the boards selected be very rough, they may be gone over beforehand with the "Jack" plane just to get them into fair working order. This, however, is not necessary, and whether to do so or not may safely be left to the discretion of the worker. It will also be seen that widths of over that given will in ordinary cabinet work seldom be required, so it may almost be taken as a definite rule that wood is smoothed over after it has been joined.

The "Jack" plane has been referred to, and I suppose that even but few intending workmen will need to be told that with it the coarser planing is done; but, in any case, we are concerning ourselves with joints, not with planes, so it must be taken for granted that the ordinary forms of this tool are familiar to the worker, if only by name. And here please note that the ordinary "Jack" plane and the trying plane, though very similar in appearance, cannot be used indiscriminately in preparing edges of boards for jointing, nor can the smoothing plane be used so efficiently as the trying plane for the same work. I may almost go the length of saying that a long joint could not be made perfectly with a smoothing plane. This statement ought, perhaps, to be qualified a little, for I am aware that some workmen can joint up with the smoothing plane just as some persons can write with the left hand, but it is not usually done. No; the trying plane is the proper one to use. It cuts finer than the "Jack," and its greater length gives it an advantage over the smoothing plane in planing up a straight edge.

Well, with the long plane known as the trying plane the edges of the board which are to be glued must be got perfectly straight. Get one of them so first, as it will serve as a test for the other. Whether it is perfectly straight or not can easily be ascertained by casting the eye along it, as one does when looking along a gun barrel. Irregularities can easily be detected in the length of the cut, and in reducing any remember that a fine shaving or two will make all the difference. Whether the edge is at right angles with the surfaces of the wood cannot, however, be determined by this means, and it must be tested by the square. For short lengths the ordinary shooting board will be found invaluable, but it cannot be used with long pieces. As long and short are only comparative, I ought, perhaps, to say that anything over three feet may be considered long, but, of course, very much depends on the length of the shooting board. In cabinet work a board six feet in length would be decidedly called a long one, and such only require to be used for sideboard tops, wardrobe ends, etc. etc.

When one piece has been got ready with a perfectly straight edge, the other may be prepared to fit it, and the two should be tried together before gluing them. With short joints both edges should be perfectly straight and level. To try them fix one in the bench screw with the prepared edge uppermost, then take the other and note if it fits closely. If the boards are fairly thick it will not require much experience to know by the feel whether the joint is a good one, or, rather, whether both edges are true. The feel of properly worked edges when rubbed against each other is not easy to explain in words, but it almost may be described as suction. It is almost imperceptible, but is to be distinctly recognised by trained hands. This is alluded to, not so much because the novice can be expected to do such accurate work, as to show those who have no opportunity of seeing good cabinet work in progress what their aims should be. We are almost all more or less familiar with the appearance of things when made up, but comparatively few have an opportunity of seeing work in progress, and I wish to convey to those who have not, as far as may be, some idea of the actual manipulation of material as practised in the workshop. Naturally, it will be a very faint reflex of the actual, but at the same time it will be better than nothing, and if the details seem tedious, remember that in reality the work is much more so. Here, however, I must pause, and leave further remarks on this subject for another paper.

OUR GUIDE TO GOOD THINGS.

60.—The Cartoon Collector's Frame.

It is a relief to turn for a time from the consideration of lathes and appliances of a more solid character to articles that have the charm of absolute novelty, or, at all events, newness of adaptation, such as those which I am now permitted to illustrate and describe, and which are manufactured and supplied by the "Surprise" Box-Table Company, 3, New Inn Yard (186 A), Tottenham Court Road, London, W. Although the first of these is not yet in the market, or, at least, was not in the market when the inventor furnished me with particulars about it, and the second, in its various forms, or, as suited to various purposes, has barely touched it, and is as yet but little known, it is desirable, I think, to call attention to them thus early that retail dealers, many of whom read Work, may seize the opportunity of making arrangements for agencies for their sale, and that, if the inventor grants licences for their manufacture, makers of such goods may hasten to secure the right of manufacture in their respective localities, for, unless I am very much mistaken, both the one and the other will meet with a large and ready sale.

The object of the "Cartoon Collector's Frame," to use the words of the inventor, "is to provide a picture frame with a recess at the back, in which prints, etchings, drawings, etc., may be stored, to enable those who use it to change at pleasure the print on view next the glass, and to store such additions as may be made to the collection from time to time, affording thus a continual variety of pictorial effects in the decoration of a room or other place." This is, of course, from the home or collector's point of view, but professional men, in many cases, can turn the invention to good account, as it would enable a dealer to keep and display some of his stock to the best possible advantage. Again, by its aid, any architect, designer, or artist could collect and place his drawings and sketches, one at a time, under glass for inspection, and an advertiser could make good use of it to secure diversity of treatment and varied exposition for his notices. Moreover, by a simple arrangement of mechanism the frame can be lowered at pleasure from its place on the wall and raised again to it, and even more than this, the frame can be accommodated to the picture by transposing it from a horizontal to a vertical position or *vice versâ* at will.

Thus, in one and the same frame prints may be framed, stored, and changed, and the frame itself may be lowered, raised, and transposed at pleasure, and these various operations can all be carried out quickly and easily. When closed and in position, the frame, whether in a horizontal or vertical position, looks just like any ordinary picture frame, as all means of movement are in no way conspicuous, but, by merely touching a spring under the centre of the frame, it slides downward, stopping in its length. The front of the frame, it will be found, is secured by a button, and when this button is turned the front will open and fall forward in a slanting position, thus affording facility for a change of the picture in front or for adding to the contents. Thus, in Fig. 1, the frame is shown open, but in its proper position, and a stay is shown by which the front is prevented from opening beyond a certain extent. The picture behind the glass may be supposed to have fallen forward on and with the front, and then we see that behind it is another flap, between which and the back pictures may be stored. This is shown more clearly, perhaps, in Fig. 3, in which the flap in the interior is shown open, as well as the front. When the storing, changing, or closing has been effected, the flap and front are closed and the frame pushed upward into its place. Its appearance when reversed or transposed from a horizontal to a vertical position and closed is shown in Fig. 2; Fig. 3, in addition to a complete exposure of the interior, also shows the means of transposition, which is effected by holding the sides or ends of the frame between the hands, and moving them laterally from left to right or right to left, according to the position the picture may require. The picture cord is attached at its ends to a bar, on which are two buttons, on which a piece of semicircular form moves by means of a slot of the same shape cut near its edge. To this is attached another piece on which the frame itself slides. The frames are made in many various sizes, to take pictures from royal quarto ($11\frac{1}{2}$ in. × 9 in.) to atlas (33 in. × $26\frac{1}{2}$ in.), selling respectively at from 7s. 6d. to £1 17s. 6d. when supplied in oak.

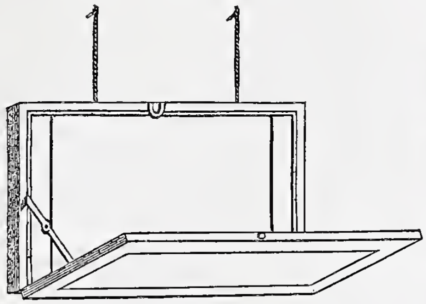


Fig. 1.

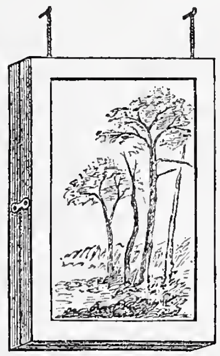


Fig. 2.

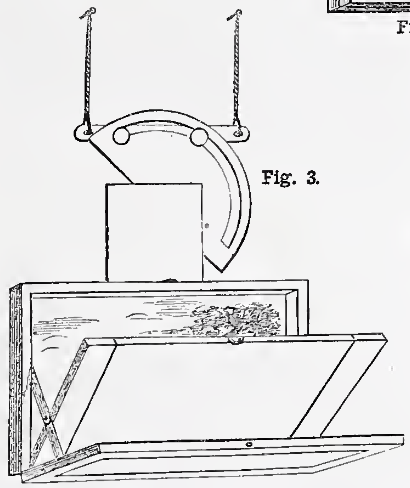


Fig. 3.

Fig. 1.—The Cartoon Collector's Frame: open. Fig. 2.—Ditto: transposed and closed. Fig. 3.—Ditto: open.

61.—The Artist's "Surprise" Box-Table.

This ingenious invention enables what is apparently nothing more than a simple box or case with a handle for transportation from place to place, and a surrounding cincture, to be turned with very little trouble and very quickly into a table displaying every convenience for artists' work, as shown in Fig. 4. The height of the table when opened out for use is 27 in.; its size, when closed up, that is to say, when in its box form as shown at c, in Fig. 4, is $14\frac{3}{4}$ in. × $11\frac{3}{4}$ in. × $4\frac{1}{4}$ in., and its total weight is 8 lbs. The artist's table is supplied at present in two forms —No. 1 and No. 2. The former costs £2 10s., made in oak, walnut, or mahogany, or £2 15s. if polished. The latter is supplied with three trays for pastels, and fold-over flaps for table, and is supplied at £3. Waterproof bags to contain the box-table when in transit are to be purchased at 3s. each. No more complete or portable apparatus can be imagined for the use of artists. It may be bought in other sizes than that given above at proportionate prices, and the principle is applied in the same manner to box-tables for writing, match scoring, chess and other games, luncheon, and for work-box and toilet purposes, storage being provided in every case for all necessary articles in connection with the purpose for which each box-table is made. Supposing the box-table to be closed, as at c, all that is necessary to bring it to table form is to unbuckle the strap, and, holding the box firmly between the feet, to lift the upper portion evenly until the legs of the trellis work shown in Fig. 4, at A and B, are drawn up to the stops. Then, lifting the catch, the cross bars at the bottom must be turned towards the trellis feet till the catch drops in the slot and holds. Lastly, gently press the top down till all the feet are tight up against the bars, when the table will be found perfectly rigid. To close the box, all that is necessary is to release the check at the bottom and press downwards, when the table will shut up and resume its original box-like form. At A, the table, when opened, is seen as from the front, the top being lifted, to form an easel. At B, it is shown as seen from behind. Within the box are the levers by which the parts within are elevated or depressed. These parts come out of the lower case, and consist of an upper portion forming table, material case, and easel, and a tray with divisions for colours, brushes, dippers, etc., and a lower portion forming a tray for the palette and support for brushes, etc., when painting. There is a recess in the lid in which two millboards, each $13\frac{3}{4}$ in. × $10\frac{3}{4}$ in., may be carried, with means to keep them from touching. The lid is adjustable to any angle, and provided with check rests for sketching board. The bottom is furnished with a spike to hold to the ground. When closed, a strap is passed round the centre, or a metal band with lock and key is used to keep all secure. A camp stool may be carried with the box under the strap to complete equipment, and if it be considered desirable to provide means of obtaining shade and shelter as well as rest, an umbrella may be added which may be placed under the strap that surrounds the box and holds the camp stool in durance until released to meet the needs of its owner.

The Editor.

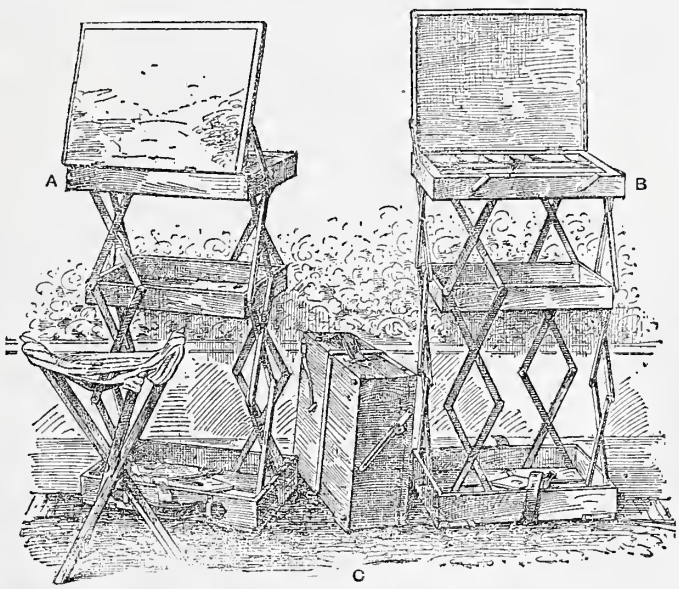


Fig. 4.—The Artist's "Surprise" Box-Table in Position for Use, showing Front (A) and Back (B), and Appearance when closed.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Securing a Patent: My Experience.—AJAX writes:—"Having made up my mind to apply for a patent, my first step was to get the Patents, Designs, and Trade Marks Act, so as to get the fullest information. This can be obtained from Eyre and Spottiswoode, price 1s. 10½d. And having learnt that the Patent Office Library (25, Southampton Buildings, W.C.) is open free till ten o'clock each evening, I spent several evenings there, after I had done work, searching the Index Books, to make sure I should not be infringing any existing patent, examining specifications and drawings made out by the various agents, and taking notes to assist me in making out my own. Having procured the necessary form of application for provisional protection, which can be had free, at No. 6 Room Royal Courts of Justice, I filled them up at my leisure, and took them back to the Royal Courts of Justice to get them stamped, the cost of which is £1. This gives protection for nine months. I then deposited them at the Patent Office close by. During the next few weeks I was kept well supplied with circulars from patent agents, offering to get it through for me. But as my funds would not allow of this, I was obliged to dispense with their services. Some I received from America and Canada, which I declined for the same reason. About a fortnight after my application I received a letter from the Patent Office objecting to the title I had given as being of a fancy nature. The letter went on to say, 'If, as appears from the description, the invention is an improved apparatus to facilitate, etc., this should be clearly stated in the title.' I understood by this that if I wanted a fancy title I should have to register it as a trade mark, and that the only title the Patent Office would accept was the one indicated in the letter. I accordingly made the necessary alteration; and shortly afterwards I received a notice to say my application had been accepted. My next step was to hire a small workshop where I could work for an hour or two in the evening. And as my invention was an article complete in itself, I thought I would make several, and advertise them, and as I sold them use the money to increase business. This appeared to be very good in theory, but it was very different in practice. I had some circulars printed giving a full description of the apparatus, and inserted a few advertisements in suitable papers. I received many replies from all parts of the country, asking particulars and name of nearest agent where it might be seen. The only answer I could give was that I had no agent at present near them, but would send article on receipt of cash. This was like buying a pig in a poke, and looked so much like a swindle that it is not surprising that I heard no more from them. Now and then, one more venturesome than the rest would forward the money. But they were too far between to be of much help to me, and I found myself gradually getting into difficulties. Five journals, including *Invention*, kindly gave an article in its praise, and I received several testimonials. This gave me the hope that if I could hold out long enough I might succeed in the end. The months flew by, and it became necessary for me to send in my complete specification. I got the form in the same way as before (unstamped), made out my drawings, and wrote a more detailed account of my invention, clearly stating in what I claimed protection. And as the Patent Office made no objection, I received my patent in due course by post, twelve months after my first application. The stamping of these papers cost £3, making a total cost of £4 for the patent. This was the last straw. I had secured my patent, but I found myself very much in debt. Most working men with a family know what that means. It means a long struggle before you get straight again. I gave up making, and tried to sell the patent. And now for the first time I began to see the advantage of employing a patent agent. Had I been able to do so at first he would have been interested in trying to find a customer for it. I also found that capitalists have very little confidence in a patent that has been secured without the aid of an agent. Of course, if a man in business makes an improvement in an article that he has already before the public, it is all very well. But my advice to any one without capital who has something new is to place it in the hands of an agent to get it provisionally protected, and place it in the market at once, so that the buyer bears the expense of patenting it. But should he prefer to act for himself, there is nothing to prevent him doing so. Of course, being in London, I had a greater advantage than any one would have who lived in the country. But there are many cheap excursions to London which a man might take advantage of; and while his friends were sight-seeing, he could spend the day at the Patent Office, where there is every convenience for writing out specifications. And they could be stamped and deposited at the office the same day." [You have doubtless done the only thing I could advise—namely, to submit your invention to dealers in instruments and persons connected with the musical profession. I myself am not competent to give an opinion on it, for I cannot play any instrument myself, and know nothing about music. Possibly some patent agent might take it in hand even now, on payment of the necessary fees. At present it is, I presume, worth nothing to you, or, rather, bringing in nothing; and if it were possible to do so, I would rather dispose of it for a small sum and recoup even the original cost of the patent than permit it to be utterly unprofitable. I daresay it may be objectionable to you to adopt this course, but after all it is only a common-sense way of looking at and dealing with the matter. I cannot help you to *sell* your patent.—ED.]

In Praise of WORK.—J. P. R. (*Liverpool*) writes:—"I purchased the first copy of WORK as a matter of curiosity, and I was so pleased with the lucid manner in which the various articles were written, that I have continued to take it weekly. Not only so, but I bring the paper under the notice of my friends whenever an opportunity occurs. It is just the kind of paper required by amateurs, for it goes so thoroughly into details that the 'merest tyro' could not fail to understand and work out the instructions set down for his guidance. I wish you particularly to kindly convey my personal thanks to Mr. David Adamson for his very valuable, graphic, and lucid articles published in Nos. 2 and 3 of WORK on artistic furniture—'An Overmantel.' I read the paper with great interest, and was so struck with the simplicity of the work described, that I determined to commence at once and make an overmantel myself from the drawing shown in No. 2 of WORK. In the first place, I may say I am an amateur, pure and simple, never having earned sixpence at joiners' work in my life, with very little spare time, and very few tools; but I find a great amount of work can be got through by an amateur when his heart is in his work. I commenced the overmantel on April 1st, and had it finished and in its place on the mantelshelf on Saturday, May 21st. I have only an hour or two in the evening, and that not every day, and part of Saturday afternoons, in which to do the work. In making the overmantel I have kept to the design, but varied the measurement, so that the work when finished would be the entire length of the mantelshelf; in place of wood panels to the doors I have fitted sheet-glass, with a shelf in each cupboard for books. Fitted in the back are four pieces of plate-glass mirror; the woodwork finished with dead black and gold, and varnished. The entire cost, including timber, plate-glass mirror, glass for doors, ironmongery, paint, gold leaf, and varnish is 35s. For which sum I consider I have a very artistic and handsome piece of furniture—so much admired, that all who have seen it are so struck with the originality of the design that they are anxious to possess one like it. My answer is, 'Subscribe to WORK, and commence to make one yourself.' Not only do I consider it handsome and cheap, but from the very fact of having made it oneself, enhances its value in the eyes of the worker. I shall be very pleased to show the overmantel to any subscribers to WORK that may reside in my neighbourhood, and give any information they may desire, if they will call upon me any evening after seven p.m. I wish you all prosperity with your new undertaking—WORK; and trust it is, and will continue to be, a financial success."

Bronze Blue.—W. B. (*Lenton*) writes:—"I hereby send you a suggestion with reference to your excellent paper WORK, which I hope you will work out. Excuse me for taking the liberty for sending this. But on page 158 in 'Shop' you will find under the heading 'Litho Bronze Blue' what I wish to point out. That answer is only of use to the person who asked for it. Would it not be as well to put the question with all short ones, so that others may understand them, and so that those who are in the same trade might make use of them, and know what they are using them for? Is the question one of the blue sticking on the stone, or what?"—[Your suggestion, which is a useful one, shall be followed as far as possible. All who answer questions are requested to show by their answer what the nature of the question was. If questions were put briefly, and written on a separate piece of paper, each could always be given before or above the answers to it. But not one correspondent in twenty observes this rule, which, if universally adopted, would greatly facilitate matters. The question asked was—"I had a job to work in bronze blue, and it was rather inclined to take the work off the stone, and I should be very much obliged if you could give me any information so as to prevent that occurring again; if so, you would greatly oblige."—ED.]

Sharpening Carving Tools.—D. D. writes:—"Notwithstanding J. W. B.'s remarks in page 172 about sharpening carving tools, the method he advocates is decidedly an amateurish one, and is open to several objections. Instead of fastening the slips in a handscrew, a much better way is to practice the method adopted by most, if not all, good practical carvers, who certainly would not prefer it unless it were better. This is the advice of one who knows."

Lesson for Lesson.—J. H. (*Walthamstow*) writes to the effect that it is easier to learn how to do anything when we are *shown* how to do it, than when we are *told* how to do it. He suggests that one reader of WORK should give a practical lesson, say, in carpentry and joinery, to another reader, in exchange for a practical lesson in some other trade, and would be glad to hear the opinion of fellow-readers. This is the pith of J. H.'s letter, which I am obliged to give in this way in order that all readers of WORK may easily arrive at his meaning.—ED.

Per Contra.—C. G. W. (*Barnsbury*) writes:—"Although 'only a clerk,' with an earnest desire to 'spoil wood,' as described by one of your correspondents in WORK, permit me to congratulate you, despite the criticism which, even if justified, might have been made in a less high-handed and less conceited style than your correspondent has done. Probably if the truth were known he is not in the first rank of his craft, and, perhaps, he will permit me to inform him that the more one knows the less he thinks he knows, and he is the more anxious to learn more. It therefore follows that it is only the ignorant who fancy they know all. I should strongly advise your correspondent to start a paper on the lines he suggests, if, as he contends, he has a better knowledge of the wants of readers than a firm who are one of the largest, if not the largest, publishers in England, may be, in the world, and who annually issue a greatly diversified amount of literature. In conclusion, may I be allowed to make a suggestion that will be of benefit to the amateur and professional alike, and that is, that in the description of the manufacture of an article the approximate price of each part, and of the whole when finished, be given?"

Measuring up Painters' Work.—A. H. (*Edinburgh*) writes:—"As an admirer and anxious reader of your valuable little WORK, I venture to suggest that when the series of papers on house painting come out in your journal, you might see your way to introduce a few practical remarks on measuring. This is a branch of the business that very few painters understand thoroughly. There are books on this subject, but more practical knowledge would be gained from one in the trade. The reason I write this is that the papers on sign writing and lettering are so ably written that this subject, I am sure, would be properly treated; and, speaking as one connected with the trade, I know that the remarks would be appreciated. I wish your grand little paper every success."

Enlargement of WORK.—F. A. C. (*Bradford*) writes:—"I beg to say that I, as one of the readers of WORK since its birth, would very much like the paper to be doubled, or even trebled; and I quite hold with T. J. H. (*Trowbridge*), and I think that there will be a lot of grumbling until it is made into a larger paper (price 3d.). It is nearly impossible to treat all amateur and professional work fairly in the little space you have allotted. I am not grumbling, because I myself have had my share of oats, doing mostly woodwork, fretwork, etc. I wish every prosperity to WORK, and hope that it may be made larger."

About WORK.—G. B. P. (*Birmingham*) writes:—"Allow me to congratulate you and the powerful staff at your command in answering us correspondents in all parts of the provinces, and I must say on the behalf of workmen here and myself, that in bringing out WORK in its present perfection it will do us all good from a practical and monetary point of view, and I for one have no hesitation in saying that WORK is the premier paper for any amateur or professional man to study; but of course you must be tired by this time of having so much praise sent you, but in sending your answers to correspondents I cannot help but praise your inestimable WORK."

About WORK.—ARTISAN writes:—"I have taken in WORK since the beginning, and as a practical man think it likely to prove on the whole a very useful paper for workmen of all kinds. If it has a fault, to my idea, it is amateurish. Probably amateurs bulk largely (more largely, perhaps, than professionals) in your circulation, but still I hold that sound workshop methods of construction would be much more satisfactory all round than some of the makeshifts so largely adopted by amateur tradesmen, and sometimes advocated by contributors to your paper. This, as I have hinted, is the only fault I have to find with WORK, and I have taken the liberty of writing you, not through any carping, fault-finding spirit, but from a sincere desire to assist in making the paper even more useful as a workman's friend. Please do not suppose in what I have said above that I am making any reflections on the ability of the contributors to WORK; on the contrary, I believe them one and all to be thoroughly competent teachers of the various crafts they write about, and that, sir, is just the reason why I feel uneasy when I see talented writers such as they are sometimes advocating methods of construction which they know would not be tolerated in any workshop in the country. Under these circumstances I was very glad to see your remarks in this week's paper in defence of your review of ponderous and expensive tools. I thoroughly agree with you in all you say there, and I say review every new labour-saving tool that comes under your notice, either large or small, or WORK will not be so useful as it might and ought to be to the professional reader. I intend availing myself shortly of the undoubted ability of your staff. Your 'Shop' column is a valuable privilege, which I should be sorry not to take advantage of; meantime I shall not trouble you further than by asking you to review as early as you can the new dovetail cutter produced by the Britannia Company to work on circular saws."—[As soon as I have sufficient information about the dovetail cutter, or, better still, have seen it, I will report on it in "Our Guide to Good Things." I put your letter into type, because it is helpful with other readers. Amateurs, as well as professionals, read WORK, but the latter largely predominate, and it is very largely bought by the rising generation of workmen. It is just because the modes of construction described "would not be tolerated in any workshop in the country" that they are described. A mode of construction that is strong, stable, and serviceable, is not to be ignored or regarded as belonging to, or fit for, the amateur alone, because it is not the stereotyped method adopted in the shops. It is not "scamping," and I am not ashamed to say that I prefer work done fairly, strongly, and well, even by bye paths of construction, to things thrown together in the legitimate way perhaps, but bearing the impress of haste and want of care when you look into them, the looking-in, perhaps, being induced by the evident tendency of the parts to part company, through the article being of rickety constitution. I append these remarks to your letter, not with any idea or wish to deprecate accepted methods of construction, but to point out that there can be no absolute need to proceed on stereotyped lines, if any other method which saves time without lessening strength can be followed. Both modes are good of their kind, and the workman can follow whichever he prefers, or whichever he thinks is best suited for the job in hand without incurring blame.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Material of Kitchen Utensils.—F. C. (*Bedford Row*).—They are made of sheet iron coated with tin. The "block tin" plates, technically termed "doubles," are superior to the commoner kinds, first, because the covering of tin is thicker, and secondly, because they are well hammered upon a polished anvil, the better to consolidate the metal. —J.

Tools for Home Work.—R. R. W. (*Glasgow*).—When you ask me to decide without knowing a great deal more of your aspirations than you tell me, what are the best tools and fewest to buy for home work, such as model engine making, etc., I am puzzled to know how to answer you. That "etc." may include such a lot; then do you want to make your own patterns and castings, or to get the latter and fit them up? I shall presume the latter, in which case you might make shift with two or three files, a drill stock, a die and taps for screws, and one or two other small things, such, for instance, as those recently described in our articles on boring cylinders. A lathe also is a convenience, if not indispensable. It depends really so much on the exact class of work you wish to undertake that it is almost impossible to say more than I have; but if you will write again, and state the sum you contemplate spending on tools, I will make out a list of those which, in my judgment, would be the fewest and best.—D. A.

Art Repoussé.—(*Glasgow*).—See answer to W. E. S. (see page 205) for transferring and address for tools. Hammer and handle together should weigh from 3 to 4½ ounces. Pitch, 11 parts; resin, 7; tallow, 1; and brickdust 5, will make a very good composition; but Gawthorp's special cement can only be obtained of him, at 16, Long Acre. In mixing the above, powder the brick finely, and add, after melting and mixing, the others, stirring all the time. By "tooling over" the raised parts is meant putting in the fine texture of feathers, leaves, cloth, skin, etc., after those parts have been raised from the back, and is done by lightly and skilfully hammering a very fine tool, according to the texture required, over those parts. This is very difficult, and is more easily learnt by practical tuition than by explanation. It greatly enhances the effect of the work.—G.

Broom and Brush Making.—T. M. (*Rochdale*).—The fibre, or bast, a specimen of which you enclose, is made up into small bundles of a size sufficient to enter the holes made in the wood, and then fixed by running melted pitch into each hole. If you are going to try to make brooms and brushes for your own use, be careful with the melted pitch; fill the holes with fibre, one by one, fastening each in succession with the pitch, melting it in a can or tin furnished with a spout or nozzle, and hold the fibre firmly against the bottom of the hole when you are pouring in the pitch.

Paper for Pasted Papier-Mâché.—J. H. S. (*Romsey*).—The paper made specially for pasted papier-mâché is of a grey colour, about the thickness of medium blotting-paper, but rather more close and firm in texture, and unglazed. It is now made to order only, and may be procured through Messrs. McCallum & Hodson, Summer Row, Birmingham, who would doubtless give particulars as to price. There are plenty of papers answering to the above description to be bought at any paper warehouse which would do equally well. The special paper has no especial merits.—S. W.

Scale for Bassoon Stop.—AMATEUR ORGAN BUILDER (*Arundel*).—Your wish for a small scaled "bassoon" stop for your organ can be carried into effect by making the pipes the same diameter at the top as those of the open diapason an octave higher in pitch. Thus, your 8-foot C bassoon would be the same diameter as the 4-foot C open diapason. I presume you know that the bassoon is a reed-stop, and that the wood pipes are conical in shape, with the point at the bottom which fits into the boot containing the reed. If made of wood, these pipes are square on plan; if metal, they are circular. The "gemshorn" is a flue pipe of a conical shape, the point in this case being at the top. At the mouth, where it joins on to the foot, it should be about one scale less than the open diapason for the same note; and at the top it should be one-third of that diameter. Cut up the mouth rather more than a fourth of its diameter, and nick rather finely. You are in error in supposing that this stop is used only for chamber organs; it is used both as an 8-foot and as a 4-foot stop on many large organs, and there is one in the beautiful organ at the Temple Church, London.—M. W.

Soldering Iron.—H. A. (*Chesterfield*).—I wish your queries were of a specific character, because when you ask for "hints" I do not know precisely what kind of hints to give. In reference to soldering, of course you know that the first essential is absolutely clean surfaces, first scraped and then covered with a flux, to prevent the formation of oxides, or to dissolve them as soon as formed. Resin, or spirits of salts killed with zinc, are used. The soldering "iron," more properly the "copper bit," is first heated to a dull red, quickly cleaned with a file, rubbed on a piece of sal-ammoniac, and dipped into solder; being then wiped with tow, it is ready for use. The copper bit being drawn along the edge of the joints in contact, both melts the solder and warms the work. The copper bit must not be overheated, or it will not pick up and distribute the solder.—J.

Guide to Photographing.—P. C. G.—The best thing P. C. G. can do will be to obtain an elementary book on photography, of which several excellent ones are published. Burton's "Modern Photography," or "Photography for Amateurs," by T. C. Hepworth (Cassell & Co.), are thoroughly reliable and easily understood. These columns are scarcely adapted for a course of instruction in any art, the space being limited.—D.

Papier-Mâché Trays for Photographic Purposes.—J. G. B. (*Dudley*).—The black japan varnish with which papier-mâché is covered would resist acids for a long time, but, as any accidental injury to this coat would place the paper at the mercy of the chemicals, J. G. B. is scarcely advised to adopt papier-mâché trays. His other query he will find answered in our reply to J. H. S. (*Romsey*).—S. W.

Wood for Fret Sawing and Carving.—WOOD SPOILER.—I repeat part of my reply to E. G. (*Ipswich*) in No. 8, page. 126. With reference to fretwork, wood may be bought of R. Melhuish and Sons, 85 and 87, Fetter Lane, London, E.C.; Henry Zilles, 24 and 26, Wilton Street, Finsbury, E.C., and Charles Churchill & Co., 21, Cross Street, Finsbury, E.C. To these I may add the names of Messrs. Thomas J. Syer & Co., 45, Wilson Street, Finsbury, E.C., of whom wood for carving may be obtained. In Liverpool wood for fret cutting may be obtained from G. Busschotts, Park Lane; in Bath, of Fritz Collins; in Settle, Yorkshire, of Messrs. Harger Bros.; in East Dereham, Norfolk, of Messrs. J. H. Skinner & Co.,; and in Dublin of Booth Bros. From most, if not all, of these wood may be bought for turning or carving. I shall be glad to be favoured with the names of dealers in wood of all kinds in all large towns and other localities. I should then be able to refer any applicant to the dealer that is nearest to his own place of residence.

Carpenters' Bench, etc.—NAIOS.—You shall have the description of one or two carpenters' benches before long; a strong bench of the ordinary form, and a folding bench for light work to fall back against the wall to which it is attached. It is difficult, as I know from experience, to do without one. A paper for mounting a small grindstone has just been sent in by a valued contributor to WORK, and shall appear as soon as I can find room for it. The boards of a kitchen table may be tongued and grooved, or pointed up by dowels. You can get a patent iron tonguing and grooving plane for about 10s. 6d.

Advertisements in WORK.—AD FINEM.—I am glad to find that you are making progress in carpentry by the aid of WORK. With regard to the advertisements that appear in each number, I can only say that there are many who find them to be useful, and value them accordingly. For my part, I am disposed to think that in time to come they will be considered as constituting one of the most valuable portions of WORK, inasmuch as they will form ultimately a finger-post and directory which will help the workman to many a useful article which he might possibly look for in vain, were it not for the seasonable *vade-mecum* placed at his disposal by the very pages to which you are now pleased to take exception. It must be understood, to avoid useless repetition, that with regard to future letters on this subject I can do no more than refer their writers to this reply.

R. T. (*Bolton*) and A. B. T. (*Wycombe Marsh*) are requested to consider the above as a reply to their letters also.

Tarnished Clock Dial.—S. F. (*Gubal*).—You made a mistake in cleaning it the first time, as, in doing so, you cleaned off the lacquer, the only thing is to thoroughly clean it again with bath brick, and finish off with whiting, then give a coat of lacquer, when it will be good for years. If it gets dull or dirty wipe over with a damp cloth; the circle with the numerals on should be silvered, when it will show up the hands better, as well as the lacquered brass.—A. B. C.

Naming Deal and Pine Woods.—TYRO (*Edinburgh*).—Yellow and white deal are usually known as "deal," although pine may be so called. For instance, you speak of a "deal box;" you mean one made of pine, not of any hard wood. In the trade a "deal" is understood to be a size—*i.e.*, $2\frac{1}{2}\times 9$, 3×9, or 4×9.—A. J. H.

Covers for Bookbinding.—M. W. M. (*East Dulwich*).—C. Hindley & Son, Oxford Street, sell the Japanese leather paper. Liberty's had remnant bundles at 1s. and 1s. 6d. lately. I know no good manual on the subject.—E. B. S.

Books on the Power Loom and Weaving.—D. B. (*Perth*).—A good book on the subject is "Spinning Woollen and Worsted," by W. S. B. McLaren, 4s. 6d., published by Cassell & Co., Ludgate Hill, London, E.C.

Castings for Engine Cylinders.—T. W. (*Gray's Inn*).—Go direct to the founders. There are very few good steel founders in the market. From ample knowledge of their castings during several years past I can recommend Jessop's and Hadfield's, both of Sheffield, but I question if they will care to undertake such small work as you want; neither would the castings be of much use for your purpose; but you may try. You must not use wood for patterns that is liable to warp. Thus, you should not use elm, ash, or unseasoned mahogany or pine, otherwise, almost any wood will do for patterns. The best of all is mahogany. By the way, is not your cylinder of 2 in. bore and 2 in. stroke rather oddly proportioned?—J.

House Painting.—HARLOW.—Our correspondent desires help in estimating for external house painting in a country place about twenty miles from London. Prices of house painting are materially governed by the rate of wages paid in the district in which the work tendered for is situated. For instance, house painters' wages in best part of metropolis is 8½d. per hour, whilst in the outlying districts and suburbs 7d. and 7½d. would be the general rate of payment. In the present instance we assume that the painter's wages in the district indicated is 6d. per hour, and that our inquirer has no personal experience of such work wherewith to gauge the cost of the job. Let him, therefore, in the first place, examine carefully the condition of walls, the putty of window glazings, which frequently requires replacing, and, if necessary, provide for repointing round doors, etc., as well as the first-mentioned plasterers' or masons' work. The cornices, sashes, and doors should then be separately noted, and allowed for at the following prices:—Cornices, if consisting only of plain mouldings and no ornamental casting, and if within reach of a ladder which one man can with safety handle, 6d. to 8d. per yard, lineal or "run," as it is usually termed; if cornice has dentils, or such like enrichment, and requires more labour for ladder, etc., from 10d. to 1s. per yard, lineal, would be a fair charge. Window sashes, frames, sills, etc., if in fair condition, and twice painted, finished in two colours, 2s. 6d. to 3s. 6d. each, according to the size and number of squares of glass in each. If *sashes* are to be grained oak and varnished also, add for these two processes, 1s. 3d. to 1s. 6d. extra to above. Front doors either grained oak and varnished, or plain colours and varnished, are worth the same, since the latter must have more care and preparation to look well than the grained work, where the "figure" takes the attention of the eye, usually requires. The most ordinary front door is worth about 5s., and ranges for a good panelled door and door frame of a large house up to 30s., and higher. For the plain cemented wall-work 6d. per square yard, for two coats "white lead and oil" paint, should pay our correspondent if the house is a fair distance around and within reach of, say, a 40-round ladder. If much of the wall space is above a height of 40 ft., then more strength and time will be necessary to handle ladders with which to execute the work, and 8d. per square yard for two coats must be charged. Four coat work on new cement would be worth about 1s. to 1s. 3d. per yard, according to the convenience, etc., above mentioned. Beyond these prices very little written advice or help can be given, since much still will depend upon the condition of the work, the situation of job, its management and practical supervision, the cost of material differing very considerably between the large employer and a small buyer, and upon which questions the profit or loss depends very materially. Practical experience and observation are the best standards of judging house painting by, and although we, from personal experience and knowledge, can confidently recommend the prices given as being fair pay for fair work, we recommend the inquirer to exercise every care lest he should burn his fingers. After calculating the job on the scale given, it would be a good plan to check it, if possible, by judging the probable cost of time, materials, and incidentals required for its execution: should this leave a margin of about 20 per cent. between the measured estimate and the latter calculation, a fair tender would have been arrived at by that scale. To such as HARLOW we recommend the careful study of our practical treatise on house painting, which will shortly appear in WORK.—F. P.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Small Furnace.—G. T. M. (*Liverpool*) writes:—"Would a reader kindly tell me how to make a small furnace for melting steel, as I am going to make some steel castings, and also what kind of sand to use for moulding?"

Cylinder Marine Engine.—BON FIL asks for "dimensions, etc., for making a working drawing of a two-cylinder marine engine and boiler to be fitted into a boat, 5 ft. long by 9 in. broad, and 7 in. deep, made of sheet iron."

Gear Wheels for Lathe.—C. E. H. (*Warrington*) writes:—"I should be very much obliged if you could inform me where I might obtain two pairs of gear wheels, one pair 2 in. in diameter, the other pair $\frac{1}{2}$ or $\frac{3}{4}$ in. in diameter, to form back gearing for a lathe of $1\frac{1}{2}$ in. centres, which I am making. Please let me know as soon as possible through your 'Shop' column, as I am waiting for them. I am well pleased with your paper."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Polishing Oak Floors.—G. B. P. (*Birmingham*) writes in reply to H. N. (*Bexley Heath*) (see page 174):—"If you cannot get the required polish on your oak floor with beeswax and turpentine, adding plenty of elbow grease, why not varnish it, scrape off your wax, and give three good coats of the following, and you will have a good hard polish that will last for years:—1 lb. shellac, $\frac{1}{2}$ lb. resin, and 1 quart of naphtha; thoroughly shake till dissolved, and apply with a $2\frac{1}{2}$- in. camel-hair brush. If you would rather wax it I will send you instructions and a good recipe with pleasure."

Wood Colouring.—G. B. P. (*Birmingham*) writes in reply to OX GALL (see page 174):—"You want a good old oak stain. Procure a pint of turpentine, and add $\frac{1}{2}$ pint of Brunswick black, and you will have a good and cheap stain for your pine overmantel. You cannot dull polish without a lot of work (not properly), but try three coats of fine spirit varnish; after each coat sandpaper with No. 0 paper, and after last coat of varnish brush well with pumice powder."

Glaze for Finishing French Polishing.—G. B. P. (*Birmingham*) writes in reply to W. H. B. (*Redditch*) (see page 174):—"Glaze used in French polishing is made by dissolving $\frac{1}{2}$ lb. gum benzoin in 1 quart of methylated spirits. Thoroughly pound up the benzoin, then add to the spirit, shaking well every day for a week, then strain, and it is fit for use. Why not finish with pure spirit, as glaze is only fit for common work?"

Sounding Board of Dulcimer.—W. S. M. (*Leeds*) writes in reply to DULCIMER (see page 174):—"I see in your issue of WORK for June 1st, an application for the dimensions of a dulcimer sounding board. Dulcimers are made in several different sizes, according to the pitch of tone required. If your applicant will communicate with me, stating whether he merely wants a dulcimer for home amusement, or suitable for platform, or playing with other instruments, I shall be pleased to forward him the information he requires, or I can supply him with an instrument, if he prefers buying to making one. Last year I was awarded a bronze medal and certificate at the People's Palace, London, for improvements and richness of tone in the manufacture of dulcimers and mandolines."

Pattern of Plane for Casting.—A FOREMAN PATTERN MAKER writes in reply to E. P. W. (see page 172):—"Though there is some advantage in casting a piece across the mouth of the plane, I do not think it at all necessary if soft Scotch iron is used. If inferior hard iron is employed, then it is well to thicken the metal. Actually the metal where the iron has to bed would not come to a keen or 'feather edge' in any case, as that edge would be cut off in the pattern, and in addition there would be the allowance of extra thickness for planing on the bottom—say $\frac{1}{16}$ in. or $\frac{3}{32}$ in. Then there is the strip cast across the inside face, to give the iron a bedding above the bevelled facet, and this keeps the metal rather hotter there than elsewhere, aud so tends to prevent chilling. As a matter of fact, all the outside surfaces of an iron plane are hard when they leave the mould, but such hardness is only skin deep, and is removed by grinding, previous to using the file. I may add also that I speak from experience, but admit, at the same time, that the class of metal used will have a vital influence on results. I particularly mentioned, however, soft eastings in my article, page 50."

Etching on Steel.—G. T. (*Landport*) writes in reply to EXCELSIOR (see page 125):—"The reason for my writing is in consequence of EXCELSIOR asking in 'Shop' for a practical substance for etching on steel. The substance which I have used very successfully for etching names on steel tools is sulphate of copper or common bluestone, which can be obtained from any druggist; a pennyworth will do a good deal of work. The way I use it is this: I take a small crystal of the bluestone, and crush it into powder, and then add to it a very small pinch of salt, and moisten it with a little water; then, having written the name in soap in the ordinary way, I drop the moistened bluestone on to the writing, and after letting it stand for two or three minutes, I wipe it off, and it is marked quite plainly. Of course, the longer it stops on the deeper it goes. This is when I have a few names to mark, but when I have a quantity I make a solution of bluestone; and for etching designs I think this would be by far the better plan. To make the solution I crush some crystals into powder, and put them in a small bottle with a small quantity of common salt, and pour hot water on them, and shake until all is dissolved. It is best to keep adding the powdered crystals until the water will dissolve no more; by this means you will get the strongest possible solution. If kept corked, this will keep its strength for months. In using this for etching designs it would be advisable to make a ridge of soap outside of the design, so as to keep the liquid from running off on to other parts."

IMPORTANT PRIZE COMPETITION.

THE Editor of WORK has the pleasure of informing his readers that Messrs. CASSELL & COMPANY, LIMITED, have placed at his disposal the sum of

THREE GUINEAS,

to be distributed in Prizes for Competition for Designs for a small Bookcase, to contain the Volumes of

CASSELL'S NATIONAL LIBRARY,

which, at the close of the present year, will have attained the aggregate number of TWO HUNDRED AND EIGHT. The books are in themselves of world-wide interest, and may be regarded as forming the front rank of our British classics.

In order to give a fair and proper idea of the space or accommodation that will be required in the Bookcase for the whole of the volumes up to the close of 1889—two hundred and eight in number, as already stated—it is desirable to say that each volume, bound in cloth, is $5\frac{7}{8}$ inches long, 4 inches wide, and about $\frac{1}{2}$ inch thick; or, to be more precise, the linear space filled by thirteen volumes is $6\frac{3}{4}$ inches in length, which admits of the volumes being placed on the shelves without any possibility of being crowded too closely together, to prevent easy withdrawal of any single volume at pleasure. As 13 is the sixteenth of 208, the space required for this number of volumes can be easily calculated.

In order to give satisfaction to as many competitors as possible, the Editor of WORK thinks it desirable to divide the sum offered by Messrs. CASSELL & COMPANY into Three Prizes, as follows:—

FIRST PRIZE ... One Guinea and a Half.
SECOND PRIZE ... One Guinea.
THIRD PRIZE ... Half a Guinea.

Intending Competitors are placed under no restriction as to Form, Arrangement, or Ornamentation, as it is the Company's desire to elicit from the readers of WORK an Original Design for a Repository for the Four Years' Issue of the National Library up to the close of the year 1889 that may be regarded as the most convenient and desirable for the purpose indicated.

Competitors should send in WORKING DRAWINGS to SCALE not later than August 31, 1889, and addressed, carriage paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
Prize Competition. LONDON, E.C.
Cassell's National Library.

A motto must be affixed to each set of Drawings, and the name of the sender, etc., enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted for adjudication to Three Competent Practical Men, who will select those that are deemed worthy of prizes.

The Prize Drawings selected will become the property of Messrs. CASSELL & COMPANY, LIMITED, who will return all Designs made by unsuccessful competitors to their respective owners, carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced and engravings of the Prize Bookcases given in No. 30 of WORK, published Oct. 9th.

NOTICE TO CORRESPONDENTS.

*** In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.

Trade Notes and Memoranda.

A CORRESPONDENT in the *American Machinist* recommends the following for improving burnt steel:—Reheat the steel, and cool in a solution proportioned thus: 1 gall. of whale oil, 2 lbs. of resin, 2 ounces black oxide of manganese, the whole to be hot and well stirred at time of using. The same correspondent recommends using a lead heating bath to prevent the danger of burning small tools.

FILES whose teeth are cut with a gradual increase in pitch, *i.e.*, in degree of coarseness, from the point towards the tang, are largely used in America. They are called "increment cut" files, and are cut by machinery. They work more sweetly than the ordinary files, being less liable to chatter.

UP to the present date, on the Manchester Ship Canal works, about $15\frac{1}{4}$ millions of tons of earth and rock have been excavated, while 28 millions more have to be removed. It is thought that the work will be completed in two years from the 1st of January next. There are on the works 183 pumping engines, 82 steam navvies, 5,000 waggons, 158 locomotives, and 116 steam cranes, and in a few months 15,000 men will be employed.

A COMPANY has been formed to manufacture a new white lead, which is stated to possess certain important advantages over the ordinary compound, such as permanence of colour in a bad atmosphere, and increased covering power for a given weight. Ordinary white lead, as is well known, consists of the carbonate; the new compound is the sulphate. It is prepared directly from galena by roasting in a furnace, and condensing the fumes or vapour of sulphate of lead, which is formed by the oxidation of the sulphide. The sulphate is collected from the condenser, washed with weak acid, and after drying is ready for the market.

WORK

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3 months, free by post	1s. 8d.
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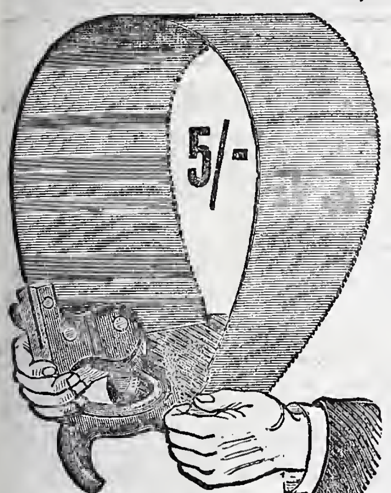

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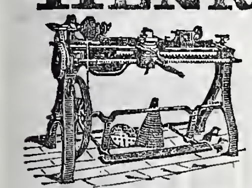

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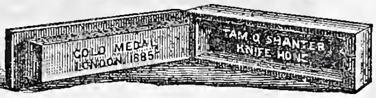

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 17.] SATURDAY, JULY 13, 1889. [Price One Penny.

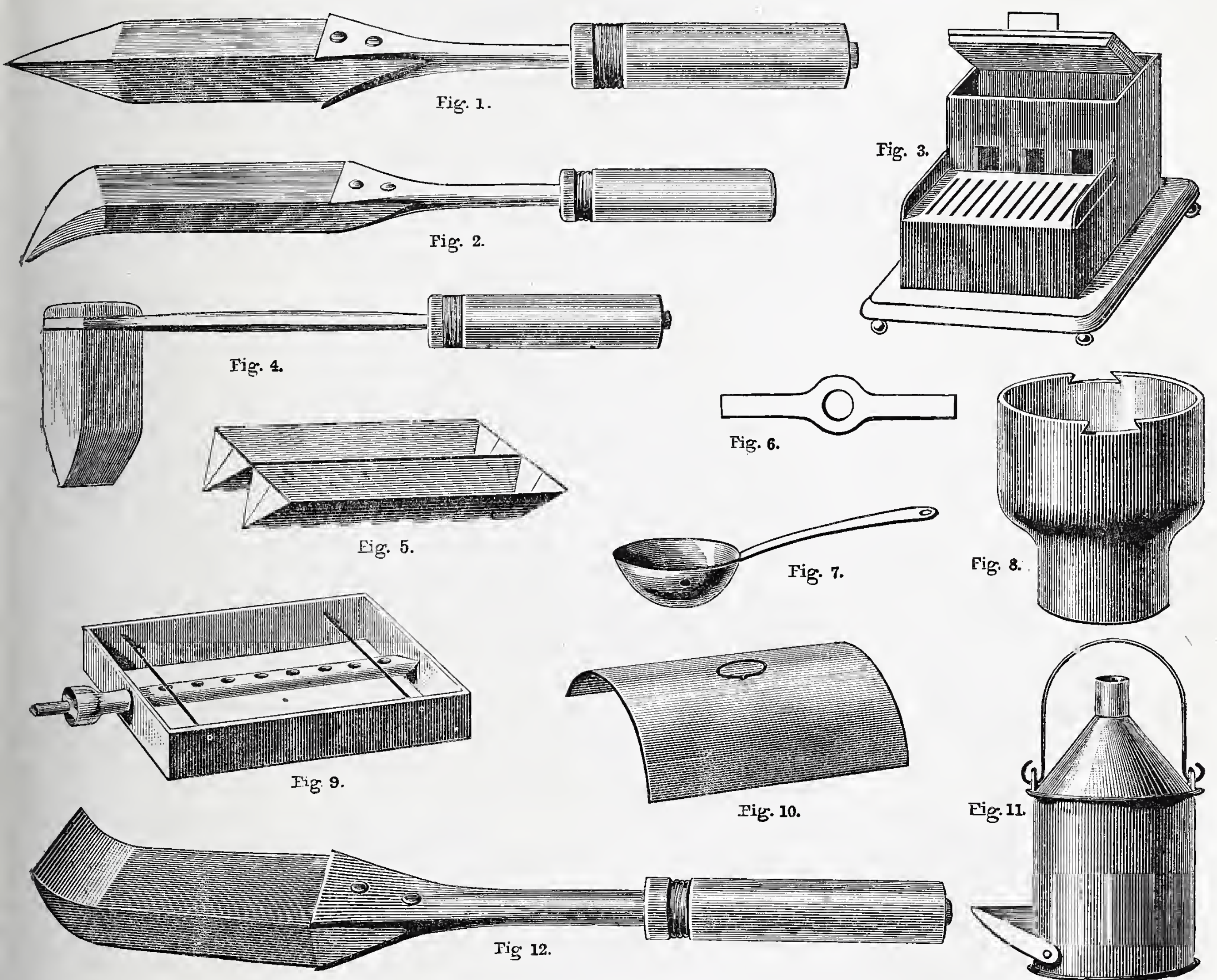


Fig. 1.—Pointed Soldering Iron for General Work. Fig. 2.—Soldering Iron with Bent Point. Fig. 3.—Stove suitable for Soldering. Fig. 4.—Hatchet Bit. Fig. 5.—Mould for Solder. Fig. 6.—Brass to fit across Air Bulb. Fig. 7.—Ladle for Melting and Running Solder. Fig. 8.—Air Bulb. Fig. 9.—Home-made Gas Stove. Fig. 10.—Cover for Gas Stove. Fig. 11.—Sheet Iron Fire-Pot for Outdoor Work. Fig. 12.—Bottoming Iron.

SOLDERING:

THE NECESSARY APPLIANCES AND MATERIALS.

BY ROBERT ALEXANDER.

Introductory—Definition of Soldering—Soldering Irons—Their Length, etc.—The Solder Ladle—Making Solder—Test for Solder—Fire or Stove—Fuel—Gas Stove—Home-made Stove—Fluxes for Soldering—Hydrochloric Acid—Rosin or Resin—Other Needful Appliances.

In these and other papers to follow I propose to try to clearly describe and illustrate the methods employed, the patterns and dimensions, and the tools used in the trade of a tin-plate worker, tinsmith, or tinman, who has, perhaps, a greater variety of work to do in the various sheet metals, tin, zinc, iron, copper, and brass, than any other workman, especially in a country shop where he has to take the whole of the work, sometimes in conjunction with a smith, but as often as not by himself.

Of the prospects of the trade, I will only say that a man who can qualify himself to take such a place as I have mentioned can always get a job, and can (in reason) name his own wages. In these articles, though I shall not be able to fully describe every article or process, yet I shall endeavour to make as comprehensive a selection as possible; and my hope is that they may be of use to many.

How I should have welcomed a magazine like Work in my 'prentice days! and I would say to all young men who have started to take it in, stick to it; don't growl because your pet hobbies and ideas do not come out in the first number, or even the first twelvemonth. Make a hobby of something that is appearing, remembering that what you put in your head no one can take away from you. With these few hints, I will commence the first part of my subject, which will treat of soldering, brazing, and tinning.

Soldering.—This may be defined as the art of uniting two metals by means of an alloy termed solder, applied to the work with a tool called a soldering iron, or copper bit as it is sometimes termed, various fluids and substances termed fluxes being used to facilitate the melting and flowing of the solder, and to assist it in adhering to the work. That soldering is not such a simple process as it looks, most people, who remember their first attempts, will readily admit. How the solder positively refused to go where it was wanted, and how resolutely it seemed to stick where it was not wanted; how, when after much patience and waste of solder we managed to do the job we were at, it as often as not fell to pieces with very little provocation. Such reminiscences must be familiar to many who have dabbled in metal work of any kind. But these faults and failures are more from not understanding the fundamental principles of good soldering than from any real technical skill being required; and it is my aim and object, in these instructions, to show clearly how to succeed and the causes of failure. Soldering playing an important part in many things besides sheet metal working is one of the reasons why I take it first in my list of subjects.

Soldering Irons.—I will now proceed to describe the soldering irons. These are of various sizes and shapes, according to the work to be done. Fig. 1 is the ordinary pointed soldering iron used for general work. Fig. 12 is called a bottoming iron, and is used for soldering round the bottoms of such things as saucepans, boilers, etc. Fig. 4 is called a hatchet bit: this is more used by plumbers than by tinsmiths. Fig. 2 is similar to Fig. 1, only bent at the point and lighter.

There are several things to be noted in buying or making soldering irons. There should be from four to five inches of copper, exclusive of that which is riveted in the shank, as with the constant usage, and the filing and drawing out, the length soon diminishes. Then it should not have a long shank, as a long iron fatigues the arm very much, not only by the weight of the iron, but by the cramped position into which it throws the arm.

Generally speaking, the soldering iron should be about 16 inches long from point to extremity of handle. The handle also calls for a few remarks. Most of the copper bits on soldering irons sold in the shops are fitted with common file handles with iron ferrules; the shank is generally drawn to a point and stuck in about two inches; the consequence is that, after using a short time, the handle shrinks, the ferrule slips off, the handle splits, and the iron draws out, causing great annoyance and waste of time. If the handles are made as shown in sketches, they will afford a firmer grasp, balance the iron better, and last as long as the soldering iron itself. They are turned from good sound beech, 5 in. long, and $1\frac{1}{8}$ to $1\frac{1}{4}$ in. diameter. A groove is turned in them to receive a binding of copper wire instead of a ferrule. A hole should be bored about three-parts of the way through the handle, the size of the round shank; the remainder should be burnt through with the pointed part of the shank till the point comes through about $\frac{1}{4}$ in. It can then be either bent and clenched into the end of the handle, or riveted with a small burr or washer. It is worth while to take this trouble with them in order to get them secure. I have more than once seen a heavy iron slip out of its handle while being carried up a ladder, to the great danger of the man's mate standing below.

The next subject to consider is the solder. This is composed of lead and pure block or grain tin, in varying proportions according to the work that it is required for. I do not intend to give ten or twelve recipes for solder, some of them only varying in their melting points a few degrees, but simply three kinds. The first is suitable for rough jobbing and outdoor work, such as zinc roofing, etc. To make 7 lbs. of it, take 4 lbs. of tin and 3 lbs. of lead, melt the lead in a lead pot, and add the tin when melted, stir well with a ladle, and remove the dross which will float on the top, and run out into strips in moulds made by bending some pieces of sheet iron anglewise, and turning the ends so as to prevent the metal running out. These moulds should be about 14 in. long. (Fig. 5.) This solder melts at about 350 deg. Fahr. For a finer solder for all general purposes, new work, etc., take 4 lbs. tin, 2 lbs. lead, or in that proportion, viz., two to one. This is a splendid flowing metal, and is good enough for anything. If blowpipe solder is required, take the same proportions as last mentioned, and add one part bismuth, run out in very fine strips.

The best way to do this is to take a small ladle, and drill a $\frac{1}{8}$-in. hole in it near the top edge. (See Fig. 7.) Dip a ladle full of solder out of the pot, and, holding it over a sheet of iron or cast-iron plate so that the bottom of the ladle just touches the iron, cant the solder towards the hole, at the same time drawing the ladle from left to right; a fine stream of metal flows through the hole in the ladle, which cools as it touches the cold iron plate. A little practice will soon make perfect. Blowpipe solder should be kept in a canister to keep clean.

It is very often required to make solder when no tin is available. In fact, in most ironmongers' shops they seldom use tin for making solder, as they buy up scrap pewter, such as old tea-pots, beer measures, etc. Pewter being an alloy of tin and lead, it is obvious that if it is used to make solder with, a smaller quantity of lead must be used than if tin and lead were being used; it is a difficult matter to give a proportion of lead and pewter to make solder, as some articles are of a better quality than others, that is, they contain more tin. But as a general rule I have found that it is not wise to put a larger proportion of lead than 3 to 10 of pewter.

Test for Solder.—As a guide in cases of doubt, after mixing the metal, run out a stick and watch it cool: should it cool with a bright silvery appearance, it will not be far wrong; should it turn a bluish grey, it shows too much lead; should it turn dull white and pit all over with little dots, too much tin. The remedy is obvious: add whichever metal is wanted, a little at a time, trying it after each addition till you get it right. It is also a common way of trying it by bending a stick; if it emits a slight crackling it is good; should the crackling noise be too pronounced it will bear a little more lead, and in fact a good working hard solder is that which on crackling very slightly has a trifle more lead added. I think this is all I need say on the preparation of solder, except that no zinc must be allowed to get into it, as a very small quantity of that metal will utterly ruin a pot full of solder. Old composition pipe also should be carefully kept out of the solder.

Fire or Stove.—Our next thing to consider is the fire or stove. There are several stoves made specially for soldering. Fig. 3 is a very good form. The top part lifts off; the front and outside grating are in one piece, and also removable to clear out the ashes that drop through from the top part; the whole stands in a cast-iron tray. They cost from 20s. to 25s., and may be procured from Messrs. Rhodes and Sons, Wakefield, a firm whose reputation as makers of tools and machines for tinmen and sheet-metal workers is world wide. To say that a tool or machine is of Rhodes' make, is to say that it is all that can be wished; such, at any rate, is my opinion, and was that of my father before me, and readers of these articles would do well to get their catalogue. There are, of course, other firms of good repute, but of these I cannot speak from experience. To return to the subject of stoves, Fig. 11 is a sheet-iron fire-pot mostly used for outdoor work; most workmen make their own, and I will give particulars of this farther on.

Fuel.—With regard to fuel for these stoves; coke is the best for the indoor stove, and charcoal for the outdoor one. Years ago charcoal was almost universally used for both shop and outdoor work, and it is no doubt the best in many respects, being easily lit and easily kept alight, but coke being much cheaper, has to a great extent displaced it, though some still would not use anything but charcoal. Coal is not a good thing, as unless it is a clear fire it blacks and smokes the irons; but, as the showman says, you can pay your money and take your choice.

Gas Stove.—Gas stoves may also be used for heating the irons, and where gas is cheap, or for amateurs who do not do a great deal of soldering, I am inclined to think that they are a better means of heat than a fire, being clean, always ready for use, easily lit and put out, and the irons are not so liable to be burnt through non-attention.

Home-made Gas Stove.—Mr. Fletcher, of Warrington, makes stoves specially suitable for this purpose, or the workman can make his own for a trifle. Fig. 9 is a stove that I made very recently, which answers the purpose for which it was intended, viz., keeping one iron constantly in readiness, very well. It consists of a frame of stout hoop iron 8 in. by 3 in. and 3 in. deep; the burner is a piece of $\frac{1}{2}$-in. gas pipe, welded up at one end, cut off 7 in. long, with $1\frac{5}{8}$ in. of thread cut on it. A backnut is then screwed on it, and a row of holes $\frac{1}{8}$ in. diameter, or a row of saw cuts, whichever comes easiest, is then made in it, commencing $\frac{3}{4}$ of an in. from the backnut and going to about 1 in. from the other end; ten or twelve holes or cuts will do. A hole is then cut or drilled in one end of the frame, large enough for the pipe to go through and an air bulb is then made as follows: Take a 1-in. to $\frac{1}{2}$-in. diminishing socket and cut a dovetail in it as Fig. 8; then cut a piece of brass the shape of Fig. 6, $\frac{1}{8}$ in thick, and wide enough at the ends to fit the dovetails; in the centre drill and tap a $\frac{3}{8}$-in. hole, rivet the piece of brass in the socket, cut a thread on a piece of $\frac{3}{8}$-in. brass tube 3 in. long, fix a No. 2 or 3 gas-burner in it, and screw it in the cross-piece of the air chamber; pass the piece of pipe through the hole in the frame, screw on the air chamber or socket, and then drill four holes in the frame and run $2\frac{1}{4}$-in. rods across to rest the irons on; support the cover Fig. 10, and the stove is complete; connect to gas pipe or bracket by means of flexible tubes. If wanted for two irons make frame 2 in. wider and insert another burner.

Fluxes for Soldering.—Having considered

he soldering irons, the solder, and the fire-
ots and fuel, we will now turn our atten-
ion to the various fluxes required for sol-
tering.

I. *Hydrochloric Acid.*—This is also known s muriatic acid, or more commonly termed pirits of salts; it is a corrosive poison, and hould be kept in a stoppered bottle. In its aw state as purchased it is used for solder- ng zinc and galvanised iron, and for pickling ınd scouring purposes previous to tinning; t is not fit for soldering tinwork till it has een what we term "killed" and diluted, which operation is performed as follows:—Into a quart jam or salt jar pour a pint of aw spirits. (N.B.—This operation must be lone in the open air.) Into the spirits drop handful of zinc cuttings a few at a time: this will cause the fluid to boil and give off offensive fumes, which you must be careful not to inhale. When the boiling has ceased to some extent, add some more cuttings and let it stand for an hour; then put a bit or two more of zinc, and if no action takes place it is "killed" sufficiently. Pour the clear liquid into a bottle, and add nearly an equal quantity of water; cork up and put by for use. Some use it without the addition of water, but it is not a good plan.

The spirits thus prepared are termed killed spirits, and are used for tinwork, wrought iron, brass, and copper.

II. *Baker's fluid for tinning and soldering.*—This is a specially prepared article sold in bottles. It is supposed to answer for all the purposes of spirits, and it is a good thing to use for new work, as it is not so corrosive as spirits; but it is not so good for zinc, especially if the zinc is a bit dirty, as the fluid does not seem to possess that cleansing power that the raw spirits have.

III. *Rosin or Resin.*—This was at one time the chief, and, indeed, I might say the only, flux used for soldering; it is used a good deal now in many places for new bought tinwork, especially any that is likely to be in stock a long while. For tinwork it is used pounded fine, and mixed with oil to the consistency of paint, and applied with a brush; it should be wiped off whilst warm. It is also used for soldering lead pipes, making joints in electrical wire, etc., being entirely non-corrosive; in fact, rather preservative. There are two kinds, the black and the white (so-called); the white is the dearest, but it is no better for our use than the black. These are the principal fluxes used.

Other Needful Appliances.—A few other tools and appliances are required in soldering, viz., a jar to hold the spirits, a lump of sal-ammoniac, a file or two, a scraping knife, and one or two brushes for the spirits. I make mine by turning a tin tube on a bit of quarter rod, cutting a knot of hair out of a broom, slipping it into the tube, and flattening it with a blow of the hammer.

Tinning Iron.—Having got all these in readiness, before anything can be soldered the soldering iron must be tinned. Heat it in the fire to a blood-red, then grip it in a vice if you have one, and file the four faces quite bright; dip the iron in the jar, in which you have previously poured about a gill of killed spirits, then rub it on the piece of sal-ammoniac, holding a stick of solder to the point of the iron and melting a little on to the lump of sal-ammoniac, rubbing and turning the iron at the same time. If it is hot enough the solder will flow and coat the face of the iron. This is called tinning the iron. Dip again in the spirits, and the operation is complete; and it should be the aim of the workman so to use his irons that they shall not require tinning oftener than is necessary. I have used, and seen other workmen use, a pair of irons for a day's work, and, by judicious management, leave them in nearly as good condition at the end of the day as they were at the beginning, without filing them at all; and, on the other hand, I have known some who seemed to have the unhappy knack of constantly burning their irons, as it is called when left in the fire too long, so that they get red-hot and the tin burns off. The degree of heat required varies, of course, with the job to be done, but, as a kind of guide to general use, it should, when taken from the fire and held about an inch or so from the cheek, give off a hot (not warm) glow, and a peculiar sharp hissing sound when dipped in the spirit pot, which should always be done before commencing to solder anything. Some workmen have a jar of sal-ammoniac water to dip the iron in, to save dirtying the spirits. It is a very good plan, but as far as my knowledge goes it is not much practised.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

(*Continued from page* 198.)

SUBDIVISIONS OF SMALL LETTERS OF ALPHABET—ITALICS—SPACING—ROMAN CAPITALS.

HAVING shown in the last chapter that all letters are formed of straight lines and curves, either singly or combined—not that they could be very well formed by any other means—the student who has never given much thought to what he might consider so small a matter, should now be better able to grasp and understand the individual construction and character of all the letters in our alphabet. But, before leaving this subject entirely, it is necessary to again subdivide the alphabet as regards small letters, technically called by the printing profession "lower case," and also "script," or handwriting letters; in the latter case both capitals and small letters being so divided. We will thus divide them into four classes, viz.: short, ascending, descending, and "kerned" letters. The short letters are A, C, E, I, M, N, O, R, S, U, V, W, X; ascending letters consist of B, D, F, H, K, L; and descending letters are G, J, P, Q, Y, Z. Again, "kerned" letters are those which have part of their face hanging over either one or both sides of their shank. In the Roman F and J are the only "kerned" letters, but in Italic (which I do not illustrate at present) they are B, D, F, G, H, J, K, L, P, Y. The reader may ask whether it is absolutely necessary to go into this minute definition or analysis of the alphabet, so I will now show that it is, and, moreover, that all good sign writers ought to possess such knowledge. In the first place, most of the different styles of letters used by the sign writers are facsimiles, or, at least, very close copies of the ordinary printing type letter.* This is caused in a great measure, I believe, by the sign writer originally learning his letter-forming by taking as examples the specimen sheets of letters found in the "Book of Alphabets" sold by decorating firms and publishers, and which are frequently printed from ordinary type to save the expense of engraving specially designed blocks suitable to the purpose. A good many professionals are also very fond of making complete sets of ornamental letters from any printed example which may take their eye, but which, I am sorry to say, is not always so pleasing to other people, especially to those with an advanced artistic taste.

Now, in type founding it is usual for "kerned" letters to have part of their face overhanging the body of the type, and the type is cast in this way in order to economise room and prevent an ungainly appearance, which would be caused if the face were wholly on the body, since a blank would intervene in the midst of a word almost equivalent to a space, *i.e.*, a blank lead inserted to divide words. This is done by the type founders because the compositor is unable to have any share in the proper spacing of letters; but with the sign writer it is different, as he has unrestricted freedom in the spacing of his letters and displaying his words, and it is to this point which I have been working up to. I would therefore point out to the novice that, in cases where he is using such letters as have just been described, he must give the utmost care and attention to their spacing, otherwise his work when completed will have a most ungainly and awkward appearance. To make this fact the more apparent, let us suppose he is called upon to write in Italic letters the word

S w a f f h a m

and executed his work as shown in the word; it would, of course, look most unsatisfactory—in fact, divided in the middle, or consisting of two words. This is caused solely by bad spacing. Now, let us try again and see how the word appears when it has been judiciously spaced, such as this specimen—

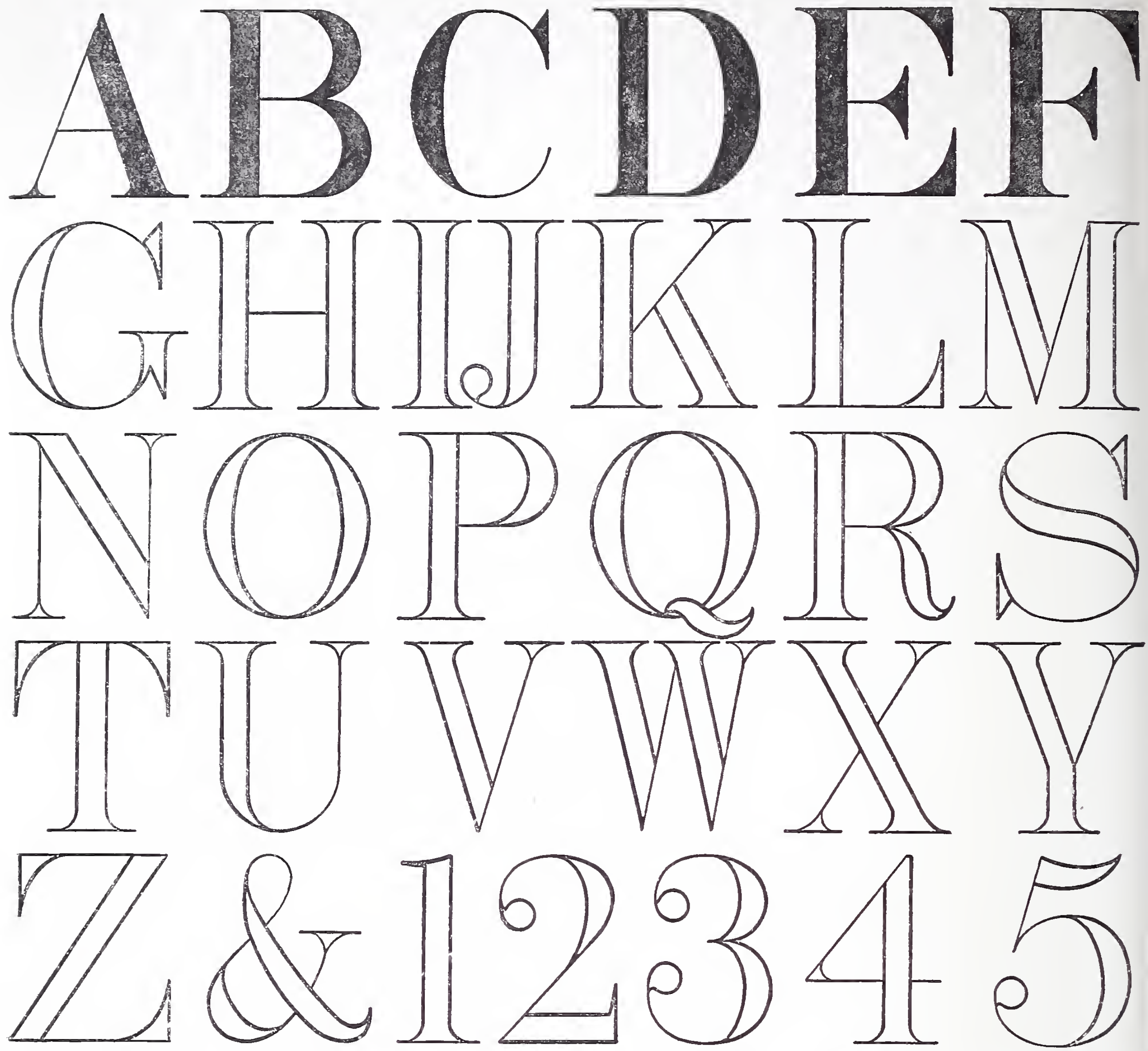
Swaffham

Now the word has a symmetrical appearance. The defect in the first example lies in the fact that the "kerned" letters take up more space in width than the others, so to have each letter regularly spaced in this identical word it is necessary to have the short letters a little wider apart than would otherwise be the case if no "kerned" letters were used. Difficult words, such as this, require much forethought, but I shall speak more fully on the subject of "spacing" in a subsequent chapter, having said enough for the present to show how essential it is for the student to consider the alphabet in all its forms and phases, and more important still—what a help such knowledge will be to him in his after-work.

Presuming that the student has by this time made a fair advance in drawing letters of the sans-seriff order, I must now direct his attention to more difficult work in the shape of alphabets of Roman capitals, Fig. 33. The small letters I leave for the next chapter. With the exception of the first six letters, I have drawn the capitals in the style known as "Open Roman." They will, of course, require more practice to form correctly than their more simple predecessors, but as the Roman is one of the most commonly used styles, they must not be left till perfection has been attained. The small letters should be in due proportion to the capitals—that is, the former should be one-half as high as the latter.

Hitherto the student has practised drawing his letters in outline only; he may now go a step further and commence to fill them in from A to Z, as shown from A to F in

*As I do my own printing I am in a better position to know this, perhaps, than the ordinary sign writer, who very often is unaware of the fact.—H. L. B.



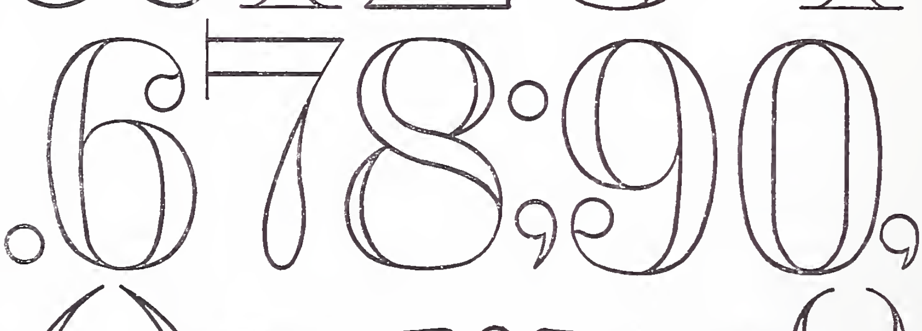


Fig. 33.—Solid and Open Roman Capital Letters and Numerals, Brackets, Dashes or Rules, and Stops.

Fig. 33. He will do this with the camel-hair pencil and paint, having first gone over the outline in the same way. This outline, be it said, should be drawn first of all, not with chalk, but very softly with a piece of Brodie & Middleton's sign-writer's pipe clay, which only costs about 3d. per dozen sticks, and will last at least a year. In filling in his letters there is one thing the novice will quickly discover, and that is that they (the letters) show up their defects more plainly when filled in than they did when only in outline, but to counterbalance this, he will also find that it is possible very often to perfect the shape of letters in the act of filling in, but this discovery should not in any way encourage him in making a careless drawing of the outline of the letters at the outset.

Having made satisfactory progress so far we must next pay attention to the numerals 1 to 0, and the stops, commas, brackets, dashes, and braces, as shown in Fig. 33. Their proper use will be described in the chapter devoted to spacing and display, so that it is sufficient for the present to learn how to make them. This, like the rest, comes with repeated practice.

LATHES FOR EVERYBODY.

BY SELF-HELPER.

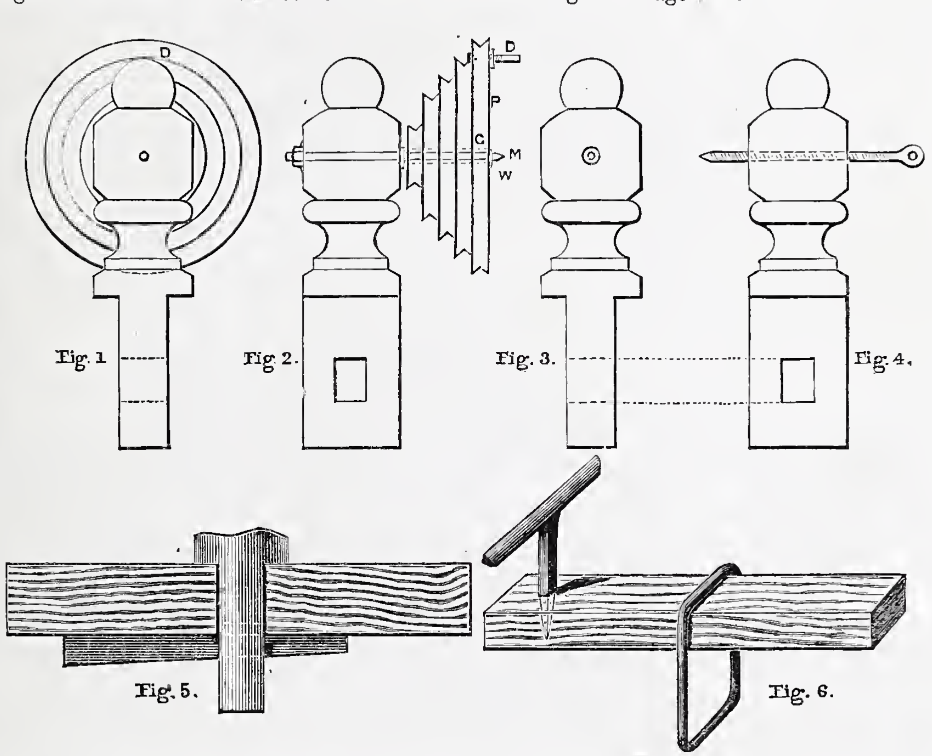
You must not imagine, reader, from the title of this article that I am the chosen advertising agent of some enterprising firm of lathe manufacturers who sell lathes from sixpence to five thousand pounds, to suit every pocket. No; I would be the worst person in the world for that task, as my passion would be sure to assert itself in the end, and that is a passion for lathe making.

Like most amateurs who have any pretensions to skill, I have had a great number of pupils in mechanics, men who would come to see my workshops, and, attracted by the beauty of the work which can be there done, would request that, if they were not in the way, they might come now and again and watch the various processes and learn as much as they could from them.

Such were usually welcome. I have had village tradesmen, and those very worthy individuals who are sometimes called handy men, sometimes Jacks of all trades, as well as amateurs in the strict sense of the word, among my pupils.

Them, as soon as I saw that their love for mechanics was really sincere, I almost invariably recommended to make a lathe. "Make a lathe!" many of them would repeat with astonishment, glancing at my highly polished and japanned machines which cost me months of patient labour.

"No, my dear friend," I would reply; "not one like that, at least not just yet, but one that will do, and do well, all that you require to do at present."



Figs. 1, 2.—End and Side Elevation of Fixed Headstock, showing (P) Pulley, (M) Mandrel, (D) Driving Pin, (G) Gun-barrel Bush, (W) Wire Knotted to prevent Pulley running off, Mortise for holding down Wedge (Scale, $1\frac{1}{2}$ in. = 1 foot, or one-eighth size). Figs. 3, 4.—End and Side Views of Poppet for Simple Wooden Lathe. Fig. 5.—Mode of Fastening Poppet to Bench with Wedge. Fig. 6.—Hand Rest with Stirrup of Half-round Iron, which passes through Bed and is fastened with Wedges.

And so I have been the father of many and many a lathe. Now, when I look back upon my pupils, I feel that my life has not been all in vain. Some of them are doing remarkably well. One, who pooh-poohed the idea of his having or using a lathe, is making a large amount of money by it, and he is an amateur. Another, a tradesman, is taking all the work from his fellow-tradesmen because he can beautify his dressers and tables with sundry turned legs and knobs, which they vainly try to imitate by hexagonal and other angular productions; while a few potter about their workshops like myself and derive nothing from their hobby but the unalloyed pleasure which it gives them.

Stay, though, is that true? Not it! Are there not sundry little tables and stools and boxes and candlesticks about the house which found their birthplace in these workshops? Yes, verily. Are there not many jobs brought there which otherwise would find their way to the village tradesmen, and have to be paid for in shillings and pounds?

Certainly there are. I am convinced that I must qualify the expression that I derive nothing from my workshop but pleasure. If it does not bring money in, it prevents it from going out, and that amounts to about the same thing.

Now a lathe was my first start as an amateur, and a lathe I made myself. Since then I have accumulated other lathes, and tools of sundry and divers descriptions about it, but the lathe was the start.

The readers of Work may be divided into two classes, amateurs and professionals. The amateurs may begin with a lathe, and build up their knowledge, with that as a basis, as I did. The professional will use his lathe as a means of increasing his income. There can be no doubt that the intelligent village carpenter or joiner would increase his income considerably by having and using a lathe. Many jobs which have to be sent to the city or the nearest turner could be done at home; for instance, rollers for mangles, spindles for washing machines, rolling pins, wooden platters, table legs, finials, knobs, and a thousand other things which are sure to turn up. These are usually paid for at a high rate considering the time spent on them, and this money the tradesman could put into his own pocket. Add to this that pieces of rustic furniture, which are now usually finished with either square or octagon legs, could have them nicely turned at the same price, while knobs which cost 3d. or 4d. could be made for nothing, and turned pillars and ornamentation could be added *ad libitum.*

The country people are vastly taken with anything that appears grand, and I am sure the village carpenter who supplied his furniture, for instance, tastefully finished with plenty of turning about it, would soon rival all his compeers, and be a rich and prosperous man.

We often see very taking advertisements in the newspapers telling us how to add £2 a week easily and honestly to our earnings. If I was asked how to do this, I would say "Buy Work, and do what it tells you. It will recommend the best plans for doing everything, and, by following its directions, you will work intelligently, and not do a thing simply because you were told to do it so."

To return to the lathes. I lately designed a lathe for a very beginner at the work, which will serve to show how an efficient tool, for it is efficient, can be made out of the very simplest materials.

My enthusiastic young friend has a good grindstone, about two feet in diameter, mounted on a low stand, and driven by a treadle. This I pitched upon as a fly wheel. He was about to make a bench. I asked, as a special favour, that the two 9-in. planks which formed the top should be left a couple of inches apart. The space could be filled up with a slip of thin wood when the lathe is not in use. I give diagrams of the heads. They are of oak, 4 in. square, and about a foot and a half long. Of course, any hard wood would do as well; beech would, perhaps, be better. I beautified them a bit by turning a knob on top, and also the space between the centres and bench, but this may be neglected by a man who has not a lathe; who, if he is æsthetic, may stop-chamfer them instead, and, if he is not æsthetic, may leave them rough as they come from the hatchet or saw. The height of centres I made was 6 in., and the tenon shown at the lower end of the heads was 2 in. wide to fit nicely between the planks which formed the top of the bench.

The position of the mortise depends on the thickness of the top of bench. In my case, it was $2\frac{3}{4}$ in. from shoulder, and was 2 in. deep and $1\frac{1}{2}$ in. wide. Fig. 5 shows how a long tapered key of hard wood fastens these heads to the bench. In Fig 2, which I will call the fixed headstock, there is a mandrel of Bessemer steel, fastened by a shoulder in front and a nut and washer behind. It extends four inches forward from the head, and has its end pointed to an angle of 60 degrees.

I turned this in the lathe; but, if any one of my readers has a difficulty in doing this, he may well be content with a piece of Bessemer steel 8 in. long and $\frac{3}{4}$ or $\frac{7}{8}$ in. in diameter. One end could be filed to a fairly true cone, and the other driven tightly into a hole bored in the headstock. I had a piece of gun barrel $\frac{3}{4}$ in. in diameter, which I made the mandrel to fit, and then I drove the barrel into a piece of wood which was to serve as pulley. This was of peculiar construction. It consisted of three pieces of oak one inch thick, and screwed and glued together with the grain crossed.

I mounted this on a face-plate, and turned a hole for the gun barrel or bush, and also the various speeds. The largest of these is 10 in. in diameter, and the smallest about 2 in. A very good job could be made of the pulley, without the aid of a lathe, by first boring the hole for the bush, and then, with a compass and chisel, making the pulley as round aud true as possible. When mounted on its own mandrel it would be turned quite true by fitting up a temporary band and changing it from speed to speed.

The pulley is kept from running off by cutting a groove round the mandrel before it, and tying a piece of stout wire in the groove in such a way that half its thickness projects over the surface of the mandrel.

With regard to the gun barrel, I am sorry that I cannot offer my readers a piece from my stock, but I just used the last bit of a long musket barrel in making a lathe similar to that I am describing. Steel tube can be got now from most large ironmongers, and if there is any difficulty about it, ordinary drawn brass tubing would do very well.

Messrs. R. Lloyd & Co., Steelhouse Lane, Birmingham, would, I am sure, supply tubing and Bessemer steel to suit for a few pence.

The other headstock or poppet has a screw 8 in. long and $\frac{3}{4}$ in. diameter to take the place of a mandrel. My friend has to revolve this with the help of a "tommy" until he gets braius and skill enough to fix a hand wheel on the end. A long, stout bolt or bed screw is a fair substitute for this screw, which, to some, would be troublesome to make.

The hand rest is somewhat original. It consists of a baseboard of oak $1\frac{1}{4}$ in. thick, 2 in. wide, and a foot long; into one end is stuck the T, and it remains there permanently.

A stirrup of $\frac{1}{2}$ in. round iron passes through the slot in bench; the baseboard is slipped through it on top, and a wedge, somewhat similar to those used for fastening the heads, slips through it under the bench top. Things are arranged, however, so that the baseboard can be raised about a quarter of an inch from the top of the bench when the stirrup and wedge are in position, and a second long thiu wedge is slipped between the top of bench and the bottom of rest, and thus clamps it firmly in any position. The plan looks crude, but works admirably.

A driving pin is fastened to the pulley. It is a $\frac{3}{8}$-in. round bolt with the head cut off and fitted with two nuts, one inside and the other outside of the largest speed. The inside nut I had to sink somewhat into the wood so that it would not strike the band when revolving. When the pulley revolves, it brings the driving pin into contact with a carrier fastened to the end of a piece of wood, and thus revolves the latter also.

I think I have now shown how a lathe can be made from materials that are found in most workshops, and a lathe which will do an immense amount of good honest work.

If a fly wheel were used instead of a grindstone it would be sometimes preferable. If the latter is used, it should be a kind which will admit of the trough being lowered out of the way to facilitate the shipping of the band.

I had intended to give a few hints on the construction of a still simpler lathe, but I will now bring this short paper to a close, hoping that it will prove useful to some.

I do not know whether I have made it sufficiently clear that when the lathe is required to work, the heads and hand rest are slipped between the two planks which form the top of the bench, and keyed there with the wedges. The grindstone is shunted underneath the bench, and a band passed between it and the pulley through holes bored in bench top for the purpose, and the lathe goes "merrily as a marriage bell."

PIN-HOLE PHOTOGRAPHY.

BY L. IVOR POOLE.

The idea of taking photographs without a lens seems, at first sight, so preposterous that readers who have not heard of it may almost be excused if, on being told that this article is written to inform them of its practicability, they are inclined to fancy that an attempt is being made to impose on their credulity. It is almost needless to assure them that there is no such intention, the desire being merely to direct attention to the possibility of taking a photograph with the very simplest apparatus, no lens at all, and no camera to speak of: nothing but a light tight box, and some contrivance to hold the plate. I do not, however, propose to write any instructions about these, but merely to make a few remarks ou pin-hole photography for readers who wish to try it.

Most of us, wheu we were boys, either in our scientific amusements or in perfunctory lessons on optics, no doubt became acquainted with the fact that if a very small hole were bored in the window shutter of an otherwise darkened room, an inverted image of the view outside would be cast ou the wall behind. I suppose very few of us ever satisfied ourselves by actual experiment; I know I never did. The conditions were altogether too irksome, and it was one of the assertions to be received on trust. No doubt it is correct, but an ordinary photographic camera is far preferable, and any one who will take the trouble to replace the lens with a piece of cardboard, through which a small hole has been bored with a pin, will find the image thrown on the focussing screen; not so vividly as when a lens is used, the amount of light which enters the camera being much less, but still, all there and quite perceptible.

Now, it stands to reason that if a sensitised plate is exposed, the image will be imprinted, the quality of the resulting negative depending on the same conditions as if a lens had been used. Of course, I am not for a moment implying that lenses are useless, or that they can be superseded by a piece of pricked cardboard, for I don't think it can be disputed that with a lens, better negatives are to be produced than without. There are, however, a few points about pinhole photography which render it something more than a mere scientific curiosity. Apart from the extreme simplicity of the necessary apparatus, which, alone, would hardly recommend it to serious consideration, there is the strange fact that it is always in focus. The size of the image varies according to the distance between the pin-hole and the plate, but near and distant objects are equally iu focus. It is therefore quite possible to make use of any small box as a substitute for the ordinary camera. Some day I may describe the arrangement of an ordinary plate box for taking several small negatives on the same plate, but, in the meantime, it will be sufficient to suggest a few ideas in connection with the photographs themselves.

It is important that the hole should be perfectly even, without any burr on the edges to interfere with the light. With a roughly-made hole it is impossible to take a pin-hole photo. to the greatest advantage. Scarcely less important is the size of the hole. This should be as small as it can well be made, sharpness of the image being greatly diminished as the hole increases in size. The merest prick through is sufficient. Instead of attempting to make a suitable hole in a piece of thick coarse cardboard or wood, it is better to make it in a thin fine piece, such as an ordinary visiting card, and stick this over a larger aperture in the box or camera, the inside of which, of course, must be black. Such an improvised pinhole lens, if it may be called so, can easily be stuck on with some of the gummed paper surrounding sheets of postage stamps.

The time of exposure, of course, is considerably longer than when a lens is used. Some idea of this may be given by saying that on an ordinary bright day with good light a photograph may be taken on a slow Ilford, with au exposure of 20 to 30 seconds. It will thus be seen that the time required hardly puts the pin-hole beyond use, even for portraiture. Instantaneous views are, however, out of the question with it, as any one who has the slightest acquaintance with photography will at once perceive. Personally, I have never been able to get a picture as sharp as if the negative had been takeu with a lens of good quality, but it must be a poor specimen which is not very superior to those taken with the cheap toy cameras, as fitted with a double convex lens. Not that a good photograph taken with a pin-hole is so blurred as to be useless, for at their best they rather resemble those taken with a lens slightly, and only very slightly, out of focus. They may almost be classed as photographs of the "impressionist" school, so that it is quite possible some may admire the slight indistinctness. There is certainly an absence of harsh outline which is sometimes rather pleasing than otherwise, or is it perhaps perverted taste which renders them not distasteful?

The evils of distortion with any but the best lenses are too well known to require attention to be called to them. With a common lens it is impossible to take a photograph of a building without the lines nearest the edges of the plate being curved. In pin-hole photography they are, however, perfectly straight and true, and to me, this seems one of its chief advantages in practical use, not the slightest distortion being observable. Enough, however, has doubtless been said on what many practical photographers, with command of the best apparatus, will perhaps regard as a somewhat trivial branch of the art, to show that is not only interesting, but at times may be useful in enabling a photograph to be taken with an extemporised camera.

BACKING ELECTROS—BALANCES.

BY GEORGE EDWINSON BONNEY.

Backing Electros.—When an engraved surface, or a medal, or a medallion, or a set-up forme of type is copied in copper by the electrotype process, the copy is named an "electro" in the workshop. A mere thin shell of copper, of about the thickness of a visiting card, is deposited in the mould, and this shell must be carefully removed from the mould to receive a backing of some stouter material before it can be used in the printing press or mounted in a cabinet. If a wax mould is employed, the removal of the copper shell is quite an easy matter, for the operator has only to pour a stream of hot water over the back of the mould to cause the wax to melt off from the shell. Any persistently adherent wax can be got off by immersing the shell in a solution of hot caustic alkali. The shell must be got off without buckling it or wrinkling its surface, and it is then ready to be backed. If a small shell, such as a copy of a coin, a medal, or a medallion, place it face downward on a heated iron plate, and brush over the back a little "killed spirits of salts," such as plumbers and tinmen use. Next coat the back to the required thickness with common tinmens' or plumbers' solder. Larger electros are placed on an iron backing plate or tray furnished with handles, and the tray with its electro is floated on a bath of stereotype metal until hot enough to melt solder. The back, having been previously prepared by brushing the ordinary soldering liquid over it, is now coated with solder much the same as copper bits are "tinned" with solder, that is to say, enough solder is melted ou to ensure a bright coat all over the back. The hot tray is next removed to a level surface, and enough backing metal is poured on the electro to make the back $\frac{1}{8}$ in. in thickness. The following formula is given by Mr. A. Watt as a good one for the composition of backing metal:—Tin, 4 parts; antimony, 5 parts; lead, 91 parts. Full information on this subject is given in "Electrotyping," by J. W. Urquhart, pp. 212—222.

Balances.—The balances or scales required by an electro-plater will vary with the class of work on which he is engaged. For the ordinary work of weighing the goods before and after plating, to determine how much metal has been deposited, a pair of scales with a stout steel or brass beam will be required. For weighing gold and gilded articles a lighter pair, indicating a turn on one grain at least, should be provided; these will also serve for weighing out the ingredients used in making up solutions. For rough assays and estimations a small cheap balance indicating a turn of $\frac{1}{10}$ grain will serve the purpose; the cost of this, together with weights from 500 grs. down to $\frac{1}{10}$ grain, will be about £1 10s. A still more elaborate and correct balance will be required for assays, analysis, and calibrations; such as an Oertling assay balance fitted with agate bearings and indicating a turn with at least $\frac{1}{100}$th of a grain. Such a balance with a full set of weights will cost from £5 to £10.

In some plating establishments the weight of deposited metal is determined during the operation of plating by means of a plating balance. This is merely a pair of large scales furnished with a scale-pan at one end of the beam and a metal frame suspended over the bath at the other end. The goods to be plated are slung to the metal frame, and the whole is balanced by weights placed in the scale pan. The pillar of the beam is connected to the negative pole of the machine or battery. As the metal goes on the goods to be plated, the beam is thrown out of balance, and the exact weight deposited can be ascertained at any time by additional weights placed in the scale pan. A full illustrated description of this balance, and the mode of working it in French plating establishments, is giveu in A. Roseleur's *Guide pratique du Doreur, de l'Argenteur et du Galvanoplaste.* An account of the same is also given in "Electro-deposition," by A. Watt.

AN ORNAMENTAL CLOCK CASE AND BRACKET.

BY J. H. MOODY.

(*Continued from page* 242.)

Fashioning of Spindles—Jointing of Pillars—Bracket-Pieces—Steps—Cornice—Canopy Roof—Scroll—Door—Fixing of Dial and Door — Treatment — Bracket — Finishing Bracket.

If my small contribution upon the subject of home embellishment be attended by no better effect than that of demonstrating to home-workers how easily an article, till now commonplace, may be made important, it will not have been written in vain; but I venture to predict that it will not be so lightly dismissed. And when the possessor of a clock like the one I altered reads how cheaply the alteration was effected, he will be impelled to undertake the same amount of transformation.

Tho pillars were each one made in three parts—a procedure which was necessary, as I did not possess a lathe; and it will not be *infra dig.* to confess that I ventured to fashion the turned portions without one, and although many difficulties would have been smoothed over by the employment of such an accessory, yet I succeeded in making very presentable spindles by using only files of various shapes and a dovetail saw. The other portions of the pillars were the top part which carried the pierced brackets and formed the capital, and the lower part which with plinth formed the shaft and base. I left a short plug at either end of the spindles, and I bored sockets in the top and bottom pieces; and when the three parts were joined together by means of these dowel-like plugs and sockets, the pillars looked quite as perfect as though they were made from one piece of wood.

My auxiliaries in carving the stages and sunk panels in the plinth and shaft were a couple of keen chisels; and glass-paper, of course, contributed its quota toward the success of the work; and for material I used $\frac{3}{4}$-in. mahogany for all the parts of the pillars, which when they were finished were fastened to the case by means of screws driven home in deep counter-sinkings. The screws were then concealed respectively by the brackets and by the plinth (Fig. 2).

The eight bracket-pieces which enriched the capital were cut from thin mahogany with a fret saw, and pierced with a brace and $\frac{3}{16}$-in. bit. They were connected in pairs, by pieces of wood of sufficient thickness to keep the individuals of each pair at a due distance apart; and each pair of brackets were then attached to the pillars by glue at the proper places, which will be seen from the drawing.

I next arranged the two steps. One I had already obtained by cutting down the plinth of the original case, and I now finished it by giving it a tread of thin mahogany. The lower step I made from $\frac{3}{4}$-in. mahogany, and also provided it with a tread, and fixed it in position, tightly jammed between the two pillars; therefore glue was sufficient to hold it firmly.

The cornice (Fig. 3) now claimed attention, and the easiest way to make it was a matter for consideration. At last I decided that my best plan would be to make it in two parts—the first part being two beads, with a depression between them. This was done with a bead plane on a piece of wood of suitable thickness. By working first one side and then the other, the two beads and depression were produced. The second part was a slip of wood to earry the carving.

Perhaps the best way to obtain this carving will be to take a cylinder of wood of suitable diameter, and cut and file the pattern right round it. This, when split or divided in its length, will give a better result than if the pattern had been cut on the edge of a slip of wood. The slips of carving being fastened upon the pieces of wood provided as their foundations, the two parts comprising the cornice were glued and pinned together. When the glue was dry, the moulding was cut and mitred to go on the top of the clock at the front and sides only, and fixed on to the piece of wood that formed the roof proper. The edge of this roof-piece became then the third part in the moulding.

The gablet or canopy surmounting the roof was built up of three pieces of $\frac{3}{4}$-in. mahogany, which were cut decreasing in size, and roughly shaped, so that when their surfaces were placed together the whole very nearly assumed the form that I intended to give to the canopy; and to obviate the objectionable weight of solid wood, I hollowed out the first and middle piece, leaving them simple frames each about $\frac{3}{8}$ in. in width. The three pieces being glued together, and dry, were finished with proper tools. A piece of mahogany pinned in to the top formed a ridge. (See Fig. 2, clock case in section.)

The scroll was made of wire, worked with the round-nose pliers and soldered; and the heads of fancy nails supplied me with flowers for it.

The door was made from $\frac{1}{4}$-in. mahogany, and cut to proper dimensions for fitting between the styles; and the panels were carved in it, but were endowed with a degree of importance which the panels upon the pillars did not possess. A piece of thin wood of suitable size and shape was glued on to the face of each panel, thereby advancing it beyond the level of the surface of the door. A circular aperture was also cut in this door for the dial.

The old dial was useless to me, and I procured another bearing ordinary numerals, and painted on delf; but there was no provision for fixing this in position until I glued thin pieces of wood at the back of the door, and just peeping over the edge of the aperture. This prevented the dial falling through to the back; but something was also needed to prevent it from falling forward, and to keep the hour of noon from displacement. To that end I filed nicks in the edge of the dial, and, placing the 12 in its proper place, drove headed pins past those nicks and through into the wooden stops which were glued on at the back of the door. I then procured a brass rim with glass, costing eightpence, from Messrs. Smith, of St. John's Square, E.C. The door was kept in position by a rebate formed by gluing slips of wood at the back of the styles, and by buttons fixed at the front. I cut an opening in the back, so that the pendulum could be readily got at for purposes of regulation, etc.

There is little to be remarked in regard to the moulded stand, save that it were best cut out of the solid plank; but if the tools are not equal to the job, do as I did, and build up and mitre it in the same way as the cornice was procured.

A clock altered in this way when finished, as far as the woodwork is concerned, may be submitted to either of two kinds of treatment: it may either receive polish by a coat of varnish or other means, or it may be covered with enamel paint—a plan that will admit of a wide range of selection, as there are so many useful tints to choose from. Light blue, light green, cream, or even white, would look equally well; and at this point I must say a word or two regarding the bits of ornament occurring in various parts of the design. These may be incised work and gold paint, if the operator feel equal to the task; but if not, the brush may be employed to do the work upon the surface. I got my clock up in black enamel and gold paint, using the latter method, and was well satisfied with the result.

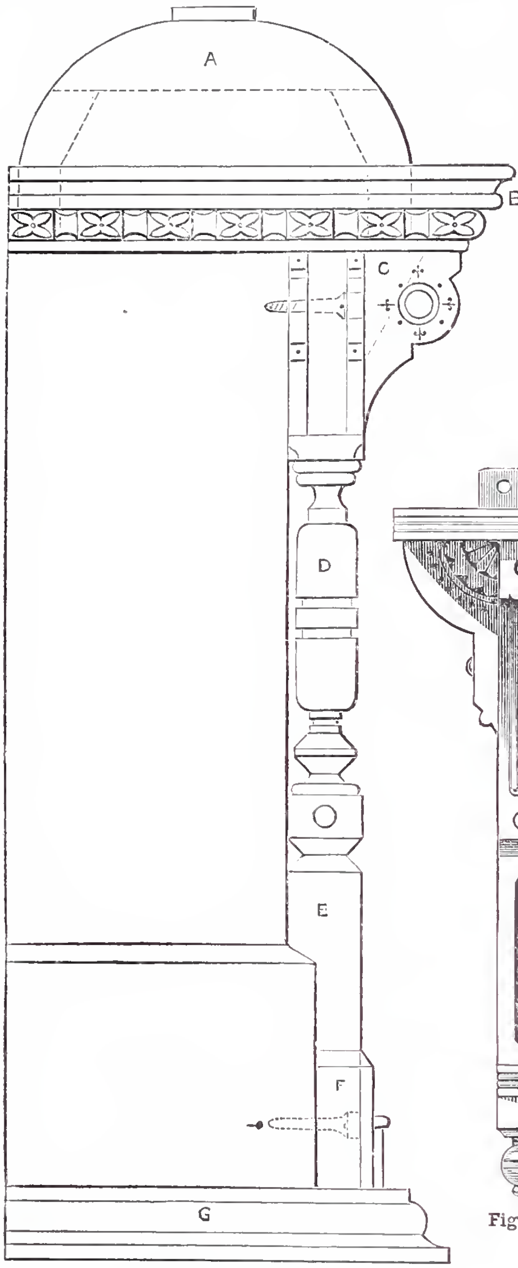


Fig. 2.—Clock Case in Section.

A, Roof, with dotted lines showing Construction. B, Cornice. C, Bracket, with dotted lines showing how to join parts together. D, Spindle. E, Shaft. F, Plinth. G, Stand.

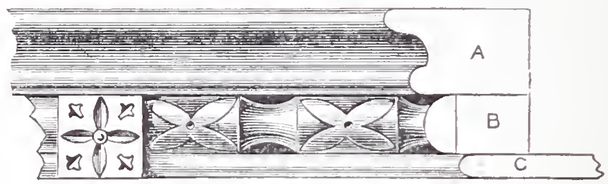


Fig. 3.—Detail of Cornice.

A, Portion made with Bead Plane. B, Portion bearing Slip of Carving. C, Top Piece of Clock.

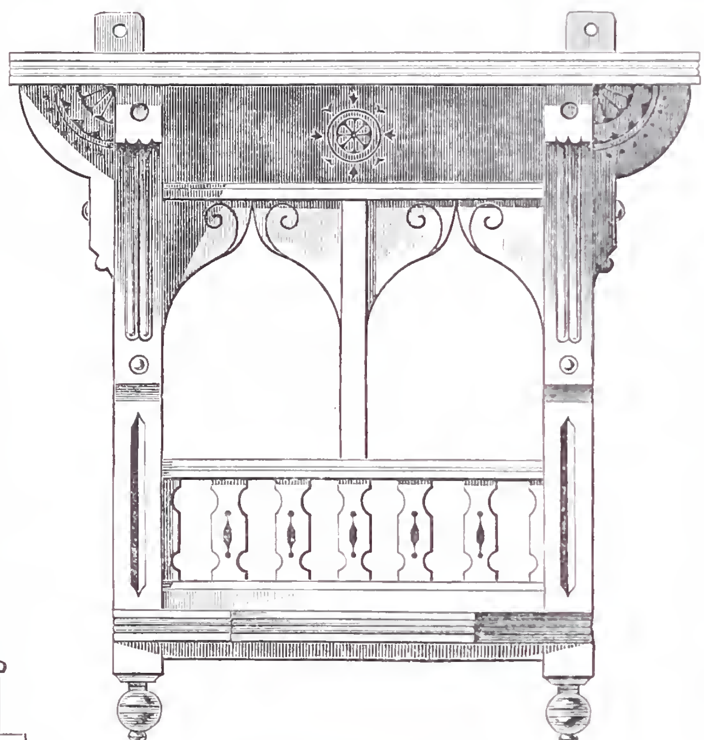


Fig. 4.—Bracket suitable for Clock (one-third full size).

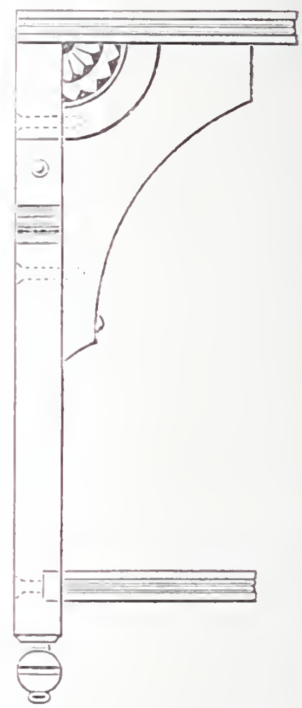


Fig. 5.—Bracket in Section.

I rather anticipate that this clock will be thought unsuitable for the mantel, because of height and narrowness; but want of width and loftiness may recommend it, especially if the other ornaments are tall or numerous. I would, however, suggest that it is particularly suited for placing upon a bracket; therefore I have ventured to append a design for a bracket suitable for this purpose or for use independently; and as the ornament it bears will be in the shadow of the shelf it will not detract from the importance of the clock above it. This bracket (Fig. 4) may be made of $\frac{3}{4}$-in. stuff, and the back framed by mortise and tenon, leaving the styles longer at the bottom for the attachment of terminals. It will not be necessary to carry the tenons right through; but great attention must be paid to the close fitting of the joints, and the square cutting of the shoulders of the tenons.

The bracket-pieces must be cut out with a turning-saw; and when the front ones are reeded, and the side ones are dressed smooth, they may then be attached in their places on the styles in manner as follows—the side brackets by dowels, and the front brackets by means of screws from the back. (Fig. 5.)

Before gluing up the framed back, it must be rebated, by the best means at command, to receive the fretwork; and the ornamental furrow, as shown in sketch, must be cut upon the styles. The handrail of the balustrade is mortised into the styles; and the short upright bar in the centre, from which the small arches spring, is let into the top bar of the frame, and into the handrail; and as these two help to support the fretwork, they also must be rebated.

The pieces for the arches and the rails being cut may be placed in the rebates, and secured by slips of beading at the back. But if, instead of being left open, it is intended to fill the spaces with mirror glass, backing boards must be used, and the whole secured by brads after the manner of a picture frame.

The top shelf is cut from $\frac{1}{2}$-in. wood reeded on three edges, and then fastened at the top of all by screws; and, being sustained by the front brackets, it is quite adequate to carry the weight which the clock represents. The lower shelf is of $\frac{1}{2}$-in. wood reeded on the appearing edges, and, not being intended to bear a greater burthen than a small vase, it is simply let into a channel in the lower bar of the framed back. It is cut away to enable it to pass the styles, and screws from the back are sufficient to hold it securely.

I would further call attention to the fact that the lower shelf is not allowed to retain full width throughout, but has its carrying capacity very much reduced by reason of its corners being cut off, thus leaving 3 in. in the centre to boast of only sufficient width to hold a small article. The turned knobs may be of a piece with the styles, or may be turned separately and joined to the styles by means of plug and socket.

Suspension of the bracket is effected by a pair of plates screwed on at the back, and by nails driven into the wall through holes in these plates.

We must, of course, put the same style of finish upon the bracket as the clock received, and then our labours will be concluded. But whether our completed work receive commendation, or whether it deserve condemnation, is largely dependent upon the attention and care that even insignificant details received at our hands whilst the construction progressed. With due care in this respect neither clock nor bracket will fail, I think, to give satisfaction.

PAPIER-MÂCHÉ.

How to Mould It, and how to Ornament It.

BY SYLVANUS WARD.

(*Continued from page 186.*)

DECORATION (*Continued*) — BRIGHT GILDING SILVERING—ARABESQUES—EMBOSSING.

Bright Gilding.—This differs from dead gilding in being done on a polished instead of on a dull ground, besides which the method of procedure is widely different. In dead gilding, the design is carefully pencilled in size, and the gold is only attached in those places where it is intended to remain. In bright gilding, on the contrary, the whole space over which any part of the design may extend is sized and gilt, all superfluous gilding being afterwards removed. The more perfect the polish of the surface on which the work is done the more brilliant will be the gilding.

As in dead gilding, if both deep and pale gold are used they must be put on separately, and the deep is generally applied first, since, being richer in appearance, it will occupy the more important parts of the design.

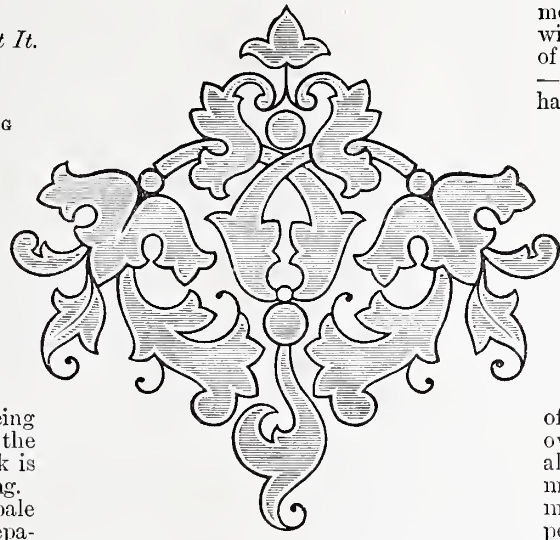


Fig. 32.—Arabesque Ornament in Bright Gold.

As a preliminary operation, the surface should be breathed upon and carefully wiped with a *silk* handkerchief; for it must be freed from even the slightest suspicion of grease. Even that left by the touch of a finger will prevent the size now to be used from lying evenly.

This size is a weak solution of isinglass—say, as much as will lie on a sixpence dissolved in a half-pint saucepan of water. The worker has to estimate the space over which his design will extend, to spread the size over it with a flat brush or with a little ball of cotton wool, and to lay on the gold at once. The design Fig. 33 is for bright gilding, the shaded portions being in deep, and the remainder in pale, gold. It is intended for the border of a blotting case or any similar purpose. As it is about an inch wide, a strip of somewhat more than an inch in width round the article will have to be sized, and to cover it a book of leaf gold may be cut through the middle—that is to say, into strips of an inch and a half.

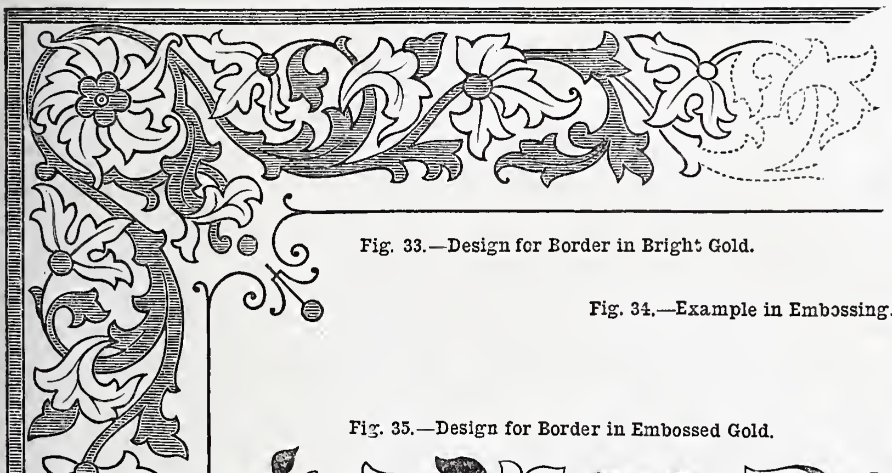


Fig. 33.—Design for Border in Bright Gold.

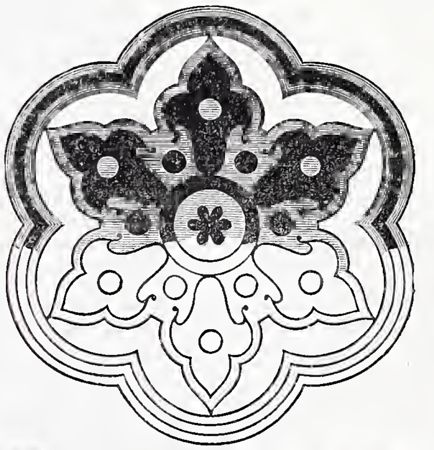


Fig. 34.—Example in Embossing.

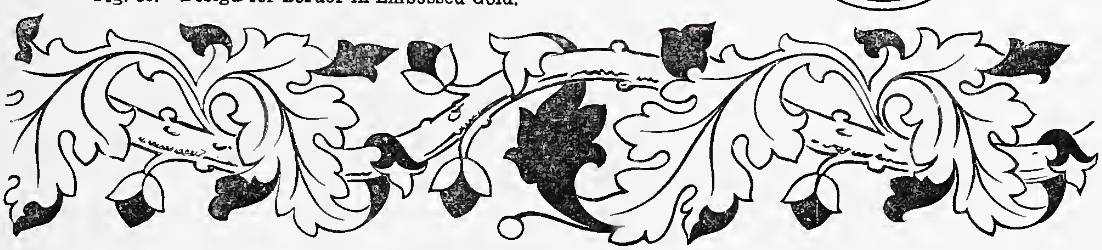


Fig. 35.—Design for Border in Embossed Gold.

In bright gilding the gold needs to be laid on with great care. If a leaf is found to be crumpled it is better not to use it, but to lay it by for future dead gilding. Different men have different methods, but the writer would not recommend the use of the tip for the work now under hand. In bright gilding it is desirable that all parts of the leaf should touch the size at once, or a crack will result; and he prefers to lay it on with the paper of the book, using *both* hands. The edge of each piece as it is laid should slightly overlap that of the preceding one. When all the space is covered, any cracks that may appear should be mended with fragments of leaf applied with the point of a penknife; and if the size should be too dry to hold the scrap of gold, it should first be breathed upon. Sometimes whilst the gilding is going on some part of the size may get too dry, and need sizing over again; if so, care should be taken not to let the size used flow over gold already laid on, or it will injure its colour.

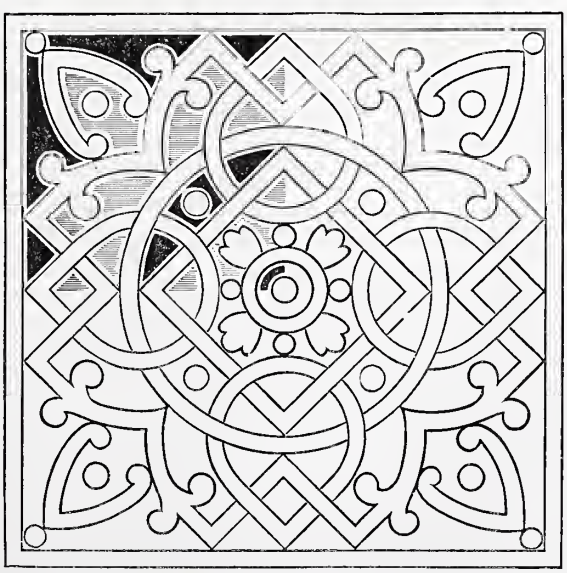


Fig. 36.—Bright and Dead Gold in Combination.

The work will at first appear dead, but as it dries it will gradually brighten. Drying may be hastened, if desired, by holding the article moderately near to the fire. When the work is thoroughly dry and the article cool, breathe on the gilding, and with a ball of cotton wool press down the gold firmly but lightly. The pressure must be applied directly downwards, not obliquely, or there will be danger of disturbing the leaf. Then hold the work to the fire for a moment, warming also a fresh ball of cotton wool, and with the latter rub off all the little wrinkles, etc., which appear. By this the brilliancy will be greatly increased.

The pattern has now to be pounced

upon the gilded surface, after which (to protect so much of the gold as is intended to remain) the design has to be painted on it in asphaltum or brunswick black. This will need drying for half an hour in a tolerably warm stove, and then all unprotected gold may be wiped off with a piece of wet cotton wool. The design—that is to say, so much of it as is in deep gold—now appears as brown ornament on a black ground.

The work is now ready to receive the pale gold. If this occurs freely in all parts of the pattern, as it does in the example before us (Fig. 33) we must gild the whole—in this case our inch strip—over again; had it, however, been in isolated parts only, it would have been sufficient to have gilded patches covering those parts. All the gilding, pouncing, protecting with asphaltum, and cleaning away of superfluous gold have to be gone through as with the deep gold; and that done, we shall have our whole design, both in deep and pale gold, on the papier-mâché, but alike hidden under a brown covering.

To remove this coat of asphaltum is a simple matter. The article having first been slightly warmed, to soften the asphaltum, a ball of cotton wool has to be dipped in turpentine, and wiped lightly and carefully over the work. This will first result in a smudge merely, but a second wiping with *clean* wool and *clean* turps will have a more satisfactory effect. When first cleaned the gold will have a somewhat yellow look, from the turpentine; but a light rubbing with finely powdered whiting will remove the discoloration and bring out the full brilliancy of the gilding. In finishing a design like the present, it is usual, where forms in deep and pale gold cross each other, to separate them by black lines. The veins may be either in black or white. The shading may be in wash black; this looks better than burnt sienna, which is often used for the purpose. The thin line which bounds the inner side of the border should be either in colour or in dead gold.

The design might have contained other ornaments in dead gold, and these could well have been introduced after the bright gilding had been rubbed with whiting as above described. The whiting, by removing all grease, would have prepared the ground for them. The required ornaments would have had to be pencilled in with japanners' gold size, as directed under *Dead Gilding*. The introduction of dead gold in this manner often gives a pleasing variety. Fig. 36 is a design in which the two kinds of gilding are shown in combination. In this the plain, outlined ornaments are in deep bright gold, the shaded parts in pale dead gold, and the black parts in deep dead gold. It should be noticed that a narrow space is left all round the dead gilt parts, of which the result will be a black line (the original ground) separating the different parts.

Note.—If it should be desirable to tint either bright or dead gold at the extremities of a leaf or ornament, it will best be done by sizing the gold over for a distance with copal varnish, to which a spot or two of oil has been added; and when this is a little dry, by taking dust colour of the kind desired, and with a dry camel-hair brush dusting it on to the varnish and letting the colour die away. Of the process of "dusting" more will be said by-and-by. Also, if bright gold be used in combination with pearl, it is better that they should not actually touch; neither should bright gold be laid over pearl anywhere, as the pearl asserts itself through the thin leaf metal, producing a disagreeable and nondescript effect.

Silvering.—Silver leaf if applied as bright silvering is apt to have a "tinny" and cheap effect in papier-mâché work where it can only be used in small quantities; it is, therefore, more commonly applied as dead silvering. The process is much the same as that of dead gilding, except that, owing to its greater thickness and weight, silver leaf has to be laid on whilst the gold size is slightly more moist.

Leaf silver, like leaf gold, is bought in books, but these contain twice as many leaves and are larger—$4\frac{1}{2}$ in. square. A book of silver costs 9d. or 10d. In addition to the ordinary silver an iridescent leaf has recently been introduced, which has a rich effect of colour, and is worthy the attention of papier-mâché decorators.

A valuable use of silvering is to give brilliancy to transparent colours laid upon it, as for lighting up the stained-glass windows in interior views of churches, for imitating the lustrous eyes in peacocks' feathers, etc. Also for a class of illuminations known among japanners as "arabesques," in which the ornament is outlined in bright gold and filled in with patches of brilliant colour; and wherever a body colour sufficiently brilliant is not to hand, the method is to lay in with silver leaf, and to cover it with a transparent colour.

Arabesques.—Fig. 36 may to some extent serve to illustrate the arrangement of arabesque ornament. The black and tinted portions of this design may be supposed to represent the coloured spaces, some slight interval being left between the gold bands and the filling. Usually, however, japanners' arabesques are combinations of the kind of ornament seen in this design and that seen in Fig. 32. In this latter diagram, the black lines indicate outlines in bright gold, whilst the tinted spaces within represent the bright patches of colour, either opaque or silver leaf stained.

The colours used for staining the silver leaf are usually—carmine and crimson lake for red, prussian blue and ultramarine for blue, verdigris or a mixture of Italian yellow (sometimes called Italian pink) and Prussian blue for green (with verdigris a little Italian yellow is generally used to warm it), and for purple a mixture of carmine and ultramarine. It will be noted that the colouring is always kept a little within the gold outline, so as to leave a line of black between colour and gold. White is sparingly used in this kind of work; so also is yellow, which too nearly approaches the colour of gold, whilst emerald green is used freely.

In Fig. 36 the brilliant colouring is confined to the ground, but in Fig. 32 it will be seen that the ornament itself, though bounded by a *strong* outline in bright gold, is the portion silvered and coloured. The ground in this case may either be left plain black, or it may be picked in with dead gold, or with some colour which does not appear in the ornament.

These papier-mâché arabesques have little in common with what might more properly be called arabesque decoration, except brilliancy of colour and formality of design, and were probably suggested in the first instance by Cloisonnée enamels.

An additional use of silver leaf, often seen in very old work, was that of serving as an imitation of gold when washed over with Italian yellow.

It is not possible to beat out silver to so extreme a degree of thinness as gold; hence the greater thickness and weight of silver leaf; hence also its comparatively high price when the relative value of the two metals is taken into consideration. It would seem probable that in the old days when silver with a wash of yellow was made to do duty as a cheap substitute for gold, that gold leaf must have been very much thicker and therefore more costly than it has been in recent years.

The practice preferred by the writer with silver as with gold, is to lay the leaf on the sized surface with the paper of the book in which it is bought; some, however, may like better to apply both in the manner considered by gilders to be more orthodox, namely, with the tip. For the benefit of such persons it ought, perhaps, to be said that the tip is an instrument which the gilder commonly makes for himself. He doubles a waste playing card, and between its two thicknesses glues a thin layer of camel's hair, so as to make a kind of attenuated brush. This he uses by first drawing it over his hair, whence it gets a faint suspicion of grease, but just enough to cause the leaf to adhere to it and allow itself to be taken up, and so slight as at once to permit the leaf to leave it on coming in contact with the more sticky gold size. In gilding an uneven surface, the value of the tip in bringing the gold leaf equally in contact with the various parts will be obvious.

Embossing.—This, as practised by japanners in the palmy days of papier-mâché, was a method of producing the effect of dead gold slightly embossed or raised upon bright gold by one operation of gilding only. The parts intended to be in dead gold were first pencilled in with gold size on the bright surface of the papier-mâché, and when nearly dry were rubbed over with a "bob" dipped in bronze powder (usually pale bronze), and this resulted in the ornaments appearing in solid bronze. At this stage the work was dried in the stove, so as to render the ornamentation hard. Afterwards it was water sized and leaf gold laid over every part, and burnished in the manner before described, where the decoration was wanted. Sometimes the whole ground of the article was bright gold, on which lay the embossed gold ornament; at other times the bright was merely a bordering to the ornamental dead gold work.

The result of this process was that, where the gold leaf was laid upon the bronze, it appeared dead and slightly raised. Fig. 34 is intended to illustrate embossing. Black represents the portions pencilled in with bronze. In this case it is supposed that a bordering of bright gold only surrounds the embossed ornament. This is represented by the tinted parts. The method of forming such a border was by pencilling over the gilding with copal varnish. So far as it extended, the varnish protected the leaf beneath it, and the superfluous gold could then be wiped from the remainder of the surface with wet cotton wool.

It is sometimes desirable, especially in borders, to represent leaves in bright gold, with fibring and turnovers in dead gold as in the design, Fig. 35. The process is exactly that last described. With some designs pouncing has to be employed first for the embossing, and again, after gilding, for the copal-varnish pencilling. The reason for using varnish and not asphaltum, as in ordinary bright gilding, is that the turpentine necessary to remove the asphaltum would be liable to disturb the embossing. In Fig. 35, the black portions, including the fibres of the leaves, will show as dead gold, and in finishing the work the interlacing portions are carefully divided by a line of black.

OUR GUIDE TO GOOD THINGS.

62.—MESSRS. HARGER BROTHERS' SPECIALITIES.

I HAVE received very recently the latest edition of the catalogue and price list of fretwork materials and appliances of various kinds used in making and fitting up ornamental work, issued by Messrs. Harger Brothers, of Settle, Yorkshire, and sent, I may say, to any applicant, post free, for 6d. Messrs. Harger Brothers' establishment in Settle may be regarded as the chief emporium in the northern counties for the supply of these articles, and as such is well worthy the attention of all retail dealers in such goods, as well as of all professional and amateur workmen who make them—the one, possibly for profit; and the other, certainly for the honour to be gained for successful achievement.

It will be useful to give an extract from a letter recently received from Messrs. Harger Brothers, as it shows what they can do and will do far more effectually than anything I might be led to say on this point. They write:—"We may say that we usually send goods the same day as order is received. Our patterns (that is to say, for fretwork, etc.) include many not in miniature, and our stock includes some hundreds of thousands for the wholesale and retail trade. We have noticed inquiries for timber for fretwork in WORK: this we cut and plane on the premises by machinery, and can make any special moulds or turning which amateurs require. We also hold enormous stocks of veneers and all fancy woods for carving or turning, and can cut to any special sizes. We also make a speciality of hinges, fasteners and fittings, locks, etc., for small boxes, cabinets, etc., and are large importers of the best American fretwork machines. Carving tools we supply all shapes."

Catalogue and Price List.—I will now proceed to notice such articles as have been sent me by Messrs. Harger Brothers as specimens of their specialities, and may well begin with a few words with regard to their price list, sent, as I have already said, post free for 6d. It is a large quarto pamphlet of 64 pages, and contains illustrations of most of the tools and appliances comprised in their stock with prices, etc. On the second page of wrapper useful instructions and recipes for various kinds of work are given, and on the fourth page an ample index to its various contents. Pages 1 and 2 are devoted to remarks on patterns, woods, machines, terms, etc., and testimonials from home and abroad. Then follows description, prices, and illustrations of fretwork goods and articles kept in stock, conspicuous among which is the page devoted to carving tools, in which is shown not only the shape of each tool, but its full-size form at the cutting edge, or, in other words, the shape of the incision that may be made by pressing the edge against a piece of wood. To enter into a specification, even of the classes of goods described and figured, is simply impossible, and it will suffice now to call attention to Harger's "Patent Adjustable Bench Stop," a useful and time-saving adjunct to the carpenter's bench. Fittings of every kind for cabinet work, fretwork, etc., hinges of all kinds, draw-pulls and handles, are abundantly illustrated; and the last 22 pages of the price list are filled with miniature reproductions of most of their fretwork designs, which is of the utmost utility in enabling any would-be purchaser to form some idea of the character of the design, before sending for the actual design itself for pasting on the wood. Those who send for the catalogue will find, I fear, that my brief *résumé* of its contents falls very short of the mark.

Designs for Fretwork, Carving, Inlaying, etc.—That the taste and liking for fret sawing has been greatly on the increase of late years is amply evinced by some of the recent designs of Messrs. Harger Brothers, which, when cut and finished, work up into large and elaborate pieces of furniture, many of them bearing the mark of having been produced by skilled designers. No. 675 is a handsome hall ornament, consisting of a bracket, with mirror at the back rising above it, contained in an elaborate frame, flanked by equally elaborate wings or side pieces. No. 679 is a quaint emblematic design for a calendar, in which are figured the signs of the zodiac, and which, by means of index hands, shows the month, the day of the month, and the week. No. 673 is a sideboard, the patterns of which extend over five large sheets, containing many parts and panels which might be utilised in a variety of ways. Bold, venturesome, and persevering must be the man who attempts to cut it. No. 676 is a work-box of Indian design, to be cut in ebony backed with white holly. No. 606, a clever design for an overmantel; and No. 609, a design for a newspaper rack or waste-paper basket. The only thing that is lacking in some of these is a representation of the article itself when made up, which Messrs. Harger Brothers will, doubtless, supply in future reprints. The patterns for inlaid work are well conceived, particularly No. 654—a round table top, ornamented with shells, birds, and foliage, and buds and blossoms of the passion flower. No. 648—two paper knives for inlay—is also good. Of the carving patterns, the most noteworthy is No. 580, a bold and well-executed wall bracket, which would present an effective appearance on completion.

Hinges and Cabinet Fittings.—Messrs. Harger Brothers also send many good samples of strong hinges of polished brass for fretwork fittings of various sizes, ranging from 1½d. to 1s. 9d. per pair, according to size, stoutness, and pattern. These are what may be termed fancy hinges; but brass or nickel-plated hinges of the ordinary form, from ½ in. to 1¼ in. in length, may be had from 1d. to 3d. each, according to size. In addition to these are some good gilt or nickel-plated fasteners for boxes or cabinets, from 4d. to 6d. each. Knobs for drawers and feet for box or tea caddy are also supplied at cheap rates, the former, in bone, ¼ in. in diameter, being 1d. each, or 8d. per dozen; and ½ in., 1½d. each, or 1s. per dozen. These fittings will be found illustrated in pages 8, 9, 10 of the catalogue.

Samples of Fretwood.—Lastly, I will call attention to the fretwood that is stocked by Messrs. Harger Brothers, solid, in boards of various widths, according to the wood, and of thicknesses ranging from ⅛ in. to ⅜ in. Samples of almost all the different kinds of wood kept in stock have been sent to me, and all seem to be well seasoned and of the best quality. Many of the woods are supplied in the form known as "three-ply wood," which consists of three thicknesses of wood glued together, the grain of the intermediate layer being transversely to the grain of the exterior pieces. I need scarcely say that any thickness of wood prepared in this way is far less liable to fracture than solid wood of the same thickness, and should be used in all cases when the design is intricate and extends over a large area. Samples of various kinds of fretwood about 2 in. square, numbering about twenty kinds, are sent out, post free, for 2s. The possession of a set of samples enables the fret sawyer to decide more readily on the kind of wood he will use for his work.

63.—MESSRS. GIBBONS & CO.'S SPECIALITIES.

I have received from Messrs. C. Gibbons and Company, 2, Avenell Road, Highbury, London, N., some specimens of the specialities in which they deal, and which they make themselves. I will notice these presently, but before coming to this part of the subject, let me say that I am more especially pleased to be asked to speak about Messrs. Gibbons and Company's goods, because they are the first working dealers, if I may be permitted to put it so, who have come forward to ask for a notice in WORK. Now WORK is essentially a working-man's paper, and I see no reason why the productions of working men should not be mentioned and described as well as the more elaborate and costly goods of the manufacturer on a large scale. I mention this here with some degree of emphasis because some persons seem to labour under the idea that WORK is an advertising paper, which means, when translated into plain and unmistakable language, that notices in "Our Guide to Good Things" are paid for. A greater mistake was never made. Everything that is noticed is noticed on its merits, and on its merits alone. Only such things as are sent for notice are reviewed in "Our Guide to Good Things," and to me there is as much pleasure in mentioning a tool, appliance, or article for sale made by the humblest workman, as in calling attention to costly machinery from the factories of the first makers in the land.

Scratch or Bead Router.—Messrs. Gibbons and Company send a very nicely made scratch or bead router with four cutters, being led to do so by the article on this subject by Mr. David Denning, which appeared in No. 7. Of this they say:—"The article on the bead router was just what was wanted. We make and have sold many of them, and I beg to hand you one for your inspection. We supply the scratch stock and four cutters for 2s., and extra cutters at 2d. and 3d. The stock, which is 8 in. long, 1½ in. broad in the widest part, and ⅜ in. in thickness from side to side, has a nicely shaped handle, and is well finished. The carrier for the cutter is clamped by three brass screws, having heads pierced with a hole to admit of their being turned by a lever in the form of a short piece of stiff wire." So handy do I find this scratch, and so little time have I for making such appliances for my own use, that I retain it in my possession, sending Messrs. Gibbons & Co. its value in stamps, for as they sell these things, the money value is as good to them as the scratch itself.

Small Mouldings.—Of these Messrs. Gibbons and Company write:—"We also send you samples of small mouldings. It is at very few places that these can be got so small in size, and we have much pleasure in drawing your attention to our samples; we have them in stock from 1d. per foot." Of these mouldings fourteen patterns have been sent neatly glued on a board. They range in width from $\frac{3}{16}$ in. to ¾ in., and are sold at prices ranging from 4d. to 1½d. per linear foot. They appear to be made with the scratch and cutters used with it, and will be found useful, I think, by many who require this sort of thing for small work, but cannot find time to make mouldings for themselves.

Violin Clamp.—Another speciality of Messrs. Gibbons and Company are violin clamps, of which a specimen is sent that is supplied at 8d. The parts of the clamp, which are ⅝-in. square, are firmly connected by mortise and tenon, and in the lower arm is a screw, by which the clamp is tightened or loosened as may be required.

Samples of Fretwork.—Messrs. Gibbons and Company are also fret cutters, and in submitting some specimens of their work, they say:—"We send you samples of our fretwork to show you we are practical men at this sort of thing, and we shall be most happy to help any reader of WORK who may want help in this sort of work. We feel competent to give advice from the long experience we have had, Mr. Gibbons, senior, being one of the first, if not the first, of the earliest workers in fretwork who used to do the work for Moseley and Simpson." The fretwork consists of four panels, well and carefully cut.

64.—FALLOWFIELD'S PHOTOGRAPHIC ANNUAL, 1889.

This well-printed volume of 336 pages constitutes for the present year the "Photographic Annual and Comprehensive Catalogue of Photographic Materials, Chemicals, and Apparatus," together with "Complete Working Formulæ for most of the Photographic Processes." This is issued by Mr. Jonathan Fallowfield, South London Photographic Stores, 35 and 36, Lower Marsh, and 86 Oakley Street, Lambeth, S.E., and will be sent by him post free to any applicant on receipt of 1s. It has all the appearance of being a sufficient directory to everything that a photographer ought to know or ought to require in the way of apparatus and appliances for the prosecution of the art of photography. To attempt even to summarise the contents of this volume is simply impossible, and it is enough to say that no photographer, whether professional or amateur, should omit to find a place for it on his shelves. The value of the book is enhanced by a good index; and another noteworthy feature is a list of agents at the end, in which a great number of towns, chiefly English, are arranged alphabetically, and under each the name given of one or more agents resident therein, who supply Fallowfield's photographic goods.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

. *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Cabinet in Fretwork.—Electro writes:—"I have very great satisfaction in endorsing to the utmost the opinion of the many correspondents who have testified to the value of Work. From the first number I have looked forward to its appearance every week with much pleasure. I have begun and nearly finished the cabinet in fretwork from Mr. White's designs. It has occupied nearly all my spare time, but I am more than repaid for the trouble I have taken, although, probably, a practical cabinet maker would shudder at the result; but I have got on with it much better than I could have expected considering my lack of experience."

Copying Fretwork Designs.—Electro writes:—"Possibly some of your readers—beginners like myself—do not know an easy way of taking copies from fretwork. Here is a little 'wrinkle' I learnt the other day. Hold a piece of thin white paper firmly over the design to be copied, then rub it all over with a piece of common shoemakers' heelball; the design will come out black, and will be an exact copy of the fretwork underneath. Of course I am speaking of the actual fretwork, and not the paper patterns."

Sounding Board for Dulcimer.—T. C. B. (*Birmingham*) writes:—"I quite agree with Dulcimer when he says the proper dimensions of a sounding-board for a dulcimer would be welcomed by many subscribers. It is what I have been waiting for. I have made two attempts at the same thing, and done fairly well, but I have had to guess the angle by seeing them in the shop windows. The body I construct according to my own idea; the only trouble I have is to get the proper length of the strings or the proper angle (as Dulcimer speaks of); this is all that is wanted, I think, by an amateur. And this, I think, could be given by a piano maker, as they are constructed on the same principle as a piano. I have seen it announced that articles will appear on piano making, which I have been waiting to see, so that I could glean what I wanted from them. Now that the subject is started I hope some professional dulcimer maker or piano maker will hurry up, and let us amateurs know what we want to know."

Sharpening Carving Tools.—H. C. (*Lincoln*) writes:—"I notice in Work No. 11, a suggestion that the slips for sharpening carving tools be held in the hand screw. Allow me to present another way. The appliance is made out of any hard wood in a few minutes; the sketch shown in Fig. 1 explains itself. It is not usual, I believe, to have a bench vice on a carver's bench, so the appliance for holding slips may be quickly held by the modification of bench screw known as 'hookey,' which I suppose is known to all carvers. I am pleased to

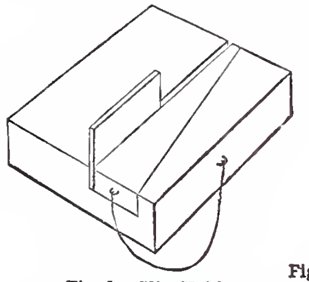


Fig. 1.—Slip Holder.

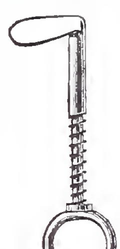


Fig. 2.—Carver's Holdfast.

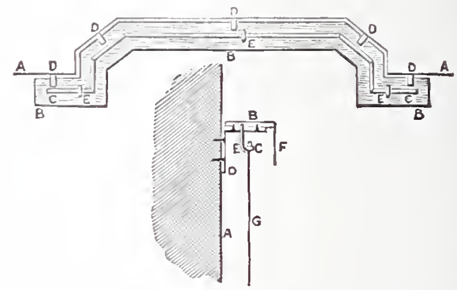
see the wide scope of Work. As an amateur in many branches besides carving, I welcome the paper as supplying a want I had felt for many years. I have seen it in many working men's houses, yet often alas, torn! I trust we shall be taught how to bind it ourselves. To return to the subject of carving, I look forward to seeing some good designs in Work. A mantelpiece with side panels in good Italian Renaissance work, not tool complex, or a Gothic sideboard with tracery panes at the back and a canopy, would be delightful! I do not mean detailed instructions, but a full-page design, with or without a little letterpress. In conclusion, let me wish a long and prosperous life to Work."

Papier-Mâché.—Disappointed (*Soton*) writes:—"I feel rather disappointed that the articles on papier-mâché have been discontinued for several weeks; have they come to an end?"—[Disappointed will see ere the publication of this that the papers have been resumed.]

About Work.—S. F. (*Gulval*) writes:—"For many weeks past (in fact, ever since I received the first number of Work) I have intended to offer my humble congratulations on your having brought out such a valuable magazine as Work. I have watched with interest from week to week the many expressions of praise bestowed on it, coupled with suggestions of improvement by my fellow-readers, but after having seen a paragraph in 'A Corner for Those who want to Talk it,' by T. J. H., which finished by asking his fellow-readers' opinion on it, I felt I could no longer refrain from sending my views respecting Work and T. J. H.'s views. He says the most tantalising of your publications is Work. Now, sir, it appears to me that some of the readers of weekly and other papers seem to think that every week there must of necessity be an article published to suit their respective requirements, according to their calling or occupation; and should one of these articles be too long for insertion in one number, it must be continued in the next issue. This I do not agree with; for instance, take the article by Mr. Adamson on 'The Screen Secretaire,' or 'Some Lessons from an Old Bureau.' Supposing, in consequence of other articles in other branches being published, neither could be continued for two or three weeks, was there not enough contained in the first part of either sufficient to impart knowledge to any reader intending during spare hours to make one to go on with until the article should be concluded in a subsequent issue? Certainly. T. J. H. says your present method is 'like feeding a lot of donkeys with one oat at a time, each donkey waiting his turn to get his oat.' Is it not much better to take a little good food at a meal, than to overload one's stomach with a large quantity which would produce indigestion? For my own part, I think that to find fault with the method now carried out by you is utter selfishness; indeed, what paper is there, whose custom it is to publish, say, a serial story, would for a moment (to gratify the wishes of a few readers) think of filling two or three issues following with it, and then for a week or two go on with general news? The success of that paper would be doomed, as would Work, if it should adopt that policy. Then respecting his suggestion to enlarge Work, and, consequently, its price, I say adhere to its present size and the penny. I once took a weekly journal which, when it first came out, was one penny, but after two years it was enlarged by the addition of tinted covers and a couple of extra leaves, and double the price. This, in my case, as I believe in many others, led me to discontinue my subscription. I believe your motive is to give knowledge to those who require it, and there is no better way in doing so than publishing a cheap weekly journal such as Work. Then, again, T. J. H. mentioned about Work, with others, being thrown out of a train on a dirty platform. Well, has this every-day occurrence in any way injured the copy of Work that he happened to buy? If it has his, I have found all mine to be as clean as when they left the publisher's office, although I happen to live near to the last country town in England. Whenever I have seen newspapers thrown on to a platform, I have seen that they have been bound with brown or other paper. I don't know that newspapers require to be very carefully packed, and labelled, 'This side up, with care,' and I doubt if T. J. H. can give an instance when he has seen newspapers in any way injured by delivery from the train. Well, sir, being a mechanic, and having charge of engines, I am glad your 'Corner' is open to questions, etc., in my calling, and that at any time I can get information from you, and some of my clever fellow-readers. I consider Work as it is just the paper that is supplying a long-felt want among artisans and amateurs generally. I wish you and Work the greatest prosperity."

About Work.—T. O. P. writes, in reply to J. P. A., page 188:—"With your permission I would like to say a few words in reply to J. P. A., in issue of June 8. He says, in reference to Work, 'I find it almost useless to practical men.' J. P. A. must be a most unusually practical and know-everything kind of man when he finds the combined knowledge of so many other practical men as subscribe to Work almost useless; and would it not look better in J. P. A. if he would help brother-readers to a little of his superior practical knowledge instead of wasting three-fourths of a column of what is 'valuable' space to others, whatever it may be to him; or was it all a preliminary blow-off to partly obscure a free advertisement at the end of his epistle? But not content with that, he must tantalise us by leading us to expect valuable information of how to make up a superior saw bench to any in the market, made up of odds and ends and anything that comes handiest, and winds up with 'it is about to be patented,' and cannot be described till that operation is performed (another prospective advertisement, I presume). But why does he say that iron planes, for instance, can be 'bought cheaper than made' (when the writer of those valued articles informs us they can be made for about one-fifth or one-sixth the outlay), and yet evidently thinks that one of the merits of his saw bench is its home-made nature out of odds and ends lying about (as of course it is)? I have a smoothing plane (iron) which cost 25s., but I have no doubt I could make one for 5s. outlay, thanks to the esteemed information in those articles; and not only that, but special work requires special tools, which are not to be bought, but can only be made to order at prices at which J. P. A. may or may not know something about; whereas a worker may make use of his 'odds and ends' of both materials and times, get his castings at a nominal cost, and again fit up at spare moments to his own satisfaction, and which he may even still have to do after paying a toolmaker a lot of money for his idea of what the requirements may be. But with those instructions on the standard articles he can easily alter to his own requirements; and, unfortunately, we have not all had the vast practical experience in every branch of work that J. P. A. has had the advantage of (has he had two or three lives to acquire his great practical experience in?). If J. P. A. wants more of Dr. Dresser's, why not go to the great Doctor himself? Some of us at least would rather be excused more of his outlandish teapots and candlesticks, or building construction. Surely there are plenty of periodicals devoted to that branch for J. P. A.'s requirements without his wanting to carry off 'our' paper as well; or 'for good old or new furniture' why cannot he be content with his *Cabinet Maker?* But I presume J. P. A. would have a paper more of a general character made to suit his own special requirements, at the same time to be vastly superior to all the specialists. He says the '*Cabinet Maker*, though cheaper, has much more information.' How cheaper, when it costs 1½d. to 2d. per month more than Work? Now, Mr. Editor, I have some fifty monthly numbers of that work since its commencement, and had the reading of many of the others; also a big pile of the other trade organ; but I find Work gives more information than either, if not both the others, to workers, though perhaps not to window dressers and counter jumpers and masters, and consequently am giving up both the others in preference for Work; and therefore hope you will not make such sweeping changes as J. P. A. would have, even if we have to lose the support of all such practical men of his type. I must apologise for this long letter, but I would like you to have a little encouragement from the other side than that of carpers and grumblers, who are never pleased with anything outside themselves."

An Amateur's Cornice.—W. B. B. writes:—"Observing in your issue for 27th April a description of a cornice (see page 83), I venture to send a plan which I adopted last year, and found to answer perfectly what I wanted. It is, I think, very much simpler to put up, and to some tastes would be as effective as the design of your contributor, Olla Podrida. At all events, any one who can handle a screwdriver, and a hammer and tin tacks, can try it at a very trifling outlay. The first requisite is an iron curtain rod with holes at each end. These can be purchased at any ironmonger's for a few pence, of such length as may be requisite. The rod should be suspended by iron hooks screwed into a ½-in. board, and the board must be fixed over



the window on iron brackets screwed into the wall. The board holds the rod, and the rod will allow the curtain rings free play. In front, and at the sides, tack a piece of tapestry, which may be purchased at the draper's, to harmonise with the curtains, to conceal the rod, and the matter is complete. Where the window is flat the matter is perfectly simple; and in the case of a bow window, a little more ingenuity is requisite, but no more than any intelligent man can overcome. The principal difficulty in the latter case is to procure a bent rod of the requisite size, and to cut the boarding to the proper shape. Any ironmonger will procure the bent rod, but the measurements require to be carefully taken. I add a couple of sketches to explain what I mean. The same plan would, of course, answer for a curtain over a door. In conclusion, I beg to offer my compliments on the work you are bringing out. Personally, I should be glad to see some wood carving designs, especially in Renaissance work, but recognise that you cannot do everything at once."

Building Construction.—C. M. (*Leicester*) writes:—"In answer to your request for the readers of Work to express an opinion on the subject of building, I think the way you suggest will be the best—in beginning from small houses. Hoping that you will be able to give early attention to it, I trust that your paper will be a success, as it has supplied a long-felt want."

Ammonio-Citrate of Iron.—P. W. S. (*Poplar*) writes:—"In an early number of Work I note 'ammonia, citrate of iron,' or something similar, which had misled a correspondent, and had been corrected by omitting the comma. But I submit the form is still incorrect, though I know often used. 'Ammonia-citrate' is as incorrect, in my view, as 'Russia-Turkish war' would be, the true phrase being 'ammonio-citrate,' not forgetting the hyphen."

An Opinion on Work.—W. V. C. (*Dublin*) writes:—"As a reader from the first number, I think I may venture to write with the object of giving my opinion on your paper. In the first place, the greatest fault (if it is a fault) your paper has, in my eyes, is that most of the articles are far above my head, and are apparently intended for skilled artisans. I think there ought to be a medium between this and the opposite extreme of presupposing your readers knew nothing whatever, and giving a definition of a hammer as an instrument for driving nails, etc. Possibly your paper is not intended for amateurs; in fact, your first number, which of any paper is usually taken as a forecast of its future line, contained as its leading article 'A Cabinet in Fretwork for Skilled Workmen.' In every other important particular I consider your paper admirable, the supplements and illustrations being particularly good. I will certainly continue to subscribe to Work, in the hope that I may advance in knowledge, and that it may come down to my level. While I think advertisements of tools, etc., not uninteresting, I do not think they ought to encroach on the pages of the paper, but should be on a separate cover, as in *Tit-Bits*, etc. I hope, too, that at some future time you will see your way to have the paper cut and stitched. I have induced a good many of my friends to take in Work, but some have dropped off for the first objection I have made. I trust, however, that I may soon have reason to ask them to rejoin. I would suggest your sending specimen copies to the reading room, Mechanics' Institute, here, and also to the workmen's clubs at Wellington Quay and at York Street, and to the Corporation Library; at all these places they would come under the notice of the class of people most interested. The addresses given will find them."

II.—Questions Answered by Editor and Staff.

Sheffield Steel and Wire Gauge.—J. H. (*Sheffield*).—I am not aware that there is any gauge known specifically and authoritatively as the "Sheffield." But I suppose that Stubs's gauge is meant, termed also the "Warrington" and the "Lancashire," this being largely used in Sheffield. In any case, the origin of all the old gauges is a matter of surmise only. No one can say with certainty how any of them originated, but a great deal of research and discussion have been expended over the question. The Committee of the Society of Telegraph Engineers, which was appointed to report on the Birmingham wire gauge, concluded—and they based their conclusion on the opinion of specialists—that the Birmingham wire gauge, in common with others, originated as follows:—Beginning with No. 1 wire, which is the largest, each successive size corresponds with a single draw of the wire through the plate, so that No. 10 wire, for instance, would have passed ten times through the draw-plate. Practical, and not mathematical, considerations, therefore, determined the sizes of the early gauges. The manufacturers would naturally draw down as small as possible at one operation in order to save labour; but they would be limited by the strength of men, and by the machinery in use in the last century, and by the cohesive strength of wire. As bearing out this theory, it is found, on investigating the series of sizes, that nearly a constant relation exists between the breaking strength of each wire and the resistance opposed by the draw-plate in drawing it down from its original diameter. Stubs's gauge, in common, probably, with all the older gauges, originated in this way. In 1843 Mr. Charles Holtzapffel, in conjunction with Mr. Peter Stubs, of Warrington, accurately determined the sizes of the best gauges in Mr. Stubs's possession, and formed a table of them. Mr. Stubs adhered to these averaged and determinate sizes, and it is from these that the tool makers of Lancashire and Sheffield have extensively copied. It is only during the last few years that Sir Joseph Whitworth, Messrs. Mallock and Preece, Latimer Clark, Robert Briggs, Mr. Hughes, and others, have proposed, or made, gauges based on strict mathematical principles, and in which either weight, or area, and diameter follow in a simple series of gradations. The outcome of these efforts is seen in one direction in the legalisation of the new standard wire gauge. As to the second portion of your query, it seems to me simply a question of mensuration. Knowing the weight of a square foot of steel sheet of definite gauge, which is supplied in tables, you can easily see how many times that is contained in a sheet of given length and breadth. Something more would be allowed for shearing off the edges: how much would depend on the practice of the rolling mills.—J.

New Adjustable Callipers.—D. R. M. (*Dundee*).—I do not happen to know the name of the maker of these useful callipers, but in reply to your inquiry as to where they may be got, I may say that they are sold by Messrs. R. Melhuish and Sons, 85 and 87, Fetter Lane, London, E.C. I think if you were to bring the notice under the attention of any enterprising tool and hardware merchant in Dundee, he would soon find out by whom they are made, and add them to his stock.

Cutting Edges and Bookbinding.—C. E. (*Hepburn-on-Tyne*).—I presume our friend, C. E., wants to cut the edges of his periodicals; if so there are three methods open to him. If he can get access to one or other of the first two methods to be named he will have his periodicals exactly as he wants them—viz., "to resemble work from a binder's hands." First, cut them with the cutting machine used by binders. Second, cut them with a binder's plough. To do this, the books will have to be screwed up tightly in a press called by binders the "lying press." The third method is a makeshift. Get a piece of deal board a little longer than the book to be cut, and about the breadth of ordinary flooring; plane one edge perfectly straight to serve the purpose of a straightedge or "cut against;" a few heavy weights, and a shoemaker's knife sharpened at the point. Make the book perfectly straight (which by this time must have been sewn) by knocking the back on a flat table. Having decided how much is to be taken off the edges, lay the board on the book in a position to guide the knife and place the weights upon it; take the knife in the right hand and cut close to the board. It will be well to keep the left hand on the board while cutting. Care will have to be taken to cut straight down—the knife will be liable to cut in. Book edges are not polished; they are burnished; and as this operation requires costly apparatus, I would advise C. E. not to attempt it. The edges can be sprinkled with Venetian red mixed with water, to which a little flour paste has been added. If C. E. succeeds in cutting his edges, the sprinkling will be an easy matter, and they will look as well unburnished as otherwise.—G. C.

Old Gold and Frames.—A. F. F. (*Leigh*).—As old frames require a deal of work and variety of treatment, I would suggest your waiting until this subject can be treated in the pages of Work.—G. R.

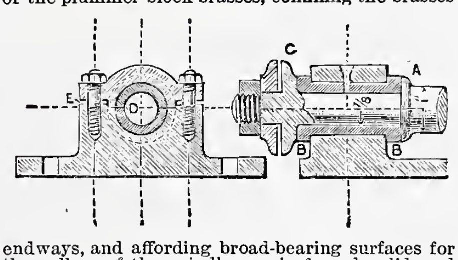
Handrailing.—Tancred.—My writer on handrailing is a working man, and one of the cleverest workmen I know in carpentry, joinery, and cabinet making. Like most of his trade he must make hay while the sun shines, or, in other words, work when and where he is wanted, so just at present his papers do not progress at the rate I should like. Even the practical work that I want him to do for me must wait, for the bigger builders' jobs must of necessity be done first. So I must ask you to be patient and abide his time, as I do, and I can assure you that when the papers appear, the simplicity of his system will amply reward you for waiting.

Bricklaying, etc.—A. S. (*Battersea*).—Bricklaying and house joinery will be fully and comprehensively treated in Work, but it is not possible for me to tell you "where you could get a thorough practical knowledge of bricklaying and house joinery at a small outlay, and the time required to obtain such knowledge." Practical knowledge can be acquired only by practice and by actually engaging in the work. You can learn the theory of bricklaying from books and articles, and how to distinguish between English bond and Flemish bond, etc. etc., but proficiency in actual work you can only attain by doing the work itself. With regard to house joinery, see papers on the "Joinery of the Workshop," which are about to appear.

Back Numbers of Work.—W. B. (*Enfield*).—Back numbers of Work are, and will be, always kept in stock, and you have only to order No. 6, or any number that you require, through the newsagent from whom you usually buy your newspapers and serial publications. I am glad you can say:—"I had the first number of Work placed in my hand by chance. Being pleased with it I have continued taking it in, and my pleasure in it has greatly increased, and I think it will in time surpass any other paper of the kind—in fact I think it does so now." (So do I! Ed.). "I forgot to buy one number—No. 6, I think—and should like to know if I can obtain back numbers, and from whence."

Quarter-Plate Camera.—Camera (*Charlton*).—An exhaustive article on the subject is now in course of preparation; the camera will be the first appliance treated upon. The idea will be to select the most simple and useful types of all appliances at present in use, accompanied by working drawings.—E. D.

Spindle for Circular Saw.—Mona.—The two figures annexed give a detail of the bearings of the saw spindle on page 141. Replying to your specific queries, A is a collar forged solid on the spindle, there being one against each inner bearing face to prevent endlong movement. B B are the flanges of the plummer block brasses, confining the brasses



endways, and affording broad-bearing surfaces for the collars of the spindle. C is forged solid and turned with the spindle. Wear is taken up by filing a little from the joints, D, of the brasses, as much as happens to be required, and screwing down the cap of the plummer block, which is made open at E for the purpose. The surfaces of the pulleys in the figure on page 141 are made round in order to prevent the strap from slipping off, because a belt must run to the largest diameter, and will only leave it when the stress of the work put upon it overcomes its power. That which you take to be a collar behind the flanged pulley is the boss on the back of the pulley, cast with it, and standing out a little beyond its back face. The drawings are to scale.—J.

Where to Buy Gold Leaf, etc.—W. S. W. (*Hummingley*).—Books of gold leaf and also of imitation gold or "Dutch metal" may be obtained at any oilman's or shop where painters' requisites are sold.—Opifex.

Wire Thread Fret Saws.—W. B. (*Enfield*).—On inquiry I find that these saws are not yet in the market: as soon as they are I will mention prices, sizes, etc.

Hand Saw.—H. A. G. (*Rugby*).—You ask, "What is the use of the little knob at the end of a hand saw, which projects above the blade at the end of it?" It is of no use whatever; it is merely ornamental, and is introduced, I take it, merely as affording less abruptness in the transition from the broader to the narrower part of the blade. The decrease in width from heel to end of the saw blade tends to lighten the weight and render the saw more manageable, if I may so speak.

Boat Building.—G. H. (*Cork*).—This subject will be taken in hand at an early date, or rather when summer has given place to autumn. Probably the canoe will be the first boat described, but in due time all kinds of boats for rowing and sailing will be described, and the mode of building them.

Model Sailing Vessel.—W. R. (*Wigston*).—Kindly see preceding reply relative to boats and canoes for fresh and salt water. You wish for a model. Will you write again and give some idea of the size and state the rig you desire? There will be no difficulty in getting papers on the subject; but the writer would naturally like to know the taste he has to suit.

Cement for Repoussé Work.—S. H. E. (*Plymouth*).—Mr. Gawthorp's paper on "Repoussé Work," in No. 7 of Work, is in no way intended as an exhaustive description of the process. It was merely an accompaniment to the pattern sheet given with No. 7, and to serve to show the reader roughly and briefly the broad outlines of treatment. Mr. Gawthorp will go into details in papers that he has undertaken to supply on this beautiful and attractive art. He will readily supply you or any other workman, professional or amateur, with everything necessary for doing the work, and will tell you how to make the cement. I append the recipe you kindly send, and which, you think, has never been published. It is:—"9 lbs. of emery or fine brickdust, and emery in equal parts; 2 lbs. of pitch, 1 lb. of resin, 1 candle, or its equivalent in tallow."

Broken Film in Developing Plate.—A Novice (*Norwich*).—Procure a tube of neutral grey, moist water colour, and then with a fine sable pencil carefully stipple over the defect until by *transmitted* light the patch is the same apparent density as the surrounding parts. It will be as well to varnish the negative first, then if the stipple has to be removed, it can be without further damaging the film. An experienced retoucher would do it before varnishing; it is a mere matter of practice to judiciously match up with the image. Novice had better try repeatedly until he succeeds. It is always best to stipple it too thinly than too much. A light patch in most photographs is more conspicuous than a dark one in the resulting print.—E. D.

Maple Varnish.—H. W. G. (*Stourbridge*).—I have never heard of this varnish being of a rich crimson colour. Maple varnish is of a pale colour, so that yours has either been reddened or is incorrectly described. In either case I should hardly advise you to shake up the sediment, though if this is "sugary" I cannot speak positively. I fancy, however, you must be mistaken about its saccharine qualities, as I do not remember any varnish of which sugar is usually an ingredient.—D. A.

Simple Measurement of Timber.—C. F. (*Bradford*).—The simplest method of measuring round timber is by the "Quarter-girt" system. Required the cubic contents of a tree 30 ft. long and 96 in. in circumference.

Circumference 96 in. Quarter-girt=24 in.
Quarter-girt 24×24=576
30 ft. long

Quarter-girt divisor 113)17280(152 cubic ft.
113
598
565
330
226
104

Answer, 9 ft. short of 153 cub. ft.;
or, according to "Hopper's Measurer,"
Quarter-girt 24×24 in. =576
30 ft. long
divisor of 12×12=144
144)17280(120
144
288
288
0

A difference of about 22 per cent.—A. G. H.

Wood Stains.—French Polisher (*Maida Vale*).—There is no book which I could unhesitatingly recommend, but the "Practical Guide to French Polishing," published by Wyman & Sons, is, perhaps, the best. The subject will be fully treated in Work as soon as possible; meanwhile the following suggestions will be of use to you:—Yellow—Methylated spirits, 1 pint, turmeric, 4 oz.; or water, 1 qt.; picric acid, 1 oz.; ammonia, 1 oz. Blue—

Solution of indigo in sulphuric acid diluted to shade. Greens of various tones by mixing blue and yellow in different proportions. Red—Decoctions of alkanet root, logwood, and kindred dye stuffs. You will find it far better to buy your stains ready made. A large variety of stains may be made from the aniline dyes which you can buy either dissolved or dry. W. R. Roberts & Co., Earle Road, Liverpool, manufacture some excellent wood stains in all colours.—D. A.

Books of Japanese Fret Designs.—P. E. (*Ebbw Vale*).—I was very interested in your letter, but to comply with your request is not possible, for, alas! I know of no real books of Japanese fret and carved designs. I own some hundred native books, and the few motives for such patterns therein are already reproduced in WORK. I have designed many which I fondly hope are not those mongrel ones you have obtained at emporiums. I have seen such, that made one blush for the artistic depravity of their draughtsmen. You have had a chequered career, and should be a master of all trades and Jack of none—some day. May you reach 6 ft.—J. G. G.-W.

Removal of Paint from Plaster Cast.—A WHITESMITH (*Norwich*).—Should the removal of the black paint at present on the cast be absolutely necessary, a strong solution of American potash may be made and some sawdust wetted with it. If the sawdust thus moistened is left lying like a poultice over the cast all night, the paint may be washed away next morning with cold water. But it appears to us that the trouble and risk of this might be avoided by painting over the old colour—by giving it two coats of new paint, mixed with oil in the usual way, and a third of flat colour—*i.e.*, colour with very little oil and a good deal of turpentine. Painted casts look better dead than shining. Terracotta colour would be very suitable. Tube colour, bought at the artists'-colourman's, is the best, but it is the most expensive. Common tinned paint, to be bought at any oilman's or ironmonger's, would be quite sufficient for the two coats, tube colour being used with the turps for the flatting.—S. W.

Hardening Cold and Wood Chisels.—C. W. (*Kilburn*).—You have described the process of hardening and tempering correctly, and therefore the only thing to advise is to practise, varying the shades of colour until you get the right one. Let down and quench at a plum colour, and if that does not succeed, try shades between it and a straw. All steel is not alike, but qualities vary widely. Do not get it too hot either in the first place, or you will burn it so that it will not take a temper. There is no advantage in using oil for chisels; water will answer as well.—J.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Drilling Square Holes.—A READER writes:—"I noticed in a paper, I think the *Railway Herald*, that the scientific method of drilling square holes has been found out, and patented in Austro-Hungary. Do any of your readers know of the same, and could explain it?"

Sharpening Carving Tools.—AMATEUR (*Stockport*) writes in reply to J. W. B. (see page 172):—"Will J. W. B. kindly tell me how tools should be ground, and oblige?"

Child's Wooden Toys.—W. A. (*Hanley*) writes:—"Can any correspondent inform me where I could purchase the above wholesale, or is there a book to be purchased on the manufacture of the above, if so, where and price?"

Ivory Walking Stick.—W. A. (*Hanley*) writes:—"Can any brother reader kindly suggest the best cement that will join broken ivory walking stick?"

Soap.—G. H. (*Manchester*) writes:—"In what manner is paraffin wax used with soap for washing, and what is the benefit?"

Joiners' Composition.—J. R. (*Oldham*) asks:—"Can any of your correspondents in 'Shop' tell me how to make a composition for filling up joints and crevices in wood?"

Convertible Furniture.—W. W. W. (*Nottingham*) writes:—"Will some experienced readers of WORK give me their modes (with sketch and few dimensions) for a suitable and convenient arrangement of constructing a neat and artistic convertible chair, which, when turned, can be made into library steps?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Pronged Rings.—Syer & Co. (75, *Chiswell Street*) write in reply to E. C. (*Battlemore*) (see page 190):—"Replying to your correspondent's inquiry *re* above, we should be glad to undertake the making of these for him."

Machine for Current of Air.—P. P. (*Withington*) writes in answer to BELLOWS (see page 190):—"He had better get two pairs of house bellows, and having screwed fast the handles to a large board (which will serve as a bell-plate or stand), connect the hinged handles to a double crank shaft, in such a manner that the bellows will alternately rise and fall, and thus if the nozzles are connected a continuous flow of air will be the result. I have the above arrangement under my bench (but without the shafting), and I work them with my feet direct. I use the wind for blowpipe work, and the result is a fairly steady blast. If BELLOWS wishes it for a forge, my advice is get a rotary blower; they are cheaper than smiths' bellows, in first cost, and last much longer. If he is an amateur, and has a small portable or other hearth, the above arrangement will act admirably."

Fretwork Patterns.—F. S. (*Dorchester*) writes:—"I am a constant and very grateful reader of WORK, and being anxious to 'do unto others as I should wish to be done unto' (in this case the helping out of a difficulty), if W. E. M. (who is making inquiries for a book of fretwork patterns) will send his address to me, also rough sketch of frame, I will send him the covers of a book I have by me, and address where to send for it. By description of frame, etc., I fancy I have the identical book."—[I insert your reply to W. E. M., but it will be unnecessary for him to avail himself of your kind offer owing to replies on this subject from other writers.—ED.]

French Polishing.—C. S. (*Radford*) writes in reply to T. A. (*Belfast*) (see page 174):—"I think the reason why your polishing goes dull after a time is that you use too much oil. I only use just enough oil to prevent the polish from sticking to the wood by applying a little on my finger to the pad. If you try that you will find a difference."

French Polishing.—R. H. (*Lewisham*) writes in reply to T. A. (*Belfast*) (see page 174):—"As regards French polishing fretwork, perhaps the following hints may prevent the excess of oil from spoiling his work in the future. After dipping the wad of wool, with its covering of rag, into the oil, apply a little French polish, and rub well in, but do not attempt to polish. After applying what you consider sufficient, put the work aside in a warm room for a few days. When you begin to polish use white polish at first; no oil at all if the wood appears greasy; change the rag each time fresh polish is put on to the wad of wool; when a fair polish appears then use French polish; when the polish is perfect, finish off with fresh wad of wool and rag, and a small quantity of spirits of wine, rubbing lightly. This will clear off all oil, and leave a first-rate surface, if only small drops of oil have been used during the polishing process. Always polish in a warm room, one with a good fire in it, and thoroughly dry and air the linen rags; put small quantities of polish on the wads of wool, very little oil, and make the circular strokes cover a fair space each time, rubbing the way of the grain only at the finish each time. If you carefully follow this advice I think you will be as successful as myself, since I had them given to me."

Wood Colouring.—W. G. (*Southport*) writes in reply to OX GALL (see page 174):—"That he will find the following answer his purpose for staining deal a dark oak colour: Two pennyworth of vandyke in oil, one-eighth of a pint of terebine, ditto of turpentine, and one fourth of a pint of kerosine or paraffin oil. Mix well, and try on a piece of planed deal, first laying it on thinly with a piece of sponge or old felt. If too dark, add more paraffin, again experimenting until the desired colour is obtained. After staining the overmantel, rub well with a piece of old woollen cloth or felt, then give a coat of French polish, using a wadding rubber. Finish with beeswax and turpentine, well rubbed with a soft, dry cloth. This will simulate the colour and dull polish desired, with as little labour as any process that I know of. Permit me to add, for the information of other readers of WORK, that this stain may be brightened by using more or less of raw sienna, also ground in oil, instead of all vandyke, thinning as required with paraffin oil. I use it largely for trade purposes, being cheap, easily and quickly applied, has a nice appearance, and leaves the work with a smooth surface ready for polishing or varnishing. And speaking of varnishing here is another wrinkle from my own practice. Before varnishing plain wood, either stained or unstained, the article must be well sized, or the varnish will sink in. Ordinarily glue or gelatine size is used. My plan is to give two thin coats of French polish laid on with a brush; when dry rub down with fine, worn glass paper, finishing with a coat of good oak varnish. This beats anything I have yet seen used."

Elizabethan Twist in Lathe.—W. P. W. (*Newport, Mon.*) writes in reply to C. C. E. (see page 109):—"I am not quite clear as to the word 'Elizabethan,' but if C. C. E. means any spiral having a convex contour—a piece of rope for instance—he is quite mistaken, it can easily be done in the lathe. I have a 4½-in. screw-cutting lathe of ordinary type, in which I have done several pieces of spiral work, and could do it in any such lathe with overhead gear, without the aid of rasp or file. If C. C. E. would wish I will send him a specimen finished by cutter only."

Refrigerator.—C. H. W. (*Hampstead*) writes in reply to URGENT (see page 174):—"A refrigerator is constructed as follows: First an inside case of ½-in. or ¾-in. deal lined with not less than No. 12 zinc; this case is covered outside with felt; a space is left between this and the outside case that can be made of inch stuff, usually with two lids or doors of cabinet pattern. On the inside lid the zinc is raised, and the space thus formed is filled with cork dust. Ventilation is made through inside case near the top, to carry off warm air that would condense and drop on contents of cupboards. I have made several, and the last one something of the pattern URGENT wants. It was used as a counter, etc., in the ice cream trade, and pronounced by Gatti's men the best on their round to keep ice. The place to store the ice was at the top, and water from same trickled down sides of cupboards in centre, into a sort of trough, and through pipe in floor, to drain. There is a lot of work in making one, and they would come expensive. I will send plans with Editor's permission."—[By all means send plans.]

Trade Notes and Memoranda.

MR. FRANKS, of the British Museum, recently secured from the gravemounds and dolmens of Japan a splendid collection of old pottery, iron weapons, and copper ornaments. The pottery is very curious, and the collection, as a whole, is unique.

A MR. ANDERSON, of Leeds, has invented a system of ventilation for the underground railways, which is, at least, ingenious. He proposes to discharge the noxious fumes from the locomotives into a long exhausting flue placed between the rails. A long sliding box underneath the locomotive receives the vapours from the smoke box, and transmits them to the flue. The sliding box travels over the flue fitted with suitable valves, which are opened by the sliding box in its passage, the valves being of such a length that a second valve is covered by the sliding box before it has quite passed over the previous one. The flue is exhausted by fans stationed at intervals along the line, and driven by stationary engines. The fan being set to work, and the train started, as the engine passes over the valves in succession, the steam and products of combustion are sucked from the engine through the valves in the exhausting flue, and are drawn from it and discharged through suitable shafts into the atmosphere. The difficulties which we should apprehend here would, however, be of a mechanical nature, due to the great difficulty of making the apparatus sufficiently free from leakage.

A RELIC of the iron age has been found at Nötterö, on the Christiania Fjord, in Norway. It consists of an iron pot with handles, a sword 2 ft. 6 in. long, an anvil, and a pair of smith's tongs, together with some bones. The mound in which it was discovered is now 300 yards inland, and was believed at one time to be close to the sea.

A SAN FRANCISCO journal contains an account of the discovery of a new method of preserving ironwork from rust. It consists in brushing it over with a thin wash of turpentine and white lead, a thin compound which will penetrate into the very interstices of the metal, which the thicker oil paint is unable to do. No corrosive action or scaling can then take place. Mr. Heald, the discoverer, is said to have been led to this result by observing that some old gasholder plates which were badly corroded still retained the "shipping marks" in a state of perfect preservation.

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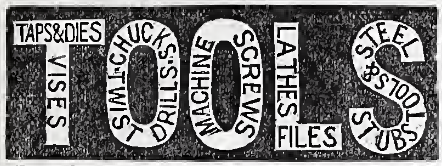

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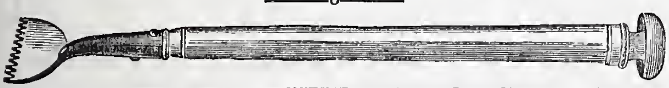

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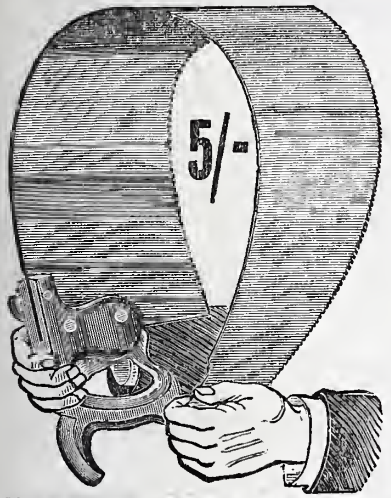

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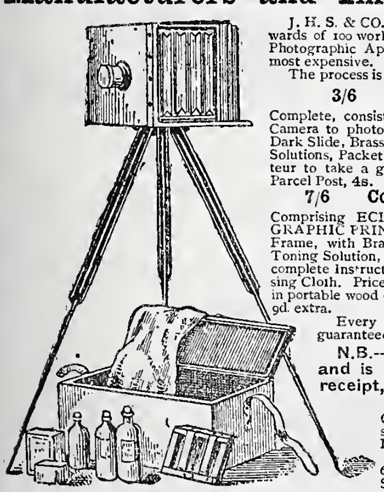

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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A MITRE BLOCK AND HOW TO MAKE IT.

BY DAVID DENNING.

INDIFFERENTLY known as the mitre trap or mitre block, the useful appliance which forms the subject of the present article is just one of those things which may be made by the user quite as well as by a specialist in tools, if indeed it can be called a tool, for it is rather an aid to the successful use of those things which come under the comprehensive name of tools than one itself. I daresay mitre blocks are to be bought in the ordinary way of trade, but they frequently, I may say generally, are made by those who use them. This is not surprising, as any cabinet maker or joiner can make one if he possesses sufficient ability to work accurately in the way of squaring up, etc., and unless he is able to do this he would be a very poor craftsman indeed. Nor will the advanced amateur experience any great difficulty in constructing a mitre trap when it is described to him. He has not the same opportunity of knowing how to make it as his professional *confrère*, for the latter is sure to have at least some shopmate who can lend him one to copy from, or improve on according to his own ideas. The amateur, however, working mostly alone, is to a great extent dependent on other sources for his information, and I don't think it would be too much to say that a large proportion of amateur wood-workers have never seen or heard of a mitre block. Anyway, its usefulness is so great to any one who has occasion to form mitres, that no apology is necessary for its mention in these pages. It may be an old-fashioned contrivance, but old or new, anything which can in any way facilitate operations is deserving of attention.

With regard to home-made articles, it will generally be found in every appliance, made by a worker for his own use, that there is some character about it—the maker knows what he wants, and has his own ideas about its construction. One man thinks one way best, another fancies that some little alteration will render the thing more convenient or serviceable. Hence, in these appliances which are made with a full comprehension of what is wanted, and an equal amount of facility in manipulating the materials of which they are formed, one finds that they are stamped with an individuality which is not, indeed, cannot be, seen in ordinary purchasable tools. Now, I don't wish you, for whom I specially write, to try and find out some feature in the block described, simply with the intention of impressing your own individuality on it, but if you think you can improve on it in any little detail, and so render it more serviceable for your own special class of work, by all means embody your ideas when making up the block. I tell you how you may make a good useful one of suitable size for ordinary purposes, but do not suppose that any departure from dimensions or even mode of construction will necessarily be a fault. If you are in doubt, or don't know anything about a mitre block, follow the directions as closely as desired, but, of course, incorporate any improvements which may suggest themselves, and if you hit on a good practical idea, pass it on for the benefit of both amateurs and professionals.

As the construction of the mitre block is under consideration at present, its use need only be incidentally alluded to, as those who know what a mitred joint is will require few directions how to use the block when they have made one. Its adaptability for its work will be evident, but in addition to the aid it affords in cutting mitres, or rather in finishing them, it may be said that if made as directed, it will afford a ready means of squaring off ends of pieces, such as door rails and styles. Indeed, to give the thing its full title, one would be justified in describing it as a mitreing and squaring block. The illustrations, Figs. 1, 2, and 3, show the block. Fig. 1 represents it in front elevation, or by merely imagining the ends reversed, as the back, and Figs. 2 and 3 the ends. A and B are two blocks, both precisely alike in size and shape. The one at the left-hand end is fixed to the frame, D, to which the other is so secured, that it can be

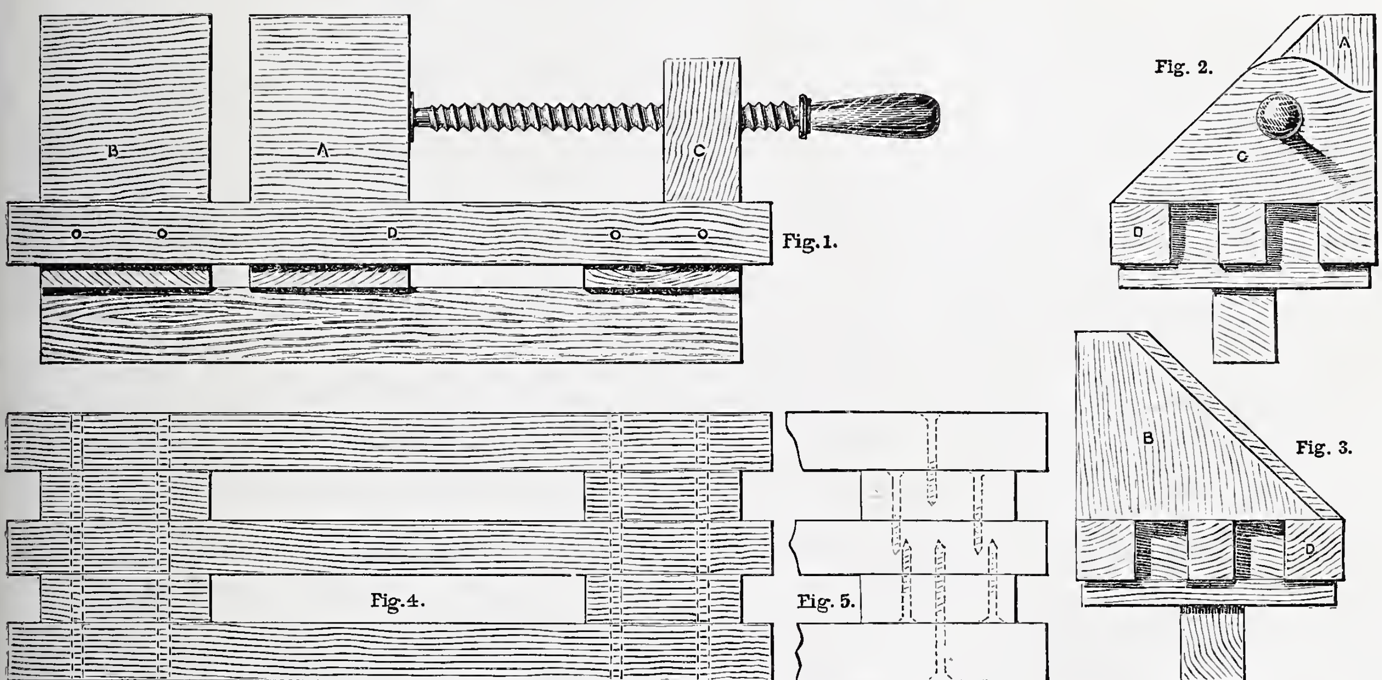


Fig. 1.—Front Elevation of Mitre Block, showing Hand Screw. Fig. 2.—Elevation of Right-hand End. Fig. 3.—Elevation of Left-hand End. Fig. 4.—Plan of Frame. Fig. 5.—Alternative Mode of Fastening Parts of Frame together by Screw Nails.

moved by the screw working in c. As will be seen from Figs. 2 and 3, one face, *i.e.*, the front of A and B, slopes at an angle of 45 degrees from the top of D, forming the guide for mitreing, while the back is perpendicular to the top of D, or rather to the triplicate bed of which D is a member.

Having said this much on the outline of a mitre block, let us now consider its construction in detail. In describing this, I take the various parts in the order in which I fancy work may be most readily intelligible, for it can easily be understood that in making the block it is of small consequence which part is made first. Before going any further, let it be said that of whatever kind of wood or woods the thing is made, the material must be perfectly dry, so that there may be no subsequent twisting or casting. If the trap is to be of any use it must be accurately made; something near exactitude will not do, so that it is necessary not only to make and fit it correctly, but to use no wood which will not remain true. If there is the slightest suspicion of the wood being damp, place it in some warm place, and let it remain till all moisture has been got rid of, or to borrow a very expressive word from the workshop, till it is almost "baked," before attempting to finish any of the pieces.

Suppose we start with the frame. I should say perhaps that the measurements and other details are described from a block which lies on the table before me. They may therefore be taken as accurate, but minute fractions are not noted. The frame, or bed, is 16 in. long by $5\frac{1}{4}$ in. wide, and is formed as shown in Fig. 4. It is of birch, but any hard wood will do. The two outside pieces are $1\frac{1}{4}$ in. square, the centre piece $1\frac{1}{4}$ in. by 1 in.; the three of them being connected by four other pieces $1\frac{1}{4}$ in. deep by 1 in. thick, and $3\frac{1}{2}$ in. long. It is most essential that the open spaces which form the guides for the movable block, A, should be perfectly true. It would never do to have them wider at one end than the other, or in any way irregular, and, of course, accuracy will depend on both sides of the centre piece being parallel with each other and the inner edges of the outer rails. If these points are attended to, and the pairs of connecting blocks are equally correct, the result must be satisfactory. These parts may be fastened together by glue, and by wooden pegs running through all of them, as shown by the dotted lines on Fig. 4. If this mode be adopted, it will be more convenient to bore the holes in each piece separately before gluing up, their positions being accurately marked. For the pegs, ordinary dowel stuff will do very well. If on fastening the pieces together it should be found that the top and bottom surfaces are not quite level through the holes not being accurately bored, the inequalities may be reduced by planing.

A somewhat easier and simpler method of joining the pieces together, and one which will probably find more favour with most readers, is simply to screw the pieces together as suggested in Fig. 5. The short pieces are first screwed to the centre rail, and then the outer rails to them. The heads of the nails should be well sunk, especially those into the middle piece, in order that they may not interfere with the glue acting properly. Glue alone might do, but I am inclined to think dependence on it would hardly be advisable, especially as the use of a few screws does not entail much trouble. The frame is further braced with two pieces of $\frac{3}{4}$ stuff fastened on underneath. The width of these is the same as the block, B, which, of course, must be screwed down before the piece at the bottom can be fixed as it is with screws.

The same may be said of the other end piece, but before considering it further, it will be convenient to describe the blocks, A and B. They are of mahogany, faced up on the sloping side with $\frac{1}{2}$-in. rosewood, which is glued to them. If the work of facing should be objected to, it may be dispensed with, though it is advisable to face with some hard wood, if not absolutely necessary. However, whether faced up with another wood or not, too much care cannot be exercised in making the work true as already stated. The fittings of the sliding block, A, are as follows: Two pieces of equal width and thickness with those connecting the main portion of the frame are screwed to the bottom of A, and work within the open spaces of the frame without either stiffness or side play. They must, of course, be so fixed that the sloping face of A is perfectly level with that of B, for if not, the intention of the mitre block will be frustrated. Another piece of rosewood, the same size as the others, must also be screwed under A, but this time instead of fastening it to the frame, it is fastened to the movable block by screws driven into the sliding pieces. By this arrangement, A is free to move backwards and forwards along the frame, but in no other direction.

We may now proceed to consider the screw and block, C, which, however, hardly call for any special remark. The face of C must be on the same slope as those of the other two blocks, to allow of the plane being used, and, of course, the back must be square. The shape of the top of the screw block is merely rounded off as shown, for the sake of appearance. It may be suggested that so long as hand screws are to be obtained as cheaply as now, there is small reason for incurring the expense of having a special screw and block prepared. That, however, is merely a detail which has not been enlarged on, as the great thing is to have a screw with tapped block. Screwing up will force the block, A, towards B, but unless some arrangement be made it will not draw it back. The simplest and most natural way of causing the screw to pull as well as push, is to have a small plate of metal with a hole in it for an ordinary screw nail to revolve freely in it. The nail is driven into the end of the wooden screw, just as if the plate were being fixed to it, but not tightening it up so much that the plate cannot revolve. This plate is then further screwed to A, as indicated in Fig. 1, when, according to the direction in which the wooden screw is turned, the sliding block is either pushed forward to or drawn away from B, so that anything placed between can be gripped as in a vice.

It will now be seen that on a piece of wood being laid on the upper surface of the bed and held fast between the two blocks, the end can either be trimmed off to form a perfect mitred joint, or squared up as the case may be. It will be understood that the block is merely used for the finishing of the surfaces, as it is not a mitre cutter. Consequently, when using the plane, care must be taken not to injure the block itself by taking any shavings from it. The remaining piece of wood at the bottom, which has not yet been mentioned, is merely for the purpose of allowing the trap to be held by the bench screw when mitres are being worked, and for fastening to the top of the bench by hand screws when the trap is wanted for squaring purposes. Though simple in construction, few who have much occasion to use one would care to be without it. If properly made on the lines laid down, and properly used, such a mitre trap as described should last a lifetime, though it may be necessary to true the surfaces now and again.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

THE microscope has of late years rendered such signal help to the cause of science, and the secrets wrested from nature by its aid are so many, varied, and of such vast importance, that almost every scientific worker finds it necessary at some time or other to turn to it for assistance; but apart from those who make use of the microscope simply as a means to an end, there are a large number of workers who make the microscope and microscopic research their special study.

The members of this fraternity are aptly named "microscopists," and the family may be readily divided into two well-marked varieties, easily distinguishable by their special peculiarities.

The first variety, comprising all those who devote their energies to the study of the microscope as a work of art, and confining their attention almost entirely to the invention and perfection of apparatus, with very little regard to the wonders revealed by their favourite instrument, may be briefly described as the "brass and glass" variety.

The second, including those who spend their time roaming the country exploring fields, hedgerows, sandhills, ponds, ditches, etc., etc., in search of fresh objects of interest for examination and preservation, may be briefly described as the "bug and slug" variety.

Though both varieties are necessary to ensure the due perpetuation of the species—the former being more ornamental than the latter, which is, perhaps, the most useful—we will for the present confine our attention to the wants of the B. and S. variety, which also, perhaps, boasts of the largest number of disciples.

The acquisition of the technical knowledge and practical skill required to successfully prepare and mount an object for examination under the microscope, is one of the great desiderata aimed at by every microscopist; and it is my desire to give as clearly as possible a few practical hints gathered from my own experience as to the best methods of preparing and mounting objects for the microscope. I don't pretend to say that all that follows will be absolutely new; on the contrary, I expect that most of what I have to say will probably be old news to expert microscopists, but I live in the hope that what I am writing will at the least repay perusal by novices.

Microscopic objects may be divided into three classes, according to the method of lighting employed in their examinations:

1. Opaque objects, which require to be examined by direct or reflected light.

2. Transparent objects, which are best seen by transmitted light; and,

3. Semi-opaque objects, which may be examined either by transmitted light alone or in conjunction with reflected or direct light.

Examples of these three classes will readily present themselves to the reader.

It may be well to premise for th

information of absolute tyros, that nearly all microscopic objects are now prepared on slips of glass measuring 3 in. × 1 in., which slips, with the edges ground, may be obtained from most opticians at prices varying from 4d. to 1s. 6d. the dozen, according to thickness and quality. The cheaper slips are cut from pretty thick glass of a coarser quality than the dearer kinds, and they are apt to contain air bubbles or streaks on the surface or in the interior at inconvenient places; however, they answer quite well enough for mounting dry objects.

The edges of the slips are prepared in two ways, ground either perfectly flat or rounded. Those prepared in the latter way are most generally used, but some prefer the former, because having a comparatively sharp upper edge, they are more readily picked up from a flat surface than the rounded ones, and not so liable to accidentally slip out of the fingers and get broken. Covers of exceedingly thin glass, which may also be obtained from the opticians, of different sizes, and either round, square, or oblong, from 1s. 6d. per half-ounce, are used to preserve the objects from contact with the air and from dust.

No workman can work without tools, but in this, as in most other things, the fewer and simpler the tools used, the better the result will be. Everything necessary for present purposes, in addition to slips and cover glasses named above, is comprised in the following list, and of those named very few items need be bought, as will be readily seen:—

Two or three dissecting needles; a small camel's-hair pencil; a pair of tweezers, curved preferably; a few vulcanite or glass rings; a turn-table; a small pair of scissors; a small bottle of japanners' gold size (to be obtained from the oilman); one or two bottles of various coloured varnishes made in accordance with instructions following; a bottle of dull black varnish, and a little marine glue.

The dissecting needles may be made out of wooden pen-holders, as follows: After removing the barrel, wrap tightly round the end a few turns of strong thread or thin bouquet wire to keep the wood from splitting; then take a common sewing needle and push the point into the end as far as it will go, taking care not to split the holder; now pull it out, reverse it, and push the head into the hole just made, and the dissecting needle is completed.

It is well to have the needle pushed in a good way, as it is not advisable for it to have too much spring, and it is also useful, instead of having all your needles perfectly straight, to bend the end of one to a right angle, and of another to an angle of about 45°. This is best done by heating the end red hot, bending it to the required angle, heating it again, and cooling suddenly by plunging in cold water or tallow. This latter operation restores the steel to nearly its original hardness.

The camel's-hair pencil needs no description.

The tweezers and vulcanite rings (cells) should be obtained from the opticians.

A small pair of ordinary scissors will answer present purposes, but if small dissecting scissors are bought, care should be taken in choosing them that they will cut right up to the extreme point, otherwise they will be almost useless for our purpose.

All the remaining articles tabulated can be obtained from the opticians, but if it is preferred to make the varnishes at home, here are the recipes for them.

Sealing-Wax Varnish.—Made by dissolving as much sealing wax (any colour) in methylated spirits as the spirit will take up. If a few shreds of gelatine are put in the bottle as well, it will have the effect of absorbing any water with which the spirit may be adulterated, and will cause the varnish to dry with a good bright surface.

Zinc White Cement.—Dissolve half an ounce of gum damar in one ounce of benzine, and add white oxide of zinc until the mixture is quite opaque.

Japanners' Gold Size.—This may be used either by itself or mixed with various coloured pigments according to taste.

Brunswick Black.—Ordinary Brunswick black makes a very good varnish for finishing slides.

Dull Black Varnish.—Made by mixing lampblack with turpentine. This varnish, if properly mixed, should dry with a perfectly opaque, dull black surface.

The zinc white and gold size varnishes are the most reliable, as the sealing-wax varnish is apt to shell off when it becomes very dry and old, being too brittle, but it looks very nice when newly put on.

The turn-table is used for causing the slide to revolve, and so facilitate the application of the varnish to the edge of the cover glass, and in choosing it you should see that the slide holder runs true and revolves freely. A turn-table will cost from 5s. to 21s., but you cannot very well get on without one, unless you are content to allow your work to look "botchy." Those having an automatic arrangement for centreing the slide are the most convenient.

Having procured the few necessaries mentioned above, let us proceed to work, and as opaque objects are the most easily mounted, and require the least preparation, we will commence with them and suppose we have to mount the wing of a small butterfly or moth.

Opaque objects are, as a rule, best examined in their natural state, and without any preparation except removal of all moisture; and as they are usually of some perceptible thickness, to avoid pressure they nearly always require to be mounted in a raised cell.

To make a cell, choose a ring of vulcanite or glass sufficiently large to enclose the object and of the requisite thickness; after carefully cleaning a 3-in. × 1-in. slip, cement the ring to it at the centre with marine glue, and when the cement has dried make the inside of the cell black by applying to the surface of the glass and the edges of the cell a thin coating of dull black varnish. When this is dry apply evenly to the top edges of the cell a thin coating of japanners' gold size.

The slide should now be put on one side for a few hours, under a glass shade or in a place free from dust, in order to allow the gold size to become "tacky," and when it has reached this stage the cell is ready for the reception of the object.

If the object, which I repeat should be thoroughly dry, is just large enough to touch the edges of the cell and the under side of the cover, well and good, place it carefully in the cell; but if the object is slightly small, the least sensation of gold size, between the object and the bottom of the cell, will have the effect of keeping the former from slipping about and so getting injured after the mount is completed. If gold size has to be applied in this way, it is as well to let it get nearly dry before completing the mount.

When all these instructions have been carried out, select a cover glass sufficiently large to extend about halfway between the inside and outside walls of the cell, and clean it carefully with a fine cambric handkerchief. I say cambric, because if a silk handkerchief or chamois leather is used, electricity is set up on the surface of the glass, and particles of dust are attracted, which is not desirable.

The cover glass, when cleaned, should be taken in the tweezers, warmed, and carefully placed on the top of the cell, care being taken that the edges adhere all round.

The slide should now be placed on the turntable, and a thin coating of gold size applied to the edges of the cover glass, and the whole should be allowed to dry. When dry, another coating may be applied, sufficiently thick to fill up the angle between the edges of the cover glass and the top of the cell walls, and this again may be nicely finished off with coatings of various coloured varnishes, sealing wax, or other fit substance.

All slides should be carefully labelled as soon as mounted, but it is often inconvenient to do this at once on account of the varnish not being dry. A good plan is to write the name of the object in ink on the back of the slide. This can be cleaned off after the varnish is dry, and a neat label affixed at one end to the face of the slide. The label should state the name of the object, where the object was obtained, date of mounting, method of preparation, and name of mounter.

Various modifications of the above method, to suit different objects, will at once suggest themselves to the careful observer; for instance, the object may be too large for any of the cells you have in stock. This difficulty may be met by cutting a cell of a suitable size out of a piece of cardboard of the requisite thickness, and using a square or oblong cover glass, instead of a circular one. Again, the object may be of such a nature that you may wish to have both sides of it displayed. In this case you will, of course, proceed as above, but omit to blacken the interior of the cell, but you must be careful to choose a cell of the exact size required, as you will not be able to use gold size to keep it in its place if it does not fit.

Sometimes the object is so thin that all your rings will be too thick; this difficulty may be met by cutting a cell out of paper with the help of gun wad punches; or a circle of gold size of the requisite width may be described on the surface of a glass slip with the help of the turn-table, and the object mounted in the cell thus formed. In this case, all that is necessary after placing the object in position is to gently warm the cover glass, which will at once adhere, then finish off in usual way.

If you have many objects to mount, the best plan is to prepare a number of slides by cementing cells to them beforehand; but great care should be taken that when the cement is dry the rings adhere at every point, so that there may not be the slightest chance of air penetrating to the interior of the cell.

You can always ensure the success of a dry mount by taking care that everything inside the cell is dry before the cover glass is put on, and making sure that when the slide is finished it is hermetically sealed. If these two rules are carefully adhered to, you need have no fear of mould appearing to spoil your work.

As mounting for the microscope requires great nicety of manipulation, it may be found difficult at first, but this will soon disappear by practice.

AN IRON REBATE PLANE.

BY A FOREMAN PATTERN MAKER.

Purpose of Rebate Plane—Why Skew-mouthed—Effect of Skew-mouth—Pattern for Rebate Plane—Core Box—Prints—Mouth—Filling in Blocks—Dimensions—Special Rebate Planes.

Hitherto I have treated only of those planes which are used for working over broad surfaces, the planes being traversed sideways at will to operate on any portions of these surfaces. In another and larger class of planes the action is entirely localised in the direction of the breadth, so that they remove a narrow zone of material only. These embrace the rebates, rounds, and hollows, fillisters, ploughs, beading, and other planes. They constitute by far the largest portion of the kit of a joiner and cabinet maker, and are mostly made in wood. The simplest of all is the rebate, because it operates only on flat surfaces, the irons of the other planes, the plough excepted, being mostly of various sectional forms. In few of these is the cutting action so good as in the common bench planes; first, because they have single irons only, and second, because in many cases, as for example in the moulding planes, the proper cutting action degenerates into scraping at certain sections towards the sides of the planes, where the angle which the iron makes in relation to the sole, and which should properly be normal at every portion of the curve, cannot be maintained. Moreover, all these irons are very slight in themselves, and apt to chatter on their seats.

It is to obviate somewhat the tendency of the rebate plane to chatter that it is usually made skew-mouthed. The skewing is not great, but it has the effect of causing the iron to sever the grain fibres in detail, in the same way as a chisel when directed obliquely cuts more sweetly than when it is thrust straightforward through the stuff. Making the body of the plane of metal instead of wood extra weight is obtained, and the best results possible from the rebate plane are secured.

A common iron plane is shown in section in Fig. 1, the pattern in Figs. 4 and 5, and the core box in Figs. 2 and 3. In Figs. 4 and 5, the print, A, of the pattern is of the same thickness as the width between the inside faces of the casting. This print is planed to gauged thickness first of all, and upon it the pieces, B, which are of the same thickness as the sides of the castings, are nailed. The thickness of these sides when finished should be $\frac{1}{8}$ in. In the pattern they may be $\frac{3}{16}$ in., or a trifle more if it is intended to plane the sides in preference to filing them.

Before being fastened on, the holes through which the shavings have to escape are cut out, and usually the top edges are shaped to an ornamental outline, somewhat as shown in the figure. Note the great breadth of the print, which is quite double that of the pattern itself, in order to enable it to balance the core properly, the pattern moulding upon its side. Being so shallow it is not necessary to make any taper in the sides of either pattern or print. If made dead square, the rapping will cause it to deliver freely. This is a case where coring out is quite necessary, because the deep and narrow body of sand between the sides would not deliver from a pattern made just like its casting, except by imparting an extravagant amount of taper thereto.

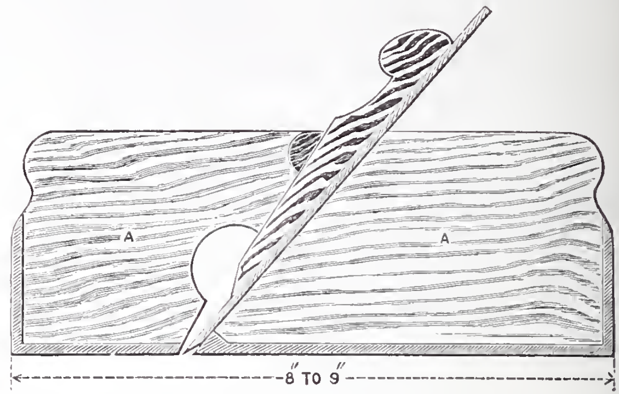


Fig. 1.—Section through Rebate Plane.

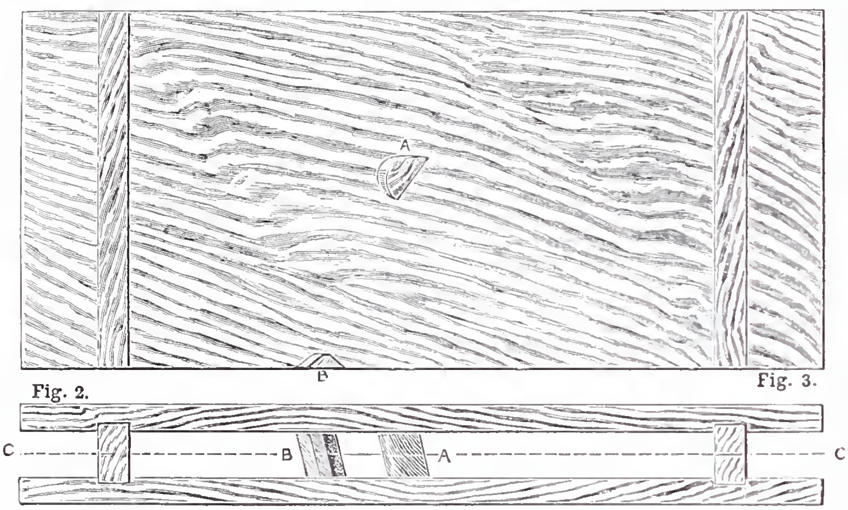


Fig. 2.—Core Box for Rebate Plane: Plan. Fig. 3.—Ditto: Section.

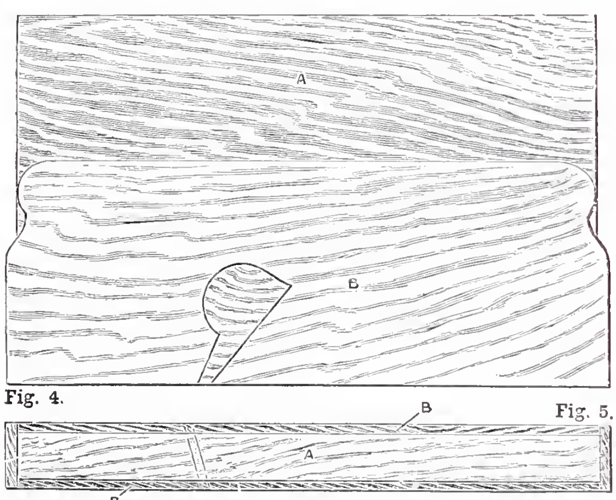


Fig. 4.—Pattern of Iron Rebate Plane: Elevation.
Fig. 5.—Ditto: Plan.

The actual mouth for the iron cannot be cut in the pattern, because it would not mould properly. This must be cut through in the casting, either with a slitting file, or with a hack saw, and finished by filing to the size required.

The core box (Fig. 2) is simply a rectangular open framed box having its ends grooved into the sides in the usual way, and having a piece, A, bridging across it to act as a stop for the wedge, and also a triangular bit, B, forming a bedding for the lower end of the iron which comes just above the bevelled facet.

The filling in blocks shown at A A (Fig. 1), made of any suitable hard wood, are fitted carefully in place, using red lead to test the accuracy, or otherwise, of their contact. Before fitting them, it will be necessary to rough file the inside faces of the casting, and to check their parallelism with internal callipers, to be sure that the width at the upper portion is not less, but of the two slightly greater than the width lower down. As in the previous examples, see that the fit is perfect everywhere, and also that the bedding of the iron on its seat, and of the wedge on its iron, are perfect, in order to diminish risk of choking and chattering. The section (Fig. 1) shows the relative arrangements of blocks, iron, and wedge so clearly that further explanatory remarks are unnecessary.

I have not given many dimensions in this instance, because the drawings are proportional, and all measurements can be scaled. An ordinary rebate plane is about 9 in or $9\frac{1}{2}$ in. long. The width for an iron plane may range from 1 in. to $1\frac{1}{2}$ in.

It is not advisable to exceed $1\frac{1}{2}$ in., nor is it well to go below 1 in. in an iron plane; though in wood we may go to $\frac{1}{2}$ in. and $\frac{3}{8}$ in.

In rebates, as in smoothing planes, it is often convenient to bring the iron close to the front, for the purpose of working right up to a shouldered end. This cannot be done in a plane made of wood, because of the weakness of the short grain. But such a plane is easily made in metal. The one here figured might be modified in such a way, but usually the tool is made altogether smaller. One of this special type will be described in a future paper.

It has been advanced that no one who can buy a tool will make one; but this is by no means the case, as many a professional workman will be found who will not only make, but even contrive special tools for special purposes. Moreover, the methods of making tools described in this and other papers on the subject are useful as forming a stepping-stone to the art of pattern making, which will eventually be treated in a more comprehensive manner.

SOME LESSONS FROM AN OLD BUREAU.

BY DAVID ADAMSON.

(*Continued from page* 246.)

Preparation of Drawers—Fitting Drawer Fronts—Treatment of Wood—Dovetailing of Parts—Lap Dovetail—Reasons Why—Improvements in Wood Working—Fastening Drawer Bottoms—Plain Bottoms—Munted Drawer Bottoms—Why Drawer Backs are Narrower than Fronts—Cock Bead—Stops—Fitting Locks—Keyholes—Plate Escutcheons—Plinth—Connection of End Pieces—Cleats for Plinth—Mouldings—Blocks.

The work, so far as it has gone, may be glued and fitted up now; indeed, it will be better that it should be before preparing the drawers. These will require some degree of expertness, though what may be lacking in this respect may, to a great extent, be made up by carefulness in every detail. Anyhow, a drawer is not the easiest thing to make if it is to work well and satisfactorily; and though it may seem such a simple piece of work, the man who can construct one perfectly may, without vanity, consider himself a skilled mechanic. Let the drawer fronts be fitted very tightly to their places before making the drawers, and in particular see that they are a little too full in width, if there is the smallest doubt about the wood being perfectly well seasoned, for if wood is cut exactly to width, and afterwards shrinks, the drawers will not fit well.

It is by no means a bad plan, in order not to run any risk, to let the wood stand for a day or two in some warm place before it is fitted. I would say that it should be placed near a fire, were it not that other risks are incurred by so doing, unless care be taken, and judgment used in turning the boards about, so that all parts are equally and gradually warmed. If this is not done, the boards, through drying more in one part than another, will probably twist and bend. If carefully watched this should not occur, and, in case of bending, it will be well to know that the hollow will be on the side nearest the fire. This arises from the wood nearest the heat shrinking most, so that the bend, if taken in time, may be counteracted by merely reversing the sides. The sides of the drawers may also be submitted to the same treatment; but whether they are or not they must be cut to fit very tightly; a rub with the glass paper will soon ease them sufficiently afterwards, if they don't run easily enough.

The front, ends, and back of each drawer are dovetailed to each other, in the way that may best be explained by reference to any ordinary drawer. In fitting the sides to the front, what is known as the "lap" dovetail is used. With it the ends are sunk in the drawer front, so that looking at this from the front no joint is perceptible. The back is fitted with the ordinary dovetails into the sides. The question may occur to the mind of the novice in drawer making, whether the pins (the dovetails) are to be formed on the ends, or on the back and front, or even whether it matters which. In this, as in most other construction, there is a right and a wrong way, and we can easily judge for ourselves which is the proper method in the present instance. Of course, the object of the dovetailing is to keep the parts together in the best possible way. The question then is in which direction, or where is the greatest strain on a drawer. The answer can only be that it is on the front, for on opening, it is that which is pulled. If it were loose it would come apart from the remainder. The same applies, though in a less degree, to the back. We therefore discover from theory, why it is that experience has shown the best way to fit a drawer together is by dovetailing the parts so that a backwards and forwards pull will not separate them. A lateral pull on the two sides would soon do so, for there is no resistance offered in this direction, except that caused by glue; but then, again, no great strength is required, for the strain cannot be so great as on the back and front.

Never thought of that! No, perhaps not, for we do so many things correctly by force of habit, that one is apt to lose sight of the fact that some one in far-off times perhaps must have pondered even on the right and the wrong way of making such a matter-of-fact article as a drawer. Did the man who first promulgated the now accepted method of fastening a drawer together meet with opposition from his fellow-workers? Did they look upon him as a dangerous character, who, instead of being content to follow his forefathers, was always bothering after some new-fangled idea? Did the antiquarian of his time think he was not a true "art worker," because he actually had the audacity to fancy that he could improve on old forms? I wonder. Probably he met with much the same kind of reception that one does now from a certain class of patrons, as they like to consider themselves, of art, when one advocates new and modern improvements.

Even in such a venerable handicraft as that of the wood worker, suggestions for improvements may be listened to with respect, unless experience shows them to be faulty in themselves; for though they are not very common, improvements are sometimes made. I saw one the other day in a piece of furniture on which it might fairly have been supposed ingenuity had exhausted itself long ago. No, it is not a patent, and I may tell you some day what it was, but as it has nothing to do with the bureau, it does not concern us at present; not, at least, further than gently reducing the shock it may be to some, when I tell them that the style of fitting the drawer bottoms in the old bureau will not be recommended for the present day workers. In it the drawer bottoms are fastened underneath the sides and back, and against the front. The grain, moreover, runs from back to front. The consequence is, that in several places the bottoms have split, although—think of it, unreasoning admirers of the antiquated—in the "good old times" workmen never—no, never—used anything but seasoned stuff. Nowadays it is considered best to let the grain run from side to side, and to make due allowance for any possible shrinkage. So that if the bottom does contract, it shall do so without detriment to the efficacy of the drawer.

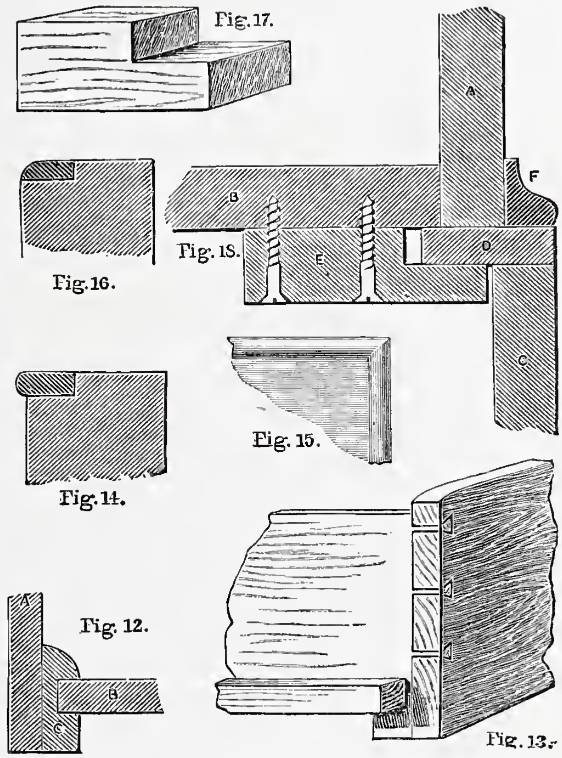


Fig. 12.—Fitting of Drawer Bottom. Fig. 13.—Back of Drawer. Figs. 14, 15, 16.—Beadings for Drawer Fronts. Fig. 17.—Cleat. Fig. 18.—Section of Plinth Fastening.

This may easily be managed by fitting the drawer bottom into grooves in the sides, similar to Figs. 10 and 11, but as the groove to a certain extent weakens the drawer side, as well as for other minor considerations, another plan is preferable and commonly adopted. In it the groove is run in a separate piece of wood, which is afterwards glued to the drawer sides, and the drawer bottom subsequently pushed in. Fig. 12 explains this more fully. As in the preceding illustration, A and B represent the side and bottom, while C shows the grooved slip. This may be about 1 in. wide, ½-in. stuff. The edge within the drawer is usually rounded off for the sake of neatness, and the lower edge is level with the bottom of the drawer side. This grooved slip runs the whole length of the end or side. It is a good plan to cut a groove also in the drawer front, into which the front edge of the bottom may be pushed, as otherwise the least contraction will leave an open space between the bottom and the front. Another hint that may be useful in connection with drawer bottoms is this:—Do not cut them off too bare at the back; let them project a little, and don't put any nails through them into the back, at any rate for a time; or if they fit so loosely in the grooves that they must be fastened to the back someway or other, let it be with screws, which can easily be withdrawn, and not with brads hammered in. If this precaution is taken, the groove along the front may be omitted, though it is never objectionable, and may often be serviceable.

Plain bottoms, such as have been described, do very well for short drawers, but when these are of any considerable length, such as the long drawers in the bureau, it is better to have a "muntin," as it is called. I am not sure about the orthography of this word, as it is not a common one in literature, and I have failed to find it in any dictionary, of which I have looked into several for the purpose. It is, however, given phonetically as used in ordinary workshop parlance, and as spelled by cabinet makers when writing for their craft, so that it will be well understood by those who are familiar with the construction it indicates.

A munted drawer bottom consists of three parts, the muntin itself and two others. The muntin is merely a piece of wood acting as a stay for these, and extending from the front of the drawer, where it is fastened, to beyond the back, underneath which it is secured. Its width may be from 3 in. to 4 in., and its thickness ½ in. Along each side edge a groove of the same width as that in which the drawer slips is to be ploughed. A recess is cut at the bottom of the drawer back, equidistant from each end, for the muntin to lie in, so that the grooves shall be in the same plane with those in the slips and front; or, instead of cutting a space in the drawer back for the muntin, this is cut down or rebated as far as the top of the groove, and then secured underneath the back. Each method has advantages peculiar to it, but the latter is the one generally adopted. The other pieces of wood are of the usual thickness of drawer bottom stuff, and it will be unnecessary to do more than state they are pushed into the grooves as if there had been no muntin.

The reason why the drawer backs (Nos. 34 and 35) are stated in the list to be narrower than the fronts (Nos. 6 and 9), will now be apparent, for the bottoms are fitted under them. Fig. 13 shows a corner of a drawer seen from behind. It will be noticed that the top of the back piece is shown lower than the sides. This generally is so, but it is not of importance that it should be, unless, perhaps, a trifle, just to be sure that it is not above the level of the sides. These, it will also be noticed, are slightly rounded at the top corners for the purpose of giving the drawers an easy entrance. The bottom corners and outside edges may also be rounded for the same reason, though it is not necessary if the upper ones are done. It will, however, be well to rub the upright angle down a little with glass paper, not too much, but just enough to allow the drawer to enter easily. The drawers as described are perfectly plain, without even a pretence at ornamentation, although Fig. 1 indicates a bead round each. This bead is represented on a larger scale in Fig. 14, which shows it to project a little in front. It is known as the "cock" bead, and though rather out of date, there is no reason, except on fashionable grounds, why it should not be as popular as ever it was. It is, indeed, one of those details of finish which, though temporarily neglected, never seem altogether discarded. To make it, a shallow rebate is cut all round the drawer front, usually as far back as the dovetails, on the ends and thickness of the front on top and bottom. In this rebate, and filling it, the piece forming the bead is glued or fastened with glue and a brad or two. The front edge is rounded, as it may easily be with ordinary appliances, for, though there is a specially constructed tool for the purpose it will not be worth any one's while to get it, unless he wants to make a great number of "cock beaded" drawers in the shortest time. The corners of the beads are mitred (see Fig. 15). Another bead, and one perhaps slightly easier to form, equally suitable as the other, though not so often made use of for oak drawers, is shown in Fig. 16. The principal diffe ence is that it does not project beyond the drawer front, and consequently only one edge is rounded. Neither of these beads should be too thick; ⅛ in. is quite enough. There is, of course, no necessity why the beads should be used, their only object being to relieve the drawers from absolute plainness, and, after all, it may be open to question whether they are worth the labour involved by them. Now, to prevent the drawers being pushed too far in, for I assume that they do not extend quite to the back of the bureau, and when quite in they should be level with the rails between them, or the merest trifle within them, unless beaded as in Fig. 16, when they should project a little, just the extent of the rounded wedge, some kind of stop will be wanted. These can easily be made of a thin piece of wood bradded to the rails, so that the fronts of the drawers catch against them. Usually a couple of stops are placed for a drawer—one near each end, and, of course, clear of the drawer sides. Their exact position can easily be ascertained by measurement and experiment. Thus, if the drawer front is exactly 1 in. thick, and it is, when in, to be quite flush with the rail, the front edge of the stops must be just 1 in. back on the bearer.

Locks may be fitted to the drawers any time after the stops have been placed, or, indeed, locks may be fitted as soon as the drawers have been made, only the holes for the bolts cannot be accurately cut till the exact position of the drawers when shut is known. These holes, of course, are cut into the under sides of the bearers; but, perhaps, before mentioning them, I should have said something about fitting the locks. These must be sunk so that their backs and tops are level with the wood to which they are attached. Nothing looks worse than a lock too deeply sunk, especially on the top of the drawer front, and it is a fault that is easily avoided by a little care. If too much wood has been cut away, the lock may easily be got to a proper level by packing with a thin slip glued. Be careful not to make the opening too wide for the lock, though, for this is a mistake not so easily remedied. The best way to do so will be to cut the space out clean, fill with a block glued in, and fit the lock afresh. Now a place for the bolt will have to be cut in the bearer above each lock. Its exact position may be ascertained by measurement, but a simpler plan will be to blacken the top of the bolt with a little gas black and glue say, then, when the drawer is in place, shoot the bolt, of which an imprint will be left where the hole is to be made. Of course, the blacking, or whatever it is, must be wet, or no imprint will be left on the bearer. The hole may be cut with a small chisel of the ordinary shape, though there is a contrivance, a kind of bent chisel, made especially for cutting holes in similar positions. It is, however, not often seen. Perhaps I ought to have mentioned something about cutting the keyholes, though really the only thing to be said about these is that they should be neatly formed if the ordinary thread escutcheons are to be sunk in them. In case, however, this is beyond the skill of the maker, he may be pleased to know that he can hide any unshapely keyholes by plate escutcheons, which are pieces of brass made to screw on to the drawer front, and having an opening to pass the key. The bulk of the bureau is now done, and those who have managed thus far will find the rest comparatively simple, though, in point of time, it may take as long. There still remain the plinth, the writing lid, the small fittings inside, and the back to be attended to. It is immaterial in what order they are done, but perhaps that just given will be as convenient as any.

The plinth may, therefore, be described first. This should be of 1-in. stuff for the ends and front, which may be either shaped, as shown on Fig. 1, or left plain. The advantage of the shaping out is that the feet of the writer do not knock against and bruise the front of the plinth, as they are apt to if it is left solid, and perhaps it is more pleasing to the eye. In length the plinth should measure about 1½ in. more than the extreme length of the bureau above it, and ¾ in. more than the width of the ends; in other words, it will extend ¾ in. beyond the upper portion of the bureau, in front and at each end, the ends of the side pieces being flush with the rest of the job behind. The front and ends may be dovetailed together, the pins being cut in the front pieces. A very much neater way, however, will be to mitre the corners, and fasten them together with the mitre dovetail. This joint, however, as already intimated, may not be convenient, and a plain mitre, though sightly, would not afford the necessary strength. This may, however, be gained without any dovetailing, by simply gluing a block on the inside of the angle. All that is required is that the block should be rectangular on two of its sides, and that these should be glued one to an end, and the other to the front piece of the plinth. The block may be one to two inches wide on each face, and if made triangular in section it will be an easy matter to further strengthen the joint with one or two screw nails driven through it into the plinth. The length of the block, of course, cannot be more than the width of the plinth pieces, and it should not be much shorter.

Somewhere near the back connect the two end pieces by another of the same width. Pine will do very well. It must be slightly shorter, as it is to be dovetailed in the same manner as the drawer bearers were—*i.e.*, a groove shaped to fit it must be cut across the end pieces of the plinth, or it may simply be attached by glued blocks such as those mentioned for the front corners. The result will be a frame, some 4 in. deep, say, with the back three or four inches within the ends. The remainder of the bureau will stand on this, but no provision has been made for fastening the two parts together. There are at least two ways by which this may be done in a thoroughly workmanlike manner, and a good many more, which, though in practice may be found sufficiently efficacious in the hands of skilled workmen, cannot be recommended to the amateur. In one of the two methods which he should adopt if he wishes to avoid all risk of something "going," pieces of oak, or whatever the bureau is of, are laid on the frame of the plinth. The thickness of these does not matter, though they should hardly be less than ¾ in., still if this is not convenient ½ in. will do very well. They should not be less than 2 in. wide, and each piece should be as long as that on which it is placed. The outer edges should be level with the outside of the plinth, so that they hang over on the inside 1 in. or so. The ends should be mitred to fit each other, and when this is done these pieces should be fastened by glue and screws to the other part of the plinth. There is now a rail through which screws may be put into the bottom of the bureau; but remembering what has been said about the undesirability of rigidly binding cross grains together, it will be seen that screws (or screws and glue) can only be used in front, as if the ends of the plinth were to be fixed to the bottom in the same way, this latter would have no freedom in case of shrinkage. Still it is necessary that the ends should be fastened, and it may very simply be managed by a couple of cleats to each, one near the back rail, and the other midway between the front and it. The exact size of these cleats (Fig. 17), or blocks, is not important, but as some idea 4 in. long × 2 in. wide may be stated. The depth of the piece cut out should be the same as the thickness of the top rails of the plinth, so that when the cleats are screwed to the bottom of the bureau they will hold the plinth to it.

This being done, the moulding also mitred may be laid on and glued to it. In addition the front moulding may be glued to the pine bottom, the edge of which it should cover and hide the joint with the oak bearer above it. Be careful not to glue the end mouldings except to the plinth, and if there is any fear of them being knocked off, or the glue giving way, a screw or two driven in on the slant from below will prevent any injury of this kind. The section of the completed plinth, with its attachment, is shown by Fig. 18; A and B are the end and bottom of the bureau; C, the lower part of plinth; D, the upper part hanging over underneath the bottom, to which it is held by the cleat, E; and F is the moulding planted on to the plinth outside. If desired, a piece similar to D may be fastened on the back rail of the plinth, and if the bureau is made much larger, perhaps it will be as well to do so, securing it to the bottom by cleats, which should allow it, or rather the part above, sufficient play. In a bureau of moderate size, however, such as the present, this extra labour need not be incurred. In the other method alluded to, the pieces, D, may be omitted, and their purpose served by blocks glued inside the plinth, and fastening it to the bottom. Those in front may be glued, but those along the ends should be fastened by the cleats. No object could be served at present by giving other methods, as the latter is as simple as possible, though not quite so good in all respects as the former; it has some advantages to recommend it, and with fair workmanship and sound, dry wood it is reliable enough for ordinary purposes.

BURGLAR ALARUMS:

How to Make, Work, and Maintain.

BY GEORGE EDWINSON BONNEY.

(*Continued from page 180.*)

THE YOKE—THE BOBBINS—THE COILS—THE ARMATURE—THE ARMATURE SPRING—THE CONTACT PILLAR AND SCREW—THE HAMMER—THE GONG AND ITS PILLAR—THE RELAY.

The Yoke.—The yoke of the magnet is the piece of metal to which the cores or legs of the magnet are attached. This should be either made of iron entirely and the legs fixed to it, or the two legs must be connected by a strip of soft iron. A short piece of angle iron of the right dimensions to suit the size of bobbin to be mounted on the legs will make a good yoke, since it will serve as a bracket as well. On reference to Figs. 4 and 5 (page 179), it will be seen that the yoke is attached to the metal frame, and is made to fulfil a double purpose. It forms an angle, one side of which serves the purpose of a yoke, whilst the other forms a lug to which the armature spring is attached. Some magnetic advantages are secured by this arrangement.

The Bobbins.—The bobbins for the cores of electric bell magnets are usually turned out of boxwood or ebonite. They are made as thin as the strength of the material will bear, and special attention is paid to the thinness of the body, the best effects being obtained in an electro-magnet when the insulated coil of wire is as close to the core as it can be brought. This consideration will also determine that the bobbins should fit the cores in every part. Should the workman make a slip and the bobbins go loosely on the cores, the space must be filled with a slip of thin paper wound on the cores and the bobbins fitted on this.

The Coils.—The wire for the coils of an electro-magnet should be of pure soft copper perfectly insulated with a silk coating. The wires generally in use for electric bell magnets are coated with green silk, and thus have an attractive appearance. The silk coating must be without a break in any part, that is, we must not be able to see the copper wire beneath. Should a bare place be seen whilst winding the wire on the bobbin, stop winding, and cover the bare spot with a thread of silk wound around the wire. If this is neglected, and two such bare spots on two different layers come together, the coil will be short circuited, and a portion of the magnetic effect of the current be lost. The bobbins may be wound with wire in a small lathe, but a little experience will be needed before a strange hand can wind the wire on regularly.

If, however, the bobbin, reel, or spool of wire is placed on a piece of iron wire where it is free to run around, and held in one hand at a distance of about a foot from the bobbin to be filled, the wire will go on in coils side by side and almost guide the hand, if this is allowed to follow its course. A fold of white tissue paper between each layer of wire enables the winder to guide the wire with exactitude. The bottom end of the wire placed on each bobbin must first be brought out through a small hole bored in the end of the bobbin, or laid in a small nick made in the edge of the end, and some 8 inches of it coiled around a small rod to form a helix. This will serve as an elastic connection between the two bobbins, or to connect the coils with any other part. The bobbins should be quite filled with wire, and the top ends secured by a string of silk to keep the wire from unwinding, or the ends passed once or twice around the last fold and then drawn tight. The top ends should also be coiled on a rod to form a helix. When this is done, the bobbins may be slipped on tight on the cores, and the two bottom ends of the wires connected together. To do this, lay bare the copper by stripping off half an inch of the silk insulation, clean the bare copper with a bit of emery cloth, and twist the two ends tightly together. These may be soldered to ensure good contact, but this is not always done.

The Armature.—This must be made of a strip of soft iron, as soft and as well annealed as the iron in the cores of the magnet. The size of this strip must be proportioned to the diameter of the magnet coils and their distance apart. It should be long enough to come to the edges of the coils, and wide enough to cover the cores, whilst it should be thick enough to hold the hammer shaft inserted in one end. A good size for a 4-in. bell is 2 in. × $\frac{5}{8}$ in. × $\frac{3}{16}$ in. This piece of iron must be filed up smooth and true. In one end drill a small hole and tap it to take the screwed end of the hammer shaft; at the other end, in the positions shown A, B, in Fig. 16, drill and tap two small holes to receive two small iron set screws. These last are intended to hold the armature spring shown at Fig. 19.

The Armature Spring.—This may be made of spring brass, German silver, or steel. Its length and width are determined by the dimensions of the armature, but it must be long enough to extend from the lug, S, Figs. 2, 3, 4, and 5 (page 180), to the contact or break pillar at P. It should be just stiff enough to bring back the armature to the contact screw sharply after the bell has been struck, but not so stiff as to require a lot of extra battery power to work it. Two holes must be drilled at A, B, to receive screw studs for holding it to the lug, S, and two holes at C, D, to receive screw studs to attach it to the armature. At E, another small hole should be bored to receive the tip of a bit of No. 20 B. W. G. platinum wire to form (when riveted to the spring) the contact speck of the spring. If the armature is intended to be used with the form of relay trigger shown at Fig. 21, two small holes must be drilled and tapped on its upper edge to receive a couple of screw studs to hold the bent strip of brass shown at Fig. 20. In the form of relay trigger shown at Fig. 25, this is not required, since the hammer shaft is made to carry the catch for the trigger of the relay. Neither is it required where the bell is to be used with an indicator relay.

The Contact Pillar and Screw.—This, with its accessories, is shown at Figs. 22, 23, 26, and 27. The pillar should be turned down out of $\frac{1}{2}$-in. brass rod, the top part above the foot should be $\frac{3}{8}$ in., and the lower part $\frac{1}{4}$ in. The lower part, or tang, of the pillar must be screwed to receive the hexagon nut (Fig. 26), or to be screwed into the wood base. Both methods are adopted by makers, but I give the preference to that wherein the pillar is secured to the frame by a nut beneath the base, as this prevents shifting of the pillar. When thus formed, a recess for the nut is cut with a brace bit beneath the base, the connecting wire is carried into this recess through a small hole, and the end secured to the tang of the pillar between the nut (Fig. 26) and the thin brass collar (Fig. 27). As the tang of this pillar will pass through the hole, P, in the metal frame, and the pillar must be insulated from the frame, we must turn a collar to the shape of Fig. 22, out of boxwood or ebonite, and fit this to the tang under the foot of the collar, as shown by the dotted lines at Fig. 23. The upper part of the pillar carries a contact screw to connect the pillar with the armature spring. This screw is made of brass; diameter of screw $\frac{1}{8}$ in., length $\frac{3}{4}$ in., furnished with a milled head. A small hole should be bored in the tip of this screw, into which a platinum wire must be fitted to form contact with the platinum speck on the armature spring. Platinum is used because the electric spark which passes at this point when the bell is ringing has very little effect on this metal, whilst it will corrode or burn away most other metals. A hole must next be bored through the pillar, about $\frac{3}{8}$ in. from the top, and tapped to receive the contact screw. The top of the pillar down to this hole should then be slit with a thin circular saw, a fret saw, or a hack saw. Across this slit, transverse to the contact screw, near the top of the pillar, bore a small hole, and tap it to receive a small steel screw. I will now explain the object of all this. The contact screw must be nicely adjusted to ensure the best ringing action of the armature on the bell. When the exact position of this screw has been obtained by practice, we must secure it there. This may be, and is often, done by using lock nuts on the screw, but as even these shake loose under the intense vibratory action of the armature, it is found best to tighten the screw by clipping it in the slit by means of a transverse screw. By this means, also, the wear of the threads may be taken up.

The Hammer.—The hammer of an electric bell is merely a small disc of brass, or ball of brass, secured to a shank or shaft made of hard iron or brass wire. The disc shape of hammer is shown at Fig. 17, but there are several other forms, including one in the shape of a small brass marble. A small hole is drilled in the hammer head and tapped to receive the screwed end of the shank, then screwed on tight. It is well to secure the head in its right position with a drop of solder in addition to the screw, to prevent the head shaking loose (as it sometimes does), and so getting this part out of its proper position. The shank is secured to the armature in the same way as it is to the hammer head. Wire of No. 11 or 12 B. W. G. may be used for the shaft. The exact length cannot be given, but must be found by measurement to ensure the head striking the bell in the most advantageous manner.

The Gong and its Pillar.—The bell itself is generally distinguished by the name of gong. Electric bell gongs are now a speciality, and are sold for this purpose nicely polished and plated with nickel, at prices ranging from 1s. 6d. to 7s. each, according to size. The pillar to support the bell may be made out of a $2\frac{1}{2}$ to 3 in. length of $\frac{3}{8}$ iron rod, turned at the ends, and screwed as shown at Fig. 18. If made thus, the bottom part may be screwed into the base and metal frame, or secured by a nut beneath the base as the contact pillar is fastened. The top part passes through a hole in the centre of the gong, and is then secured to it by an ornamental brass nut or head (Fig. 24).

The Relay.—This is an important part of a burglar alarum system, since it prevents the intended burglar from stopping the ringing of the bell by cutting the line wire or quickly closing the door. Without a relay the bell might be stopped, but when a relay is in circuit the bell will go on ringing, although all the main line wires are cut, until the local battery is switched off from the bell, and this can only be done close up to the bell itself. Several forms of relays are in use, some attached to the bell base itself and named automatic relays, others on separate bases apart from the bell. Fig. 21 shows a form of trigger employed on a relay attached to the bell base. It is made of brass, exact size and shape of sketch. A hole is drilled at A, and countersunk on both sides. This receives a cord to pull the trigger with when about to set it. Another hole is drilled at B to receive the set screw which attaches the trigger to its pillar, shown full size at Fig. 11. At C a small hole is drilled and countersunk on both sides, to hold the end of the spiral spring which pulls the trigger back when it is released from the catch on the armature. At D another small hole is drilled, and into this is fitted a bit of platinum wire to form contact with another piece of platinum on a contact pillar. I have not sketched this pillar, as it is similar in form to that shown at Fig. 23, only much shorter ($\frac{5}{8}$ in. from top to base), whilst the collars and nuts are also the same. Fig. 25 shows another form of trigger to be used on the base of a bell as a relay. Further details of this will be given in another paper, together with a sketch explaining its action. It is made of brass, shape and size of sketch, and is fitted at the small end with a steel pin, which engages with a catch soldered to the hammer shaft of the bell.

In my next paper I hope to show how to put the various parts together to form a bell, and also explain the action of the automatic relay employed on this class of electric bells.

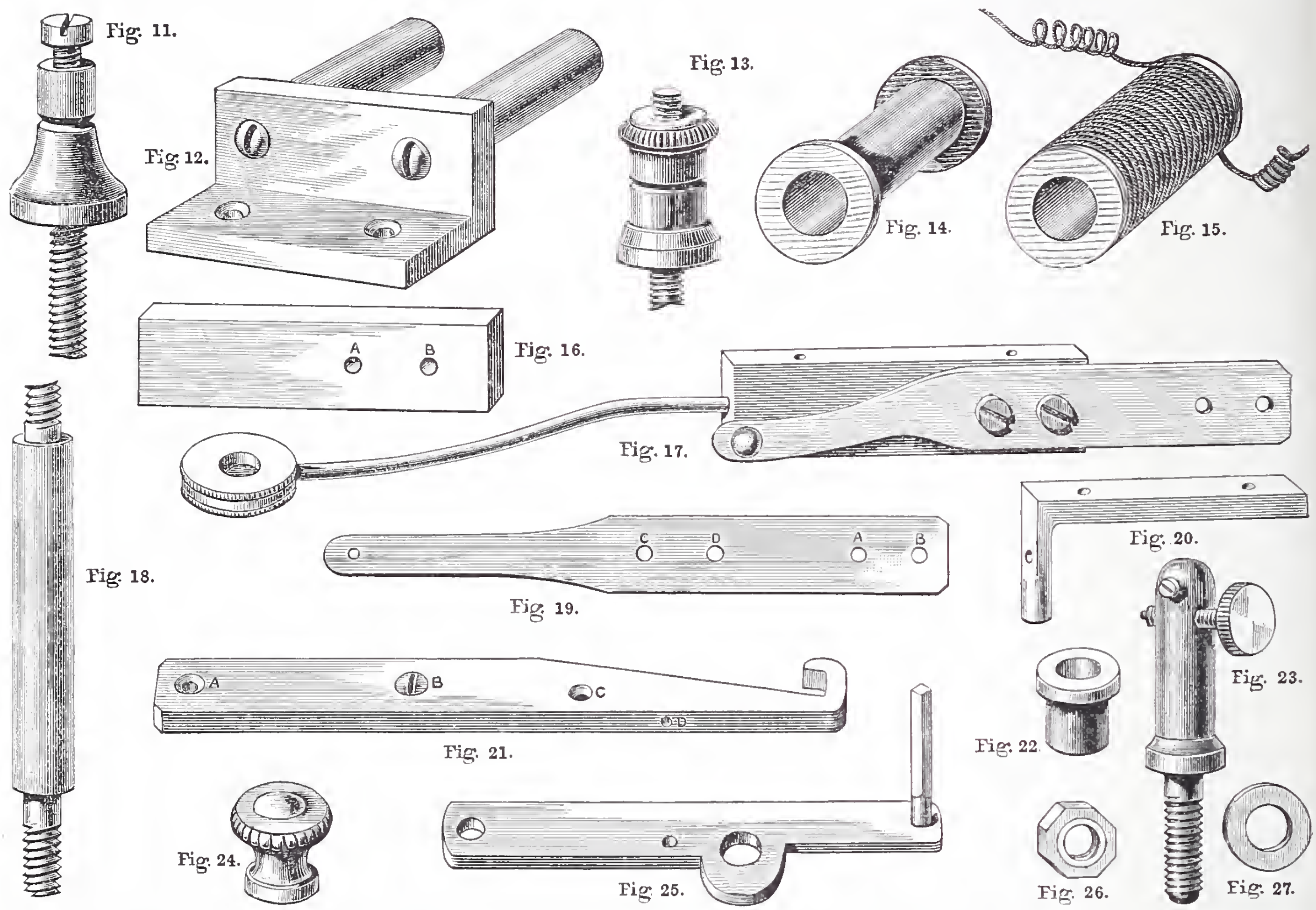


Fig. 11.—Pivot Pillar for Trigger. Fig. 12.—Magnet attached to Yoke. Fig. 13.—Binding Screw: Telegraph Form. Fig. 14.—Wood Bobbin for Electro-Magnet Core. Fig. 15.—Bobbin Wound with Silk-Covered Wire. Fig. 16.—Iron Armature. Fig. 17.—Armature, Spring Hammer, and Shaft Connected. Fig. 18.—Bell Pillar. Fig. 19.—Armature Spring. Fig. 20.—Brass Catch for Trigger of Relay. Fig. 21.—Trigger for Relay. Fig. 22.—Insulating Collar for Pillar. Fig. 23.—Contact or Break Pillar. Fig. 24.—Nut for Top of Bell Pillar. Fig. 25.—Another Form of Relay Trigger. Fig. 26.—Brass Nut. Fig. 27.—Brass Collar.

A FOLDING SCREEN IN EGYPTIAN TRELLIS WORK.

BY C. H. OZANNE.

Though the screen illustrated is scarcely adapted for the usual purpose, that is, to shelter a portion of the room from draughts or observation, it forms a very striking piece of furniture in a drawing-room. To get the full benefit of it, it should be stretched across a large window, so that the light behind it shows up the pattern effectively. If it is desired, a very little trouble will make it useful as a screen. Serge or any other material desired can be lightly tacked on one side, the colour in harmony with the rest of the furniture of the room.

The workmanship is simple and bold. As is seen in the sketch, it consists of three folds hinged together. Each fold is like the others, with the exception of the centre, which has a recess. This recess generally holds a water-bottle of porous clay, which, by the constant evaporation that goes on upon its surface, keeps the water within cool. As in England thirst is not the continual misery that it is in Oriental climes, a vase would naturally replace the water-jar.

The screen measures 5 ft. 4½ in. in height, and each fold 2 ft. 2 in. in width. I do not think it is necessary to give the dimensions of each panel, as they can be taken off the sketch, Fig. 5; and there is no necessity to keep to any special measurements, as the joinery of the screen is very elementary. Each fold consists of a framework 1¾ in. wide, and a little over 1 in. in thickness. The inner edges have a simple moulding run on them. Within these are the panels shown, made of frames mitred at the corners, and moulded slightly by way of ornament. A brace runs across the fold to strengthen it; it is of the same pattern as the frame of the panels. The general body of the screen is filled up with trellis work shown in Fig. 3, that is, the upper half; the lower half is of a rather coarser pattern, like Fig. 1, only that the intervals between the beads are plain cylindrical strips. The detail of the trellis work in the panels is shown in Fig. 6, in

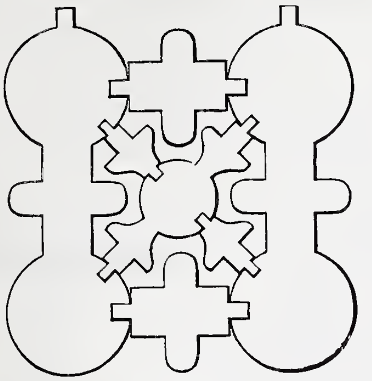


Fig. 1.

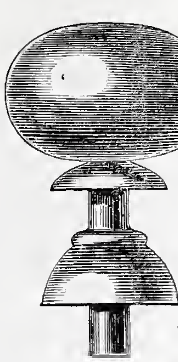


Fig. 2.

Fig. 3.

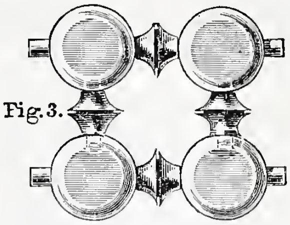


Fig. 4.

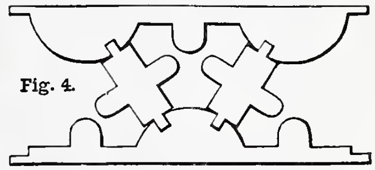


Fig. 1.—Details of Work in Lower Half of Body of Screen (half size). Fig. 2.—Knobs at Angles of Recess. Fig. 3.—Details of Work in Upper Half of Body of Screen (half size). Fig. 4.—Small Panels in Back of Recess.

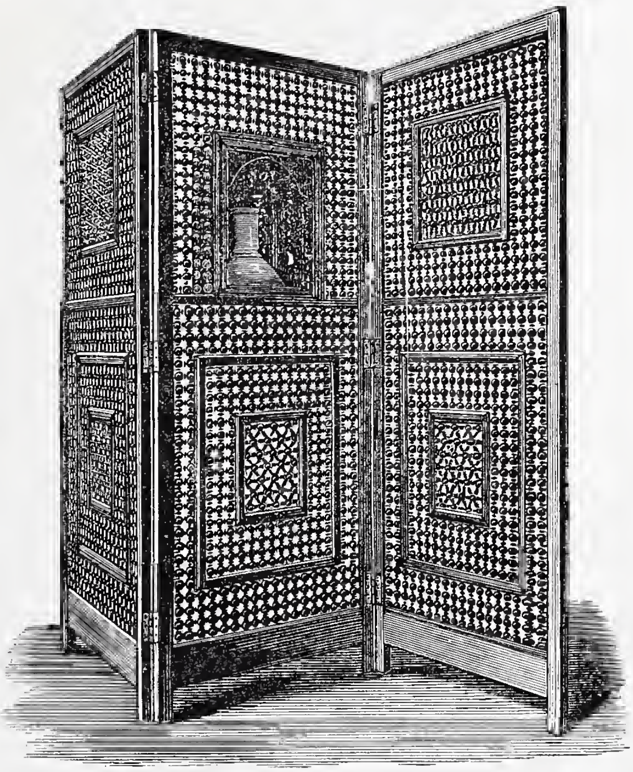


Fig. 5.—Perspective View of Folding Screen in Egyptian Trellis Work.

which is given the mode of joining it together. The solid bars on which the beads are turned can run horizontally or vertically across the pattern — the effect is different — and thus give variety to the completed screen. In putting together the trellis work, care should be taken to make the solid bars run the shortest way across any space, so as to give the greatest rigidity to the whole. The trellis is turned out of wood about ½ in. thick, so that the beads have flattened tops as shown in the sketch. It would be far too heavy if the beads were complete globes of the size given.

The panels are held in position simply by the solid bars of the trellis work inserted in the edges of the frames, and running to the framework of the screen in which the other end is inserted.

Before turning a bar into a strip of beads and intervals it should be marked off accurately, so that there may be the required number of beads and intervals. It is not necessary for the ends to be complete beads. Naturally all the bars must be alike.

The folds would each, of course, have to be built up from the centre, beginning with the panels, and finally framing all up in the outside framework, which is mortised together.

The small recess is formed of two pieces as in Fig. 7, which act as top and bottom. On this are fastened strips to form the sides. The length of these sides depends upon the size of the opening which forms the mouth of the recess. Each side is cut out, and panels are let in. In Fig. 1 is shown some of the trellis,

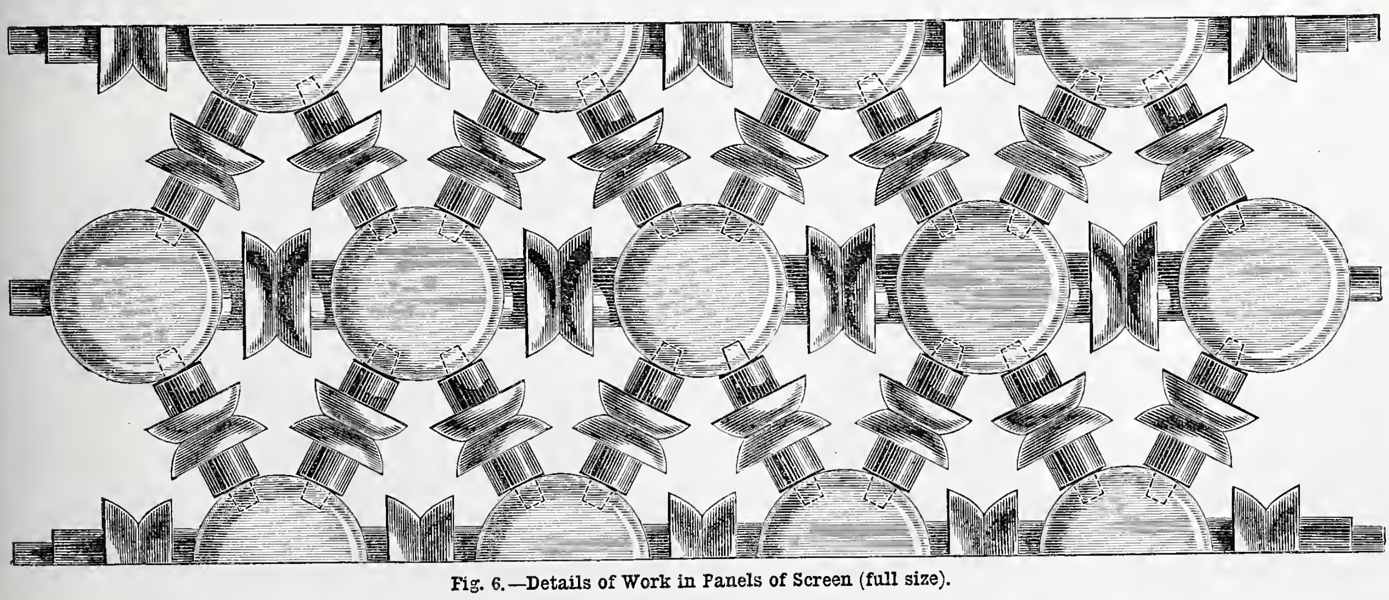


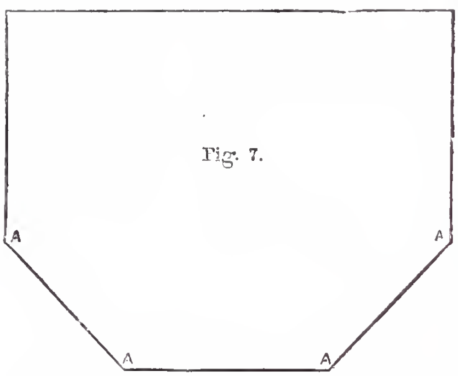
Fig. 6.—Details of Work in Panels of Screen (full size).

which fills in the centre part of the side; above and below are little panels filled in with Fig. 4. The rough sketch in Fig. 8 will explain.

This little cupboard is hung on at the back of the opening by hooks, as it must come off when the screen is folded. In front, the top is ornamented with a piece of wood cut into a dome shape, and on each side is a little turned pillar, and a third at the bottom. The top of the cupboard, as well as the bottom, is finished off by little knobs (Fig. 2) inserted at each angle.

The pattern of trellis work described is of the simplest. It can, of course, be made more ornamental, and more intricate, but in so large a piece of furniture any delicate work would be out of place, and, in the constant moving that it is necessarily subjected to, it would get chipped and shabby.

As for material, stained beech is generally used for the bead work and pine for the



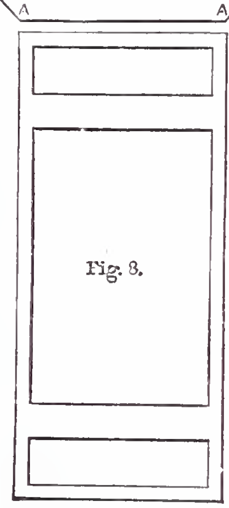


Fig. 7.—Plan of Top and Bottom of Recess in Central Fold (one-fourth size).

Fig. 8.—Elevation showing Panels at the Back of Recess (one-fourth size).

frames. Walnut would, of course, be more expensive, but would make a handsomer article.

It will be found necessary to dust the screen frequently, and, as the domestic duster will not reach the interstices of the trellis work, a tooth brush will be found convenient. If walnut is used, it can be polished with a paste of beeswax and turpentine, and can be kept bright with a stiff brush and the addition of a little of the paste occasionally.

This screen is much admired, and fills up the room conveniently, for it can be fitted into any unoccupied part, and when necessary folded up out of the way. It hides any great expanse of bare wall, without appearing to do so, for you can see through it; but, as a matter of fact, the eye is arrested by the pattern, and does not travel beyond the screen. It is not so high as to hide pictures hung at the ordinary height.

HINTS ON HOLLOW WORK IN SHEET METAL.

BY OPIFEX.

The making of cups and other vessels, and the forming of hollow work of any kind, is a most useful and interesting branch of sheet metal working; the silversmith and the plumber are equally interested in it, and the irrepressible amateur, who is anxious and ready to attempt anything and everything, should know how it is done.

Suppose it is required to form a cup- or saucer-shaped article, *e.g.*, such a thing as the copper cup in an ordinary pair of scales, or the hemispheres which, joined together, form the ball of a cistern cock, there are three methods to choose from. 1st, the article may be stamped "at one fell swoop" by machinery, involving considerable power, and, therefore, much expense; 2nd, it may be "spun" in a lathe; and 3rd, you may do what you want with a hammer.

I take it for granted that the reader will elect the third and simplest method, which is also the most artistic.

The tools and appliances required are a hammer, a vice, and a round surfaced anvil, with shank; the hammer should be rather heavy, but at the same time small on the face, so that it will be capable of inflicting a "dead blow" of considerable force, which shall not, however, affect too much of the surface of the metal; a piece of round or octagonal $\frac{3}{4}$-in. steel about $2\frac{1}{2}$ in. long, made into a hammer by having the centre slightly flattened and bored for a light, strong handle, will be found to suit this work admirably (Fig. 1); or in the absence of a special tool, an upholsterer's hammer will be effective.

The round anvil belongs to a class of tool sometimes called "stakes," which are of various shapes and sizes according to the work for which they are intended.

Fig. 2 shows a mushroom-shaped tool, with nicks or grooves in the shank, by which the height of the tool may be regulated in the vice.

There are various other tools of the same character used by sheet metal workers, but this one will be sufficient for our present purpose, which is to show how a hemisphere of copper or brass may be formed by means of the hammer.

But, first, it may be well to add a word which may encourage some reader who may not be able to procure this "mushroom" stake by pointing out that it is not absolutely necessary, and at the risk of being the innocent cause of "raising a row" in some peaceful household, I would whisper in the ears of such a one, that a poker which possesses a fairly round, smooth, polished knob makes a capital substitute.

First cut out a disc of sheet copper, say five inches in diameter, and with the compass describe several concentric circles, marking the metal very slightly, as these circles are merely meant as guides in the process of hammering; now holding the disc in the left hand, and laying the centre of it upon the centre of the "stake," proceed to hammer it firmly and evenly in a circle round the centre, gradually working in larger circles in such a manner that every part of the metal is subjected to the action of the hammer.

The worker must bear in mind that he is not to endeavour to make the metal take the shape of the rounded tool which underlies his work, but that it only serves to resist the hammer blow at the point immediately beneath, or opposite to where the blow falls, the effect of which is to strike another blow, as it were, upon the other side, and thus cause the metal to stretch, or expand, at that point.

Thus working gradually outwards from the centre the metal will be found to assume a convex form upon the hammered surface, and the hammering being continued in the

Fig. 1.—Anvil.

same way to the circumference, the result should be that the metal disc is transformed into a saucer shape nearly an inch deep at the centre; and if the direction, that the hammering be carried out in perfect circles from the centre, has been attended to, and if the force of the hammer blows has been fairly equal throughout, the work will be uniform in curve.

During the process of hammering the metal will have become hard, and, in order to restore its ductility, it should now be annealed. This is done in the case of brass or copper by heating the metal to a dull red over a clear fire, or with a blowpipe, etc., and then plunging in cold water.

The operation of hammering in circles from the centre is now repeated several times until the metal assumes the required shape; but the reader must not be disappointed if absolute success does not attend his first attempt. With a little practice, however, the work will be found comparatively easy, and most effectual in the forming of innumerable articles both useful and ornamental.

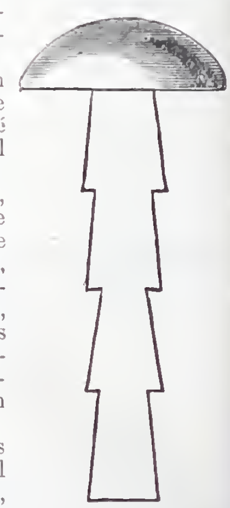


Fig. 2. — Mushroom Stake.

Surfaces raised in this way may be worked in repoussé and chased, the metal being first annealed.

Sheet brass, copper, etc., of considerable thickness may be worked by this method, and by employing anvils of different shapes, coupled with judicious hammering, it is surprising what the practised workman can produce.

The bowls and bases of goblets, ornamental cups, teapots, kettles, lamps, candlesticks, etc., etc., etc., are wrought in this way in the first instance, being afterwards chased and otherwise ornamented.

I have pointed out that there are other means of forming hollow work in sheet metal—namely, stamping and metal spinning in the lathe. I am in no way alluding to the manufacture of hollow balls in one piece, which are formed by the action of machinery, to be described at no distant time by another writer.

OUR GUIDE TO GOOD THINGS.

65.—Macnaughton's New Spring Ferret Muzzle.

The readers of Work, I am pleased to know, are to be found in all classes and grades of society, and the workmen who take "ours" may be somewhat surprised to learn that a great many country gentlemen, who naturally take considerable interest in field sports and outdoor amusements, are to be found among them. Even if direct and personal evidence in support of this were wanting, which it is not, there is yet indirect testimony to the fact in much that appears in the pages of the Magazine itself. Some little time ago, for example, our friend Opifex, who clearly indulges at times in a little congenial rabbiting, and perhaps ratting, mentioned in his "Tips for Tyros" (see page 90) a muzzle for ferrets which he had found to be very useful in the field. This catches the eye of Fal, another valued contributor and reader, who gives us his ideas and experience on the subject in page 189. And this metaphorically brings Mr. Macnaughton, gunmaker, Edinburgh, to his feet, and he sends me specimens of his New Spring Ferret Muzzle (Registered, No. 24326), which is made in four sizes, numbered 1, 2, 3, and 4, sold at a uniform price of 1s. each. Thus it is plainly shown how action and reaction, with regard to any particular subject, takes place; and how the thoughts and words of one elicit the views and opinions of another, confirming a remarkable assertion in Holy Writ: "Iron sharpeneth iron; so a man sharpeneth the countenance of his friend." Even in this way may we long continue to sharpen the countenances of one another by that which is set forth in the pages of Work.

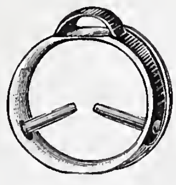


Fig. 1.—Form of Ferret Muzzle.

Fig. 2.—Muzzle Placed on Ferret.

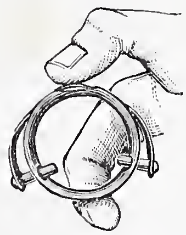


Fig. 3.—Muzzle with Spikes Withdrawn.

The value of the ferret muzzles to which reference is made may be ascertained from the illustrations afforded of it in Figs. 1, 2, 3, in the first of which the muzzle itself is shown. This consists of a brass ring, concave in form on the outer side, and carrying in its concavity a spring bowed at the top, and carrying at each end a short iron spike, which enters through the brass in holes specially contrived to take them. In Fig. 3 is shown the method of pressing the spring and withdrawing the spikes when it is desired to pass the ring over the muzzle of a ferret; and in Fig 3, the muzzle when placed over the ferret's mouth. "To fix the muzzle," says the inventor, "hold the ferret round the shoulders with the left hand, compress the arch of the spring with the thumb of the right, slip the muzzle on wide side first, to suit the taper of the ferret's jaw; the muzzle should fit just over the tusks; when there, ease the spring and the pins will slide in behind the tusks. The spring muzzle cannot fall off if the suitable size be used, and the ferret's tusks are all right. A ferret unaccustomed to a metal muzzle, should have this put on once or twice for a short time before being hunted. A ferret, when systematically muzzled, will hunt a whole day; as without a muzzle, he spends his strength in worrying at sulky rabbits; with a muzzle he soon learns to bolt those rabbits that will bolt, and to leave the sulky ones, as he cannot lay hold."

66.—The Lingham Sash Fastener.

This excellent sash fastener is manufactured and supplied by its inventors, Messrs. Lingham Brothers, locksmiths, makers of fireproof safes, brass-founders, etc., 22, Great Hampton Street, Birmingham, its price being 12s. 9d. per dozen, net. It serves two purposes, for it not only affords a simple mechanical arrangement of easy action for fastening window sashes with perfect security, but it also prevents any unpleasant rattling of the sashes, which often occurs in stormy weather. On the outer sash is screwed the socket piece, shown in the upper part of Fig. 4, lettered A; and on the inner sash is attached the catch piece of the fastener, marked B. From the upper side of A rises a square socket, in which is inserted the square end of the barrel, also marked A in the illustration. The connection between barrel and socket is made by an iron pin, which passes through socket and end piece from side to side, and is securely riveted. This pin is not shown, as it should have been in the engraving. In the barrel is a helical spring of considerable strength, which acts on a disc formed on the inner end of a small spindle, square in form, which projects from the end of the barrel, and carries a winged finger-piece which abuts on a knob forming a termination to the spindle. From the plate on the inner sash rises a double catch, B, and when it is desired to secure the fastener, the object is attained by pressing the finger-piece down over the inclined surfaces of the catch. This causes the spring in the barrel to be compressed, and the square portion of the finger-piece slips under the notched portion of the catch, where it is securely held by the pressure of the helical spring against the disc of the finger-piece. The release of the fastener is accomplished in a moment, whenever necessary, by placing two fingers against the curved ends of the finger-piece and drawing it towards the operator, so as to compress the helical spring to a greater extent, the compression affecting the release. Below the square end-piece of the barrel is a movable plate, which is pressed upwards by a spring fastened to the inner surface of the socket-piece, A. This spring is necessarily hidden, and is not shown in Fig. 4, by reason of its position. This plate serves to retain the movable part of the fastener in a vertical position when thrown back. The Lingham Sash Fastener is well made in brass, with the exception of the pin, spindle, plate, and spring. It has a much better appearance than the ordinary sash fastener when placed in position on the sash, and as I have been enabled to test it practically by placing a specimen on one of my own windows, I can bear testimony to its utility and manifest superiority to the old-fashioned regulation spring catch which has held its own for many years.

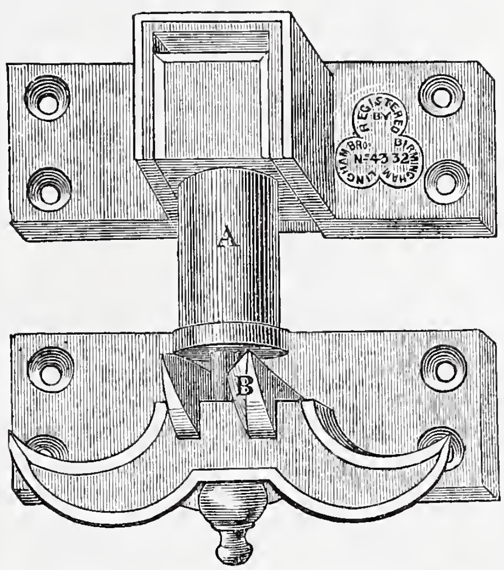


Fig. 4.—The Lingham Sash Fastener.

67.—Broadway's Patent "Eccentric" Casement or Fanlight Stay.

These casement or fanlight stays are also manufactured by Messrs. Lingham Brothers, Birmingham, and are supplied in two patterns, namely, that which is shown in Fig. 4; and another, in which at the end of the stay, a stud or button is substituted for the turned end which appears in the illustration. All the stays are 12 in. in length, without reckoning the knob at the end. Those with the knob are sold in brass, polished, at 27s. per dozen, net; and in brass, sanded, at 25s. 6d. per dozen. Those with the button are of iron bronzed, with brass fittings, and are sold at 13s. 6d. per dozen, or 9s., according to quality. All prices quoted are net. They can be made in any length. The stay itself is similar in form and arrangement to ordinary casement stays, with this difference, that the patent stay is solid throughout, while the ordinary stay is pierced with holes, to be passed over a peg rising from the plate, over which the stay is caused to move. Thus, it can only be secured at certain points in its length; but the "Eccentric" Stay can be secured at any point throughout its length, as it runs in a socket rising from the plate which carries the locking arrangement, and by which it can be fastened at any point at which it may be desired

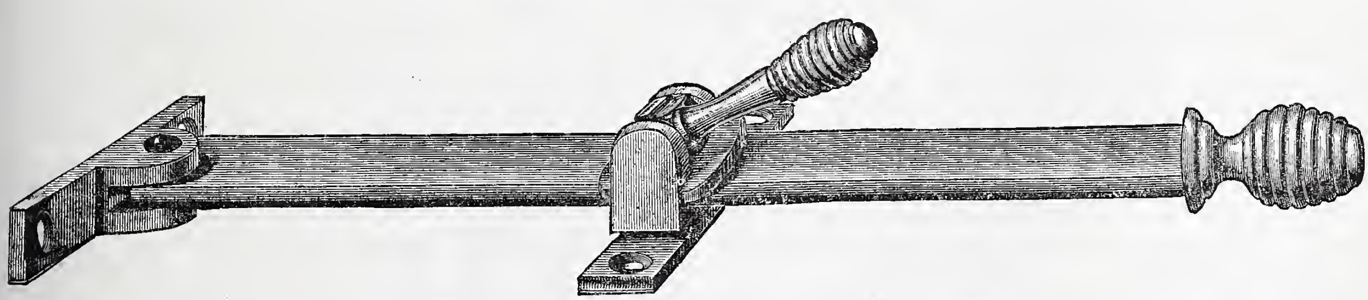


Fig. 5.—Broadway's Patent "Eccentric" Casement or Fanlight Stay.

to do so. The principle of the locking arrangement, shown in the centre of Fig. 5, is simply that of an eccentric or cam, actuated by the short handle that proceeds from it. Thus, supposing the stay to be fastened, it is only necessary to raise the handle, which liberates the plate resting on the stay, and sets free the stay itself. Again, to fasten the stay it is only necessary to press down the handle as shown in the illustration. This immediately locks the stay, making it quite secure. At the same time the eccentric acts as a fastener when the casement is closed, making it impossible to open it from the outside. Moreover, being perfectly tight all rattling of the casement is prevented, which occurs, more or less, with all stays in which pegs, screws, or springs form part of the construction. The advantages to be derived from the use of the Broadway's Patent "Eccentric" Stay are perfect security, extreme simplicity of action, and rapidity of adjustment. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Circular Saw Rigs.—G. E. writes:—"In No. 11 (see page 172) I regret to see FOREMAN PATTERN MAKER'S failure to understand me, but will try to be more explicit. Respecting Fig. 1, very few amateurs are capable of making it as drawn, because it requires to be centred and boxed up in a collar plate, tapped between centres, faced, and the recess turned out to clear thread—therefore, superfluous work with small results. I must always take exception to cutting a thread in a saw spindle, because (according to the law of mechanics applied) the action (if possible) should always be between centres, and certainly possesses the advantage of being the simplest form. Again, if the spindle be made from cast brass to pattern, it will be too soft to be of much practical use. Bessemer steel is best. The fitting of chucks to a lathe is different in every respect (without exception); to cut and fit a chuck is one thing, but to screw a 6-inch brass spindle is another; and if you expect the same results, I am afraid you will be very disappointed. Wood turners mostly use wood, where possible, in all appliances for their lathe; but I must say (after thirty years' experience) I never knew of a piece of wood (hard or soft) that kept true for several years. Then what about the saw? The mandrel nose terminates at the face of collar fitting. Yes; then the amount of steadiness given to chuck depends on whether the face is true and ground flat, and how the mandrel fits in the collar. The table in T-rest socket is preferable because simple, easily fitted with angle metal fence, and fixed with bolt, nut, and slot; therefore adapted equally to amateur and professional. I must object to complicated appliances for amateurs, as productive of unfavourable impressions, rather than an incentive to work."

Small Cabinet Fittings.—C. C. (*Chippenham*) writes:—"On going for my magazines last month I chanced to see Part 1 of WORK, which I purchased, and was fairly astonished at the contents; it is, indeed, a splendid work, just what was wanted. That overmantel, by David Adamson, is a capital thing for amateurs, and those who couldn't see how to do it after reading the description should never touch a tool again, as they would never make much use of it. Could you inform me, through the medium of 'Shop,' the cheapest place to get small cabinet fittings? They must be produced very cheap somewhere. I have a list of Mr. Zilles, but if the makers of the small articles you see in fancy shops gave the price for their fittings that he charges, that alone would be more money than the article is sold at. As I think the greater part of amateurs are wood workers, I think a fair proportion of the contents should be devoted to that trade."—[For small cabinet fittings you may apply to Harger Bros., Settle, Yorkshire; Skinner & Co., East Dereham, Norfolk; G. Busschots, Park Lane, Liverpool; Fritz Collins, Bath; and others, who deal in these articles. R. Melhuish and Sons, Fetter Lane, London, E.C., have some, without doubt, although the fittings principally kept there are for full size furniture. The hinges and connecting hooks, etc., used by "the makers of the small articles you see in fancy shops," are the cheapest possible, and of necessity must be. They are sold in large quantities—at per gross, very likely. They would not suit you, and I strongly recommend you to use such fittings as are supplied by Mr. Zilles, for your own work, which I have no doubt as much surpasses the cheap wares of the shops as the fittings sold by Mr. Zilles excels the fittings that are put on them. There is a passion for cheapness in the air at the present day, I know, but there is something too often bracketed with cheapness which always hangs about very cheap goods, and of which they can never be purged.—ED.]

About WORK.—PRO BONO PUBLICO writes:—"Allow me a short space in what I am pleased to call 'ours,' to add my testimony to what I consider the value of such a well got-up paper for such a nominal sum, although the high compliments paid to you and your organised staff by previous correspondents leaves but little to be said by me. My opinion is this, were I to write a volume in praise of WORK it would not express my satisfaction with which I read each number. (1) Pray keep from technical terms, or, if used, use them sparingly and with an elucidation, as this is, in my opinion (and I speak from practical experience), a shoal whereon amateurs get metaphorically shipwrecked. (2) I would also, wherever practicable, like to see working drawings, when reduced, given as $\frac{1}{4}$ in. to the foot, leaving other fractional scales till an amateur has gained some experience with the rule, bevel square, etc. (3) I would, as an amateur worker having a number of hours each day at my disposal, and sitting amongst a multitude of different articles of my own make, like to give a little of my own experiences to others, whereby home may be made attractive and the pot-house kept in the distance (I am not teetotal), and if acceptable, a few designs of artistic articles, and also as many difficulties surmounted as you advise this week. Buy tools wherever you see them cheap. This course I have adopted for some years, and I am convinced the pawnbrokers' shops have a good stock, where, if an amateur is short of cash at the time, an article can be secured for a deposit, and got at some more convenient time. (4) Surely each amateur has amongst his acquaintances a friendly joiner or one meeting his requirements according to his hobby, and to him I would go for a few practical lessons, getting to know, above all, something of the fundamental principles of geometry, a few problems only being worth a gold-mine to an amateur."—[(1) WORK is for professionals as well as amateurs, and technical terms cannot be excluded. But why object to technical terms at all? After all they are the right terms, and terms that are recognised by the trades. Any term you do not understand can be explained to you in "Shop," if you will ask the question. (2) No object can be gained by bringing all working drawings to a scale of $\frac{1}{4}$ in. to a foot. There is nothing, or ought to be nothing, puzzling in the proportions for working drawings, but if you cannot understand them a paper shall be given in explanation. (3) You are always at liberty to communicate the results of your experience with designs, working drawings, etc., and papers on any subjects on approval. (4) By all means go to the "friendly joiner" for practical lessons in carpentry, but the "fundamental principles of geometry" will be best gathered from a text book, such as the "Lessons in Geometry" in the "Popular Educator."—ED.]

Overmantel with Cupboards.—KILDONAN writes:—"Having procured the glass and some narrow moulding, I found myself face to face with a difficulty—namely, how was I to secure the three glasses at the bottom, so that when the overmantel was lifted they would not slip out between the back and the moulding, and come to grief? This required a smoke. I offer my plan for what it is worth to any novice in a similar quandary. Ferreting out some pieces of sheet brass and an old file, I proceeded to shape six strips, each $1\frac{1}{4}$ in. by $\frac{1}{2}$ in., and then to bend them at right angles $\frac{1}{2}$ in. from the end, as in Fig. 1. The dimensions are probably

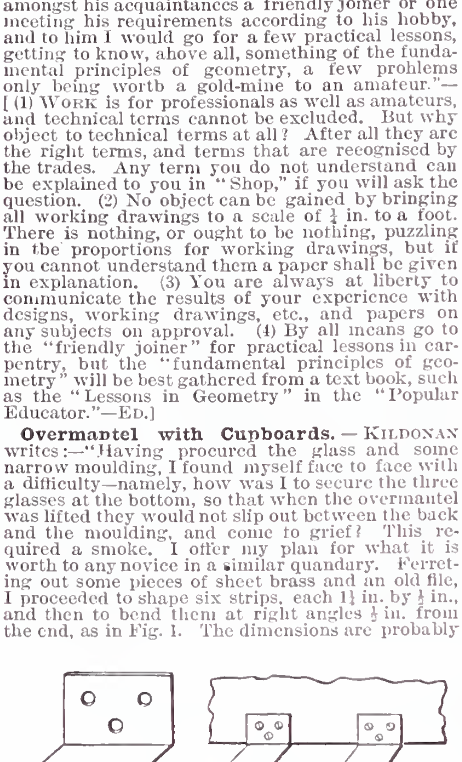


Fig. 1.—Glass Support. Fig 2.—Method of Securing Glass Supports to Back.

a little larger. As they are not seen I was not particular about their appearance. Using two of these brackets to each sheet of glass, I screwed them to the inside of the bottom of the back, as in Fig. 2, with the sole projecting under the edge of the bottom moulding, in which I cut shallow grooves, so that the whole would be flush throughout its entire length, and thus allow the article to stand straight, and not on tiptoe. I borrowed a brace and countersinker to make the holes. I may say that I have as yet completely failed to gild the panels according to OPIFEX'S directions, and have consequently handed the panels over to a painter friend."

Weight of Fly-Wheel.—MR. F. CAMPIN writes:—"The formula from Molesworth for above $W = \frac{\cdot 6366\ F\ S\ C}{D}\left(\frac{N}{60}\right)$ is wrong (you quote it page 189). The weight varies *inversely*, as N, as shown in the remark—'A slow-running engine will require a greater reserve of energy than a fast-running one.' The fallacy of the above formula has previously been exposed in the *English Mechanic* and elsewhere. The theory of the fly-wheel is perfectly clear, and leads to the expression—

$W = \frac{10648\ E}{V\ d^2\ N^2}$—where W = weight of fly-wheel in cwts.

d = mean diameter of rim in feet.
N = number of revolutions per minute.
V = total variation in per cent. of mean speed.

As my name is on my article, I am sorry this error occurs over initials the same as mine—F. C.—as it might naturally be attributed to me."—[The initials F. C. were appended in error. The reply in question should have been signed J.—ED.]

Metal Ball Making.—B. W. R. (*Walkley*) writes:—"The balls mentioned by your correspondent, on page 172 of WORK, are not made as you suggest, by soldering two halves together, but in this wise: A piece of metal is cut round and put under a press called a 'fly,' and in the bottom is a hollow cup; in the fly nose is a punch. The metal is put over the cup or hollow, and forced down by the top punch, not all at once, as a set of dies or cup are used to bring it down gradually so as not to crack the metal. When got to semi-spherical shape, they are put in a furnace until red hot, or, as it is called, 'annealed.' When cold they are put into the cups, round parts uppermost, and instead of round punches cup punches are used, with small hole in centre to allow of air escaping, so as not to burst them, granitoid punches being used in doing them; they must be annealed two or three times, or cracked balls are usual. I make mine by using a machine with graduated grooves in its top and bottom table, allowing them to work in quite opposite directions by cross bands working from pulley on main shaft, the balls being half cupped first in the hand fly. Plenty of oil must be used in the machine so as to keep balls cool, or they would clog. If you would like one ball I will forward you a specimen, or you can see them in any silver plate show rooms as feet for frames, etc. They are made plain, fluted, and with a ridge round them, so that a bead can be turned on them, and in all sizes, from $\frac{1}{16}$ of an inch to 3 in. diameter."

A Rejoinder about WORK.—PHAETON (*Ipswich*) writes:—"In respect to the strictures so thoughtlessly (I had almost said ignorantly) expressed by J. P. A. on the various and most useful articles treated so ably in your, or, rather, our, valuable and most interesting weekly magazine, WORK, I am surprised to find a man so thoroughly practical as he represents himself to be calling a space devoted to so important a subject as 'Hinges, and how to Fix Them,' 'wasted.' Is it possible that any man practical at anything can be so shortsighted as to call those valuable hints and suggestions on that subject 'wasted'? Truly, I can scarcely credit it. I, sir, am engaged in carriage building, and have had considerable and long practised experience in the different forms and methods of fixing hinges; and yet I feel bound to offer my most grateful thanks to Mr. David Adamson for valuable information I have imbibed from his able pen; and I would ask, does J. P. A. really understand the full meaning of the word 'trifles'? I cannot think he does, or he would not so distort the real name that belongs to any act that has for its object the benefit, improvement, or pleasure of his fellow-men; and judging him by the 'spirit' of his remarks, am inclined to consider him one of those individuals whom we are told 'rush in where angels fear to tread.' Although a coachmaker, and in respect to which trade I have not yet seen any reference (excepting Mr. Adamson's too brief notices in his article on hinges), I am bound to say that I not only feel some impatience for the appearance of WORK from week to week, but I read and thoroughly enjoy every article treated therein, and then take a good look through the advertisements, as a likely means of 'dropping' upon something, either necessary or desirable of possession. If J. P. A. possesses a sawing machine of such unrivalled merits, surely he could tell us about it without this tirade of objections; and his wonderful saw must lack lustre indeed, if to make it shine visible at all necessitates the total extinguishing of every other object of note or importance. It is just possible, sir, that if you could arrange the sale of a few of J. P. A.'s Elizabethan twists for him, it might tend to remove somewhat of the jaundice with which he seems to view the wants and necessities of his more grateful and appreciative fellows; and in respect of the prophesied exodus of practical men as subscribers, I cannot help thinking that it is only such as J. P. A. who would be 'missed,' but not 'wanted.' Personally I am delighted with WORK, of which I take and dispose of a dozen or so every week; and I offer my humble, but warm, thanks to all concerned; and if I can at any time be useful in 'Shop' to any brother in want, kindly do me the favour to apply to me."

Screen Secretary.—C. H. O. (*Alderney*) writes:—"You remark upon the resemblance between Mr. Adamson's screen secretary and Mr. Gleeson-White's cheval screen escritoire. I was also struck by it, as not a fortnight ago I had just finished a secretary similar to Mr. Gleeson-White's. Yesterday I met a friend, and he told me he had also just designed something similar, when No. 13 of WORK was issued. In all these cases the idea seems to have occurred simultaneously to different people. My secretary is of a portable character, and not of the ornamental style of Mr. Gleeson-White's handsome design. That gentleman says he is doubtful whether the projections in Fig. 3 would not be needful. I took off mine, which are almost exactly the same as his, and are fastened on by a keyhole and screw arrangement, and I found that the secretary rocked very much. My base is 1 foot deep without the projections. I have the projections only under the writing flap, and about 3 in. on the other side. This is sufficient. The height of mine is 4 ft. 5 in., and it is 2 ft. 6 in. across."

Boot and Shoe Making.—BOOTS AND SHOES (*Farnworth*) writes:—"I would be pleased to know if you intend to give papers in WORK on boot and shoe making and repairing, with all particulars as to the tools required, etc., with drawings, as I am sure many fathers with large families would gladly welcome such a subject. In the meantime will you please give me the names of the tools required for finishing a pair of old boots, after being resoled, so as to make them look well? I have a little knowledge how to repair, but that's all. I may state I am very well pleased with WORK, as it is just the thing I've wanted a long time, and I hope you will have great success with it."—[At present I cannot promise the papers you ask for, because there is so much in hand which must be dealt with first. I have given publicity to your question about repairing by inserting your letter, and possibly some reader of WORK will reply to it.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Particulars for Intending Frame Makers.—W. L. (*Wigan*).—(1) Best shops for tools that I know of, and are generally acknowledged for good tools, are—Buck's, Whitechapel; Tyzack's, next Shoreditch Station, L. and N. W. Railway. (2) We do not in trade use any cramp; we use cutting blocks, stinting block and plane, and vice and hammer. (3) No books that I have heard of give any practical hints or information of any value to trade. (4) There was a trade paper recently started. I do not know if it is now in vogue, but it gave no simple information, as it was a trade paper, and naturally assumed its position amongst practical men who had served their apprenticeship.—G. R.

Spiral Springs.—VULCAN (*Wakefield*).—Here is one method. Mix of sperm oil, 1 gill.; melted suet, 1 lb.; neatsfoot oil, 1 gill; resin, ¼ lb., and smear the spring all over. Place the spring—if a long one —on a mandrel and hold it inside a red-hot pipe until the composition burns uniformly all over and with a blaze, when it must be quenched in oil. An even blue temper is required. If any part blazes before another, it must be cooled with grease and blazed afresh. Thick springs require repeated applications and blazing. A few trials will give the necessary confidence.—OLLA PODRIDA.

Annealing Cast Steel.—B. P.—Heat the steel to a low red heat and bury in quicklime until cool. Another method is to pack the steel in an iron box filled with lime or whiting and covered tightly with clay; then heat the whole to a red heat and allow it and the fire to die out until cool. By either method the steel should be soft enough for any purpose.—OLLA PODRIDA.

Small Fan.—DA CAPO (*Grosvenor Park*).—One about 3 in. in diameter would suit you, running at about 1,000 revolutions per minute. Any handy tinman could make you one. The body of fan should consist of a disc of tin with four blades or vanes soldered on each side, the whole soldered to a brass spindle and cased in a tin box, the bearings for spindle soldered to sides of case. Spindle to carry a small grooved pulley at one end for gut or leather band. If you require a sketch, please say so, and I will try and furnish you. It will save talk, and I am rather overweighted with work at present.—OLLA PODRIDA.

Circular Saws.—A READER.—I gave the power with working margin for hard wood and heavy work. This would be the practical way to meet light work of any description under. I regret that I have no data by me with which I can meet the theoretical expenditure of power, and I doubt very much if such can be obtained in reliable form dealing with different gauges.—OLLA PODRIDA.

Injector for Small Engine.—P. A. (*Girvan*).—To make a small injector of the size you want is not so difficult as the getting of it to work satisfactorily is. The writer regrets that pressure has prevented him replying earlier, and also getting a design prepared to meet your case, but hopes to forward a sketch in a few days.—OLLA PODRIDA.

Fret Saw for Small Lathe.—E. A. P. (*Co. Carlow*).—Your idea for fret saw is all right, except that the motion slot should be in *lower* arm, so that the saw blade may be held in tension both ways. As made by you, the saws have no chance but to break directly a cut is made. Raise the table and shift the driving point, and the saws will stand with fair play.—OLLA PODRIDA.

Valve Gear.—E. C. M. (*Ipswich*).—Your drawings duly to hand, but I have not seen the copy of *English Mechanic* referred to, and this is necessary for complete reference. The design is very ingenious; but there are several gears in the field already so closely resembling yours. In the face of this, therefore, I would not advise you to risk money upon it. When I see the *English Mechanic* I may be able to give you further opinion.—OLLA PODRIDA.

Lettering Watch Dials. — W. F. B. (*New Wandsworth*).—I am sorry to say I know nothing of the subject, and cannot refer you to any one, unless the editor of the *Horological Journal*, Northampton Square, Clerkenwell; he could, perhaps, through his paper. I will send the query to him if you like; but that is a monthly, and published on the first, so I should have to wait a month. —A. B. C.

Lithographic. — P. BROUGH (*Glasgow*). — The paper for lithographic writing is a good printing paper—not too stout—brushed over with a preparation which may vary with the fancy or requirement of the operator; ordinary flour paste, or even starch, tinted with dark chrome, may be mentioned as simple formulæ; and there are more complicated recipes, numbering isinglass and plaster of Paris among their ingredients. The coated paper is then finished by rolling between metal plates or by being pulled through the litho press over a clean and dry stone to obtain a smooth surface. I would scarcely advise you, however, to take all this trouble. The paper may be obtained ready prepared of any lithographic sundriesman. Cornelissen, 22, Great Queen Street, London, W.C., or Winstone, Shoe Lane, London, E.C., would doubtless supply you. The price is about from 3s. per quire demy. Writing on stone for printing purposes is, of course, done backwards; an exceedingly minute sable brush is the tool employed, and a large amount of practice is necessary before the tyro can command this tool sufficiently to produce legible work; but application and perseverance in this process, as in all others, will work wonders.—J. H. M.

Advertisement Pages in WORK.—R. T. (*Bolton*).—You should write to the publishers, and not to the editor, of a magazine with respect to wrappers for weekly numbers, the numbering of advertisement pages, etc. The editor's business does not include any of these matters. It is no use writing to the captain of a ship about the manner in which she is fitted up and the provisions that are put on board for the crew and passengers; but if you have any cause of complaint, you must write to the owners. Nor is it a step in the right direction to take the driver of a coach to task if you do not exactly approve of the team he drives. Men think differently about different things, and an article which one does not like may be highly approved of by another. I can assure you that advertisements are not put in for the sake of filling up the paper; their mission is a far higher one than this. It is true that this is an advertising age, or, as you aptly put it, "the public can get such information by the ton." True, the public could, if it bought serial publications by the ton. It does do so, in point of fact, collectively, but as the public is an aggregation of units, each unit gets just a small share of information about the things that are selling and offered for sale from year to year and all the year round, by the two or three serials and papers, more or less, that he may happen to purchase; and so individually the public only gets such information by the ounce. You continue—"Excuse me, I have no intention of hurting your feelings, though I have seen it doubted whether editors had any." It is very good of you to say this; but say what you will, you will never hurt *my* feelings, for, editorially speaking, I have not got any. Ah! you wind up your letter by saying—"Believe me a hearty well-wisher for the success of your paper." Well, that is just the termination I like to find to all letters—a burst of sunshine after a little wind and storm. *Pax vobiscum.*

Buckram for Bookbinding.—J. H. B. (*Pendleton*).—The buckram enclosed is quite a distinct material. When I tell you I had to tear one slip of white cardboard to find out if it were buckram, you will understand what it should be in appearance—fine, thick, and white, pasting perfectly. The parchment is rather thin, and not so glossy and ivory-like on surface as it should be. The covers should certainly be folded before the material is pasted on, and the pasting done in the final position they are to occupy, even if they are opened flat to press afterwards.—E. B. S.

Wood Colouring.—OX GALL.—One of the simplest methods of staining deal and obtaining the dull polish seen on very dark oak is to stain it first, and then varnish with flatting varnish. The way to proceed is as follows:—First see that your work is entirely free from glue, grease, or rough places, and then twice stain with dark oak stain (Stephens', for instance), softening the work down between each coat with a soft brush, called a badger, before the stain dries, which will take out all marks, etc., left by brush in staining, particular notice being taken that this is done very thoroughly and expeditiously, as any touching up is almost sure to show. When the stain is properly dry, rub it down with a piece of canvas, not glass-paper, as the latter is very liable to leave white marks, and the canvas can be got more easily into the members of columns, mouldings, etc. (The less glass-paper is used in all stained work, even in preparing, the better, and in no case paper across the grain, as it is sure to show.) Then twice size with best clear size, rubbing down between each coat as explained for staining. If the work is now varnished with good flatting varnish, and when hard rubbed with a soft rag or piece of silk, it will be found that the surface has a nice dull gloss. A cheap substitute for dark oak stain can be obtained by thinning down good Brunswick black to the shade required with turpentine; but unless one thoroughly knows the nature of these materials, this plan had better not be adopted.—E. D.

Stretching and Priming Canvas.—WAITING.—Canvas, like other fabrics, is best stretched by first tacking loosely all round the stretcher, then tacking firmly at one corner, tightening across (diagonally) to the opposite corner, and then treating the two other corners in the same way; lastly, by pulling level and tacking the intermediate spaces. A pair of pincers with flat tips 2 or 3 in. broad is used for stretching canvas. A bought canvas will show how the wedges are adjusted at the corners of the stretcher for further tightening after tacking down. Calico for tempera or other rough painting may be strained by tacking laths to its top and bottom, hanging it against a wall, sizing it, and, whilst it is wet, by hanging weights to the bottom lath. This will pull the cloth taut, and the size will keep it so. Bought canvas appears to be sized and heavily coated with paint, which is scraped smoothly off by some apparatus which, acting like a huge palette knife, sweeps its entire width. This could scarcely be imitated at home. WAITING is advised, after sizing, to give his canvas a not very free coat of paint, to level this with a broad, flat camel-hair varnishing brush. When dry, to give a second coat of white paint warmed with a tint of burnt sienna or light red, and smooth as before. Then after laying in his sky (from his remarks it is concluded that he paints landscape), to stipple it with a badger-hair brush. Indeed, the granulated surface produced by this latter process is always pleasant for painting upon; the better canvas that one buys has a tooth given to it by mixing finely ground rottenstone or Bath brick in the priming colour.—S. W.

Fret-cutting Machine.—A READER.—A capable and competent writer on the staff of WORK has been commissioned to write on this subject.

Lathes and Turning Appliances.—A READER (*Huddersfield*).—You will have noticed that this subject has been brought to a close. You must remember, however, that although "lathe work is the first thing an apprentice is put to in the engineering line," he is certainly not put to it first, if at all, in other trades, to which the majority of the readers of WORK belong. Plans and specifications will appear in due time.

Mists in Painting.—The art of painting mists is by what artists call "scumbling"—that is, taking a brush filled with colour, and rubbing thinly over any part that has been distinctly painted up, which must partially appear through. It can be done with any colour mixed with white according to the local colour of the mists.—J. A. F.

Preparing and Mounting Photographic Views.—G. A. C. (*Nunhead.*)—It is imperative that a lantern transparency should possess qualities that are peculiar to itself, and unnecessary in any other kind of transparency. They must have absolutely clear glass in the high lights, be thin, and have a good colour. In your case, the prints had better be placed in optical contact with glass. This is done in the following manner:—A piece of thin patent plate glass, rather larger than the print, and free from defects—scratches, stria, etc.—is selected. The print is placed in clean cold water for a few minutes; the glass is also put in the water, the print being adjusted face down on the glass, the glass and one edge of the print being grasped; both are slowly lifted out of the water together; this is in order to avoid air bubbles, which would produce imperfections on the transparency, being imprisoned between the glass and print. A squeegee is then lightly passed over the back to get rid of much of the moisture, and to press the print into close contact with the glass. Now carefully examine it, and if there are any air-bubbles not easily pressed out, repeat the process until the print shows a perfectly bright and even surface. Now place three or four folds of white paper, also wet, at the back of the print, and, with another piece of glass of the same size laid over, press together, and carefully wipe the front glass dry and clean; the advantage of this proceeding is that the print is kept uniformly moist during the time occupied in copying, and can be easily removed and dried afterwards. Now set the prepared print as sandwiched between the glasses upright against a board, to which it can be attached by a tack or two to keep it from falling forward, and photograph it in a strong side light, taking care there are no reflections to interfere with the definition. The exposure must be carefully timed, rather under than over, and the development conducted as much in the dark as possible. The high light must be perfectly clean glass; any deposit on them will spoil it for lantern work. A development made with one of the fixed alkalies is preferable to ammonia; the following is a very good one:—Solution A—pyrogallic acid, 3 gr.; sulphate of soda, 12 gr.; bromide of potassium, 6 gr.; water, 1 oz. Solution B—carbonate of potash, 20 gr.; water, 1 oz. Use equal parts of the two solutions, and fix in a bath of hypo, one to five, freshly made, to which about 10 per cent. of sulphate of iron has been added. Wash well, and then place the transparency in a bath of alum and citric acid. Wash again well for a few hours, and dry; the slide is now ready for mounting. A number of masks of different shapes being at hand, choose the most suitable, lay it on the transparency film side, and cover with a piece of thin clear glass; bind them together with gummed paper. Write on the title, and place two white spots on the top front edge as a guide to placing it in the lantern for exhibition, and the slide is complete. After development we have a negative from which any number of lantern slides may be made. To do so, we carefully place the negative in contact with a sensitive plate (plates are specially made for this purpose), in an ordinary pressure frame, and expose to weak diffused daylight, or a gas burner, according to the sensitiveness of the plate used, and which vary greatly. A slow plate is to be preferred, giving a finer image than a rapid one. The size of the slide must not exceed 3¼ in. square. Masks and gummed paper may be purchased at photographic warehouses.—D.

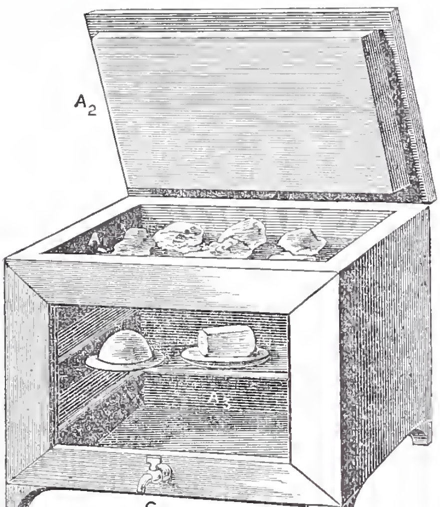
Erratum.—MR. G. E. BONNEY wishes to call attention to an error in page 70, col. 1, in which read "mindererus" for "minderus."

IV.—Questions Answered by Correspondents.

Joiners' Composition.—W. M. (*Market Drayton*) writes in reply to F. B. (*Guernsey*) (see page 158):—"The composition is made of beeswax and resin mixed with colour to match whatever your work may be; it can be melted in an iron spoon, and poured into the defects while hot; it sets directly, and when sandpapered down could not be detected. I have enclosed you a specimen. This is mixed with venetian red; it is a little darker than the wood, so that you might see the way it is done."

Making a Xylophone.—Electron writes in answer to Correspondent (see page 206, No. 13):—"The xylophone is made of pieces of wood about 1 in. square, the upper side of which is rounded; a hole is bored near each end, through which cords are passed, and knots made to keep the pieces apart—pine may be used, but rosewood is considered better; when played they are laid on two straw ropes and struck with small wood hammers; the compass is from twenty-eight to thirty-six notes; the length may be from 1 foot; they are tuned by cutting the pieces shorter."

Refrigerator.—J. M. (*Newhaven*) writes in reply to Urgent (see page 174):—"As you wish to know how to make a refrigerator, I send a sketch of an American one. The drawing is as plain as I am able to make it, as I never learnt that art. A_1 is a zinc tray to hold the lumps of ice; A_2, lid, is zinc lined; A_3, interior lined entirely with zinc, with small pipe at back from tray above, to let the water trickle down the back and run out by the tap. The door when put on also lined with zinc. The top tray slightly deepening to the back, and bottom one deepening to front to the tap. The dimensions as regards width, depth, and length can be of any size, according to the wants of Urgent."



Blue Prints.—W. J. R. (*St. Germans*) writes:—"May I be allowed to supplement Mr. Poole's excellent article on 'Cyanotypes' (see page 194), which appeared in No. 13, by stating one or two simple methods of improving the colour of these blue prints? To produce a green tone, immerse in sulphuric acid, 1 dram, water, 16 oz. Brown tones may be obtained by immersing the prints in water, in which about 10 gr. to the ounce of caustic soda or potash has been dissolved, then washed and transferred to a 6-gr. solution of tannin. A sepia tone may be produced by taking the print, when arrived at the stage last indicated, and immersing in a bath of plain soda and water, taking care not to let it act too long. The original blue colour may be intensified by immersing in sulphuric acid, 1 oz.; saturated solution of protosulphate of iron, 1 oz.; water, 1 oz."

Saws Running out of Truth.—Alpha (*Grangemouth*) writes in reply to A. R. (*Scorrier*) (see page 204):—"I have read A. R.'s (*Scorrier*) remarks in your issue of date about saws running out of truth, and hope to derive some benefit from same. Would he kindly say the gauge of a swedge saw at centre and point he would consider most suitable to cut three boards ⅝ in., and one board ⅞ in. out of a 7×3 deal. The boards to stand that thickness after being dressed into lining."

Joiners' Composition, or Beaumontague.—H. M. B. (*Edinburgh*) writes in reply to F. B. (*Guernsey*) (see page 158):—"Required beeswax, resin, colour. For mahogany, mix yellow ochre and Spanish brown; for ash and light oak, ochre and chalk; for walnut and dark oak, brown umber and chalk. Rub the colours very fine, and use common sense in mixing them and the various materials together. Melt the wax in a large spoon, add the colour till pretty thick, add a small quantity of ground resin, just enough to harden the wax. When partly cold roll it between the palms so as to form a stick handy for the pocket. To use it light a match, or heat a small poker, and melt it, dropping some on the defect, then with wet finger point press it home, and in a minute or so the surplus will sandpaper off."

IMPORTANT PRIZE COMPETITION.

The Editor of Work has the pleasure of informing his readers that Messrs. Cassell & Company, Limited, have placed at his disposal the sum of

THREE GUINEAS,

to be distributed in Prizes for Competition for Designs for a small Bookcase, to contain the Volumes of

CASSELL'S NATIONAL LIBRARY,

which, at the close of the present year, will have attained the aggregate number of Two Hundred and Eight. The books are in themselves of world-wide interest, and may be regarded as forming the front rank of our British classics.

In order to give a fair and proper idea of the space or accommodation that will be required in the Bookcase for the whole of the volumes up to the close of 1889—two hundred and eight in number, as already stated—it is desirable to say that each volume, bound in cloth, is 5⅞ inches long, 4 inches wide, and about ½ inch thick; or, to be more precise, the linear space filled by thirteen volumes is 6¾ inches in length, which admits of the volumes being placed on the shelves without any possibility of being crowded too closely together, to prevent easy withdrawal of any single volume at pleasure. As 13 is the sixteenth of 208, the space required for this number of volumes can be easily calculated.

In order to give satisfaction to as many competitors as possible, the Editor of Work thinks it desirable to divide the sum offered by Messrs. Cassell & Company into Three Prizes, as follows:—

First Prize ...	One Guinea and a Half.
Second Prize ...	One Guinea.
Third Prize ...	Half a Guinea.

Intending Competitors are placed under no restriction as to Form, Arrangement, or Ornamentation, as it is the Company's desire to elicit from the readers of Work an Original Design for a Repository for the Four Years' Issue of the National Library up to the close of the year 1889 that may be regarded as the most convenient and desirable for the purpose indicated.

Competitors should send in Working Drawings to Scale not later than August 31, 1889, and addressed, carriage paid, to

Messrs. CASSELL & COMPANY, Limited,
La Belle Sauvage,
Ludgate Hill,
Prize Competition. London, E.C.
Cassell's National Library.

A motto must be affixed to each set of Drawings, and the name of the sender, etc., enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of Work.

The Drawings sent in Competition will be submitted for adjudication to Three Competent Practical Men, who will select those that are deemed worthy of prizes.

The Prize Drawings selected will become the property of Messrs. Cassell & Company, Limited, who will return all Designs made by unsuccessful competitors to their respective owners, carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced and engravings of the Prize Bookcases given in No. 30 of Work, published Oct. 9th.

NOTICE TO CORRESPONDENTS.

*** In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.

Trade Notes and Memoranda.

Messrs. Crossley Brothers have just completed two pairs of double cylinder gas engines for a paper works at Godalming, which are the largest yet constructed. Each pair is of 100 h.p. Dowson gas is to be used, and the consumption is guaranteed not to exceed 1½ lb. per h.p. per hour.

Recently, an examination of plumbers for registration was held at the Guilds' Institute, the examination embracing joint making, lead laying, etc., and various questions relating to the trade. Applicants came from London, Kent, Hants, and Devon, and rather over three-fourths of the number failed to pass. The examiners were Messrs. Charles Hudson, W. H. Webb, G. Taylor, H. B. Lobb, C. T. Millis, and R. J. Lyne.

Two instances of rapid work in marine engineering have just been recorded. The ss. *Khio* was launched from the ship-building yard of Messrs. E. Withy & Co. on Friday the 5th at 5 p.m., and went into the Victoria Dock that evening to receive her engines, by Messrs. Richardson & Sons, Hartlepool. The work was begun on Monday morning, and the engines were tested under steam on the Thursday following at 11 a.m. The engines (triple expansion) had cylinders of 22 in., 37 in., and 61 in. diameter respectively. The other case is that of a crank shaft of steel, having a double throw, which was commenced on a Monday, forged from the ingot, finished, keyways cut, and despatched on the forenoon of the following Thursday.

The late Mr. Warren de la Rue was a splendid illustration of the fact that a commercial career by no means unfits a man for original scientific research. He did not retire from business until 1880, and the bulk of his scientific work was also accomplished, and his reputation made previous to that date. It is quite impossible to enumerate the work of his life. He held office in many societies, was a corresponding member of the principal foreign academies and societies, was a voluminous contributor to the transactions of many learned bodies, and was an accurate experimentalist, astronomer, photographer, chemist, electrician, and physicist.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

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3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

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One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
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*** Advertisements should reach the Office fourteen days in advance of the date of issue.

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Prize Medal for excellence of

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TAPS & DIES. VISES. CHUCKS. TWIST DRILLS. MACHINE SCREWS. LATHES. FILES. STEEL. TOOLS. STUBS.

For all Workers in Metals, also Joiners, Wood Carvers, etc.

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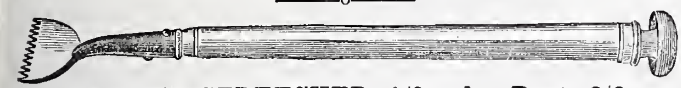
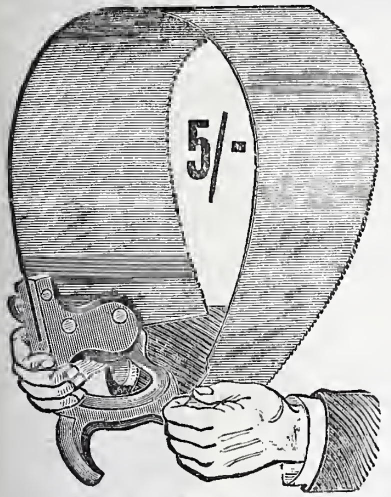


CARPET STRETCHER, 1/9; do., Bent, 2/6.



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WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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SWORDS: THEIR MAKE, WEAR, AND CAUSES OF FAILURE.

BY JOHN C. KING.

WE must first ask and answer the question —What is a sword? A steel weapon to cut, pierce, and parry. This triple action requires exceptional potency in the form and the temper of the blade, so that it is to these two last-named material conditions of a sword we must look for efficiency, or the cause is failure. The best of swords will yield to excessive strain; but if they fail upon slight impact with any substance they should cleave or pierce, they may be regarded as weapons made to look like swords: for sale, etc. etc.

A sword we select for consideration is the ordinary cavalry sabre of the British service. Besides the blade, we shall have to consider the form and materials of handle, guard, and scabbard.

The Blade.—The main consideration is the blade, its length, shape, sectional form, and temper. As any sharp weapon will pierce, but without proper sectional form it will not cut effectively, and cutting being the prime factor in sword effect, we make the sectional form the first matter to investigate.

The accompanying illustrations of cross sections of sword blades show the best, the indifferent, and the worst forms for cutting;

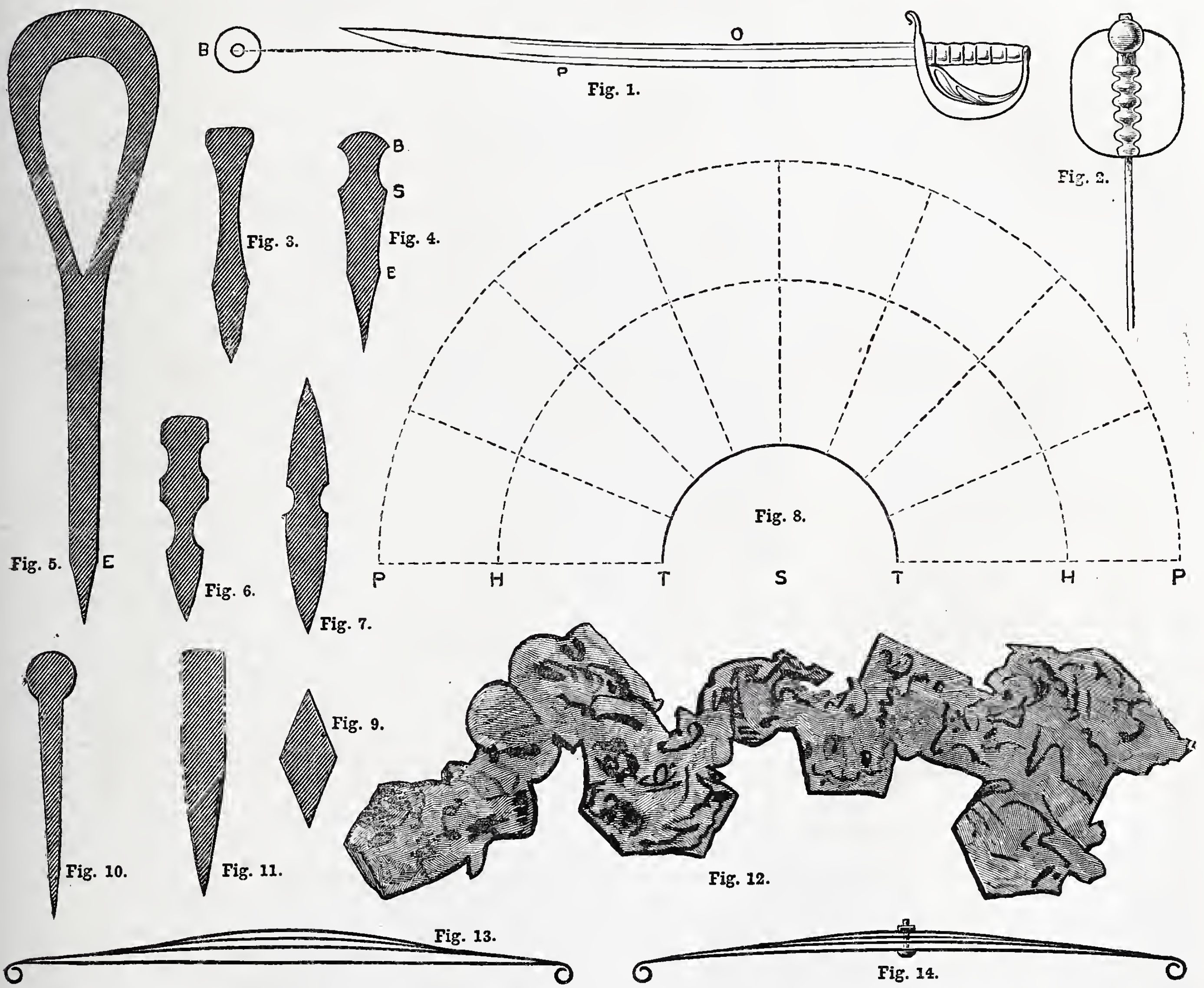


Fig. 1.—Form of Sword generally used by Cavalry. Fig. 2.—Hilt of Oliver Cromwell's Sword. Fig. 3.—Section of Cavalry Sabre in Use in the British Army. Fig. 4.—Cavalry Sabre best adapted for work. Fig. 5.—Section of English Woodman's Axe. Fig. 6.—Infantry Officer's Sword. Fig. 7.—Presentation Sword. Fig. 8.—Radiating Power of Sabre from Horseback. Fig. 9.—Toledo Rapier of Sixteenth Century. Fig. 10.—Sword or Cutlass often seen in Armouries. Fig. 11.—Blade, heavy but devoid of strength. Fig. 12.—Piece of Machine-made Steel magnified at its fracture 550 times. Fig. 13.—Main and Second Plates of Elliptic Spring before bolting. Fig. 14.—Ditto, when bolted together.

which will be explained in detail. The cuts effected by a sword on any yielding substance are either chopping or drawing cuts. As we are now considering straight blades with points only curved about the width of the blade, we may compare the force of the blows of an axe with that of a sword; the one, expending a thousand or more blows on a massive tree butt, without needing to be freshly ground, and rarely failing in the true temper and keenness of its edge; and the other, having to give a few desultory blows, mostly upon a yielding body, and too often failing. A sword may be regarded as an elongated axe, as an axe may be viewed as a section of a sword blade, with the addition of an "eye" for the handle fixing.

The section of an English woodman's axe (Fig. 5) shows a form for effective work on hard wood. This illustration of an axe is described in "Technics of Forestry" in the "Journal of Forestry," by the present writer. It will be noticed that the sharpness of this axe, shown by the part ground to an edge, to the angle E, is keener than four of the six sword edges shown by the illustrated cross sections of swords. The sharpening shows the hollow formed by the grindstone to E, producing a faint angle; this is technically known by woodmen as the "eth" of an axe; this is left prominent for a special purpose, causing the chips to flick out of the cleft of the tree being felled.

The blacksmith who "lays an axe," as steeling it is termed, mostly has a technical mastery of his craft; he does not blame the steel or the coal if failure sometimes results, but adapts his coal, and works his steel to suit his purpose. Why, we may ask, are not swords as reliable as axes?

The use of a sword is more exigent. Much may depend upon a sword parrying without bending or breaking; for a thrust to pierce, or a stroke to cut; life, command, even a nation's destiny may be involved by failure. We have dwelt on this comparison as our experience extends to the making and using of both tool and weapon, and it enables us to point out explicitly that the sectional shape of many sword blades do not fulfil the purpose of this weapon in warfare.

Of the many varieties of sword blades in use, we select for illustration seven of the leading types of swords, to indicate their value for cutting and resistance to strain by drawings of sections at the middles of the blades.

No. 3 is the cavalry sabre in general use in the British army. The "fullers" to lighten and strengthen the sword are worked by "swages," or "top and bottom tools," at the anvil, and by being generally too wide and too deep leave only a thin shell of steel between them. This destroys the rigidity and mars the stability of the blade, causing the sword to yield to a curve at a hard thrust, and breakage to follow; for it must not be lost sight of that this bending easily is insipient breakage, more surely so in a hard tempered blade than a soft blade. This will be made obvious to the reader when tempering is referred to.

The inclination of the bevels of the cutting edge is less acute than the woodman's axe, and would not cut through the collar of a coat or the head piece of a bridle. In fact, the edge is thicker than a new plough "coulter," which has to cleave through stony ground in the front of the ploughshare.

No. 6 is an officer's sword (infantry). The two fullers, narrow and deep, with a ridge between on each side, make a rigid blade, but worse for cutting than No. 3.

"It would be ground sharp before going into action," is said in answer to the objection to the obtuse edge, which would make a soft sword that would bend if much of the surface steel were ground away. This will be demonstrated when tempering is explained.

No. 7 is a section of a blade which may be seen used for presentation swords, but mostly without the middle fullers, so that the writing and devices may more easily be displayed on the blade. It is not suited for actual warfare; very few presentation swords are.

No. 10, with a beaded back, is met with in armouries, and, with two fullers at the back of the blade instead of the beaded back, is the sort of hanger or cutlass used by seamen in the old wars of this century. There has been nothing better devised for the navy.

No. 11 is a section of a blade sometimes seen in use where price determines form and finish. It is heavy, and not so strong as if it were to be properly fullered. Its obtuse edge would have little penetration in cutting. No. 9 is a sectional view of a sixteenth century Toledo rapier. It is introduced here, as reference will be made to it under the head of tempering.

No. 4 shows section of a cavalry sabre best adapted for work. From the edge to the "eth" E is more acute than any except the cutlass, No. 10; from E to S, forming about three-eighths of the total width, is only slightly hollow; the "fullers" are narrow from S to B. This is a reliable form for rigidity for piercing and strength for cutting penetration, with least risk of breaking or bending.

Fullering.—It seems paradoxical to lessen the bulk of a thing, making it lighter, yet making it stronger. But it becomes plain upon reflection that it is the surface form which decides the strength. A form which presents portions of its surface edgeways has edgeway strength. A gun barrel will serve for illustration. Regard the inside of this as two deep fullers as of a sword blade, joined, making a circle, the strength of surface shape becomes obvious. Compare the strength of a gun barrel with the strength of the same weight of a rod of solid iron; thus it will be understood that narrow channels fullered into the blade at the back edge of the blade are the best. Old Scotch claymores sometimes show four or five narrow fullers in the strong or wide part of the blade. The fullering of most blades extends only for three-fourths of their length, the back of the blades being sharpened the other fourth of the length.

The Springing of a Sword Blade.—The springing of a blade and its resilience is a merit to a limited extent only. The less a sword yields from straight to curve under strain, the better for the user of the sword. It must be obvious that a blade which bends to slight pressure, however perfect its resilience, is a defective form of blade for a cavalry sabre. A pliant blade, if struck on a hard substance, with its surface nearly in the same plane as the orbit of the stroke, would glance from it, and in the attempt to pierce a moderately hard or tough substance, the pliant blade would bend instead of piercing. The blade shown in section No. 4 best fulfils all the requirements for piercing, cutting, and parrying.

The Shape and Length of a Sword Blade.—We assumed at starting that a straight blade is best suited for modern requirements for cavalry; the length should be proportioned to the stature of the soldier, and the height of the horse on which he is mounted. The service patterns for cavalry are too short to reach a crouching foe a yard away from the course of the horse on the near side. For cavalry a sword half a foot longer would make a more effective weapon. Its power is augmented in the charge and need not be diminished in defence, at which the better soldier would not long accommodate an antagonist by parries. Fig. 1 shows the form of sword now generally used by cavalry; it will be seen that it is not quite straight along the back to the point, which is a defect, more especially for a long sword. The diagrams of the relative circles formed by the turning the wrist in presenting the back of the sword to guard a cut will show that the adverse cut has no axial leverage offered to its force in a straight sword; but on the curved blade the user offers a leverage out of the straight line at the point just as much as the circle, B, shows is the curve deviation of this sword. The wrist has to sustain this strain in guarding a cut on the blade near the point. It has been urged that a slightly curved blade produces an oblique entering cut into any object, but angles of cuts are always determined by the angle of surface presented to the sword.

The business part of a sword may be reckoned from the point to P, the centre of percussion, both for cuts and thrusts. If the point in cutting meets an unyielding substance, the breaking strain is thrown on the cutting edge at P, and by gradations of points of concussion back to P, the strain on the edge is thrown on the blade back to O; but the concussions of edge of blade, back from P to O, create a cantaliver strain along the back of the blade from P to O, due to the momentum of the weight of the blade from those contact points. Now, breakage, apart from faults in tempering, results from the sudden inertia after sudden motion; that inertia is increased by the edge *not being able to cleave through the objects it strikes*, hence the necessity of a keenness of edge to diminish risk of breaking. For thrusting, a curved blade springs under the impact more than a straight one, and lessens the force of penetration. The diagram (Fig. 8) illustrates the radiating power of the sabre from horseback. S is the saddle centre from which the stirrups should hang vertical, as the cavalry man works standing, his seat being only a contingent support. This steady level foot-bearing on stirrups is best attained by the stirrup being hung to the saddle by V-shaped stirrup-leathers from pommel and cantle. As the neutral axis of the animal's movements is nearly central between the fore and hind legs at junction of the body, the soldier is less affected by the horse's motions than if the stirrups are hung forwarder on the saddle. From S to T may be viewed as the extent of body, arms, and legs to be guarded; from T to H, the range of arm and reach of body, also the orbit of guards and parries; H to P, the sword from hilt to point in its sweep at cuts and effective thrusts. A weapon six inches shorter diminishes the radiating power and range of cuts and thrusts and far-reaching parries. Every horse soldier knows that a cut or thrust short of the mark is perilous in combat.

Steel of which Swords are Made.—We have not yet spoken of the sort of steel of which swords should be made, assuming that good steel would be used in the manufacture of sword blades; nor is it of so much consideration to a sword-smith, as is the shape, section, and length of blade, properly tempered, to the soldier. We therefore combine the matter of consideration of steel and tempering, in the hands of a skilful smith, under one heading. Here arises the talent of the forger, who can make and temper the blade which will either cleave iron or silken floss; for this, the man who forges the blade should temper the blade to ensure success. If ignorant of steel working and tempering, a smith may make a good weapon to look at of the best shear steel, yet it might not be so serviceable a weapon as a better smith would forge out of old iron barrel hoops, that process being simply making your steel out of iron, welding, hardening, and tempering. As this is a matter of the technology of iron working, we may treat of it some future time; it would take up too much time to detail its processes in this essay. A volume might be written on steel for swords; after all, it would be what sort of steel the smith converts it into—good or bad; for every heat he takes, every blow he strikes, every chill he gives, modifies the molecular structure of the metal, making it better or worse than when he began the job. We must not forget that smiths of old had to make their steel out of iron during the process of making the weapon. How few smiths—especially where machinery supplements labour—forge and temper a weapon throughout; the division of labour is too often the blight of earnest skill and the bane of enterprising talent. The contractor, perhaps technically ignorant of the proper manufacture of a sword, and assuredly practically incompetent to know what it should be for efficiency as a soldier's weapon, does not simply want to grind his workmen's "bones to make his bread," but perils the nation's welfare by producing worthless weapons, and, forsooth, something worse sometimes — a parliamentary committee which manages to screen the culprits and start the grinding game afresh. Wrong begets other evils; the wasteful process of bad sword making finds its way into the "dunces' dustholes," as the Encyclopedias are not inaptly termed, when they assume to describe the humble technics of toil. For instance, they say swords are forged, tempered, set true, ground, etc. Contractors' swords may, and no doubt are, ground after they are tempered—it comes cheap; but a sword-smith who knows his work would grind his sword before he attempted to temper it, and so ensure the temper being secure from injury by grinding.

Forging Sword Blades.—This may be well done by smiths without any other adventitious aids than the common forge and a suitable muffle for beating, for getting perfect granulation and fibre into the texture of the steel. A hollow fire is made, which is a culvert of banked-up small coal and ashes, at right angles to the nozzle of the "tew iron." This is mostly done over pieces of wood which form the core; these, when burned out, leave the culvert for the steel, called a "hollow fire."

"Drawing down" the Steel.—This is a very elementary matter for a smith who has worked in steel. The proper heats, and the rapid, regular blows of the hammers and sledge, start the jobs; then avoid any hammering while the steel is only black hot, except light taps that do not jar the grain of the steel violently. This is well understood by steel-smiths. For straight blades, the bending of the steel to a concave curve on the cutting edge is necessary, to counteract the action of thinning the cutting edge, and swageing the "fullers," which bring the blade straight; all is the plainest of work, yet requiring experience and judgment. It is while doing this that the smith learns what sort of steel he is working, and how its tempering should be modified. Here we can appreciate the critical mental power of the worker, which is lacking in the action of machinery which aids his work, and too often is made to do imperfectly, though cheaply, what hand labour can do better. The illustration of a piece of machine-worked steel, Fig. 12, magnified at its fracture, shows a grain quite unfit for sword blades, yet it is good steel spoilt by bad working, and is made into blades for swords, hence their defectiveness in too many instances.

Tempering Sword Blades.—We may here at once demonstrate that two distinct principles of tempering have to be adopted with steel tools or weapons to adapt them to the requisite power for resistance to strain required of them. For some purposes, the outside of the steel tool or implement consists of a tough layer protecting a more brittle-grained core. "Springs" for road and railway carriages, for instance, have the brittle resilient steel protected by a sheath of tough steel, which does not impair the resiliency desired in such springs. This is done by tempering. Railway "springs" are about semicircular in shape before the weight of the carriage is put on them, when they are made to yield to a faint curve, nearly straight. Compare the work done by each of these many plates to a "spring," with the idle existence of a flashing sabre—

> "That sometimes plays at havoc with the work of God
> To drink the stain called Glory!"

By detailing the simple process of hardening and tempering of "springs" of the sort made up of leaves of steel for ordinary carriages, it will explain what was advanced of two principles of hardening and tempering steel, and further elucidate some features of sword-blade tempering which may be new to the sword-smith as well as the general reader, and interesting to the swordsman. Carriage spring plates are drawn out as thin as a knife blade at their extreme ends, and they are fitted together so that each successive shorter plate in the series of layers is more curved than the next longer one it fits against, as will be seen by the sketch of a bow, or half of an ellipting spring, before it is bolted in the middle to close the plates to a dead fit one against the other. Fig. 13 shows the long main plate, which is about $1\frac{1}{2}$ in. fainter curve than the second plate; this again is 1 in. less curve than the next, and so on to the shortest plate, which is only about half an inch more curve than its longer fellow plate. These diminishing gradations of spaces between plates increase resiliency. Fig. 14 shows the "spring" when bolted together. Here we have a tension on each plate permanently as long as the spring lasts, and when in use it is often bent to a reverse curve, and yet it springs back to its true shape. Plenty of such springs have been in regular wear on vehicles for more than fifty years, and are still good. This success is attained by first hardening the curved plates, separately, by plunging them, when cherry-red hot, into water till cool, then passing each plate into a "hollow fire," so that the plate becomes black hot, and yields the following tests: either to flare grease if rubbed on it, or to make a piece of dry, soft wood give out sparks when rubbed hard against the edge of the heated plate, which is then allowed to cool. This process sheaths the diamond grain of the plate in an envelope of tougher steel, which prevents fracture of the plate, even under excessive strain and concussion over rough roadways. With sword blades, the reverse principle of hardening and tempering is necessary; for though a sword may spring, that action is only incidental to occasional strain; the less a sword yields to a curve the more efficient it is both for cutting and thrusting, as has been previously explained. Here it is necessary to get the diamond grain steel on the outside of the blade.

Hardening and Tempering Sword Blades.—There are other ways of forging sword blades besides drawing them out of steel bars; as a bar of iron for the core, and two thin bars of steel for the cutting edge and surfaces welded together, was a common plan of old. In the United Service Museum, Whitehall, London, is the sword used by Oliver Cromwell (Fig. 2) at the siege of Drogheda. It has the marks on it as if it had been struck by bullets in two places, fracturing the shell of outside steel and dinting the softer iron core under it, which is seen where the outer steel surface is broken away; this makes it appear as if thus made. The perfection to which steel is wrought ready for working into sword blades dispenses with this form of making a tough blade, and the process of tempering is as simple as can be, bearing in mind that steel needs the thoughtful study of how to prevent sudden atmospheric action on its constituent fibres from injuring them during the cooling processes, after making and while tempering. Such highly wrought matter as heated steel requires adequate time for the expansion and compacting of its fibres. We know sudden chill will make it brittle as glass; slow cooling soft as iron; so proportional heat or cold will modify its texture, and throwing a hot sword blade to cool on the floor will do harm to the steel by producing unequal tension of fibre in the sides of the blade. A forged blade should, as soon as done, be thrust into charcoal dust or dry sawdust, or the ashes on the forge, to get cool gradually, by which its fibrous grain obtains better form throughout; grinding should follow. In preparing for tempering, two baths may be used for cooling, or only one. We will describe both plans. One is a brine bath, 1lb. of salt to a gallon of water, with three or four inches of oil on the top—linseed oil is suitable—and the brine water should be at 100° temperature. The blade, with others, is put into a "muffle" or pipe packed with charcoal, so that they do not touch each other; six blades, or eight at most, is enough in the muffle, and this is put in a furnace and heated slowly till the blades are a bright cherry-red colour; one at a time the blades are immediately drawn out of the muffle, and plunged straight down through the oil into the brine bath, and held immovable till the tremor of the bubbling of the water almost ceases. This is known by the tremor of the blade ceasing to be felt by the hand that holds the tongs. The blade has been in a sheath of vapour, and the oxygen of the water, it is assumed, has been drawn to the steel, or the carbon on the steel, and has crystallised the grain, making it very hard; the sword blade is drawn slowly out of its bath and laid horizontally in the oil on the top of the water, resting there till quite cool; when seemingly cool it must not be thrown in a very cold place, but should for some little time longer be kept at the same temperature in charcoal, sawdust, or ashes. This is hardening a sword blade. The final tempering is done by heating to 560° Fahr., which produces a blue colour, and cooling the blade in water. This heating should be in a lead bath, so that the thin parts of the blade are not made hotter than the thick parts. The other plan of hardening is to have two baths, one of brine water, the other of liquid resin and oil, three gallons of lard oil to one of liquid resin, well mixed. The blade is operated the same way; first, straight down into the brine water bath till the tremor imparted by its sheath of vapour has nearly ceased, and then drawn out and plunged straight down into the oil and resin bath till cool. Then heated in the lead bath as before described till surfaced with dark blue colouring, then cooling in water, then packed in charcoal or dry sawdust. The smith who has made the blade can tell if the hardening should be at dark or bright cherry-red, and the tempering light blue, or dark, or purple, according to the nature of the steel. Referring to the Toledo rapier (Fig. 9), quite three centuries old, a perfect weapon, the owner desired it to be made six inches shorter, without drawing down and re-tempering; the writer of this essay warned him that it would produce a soft steel point, as it would bring the core of the blade to the point by the process of grinding. It did so, and the weapon was soft pointed, though the grinding was done slowly in very cold water.

The Sword Handle.—It may be a tang, or a flat haft, to have the handle riveted on to it. The tang admits of a better formed handle for grip and plug in the hand. The regulation pattern handle is bad in form and in roughing of the hand-piece, which roughness is not perceptible through the leather glove. We again have to turn to Oliver Cromwell's sword; the handle and guard, or hilt, are unique. The sketch (Fig. 2) shows the handle and outline of hilt. The power to grip this sort of handle is manifest; the ball end ensures the hold of the sword at a swinging cut. The hilt shows the same common-sense application of a light impenetrable metal cover for the hand, the basket part being pierced with small oblong oval holes, smaller than a grain of corn. It looks more serviceable than ornamental, but a soldier's weapon withal.

The Sheath.—The steel scabbard is an absurdity for real service by its weight, trouble of keeping bright, and annoyance in striking the next horseman when flying about like the sweeps of a mill. It is a minor matter, but experience has shown the great service of leather metalled at the mouth; the sling-rings and points to take the wear of the spur and the ground. The soldier with this sheath is not so distressed by the weight of his sword.

Sword Belts.—The present double strings are a makeshift, and a bad one; a belt-frog, eight inches long, with a metal loop to take a spring clip at the back edge of the scabbard near the mouth, answers admirably. When dismounted, the spring clip is fastened on to a loop of the waist-belt to admit walking without clanking the scabbard. Shorter swords for cavalry, fastened to the saddle, are spoken of. The carbine is now fastened to the saddle, so that in a skirmish a dismounted rider has perhaps a broken sword and his ammunition only. A soldier should carry his tools with him, as his horse carries him. With good belts they would ride easy, and be with him on or off his horse.

The sword is a weapon that is attracting considerable attention at the present time, and it is hoped that the above remarks on the sword itself and its appurtenances will not be found uninteresting or devoid of value.

HOW I MADE A DRILL CHUCK.

BY ELECTRON.

SOON after I became the possessor of a lathe, I found a want of an appliance for drilling holes above $\frac{1}{4}$ in. in diameter. I had a few drills with square shanks, which had been made for use with a brace, but I had no brace, and the lathe had no drill chuck, nor had I in my possession any taps, or

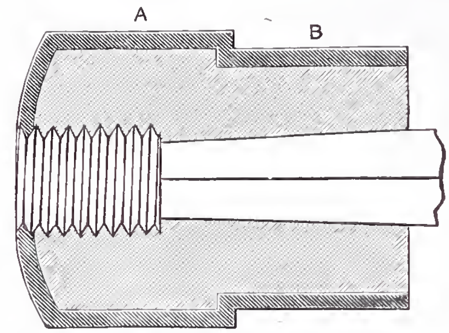


Fig. 1.—Section of Chuck.

chasers wherewith to make a screw to fit the nose of mandrel.

I began to consider how I could overcome this difficulty, and in looking round, I found a brass cup, about 2 in. diameter, with a small hole in the end; this was carefully enlarged till it would just fit on the nose of mandrel, but when pushed up to the end it was only $\frac{1}{2}$ in. in front of the end of mandrel. I then got a piece of brass tube, that fitted inside the cup, and cut a piece off, about $1\frac{1}{2}$ in. long; the headstock was then taken off, and set on its end, with the nose of mandrel upwards, and the cup and tube fixed on; one of the drills was then driven into a piece of wood which was fixed on two supports, so that the end of drill rested on the end of mandrel, and was fixed as nearly in line with the mandrel as it could be; the shanks of drill and mandrel were covered with grease, and the tube and cup filled with melted lead. Fig. 1 is the representation of a section of chuck, A being the brass cup, and B the tube.

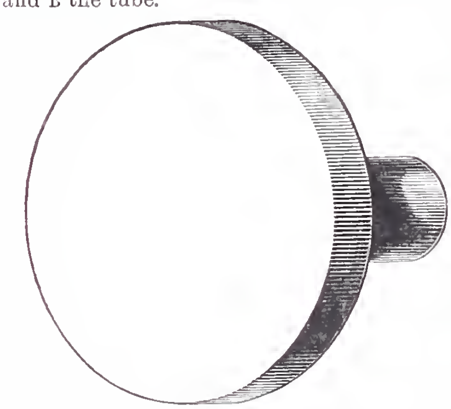


Fig. 2.—Face Plate for Drilling in Lathe.

On fixing the headstock, and revolving the drill, I found it a little out of truth, but by taking a little off one side, and punching the lead on the opposite side, I got it as true as such a drill could be got. I have drilled holes in steel, cast and wrought iron, and brass, and although it has been in use for a long time, it is very little worse. Of course, I don't recommend such a drill chuck where a proper one can be got, as for good work good tools are required; but there may be many a beginner, who may be in the same position as I was, to whom the hint may be useful.

An improvement in making a chuck of this kind would be to have the shanks of drills turned, and drill a hole in the lead when fixed in position. This would ensure it being central; and a set screw put through one side, and bearing on a flat, filed on one side of drill shank, would hold the drill fast.

A cup for holding the lead might be made as follows:—Get a brass tube about 2 in. diameter and 3 in. long, turn the ends true on a wood mandrel, then make a circular plate of brass, with a hole in centre to pass over screw of mandrel; tin the edge of plate and inside of one end of tube with a soldering bit, making the plate a tight fit in the end of tube, and drive it in till level, then solder round the outside of joint, and clean off with a file.

If the tube can be got $\frac{1}{4}$ in. thick, it will prevent the set screw in side of chuck wearing the lead. In drilling with the lathe, a face plate should be made to fix on the end of the screw of loose headstock, to keep the work square. Fig. 2 shows this face plate; it should be covered with wood, to prevent damaging the points of drills.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

(*Continued from page 260.*)

ROMAN SMALL LETTERS—OLD ENGLISH CAPITALS AND SMALL LETTERS—SCRIPT CAPITALS AND SMALL LETTERS.

I PROMISED in my last paper to give a set of Roman small letters or lower case, as a necessary pendant to the complete alphabet of Roman capitals. These will be found in Fig. 34. Any special comment on them seems to be unnecessary.

The student should, as soon as possible, commence working on the Old English letters, proceeding in the same way as before, viz., outlining the letters first and afterwards filling them in. He should first of all take up the capitals only, Fig. 35, and when fairly successful turning his attention to the small letters, Fig. 36. Of course he will find these the most difficult work of all he has yet attempted, but he need only practise their formation in leisure moments, and not force his hand or his patience. It will not do to neglect these Old English characters altogether though, as once they can be drawn with precision, it is a comparatively easy task to learn how to form any of the ornamental and fancy alphabets and church text letters which he will eventually be called upon to paint.

These lessons on forming the alphabet may appropriately conclude with a few remarks on "script," or hand-writing letters, which are illustrated in Figs. 37 and 38. This is the ordinary writing we are all taught when at school, and is known in the copy books as "round-hand." It is much harder, however, to execute this writing with the camel-hair pencil than it is with the pen, but it must, nevertheless, be thoroughly practised, as it is in great demand in the sign-writing business, and must be done well or not attempted at all. It is best to use a sable writer for practising "script" writing, and no previous outline should be allowed, excepting a straight line to work upon. The wrist must also rest comfortably on the mahl-stick, and the work done in a quick, bold, unhesitating manner. I should mention that Old English and "script" letters may for some considerable time be practised with much advantage in pen and ink on some good glazed writing paper, and afterwards on an a b c d e f g h i j k l m n o

p q r s t u v w x y z

Fig. 34.—Roman Small Letters.

enlarged scale on Whatman's or Rowney's hot pressed drawing paper. Of course in cases where this has been previously learnt at school, such a preliminary canter is not requisite.

The hardest part of the work, as far as the writer is concerned, is now over. Specimens of five different forms of letters (those most commonly in use) have been given with the accompanying instructions. They are, so to speak, the root and foundation of all other styles and varieties (German text possibly excepted) in use at the present day, and once let the student become complete master of them, together with the freehand drawing lessons given at first, and he may at once style himself a sign writer. He has nothing more to learn beyond what experience will dictate to him, such as spacing his letters and the proper display of his words. This I will, however, endeavour to assist him in, and also in succeeding chapters point out the necessary tools for a complete outfit, their treatment and care, the colours, with hints on using them, together with directions for painting coats of arms and a pictorial sign; also give a few

A B C D E F G H I K

L M N O P Q R S T U

V W X Y Z &

Fig. 35.—Old English Capitals.

a b c d e f g h i j k l m n o

p q r s t u v w x y z

Fig. 36.—Old English Small Letters.

A B C D E F G H I J

K L M N O P Q R S T

U V W X Y Z

Fig. 37.—Script Capitals.

a c e i m n o r s u v w x	1 2 3 4 5
b d f g h j k l p q t y z	6 7 8 9 0

Fig. 38.—Small Letters.

illustrations of specimen signboards and alphabets of ornamental letters and church texts, and concluding with some dodges and receipts of English, Continental, and American origin. There is nothing, therefore, in what has to follow, but pleasnrable and interesting reading for the aspirant to sign-writing honours, and in perusing which he will be adding to his knowledge without any apparent effort on his own part. And, moreover, he will always have in these latter chapters a handy book of reference, which he may fly to in any moment of uncertainty or doubt. Every nerve has been strained to exert and encourage the learner and keep him up to his task, and this branch of the painting art has been placed before him in as popnlar light as it could be, and it now rests with him and his indomitable pluck and energy whether he fails in his attempt, or blossoms forth into a respectable member of the sign-writing profession, and pocketing, as his weekly and easily earned salary, a £10 note.

SMITHS' WORK.

BY J. H.

(*Continued from page 226.*)

THE "PIG-BOILING" PROCESS—DRY PUDDLING PROCESS—MR. HALL'S EXPERIMENTS—BESSEMER'S PROCESS—MUSHET'S BATH OF DECARBONISED PIG—SIEMENS AND SIEMENS-MARTIN OPEN HEARTH PROCESSES—PRESENT DEMAND FOR STEEL.

IN my last, I intended to commence an account in this third article of the work of the mediæval smiths. My readers will permit me to postpone the commencement of this subject nntil the fourth article, in order that I may make a few remarks on certain processes for the mannfacture of iron and steel, which were briefly touched on in my first paper.

Since that was printed, I have received, through the Editor, a communication from a gentleman relating to the "pig-boiling" process, a process to which I made a passing allusion in the first article. It appears to me desirable to notice this commnnication somewhat fully, in order to give publicity to a chapter in the history of iron making which is not generally known, and at the same time I will point out a few of the essential differences in the wrought iron and mild steels made at the present time. In taking this course, I shall not lay myself open to the charge of digressing from the snbject of smiths' work, since most readers will probably like to know what constitutes the essential differences between the iron and steel in their various grades which they use in daily work.

The commnnication referred to is as follows:—The writer has received a small volume* from Mr. William Hall, of 14, Broad Street Corner, Birmingham, who claims for his late father the merit of having invented the "pig-boiling" process and the patent cinder, or "bull dog," a refractory oxide, by which the increased temperature required in the "boiling" process was successfnlly resisted; and as this is a fact not generally known, a brief account of the history of this process may be of interest. Since it is probable that some of the readers of WORK who may be interested in these articles of mine do not know the essential method of operation of the process termed "pig boiling," I will first very briefly note the difference between it and the original puddling process.

In the original, or dry puddling process, grey pig iron is first refined on the hearth of a rectangular fnruace, or "refinery." Coke or charcoal is the fuel nsed. By means of oxidising agents, as basic slags, cinders, and hammer scale, and a strong blast of air directed down npon the hearth from inclined twyeres, the metal is decarbonised, and white iron, in which the carbon is in the combined condition, results. The refined iron is then puddled on the hearth of a reverberatory fnrnace, whose bottom is lined with oxide of iron. The metal being white, does not mclt, but becomes pasty, and when in this condition it is rabbled over the hearth in order to mix it with the oxide of iron, and also with the hammer scale which is added to the charge, both basic materials, by means of which, and by the aetion of the atmosphere, the impurities are oxidised out from the metal. Finally it is worked np into balls, and hammered or squeezed, in readiness for rolling into bars and rods. In the later, or "pig-boiling" process, the preliminary aud costly refining into white iron is not necessary; grey pig iron, or a mixture of grey with white, being used. The furnace lining consists of broken slags, tap cinder, hammer scale, and old hearth bottoms broken up; while the fettling consists of "puddlers' mine," which is a pure red hæmatite, and of roasted tap cinder, or "bull dog." In these substances when fused, all rich in oxygen, the grey pig is immersed, and the carbon is thereby oxidised out, the period of the boil coinciding with the complete oxidation of the carbon to carbonic oxide, and with the oxidation of the sulphur, phosphorus, and other ingredients. Soon after, the metal drops quietly upon the hearth, and it is then "balled up" in readiness for the hammer.

This is a very brief account of the process, and many details are omitted, but it will suffice to furnish a comparative idea of the two methods.

Somewhere about the year 1820, Mr. Hall's father was engaged in an iron-works, in which, according to the universal practice up to that period, the older dry puddling process was carried on. At about that time, or a little earlier, about 1816, iron bottoms for puddling furnaces, eoated with oxide of iron, or cinder, were substituted for those of sand, originally used by Cort. Now Mr. Hall had beeu in the habit of saving and puddling up odds and ends of scrap metal, apparently as a perquisite, making use of the ordinary furnaces with cinder bottoms for the purpose. When he first charged a puddling furnace of the new type, the scrap mixed with the bosh slag produced in the cinder bottom a surprising result. The contents of the furnace literally boiled over, running over the fire and flue bridges, through the stopper hole, and down upon the plate where the puddler stands. The experimenter was alarmed at first, and resolved to abandon the work. But this resolution was quickly changed, when on the following week the quality of the bloom of iron thus produced was found to be superior to any made by the intermediate refinery methods. The question naturally arose in Mr. Hall's mind, "If such a fine specimen of iron can be produced from the refuse of the puddlers' boshes, what will not good pig iron yield, with equally good fluxes?"

Three years of experiments followed, with the ultimate result that any grade of iron could be produced either from the bosh slag or from pig iron direct. Then follows an account of the difficulties met with by Mr. Hall in the search for materials of a sufficiently refractory character to withstand the corroding effect of the flux. Finally after thirty years of search, cast-iron plates backed with air spaces, with burnt tap cinder or bull dog for a lining, were employed, and a patent was taken out for the latter in 1839. During the whole period of Mr. Hall's connection with the trade, "bnll dog" only was used for "fettling," and at Bloomfield I believe it is still continued. Mr. Hall's experiments cost him not less than three thousand pounds. The roasting of tap cinder to make "bull dog" was patented by Mr. Hall, who, from various reasons (foreign to the object of this paper), did not follow up the legal advantages that he had in this respect.

It is satisfactory to know that Dr. Percy, the ablest and most scientific and accurate writer on the metallurgy of iron and steel, accords Mr. Hall credit for his invention. He says, "The merit of introdueing 'wet' puddling or 'pig boiling' is ascribed, and, as I believe, with reason, to the late Mr. Joseph Hall, of the Bloomfield Iron Works, Tipton, Staffordshire; but that merit has been disputed, and in this respect Mr. Hall has only met with the fate which seems especially to have befallen the authors of every other improvement of importance in the smelting and manufacture of iron. Mr. Hall, whom I knew personally, was, undoubtedly, one of the most experienced and skilful producers of wrought iron in South Staffordshire, and no firm in that county has enjoyed a higher reputation for the quality of its manufactured iron, for example, boiler plates and horsc-nail iron, than Bradley, Barrows, and Hall. As far as I have been able to ascertain the truth, I believe that Mr. Hall was fairly entitled to much of the credit which he claimed for himsclf."—"Iron and Steel," p. 670.

A tone of evident disappointment pervades Mr. Hall's book.* He smarts uuder a sense of unrequited merit. We can well understand this when he says, that "the pig-boiling principle, with its furnace, had they been patented, would have realised by this time perhaps a million of money, and the trade has received the full benefit of them without any remuneration to the inventor."

Self-made men are apt to be somewhat egotistic. A successful business permitted him to be independent of the necessity of realising on his own inventions, but he. nevertheless, had a pardonable desire to see his endeavours recognised. They were to some extent acknowledged by one or two.

Mr. Hall's account was written at the period when Bessemer's process was nnder a cloud, and his early failures afforded a ground at that time for Mr. Hall's unfavourable comparisons of the pneumatic with the pig-boiling process. Mr. Bessemer met with ill-success during three years, aud spent thousands of pounds before he could perfect his converters, or produce sound steel. And even then, justice compels us to acknowledge that but for another inventor, David Mushet, whose lack of means alone prevented him from deriving benefit from his discovery, Mr. Bessemer's process could never have been a success. Mr. Mushet had patented the addition of spiegeleisen or ferro-manganese to decarbonised iron, and it is this which has reudered the Bessemer and open hearth processes practicable. Mushet allowed his patent to lapse for want of funds, and others reaped the advantage of it.

*"The Iron Question," by Joseph Hall. Hamilton, Adams, & Co., 1857.

* See *ante*.

To those not acquainted with the practical difficulties of steel making, it may seem the simplest thing in the world to decarbonise a bath of pig iron to that precise stage required for mild steel. But it is not so in fact; and more than that, the iron becomes rotten and "cold short," and worthless in the process. Hence, in the manufacture of all mild steels, the process invariably is, to first burn out *all* the carbon, and then to *add* the measured quantity required in the form of "spiegel" or "ferro." Besides, it so happens that manganese is as essential to the production of mild steel as it is to that of crucible steel. Steel, which before the addition of manganese would be absolutely rotten, is rendered malleable by such addition. It is not that all the manganese remains in the metal, but that it reduces the oxide which is the cause of rottenness. But for the addition of carbon and manganese, therefore, in the form of "spiegel" or "ferro" to the bath of decarbonised pig as originally patented by Mushet, Mr. Bessemer's invention might have been unknown except to students. Mr. Nasmyth's invention, for example (patent No. 1001, May 4th, 1854), was in its essential method very similar thereto, consisting of discharging a current of steam from a nozzle bent downwards to the bottom of a bath of molten metal. For a discussion on the claims of Mr. Mushet, see several letters in *Engineering*, 1884, vol. 37.

It follows as a necessary consequence of the method of dry puddling, that iron so produced cannot be homogeneous, but that it will consist of iron with scale and cinder mechanically intermixed therewith. The processes of piling, squeezing, tilting, hammering, and rolling, expel the major portion, but not all of the scale and cinder. The larger the number of reheatings to which the iron is subjected, and the greater the amount of work done upon it, the more free, other things being equal, will it be from these impurities which are mechanically intermixed. B B B iron has more work done upon it than B B, and this again than B, or merchant iron. But the best iron cannot be wholly freed from scale, and every reheating costs more money for fuel and labour. Herein consists the superiority of mild steel that it is *fused*, and, therefore, freed from scale.

Another point is, that it is more difficult to obtain large masses of iron sound than masses of smaller size, because the amount of scale present is a cumulative quantity, and the difficulty of sound welding increases. No such difficulty exists in steel, ingots of which can be made of 100 tons weight.

The Siemens and Siemens-Martin open hearth processes are growing in public favour more rapidly than the Bessemer. The reason is this, that immediately the Bessemer blow is finished and the spiegeleisen has united with the decarbonised metal, the product must be emptied at once into the ladles for casting. But the metal may be allowed to lie in a molten condition for an indefinite period on the open hearth. The Bessemer process is completed in about twenty minutes, and must not exceed that period; the open hearth process is not completed for seven or eight hours, and may be allowed to continue longer. If on testing, therefore, the chemical and mechanical properties of the metal are not precisely what are required, there is time in the latter case for making such modifications as are deemed desirable. Besides this very valuable power of control over the ultimate product, it is considered better to deoxidise the metal by means of metallic oxide, as is done on the open hearth, than by means of atmospheric air as in the Bessemer process. Bessemer steel is more agitated, and occludes bubbles of gas much more readily than the Siemens open hearth and the crucible processes. Still, there are many things for which the Bessemer process will always hold its own, as tyres, rails, and heavy forgings for cranks and shafts.

In the early days of Bessemer steel making, many manufacturers abandoned its use after trial, as being untrustworthy and treacherous. The fault lay partly in the material, largely, however, in the method of treatment adopted, because the treatment that secures good results in the working of iron does not invariably answer with steel. Iron plates fail, and have failed over and over again. Yet such was the suspicion with which, until very recently, steel was regarded, that the fracture of a single steel plate was invested with far greater importance than that of many plates of iron. So great has been this prejudice that steel has been sold under disguised names—as homogeneous iron or homogeneous metal, and thus found a market, where, as steel simply, it might have failed to do so.

Every branch of manufacture demands its own special grade of steel, and the readiness with which steel of any required grade can be manufactured is one of the chief reasons why its use has become so general. The grade of steel suitable for ship plates and bridges will not serve for ships' boilers, nor for cannon, nor shells, nor for rails, nor tyres, nor tools.

It does not follow, however, that because steel is so widely used for purposes to which wrought iron was formerly applied that there is no longer any demand for the latter. It was only in May that Sir James Kitson told the members of the Iron and Steel Institute, that with the enormous expansion of the purposes to which steel is applied, there has followed a multiplication of the many special purposes for which iron is needed. Iron will never replace steel for rails and tyres, hardly for ship plates or for bridges, or for guns; but for chains, cranks, boilers, and for the innumerable purposes of the smith, in the form of rods and bars, it will hold its own for an indefinite period.

THE "BATTLESDEN" CART.

BY OPIFEX.

Good Qualities of "Battlesden" Cart—Body—Sides and Front Board—Floor—Alternative Method of Fixing Floor—"Fixing up" Body—Stays—Materials for Floor and Sheckle Stays—Painting and Jointing—Pieces to Extend Seatage—Angle Pieces—Supplementary Sides—Falling Footboard—Method of Fastening Board—Shafts—Cross Bar or Transom—Fixing of Shafts—Sockets—Springs—Iron Sheckles—Springs—Axle—Wheels—Wings—Fixing Wings—Dashboard—Mountings—Lamps—Painting—Varnishing—Treatment of Wheels—Treatment of Ironwork—Painting Inside of Body—Upholstering Back Rest—Cushions—Holes in Floor—Perforated Rubber Mat—Linoleum on Inside of Falling Footboard.

For a good, useful, commodious, and light-running trap, I know no better than the "Battlesden" cart; the family to which it belongs came first from Croydon, from which town they took their name. But the old "Croydons" multiplied so fast that many of their descendants changed their patronymic, and during the process of evolution they have in a great measure altered their appearance also, the "Battlesden" amongst the number.

The construction of this trap is simple, and well within the reach of any fairly skilful amateur, while in the hands of a good workman every item will be "plain-sailing."

The writer has built many vehicles which, upon inspection by his friends, have drawn forth such questions as "Did you really build it yourself?" "Did you make the wheels?" "How did you make these springs?" etc. etc.; and when the reply was "No, I made none of these things," it is to be feared that in some cases he fell considerably in the estimation of the questioner in his character of coach-builder.

But no builder ever does make all these, or turn out a vehicle all of which has been his own unaided work.

In the professionals' manufactory there are many hands employed in the construction of the simplest form of vehicle.

The "body maker" is distinct from the "wheeler," the smith quite a different individual from the painter, the painter from the "trimmer," and so on through the long list of hands.

But we are going to do the work of most of these men ourselves. We shall buy our wheels and springs ready made, and, having procured these, hope to have to call in the aid of the local blacksmith only in the case of a part of our ironwork, and some workers may even dispense with his assistance.

To my mind coach-building possesses a peculiar charm for this very reason: that there is so much variety, and one has to fill so many *rôles*, being, alternately, carpenter, smith, painter, upholsterer, and saddler.

But we must get to work without further delay, and the character we shall first assume is that of "body maker."

The sketch is perspective. Fig. 4 gives the reader a fair idea of what we are about to construct.

It represents the body proper, and consists of two sides (Fig. 9), front board (Fig. 11), and flooring.

To save space, we shall assume that the worker is supplied with the necessary materials, merely describing them in the directions for building.

The two sides and front board are of elm or walnut, and the shape and dimensions are indicated in the drawings, these, of course, referring to finished work, so that allowance must be made accordingly when selecting the timber and sawing it out. If the wood is of even thickness it should be chosen about $1\frac{1}{8}$ in. thick, which, when cleaned up, will be of the right substance.

The upper and lower edges of the sides are bevelled to suit the angle at which the sides are pitched, so that when in position they may be horizontal.

The front board (Fig. 11) is of the same scantling as the sides, and is secured to them by four long screws at each end, the screwheads being countersunk below the surface, the countersinkings to be afterwards filled with putty coloured to suit shade of wood.

The floor is fixed to the sides by means of screws inserted at the proper angle, at least four to each board and heads countersunk, an overlength of about half an inch being allowed at each end to form a small bead along the edge of the bottom and front board of the trap.

An alternative method of fixing the floor consists of placing a "slip" in the internal angle, to which the boards of the floor are screwed; for detail, see Fig. 19.

If this mode be adopted the floor of the cart will be flush with the lower edge of the sides; thus the body will lose a little more than an inch in depth. It will also lack the finish furnished by the bead before mentioned; this might, however, be regarded by some as an improvement.

In "fixing up" the body in the first instance great care will be called for in order to pitch the sides at the proper angle with the floor, and also that the boards of the latter may be quite square to the sides.

To ensure success in this matter it will be well to "tack" the several portions together by means of temporary stays, or light battens across the top and bottom, or by having the body stay, Fig. 14, first made; this is of best quality, half-round iron, $1\frac{1}{4}$ in. wide, $\frac{1}{2}$ in. thick, and of the shape indicated at Figs. 14 and 4, the former showing the dimensions and angles, the latter indicating the position; this stay is secured to the body by three bolts through each side, and by five bolts through the floor, two of which serve also to secure the hind step, and two the block and back spring. See Fig. 1.

The first, third, and last board in the floor, counting from the front, should be of sound ash, the sheckle stays, etc., being bolted through those portions; the other boards should be of well-seasoned red deal; and all, with one exception, being 1 in. thick, finished work; the exception referred to is in the case of the board at the extreme back, to which the hind step, stay, spring, etc., are secured; this should be of ash $1\frac{1}{4}$ in. thick finished work.

Now, an important part of our labour is before us. Great attention must be paid to painting, jointing, etc., as so much depends upon following them, especially at this point in our work.

The next items are the pieces which give additional width to the "seatage" of the trap, and to which the supplementary sides across the 3-in. pieces, and down the sides about 6 in.; these are to be fixed with stout inch screws (see sketch and Fig. 18).

The supplementary sides, Fig. 12, are of $\frac{3}{4}$-in. walnut, etc., slightly tapered toward the curved and upper portion, and are made to assume the slight outward bend by means of four stays (Fig. 13) which are of half-round iron, 1 in. wide, $\frac{3}{8}$ in. thick, and tapered in width and thickness towards the upper ends; these are secured to the horizontal 3-in. piece at points about 9 in. from back and front by two small bolts, and to the supplementary sides by four stout inch screws through each stay—heads countersunk—which, upon being screwed home, will cause the wood to assume the required outward bend.

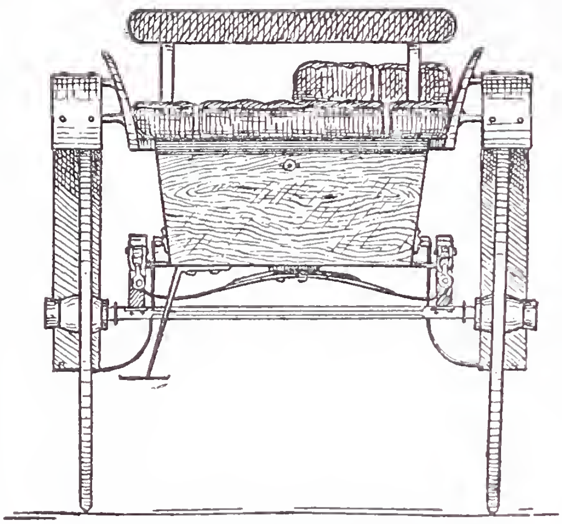


Fig. 1.—Back Elevation of "Battlesden" Cart.

The supplementary sides are also secured to the 3-in. pieces along their lower edges by $1\frac{1}{2}$-in. screws about 6 in. apart; the edges to be flush with the under surface of the floor, and bevelled to suit the angle; the upper edge should coincide with the upper edge of the 3-in. pieces.

The spring hooks used in fastening this board are to be attached to the inside of body at points about 2 in. from the top of the sides. "How," the reader may ask, "is this to be done?" This falling board is attached to the body by a pair of strong "butt" hinges, and when open is secured in position by chains, which may be covered with leather. It is fastened by spring hooks, which are attached to the body on the inside of the sides, and which pass through square mortise holes in the falling board; but there are various methods employed, among which we leave the reader to choose.

Having completed the body we next turn our attention to the shafts, which may be of lancewood, hickory, American elm, or ash. They are obtained from the timber merchant ready bent, and are usually 12 ft. long; and as in this instance there is no plate or other strengthening resorted to, they should be selected free from knots or shakes of any kind.

For this cart the extreme length of the shafts is 11 ft., 6 ft. from the point to the cross-bar or "transom," and from the point to the end socket 5 ft.

The transom consists of a piece of sound ash about 2 in. square, which extends from shaft to shaft, and is a most important item, as it supports the whole vehicle in front, serves to connect the shafts, and to it also the steps are attached. Figs. 10, 15, and 22 explain the method by which the transom, shafts, and steps are secured, and also the arrangement by which the body is hung. Fig. 22 represents the step. Fig. 15 the under plate, with bolt and nut arrangement at one end, and sheckle socket underneath.

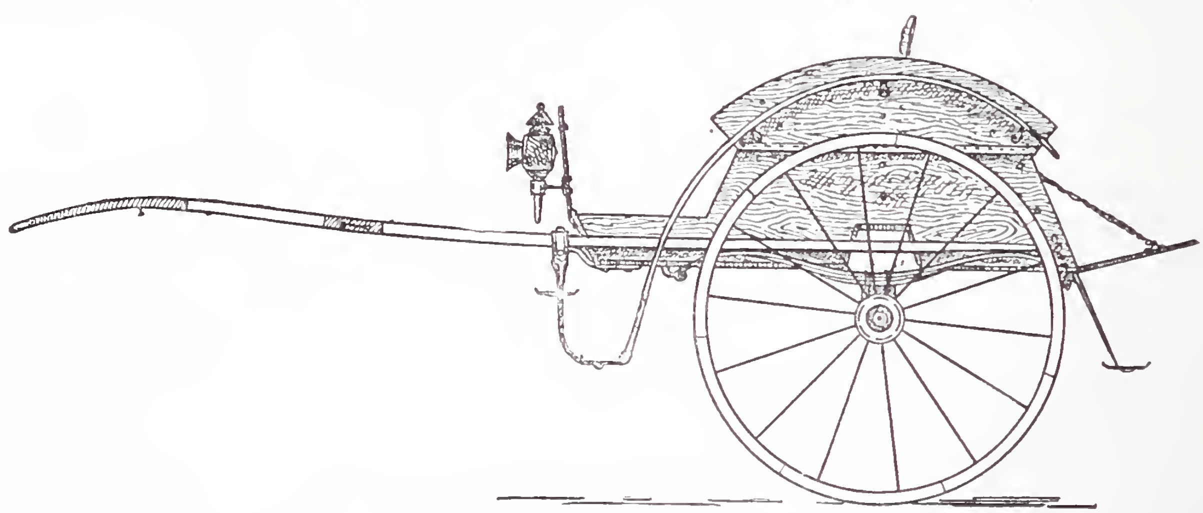


Fig. 2.—The "Battlesden" Cart: Side Elevation.

(Fig. 12) are fixed. These are of ash; the dimensions are indicated at Fig. 17, and the shape, position, and method of securing are represented in detail at Fig. 23. They are secured to the body by strong $2\frac{1}{2}$-in. screws, well countersunk in the sides, and placed about 6 in. apart.

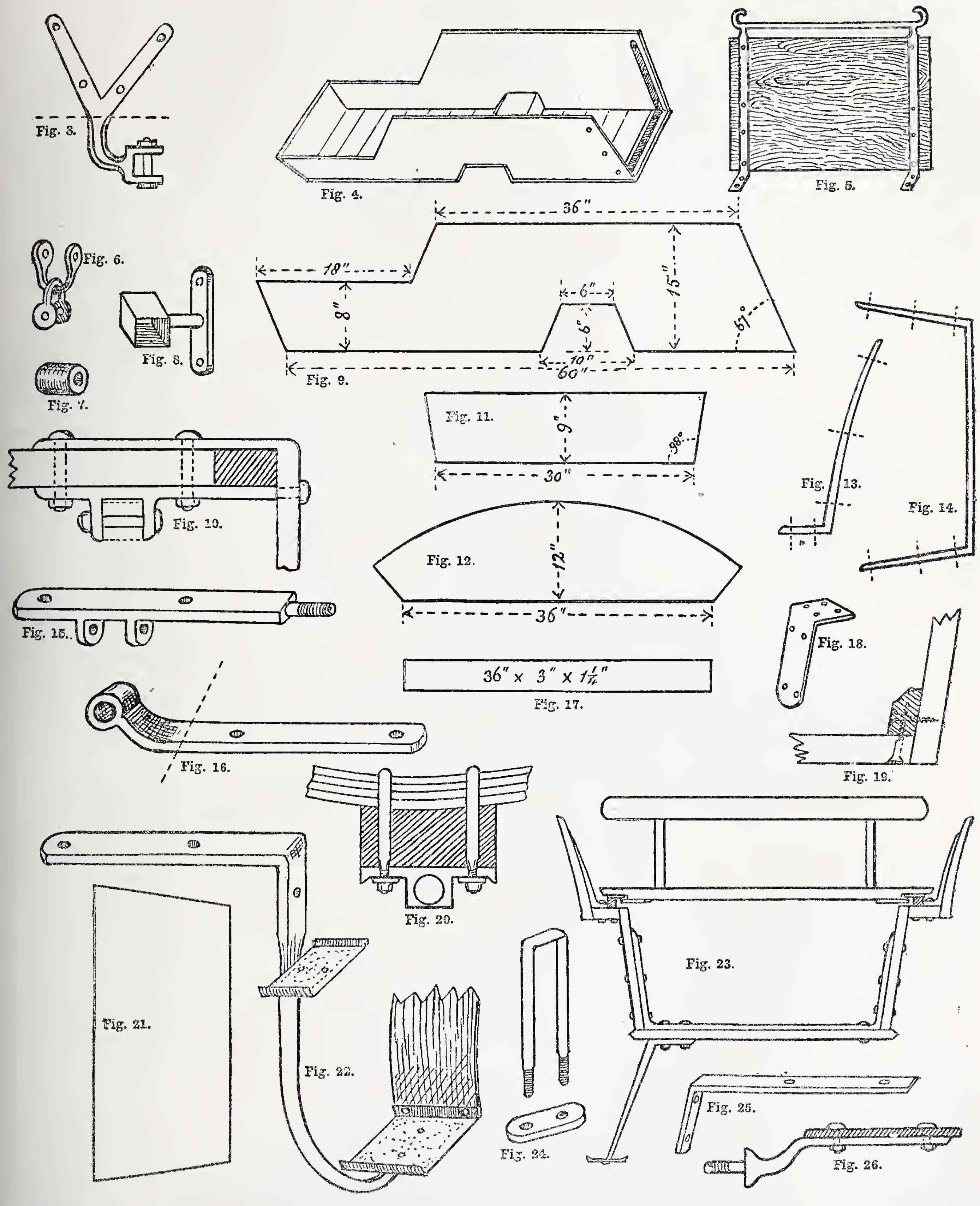
To further strengthen the attachment of these pieces to the body, it will be necessary to place small angle plates of iron, 3 in. wide by $\frac{1}{8}$ in. thick, at points about 6 in. from each end, and which shall extend heads countersunk, to be covered eventually by a brass bead, etc.

The falling footboard (Fig. 21) at back should be cut sufficiently large to allow of a projection of about $\frac{1}{2}$ in. at each side, which is to be treated in the same way as the ends of the floor and front board, so as to continue the bead; or if the alternative method suggested at Fig. 19 be adopted, then the side edges of the backboard may be merely rounded, or left square, and projecting beyond the sides about $\frac{1}{2}$ in. or $\frac{1}{4}$ in., the lower

Fig. 16 is the front sheckle, which is secured to the floor of the cart by two bolts, the "eye" being sufficiently large to allow of a rubber tube washer (Fig. 7) being inserted round the bolt which secures it in the socket.

Fig. 10 being a side elevation with section of shaft (diagonal shading), will explain, better than words, the details of this most important part of our work.

The shafts are fixed to the body at the back by means of square sockets (Fig. 8),



Details of Battlesden Cart. Fig. 3.—Front Spring Sheckle (2). Fig. 4.—Perspective View of Body. Fig. 5.—Dashboard and Mounting. Fig. 6.—Spring Couples (2). Fig. 7.—Rubber Sheckle Tube (2). Fig. 8.—Shaft Socket (2). Fig. 9.—Shape and Dimensions of Sides (2). Fig. 10.—Method of Fixing Transom Shaft and Step. Fig. 11.—Shape and Dimensions of Front Board. Fig. 12.—Shape and Dimensions of Supplementary Sides. Fig. 13.—Stay for Supplementary Sides (4). Fig. 14.—Iron Body Stay. Fig. 15.—Under Plate for Front Step (2). Fig. 16.—Front Sheckle (2). Fig. 17.—Shape and Dimensions of 3-in. Piece (2). Fig. 18.—Angle Plates (4). Fig. 19.—Alternative Method of Fixing Floor. Fig. 20.—Method of Clamping Spring and Axle. Fig. 21.—Falling Footboard. Fig. 22.—Front Step (2). Fig. 23.—Back View, showing Details. Fig. 24.—Clamp, etc. (2). Fig. 25.—Wing Bracket (2). Fig. 26.—Alternative ditto. Figs. 1, 2, 4, ½ in. Scale. Figs. 5, 9, 11, 12, 14, 17, 21, and 23, ¾ in. Scale. Figs. 3, 8, 10, 13, 15, 16, 22, 24, and 25, 2 in. Scale. Other Diagrams not to Scale.

having a shank about 2 in. long with T-shaped end provided with two holes, by which it is bolted to the body, at a point about 6 in. from the bottom or floor of the cart.

These sockets should be of best Swedish iron, and must be carefully made, the shanks being at least ⅝ in. thick. The shafts are tapered, and the corners rounded from the transom to the sockets—*i.e.*, reduced from, say, $2\frac{1}{4}$ in. by $1\frac{1}{2}$ in. at the transom, to $1\frac{3}{4}$ in. by $1\frac{1}{4}$ in. at the socket; they should also pass through the sockets and project behind them about $1\frac{1}{2}$ in., the ends being simply rounded, or otherwise finished, according to the fancy of the builder.

From the foregoing directions, it will be seen that the shafts are placed about 2 in. from the body of the cart, and are secured only at two points, viz.: by the sockets and transom, between which points they are parallel; the length of the transom will, therefore, depend upon the distance between the shafts.

That portion of the transom lying between the ironwork which is attached to it at each end should be chamfered, or it may be turned in a lathe, but in the latter case care must be taken not to reduce its thickness to less than 2 in. diameter. The front portions of the shafts from the transom forwards should be "dressed" and tapered at the points, fitted with brass, or japanned metal "tips," and covered with rather thin harness leather for the length of about 22 inches from the points; they are also fitted with "tug" stops, loops for kicking straps, etc., and trace hooks, but I leave these minor details to the worker.

The springs are three in number, the side springs being secured to the body in front by the sheckle (Fig. 3), the V-shaped ends being made to take four stout ⅜-in. by 2-in. bolts, by which the sheckle is secured to the floor.

The side springs are attached at the back to the hind springs by loops or couples (Fig. 6), and the hind spring is fixed to the centre of the piece of ash, described above, at the extreme back of the floor. Between this and the spring, a thin block of hard wood of the width of the spring, and 7 in. long, intervenes, and the whole is firmly secured by two strong bolts about 4 in. apart.

The springs and sheckles may be had of any large ironmonger or dealer in coach-building materials, and are made in different degrees of strength; the width of the plates in the present instance should be $1\frac{1}{2}$ in., length of side spring 4 ft., hind spring about 3 ft., and four leaves in each spring.

Between the springs and axle, blocks of hard wood, 6 in. long, $1\frac{1}{2}$ in. wide, and about 5 in. deep, are placed. These are shaped on the top to suit the curve of the spring, and rest upon the flap of the axle, which should be solid, *i.e.*, forming a part of it; the spring, block, and axle flap are secured by iron clamps (Fig. 24), and details of fixing are shown at Fig. 20.

The best axle is that known as Collinge's patent, which, with boxes, costs about £1 10s. Axles are sold in two pieces, and when the required length is obtained, the axle is "closed" by being welded in the middle. This is a most important matter, and should be done by an experienced hand. The best way is to get the job done at the wheel works where the wheels are procured.

The wheels required for this cart are 4 ft. in diameter, and should be of a light make. When ordering, instructions should be given to have the wheels delivered perfectly clean without paint, and free from any flaws whatever, as although slight imperfections would be of little or no consequence were the work to be painted, in the case of varnished work like the present, they would be very unsightly and cause much trouble.

The sketches, Figs. 1 and 2, will explain to the reader the shape, position, and method of fixing the wings; they are usually of beech 6 in. by ½ in., and are sold ready bent. Fig. 25 shows one form of bracket with section of wing, and Fig. 26 is an alternative and simpler bracket. The front end of the wing is secured to the flange upon the front step as indicated at Fig. 22. When attaching these, allowance must, of course, be made for up and down movement of the vehicle upon the springs, and this will depend upon the strength of the latter. The upper edges of the wings should be bevelled or chamfered on both sides and back end, and the curve should be as nearly semicircular as possible.

The dashboard, Fig. 5, should be of American walnut, or of timber the same as the sides, etc., and is 2 feet long by 18 in. deep.

The mountings, by which it is attached to the front board, Fig. 2, are represented at Fig. 5, and are of half-round inch iron, joined at the top by a round rod; but this is not absolutely necessary, and the upright irons may be rounded off within an inch of the top of the board.

If lamps are required, the sockets, usually sold with them, are welded to a T-shaped bracket, provided with two bolt holes, and shanks to be sufficiently long and curved outwards, to allow the lamp to clear the side of the dashboard, to which they are attached on each side.

The inside of the body and bottom should, on its completion, receive two coats of priming colour; the outside should be kept as clean as possible, and any marks carefully removed with fine sand-paper.

If the body is of walnut, it may be varnished as soon as made, but if of elm, it will be greatly improved by being stained a rich walnut colour; vandyke brown ground in water, with a little washing soda added, makes a good stain; it should be applied warm, with a medium-sized brush, and when dry, the work should have a coat of best carriage varnish; a very little gold size is allowable, but only a very little. All varnishing operations should be carried out in a room which is as free from dust as possible.

The wheels are not stained, but when thoroughly cleaned with fine sand-paper are varnished in, at least, three or four coats. When the first coat is dry, rub down with fine pumice and water, until the surface is perfectly smooth; wash off all trace of pumice, and when the water has dried, give the next coat; when dry, again rub down, and repeat for each coat, until the final one, which should be laid on very evenly, and allowed to dry in a place free from dust, flies, etc. When this first coat is dry, wash well in cold water, and wipe with a chamois leather, as this will help to harden the surface.

The best method of varnishing wheels is to fix a strong bar of round iron in a heavy block or beam, about 3 feet from the ground, and at a slight upward angle. The bar being passed through the box, the wheel may be made to revolve during the process of varnishing, which will be found most satisfactory.

The above remarks as to varnishing apply to all portions of the vehicle, except the ironwork. This should have first two coats of priming colour, and when rubbed down with very fine glass-cloth, should receive an even coat of "quick" black. This consists of ivory, or vegetable black, ground and mixed in turpentine, to which is added a small quantity of black japan to give "body" to the mixture, which will dry quite "flat" and harden very rapidly.

When dry, give an even coat of black japan. At this stage the parts of the vehicle may be put together, and all nuts and bolts screwed up, and touched up with black japan, when the whole of the ironwork should have, at least, two coats of carriage varnish.

The inside of the body should have two coats of some warm brown, or drab colour. The movable seats are japanned and varnished, and the cart is ready for the "trimmer."

The backrest upon the front seat may be upholstered in American leather, or any other suitable material, but much padding is not advisable; in fact, two or three plies of thick baize, or part of an old rug or blanket, placed flat, and covered with the cloth, etc., will be found more comfortable than a cushioned back; besides, it takes up less room, which is a decided advantage in vehicles of this kind when both front and back seats are occupied.

The cushions are three in number, two 18 in. by 16 in. for the front, and one 36 in. by, say, 14 in. for the back seat.

If a higher seat is required for the driver, the right-hand cushion may be made much thicker than the other, and also about twice as thick at the back as in front. Or the front seat may be fitted with a light driving box about 4 in. deep in front and 6 in. at the back; the four sides to be covered with the same material as the cushions. This box is fitted to the seat with four loose dowels or "spuds" which allow of its being removed when required.

Each front cushion is secured in position by one, and the hind cushion by two leather straps (Fig. 1).

Two holes should be bored with a half-inch centrebit through the floor near each corner in front, to allow the water to escape when the cart is being washed.

Do not cover the floor with oilcloth, which holds the water and causes the wood to rot, but use a perforated rubber, or fibre mat.

The inside of the falling footboard at back may be covered with linoleum or oilcloth, cut to fit the opening at the back of the cart, and well tacked down and fastened with the shellac cement used for laying linoleum, etc., on floors.

I now bring this paper to a close, hoping that it may prove useful to any reader who, not knowing how, may wish to attempt the construction of a "Battlesden" cart.

MEANS, MODES, AND METHODS.

In commencing this department of Work, the Editor takes the opportunity to point out that it cannot fail to prove of considerable value to the readers, and to ask them to forward to him *pro bono publico* any "means, modes, and methods" of doing things that have been tried by themselves and found to be reliable and of advantage to the user. Every recipe given will bear the initials of the sender's name, and this ought to form a guarantee for its goodness and reliability.

Waterproof Cement for Glass.

Well mix together, litharge 3 parts; white lead, 3 parts; plaster of Paris, 3 parts; powdered resin, 1 part; each by measure. When about to use the cement, make this mixture into a paste with boiled linseed oil. The consistency of the paste will depend upon the quantity of oil used in making it up. It will set hard in the course of three days, and is an excellent cement for glass aquariums, and for cementing glass to wood where this is liable to be exposed to damp. —G. E. B.

How to Ebonise Door Knobs.

The best woods for ebonising are those white woods which do not show a definite grain marking—such as alder, willow, sycamore, and holly. The bobbins, or knobs, must be first turned smooth, or else glass-papered to the requisite smoothness, as they cannot be glass-papered after they are ebonised. The process requires the use of three separate liquids:—(1) Procure $\frac{1}{4}$ lb. logwood chips and boil them in $\frac{1}{2}$ gallon of water. Soak the bobbins, or knobs, in this hot liquid for half an hour, then dry. (2) Dissolve 1 oz. of green copperas and 1 oz. of bluestone in 3 pints of hot water, and add a teaspoonful of wood vinegar. Soak the dried knobs in this liquid for a quarter of an hour, then rinse in clean water. (3) Dissolve 2 oz. of common soda or potash in 3 pints of warm water. Immerse the knobs in this liquid for a few minutes, then dry. The first liquid will stain the wood a brownish-yellow tint. The second liquid will change the tint to a blue-black. The third will fix the tint as a dead black. Nutgalls do not improve the first liquid if the logwood is good and the liquid freshly made. Run the knobs or bobbins in a lathe when quite dry, fill in with white wax, and polish with a piece of linen canvas, or duck. They may be varnished, if so desired.—G. E. B.

Writing on Zinc Labels.

Zinc labels are used by gardeners and foresters to label their plants and trees. The names of the plants may be written on the labels with any ordinary black ink, but this is liable to be injured by the weather. A more permanent ink for this purpose is made by dissolving platinum bichloride in rain water, and adding to this a few drops of muriatic acid. The ink may also be made direct from platinum foil. Procure a wineglassful of muriatic acid and half a wineglassful of nitric acid, and mix them in a porcelain dish or saucer. Place this on the hob of the stove in a chimney corner, with a good draught to carry off the noxious fumes. Place in the warm acid mixture from five to six grains of platinum foil or fine platinum wire. The platinum will dissolve in the warm acid, and when this is completed, keep up the heat until all the free acid has evaporated, leaving a thick liquid similar in colour to treacle. This, when cool, will crystallise to a red mass. Dissolve this in a wineglassful of rain water, when it will form the amber-coloured writing fluid. Clean the labels bright, and write on them with a quill or gold pen. The writing will become a deep black as it dries, and then cannot be easily washed off. A cheap substitute may be found in a strong solution of copper sulphate, but the writing from this is not so black or so permanent as that from platinum.—G. E. B.

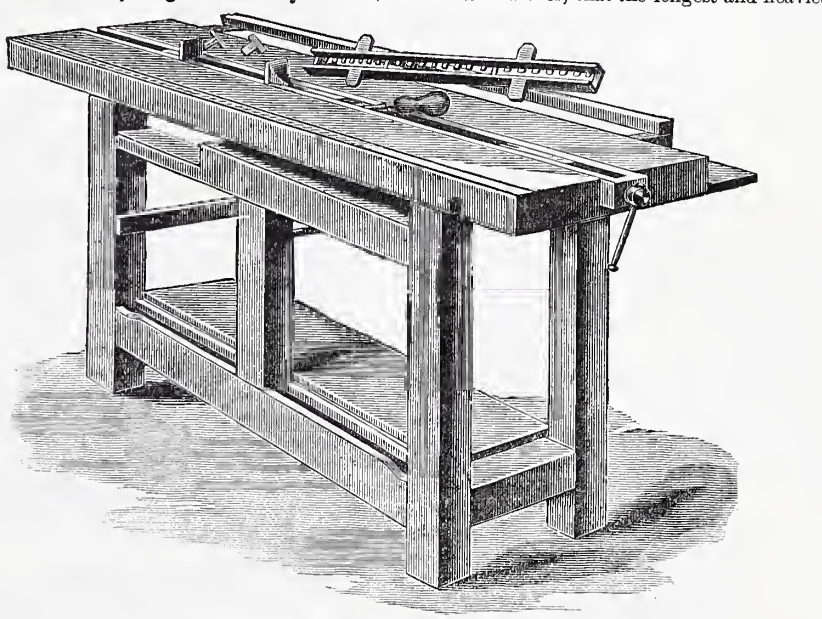
OUR GUIDE TO GOOD THINGS.

68.—Lister's Patent Screw Holdfast and Cramp Combined.

The accompanying illustration affords a representation of a New Patent Screw Holdfast and Cramp combined, invented and manufactured by Mr. F. Lister, 40, Beckett Street, Leeds, which is used in connection with, and forms an adjunct to, the ordinary carpenter's bench. I have not seen the actual appliance at work, and therefore I cannot speak of the invention from actual experience; but from a small wood model before me, which shows fairly well its construction and action, I am inclined to think that it will be found a most useful and serviceable means of carrying out the purposes which it is intended to serve.

The general relation of the Patent Screw Holdfast to the carpenter's bench, and the manner in which it is fitted to it, will be seen from the illustration given herewith. It is composed of various parts, fixed and movable, the fixed portion being a hollow casting of malleable iron, which traverses the whole length of the bench from end to end, and can be made of any length to suit any size or kind of bench that is used by joiners and cabinet makers. The casing is hollow, being formed of a bottom and two sides, each side being rebated, so as to leave a projecting flange along the top of each side on its inner surface, within which the parts about to be described can work backwards and forwards as desired. The upper end, or end most distant from the operator, is open in the model to admit of the entrance of the fittings. The lower end is closed and pierced to receive a screw, which is worked to tighten or release the grip of the jaws of the appliance when brought into play. The bottom is pierced with two rows of square recesses or holes, so placed as not to be precisely opposite each other, but in alternation, so that each hole is partly opposite the hole in the other row, and partly against the solid material which intervenes in each row between each pair of holes. This casing, it may be said, is placed in and along the centre of the top of the bench in such a manner that the top of the casing may be flush with the surface of the bench. Within the casing, work up and down two carriages furnished with jaws, to grip anything that may be placed between them. The top of each carriage is flush with the top of the casing itself and the surface of the bench; but the jaws project above casing, carriage, and bench for obvious reasons. The carriages are both movable along the casing, and that which is placed at the top of the bench is furnished with a catch which can be depressed or raised at pleasure, and is used in order to secure the carriage and the jaw it carries in any part of the casing by pressing the catch into the recess or hole nearest to that part of the recess at which it is desired to fix it. The action of the catch, it may be said, is such as to hold the jaw immovable. The second carriage intervening between the bottom of the bench, or end nearest the operator, and the carriage at the upper or more distant end, is in itself longer than the carriage at the top end, and is capable of being lengthened still further, the extension being regulated by means of a suitable screw. This carriage is also provided with a catch that is raised and depressed in the same way as the catch attached to the carriage at the top. "It can also be provided with as many stops as may be desired, according to the work required." I am now quoting from the maker's description. "These stops are placed into grooves, and they can be made to slide and stop at will, when they lock the moment you cease to slide."

The invention is certainly remarkable for its great simplicity, and the ease with which it can be worked. It is claimed for it that it completely supersedes the German bench screw, and provides a substitute for this which is in every way superior to it. Further, that the longest and heaviest pieces of work can be cramped and held in it with as much readiness as the smallest pieces, and that you can work and bevel short or long lengths of wood with the greatest ease when held in the cramp. The quickness and facility with which the cramp is applied, tend, moreover, to lessen the time and labour generally employed in cramping up; thus rendering it of value and importance to all who work by piecework or contract. For this reason employers will find it a most useful adjunct to the benches in their workshops, and amateurs who are without such an appliance will find it to their advantage to adopt it. It should be said that there is a centre jaw which can be introduced between the top and bottom jaws as may be required when dealing with short lengths of wood, or taken out and put at the lower end of the bench when cramping large work. Every particle of the Patent Screw Holdfast and Cramp is of malleable iron, except the screws, which are, of course, made of steel, and have square turned threads.



Lister's Patent Screw and Cramp.

The price of this useful article complete, with three sets of jaws adapted for different kinds of work, is 35s., carriage paid. To save inquiries, I had better add that, at present, it is to be had of the inventor and maker only. Every one, without dispute, knows his own business best, but it seems a pity that he keeps the sale of this bench appliance in his own hands, and does not, as far as I can see, push its sale among dealers in tools. The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

**** All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Log and Deal Frames, and their Advantages.—A. R. (*Scorrier*) writes:—"As I have written a little on the working of circular saws, perhaps a few remarks on frame saws will be acceptable by those who have little or no experience in the working of them. The frame saw has been in use a great number of years, and no doubt many men understood the working of it even before the circular saw was introduced. Yet though there is not near the practice or skill required to work the frame saw satisfactorily, many are ignorant as to the proper working of it. Some are of opinion that the timber should be fed to the saw when it is making the down stroke, which is a mistake; others think that the saws should be perfectly upright, which is a much greater mistake. All timber, whether it be a log or deal fed in log or deal frame, should be fed just after the saw or saws commence to make the up stroke, so that the timber may be stationary, to take the thrust of saws when making their down stroke. Again, should the saws be perfectly upright in making the up stroke, they will bring up the sawdust and choke the saws, consequently they become heated, and will run out of truth. All frame saws should have a lead—that is to say, the top of saw should overhang the bottom; the amount of lead should be governed by the length of saw. A good lead for saws in cutting soft wood is about $\frac{1}{16}$ in. to the foot in length of saw; a much less lead will do for hard wood; this lead will allow the dust to fall freely instead of being brought back into the cut. Again, the keying of the saws is of importance. Some men when they have a hammer in their hand, and commence to hammer, are like children, they don't know when to stop, and keep rapping away until they do some mischief. When a frame saw is strained enough it will give a sharp sound, when the hammering should at once cease. Many are not content with this sound, and keep rapping away until the saw, if soft, gives away in the rivet holes, and if it is hard or rash it breaks. Again, the saws should not be overfed; the feed should vary with the depth of timber and the number of saws at work; the deeper the timber and more the number of saws, the slower should be the feed. There are many advantages that the circular saw has over the frame saw, yet the frame has its advantages. We will suppose we have a large round and crooked log of timber to be sawn into 1 in., 2 in., and 3 in. planks; if sawn with circular saw on the rack bench, the diameter of saw has to be great and the plate thick, consequently a lot of power is required to drive it, and after every cut the log has to be brought back and moved, and so set as to cut the plank its proper thickness; and at the same time perhaps the log is far from being steady, which is very annoying. But it is not so when sawn in the log frame; the log is so clamped that it cannot move, and should there be six, eight, or more cuts to be made, the number of saws can be put into the frame and the log sawn to the number of planks required by passing through the machine once. The same with the deal frame: the number of cuts required is made at one and the same time, and if deals are very deep can be sawn with less power than could be done with circular saw, therefore you will see that where one saw could be worked to an advantage the other would be to a disadvantage. I hope these remarks, though brief, may benefit some of our readers; and I hope in a future issue to write a little on band saws, of which I have had some little experience."

About WORK.—R. B. R. writes:—"After taking WORK from the first, and reading it carefully, I am shocked to see what subjects you are taking up. It would just be fair on your part to give a lease of half the space that you take up with wood and devote to iron and steel. What I say is for the welfare of WORK, as I hear lots grumbling about the space you are taking up with burglars' alarms, papier-mâché, and "Monarch" Play Chair, etc. It looks very like as if it was an advertisement paper. I hope you will see the errors that I point out, and get a paper on something that is useful to practical men."—[I am sorry you are so easily shocked. It takes something of an entirely different character to shock me, and even then the shock is never very severe, as I have given up being surprised even at the letters I get from men like yourself. Perhaps you will be almost annihilated to hear that some men in a large upholstery establishment were wishing the other day for more cabinet making. "Every man for his trade, you know;" and "What is one man's meat is another man's poison." Scores and hundreds of practical men pat me on the back, and the patting amply makes up for the scratching. I cannot please everybody, unfortunately, so I rest content with pleasing the majority and—myself.—ED.]

The Scratch or Bead Router.—C. E. F. (*Boro', S.E.*) writes:—"Every man who tinkers at a bit of amateur work now and then will be glad of your present publication, WORK, and if he does not see anything in any particular number which may bear on the particular hobby of the time, still his general knowledge of mechanics must surely be considerably increased, and widened by a carefully conducted course of reading in your new technical journal; but quite apart from his wider ideas of general construction, I feel sure that we shall all, sooner or later, find the exact thing that we want, and have, or fancy we have, been looking for for some time, as the following will show. Some years ago I bought a large and handsome bookcase, from which, however, the sides of the cornice had been cut away to enable it to be placed in a recess. I tried in vain to match the moulding, but except at what I considered a very outrageous price could not get any one to undertake the job, so gave it up in despair. However, about three weeks ago I was sitting at tea, when I spied a short article about 'Scratch Moulding Tools' in your Magazine, and immediately jumped up crying 'I've got it.' The result was that I got a piece of 19 gauge sheet steel, and with three cutters which I made with files, and mounted, as your correspondent suggested, I succeeded in about six hours (three evenings) in producing 8 ft. of moulding, of which I enclose you a section as an example. I may say that the section is just as the cutters or scratchers have left it, and has not been touched up in any way. You can imagine my delight in selling my bookcase, finished at so small a cost. You are quite at liberty to publish this if you think fit."—[I publish your letter with pleasure, and heartily congratulate you on your success with the scratch. The bit of cornice sent shows that you have done a very creditable piece of work. The writer of the article was with me when your letter reached me, and was much pleased when he read it to think that he had rendered one reader at least good service. I trust you will find much in WORK from time to time that will be useful to you, and that your letter will enlighten some of those who appear to think that WORK is purposeless and hopeless, because it is not exactly in accord with their own peculiar notions on the general fitness of things.—ED.]

Home-made Planes.—BERT writes:—"Having been interested in the article on home-made planes and E. P. W.'s remarks, I think that he is quite right in his idea in having a piece over the mouth of the pattern. I have made two or three dozen of them myself. I am an iron moulder, and I find that to cast them with the mouth left open not only causes them to get hard but causes them to warp, being weak in the middle. And another thing I notice, the writer is very scanty with the taper, as most pattern makers are. He says the merest trifle will do. Now, I say it is not enough; if he wants a clean casting he should give a little more taper, then a moulder has a better chance to get his pattern out without shaking any of what we call the cod down—that is, the inside of the pattern—and if that is left intact he can depend on a good clean casting. I have taken WORK since the beginning, and I am very pleased with it. I see you mean to go in for all trades, but I have been wondering if you will go in for ours. I have taken in two or three journals, but none reached as far as that. If you could give a little about the working of a cupola, it would be very welcome to not only me, but some friends in the trade who take in WORK every week. I may add here that I succeeded in making a table of Mr. Adamson's design in No. 1 of WORK. I hope that my suggestions will not be considered offensive."

A Wood Worker's Eulogy.—C. N. (*Sherburn-in-Elmet*) writes:—"I will briefly introduce myself to you as a practical wood carver and fret cutter, it being seventeen years since I commenced to learn that art. I am a regular subscriber to WORK, and intend taking it weekly until some unlooked-for cause should deprive me of the necessary copper for its purchase. I have read all the articles on wood working, and I conclude they are a credit to the writers, and will considerably help great numbers of wood workers, both practical and amateur. WORK has not come out a day too soon. There has been great need of a paper of this kind. The papers I have taken before on wood working, etc., have not been as clear as they should have been; their articles have been too short, and as a result of this many men have been unable to understand them, more so the amateurs. Better far have one long and continued article, and that article understood and useful, rather than a lot of short useless articles, which are really a puzzle to the amateurs. How different are the articles in WORK. When I read them I can almost imagine the practical hand is executing the work before my eyes, they are so clear. No wonder, Mr. Editor, so many thank you for and wish WORK success. I have been going to write to you several times, but have held back, so that others might air their views. But after reading the article by F. Miller on wood carving in No. 13, I can refrain no longer. The designs are very good, and I take this opportunity of thanking F. M. for the pains he has taken to instruct in the art of designing. I shall benefit by the instructions, and I shall eagerly look for more. I am a poor designer, owing to my parents being unable to afford sending me to a school of art, and I thus missed tuition in drawing, which I now feel the need of. In the course of time I hope F. M. will contribute some designs for antique carving, such as panels, pilasters, and mouldings. I am afraid I have encroached too far on your space. Therefore I will conclude by saying I recommend WORK to all wood workers I come in contact with, and I wish WORK unbounded success, and may health, happiness, and God's blessing rest on all its staff."

Utility of WORK.—D. C. (*Marsden*) writes:—"Allow me to add my testimony to the value and worth of WORK. I anticipate for it a very useful career in future, and am expecting to cull from its pages much useful information and pleasure; it is just such a paper as I have been looking for a long time. I cannot tell you how delighted I was when I came across WORK accidentally at a newspaper stall when I was hunting for some such books or papers as would give me the information I was then seeking. I am very pleased to find that WORK is likely to supply all needed information. I am anxiously looking forward to the promised articles dealing with camera making, joinery, and cabinet making for beginners. I hope these last-named articles will deal with and show how to make good strong kitchen chairs, square tables with leaves or without, bookcase, and other useful articles of household furniture for a working man's home. I can assure you that I have been very much encouraged to write to you because of your cheerful and encouraging replies to your various correspondents, and especially for your very feeling reply to H. D.'s (*Bury, Lanc.*) queries, because my own circumstances are very much akin to his. My means are limited; I want to use them to the best advantage to myself in purchasing tools, etc., hoping to receive the same consideration at your hands as other correspondents. I wish every prosperity to WORK."—[A very good bookcase has been given, and others will follow. Everything mentioned in your letter will be touched on as speedily as possible, and good strong furniture of a plain character will not be neglected. Any special information that you require will be supplied whenever you may ask for it; but I do not notice anything in the above letter that requires more than a general answer.—ED.]

About WORK.—W. H. H. (*Bradford*) writes:—"I write to support the views held by T. J. H. (*Trowbridge*) and J. P. A., and expressed in your issue of June 8. (1) I quite agree with all T. J. H. has written, especially about the cover. I cannot imagine why you refuse to put WORK in a cover, unless it is that you think that if we got a cover we should want it made into an insurance policy. (2) I thought when WORK was first published it would form a good companion to the 'New Popular Educator.' I do not think so now; I do not consider it worth a more valuable binding (in its present form) than I could make myself from reading 'Binding made Easy.' One page out of every eight being advertisements, the other seven so amateurish, one has scarcely patience to read them. (3) I am a painter. The sign writing articles are very good, and well written, but far too elementary. I ask you, do you think there is any one who would buy WORK and be interested in its pages but what has got past the elementary stage? (4) I do hope, with a new volume, you will alter WORK considerably, taking for your model the 'Popular Educator,' and inserting in it good articles that would be of some use to others than amateurs. 'Or (to quote J. P. A.) before long you will not be able to number a practical man in your subscribers.' (5) I think you printed Fig. 27, border in dead gold for papier-mâché work, upside down. If so, perhaps you will correct the mistake.—[(1) Unfortunately you altogether mistake the functions of an editor, who is responsible only for the matter supplied in a magazine, and not for the form in which it appears. Curious as it may seem to you, I have really no more to do with putting or not putting WORK in a wrapper than you have. (2) Of course you must please yourself about the binding, and if you please yourself you will please me. WORK and the "New Popular Educator" are not modelled on the same lines, and there never was, and never will be, any thought or intention of doing so. They are as different in their constitution, aim, scope, and purpose as chalk is to cheese. Again, if fourteen pages were advertisements, and two text and illustrations, the arrangement would be altogether beyond my control, but with the fourteen pages of text and cuts you get value, and very good value too, for your penny. As to the "amateurish" tone, kindly remember that WORK is not a trade organ, but is intended for "all workmen, professional and amateur." (3) Yes; you are a painter, and find Mr. Benwell's papers on sign writing "very good and well written, but far too elementary." The great mistake made by many who know their own trade thoroughly is that because they themselves do not require elementary instruction nobody else does. As a painter you often have to climb a ladder, but I do not think you would be satisfied with a ladder that had a few rungs at the top only, the rest being all left out. We must all begin at the bottom, and even you would begin to recognise the value of the elementary rounds in such a case as that which I have just mentioned. As to the question you put to me with regard to the readers of WORK, let me tell you that I *know* that the magazine is largely bought by lads and young men just beginning practical life in the workshop. More than this, I have been told by a workman who takes an active part in Sunday teaching that sixteen lads in one school, with which he is concerned, and nearly as many in another, are buyers and readers of WORK. (4) I am afraid your hope will not be realised as far as considerable alteration, such as you contemplate, is concerned. When the second volume is reached I confidently expect that there will be even more practical men among its readers than there are now. (5) You are perfectly right in supposing that Fig. 27, in page 185, is presented upside down, and in accordance with your request I "correct the mistake," which will sometimes happen in dealing with cuts of this kind.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Jewellery Colouring, Soldering, etc.—YOUNG AMATEUR (*Douglas*).—YOUNG AMATEUR cannot colour his brooch as it is, for the process of (wet) colouring is not used in a general way for any quality less than 15 ct. gold, whereas he has soldered a 9 ct. catch on to a fine gold brooch with silver solder. Colouring is a process in which the surface of the article coloured has its alloy (silver and gold) taken out and the fine gold left. Consequently as silver solder is just the very material that colour acts on, the whole will be eaten away, and the 9 ct. catch will drop off, even if it be not destroyed as well, as it is very likely to be. Perhaps, to save further bother, in this case the brooch had better be electro-gilt. But as it is possible that others may have got into a similar muddle, I will give the method that I should follow, were the brooch put in my hands to do properly. First get rid of all the silver solder—for that we place the brooch in nitric acid; try nitric acid and warm water (1 part each) at first, and add acid until you see it works. This ought to eat all the solder away in an hour or two. But this is only to be done if your brooch is better than 15 ct. gold, and if it has not been soldered together anywhere else with common solder. Yes, I know YOUNG AMATEUR says his brooch is fine gold; but that title is often given to 12 ct. gold in a jeweller's shop window, and it is just possible that AMATEUR, being also young, has taken that as his authority. Most "jewellers' materials" shops now keep gold and silver and solders, so you can either send for some from Gray & Son, Clerkenwell Green, E.C.; Calipé, Poland Street, Oxford Street, W.; or King, St. John's Square, Clerkenwell. Now make your catch of 15 or 18 ct. gold, and solder it on, if a plain, solid article, with solder made thus:—15 ct. gold, 1 pennyweight; fine silver, 3 grains; fine copper, 1 grain. Or thus—Fine gold, 13 grains; fine silver, 6 grains; fine copper, 5 grains. If it be rather a light and thin affair you might try this, which is the commonest I use for coloured work:—22 ct. (that is, the same as sovereigns are made of), 1 dwt.; fine copper, 2 grains; easy silver solder, 10 grains. Melt the first two all together, but if you make the last, melt your gold and copper first, and add the silver solder when they are in a fluid state, and don't forget to use a fair amount of borax (to the last one especially), and also remember that it will not stand being melted more than once, as the zinc in the silver solder will go off (become oxidised, I think, is the chemical term). See that your brooch is scraped clean, and the catch too, where you are going to solder them together. After soldering, etc., polish your catch and brooch, then get it clean and quite free from grease. I prefer to anneal the articles when I can, and let them get cold by themselves, and black. Now tie the brooch on to two or three horsehairs (you can use platina or gold wire if you like, but there is no advantage in so doing), and it is ready to colour. I shall simply give the plainest directions to colour a plain article. First we must have ready some boiling water and a basin. Secondly, some colouring mixture well pounded up and thoroughly mixed, and in quantity sufficient to three quarters fill your pot, which for regular work is specially made of black lead, but for only an occasional job the ordinary crucible is good enough, and much cheaper. The ingredients are—Saltpetre, 2 parts; lump alum (not burnt alum), 1 part; salt, 1 part. The quantity you must judge for yourself by the size of the pot, which should be at least ½ in. wider halfway down than your work is. Add a little water to it—don't cover it all up with water—say, until it looks damp all through, and set it on the fire, heat it slowly, and stir it up occasionally with a piece of wood or iron, until it boils up; then put your work in, and keep it there for several minutes, moving it about all the time, in order to give every part of the colour a chance to do a little work; if it boils dry too soon, add just a little hot water, and put your work in again until it gets of a dark colour; this you can see by dipping it in some of your warm water in the basin. When it is dark enough—and only experience will tell you that—you must weaken your colour by adding hot water to it; then when it boils up again redip the brooch until it becomes of the rather pale yellow colour that fine gold has. The whole process from the time of boiling up the colour should not take longer than from ten to twenty minutes. Rinse it well, and it is ready for finishing, either by the scratch brush or burnisher, or if Etruscan work or a coin it may do as it is. One word more, and that is—single articles rarely colour well; a good bunch of them and a good size colour pot is what is preferred by H. S. G. To clean up jet work, a little powdered rottenstone, whiting free from grit or rouge well rubbed over it, will bring up the polish again. If the work is plain, use the ball of the thumb and whiting, and don't be afraid of rubbing hard and rapidly; if it is shaped you will have to use a brush, lap, dolly, bob, or whatever tool will get at the parts, and subject them to the friction required; then wash with soft brush and soap and water.—H. S. G.

Wood for Violin Making.—F. J. C. (*Brockley*). writes for the information of FIDDLER (*Highbury*):—"Your correspondent will be able to get this in any quantity, and at a moderate price, at J. Thibouville-Lamy, Musical Instrument Makers, 10, Charterhouse Street, E.C."

Indiarubber Stamps.—C. S. P. (*Greenwich*).—The name or inscription, whatever it may be, is first set in ornamental type or plain type, as may be desired, and a cast of the type is taken in plaster. Vulcanised indiarubber in a state of fusion is then run into the cast, and a facsimile of the type in a yielding material is thus obtained. The stamp is afterwards mounted. Of course, various appliances are required for carrying out the process; but to go into these would require a special paper, and you only ask to be told how they are produced.

Frame for Wardian Case.—W. P. (*Southport*).—The frames or astragals for cases made in wood are similar to window astragals for window sashes, a section of which is shown in Fig. 1. Astragals for corner uprights are made as shown in section in Fig. 2. The glass is set in and bedded with putty, the putty bedding being shown in each figure by dotted lines. An example of each kind of astragal, in which the glass can be set without putty, is shown in Fig. 3. The uprights are made without a cut-out cheek for glass, a saw draught equal in width to the thickness of the glass being sufficient to slip the glass into, the same being removable by unscrewing the vase finials shown at the top of the corner astragals in Fig. 4, which is the front elevation of a plain and simple wardian case in wood. These finials are filled with a double screw, one end of which enters the finial itself, and the other the upright astragal. The framing at the top of the glass is held down by the finials.

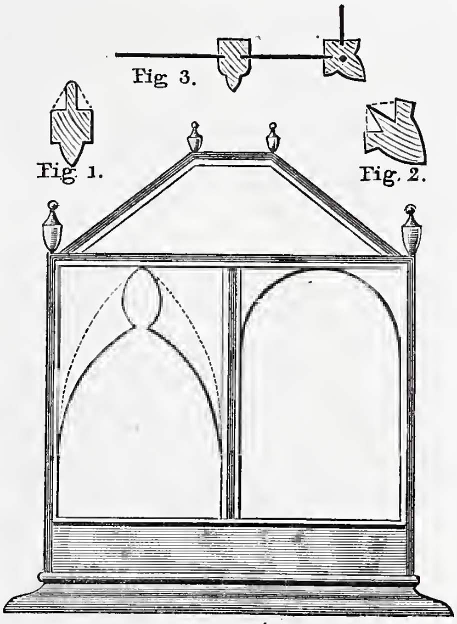


Fig. 4.

Etching Names in Cutlery.—J. W. (*Crooks, Sheffield*).—Your letter has been sent on to J. W. C. (*Walkley*).

Colonial Mouldings.—E. D. H. (*Tranmere*).—For chief importers refer to Kelly's London Directory, or apply to Gus. Rochfort, 29, Basinghall Street, London, E.C.—F. J. C.

Pocket Technical Guide.—P. J. (*Burnham*).—The price of Beaton's book, published by Crosby, Lockwood, & Co., is 1s. 6d.

Protecting Papier-Mâché Joints from Sea Water.—BOFIN (*Galway*).—Before this is read our correspondent will have become aware that his present question is answered with his former one. If the solution of gutta-percha which we recommended will protect the paper from the action of sea water, it will, of course, protect the glued joints also.—S. W.

Small Casts in Plaster.—W. R. (*Mile End*).—Directions for working even "small casts" must, to be of any use, be longer than could well be given in "Shop," especially as W. R. does not mention the kind of objects from which he wishes to cast; but we shall hope, before long, to give him full information on the subject in the other columns of this paper.—M. M.

Combination Lathe and Fret Saw.—J. H. S. (*Braishfield*).—I take it that you want a machine or tool for real work. The Britannia Company's No. 3 is certainly a useful tool in the hands of a practical man, and the price is low; but as you are an amateur in wood working, I would advise you to go a step further, and try the B. C.'s 4 in., and if so, you will find results more satisfactory, which is the great desire of both amateur and professional. This would also apply to your question respecting the fret and circular saw action, as attached to the lathe for steadiness. The amount of vibration given off and the want of power in roughing down a piece of wood in a 3-in. lathe is often a most discouraging start for an amateur, as also disappointment in the result.—G. E.

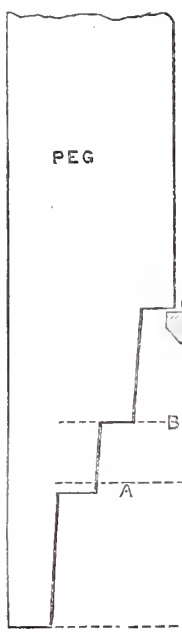
Joints and Cabinet.—R. M. W. (*Burnley*).—Don't apologise for troubling me. Letters such as yours are not regarded in that light. The desire is to make WORK useful, so that practicable suggestions and encouragement are always welcome and cheering. I am glad you, among others, have found the friendly hints to amateur wood workers helpful. Mr. Denning, to whom your thanks have been conveyed, has papers on both the joints you name in preparation, as well as other topics of a similar character, all of which, no doubt, you will find of assistance, and your "sincere hope" is cordially re-echoed. The cabinet, by which, if I am right in thinking, you mean the piece of furniture commonly known among cabinet makers as a nest of drawers, will have attention at an early date. In case you do not understand what a nest of drawers is, I may say it is a kind of square-cornered pedestal fitted with drawers only. These run from side to side, and are usually secured by one lock fitted on a hinged style to the right of them. If this is not the kind of thing let me know, and I will see what can be done to meet your wants. In any case I think I may safely promise that sooner or later a description of whatever the piece of furniture you wish to make will appear in WORK. Why not send me a rough sketch or diagram of the article? No matter how roughly drawn, a sketch often shows more plainly than any description what is really required, and when the subject seems likely to be of general utility, you may be sure that arrangements will be made for a paper on it. I am pleased to hear you are making one of the tables described in No. 1, and I trust it will come up to your expectations. Thanks for your good wishes.—D. B.

Cement for China Mending.—JEUNE ÉCOLIER (*Capel*).—We question whether anything short of rivets will mend china, so as to be safe under the rough handling it will have in constant use. White lead will resist boiling water, and make an exceedingly strong joint if sufficient time is given to it to set thoroughly, which will be a matter of weeks. It needs to be used neatly, as any smudge on the face is not easy of removal when hardened. The advertised cements are numerous; we have not tried the "Coaguline" mentioned. For mending china for ornamental purposes only, we know of nothing better, stronger, neater, more cleanly, or easy of application, than isinglass dissolved in acetic acid. Any one can make it himself, or buy it ready prepared at fancy shops. It is sold under different names as "Diamond Cement," and at the Soho Bazaar, London, as the "Soho Cement." The bottle containing it is placed in a cup of boiling water to liquefy it, the broken edges warmed, and the cement applied to both with a camel-hair pencil. It sets in about twelve hours. China thus mended should, however, be washed in cold or moderately warm water only—not boiling.—M. M.

Banjo Making.—R. Y. (*Canning Town*).—The best and most useful size to make your banjo will be one with an 18-in. finger-board and a 12-in. hoop or drum. By making your instrument to this size, if you wish to tune it to and play with piano, or any other instrument tuned to concert pitch, you will be able to do so. If you make the finger-board or neck any longer, you will not be able to tune it up to such a high pitch, and if you were to try to do so, you would find your strings would not stand the strain, and would break, which would make banjo-playing a rather expensive luxury, if you tried to pull it up to pitch very often. The exact measurements are—the hoop 12 in. diameter, 2¼ in. deep, or you could make it deeper if you chose to, but I should not recommend it to be made any shallower than the size I have given. Length of finger-board from the end that fits against hoop to the nut, 18 in. The nut is the small piece of wood or ivory, etc., that is grooved into the finger-board at the end where the peg head falls back, and in which notches are cut to keep the strings at equal distances apart. The distance from nut to thumb-string peg will be 6¼ in., and 6¾ in. to the small piece of wood or ivory that you will put in to carry the thumb-string. Length of peg head from nut, 5¼ in.; width of finger-board at nut, $1\frac{3}{16}$; at thumb-string peg, 2⅛; full at end; where neck butts against hoop, $2\frac{1}{16}$. These are exact measurements taken from an instrument made to be played on, and not merely for show. A great many 7-stringed banjos sold by music sellers are made with the finger-boards too narrow, making it impossible to finger the strings, and play some of the chords properly, therefore if you are wise you will work to these measurements I have given. Let the bridge stand on vellum about 3 in. or 3½ in. from edge of hoop. If my answer to your query is not sufficiently clear, or if you require any more information, I shall be pleased to put you right on hearing from you again (through Editor).—J. G. W.

Die Stamping.—BON FIL (*Birmingham*).—You do not state whether you possess apparatus and material for this work or no; if not, you must procure them before you can obtain even a glimpse of success. A press is essential, and cards and gutta-percha to make counterparts cannot be dispensed with, as great pressure has to be exercised, and the simple die cannot do its work unaided. You can obtain of Messrs. Hughes & Kimber, West Harding Street, Fetter Lane, London, E.C., anything that you require for the purpose, and the plant will cost you from £5, and upwards. I do not, however, think that your brass dies will be of much use, as I suspect they were originally cut for seals. If that is the case, don't expect from them more than impressions in which the ground is coloured and the engraving white, technically termed cameo stamping, or perhaps only white impressions called plain stamping. You might colour those impressions, according to the laws of heraldry, by hand, for die stamping in colours necessitates a separate die for each colour, and I imagine you do not contemplate going that length. I would also mention that steel dies are invariably used, which are cut in accordance with the style of stamping required. For plain and cameo stamping the die is cut to give an impression in high relief, and a cameo impression is obtained by passing a colour roller over the face of the die. On the other hand what is called relief stamping is akin to copperplate printing, inasmuch as the engraving is more on the surface, and lines are employed for shading. To obtain an impression from a die so engraved, colour is brushed into the incisions, and the face of the die is wiped clear of ink; the lines are thus left full of ink, and consequently only the parts that are engraved appear impressed upon the paper. Any further information I shall be most happy to give with the editor's permission through the medium of "Shop."—J. H. M.

Watchmaking: How to Pivot a Cylinder.—COUNTRY WATCHJOBBER.—The simplest way I know is as follows:—Take a peg, cut the bottom



flat, and rest on the bottom jewel hole; cut a step or notch, A, where the rim or band of scape wheel comes; another, B, the height of scape teeth; another, C, just free of top of scape cock; place the peg on a new cylinder and see if suitable for length by resting top of notch, C, where the balance is to go, and notch B halfway down pallet, and A in centre of space of cylinder. The bottom of peg shows where the shoulder of bottom pivot should be; cut off the plug, leaving suitable length for pivot; take off both end pieces, screw on cock, and take length by gauge and cut off top plug to it, leaving a little over for rounding off when finished. To gauge the size, if you have no cylinder gauge use the pinion gauges. The plugs are merely fitted tight and driven in. For running in cylinders I fill them with sealing wax or shellac; and for other jobs, half beeswax and half resin make a very useful wax, as it requires but slight heat to put on or off.—A. B. C.

Violin Carving Tools.—I hasten to correct an error which appears, *re* sharpening carving tools, in No. 11; in the last sentence the word *tool* should have been *oil stone*. If the fault be mine, please accept my apology for making such a blunder, and, if possible, insert correction in next issue.—B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Indiarubber.—PERPLEXED (*London*) writes:—"Will some reader kindly tell me how to make such a thing as a glove of indiarubber, similar but a trifle stouter than the children's common air balls before they are blown out? It must be elastic enough to pull it on and off without tearing."

Cake Firelighters.—J. C. (*Dundee*) writes:—"Would you inform me, through your valuable paper, where a machine can be got for the manufacture of cake firelighters, and the materials employed in the manufacture of the same?"

Tuition in Carpentering.—AMATEUR (*Bayswater*) writes:—"Would you kindly inform me in your issue, whether there is any institution or place where a person desirous of learning carpentering might get some elementary practical knowledge?"

Incubator.—B. F. (*Liverpool*) writes:—"Can any reader give me a plan of a simple incubator, with particulars, for me to make at home? I have a large square tin box, which might come in for it, and can use the soldering iron."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

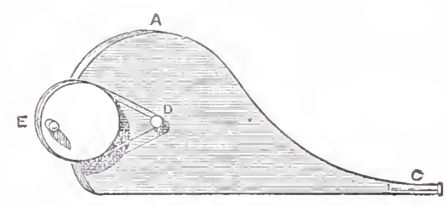
Fretwork Patterns.—MESSRS. CHARLES CHURCHILL & COMPANY, Importers of American Machinery (21, *Cross Street, Finsbury, E.C.*) write:—"*Re* Fretwork Patterns and W. E. M. in your issue dated June 1st. The book is one of our series, No. 4, 2s."

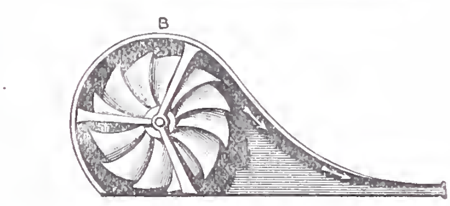
Fretwork Patterns.—W. H. J. C. (*Highbury*) writes:—"In No. 11 of WORK (see page 174), I note that W. E. M. wishes to ascertain the publisher's address of a pattern book on fretwork. I think I can give him that information, as, strange to say, I was at work on the first pattern of the book when I received my last copy of WORK. The book is Part 4 of an American publication, published by John R. Bowman, 40, Beekman Street, New York, at 50 cents (Part 4), and is very cheap, I consider, for the price; the only drawback is that no explanations are given for putting the patterns together, a fault with some English editions. If W. E. M. wishes for some really good and artistic patterns, I should advise him to get No. 10, published at 2 dols. One of the patterns I have forwarded to you out of No. 10 book. I cannot close this without wishing WORK a great success, for I think that it will be the means of brightening many a home by its very plain and intelligible articles on home decoration. I am not a mechanic by trade, but I spend my leisure time in fretwork and picture-frame making, and with the help of your valuable paper I intend starting on some article of furniture. I also hope that you will give us amateur fretworkers a few patterns now and again, something less elaborate than that cabinet issued with the first edition, which was a splendid pattern, only rather too difficult for me at any rate."—[You shall have some simpler fretwork designs.—ED.]

Moulded Indiarubber.—J. writes in reply to OSLEK (see page 190):—"David Moseley & Sons, Chapelfield Works, Ardwick, Manchester, can supply them."

Colouring Photographs.—F. H. Y. (*Kentish Town*) writes in reply to EXPECTANT (see page 174) on how to colour photos with water-colours:—"I think I can help him a little if he carries out the following directions: Rub the photo over with calcined preparation of magnesia, and use gum arabic and water to mix his colours."

Machine for Current of Air.—A. H. (*Wolverhampton*) writes in reply to BELLOWS (*Gloucester*) (see page 190):—"Seeing in 'Shop' an inquiry on how to make a machine for an intermittent current of air, I beg to submit the drawing herewith (if you can understand it). A is the apparatus complete, the sides being of wood, and the point, C, of brass. Inside as seen at B is a fan, which may be made of tin, and is worked by a





small pulley, D, and a wheel, E. If you wish I can, another time, give a fuller description."

A Pronged Ring.—J. writes in reply to E. C. (*Battlemore*) (see page 190):—"Harrison & Co., Malleable Iron Works, Lincoln, is a good firm."

IMPORTANT PRIZE COMPETITION.

THE Editor of WORK has the pleasure of informing his readers that Messrs. CASSELL & COMPANY, LIMITED, have placed at his disposal the sum of

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Full particulars of the Scheme will be found in WORK No. 17, page 254.

Trade Notes and Memoranda.

THE citizens of New York are becoming painfully aware of the fact that the complex conveniences of civilised life in a big city are fraught with danger. Not a day passes without a break in the mains of the Steam-heating Company, which supplies both heat and power to the principal buildings in the city. The pipes form a perfect network under the streets, and owing to the enormous pressure of steam, constantly explode with a loud noise, hurling fragments of stone and quantities of mud, mingled with steam, into the air. The steam for that particular quarter of the town in which the explosion occurs has then to be shut off, leaving many of the establishments destitute of motive power. The gas mains also are put together so defectively that there is an enormous escape continually going on, so that the subways of the electric companies become invaded to such an extent that the men have to use great precautions when going underground. Disastrous explosions sometimes result from a break occurring in the electric conduits, which break produces an arc, so igniting the waste gas. In one of these which occurred recently in front of the Fifth Avenue Hotel, 200 feet of the pavement was torn up. Again, the overhead electric light wires which carry a powerful current often break, and have caused the death of several men and horses who have come into contact with the broken circuit. At the present time the relations between the electric light and the telegraph companies and the municipal authorities are somewhat strained, owing to the refusal of the companies to lay their wires underground as demanded by the municipality.

WORK

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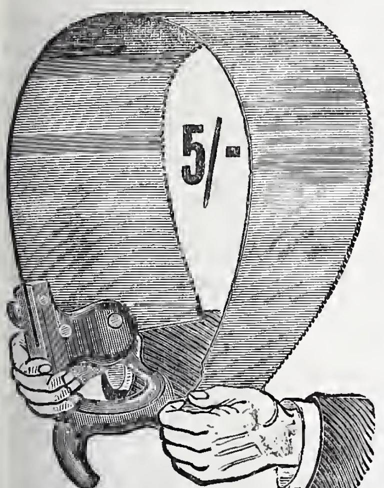

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—NO. 20.] SATURDAY, AUGUST 3, 1889. [PRICE ONE PENNY.

A SUMMER-HOUSE OR GARDEN CAVE.

BY C. MAYNARD WALKER.

A SUMMER-HOUSE! "One of those sweet retreats which humane men erect for the accommodation of spiders," says Dickens. However true that may be, the writer in the following instructions will be unable to lay down any plan which will prevent these and other interesting insects from sharing the occupation with the owner. But Charles Dickens was not the first to discover this co-tenancy, for a very ancient philosopher, "good old Solomon," wrote thousands of years ago, "The spider layeth hold with her hands, and is in kings' palaces." However, these drawbacks notwithstanding, a summer-house of some sort is considered by most people a very desirable acquisition to a garden, more especially by London people, some of whose suburban edifices of this kind "are fearfully and wonderfully made," and present, when finished, admirable specimens of "patchwork;" and it is not until the intelligent observer has seen one of these that he has any idea to what extent a couple of empty egg-chests may be utilised in building operations.

The object of the writer in the present article is to give such instructions as will enable the reader to erect a substantial and commodious apartment, upon a novel plan, at a very moderate cost, even though he may never have tried his hand upon similar work before; in fact, I don't think any one can possibly go wrong in the matter, and for those who possess it, there is ample scope for the exercise of considerable artistic taste in the work, and moreover, the rough and perhaps clumsy work of a beginner is rather pleasing than otherwise in its effect, especially as Nature herself will give the finishing touches in due time. Fig. 2 effectively and graphically illustrates the appearance of a garden cave constructed upon this plan, and consists of a framework of galvanised iron wire netting laced to upright iron rods driven into the ground a few inches, and covered with rustic rockwork, formed with Portland cement and sand and ordinary rough gas coke, and is adapted to the requirements of a small garden. The dimensions, of course, may be varied indefinitely, but it is necessary that they should be decided upon before the work is commenced. Let us suppose that it is decided to have a rustic building, whose extreme height is 8 feet, constructed to stand alone (and let me say this kind of building should not be placed as a lean-to against a wooden wall or fence, or against any support which is not rigid), we shall require to set out a rough plan with pegs on the surface of the ground it is to occupy; I prefer to see an irregular polygon of, say, six sides of different widths.

In such case, it is necessary first of all to measure out the ground as in Fig. 3, regulating the width of the sides by the measurements of the galvanised wire netting, which you can obtain at any available shop; the wire netting should be of large mesh for obvious reasons, and it is moreover cheaper. Having settled this point, you will now

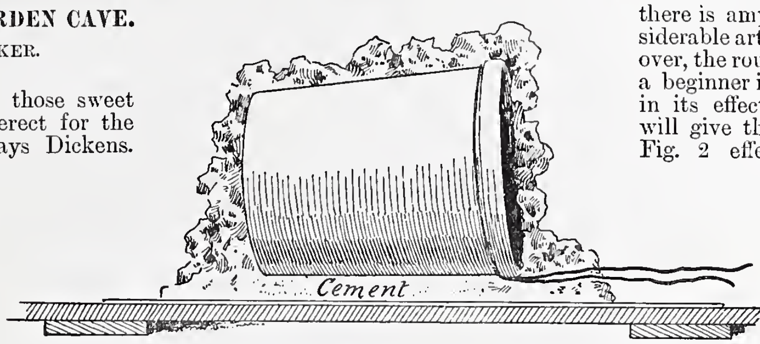


Fig. 1.—Section, showing Method of Making the Pot Pocket.

Fig. 2.—External View of Summer-house or Garden Cave.

require to set up six lengths of $\frac{3}{8}$-in. iron rod at the points indicated in Fig. 3. These should range from about 5 ft. 6 in. to 7 ft. 9 in., so as to produce an irregular appearance, and then a complete cage is to be formed over sides and roof with the galvanised wire netting laced to the iron rods with iron tying wire, the upper portion of these rods being carried crosswise to the highest point on the roof.

Take care that the whole of this caging is securely finished before attempting the next stage; the entrance or entrances must also be provided by cutting an irregular piece of wire netting out from one or more of the sides. Inlets for light here and there

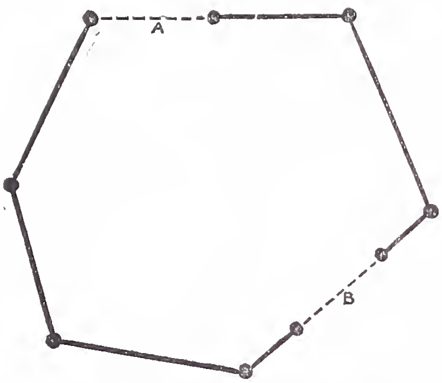


Fig. 3.—Plan and Position of Rods: A, B, Entrances.

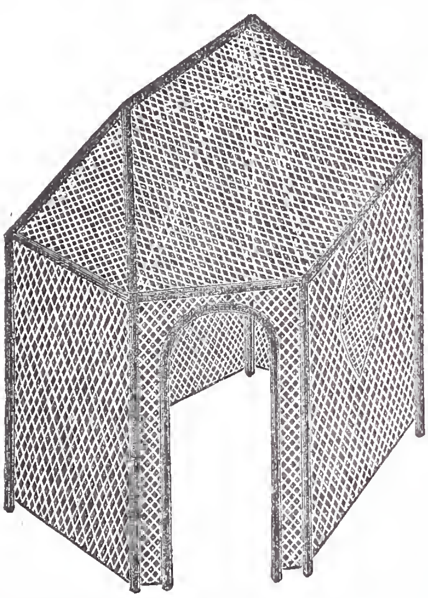


Fig. 4.—Iron Rods Laced with Netting on Irregular Hexagonal Figure.

may also be made in the same way. A charming effect may also be made in the finished cave by placing on the roof part at the highest points pieces of blue-tinted glass before making the rockwork. A most pleasing illustration of this effect may be seen in the Alhambra Court of the Crystal Palace, Sydenham.

With the view of making the summer-house or garden cave of still greater use, it will be well to provide it with a number of external pockets in which to grow ferns, flowers, or creepers; these should be made at this stage. Take a flower-pot, as in Fig. 1, and secure it round the rim with a piece of stout wire, leaving a convenient length of the latter; lay it on its side on a piece of board covered with paper, and having a layer of cement, and cover all over the surface of the pot pieces of coke well cemented together with Portland cement and sand. The coke for the whole of the work should be dipped in a thin batter of cement before use. Make as many of these pockets as are required, and put aside until quite set, when they can be secured to the wire netting by the wire, and left exposed for that purpose.

Having done this, the building up of the cave may be done. Having a good heap of cemented coke ready, and a bucket or slab of cement well mixed up with sand and water—about 1 part cement to 2 parts sand—one person should keep on mixing up the stuff well, while another cements the work. This should be done with a trowel. Take each piece of coke singly, and lay it so that a portion of it *goes into* the mesh of the netting, and see that each layer and every piece is well cemented, and as the work proceeds, every bit of the wire netting is hidden, and forms part of the rockwork, by going over it again from the inside; leave the roof part for a few days, and this will be much more substantially and neatly finished on the inside by temporarily fixing some boards under, and within about $\frac{1}{2}$ in. of the wire netting. Cover this with paper, so that it will hold a layer of cement laid on from the top, then when the coke pieces are laid in this and through the meshes, set hard, and the temporary boards removed, you will have a neat, secure, smooth surface on the under part of the roof. The form of roof being angular also gives it greater strength when cemented up.

The work of preparation is by this time all but finished, and having cleared up all the inevitable mess, the worker will probably think that the colour looks rather raw. Nature will change all that in due course, but a temporary tinting of the projectives may be done *sparingly* by mixing some boiled oil and colour, and lightly touching up the surface with shades of brown and green. There remains now nothing but the seats to be provided for, which may well consist of planks fastened to uprights of wood staked into the ground. An irregular border bed all round the base of the summer-house, except the entrances, will add very much to the pleasing effect, stocked, of course, with suitable plants. I think that the worker, looking to the substantial and tasteful character of the erection, will agree with the writer that he has succeeded in building a commodious and useful house at a most moderate cost.

THE WATCH: HOW TO CLEAN AND REPAIR IT.

BY A PRACTICAL HAND.

In this, and in papers to follow, I propose to describe the various watches in general use, plainly and concisely, showing how to take to pieces, clean, and repair them—at least, the repairs which an intelligent amateur can do. I shall keep as much as possible from using the trade names of the parts, etc., so as not to mystify, seeing I am not writing for those already in the business, as they will receive full information and experience in their apprenticeship by those under whom they serve. My object is to make the watch a pleasant study, and, as a rule, all intelligent men or women look upon a watch with a degree of wonder and delight, as a thing of beauty to be admired. I, though thirty years in the trade, feel, when undertaking to put a watch (so dirty and out of repair) into order again, that it is next to restoring life. An amateur, then, after his first attempt upon some old timekeeper, may well feel a glow of pleasure on its commencing to tick once more, and by his own handiwork. Many attempt such work, but on account of not knowing how to proceed properly, take some part to pieces, forgetting the spring, which being in full force, as the watch may have stopped by dirt, the consequence is smash goes one or two pinions—cost, two dollars to replace, and never as good as the original ones. By following the instructions, no one with fair care need have any such mishap.

The Watch.—This word is derived from the Anglo-Saxon word signifying "to wake;" and in the sense of timekeeping first occurs in a record of 1542, which states: "Edward the VI. had onne larum, or watch, of *iron*, case being likewise of iron gilt, with two plummets of lead"—in other words, it was driven by weights. The invention of the watch originated at Nuremberg, 1417, so that watches were nicknamed Nuremberg eggs. Many curious designs were made, some in the form of a skull; the top part opened with a hinge, showing the dial, where the brains were located. Catherine I., Empress of Russia, had a musical watch, in the inside of which were the Holy Sepulchre and Roman Guards; by touching a spring the stones moved away from the door, angels appeared, and the holy woman stepped into the tomb and sang the Easter hymn of the Russian Church. In the Swiss Museum is a watch $\frac{3}{16}$ths of an inch in diameter, inserted in the top of a pencil case. Its tiny dial not only indicates hours, minutes, and seconds, but also the day of the month. The watch of Queen Elizabeth of England—a great curiosity—may be seen in the Mayers' collection of the Liverpool Free Museum; and all the old style of verges, etc., down to one of the smallest and handsomest Swiss productions. Also in the Guildhall, in London, various forms are shown—the old alarum watch, repeating ditto, and those having "catgut cord," from the spring barrel to the fusee, in place of our modern chain, to give impetus to the wheels. They are shown in order of date when in use; so are the old grandfather brass dial, carved cased clocks. To me, and thousands of others, they were a great source of interesting thought of bygone ages, picturing the care bestowed upon them by the wearers, who would a couple of hundred years ago pull them out of their deep fob-pockets and look with reverence as they denoted the time, in a manner that an apprentice would scorn nowadays. Like Captain Cuttle's watch in "Dombey and Son," that required to "be put back half an hour in the morning, and a quarter of an hour in the afternoon; then *Waller*, my boy, it will do you credit." Those old verges were well finished, and as they have such a good coat of plating upon the movements, at the present day many thousands of beautiful perforated cocks (or covers to the balance wheel) are worn as brooches, necklets, etc. etc. Then the silver used in their unwieldy cases was of the purest quality. I can well remember the old men who used those verge watches undoing the outer case, or cover, and placing it on their left thumb until the watch was wound up, with solemn gravity! At the beginning of the present century they were regarded as heirlooms, and handed down from father to son. "The big auld watch, yance my father's pride."

The last thirty years watches have become very common, even down to schoolboys; but the market is flooded with rubbish not worthy of the name of watch, and, like "Pindar's razors, made to sell." They are minus jewels, finish to wheels, pinions, etc., and with untempered springs. Such cause a vast amount of trouble to those who have to clean or repair them, and, worst of all, are costly to the wearer, who in time pays the original price in repairs. The best and most reliable watches are made at Clerkenwell, in London, taking all things into consideration, durability especially. I know many desire to give preference to the Waltham watch, but that matter was freely discussed a few years ago, across the water, and the decision was in favour of Clerkenwell.

It is astonishing how a well-made and finished Swiss watch will wear and keep the best of time, though it is minus the fusee wheel and chain that English ones have. Many that I have worn, and tried well, kept accurate time, and I could rely on them equal to any lever, though only horizontal movement. One I had—a Swiss lever—went the most accurate of any watch I had in my lifetime, keeping time to my satisfaction, and better than a gold English centre seconds costing £20. Its price was only £3. But for those who have hard work, or who are careless in using a watch, they are unfitted; a hunting-case Waltham or English lever would be the best, and prove a good investment in the end. Having a watch cleaned yearly in the fall, to pass through winter, clean and unclogged with dirt or oil, also to wind it regularly every night, hanging it up in position worn during the day, will give the best results. Sometimes hanging up and sometimes laying down will cause variation, no matter how good. Try it. By regularly cleaning, and not running them until they will run no longer, you will increase the durability of the watch. You may say, Why? Well, simply because the holes get ground in time to an oval shape by dust and dirt. Some men will boast: "My watch has had nothing done to it for three or four years." They are only showing their own folly. In the next paper I will show how to clean and repair the verge watch.

JOINTING UP—FOR "'PRENTICE HANDS."

BY DAVID ADAMSON.

PLAIN GLUED JOINTS (*continued*).

IN my first paper on this subject I showed what was necessary to be done in order to make a perfect joint, but space prevented me from bringing my remarks to a close at that time. I hope, however, to be more fortunate on the present occasion, and to find room to finish all I have to say on the plain glued joints, which after all forms the first section only of my theme.

Carlyle's well-known definition of genius may be applied to the artisan by slightly altering it, for it is quite certain that the best workmen are those who are most largely gifted with the capacity for taking pains. Even in "jointing up" much care may be, indeed, must be, taken if the work is thorough. The good practical workman takes all precaution to make it so, bestowing an amount of care which the clever amateur who is so handy knows little of. May I, without seeming ill-natured, just suggest to these latter, that they would get many valuable hints if they would be content to learn and listen respectfully to any practical mechanic, instead of trying to teach him, as so many do. Excuse the hint, my friends, who have done a little joinery, or as you may think it, possibly, a great deal. We won't cavil about the magnitude of your operations; but the probability is, that any artisan did more before he was "out of his time" than you would do in a lifetime. The skilled artisan, therefore, naturally resents advice from amateurs; but, on the other hand, is generally willing to assist in friendly conversation. You, the clever amateurs, generally know too much, and the bench hand is so well able to gauge your capacity that he does not care to waste his time by giving you information or discussing matters with you. He is certainly not the loser, and neither will you be if you approach him properly, and are willing to profit by his experience.

Is this little bit of plain speaking too straight for some of you? I hope not; but if it seems somewhat severe let me say that I have had some experience with amateur workers and with journeymen; and in writing these lines it is my desire to help the former by showing them how they may learn from the latter; at the same time, perhaps, indicating why their efforts to get information from practical mechanics may not have met with much success. There may be, and, doubtless, are, churls among these as in every other path of life, but I may with confidence say that the practical mechanic is by no means so reluctant to convey information, or to talk about his particular craft, as he is sometimes represented to be. I should say, perhaps, that I refer specially to cabinet makers as I am best acquainted with them, and though they are, from the nature of their work, among the highest class of craftsmen, I imagine others are not unlike them. They will resent instruction from those not competent to give it, for here in the workshop the tool handler is master of the situation, and he is by no means ignorant of it. Therefore, amateur, whether young or old, whenever you get a chance of seeing a good workman at work keep your eyes open and watch. You are sure to learn something. It has been said that women and fools should never see unfinished work, and there is no doubt that many men come under one or other of these classes—they must decide for themselves which, when they enter a workshop, by offering their valuable "suggestions." Let them keep these back, and they will be as welcome as they are the reverse when they don't. Once more I hope these remarks will be taken in a friendly spirit, however awkwardly they may have been given, and, if acted on, I am convinced that the hostile feeling sometimes said to exist towards amateurdom will be greatly diminished, if not removed altogether. But we left the boards while referring to the feel of a perfectly made joint, and, of course, if they are found to be all right, nothing more is required except gluing together. It is, however, extremely unlikely that the edges will be so truly "shot," *i.e.*, planed or worked up, as to be in contact at all parts. If they rock, from one or both being planed away more at the ends than in the middle, do not attempt to glue them; but if the boards meet at the ends, but not towards the centre, then if the space is not great no great harm will result. Look upon absolute contact at ends as indispensable; but though the same may be of advantage throughout the entire length of short pieces, it is not necessary, indeed is not advisable, for long pieces. The space must not, however, be great, not more than enough to put the contact at the ends beyond a doubt. Perhaps the best way of conveying a notion of the hollowness of the edge towards the centre, will be to suppose we have a couple of boards 5 or 6 ft. long, with edges perfectly true. Now with the plane remove a shaving or two, just the suspicion of one at its commencement, a few inches from the end of the board, till there is, when the boards are placed together, a perceptible space between them tapering from the centre to nothing near the ends. Even at the widest the space must not be so great that it cannot be closed by pressure of the cramps, within which the boards will be placed while the glue is setting. This is really all that it would be useful to say about planing up the edges, and much will depend on width, length, and other qualities; but, to sum up briefly, it may be said that the edges of short pieces should be "shot" straight, while long pieces should be hollowed towards the middle. Now for gluing the joint. Let the glue be good, freshly and properly made, hot, with cramps and wood handy, so that the glue, when rubbed in, may have no time to harden while getting ready for fixing the two pieces together. No precise instructions can be given for every possible case. Short pieces may not even require cramping, and a few general instructions will probably be sufficient. Practice varies, and I have no wish to name one procedure and ignore others. One great matter is to have the edges of the board warm, so that the glue does not chill as soon as applied, but remains liquid and sticky. They must not, however, be too hot, but there is not so much danger from this as from being too cold. Do not put too much glue on; a very thin coat well rubbed in is all that is necessary. If one piece is held by the bench screw, it may very possibly happen that the glue has hardened on it, or at least is not in its most adhesive state when the other is put to it. There might be a slight film on its surface, and, of course, this prevents it adhering as well as it might to the other piece. Well, just let this be sufficiently warm to melt the glue again, and the adherence ought to be perfect. It will thus be seen that the glue may, or may not, be rubbed on both pieces. When placing the glued edges in contact, do not be content with simply pressing them together, but having brought them cleanly together, slide them slightly against each other, lengthwise, using as much pressure as convenient. This expels any air, as well as a good deal of the superfluous glue, the presence of which, were it suffered to remain, would be fatal to a good joint. It then only remains to cramp the two pieces together, and let them remain till the glue has thoroughly set, when the boards may be worked on as if there were no joint. It may be news to some that a properly glued joint ought to be stronger than the natural wood, that is to say, on splitting a board by bending or pulling it ought, except perhaps in the case of some tough woods, to split at any part rather than at the joint. With ordinary pine or bay wood, if the fracture is along the joint, depend on it that the workmanship or the glue is at fault. Should such a disappointment await the novice who applies this test, it must not be overlooked that all glue must be removed before applying any more; in fact, the joint must be "shot" afresh. Attention will next be turned to the dowelled and tongued joints, but these must form the subject of a future "chat." Meanwhile, a little practice in planing up edges will not be wasted.

JAPANESE MOTIVE FOR PANEL IN FRETWORK.

BY E. BONNEY STEYNE.

To obtain new effects in a method so limited as fret cutting is less easy than it looks, especially if the taste of the designer forbids attempts at purely pictorial renderings of common objects, which, in spite of their popularity (if we may judge from their frequency in trade catalogues), surely contravene ever recognised laws of fitness. For in fretwork even the art of silhouette presentation can hardly be employed as felicitously as in black-and-white design upon paper. In pen-and-ink work the clear definite edge of the design is valuable beyond question to express any simple form; but in fret cutting the thickness of the wood itself insists upon being seen, and consequently destroys the clean exactness of the outline. Then, again, the contrast between the cut-out wood and its background is hardly likely to be as definite as in a printed silhouette; even though the wood be black and the white pure white, the cast shadows will come in and confuse the pattern.

Bearing in mind these limits, it is doubtful if such a design as this one given here can be strictly defended. In it an attempt has been made to conventionalise, after the manner of the Japanese, a subject that is very popular with those wonderful decorators. That the design in any way approaches the beauty of true Japanese art dare not be said, but that it is not quite so abjectly hideous as many a widely-diffused travesty of that inimitable school of ornament the limner humbly hopes. To cut a thing that shall vaguely suggest a landscape out of wood is not easy. "Would that it were impossible," do I hear you say? Very well; you can leave it still undone, and so assist in making it so. But if a rococo treatment of a square panel is desired, and if a somewhat distantly removed view of Fusi-yama, from the frequently-recurring native treatment of that sacred mountain, is not too gross a breach of good decorative taste, I beg leave to submit it with a thousand apologies. In flatly treated painting this typical presentation of certain forms, easily recognised as clouds, moon, mountain, water, flowers, etc., may be used with unquestionably pleasant effect; but in cut-out wood—unless the wood be very thin, and the saw very truly and rigidly kept to its exact line of cutting—I fear the result may be not quite so good. Yet if I understand the noble ambition to do something fresh, that characterises the supporters of WORK, they will be ready like many worse, ay, and even a few better, men (if, indeed, such could be found) to pardon its faults in view of its one virtue—unexpectedness.

Japanese Motive for Panel in Fretwork. (Scale, half size.)

For future use such a panel may form one side of a hanging lantern, the cover of a blot book, the upright back of a bracket, the door of a small cupboard, or a hundred kindred purposes. It may be left untouched by stain or polish, but only, I think, if in self-coloured wood with no vividly prominent pattern. Should the wood be mahogany or oak, it should be stained or gilded to avoid the conflicting lines of design and natural marking of the grain; either tending to destroy the force of the other.

The Japanese rarely use fretwork without a low relief carving of its surface. To put it less correctly but more vividly, it is pierced carving they favour to the exclusion of what we imply by fretwork. The fret ornament of their marvellously intricate lattice-work panels is veritable joinery, and built up of small bars of wood, not saw cut.

But a series of actual patterns from the land of the Rising Sun were lately given in these pages, and this proof of my own admiration for such, with its evidence in the attempt to rival the beauties of the original in a disrespectful parody, is English, you know, quite English. But let us be sure that the work so freely lavished upon our ornamental trifles is as good as the Japanese finish. It seems to me that ornament should never be used, unless it is good of its sort; a well-finished piece of cabinet work, exquisitely neat in its construction, is far better left unloaded by vicious ornament. But if the ornament is applied let it be well worked, for wood carving vigour and bold sweep of its curves, with the parts well massed, are more important than precise accuracy. But in fret cutting, which so narrowly escapes the reproach of being mere mechanism, and can only by very capable use be raised to the dignity of an art at all, extremely dainty finish is not only pleasant but absolutely necessary to atone for the intrusion of a pastime like the craft of the schoolboy in honest cabinet making. Therefore, for all such work used to adorn a larger structure grudge no labour, use fine saws, keep conscientiously to the line of the pattern—the whole line, and nowhere but on the line—going as fast as the Flying Dutchman if you can, but never leaving the line. Then let the file and sand paper be used unsparingly. And if your design is a good one, and the tracing itself geometrically true, and a duplicate, if not an improvement on the published pattern—if all these items are done well, little fear but that the whole will be well done.

SOME LESSONS FROM AN OLD BUREAU.

BY DAVID ADAMSON.

(*Continued from page* 279.)

WRITING FLAP OR LID: ITS CONSTRUCTION—HINGES—TREATMENT OF INSIDE OF LID—VENEERED BORDER—LOCK AND ESCUTCHEON FOR KEYHOLE—FITTING OF INTERIOR OF DESK—ORDER OF FITTING PARTS—MUNTINS FOR BACK—PANELS FOR BACK—FINISHING—HANDLES FOR DRAWERS—LINING—HOW TO PASTE IT TO WOOD.

THE writing flap or lid may next be attended to as being the next part of our work. It consists of four pieces forming a frame, and a panel fitting into it. The frame is mortised and tenoned at the corner, where it should also be mitred, as this looks better than if the shoulder were left square. As the combined mitre and tenon may not be understood by those not well up in carpentering, the mitred end, with the tenon, is shown in Fig. 19, first in perspective, then in plan and elevation. It will be as well that the tenons should be on the ends of the two long pieces of the frame, those which form the back and front of the lid. Grooves must be prepared all round the inner side of the frame, and a corresponding tongue round the panel, so that the whole may be closely fixed together firmly and neatly. I do not know whether it is necessary to say that the whole of the lid must be flush on both sides—*i.e.*, the panel should not be sunk below the framing. At the ends and front of the lid a rebate must be made, that when closed it may rest on the ends and top without having the clumsy appearance it would present if left to its original thickness. It will be noticed that the inner top is shown in Fig. 4 (page 116) slightly below start of slope in order to allow for this rebate, which may be about ½ in. in depth. The top piece of all is also shown bevelled for about half its thickness in continuation of the slope of the ends for the same reason, as the front or top of the lid when closed should not project above the top piece.

The lid when finished in the wood is fastened to the bureau, with a couple of hinges sunk on the upper side of the lid and (inner) top. These hinges may be the sort specially made for desks, or the ordinary "back flaps" may be used. In either case they are fitted in the same manner, as they are to all intents and purposes the same in everything except proportion. The inside of the hinge must be uppermost to allow them to fold properly, and in case the projection of the knuckle above the table is objected to, the ordinary card table hinge, which, however, is hardly so suitable, may be used.

Next comes the treatment of the inside of the lid. This may either be polished or lined, preferably the latter, as the leather or cloth gives a pleasanter surface at which to write than the hard wood. The lining, however, must not be done yet, and it is only mentioned here as it is usual in tops so finished to have a veneered border. This border may be of any width, but should hardly exceed 2½ in., and it may very well be dispensed with altogether. Still for those who prefer having it, it may be stated that it can easily be laid with glue, the surplus of which should be thoroughly pressed out. The grain of the veneer should run in the same direction as that of the panel—viz., parallel with the length of the flap. The veneers should be damped on the upper surface before laying, otherwise the moisture from the glue will cause them to curl up. To lay such pieces the veneering hammer is generally used, but a good substitute may be found in a piece of wood applied to them with pressure, and worked along to squeeze out any excess of glue. Should this and any air bubbles not be properly pressed out, blisters will be formed. These, if suspected after the veneer is laid and dry, may easily be detected by tapping, or if they are very bad by merely passing the palm of the hand over the surface. The best way to lay them is to prick a small hole in the veneer, and then to press it down with an ordinary flat iron or a hammer head heated sufficiently to soften the glue, but not to burn it or the veneer. On the whole, however, it is hardly well for the amateur without competent guidance and practical demonstration to attempt veneering.

Fig. 19.

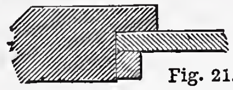


Fig. 21.

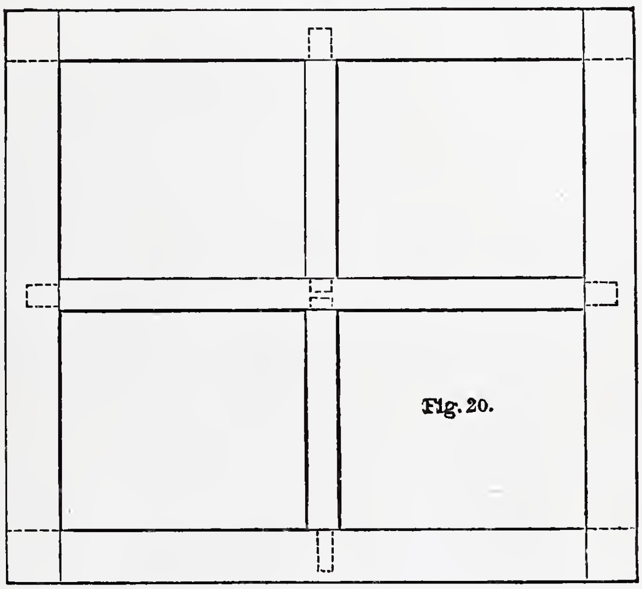


Fig. 20.

Fig. 19.—Tenon and Mortise. Fig. 20.—Panelled Back. Fig. 21.—Mode of Securing Panelled Back in Rebate.

A lock should be fastened to the flap, but if not considered necessary a spring catch will do instead, though if it is not desired to lock up the desk part, it is hardly worth while taking the trouble to attach any fastening, as the weight of the lid is sufficient to keep it closed. Any way, instructions for making the bureau could hardly be considered complete without mention of the lock. This should be let into the flap level with its surface, and for the sake of symmetry the keyhole should be equidistant between the two ends. I am not aware whether a special lock was made for this purpose when bureaus were more common than now, but I believe there is not now. The difference between them—if there ever were such things—and the ordinary drawer or till lock could be but trifling, so that a drawer lock will answer every purpose. A space for the bolt must be cut in the top, and this should be done very neatly, for it will be found that the wood remaining above the hole is very thin indeed, so thin that a very slight pull would tear it away altogether. The probability of such a mishap occurring appears to have been foreseen by old cabinet makers, and provided against by letting a slip of brass in along the edge of the top just by the bolt hole. The strip extends a short way on each side of it, and is fastened down with screws. The keyhole should be provided with an escutcheon plate to match the drawers. The fitting of the interior of the desk next claims attention. The fitting of the whole of these pieces is exactly alike, and it will be an economy of time and labour to mark the various distances where a partition is to be placed before commencing to cut the grooves across. For example, take the piece No. 17 (page 115), which is to form bottom of pigeon holes and top of the centre three drawers. Mark out on its upper surface the distances of the pigeon-hole partitions, and with the square draw lines right across. Now, on these lines cut grooves from the back to within a little, say, ½ in. of the front. These grooves should be just wide enough for the partitions to enter them, and they should not be more, at the outside, than half the thickness of the wood in depth. The half inch left in the front should be cut into a V-shaped groove, and the bottom of the partition for the same distance back cut to fit it. For such small work a mitre block would be rather an encumbrance than a help to most workers, but judgment in cutting will be required. It will not be necessary to mitre the pieces fitting into the ends and top, that is to say, the divisions between the drawers and the upright partitions will require only grooves.

The various parts may, perhaps, best be fitted together in the following order:—1st, the bottom piece of all, No. 16; 2nd, the pieces No. 18, separating the end drawers and the pigeon holes; 3rd, No. 17, forming the bottom of the pigeon holes. It should then be an easy matter to fit the other pieces in any order preferred. I think it will be understood that each piece is to be pushed in from behind. All the parts should fit firmly and tightly, but without any undue strain which might distort them. The front edges should be uniform and set back a trifle under the top. The appearance will also be improved if they are rounded instead of being left square. The small shaped pieces which are seen at the top of the pigeon holes are principally for ornament. They are cut to fit accurately between the spaces, and are secured with blocks glued in behind them. With this exception glue is not required in fitting up this part of the work, unless, indeed, the drawers are considered as part of it. They, of course, must be glued up. They are made precisely as directed for the larger drawers, and in fitting them there is scope for a nice display of the joiner's skill. In small drawers such as these, it is not generally considered necessary to run the bottom into grooved slips. The grooves are cut into the sides instead, as it can hardly be supposed that these small drawers will be required to support much weight. The back of the bureau is now the only part of the construction which remains. If it is to stand against a wall, a back formed in the simplest manner will suffice. For ordinary backs, muntins similar to those for the long drawer bottoms are generally used, as this form is decidedly preferable to plain boards glued up to form one piece, without involving much more labour. After what has been said about munted bottoms, it will not, however, be necessary to explain the construction further. It may, however, be said that a piece of muntin must abut against each end of the bureau, and take, as it were, the place of the grooved slips in the drawers. The number of muntins is not important, but four, including the two end ones, may be named as about the quantity for a job the size of the bureau. They should be at equal distances from each other, and be fixed perpendicularly, not horizontally.

Matchboarding will answer every purpose, and as it can be bought ready ploughed and tongued—*i.e.*, "matched"—it is very convenient to those who wish to avoid a needless expenditure of labour. The back, whichever way it is formed, should be let into a rebate run round the top, bottom, and ends of the bureau, and be fastened down with screws. It is, however, quite conceivable that the bureau may be destined to stand in some position where its back could be seen, and in that case the matchboard backing, though serviceable enough, may be rightly deemed out of harmony with the appearance of the rest of the work. A panelled back will be more appropriate, though its construction entails more work than the other. Still, work if properly applied means value, so it need not be grudged. The panelled back should consist of an outer frame of stuff, say, 3 in. wide × $\frac{3}{4}$ in. thick, the ends fastened to each other by mortise and tenon. Within these there should be a cross rail and upright also secured by mortise and tenon, or dowels, the whole enclosing four panels, for which $\frac{3}{8}$-in. stuff will serve (see Fig. 20). The panels may be either fitted to grooves in the framing—be it understood these panels are sunk, and not necessarily level with the surrounding frame—or the framing may be rebated on the inner side, and the panels let into it and secured with beads. This latter will probably be deemed by most the easier of the two methods, and it is shown in section in Fig. 21, so clearly as to prevent any misconception. It will be just as well for reasons which I trust have been made sufficiently clear already not to glue the beads to the frame and the panels, but to fasten them to the former only. Such a back as this should be fastened in with brass screws, as they look better than the ordinary iron. The bureau may now be considered made, as far as wood working is concerned, and those who have carried out the instructions given will find themselves in possession of a piece of furniture they may well be proud of, for it is a thing that will last, being made on sound principles. In this respect it will bear comparison with a similar thing whether of modern or ancient date. Even if the finish is not equal to the best the constructive details are, and if they have been manipulated with anything like skill the bureau may stand a very fair chance of becoming in time a genuine old bit of woodwork. Put the date on it somewhere, my amateur friend. It may some day interest somebody when he wants to tell his own decrepid, incapable generation that a former one turned out only honest work. We know better, but the prospective antiquarian will not be the only one who has made a similar mistake, and an excusable one, if all furniture were as well made as the newly constructed bureau.

Perhaps before closing a few remarks on finishing may not be out of place. Handles are wanted for the drawers. Those on the lower part should be good substantial brass handles, two to each of the long drawers, and one to each of the smaller. Fasten them on with round-headed brass screws. The small drawers in the desk part will only require a small brass knob each, except the long centre drawer, which should have two. Similar knobs may be fastened to the ends of the lid bearers, which, by the way, I think I have omitted to say, should be prevented from coming quite out by wooden stops similar to those under the drawers, nailed to the side. Polishing, also, should be attended to, but of this nothing need be said at present. The lining of the lid, however, affecting, as it does, the comfort of the writer, should have some consideration. The usual lining, as I have stated already, is leather, commonly supposed to be morocco, but in reality skiver, a thin leather formed by splitting a skin. All leather, however, is apt to get hard, and though now looked on as somewhat old-fashioned a cloth lining answers the purpose better. It is quite as durable, and moreover is a softer substance, so that a sheet of paper may be written on without the necessity of a pad of blotting paper underneath. These considerations are, however, for the user of the desk, and he can line it either with leather or cloth as he may prefer, but whichever it is the colour should not be too bright, but something restful and not tiring to the eyes. I may say that if the appearance of leather is preferred to cloth, the principal advantages possessed by the latter may be gained by interposing a layer of flannel between the wood and the leather. The lining, either cloth or leather, should be fixed to the wood with paste applied to the wood, not to the lining. The paste of ordinary bookbinders is the best for the purpose, and it should be well rubbed in before the lining is laid on it. A convenient way to apply the paste is to put a little in a piece of Hessian, or similar coarse canvas, and to rub it over the wood. This canvas serves as a kind of filtering medium for the paste, and prevents any lumps there may be in it from getting on to the wood. The lining should not be trimmed at the edges till after it has been laid and allowed to dry.

Before concluding this article I hope to show how the plain bureau may, without altering its shape or general construction, be finished in various styles, such as those of Chippendale, Sheraton, etc., so that those who wish for a more ornate piece of furniture may gratify their taste. Sundry modifications in detail will also be suggested for the advantage of those who, though unable to formulate exactly what they do want, are able to recognise the fulfilment of their requirements when it is placed before them. In the meantime the "Lessons from an Old Bureau" will not have been studied without, let us hope, some benefit accruing to those who have been disposed to follow and think over my remarks in the same spirit in which they have been written.

HOW TO SHARPEN PLANES.

BY B. A. B.

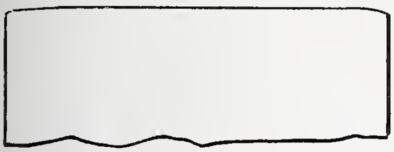
HAVING had opportunities of helping many beginners in woodwork, I take the first chance I have to point out in WORK the most common mistakes made by novices. It is not reasonable to expect a beginner to sharpen and set his planes, and yet how can he use them unless they are well set and sharpened? I recommend all young at the craft to take lessons in sharpening from a good workman, if they know one willing to instruct them; failing this, I will try to explain. Have a clean oilstone standing steadily on the bench with two or three drops of oil on it; observe carefully the angle at which the plane iron is set in the plane, and rub the iron on the stone lightly, with the chief pressure in the forward stroke, at an angle *less* than that at which the iron stands in the plane—that is, the left hand grasps the iron across, palm downwards, and the right hand holds the end, thumb uppermost; then be careful to keep the right hand lower than if held in the same manner in the block of the plane. Now rub lightly (if the iron is freshly ground very lightly), keeping the angle as constant as possible. This is the chief difficulty; wrist, elbow, and shoulder joints must each contribute some movement to make the hands a parallel motion. Do not stoop over the stone, or move the whole body. After a little rubbing feel the front carefully with the finger; if the steel has just begun to turn slightly forward, that is enough; if not, rub till it does. Then, laying the iron face downwards on the stone, rub this fine line of steel off by thrusting while rubbing—that is, chief pressure *from* you and against the edge. The face of the iron must be perfectly flat on the stone, and the fine line of steel must not be bent back by this last operation, but *removed;* if only bent back, try again with *less* pressure, both operations, till successful. It is obvious that any excess of rubbing only makes the "wire edge," as it is termed, too coarse, wastes time, and causes grinding to be needed sooner. Having sharpened the plane iron, screw the front iron on; first with the fingers, adjusting it about $\frac{1}{16}$ in. from the cutting edge. Do not let it pass the sharp edge, or it will injure its keenness; then with the head of the screw upwards, just close to, but not on the edge of, the bench, screw it as tightly as you can without letting the screwdriver slip.

Now get in a good light, and, with the plane in left hand, put the iron in, *holding it in* position with left thumb. You want the iron to project as much as the thickness of the shaving you intend to take off, or a trifle less, as the wedge now to be inserted and gently tapped with a hammer may, and most likely will, drive it out a little. The plane, on trial, should now work well, but if not, try to find out why it does not. You will easily remedy the defect if you are careful in the investigation. A likely fault is that the iron is sharpened obliquely, consequently giving a coarse shaving in the corner of mouth, where it can less easily escape, and leaving a series of furrows in the work.

It may be sharpened well, and put in obliquely, there is a little liberty and you may have taken it in the wrong direction, the front iron may have slipped, or shaving may have got between the irons. Do not keep striking the plane, or the iron, or wedge, as most beginners do, blindly hoping it will presently come right. Find out th fault; remove iron and wedge, and put together more correctly, as above described.

When successful in setting, be sure to keep behind the plane; you have more power, and should you come to a hard knot you are less likely to hurt your wrist. You are to make more use of the left hand than beginners usually do, as the pressure on front of plane very much checks those vibrations which, leaving a wavy appearance on the work, also very much weary the worker.

Now supposing the plane well sharpened, the cap iron well adjusted and tightly fixed, and the cutting iron projecting just enough, yet the tyro may find a difficulty still. He may find, as he passes his fingers across the work, those furrows like a series of shallow rebates that quite spoil its appearance; he may tap the iron first one way and then the other without curing the evil. The reason is that the edge of iron is either straight, or worse—concave; if so, he can never plane a surface wider than his plane iron without these marks, which show, too, that he is a beginner by their tendency to the near front corner. The cure is to very slightly round the iron in sharpening at the corners (as in the annexed figure) only as much as the



Edge of Plane Iron properly sharpened, showing rounded corners.

stoutest shaving he intends to remove. I hope I have made this important point clear. Let me put it in other words. Suppose the iron quite straight as to its edge; say it is $2\frac{1}{4}$ in. (a fair average width for jack plane); let 2 in. *remain straight;* let the $\frac{1}{8}$th at each edge be rubbed away, say $\frac{1}{40}$th of inch, at the corner. A shaving taken with a plane with iron so sharpened will not have a stout edge, but will gradually fade away to nothing at each edge.

Do not, however, in avoiding one error, fall into another; do not make the edge of the iron a segment of a circle in order to prevent the corners catching. Such sharpening is only allowable in planes for the coarsest preliminary work, and the beginner must aim at more careful sharpening.

Now, these two opposite errors may spring from one cause: viz., the inaccuracy of the oilstone. Given a wide oilstone used frequently to sharpen chisels upon, you soon obtain a stone that will cause the too rounding error, and if an attempt is made to rectify this error by rubbing the centre of plane iron on the marginal edges of stone alternately, as is often attempted, there is possibility of the opposite or concave error. The remedy is to rub the oilstone flat on a piece of paving stone with a little silver-sand and some water, taking care to dry the stone of water before again applying oil.

These directions for sharpening plane irons apply to jack, tying, and smoothing planes, and their fellows; not to rebate, moulding, or fillister planes. Rebate plane irons must project equally across the sole of the plane, and must be exactly the width of plane; fillisters nearly the same; moulding planes should either be sharpened so that the iron projects equally all over profile of moulding, or else *slightly* more projecting at the leading parts. For instance, say a bead: if the part of iron making the quirk takes off but little, and the hollow of iron which makes the round takes more, the worker finds it very difficult to make a good bead. Rapidity and good finish are best secured by leaving the quirk, the most projectant part of cutter, slightly more prominent than the rest.

If I have failed to make any beginner understand—and this article on sharpening is only for beginners—I will answer any inquiries; but in case any one fails, before asking try again, using less pressure on the oilstone, especially just as the finishing strokes are being made, as too heavy a pressure is a common fault among beginners.

BURGLAR ALARUMS:

How to Make, Work, and Maintain.

BY GEORGE EDWINSON BONNEY.

AUTOMATIC RELAYS—MAYFIELD'S ELECTRIC ALARUM BELL—DALE'S ELECTRIC ALARUM BELL—INDICATOR RELAY—PUTTING PARTS OF BELL TOGETHER—TESTING BELL—COVER FOR BELL.

Automatic Relays.—The action of an automatic relay will be more clearly understood by referring to the plan of one shown at Fig. 35. This relay is similar to that shown at Figs. 28 and 33. The trigger, L, of the relay is here shown on the face of the bell base, released from the catch, G, and drawn by the spiral spring into contact with a piece of brass, H. This piece of brass is connected by a wire leading up the back of the bell base (the course is shown by a dotted line) to the binding screw, B, and this is connected by a wire with one of the terminals of the battery, M. The other terminal of the battery is connected by a wire with the binding screw, A, and thus the local battery is thrown by the relay into short circuit with the bell, which is by this means rendered independent of current from the main line battery. When the circuit of the main line battery is closed by the act of opening a window or door placed in circuit, the current passes from A to D, then through the magnet coils to E, F, by the armature spring, to the contact post, K, then to C, and back to battery. As the current traverses the magnet coils, their cores attract the armature, and with it the hammer shaft; this movement causes the catch, G, to slip away from the end of the trigger, and the spiral spring at once brings it in contact with the small lug of brass, H. The lug, H, is connected with the binding screw, B, by a short length of insulated wire passing up the back of the base (its course is marked by a dotted line). The lever connects H with its pivot, I, and this is connected with the contact post. To render the action clearer, I must first explain that a wire is carried from A to D at the back of the base, and is brought up through a hole at D, and there connected with one end of the magnet coil wire; the other end of the wire is carried down through a hole at E, and connected to the metal frame of the bell by the screw, F. As the frame and the armature spring are connected together at S, the result is the same as it would be were the wire connected direct to S.

Mayfield's Electric Alarum Bell.—Fig. 28 shows an electric alarum bell, fitted with automatic relay, as manufactured by Messrs. Mayfield, Cobb, & Co., 41, Queen Victoria Street, London, E.C. The interior fittings of the instrument are similar to those shown on the plan, Fig. 35; but the relay is neatly placed in a recess cut out at the back of the base, as shown at Fig. 33. The fittings are well made, and are mounted on a metal frame, fastened to a base of polished teak, whilst the whole is protected from dust by a polished cover, made out of the same wood. The bell has a 3-in. gong, highly polished and nickel-plated, giving a good tone when rung. The instrument may be worked with current from one cell of the Gassner battery, sold by the same firm. I hope to give a notice of this battery further on.

Dale's Electric Alarum Bell.—Another form of electric alarum bell, fitted with automatic relay on the same base, is shown at Figs. 29 and 30, which illustrate a bell manufactured and sold by Messrs. Dale and Co., 26, Ludgate Hill, London, E.C. Fig. 30 shows the instrument with its cover off, exhibiting the interior fittings and working parts. It will be seen that the relay differs in form from that of Messrs. Mayfield, and is attached to the face and frame of the bell between the gong and the magnet coils. It is composed of the peculiar shaped trigger, shown at Fig. 21 (page 280), mounted on the pivot pillar, Fig. 11. This pillar is connected by a short piece of insulated wire, passing under the magnets, with a strip of brass attached to the right-hand binding screw of the instrument. A short contact post is inserted in the neck of the metal frame near the gong, and insulated from the frame by a wood collar. The tip of the screw from this post is made of platinum, and this comes into contact with another piece of platinum soldered to the trigger, when this is drawn to the post by the spiral spring. This post is connected with the middle binding screw by a piece of wire passing up the back of the base. The hook of the trigger engages with a catch attached to the armature, shown at Fig. 20, when the bell is set with the relay as an alarum. The action is similar to that of Mayfield's relay when the circuit is closed.

Indicator Relay.—When a house is furnished with a complete system of burglar alarums, with every room protected by suitable contact pieces to the windows and doors, the owner naturally wishes to know how he may locate the room into which the burglar has broken. Having been aroused in the dead of night by the ringing of the alarum, must he arm himself and search the house from top to bottom until he finds the thief, or the thief pounces upon him? He need not do so if an indicator relay or a set of these relays are placed in circuit with the various rooms. A neat polished case with glass front, containing a set of relay indicators, may be hung up on the wall near the alarum bell, and a glance at this will tell at once which room has been entered, or which door or window opened. Fig. 31 shows a small case of indicator relays, manufactured and sold by Messrs. H. Dale & Co., Ludgate Hill, E.C., and Fig. 36 is a plan of one of those relays mounted on a base by itself. In this form it is used as a single indicator, connected with a greenhouse or conservatory, either with a fire alarm or a burglar alarum. In the plan, Fig. 36, it is shown connected to one of Mayfield's circular bells, and worked with one cell of a Gassner battery. I may say in passing, that this well-made, excellently toned bell is quite an ornament to any room. The nickle-plated 4-in. gong is recessed into a disc of polished walnut, the edges of which are raised as a moulding around the gong. The gong serves the double purpose of a bell and a cover to the fittings beneath. I hope to describe its construction in a future paper when dealing with the broader subject of electric bells; the price of this is 9s. 6d. I have sketched this, together with Dale's relay and Gassner's battery, to show that this valuable instrument may be used with any form of electric bell, and can be worked with small battery power. The combination shown in sketch worked very well.

To show more clearly how this relay works, I have given an end view diagram of its working parts at Fig. 32, and this I will now explain. At the right-hand side of the plan, Fig. 36, will be seen a black knob connected to a brass rod. The end of this rod carries a curved brass lever, curved round so as to rest just under the lower edge of the indicator flag, D; a short transverse lever at H serves as a stop to prevent the curved lever from falling too low. When we wish to set the indicator relay, we give the black knob a sharp turn to the right; this brings the curved lever up smartly beneath the flag, and jerks it into the position shown at Fig. 32, with the white part of the flag covering the hole in the indicator case. In this position it is held by a pin projecting from the armature, A, engaging with the upper looped guide of the flag shown at N. When thus set, and contact is made in the main circuit by opening a door or window, the current from the battery traverses the magnet coils, B, B, magnetises the cores, C, C, of the magnet, and causes them to attract the armature, A. In doing this, the pin of the armature slips away from the guide, N, and leaves the flag without support, when it slips down the slide, E, to the bottom. As it does this, a stout, projecting pin, P, strikes the end of the thin brass spring, H. and forces it to break contact with the spring, I, above it, at the same time bringing it into contact with the brass spring, L, below it. (Both of these are guarded with platinum at their points of contact to prevent burning.) When this happens, the coils of the indicator magnets are out of circuit, and the current passes by an easier path to ring the bell, which it does with more vigour since relieved of the resistance of the magnet coils. As the flag falls, its upper or red part covers the hole in the face of the relay case, and shows at once the cause of the alarm. Any number of these indicator relays, up to fourteen, may be included in one case, and each number plainly marked as shown at Fig. 31, with a number corresponding with a number given to each guarded point, or the openings may have the names of the rooms printed beneath them. The bell may be stopped by taking off the switch shown at Fig. 36. In Fig. 31 this lever switch is shown projecting below the case. Any one of the indicator flags, or all of them at once, may be set by a sharp turn of the black knob at the right. The cover conceals all connecting screws, and is screwed on after connections are made; this acts as a deterrent to domestics who may have a desire to meddle and tamper with the movements inside the case. The switch is only turned on the last thing at night, when all doors and windows should have been previously secured. Should one of these be left open, or unsecured, its indicator will at once fall, and the bell ring until the faulty point has been properly guarded. Arrangements to guard the various points will be considered in a future paper.

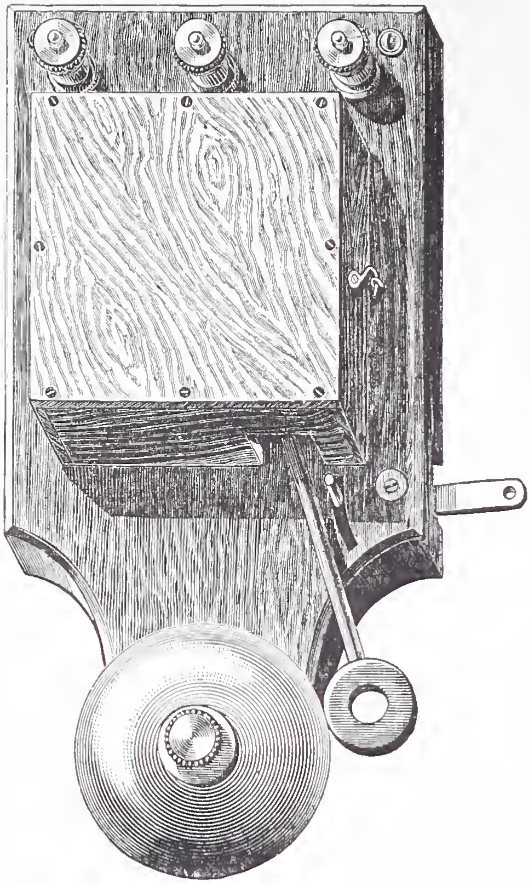


Fig. 28.—Mayfield's Alarum Bell with Automatic Relay.

Putting the Parts of a Bell together.—Supposing, now, that some of my readers have determined on making an electric alarum bell for themselves, and have got together the necessary parts mentioned in preceding chapters; we will next set about putting them together. But first let me say that each part must be proportionate; the metal frame suited to the base; the magnet coils and cores to the size of gong; the armature for the magnet; the spring of the right length and stiffness; and the hammer shaft sufficiently long to properly ring the bell. The relay must also be suited to the style of bell employed; but on this point much latitude of choice can be given, for the parts may be modified to suit each other. The right proportions for each part are given in pages 279 and 280, and most of the sketches of these parts are sketched full size to suit a 3 or 4-in. gong.

The metal base plate should have countersunk holes for the heads of the screws used in fastening this to the wood base; fasten this part on first. Next fasten the yoke of the magnet to the base plate; then attach the cores to the yoke, and slip the wound bobbins on the cores. Strip off the silk covering from the

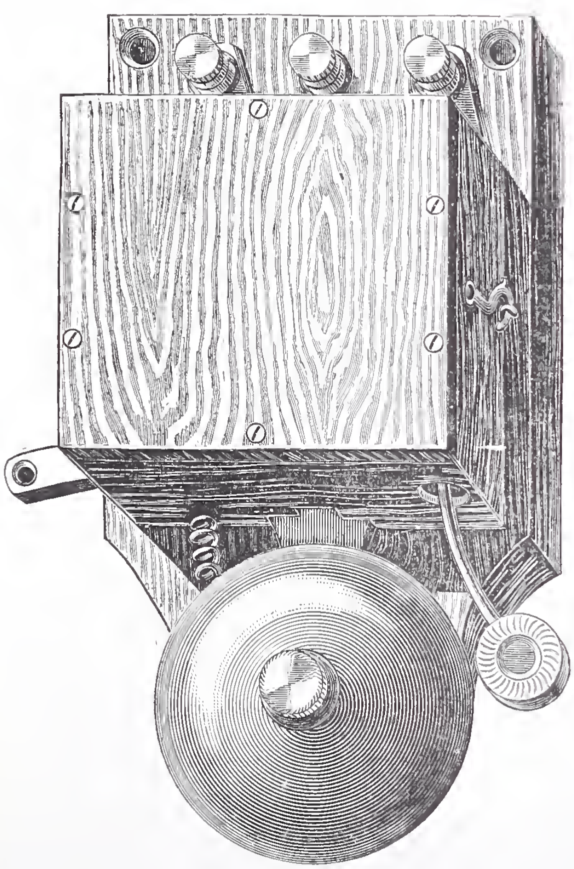


Fig. 29.—Dale's Electric Alarum Bell, Closed as when Fixed in Position for Use.

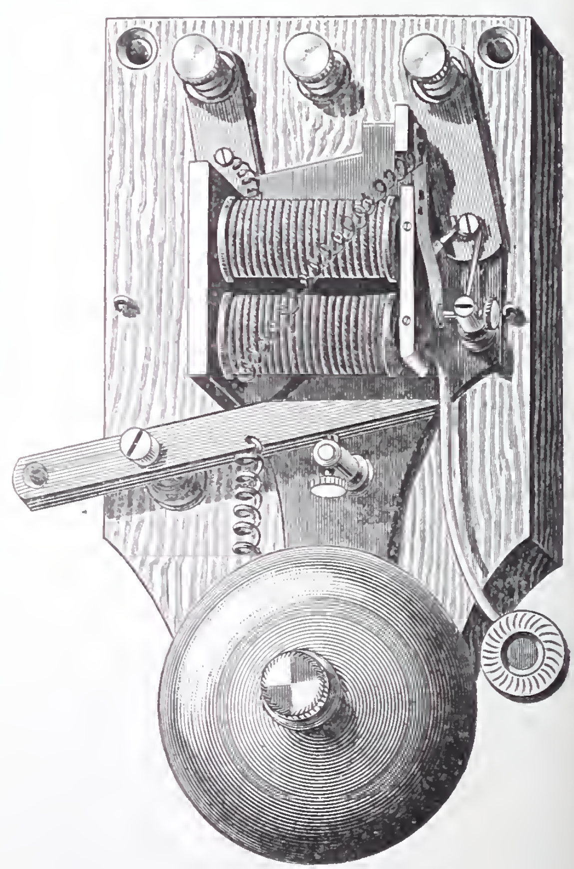


Fig. 30.—Dale's Electric Alarum Bell Uncovered, to show Automatic Relay and Working Parts of Bell.

inside ends of the two coils, clean the wires on a bit of emery cloth, and twist them together as a rope is twisted. Serve the outside ends of the coils in a similar manner, and attach one of these to the left-hand terminal, or binding screw, of the bell (see Fig. 35), and fix the other to the metal base plate or to the lug carrying the armature spring; in both cases with metal screws—clean metal touching clean metal. This done, fasten the armature to its spring, and this to the lug on the base plate by small steel screws or screw studs. The hammer shaft should be previously inserted in the end of the armature, and if the relay shown at Fig. 30 is to be used, the catch shown at Fig. 20 (page 280) should also be fastened to the armature before this is mounted in position. The contact

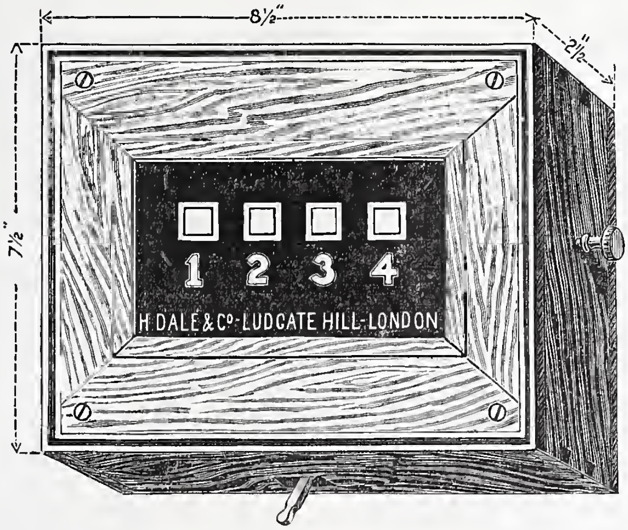


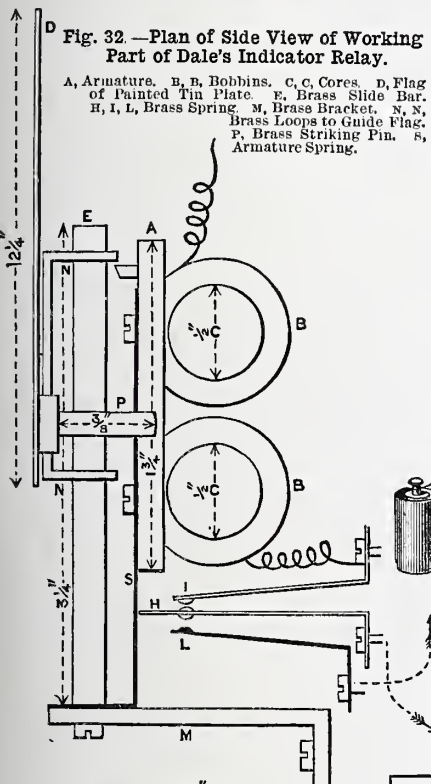
Fig. 31.—Dale's Indicator Relay.

The pin or the hook of the relay lever should not engage too deeply with the catch, but only just enough to hold it securely until the armature is vibrated with current from the battery. If it works too stiff the battery may fail to release it at the proper time, and if too tender it may be accidentally jolted into action. The right position can be found by actual practice.

Testing the Bell.—We may now set about testing our work. The three connecting terminals or binding screws, A, B, C (Fig. 35), having been screwed into the baseboard, the various wires are to be connected to them as shown in this figure, or in Fig. 30. It will be seen in both sketches that the central terminal (B, in Fig. 35) is connected with the contact post or piece of the relay; the right-hand terminal (C, in Fig. 35)

Fig. 32.—Plan of Side View of Working Part of Dale's Indicator Relay.

A, Armature. B, B, Bobbins. C, C, Cores. D, Flag of Painted Tin Plate. E, Brass Slide Bar. H, I, L, Brass Spring. M, Brass Bracket. N, N, Brass Loops to Guide Flag. P, Brass Striking Pin. S, Armature Spring.



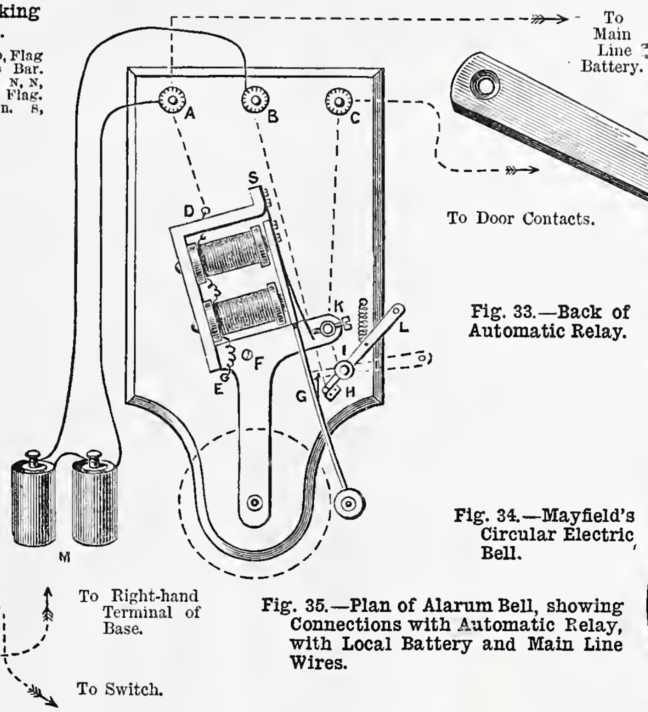


Fig. 35.—Plan of Alarum Bell, showing Connections with Automatic Relay, with Local Battery and Main Line Wires.

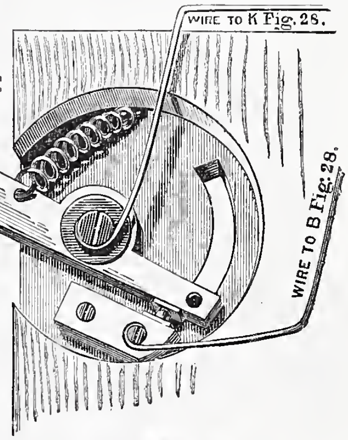


Fig. 33.—Back of Automatic Relay.

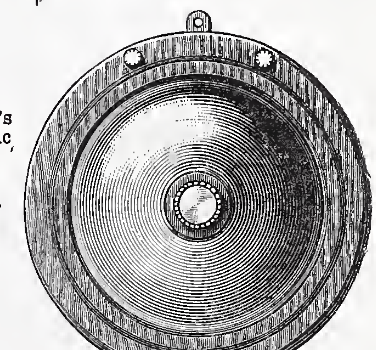


Fig. 34.—Mayfield's Circular Electric Bell.

pillar (Fig. 23, page 280) should now be placed in its place, and in doing this, see that the insulating collar (Fig. 22) entirely prevents the metal of the tang from touching the metal base plate. Next put in the gong pillar, and screw the gong in its proper place. Now proceed to adjust the various parts of the movement. The armature spring must be bent outward a little, so as to just touch the platinum tipped screw on the contact post, when the hammer is about a quarter of an inch off the side of the gong, and to be just a shade off from contact with the platinum tip when the hammer touches the gong. The various parts of the automatic relay may now be attached to the base with the same care as that used in fixing the other parts, and these must also be adjusted to work freely, and in unison with the movements of the armature.

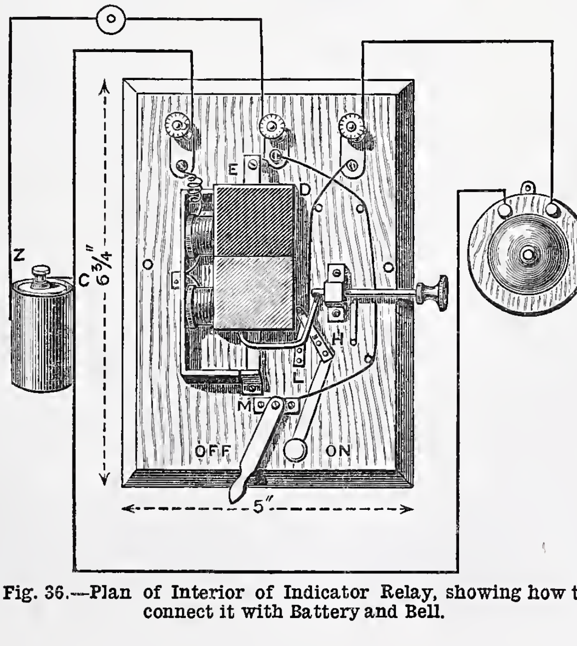


Fig. 36.—Plan of Interior of Indicator Relay, showing how to connect it with Battery and Bell.

is connected with the pivot post of the relay lever, and with the contact post (K, in Fig. 35) of the armature spring; whilst the left-hand terminal (A, in Fig. 35) is connected with one end of the magnet coil. All these connections may be made beneath the base of the bell, if so desired, to ensure safety from tampering, and for the sake of neatness. The wires are secured to the tangs of the various posts and terminals by small brass nuts recessed in the base, and the wires led along in saw cuts made in the back of the base. These recesses and cuts should then be filled up with paraffin or with elastic glue.

All parts having been connected, test the bell by trying to ring it with current from the battery. Adjust the contact screw of the "break," either by screwing it up tighter or unscrewing it, until the best tone is got out of the bell. If the armature strikes the magnet cores with a tapping noise as it vibrates, bend the spring a little outward so as to move it further away from the cores. If it vibrates feebly, bring this part nearer the cores by bending the spring inwards. It may be necessary to bend the hammer shaft a little, one way or the other, to ensure it striking the gong properly. The battery power used in testing and adjusting the bell should be the same as that to be used in working the bell. A weaker battery might just work the bell and a stronger prove too strong to ring it well, whilst it might ring well with a strong testing battery, but fail altogether with a feeble current from a weaker battery.

The Cover for the Bell.—As the working parts of an electric bell are very delicate, and liable to be injured by dust and damp, they must be protected from these by a suitable cover. This is usually made from the same kind of wood as that employed in making the base of the bell. It is really a little wooden box without a cover, turned upside down over the works. It is made out of ¼-in. wood, neatly put together with dovetail joints or mitred corners strongly glued, and is highly polished when finished. Holes or notches are cut to allow free working of the hammer shaft and lever of relay. The cover is secured to the base by two small brass hooks screwed to the sides, and engaging with two small brass staples fixed in the base. The top part of this cover is attached to the frame by small brass screws, in addition to glue, to give it greater strength; these screws are shown in Figs. 28 and 29. Two holes (bushed with brass eyelets) are drilled in the base close to the outside terminals, and the bell is hung by means of screws passing through these, or by pins, to a wall or a partition.

SADDLE BARS AND SAFETY STIRRUPS.

BY J. CHARLES KING.

The term "saddle bars," to attach stirrup leathers to saddles, is derived from the part of the "tree" which formerly held the stirrup leathers, the tree of a saddle being the wooden framework of a saddle, the "bars," one on each side, connecting the "pommel" and the "cantle" at front and back of "tree." This plan is still in use in some Continental and American armies for their cavalry.

Notwithstanding the improvements in much that pertains to horse gear, the saddle seems to remain much the same as it was a century or more ago in some of its leading points. A few improvements now and then slowly make their way to the front; amongst them are the releasing bars, or, as modified in form, "latches" have become the recognised term, as a spring is mostly used in the construction of them, to open and close a latch. In the hunting field this season, one lady and six gentlemen met their deaths by falls from horseback, and about six hundred were thrown, many of them receiving severe injuries; and it is stated that the accidents were to experienced horsemen and good riders, most of them young or in the prime of life. Some of the accidents were due to the riding habits worn by ladies catching in the pommel when they were thrown from their horses. The hinged pommel prevents this form of accident, or is supposed to do so.

The stirrup bars, or latches, are credited

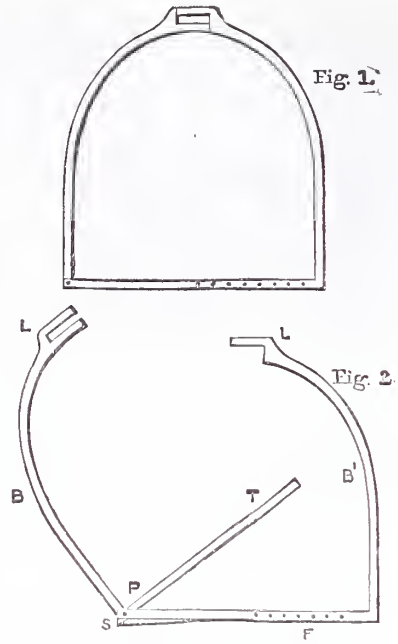


Fig. 1.—Stirrup with Joint at Strap-eye.
Fig. 2.—Same Stirrup shown half open.

with being the cause of many accidents, singularly enough from the very cause they are invented and patented for—"releasing a rider from the saddle;" but the patent goes on to state, "when thrown from the saddle, and preventing the rider being dragged by his foot in the stirrup." Now, being dragged by the stirrup holding the foot as in a trap is entirely prevented by the latch stirrup used by horse breakers and trainers for the past one hundred and fifty years; by the use of which the foot is released when hung up in it, without the chance of an instant's drag by it.

Fig. 1 shows such a stirrup, which, when

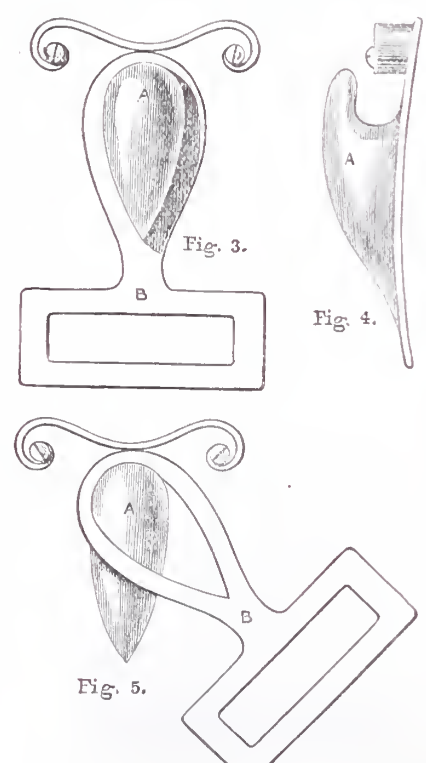


Fig. 3.—Stud (A), Cock-eye (B), and Spring for Stirrup Leather. Fig. 4.—Side View of Stud and Spring. Fig. 5.—Cock-eye pulled obliquely as when Rider is thrown or dragged.

new, does not show the opening joint at the strap-eye. In fact, it requires an expert to know if it is different from any other stirrup that does not open.

Why are they not general, as they suit for women as well as men? Simply because it is not the fashion; and many riders have little notions, easily swayed by their grooms and jockeys, about their saddle gear.

Fig. 2 shows the same stirrup half open; L L is an eye which is a jointed end of the stirrup bow, somewhat like a split ring, which gives the stirrup leather a release from the stirrup in case it is caught by a tree branch or a gate hook; this saves the saddle bar from being torn from the saddle, or the stirrup leather being broken. It will be seen that a portion of the tread of the stirrup, T, is solid with the bow, B. The other part of tread is solid with bow, B^1; this tread part is like the prongs of a tuning fork, between which the tread part, T, closes, and resembles an ordinary stirrup tread part, with its jags to prevent the boot sole slipping. The action is due to a pin at P going right through the prong-like ends of F, and the inner angle of the part that opens, F, B^1, L. As the bow gives way to the pull of the foot, the tread, T, rises and forces the foot free of the stirrup.

The actuating force which keeps the two halves of the stirrup close at the eye, L L, is a concealed spring, S, between the prongs of the tread, F. This is shown depressed at the point S, where it impinges with great force on the lower edge of the bow, B^1, at S.

We are pleased to hear that there has arisen a sudden demand for these stirrups, which cost about 18s. a pair of the best make; anything inferior should not be accepted. How is a buyer to tell? will be asked, and met with the usual advice, "Go to a good house and pay a good price." This is a poor assurance, seeing that the "good house" takes what the stirrup manufacturers offer; and if not good, the price becomes a fraud without the good house intending it. Here comes in the advantage, not of trade marks, but of grade marks, as of plate and swords, gun barrels, or any other thing capable of being tested. For about 2d. a pair a maker could get experts to mark the first, second, or third qualities to such goods.

But to return to saddle latches, which are desirable even with safety stirrups. We referred to accidents frequently occurring from the release of the leathers from the latches without the rider being thrown by his horse, but which caused him to be thrown by his faulty "latches" on his saddle. It would be only an advertisement to mention such, and they are numerous, and will be made and used till the simplest and best is found out and becomes generally adopted. What is known as the old spring bar is useful for a back pull, to allow the leather to come away from the saddle, but it is useless for a forward pull or overthrow pull across from one side of the saddle to the other.

A new saddle bar is patented about once a week in England, but they seem old patterns of worthless bars revived in too many cases.

The falls a man or woman get are not often serious if the distance the rider is thrown from the saddle is great. It is the short fall down from the saddle that is so dangerous, and the least hitch of the foot augments the force of the fall by the snatch turning the rider's head downward. Few of the latches serve for all kinds of falls. We illustrate one, as it embraces all that are of any worth, and has the advantage of being made at a lower price than any. The inventor, though patenting it with other saddle improvements, allows any lady or gentleman to have it put to their saddle by their own saddler, upon application for the permission. In this invention, the folding of the leather over the bar, which is the cause of breakage when worn, is entirely done away with; the leather is single half-way down to the stirrup; where it reaches the saddle it ends in a light nickel cock-eye, B, shown in Fig. 3; this hangs on to a notched stud, A, fixed to the saddle tree; a light cover spring, with bow and scroll ends fixed above it, holds the cock-eye down in the notch of the stud.

Fig. 4 is a side view of the stud and spring.

Fig. 5 is the cock-eye shown, being pulled obliquely as if a man were being flung out of the saddle with his foot in the stirrup, dragging the stirrup leather; a hard pull more obliquely is necessary to effect detachment of the loop from the stud. It is obvious that release is sure, whether the pull be backwards, forwards, or directly over across the saddle. If the sporting papers were to devote a little of their space to the records of faulty saddles and saddle bars that cause accidents, it might lead to the adoption of the safest to ride with, and save some valuable lives.

OUR GUIDE TO GOOD THINGS.

69.—The Rolymeter, or Automatic Measurer.

In the accompanying illustration a representation is given of a handy little instrument, to which the inventor and patentee has given the somewhat curious name of the "Rolymeter," from the principle of its action when at work—that is to say, the rolling of the wheels on discs that appear one at each end of the transverse portion of the appliance over the surface to which it is applied. As may be seen from the engraving, a short wooden handle, $4\frac{1}{2}$ in. in length, including the portion that enters the brass socket immediately above it, is attached to a cylinder of brass which is fixed to it in a direction transverse to its axis, and at right angles to it. The cylinder assumes an octagonal form at and along the upper part, so as to present three flat sides, of which the central and upper one is slotted along its length to permit a pointer to travel along it from end to end. The surfaces on each side of the slotted surface are engraved with figures from 0 to 10, which represent feet; the central part along which the pointer moves being divided into ten parts, which in their turn are subdivided into fourths. Thus, practically, the graduated scale along which the pointer passes is divided into equivalents of feet, each foot space being again divided into parts representing 3 in. Through the centre of the brass cylinder a screw-cut axis passes from end to end, and to its extremities are attached wheels or discs, about 1 in. in diameter, with milled edges. The screw works in a traveller, to which the pointer is attached, and at each revolution of the side wheels the pointer passes over a space on the graduated scale representing 3 in., or $\frac{1}{4}$ ft. Thus, it will be seen, the Rolymeter is possessed of sufficient capacity for the measurement of 10 ft., after which the wheels must be canted to revolve in the opposite direction for the measurement of the next 10 ft., and so on. It will be found useful for a variety of purposes in which linear and superficial measurement is involved, and its use will save much time. Thus, in estimating the quantity of paper required for any room, the height and circuit of the room can be quickly determined by aid of the Rolymeter, and the area to be covered ascertained. The instrument has been submitted to me by Messrs. Richard Melhuish & Sons, 85 and 87, Fetter Lane, London, E.C., who will doubtless soon have them on sale, if they are not at present actually in the market. The price of the Rolymeter is 4s. 6d.

70.—Cook's Patent Level.

Another handy appliance which I have lately been permitted to examine through the courtesy of Messrs. Richard Melhuish & Sons, is Cook's Patent Level, manufactured by Messrs. Davis and Cook, Watertown, New York, U.S.A. For constant use in a shop I know of nothing more handy than this instrument, which is a plumb and level combined, enabling the workman to test the level of horizontal surfaces, and to see that vertical surfaces are perfectly upright by a half turn of one and the same appliance. I regret very much that it has not been possible to give an illustration of it, but its form and dimensions will doubtless be understood from the

Automatic Measurer for Effecting Linear Measurements with Rapidity.

following description:—First of all, the body of the Patent Level consists of a piece of hard wood 16 in. long, $3\frac{1}{8}$ in. wide, and $1\frac{1}{4}$ in. thick. This wood is secured from damage and wear-and-tear at each end by a stout cap of metal, nickel-plated, and attached by three screws—one at the end and two at the sides—the metal being bent, so as to extend $\frac{3}{4}$ in. up each side. On each side of the wood two circular rebates are cut $2\frac{1}{2}$ in. in diameter, to receive nickel-plated rings rather over $\frac{1}{2}$ in. in width. These rings are each attached to the wood by three screws, and the centre of the rebate in each case is $5\frac{3}{4}$ in. from the end of the appliance. Within these metal rings are flat pieces of glass, which protect from injury the tubes which form the plumb and level. These tubes are placed in circular holes carried completely through the wood, the centre of the holes themselves and the centre of the circular rebate coinciding. The tubes containing the spirit and air bubble show a length of $1\frac{3}{8}$ in. to the eye of the observer, and are $\frac{5}{16}$ in. in diameter. They are set in a circular metal carrier about $\frac{1}{2}$ in. in width, which is fastened to the wood, in the case of the plumb, with strong brass pins; these pins, however, do not appear in the metal ring that holds the level. A ring is painted round the tube on its external surface to indicate the level or plumb, as the case may be, by determining whether the air bubble is exactly central or otherwise. On one side of the instrument is a metal plate, also nickel-plated, and attached to the wood with screws; and in this plate are also two screws each marked "Adjusting screw," which are used to keep the instrument in perfect truth. The tube which is used in levelling is set parallel to its length, and that which is used as a plumb is set transversely to its length. The inscription, "This end up," on each metal disc that holds the plumb in place and protects it, leaves no doubt in the mind of the workman as to which end of the instrument is really to be kept uppermost when using it as a plumb. Its price is 10s. 6d., which is not a high figure, considering its manifest utility. It should be kept ready at hand for the use of workmen in every shop throughout the country.

71.—Cheap Mathematical Instruments.

There must be many a lad just commencing work, and men too, for a matter of that, who are not able to go to any considerable outlay in the acquirement of a set of mathematical instruments who will be glad to avail themselves of some cheap sets of German manufacture recently brought into the market. The cases which are before me as I write are respectively $7\frac{3}{8}$ in. by $2\frac{7}{8}$ in. by $\frac{7}{8}$ in., and $6\frac{5}{8}$ in. by $2\frac{5}{8}$ in. by $\frac{7}{8}$ in. They are covered with paper, grained in imitation of morocco leather, and are lined with cotton velvet. They are fastened by a pin working along the front edge of the box for half its length, and entering an eye fixed in the front of the lid. The smaller box contains a saucer for Indian ink, a cake of Indian ink, a pair of compasses with pen and pencil points, a small case containing leads for the pencil point, instead of a pencil, and an appliance for tightening or loosening screw at head of compasses. In addition to these are a small set square and graduated 6-in. rule, both in wood, retained in places made for them in the lid by means of a brass holder or button. The longer case contains, in addition to the articles already named, a ruling pen and a brass protractor. They are sold at 3s. 6d. and 5s. respectively.

72.—"A 1." A Magazine for Family Reading.

Part 19 of this magazine, whose aim and scope are sufficiently indicated by the above heading, has been sent me by the publishers, Messrs. S. W. Partridge & Co., 9, Paternoster Row, who call attention to two instructive and pleasantly written articles by Mr. Frank Rede Fowke—one on "Furniture and Woodwork at South Kensington," and the other on "Mosaic, Fresco, and Mural Decoration at South Kensington." Both articles are appropriately illustrated: the first giving examples of a Roman bed, or rather bedstead, and of a mediæval bed and chairs, and an illustration of a writing-table used by the ill-fated Marie Antoinette, the wife of Louis XVI. of France. Reference is made to a curious doll's house from Nürnberg, about 200 years old, and the *cassoni*, or elaborately carved chests which contained the trousseaux, etc., of Italian brides, and linen for the households over which it was their destiny to preside. In the second paper the most noticeable illustrations capable of being utilised as patterns are a piece of Indian mosaic from the Taj Mahal, and a specimen of sectile work from Monreale.

I find that I have omitted to say that Cook's Patent Level is made in different sizes ranging from 16 inches to 3 feet in length, and, as a matter of course, the larger sizes will be found better suited for general use in workshops. Prices range from 10s. 6d. upwards, but the progressive rate in price is not in proportion to the progressive increase in length and dimensions generally. The actual rate of increase has not been supplied, and so I am unable to state it.

The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

An Appreciative Subscriber.—H. H. W. (*Blackheath*) writes:—"At the end of the year will you issue an alphabetical index to WORK? as I think it is well worth binding, and will be extremely useful as a reference. I fully appreciate its value; it explains everything so accurately and clearly that any one with the least amount of common sense cannot go wrong in following the instructions, and I sincerely hope that its circulation may increase more and more, as it will help numbers, and also show that the several articles by yourself and our other friends are thoroughly appreciated. I see in part for May 11th AN AMATEUR complains of the advertisements. How a disfigurement? It is only one little corner, and I have found the information extremely useful."

About WORK.—F. J. C. (*Brockley*) writes:—"Allow me to add my vote to those you have already received respecting the advisability of adding a cover to 'our' paper. I say 'our,' as I feel for my own part quite a personal interest in its success, and greet its appearance each Wednesday morning with joy. The suggestions *re* cardboard covers for the weekly issues are all very well for those who only look at the paper at home; but I for one have a copy as my constant companion in the train, and elsewhere, and by the time the week is over my poor WORK is in a sad state about the corners where it has been doubled to go into the pocket. Now, a cover would certainly be a great protection; it would help to keep the paper for binding after being read, and would do away with the necessity of binding all the advertisements with the volume. A paper cover would also have greater space for the advertisements, which would more than pay for the extra expense involved in its adoption."—[A contributor to WORK, when with me the other day, told me that he always bought two copies of WORK, one for daily use at the time of publication, and the other to be put away for binding. As WORK is issued at a very low figure, and contains an amount of technical information that cannot be found in any other paper, I venture to suggest this course for the adoption of yourself and others, who wish to preserve WORK entire and intact for binding. It is impossible, as I daresay you know, to eat your cake and have it too.—ED.]

About WORK.—ALEXIS writes:—"It was with great disgust that I read the tirade of J. P. A. in the issue of June 8th, and with your permission I should like to have a cut at him. He seems, from his letter, to think that all the information and instruction promised in the prospectus was to be found in the first number, and because he found nothing to suit him condemns the whole thing. How selfish to complain because full instructions are given to make what he calls trifles, or to expect that all articles, whether cabinet making or anything else, are to be written up to the level of the professional. I flatter myself that in my own trade I am as good as the next man, but I expect to learn something from WORK, and I reckon that J. P. A. will, too, if he continues to take it in. Then with regard to his advice to the editor to follow on the lines of the 'Technical Educator,' and Dr. Dresser, and Professor Church, and so on, I fancy that for every one subscriber gained of the J. P. A. kind there would be fifty leave it off. The *English Mechanic* is a good paper, but I am prepared to maintain that hundreds abstain from taking it because it is too scientific, and takes up too much space in discussing what I call fads, and though a subscriber to it for years I prefer WORK, and I say long may it prosper, which I believe it will, in spite of the grumbling of a dissatisfied few."

Building Construction.—F. W. L. (*Norwich*) writes:—"I have pleasure in stating that I take the weekly numbers of WORK by Messrs. Cassell, and have done so from its commencement, and can truly say it supplies information which has long been a want felt among our artisans in the building trade. I have read with interest the remarks of W. P. and A. E. D. (why don't they sign their names in full?) with reference to building construction in WORK No. 13, and quite agree with them that it would meet with the great approval from many artisans, who, like myself (a bricklayer), wish to live and learn, but are debarred by excessive charges of art classes, and the dear rate of papers connected with the building trade. I wish your paper every success, as I know that Messrs. Jarrold in this city have a good sale for it."

An Opinion on WORK.—CENTRE BIT (*Tullow*) writes:—"I like WORK very much; it is a very useful paper. I am an amateur carpenter, and it is a great help to me, and by its aid I have turned out several very nice pieces of furniture described in it, viz., one of the small tables in No. 1, and the summer fireplace fitment. As a hint to other amateurs like myself, I enamelled it in Aspinall's electric blue, and then painted several of the Japanese designs in japan."

Fret Cutting.—A 'PRENTICE JOINER (*Glasgow*) writes:—"I enclose you two simple patterns which may meet with your approval, and others. I take a piece of white cartridge wall paper, lay it flat on top of pattern, get or take a flat piece of cork, or other soft wood, a piece of common upper shoe leather, 3 or 4 in. square; apply it to the cork as you would a square of sandpaper, rub back and forward on the top of the paper, and you will have a correct copy. Afterwards glue or gum it to the piece of wood you wish to cut it from."

Wrought Iron and Steel Girder Work.—H. W. (*Oakworth*) writes:—"I was rather surprised at FEN MON expressing a hope that the paper on this subject should be discontinued. I assure him that this subject is well worth the room that it occupies. Though I am not in the trade I shall follow it till its completion. I wish all success to the editor and staff for all the subjects they are taking under hand."

About WORK.—A 'PRENTICE JOINER (*Glasgow*) writes:—"For the first time your paper last week caught my eye. I bought it, and after perusing it I must say it is a valuable little paper for all classes of workmen, especially mechanics and young lads of the rising age; and by them carefully perusing it now when mind and memory are free, much could be learned and committed to memory, which would prove of incalculable value to them in after years, and a well-spent penny weekly. For as books so are papers judged, not by their covers, size, or number of pages, but by their contents. So, again, I wish your paper every success, and after this be able to have my penny always at hand and eye ready for your next coming issues."

Men Worth Knowing.—HELP EACH OTHER writes:—"I should like to add my share of praise as to the usefulness of WORK, and must say I look forward to each Wednesday for a pen'orth of something fresh, and am never disappointed; if not exactly my hobby I always pick up some wrinkle, and though an old amateur joiner, etc., am always open for improvement. May I venture to recommend two makers with whom I have been in the habit of dealing? One of these is Mr. Massey, of Spalding, from whom you can get a good new 3-in. slide rest for 35s., and very well made. Doubtless, many readers, who, like myself, have their hobbies, will be glad to hear of such a cheap and good maker as I have found Mr. Massey to be. I should also like to recommend C. Pool, Hockley, Nottingham, as the cheapest and best maker and dealer in tools I have come across. I enclose my business memo., and can assure you I have not the slightest interest in either of these people, further than having had goods from them, and found them very good, and 20 per cent. cheaper than most people from whom I have had lists."—[Thank you for your letter. I am always glad to give the names of cheap and good makers. I have been compelled to omit part of your letter. You know, doubtless, what Mrs. Malaprop said about comparisons.—ED.]

Chamfer Plane.—J. W. (*Burton-on-Trent*) writes:—"In page 61 of WORK I see you give a description of a chamfer plane sold by Melhuish and Co., but you omit to describe one of its chief advantages, that it not only works the chamfer but cuts the stops. I made one myself about two years since from a working drawing published in the *Carpenter and Builder*, and can highly recommend it, for it saves quite half the time spent in the ordinary way, and cuts a nice clean stop, which is one of the chief points with a stop chamfer. If you like to insert this in 'Shop' it may induce some brother chips to become purchasers of a tool that I am sure they will prize. I wish every success to WORK."

Wrought Iron and Steel Girder Work.—BOILER MAKER (*Liverpool*) writes:—"I am surprised that FEN MON should show himself so selfish as to express a hope that the paper on 'Wrought Iron and Steel Girder Work' should be discontinued. I have been taking in your paper since the first number was issued, and have been very much interested in all papers relating to wrought iron work, and I sincerely hope you will continue them. Also give us a little on boiler making and iron shipbuilding. There are plenty of subscribers in Liverpool who would be glad to read them. I may say I am deriving great benefit from your 'New Popular Educator.'—P. S. Excuse writing, as twelve months ago I could hardly write my name, and what I know now I owe to Cassell's papers."

Oil for Watches.—J. T. (*Birmingham*) writes:—"I see in WORK No. 15 reference is made (in 'Shop' column) to watch and clock oil. I quite agree with your correspondent that Kelly's oil is an exceedingly good oil. But it is capable of improvement—viz., by mixing with another make of oil. At our works we use a deal of oil, and after repeated trials the best oil for watches (clocks I have never had much to do with) we find to be a mixture of Kelly's and Stretton's. Proportions, three bottles of Stretton's to two of Kelly's. It is extremely important that watch oil should be of the very best quality, as all in the trade know, and while each of the oils mentioned is good, mixed as above, they are all that can be desired, and if your inquirer will try them I feel sure he will endorse this opinion. Allow me, Dear Sir, to add my thanks for your excellent production, WORK; it is the best paper I have ever met with. I wish you every success; you deserve the thanks of every mechanic, and I feel sure you have the thanks of all who know of your paper. We quite look for it week by week here. I hope soon to see some articles on the various branches of watch making; they would be very welcome in our works, I am sure."—[Articles on watch repairing are begun in this number. They will form the stepping-stone to papers of an advanced character for the professional workman.—ED.]

Violin Clamps.—WREN (*Glasgow*) writes:—"I am glad to see that some of our violin makers are walking into the 'Shop.' I see in page 222 of WORK that J. G. writes to E. P. W. on fiddle clamps. I say, with him, that it is a cheap method of making them; but I cannot agree with him in saying they give satisfactory results. If J. G. has no way of fixing his top piece of wood to the head of the nail, what is the outcome? It is this: if the bottom piece be the least tight round goes the nail with it, and where are you then? It is thirty-two years since I put a fiddle together with the same sort of things; but the way I screwed them up was with a screwdriver. They have more faults than that after being used some time. I have got the back and belly of a violin made, and working at the corner blocks and handles. This time if I can get screw nails to fit I will try another plan by running the top piece of wood hard up to the shoulder of screw; it will hold tight enough for all the pressure you need put on the lower piece of wood. The screw on the nails will require to be $2\frac{1}{2}$ in. long. If they cannot be got I will fall back on the nails I have, and file off two sides of the head, then sink them into the top piece of wood, and fill up with glue and sawdust to hold them fast. There is a short article on fiddle making by H. P. in the *Boy's Own Paper*. He gives a drawing of a cheap substitute for fiddle clamps. It appears to be a piece of wire with a knob on the end of it; it is screwed up to the knob. There are two round pieces of wood; one is screwed up to the knob, the other on the point. He calls them shutter screws. I have been looking for them, but they know nothing of them in Glasgow."

Classes in Handicrafts.—H. N. (*Kingston-on-Thames*) writes:—"I have had sent to me a copy of your paper, WORK, for June 1st. Allow me to state I was very pleased with it, and I have every sympathy with the effort you are making to extend a real and practical interest in such subjects. I wish to ask your advice, for I can imagine that from your position and your experience you and members of your staff would be fully able to give it me; or, if you think better, would you put my case in those useful columns at the end of your paper, where those who want information ask for it? My case is this. We have a club here for young men—many of our members are of a right, good sort—and we can count upon a certain amount of financial support; we have too certain offers of personal help from practical men. In this club the committee are anxious to arrange classes in handicrafts—*e.g.*, carpentering, brasswork, moulding; but we are rather shy of making experiments in the dark, for we are not practical men, and the first expenses seem very heavy. Can you, or any of your staff, or any of your readers, give us any directions how to make a start, or tell us of any place or institution where, in a small way, such classes are worked with some success? I must apologise for troubling you. I can only say your paper suggested to me this idea of seeking your advice."—[I think it to be the better course to give publicity to your appeal in this section of "Shop." I do so in the expectation that some reader of WORK who has taken part in the establishment of such classes will write a paper describing the course of action he himself has taken, and the results of his experience. Such a paper cannot fail to be helpful to many who may be seeking to establish technical classes in town or country during the winter months.—ED.]

On Trial.—E. Y. (*Liverpool*) writes:—"I cannot tell you how pleased I was when I first saw your advertisements of WORK, or how anxiously I waited for the first number to come out. I have taken in several of your publications, from the first 'Popular Educator,' onwards, and was always well satisfied; so much so, that when I heard of WORK, I said, 'Why, here's the very thing I want.' I am always trying to find out something I can make at home in my spare time, and, so far, I have succeeded very well, being rather handy with tools of all sorts; but I am sorry to say WORK does not come at all up to my expectations, yet I can't very well say why. Anyhow, I am going to take in the first volume, and hope by that time to like it better, or be able to state my reasons more definitely; but at present I see so many letters speaking well of the paper that I am afraid there is something wrong with my judgment. At the same time I wish you every success with your new venture, and hope it may at least be a means of encouraging men to work at home and keep out of public-houses. I may just mention that I have lately bought a small lathe and fitted to it an arrangement for fret sawing, entirely my own idea, which will take in either fret saws or frame saws up to 9 in. long, and table wood up to 2 ft. square by $\frac{3}{4}$ in. easily, and truly square on edge. Some time I will try and let you know how I have done it. I hope you will excuse me if I have taken up too much of your time."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Advertisement Pages.—A WELL-WISHER OF WORK (*Kirkcaldy*) must kindly accept the reply given to AD FINEM, page 263, as an answer to his communication.—ED.

Clocks.—G. H.—(*Hetton-le-Hole*).—By sending your business card to Grimshaw & Co., 35, Goswell Road, Clerkenwell, you can get their illustrated price list of everything; or from Morriss Cohen, Kirkgate, Leeds, from either of which you could get most of what you require; while for clock wheels and parts you can't do better than J. Mayes, 55, Red Lion Street, Clerkenwell, of whom I get all wheels, castings, forgings, etc., for all the clocks we make.—A. B. C.

Mixing Plaster of Paris.—A SUBSCRIBER (*Birmingham*).—For ordinary casting plaster is always mixed with water. In waste moulding, the water for the inner mould should be tinged, and nothing is better for this purpose than common black ink—a few drops will suffice. It is well when thus tinging water, as also when colouring it with yellow ochre, Prussian blue, etc., for tinting an actual cast, to thoroughly mix the colouring matter with water in one vessel, and pour off into another for use, so that no sediment may be allowed to go into the plaster.—M. M.

Composition.—A. W. (*Great Yarmouth*).—The price per column of news (14 ems brevier), including distribution and corrections, is 8½d. per 1,000 ens. The cost of a column would depend on its length, which is not given in the question.—J. T. P.

Automatic Application of Brakes.—C. J. W. (*St. Mary's, Beccles*).—Your invention is simple and ingenious, and with properly-formed levers would work satisfactorily. The levers must be so shaped as to be actuated without concussion, but this detail you would settle before drawing your specification. Before applying for a patent I should advise you to have a careful search made to see if you are anticipated, as there have been so many patents granted in this connection that this question cannot be answered off-hand.—F. C.

Instructions for Making a Model Locomotive.—A CONSTANT READER (*Dublin*).—Your best book would be Pocock's "Model Engine Making," 2s. 6d. (Sonnenschein & Co.).

Circular Saws.—A. R. (*Scorrier*).—Those who criticise an author should be at the pains to ascertain his meaning. A. R. takes me to task *re* my article "The Saw: how to use it," page 162 of WORK, saying, I "am of opinion that himself (J. H.) nor any other man ever saw a hand saw with teeth as shown in Fig. 6, if so, I am confident that no man, let him be ever so skilled in the working of the hand saw, could work it either in soft or hard wood with rake there given." Now it so happens that I said the same thing, but in other words. I was comparing cutting action with that of scraping, and the words I used were, "It will be noted that the rake of the teeth" (the hand saw teeth in Fig. 1) "is such that there can be no true cutting action. For the teeth to cut truly they would require to be formed with a good deal of rake, as in Fig. 6. But the quantity of rake thus represented would unfit a hand saw for general work. Actually, then, the hand saw teeth are in principle an assemblage of scrapes, and as such they have little penetration."—J.

Bordering for Garden Paths.—T. H. C. (*Maidstone*).—It is difficult for me to say what would be the *cheapest* bordering for garden paths in your locality, because I do not know what local material may be available there. Edging tiles and cement coping in lengths are certainly expensive, and liable to be broken if spade or roller come in contact with them. A wood edging is not costly, for if you use 9-in. boards and rip them down the centre you will get 24 ft. run out of a board 12 ft. long, and the edging will be 4½ in. deep. If you use 6-in. floor boards, ripped down in the same manner, it would be even cheaper, if you can content yourself with a 3-in. edging. In Devonshire, the stone of the country, which readily splits into thin layers like

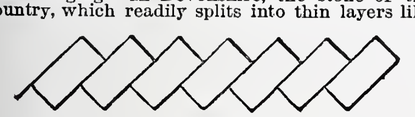


Fig. 1.

Fig. 2.

scales, is largely used; and slates themselves may be utilised in the same way; but to you, in Maidstone, they would prove an expensive mode. Flints from the chalk carefully set in the soil form a nice edging, though they are liable to get disturbed, and present a pretty appearance when backed by aubretia, yellow or white alyssum, or any dwarf-growing plant. Box, I think, is as pretty an edging as any, its only fault being that it often affords a harbour for slugs, especially the small greyish-white slug. If you can get hold of a number of old bricks and have the mortar that adheres to them cleared off, you may make a good edging of them by setting them on end in the soil in a slanting position, as shown in Fig. 1. Again, a rustic edging may be made by obtaining a number of sticks, such as are used for staking dahlias, hollyhocks, and kidney beans or scarlet runners, cutting them into lengths, and stringing them on wires, as in Fig. 2. In this the sticks are disposed alternately in long and short lengths, but other forms may be produced. At intervals—say, from 12 to 18 inches—a long stick sharpened at the end should be introduced, to be driven into the ground to impart steadiness to the edging, and the intervening sticks should be long enough to be buried, say, to half their depth in the soil.

Galvanic Battery and Shocking Coil.—A. S. (*Falkirk*).—An instrument for "trying the nerves," as you express it, by sending through them a current of electricity, is named a "shocking coil." It is made up of a short coil of covered copper wire wound on a bobbin furnished with an iron core. Outside this coil is wound another very long coil of fine, covered, copper wire. The current from a galvanic battery is sent through the short coil and made to pass by way of a breaking apparatus or interrupter, which causes the current to go through the coil in jerks and spurts. These are transmitted to the outside long coil of wire, and sent by it through any part of the human body placed in contact with its two ends. The sharp jerks or tremors sent through the nerves are said to "try" them, because only those persons with a strong nervous system can suffer them to be thus shocked. A full description of this instrument would be too long for "Shop." If readers desire such a description, I will try to prepare an illustrated paper on this subject.—G. E. B.

Cracked Piano Sound-Board.—F. K. (*Hinckley*).—The reason your piano sounds thin from E? to B?"' is not because of the crack in the sound-board, but that your sound-board has sunk, and probably caused the sound-board to split. I expect it is weak just under the bridge, or it has had too much down pressure on it. You will have to strengthen it. Take out the backing material which is tacked at the back of your piano. Now you will be able to see the damage. Make some feather-edged pieces of soft wood and glue them in the crack as well as you can; then level it off; it will be rather awkward for you, as you will find the uprights in your way, but with patience you will get over it. Now, where you can get to it, glue and screw, with small screws, some pieces of wood 3 in. wide over the back of the bridge where it was split; use thin wood, such as is used for cocoa or blacking boxes, that you can obtain at some shop in your locality. Having done this, get three or four large corks—such as are used for quart bottles—and where you found the tone thin, cut the cork so that you will have to press it tight between the uprights and the sound-board—the tighter the better. This will have the effect of raising your sound-board up, and restoring the tone. Put one cork to every upright in the line of the crack. It would be better to do this after your pieces of wood have dried a day. It would assist me much in giving answers about pianos if the writer would state what kind of piano it is—cottage, square, or grand—maker's name, and whether new or old, wood frame or iron, as I wish these answers to be as complete as possible. If you would communicate the result to the editor it might help some other reader.—T. E.

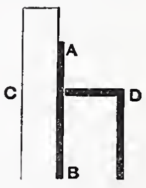
Application of Reeds to Pipe Organ.—J. C. (*Cannonburgh*).—There are many objections to the method you suggest of fixing harmonium reeds in the sound-board channels of a small pipe organ. One of the most important points to be considered, in order to make a harmonium reed speak properly, is its distance from the pallet hole; for instance, C' must be exactly opposite the hole, and not more than ½ in. below it; pitch C should not be more than an inch away from the hole, and half an inch below it; and 8 feet C should be about its own length distant from the hole, and 1½ in. below it. Now, although your idea is to reverse the usual system, by having the reed above the pallet, it would still be necessary to keep the same relative distances between them. And then again, how would you manage to turn them? If you have made up your mind to adapt a set of free reeds, by all means let them have their own pan, and separate pallet action. I cannot suggest a method of doing this without knowing how your organ is constructed. If you will send a small sketch showing a section of the key, sound-board, and pallet, with position of bellows, I may be able to help you.—G. N.

Restoring Piano Keys.—H. W. (*Sheffield*).—The method usually adopted for restoring the colour of ivory piano keys is by planing, scraping, and polishing; but as I presume our reader may not be possessed of the necessary tools to accomplish it in this way, I must simplify the procedure. Raise the top of piano, draw forward the door containing the fret or panels, then you can raise the part which covers the keys; take this out, also a slip of wood which lays behind the keyboard. Having done this, you raise the key up, until it clears the pin in the centre; then draw the key forward. It would be as well to try a few at first and see the result. You will find them worn more in the centre of the piano, as it is used more; be careful not to rub through the ivory. Get 4 sheets of 1½ glass paper, also 4 sheets of 1, also 4 sheets of 0. Now lay these on a level table, or bench, take the key in your hand, and rub it on 1½ first, and then on the other two sizes of glass paper. This will take the scratches out; as you rub, give it a rotary motion; you will see it come whiter as you rub it; now serve the remainder in the same way. Now, to polish them you will require a piece of wood about 3 in. square, and wrap round it a piece of white flannel. Now get half a gill of methylated spirits, rub some whiting on your rubber, and sprinkle the spirits on, until it forms a rather moist paste; then rub to and fro quickly until you see the polish; now clear off all superfluous whiting with a damp cloth and wipe dry. Having done this through the set, take a little tallow candle and rub on the palm of the hand, and rub the ivory sharply; then rub with a soft cloth, and your keys ought to be white and polished. I should be pleased if you would communicate the result of your work.—T. E.

Reed Holes, etc., in American Organs.—S. M. (*Croydon*).—You cannot purchase American organ reeds separate from the board into which they are grooved; and even if you could do so, it would be impossible for you to make the reed board, as the boring of the cavities can only be done by very costly machinery. Both the reeds and reed boards have to be imported from America, for there are no makers of them in this country. They can be had in several sizes, the largest of which contains four 5-octave sets—viz., one of 16 ft., two of 8 ft., and one of 4 ft. pitch, and these are arranged so as to work with one pallet. 2-ft. reeds can be obtained by special order to the makers, but are not carried beyond top F. Very few makers of organs use them, as the effect produced is certainly not worth the extra work entailed in putting them in. It is difficult to give the size of the "exhauster" (erroneously termed the bellows) sufficient for 8½ sets of reeds, without knowing something of the instrument for which it is intended. To make a rough calculation, each primary exhauster should have a wind capacity of about 2,200 cubic inches, and the size necessary for this would be 2 ft. 4 in. long by 1 ft. 8 in. wide, with an opening of 8 in. at the widest part. The wind capacity of the reservoir should be nearly double that of each primary exhauster. I can supply you with a reed board, containing unvoiced reeds, at the rate of 10s. 6d. per 5-octave set.—G. N.

Making Electrical Dynamos.—H. E. A. (*Hackney*).—Electrical dynamos are machines for converting the dynamical force generated in any motor into electricity. Such a machine is furnished with two large iron electro-magnets wound with coils of insulated copper wire. These are named the "field-magnets." In their field—that is, within their influence—is caused to revolve a cylinder, or ring of iron (named an armature), wound with another coil of wire. The ends of this coil are fixed to a commutator, which arranges the current of electricity set up in the armature, and sends it around the coils of the field-magnets. The current is taken off from one end of the field-magnet coils and one of the brushes of the commutator. This, briefly, is a description of "the construction and action of an electrical dynamo." Doubtless it is valueless for the purpose you have in view. To understand how to make a dynamo you will have to read a long series of articles, or a book, on the subject. I can recommend to you Mr. Bottone's book on "The Dynamo: How Made and Used."—G. E. B.

Summer Fireplace Fitments.—KILDONAN writes:—"I am at work on the summer fireplace fitment described in No. 9 of WORK. Can you give any suggestions as to the construction of a fitment, equally substantial and tasteful, for a fireplace where the ribs of the grate project beyond the stone jambs and lintel, and the mantelpiece is not a plain pilaster structure such as his design shows? It is an old-fashioned affair, though elaborately ornamented, the pillars being very light, and shaped something like the architraves round a door or window, while above the lintel there is a series of alternate friezes and mouldings up to the shelf itself, which forms the finishing member of the topmost moulding. I cannot specify it as an architect would, but it is not suited for taking in a frame like that shown."—[I know precisely the kind of grate you mean. You can use the design just as it is given, and hide the gap caused by the projection of the bars of the grate by strips of wood of the proper width nailed to the edges of the top and sides of the fitment, thus boxing in the grate. To ensure stability in the fitments, I think sheet metal hooks, of which a side view is given in the annexed diagram, should be screwed on to the cross piece that holds the bracket, to hook over and on to the topmost bar of the grate. In this, A B is the plate to be screwed to the cross piece; C, shown in section; and D is the hook.—ED.]



Polish for Cedar, etc.—H. A. (*Batley*).—French polish is generally used as the finish for these woods. It may be made by dissolving shellac in methylated spirits—say, 4 oz. of the former to each pint of the latter. Bleached shellac should be used if white or colourless polish is wanted. Mahogany and open-grained woods should have the grain stopped by rubbing in a filling of some kind. Whitening and turpentine with a little colouring matter—such as rose-pink for the woods you name—to match the wood, is a very good one. To enrich the colour, the wood is generally oiled with raw linseed oil. The polish is applied with a rubber of cotton wool enclosed in a piece of soft rag, the finish being obtained by lightly using a rubber moistened with spirit only. Pencil cedar does not require any filling. This is an outline of the process, which, I hope, may help you. To give details would occupy more space than can be devoted to any subject in these columns; but, as you will have seen from answers to previous inquirers, a series of articles on French polishing, etc., will appear as soon as practicable in WORK.—D. A.

Polishing Dining-table Top. — W. H. B. (*Peterborough*).—The dead surface is produced by oil polishing. The process simply consists of rubbing linseed oil, and polishing with a soft rag. The oiling and polishing must be continued at intervals till the requisite shine is obtained. To get the best results takes time and friction. Oil polishing is not difficult, but it is decidedly fatiguing and tedious. The more the surface is rubbed the better, and the process may be extended over some weeks. —D. A.

Screw for Wooden Copying Press.—COPYIST.—You ask for "some simple method for making the wooden screw" for the copying press described in WORK by Mr. David Denning, "and the threaded block through which the screw revolves." The simplest method for you to adopt, and the best one too, is to buy one of any ironmonger and dealer in tools who keeps such things. You would get one for 2s. or 2s. 6d. These screws and the blocks in which they work are cut by what is called a box and tap, which would be costly for you to buy for the sake of cutting a single screw. You give me no clue to your place of residence, but if you live in a large town you might pick one up cheap among the odds and ends of some marine store dealer.

Hatching Machine. — G. P. (*Birmingham*).—I note your request for instructions for making a "hatching machine," or incubator, as it is generally called. At present the pressure on my space is too great to enable me to give a paper on it promptly, and it must form the subject of a paper, or even two, for it is not possible to deal with it satisfactorily in "Shop." Perhaps this reply will bring offers to write on the subject from some reader who has taken the task in hand for himself.

Subjects for Work.—W. H. A. (*Gorton*).—For "Design in Textile Fabrics" you could not have a better work than the book of that name, by Mr. T. R. Ashenhurst, published at 4s. 6d., as one of the series known as Cassell's Technical Manuals. I am waiting for promised papers on the spinning wheel and simple hand-loom, as these are wanted in some of our Colonies. Then possibly we may go on to higher subjects in this direction. I cannot make any promise about oleographs and chromographs. If you want any special information with regard to their production, if you will state your difficulty I will endeavour to get it answered. I do not think it desirable to enter on the feeding and rearing of silkworms and their treatment, as there is no likelihood of the production of raw silk being attempted in this country on a large scale. It was tried, if I remember, some years ago, and the worms were fed on the leaves of the Ailanthus. Silk manufacture is different, but if I begin too many subjects at once, one will stand in the way of the other.

Watch and Clockmaking.—R. D. (*Rathgar*).—Papers on this subject will be found to be commenced in the present number. No specific promise of papers was made in the preliminary prospectus of WORK. It was only sought to give a list of the chief trades relating to which papers would be given at sometime or other.

Sheet Metal Working.—ST. MUNGO.—You will have noticed that a beginning was made in "Sheet Metal Working" in No. 17 in the paper contributed by Mr. Robert Alexander. Instructions will be given independently of these for the manufacture of fern cases, aquariums, etc. It is well to take care of the numbers of WORK, as the Magazine will constitute a valuable reference encyclopædia for workmen of all trades. I am not acquainted with any book that deals exhaustively with sheet metal work.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Book Machine.—J. M. F. (*Dublin*) asks:—"Could any of your correspondents inform me where a machine could be had which would make an ordinary book rim with a single stroke?"

Rickety Table. — A. J. T. (*Holborn*) writes:—"Could you advise as to cure of above? It is a substantial two-leaved dining-table on castors. The legs screw on and off. If you happen to knock against it at tea 'over goes the show.'"

Model Engine.—W. H. M. (*Nottingham*) writes:—"Will some reader of WORK say if it is possible for an amateur to make a small gauge for model engine boiler about $1\frac{1}{4}$ dial, and to register about 30 or 40 to the square inch? If so, kindly describe its working parts."

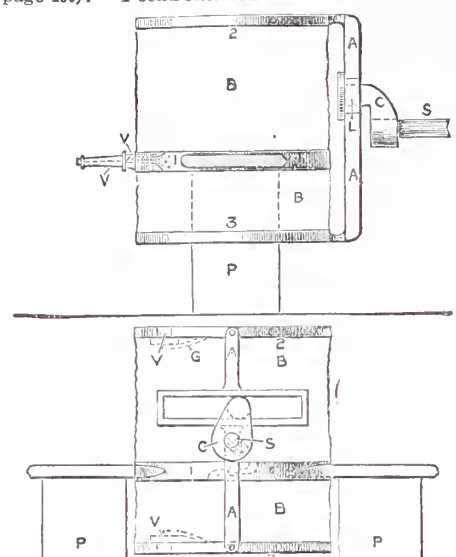
Paint on Leather. — J. B. S. (*Nottingham*) writes:—"Would a correspondent inform me how to prepare leather to receive paint, or how to prepare paint to put on leather, so that when the bag or portmanteau is in use it will not crumble off?"

Illuminating. — H. C. (*Lincoln*) writes: — "I wish to know how to illuminate upon parchment. Is there a preparation to apply to the surface before working upon it? I have been using ordinary moist pan colours; they are not sufficiently brilliant. I have also used the gold and silver in shells, but these are not satisfactory. I shall be grateful for help."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Joiners' Composition.—A. F. W. (*Upper Tooting*) writes in reply to F. B. (*Guernsey*) (see page 158):—"I forward a well-tried recipe—viz., melt in a tin in the oven, or on top of a stove, 2 oz. shellac, 1 tea-spoonful resin, a piece of beeswax, size of half a walnut. When melted add any dry colour to match your wood, then pour out a little on a board and roll out in sticks like sealing wax. To use get a piece of iron or an old file, hot, not red hot; hold the end of one of the sticks over the crack or hole, apply the iron, and rub the stopping well in. Clean off with scraper and glass paper."

Machine for Current of Air.—C. H. (*Birmingham*) writes in reply to BELLOWS (*Gloucester*) (see page 190):—"I send enclosed sketch of machine of



my own invention, hoping it may be of use to your correspondent BELLOWS. 1 is a circular board which forms an end of each bellows; this board is stationary. 2 and 3 form the other ends of the bellows; S is the revolving shaft on which a crank, C, is fixed. The crank pin works in a grooved piece of iron, L, and as the crank revolves this is lowered or raised. Attached to this are two arms, A A, one fastened on each of the ends, 2 and 3. Then as one board is raised, the other is lowered, producing a constant stream of air. The nozzle is divided, and a valve placed in each side, so as to prevent the suction of one bag taking the air from the other."

Cleaning Oil Paintings.—C. H. (*Birmingham*) writes in reply to L. S. (*Lower Broughton*) (see page 190):—"I may state that hydroxyl (a compound of hydrogen and oxygen, which may be obtained of the principal chemists) will clean oil paintings, without injuring the colours, and restore them to their original freshness. The oxygen of the hydroxyl oxidises the lead sulphide (the blackening material) into lead sulphate, which is white, while all the original colours remain unaltered."

Blue Prints.—A READER writes:—"After reading in 'Trade Notes and Memoranda' 'An American writer's Note on Blue Prints,' it occurred to me that it would be greatly beneficial if blue prints could be coloured, thereby saving tracing cloth for shops, and lessening labour, the tracing from which print was taken being ready at any time necessary to make another print. I dissolved some soda in water, and used same to mix colour with, then applied to print. The soda in the mixture had the desired effect on print—*i.e.*, changing colour of print, and leaving colour on same as bright as when applied to drawing paper. I then followed our "Cousin's" directions regarding red ink, which I used for centre lines, and a similar method for blue ink, which I used for dimension lines. I was pleased to see they came out very clear, and answered the purpose well. I afterwards used some soda water for figuring in the dimensions, but finding the solution blurred, I added a little gum, which overcame the evil, and good, firm figures, and clearly white, were obtained. I dare-say this would be useful to some readers of WORK, as I presume the aforesaid are to be found in all branches of industry, and I should be greatly obliged if you would enter this in your column."

Organ Builders' Tools.—W. J. C. (*Clapton Park*) writes in reply to W. P. (*Grantham*) (see page 190):—"Noticing your correspondent's inquiry *re* organ builders' tools, I would suggest that he make inquiries of (or, if a resident in London, call personally at) Messrs. Thos. Syer & Co., 75, Chiswell Street, as I have often obtained through them things which I could not get anywhere else, and feel sure, from my own experience, that if they have not got in stock what our fellow-worker wants, they will get them for him, and think it no trouble."

Trade Notes and Memoranda.

THE Chelsea Public Library Commissioners have awarded their premiums for the plans sent in for the new building to be erected in Manresa Road, King's Road, S.W. The premium holders are—(1) Mr. J. M. Brydon, F.R.I.B.A.; (2) Mr. E. W. Mountford, A.R.I.B.A.; (3) Mr. C. Pemberton Leach, A.R.I.B.A. The proposed South-Western Polytechnic will probably be erected on a site adjoining this library.

THE California Electric Light Company, of San Francisco, has erected at the Chollar Mine the largest electric power plant in the world. It comprises six 120-horse power Brush dynamos, each driven by a Pelton water wheel with water under a head of 1,630 ft. The water is conveyed through two pipes of 8 in. and 10 in. in diameter respectively. The station is situated in the shaft of the mine, and the exhaust water is carried off by a tunnel to the Caron River. The current is led to the mill, where it drives six Brush motors of 125-horse power each.

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Full particulars of the Scheme will be found in WORK No. 17, page 254.

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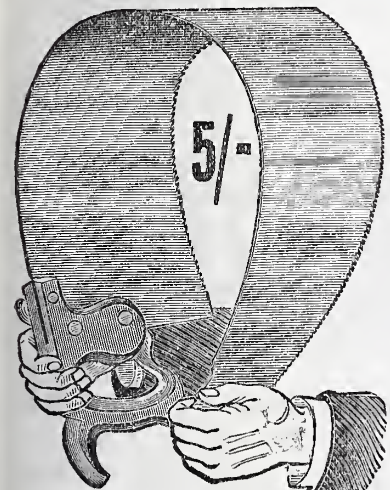

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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LOCK REPAIRING AND KEY FITTING.

BY THOS. WILSON.

Back-spring and Tumbler Locks.

No doubt most if not all the readers of Work have at some time or other had occasion to employ a locksmith. Now, I do not say that after reading the following article they will be able to entirely dispense with his services, but I purpose showing how any workman, professional or amateur, can keep his own locks in repair. There are several reasons why they should do so, and before commencing this article I will mention one or two.

In the first place, there is the saving of money. Workmen's time in London and most of the large towns is charged for at the rate of a shilling per hour, and although the number of hours are not generally specified in the bill, that is the price the customer has to pay. I have frequently seen bills made out as follows: Man's time, taking off, cleaning, repairing, and fitting new key to lock—two shillings and sixpence. This represents two hours' time, and sixpence for the key. In the country the customer would probably be charged three hours' time at ninepence. If the reader follows the directions I am going to give him, I think he will be able to save two shillings out of the half-crown.

Besides the question of cost, there is a graver reason why householders should do their own locks as far as possible.

"It is an ill bird that fouls its own nest," and I have not a word to say against workmen in general, but there are black sheep in every fold. What is to prevent a man when fitting a key for a front door or safe lock from fitting an extra one for his own use? Of course, he would not use it at once; it would be laid by for a year, perhaps two, but he would be sure to use it at some time or other. For my part, I am convinced that many burglaries take place in this way.

One more reason, and I have done. When a workman takes a lock into the shop that requires a key, he has a key or blank served out to him, and it is charged to the job. If, through carelessness or ignorance he cuts the key wrong, he will have to apply for another, and will come in for a "wigging" from the shop foreman. Sooner than do this, he will take out the wards or alter the levers of a lock, and so fit the lock to the key, instead of the key to the lock, thereby reducing a good lock to the level of a bad one. Having, I hope, shown why locks should be repaired at home, I will now proceed to show how. First as to tools. Well, the only tools absolutely necessary are a vice, hammer,

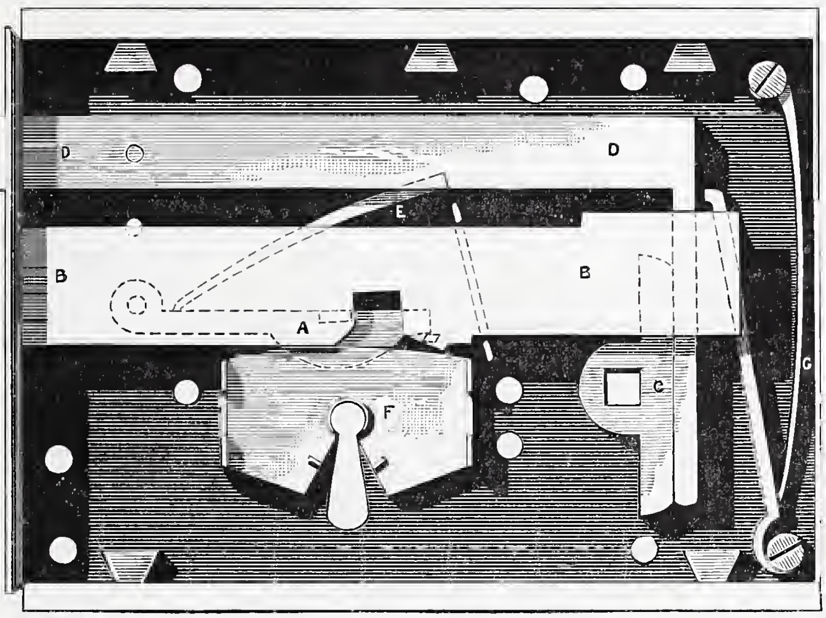


Fig. 1.

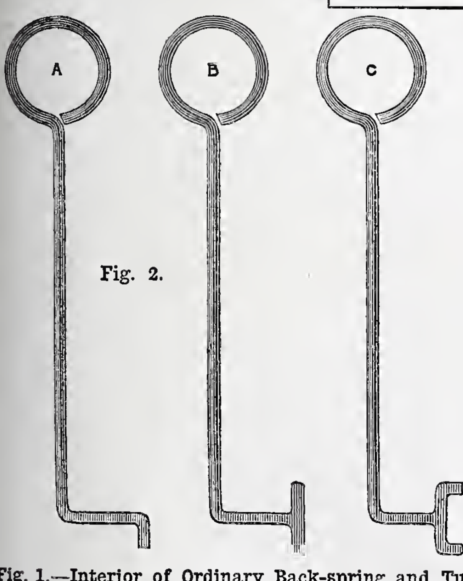


Fig. 2.

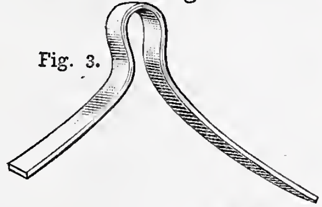


Fig. 3.

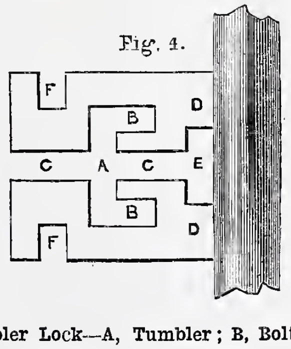


Fig. 4.

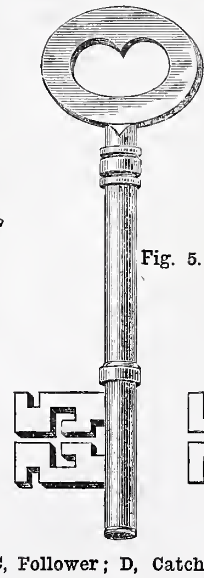


Fig. 5.

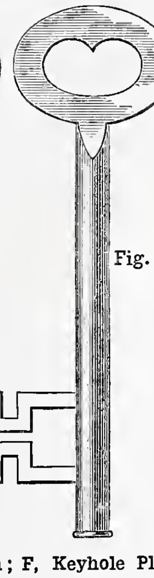


Fig. 6.

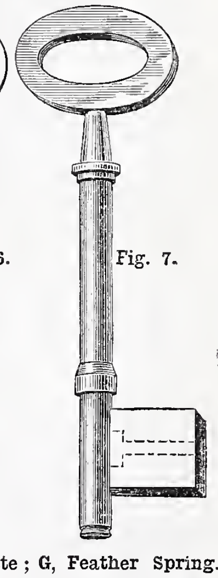


Fig. 7.

Fig. 1.—Interior of Ordinary Back-spring and Tumbler Lock—A, Tumbler; B, Bolt; C, Follower; D, Catch; F, Keyhole Plate; G, Feather Spring. Fig. 2.—Different Forms of Picks. Fig. 3.—Scotch Spring. Fig. 4.—Enlarged Diagram of Key in Fig. 5—A, Spot at which to Drill Hole in Blank; B, B, the L Wards; C, C, Bridge Wards; D, D, Parts at which Key is liable to break when cutting L Wards; E, Collar Ward; F, F, External Wards. Fig. 5.—Key belonging to Lock. Fig. 6.—Skeleton Key capable of Opening Lock. Fig. 7.—Blank with Bridge and Collar Wards Cut.

screwdriver, and a few warding files and chisels. Other tools will be described for the benefit of those who may care to purchase them, but, although, of course, it is better to have them, they can be dispensed with. Every house possesses a hammer and screwdriver of some description, so that brings us down to the vice, warding files, and chisels. Most amateurs possess a vice, but those who do not can get one for about half a crown that will answer the purpose; though it will be better to give a little more if it is intended for any other use. Some vices have small square anvils, or heads, attached to them, and these will be found of great service in key fitting. Warding files can be purchased for threepence or fourpence each, and chisels for about sixpence.

Having got our tools together, and the vice fixed, we will now commence work. We will commence with the ordinary backspring and tumbler locks, as they are more frequently used than any other, and will afterwards take the Bramah and the various kinds of lever locks.

The one shown in Fig. 1 is a fairly good one of its class, but it will be seen that a skeleton key of the description shown in Fig. 6 will open it as easily as the original. The keys of a tumbler lock rarely, if ever, have corresponding wards in the lock to more than one or two cuts in the key, as will be seen on looking at the illustration. Skeleton keys are made in a variety of patterns, and will pass almost any warded lock; in fact, warded locks, although still made by thousands, are gradually being superseded by lever locks. If a skeleton key will not pass the wards, they can easily be found by first holding the key in the flame of a candle, lamp, or gas, until it is blackened, or covering it with a film of wax, then inserting it in the lock, and pressing it against the wards. On removing the key the impression of the wards will be found on it, and when these are cut away the key will pass easily enough.

It is much quicker though (if a skeleton will not pass) to use a pick. These are made in various shapes; a few of which are shown in Fig. 2.

To open the lock shown in Fig. 1, it would be necessary to use two picks like A (Fig. 2), one to raise the tumbler, A, and another to throw back the bolt, B.

A locksmith or (I presume) a burglar always carries a bunch of skeleton keys and picks with him when he goes to pick a lock, and if the lock is a warded one, he never fails in opening it. We will suppose that a new key is required for the lock shown in Fig. 1. This is rather a difficult key to cut, and it will be better, if possible, to get a blank, with the bridge and collar wards also cut, as shown on dotted lines, Fig. 7.

If, however, he is unable to get anything better than a blank, he will have to cut these wards himself.

As I mentioned before, there are not so many wards in the lock as one would imagine by looking at the key; but we will suppose them to be there, and that it is necessary to cut the key as shown in the drawing.

If the reader has a small drill, it will be better to drill a hole at A (Fig. 4), and cut the L wards, B B first; if he has not, he must cut the bridge ward, C C, first. To do this he must make a straight cut with a warding file through C C. After cutting the bridge ward, he must lay the key on a flat surface (if there is an anvil or head on the vice, use that; if not, a flat iron held in the vice will do), and cut the L wards with a key chisel. Great care must be exercised in cutting these wards, or the key is liable to break at D D. The collar ward, E, must also be cut with a chisel. It is not necessary to cut the whole of the wards with a chisel, but only sufficient to allow the point of the warding file to enter. The two wards, F F, can easily be cut down with a file.

It frequently happens that the spring of a lock breaks. If it is a Scotch spring, as shown in Fig. 3, it can be purchased for about threepence; if a feather spring (G, Fig. 1), it will not be more than a penny. No directions need be given for fixing these, as the way they are put in is obvious to any one.

Should a new follower (C, Fig. 1) be required for this lock, it will have to be riveted in. To do this, it is necessary to take out the bolts, etc., and hold the face of the follower on the small head of the vice, if it has one, or on the face of a hammer held in the vice, and then rivet it on to the back of the vice. It must not be riveted on too tight, or it will not work. After riveting, it will probably require cleaning out with a small square file, or the knob spindle will not pass through. The price of a follower for a lock like this would be about three halfpence.

If the lock requires cleaning, all the movable parts must be taken out, and the case washed out with paraffin or benzoline; the bolts, staples, etc., must then be held in the vice and cleaned with emery cloth. Although not necessary, as far as the working of the lock is concerned, it is as well to clean the ledges of the case and the heads of the screws, as it gives a much better appearance to the lock. A drop of oil should be put on all parts where there is friction.

DOWELLED JOINTS.

ANOTHER PHASE OF "JOINTING UP."

BY DAVID ADAMSON.

For these the preparation of the edges must be the same as for plain joints, but, before going further, I ought to explain what dowels are. No doubt all who read these lines are familiar with them by name, but as dowels are invisible when work is at the stage in which it is most commonly seen outside the workshop, viz., when finished, it is quite possible that some may never have seen them, and may have very hazy ideas about them. Those who have access to an ordinary extending dining table may be referred to it as a familiar instance of the use of dowels. Open it, or look at one of the loose leaves. Little wooden pegs will be seen. These are dowels to all intents, but one end of them is unglued and merely fits tightly into a corresponding hole in the next leaf. In the dowel joint the dowel is fixed into both boards permanently with glue. Now with a fair notion of what a dowelled joint is, a clear start may be made to put its execution into practice. With a little attention it is not a difficult joint to make, always provided that the worker can plane up edges truly, but it may fairly be questioned whether there is any superior to it, either for strength or for speed of construction, as well as the number of situations in which it is available. We have, however, for the present only to consider it in jointing up boards for width, and we can hardly get a better example than by supposing two of the dining-table leaves glued together.

From the very nature of the dowel joint dowels are hardly ever used in wood under $\frac{3}{4}$ in. in thickness, but for anything above this they may be employed with advantage. The ordinary thickness of dowels is $\frac{3}{8}$ in., but beyond this being a generally convenient size there is no special reason for it. It is, however, very important that whatever their thickness it should be the same as that of the bit with which the dowel holes are bored. The dowels must fit tightly in if they are to be of any use. Where they are used in large quantities, the dowels are bought ready made, or, rather, the lengths from which the dowels can be cut when wanted are got. They are not, however, any better than those which any one can make for himself, but are preferred because it is cheaper to buy them. Those who wish can, of course, buy them, but I do not think they are to be got in our smaller towns, and it will be just as well for the amateur to make his own. To enable him to do so a dowel plate will be required. It is merely a piece of iron, or better, steel, with a hole through it. This hole is bored clean and true, with square sharp edges. For occasional use a good serviceable dowel plate may be made out of a stout iron hinge flange. The screw-hole nearest the centre should be enlarged to $\frac{3}{8}$ in. diameter, or just sufficient to pass the bit which will be used for boring the dowel holes. The plate thus prepared may then be screwed on to the bench, through which a hole must be bored at least as large as that in the plate, or to a piece of hard wood of, say, an inch or so in thickness. This latter is the more convenient of the two, as the plate can not only be put out of the way when not required, but a groove can be cut in the dowel while it is being formed. This groove is not invariably found in dowels, but there can be no doubt, for a reason which will be apparent later on, that it is advisable. It is not generally found in the bought machine-made dowels, from which, instead of it, a shaving should be taken off, or the dowel stuff passed through a block such as that about to be described, not all round, but enough to flatten it slightly at one part. In the block to which the plate is screwed a hole must be bored, as in the case of the plate being fastened to the bench. Through the thickness of the wood, say midway between the under and upper surface, insert a screw nail till the point just comes through into the hole sufficient to catch against anything fitting tightly into and passing through the hole in the plate. The plate is now ready, and may be used; but before attempting to do so, attention may be given to the dowel wood and its preparation.

Almost any straight-grained, strong wood will do for dowels, but beech and birch are those generally employed, though I do not know that they possess any qualities which may not be found in several other sorts. Waste pieces of any strong wood may be used instead of them. The pieces are cut into sticks roughly rounded, and then hammered through the dowel plate. This removes any irregularities, and the screw beneath it forms a rough kind of groove or furrow in the stick as it passes through. The length of the sticks is not of much consequence, but on account of the liability to breakage it is not convenient to have them more than nine to twelve inches, and they may be considerably shorter. I may as well say that the dowels to be effectual must be as dry as possible. If not, they will shrink, and not retain their proper hold on the wood in which they are inserted. Neglect of this precaution, and one or two other small matters, is, I take it, the reason why dowel joints are not altogether in favour in some quarters. When made carefully and intelligently, it is an open question whether they can be improved on by any other form.

With this, we may now dismiss the dowels themselves, and proceed to see how to use them. Now, it is quite evident that as the pin or dowel is inserted in two boards, half of it being in each, the holes bored for its reception must be exactly placed. To do this is not difficult. Presuming the boards have had their edges trued, place these side by side, and either hold them together in the bench screw or any other way that may be handy. Now with the square mark off across the edges of both at intervals of from 8 to 12 in.—more or less according to circumstances. If the boards are then placed edge to edge, it is clear that the lines on each must correspond with those on the other. Now, with the gauge set to about half the thickness of the wood, mark off a point on each of these lines. This point, of course, gives the centre of the hole to be bored in each. An ordinary centrebit may be used, but a twist bit is better, as it leaves a cleaner hole. In marking off with the gauge be careful to work from the same surface of the two boards, either from the face of both or from the back of both. Fixed, as they are supposed to be, in the bench, and then applied edge to edge, the necessity for this will at once be apparent, though, unless attention were directed, it might be overlooked.

Before preparing the edges it will be as well for the workman to look at the surfaces of the boards. Both may be equally good, but it will often be found that one side of a plank is better than the other, and it is just as well to let the better one be on the visible side. The dowel holes should be bored to a uniform depth of, say, one inch, and in practice it will generally be found better to bore them in pairs than to make them all in one plank before beginning with the other. To do this, of course, it is assumed that they are left in the bench screw and bored right off after marking. In order to get all the holes the same depth, a very simple contrivance may be used to prevent the bit boring further than necessary. Expert workers can do without it, but even they will often find it more reliable than guess work, sufficiently accurate though this may be. When I say that the little appliance suggested is merely the ordinary wooden stop so well known in the principal workshops, no further description can be necessary for the professional artisan. For the sake of the amateur, it may, however, be explained as being nothing more than a piece of wood with a hole bored through. The length of the wood—it is generally bored along the grain—must just be such that one end when the bit is passed through the hole will be against the stock, and from the other the length of the bit, equal to the required depth of the hole, will project. Those who do not care to take the trouble to make even this little arrangement may bore the holes fairly equal by noting the number of turns of the brace given to the first one, and making the others with the same. The mouth of the holes must then be widened with the rhymer or rose bit. This bevels them off at the edge, and not only facilitates the insertion of the dowels, but is useful for other reasons, which, however, need not be enlarged on. The rhymer must not be used too freely. One or two turns according to circumstances, in fact, barely more than necessary to remove the sharp edges, and any burr there may be from the bit used in boring the holes will be sufficient. By the way, as boring the holes has a tendency, more or less marked according to the wood and the kind of bit used, to raise the wood round the hole, it is sometimes advisable to run the plane over the edges again afterwards. This, of course, levels them, and though it may not always be necessary to do so, no harm can result from having recourse to it.

I said just now that the widening should not be too great, and it may be interesting to beginners and to amateurs as well to have their attention called to the reason. It is this :—The object of the dowel being to hold the boards together, it is important that as much as possible of the dowel should be in contact with the wood in which it is inserted. Now if the rhymer widens the hole to the depth of a quarter of an inch, that is, if the bevel formed by it commences at this distance from the surface of the wood, it must be evident that this space is waste so far as adherence of the dowel is concerned. Repeat this distance in the other plank, and we have at once a space of half an inch, which is practically wasted. Not of much consequence, perhaps, but, as I have more than once said, it is just by such small indications that the difference between the best and medium workmanship may be recognised. Too often one sees dowelling done in a careless manner, perhaps because the want of care is not so visible, nor attended with such disastrous results as it would be in some other operations. For similar reasons to those given for not widening the mouth of the hole too much, the dowel ought to go right to the bottom. If it does not, it is no unusual thing to see the surface of the wood joined plainly indicating the fault. There will be a hollow just above the empty space, especially when the wood is comparatively thin. It may be some time before this defect becomes apparent, but there is always a risk of it, a risk which should not be incurred, as it may easily be avoided by a little care.

In order to facilitate the dowel entering the hole, it is usual either to round off the entering end or to hammer its edges just sufficiently to make it slightly blunt. Both methods are practised, but the latter is to be preferred. If the end of the dowel is rounded by cutting or filing, of course some of the substance is removed, and in practice no bad results follow if the rounding is not too great. Mind, only the edge must be removed, and that it is neither advisable nor necessary to taper the pin, nor yet to make the end into a hemispherical shape. Perhaps this seems very similar to telling one how not to do it, so I may explain that the reason for calling special attention to improperly rounded dowels is because one frequently finds careless workmen shaping them so. Personally, I prefer hammering the ends. This removes none of the wood, but compresses the fibres, so that to all intents and purposes the end of the dowel is tapered off, but swells again under the action of the glue when it has been driven home, thus making a perfectly tight fit. Let us now suppose that two boards are to be fixed together. We take a piece of the dowel wood, whatever its length may be, and round one end with the hammer. Then glue the inside of the hole, though some adopt the somewhat speedier, but not so good, plan of dipping the end of the dowel in the glue pot. It is a slovenly way of doing, though, and it is better to glue the hole. In doing this, do not fill the hole with glue, nor yet put only a drop in, leaving the dowel to force it round. The best way to glue the hole is either to have a small brush with short end just about filling the hole—a suitable brush with short fibres can easily be made from a piece of cane—or to use merely a piece of stick a little less than the thickness of the dowel. This carries enough of the glue and disperses it easily in the hole. As quickly as convenient, so that the glue may not set before it is done, hammer the dowel home. The reason for the groove in this will now be apparent, for if there were no such channel there would be no means of escape for the glue, which will be forced down to the bottom by the dowel, nor yet for the imprisoned air. This latter might seem of small consequence, but it will be sufficient to say that if no allowance were made for it there is considerable risk of the board being split by it. Glue which may exude should not be allowed to set, or

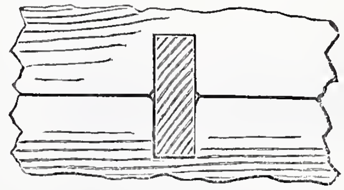


Fig. 1.—Dowelled Joint properly made.

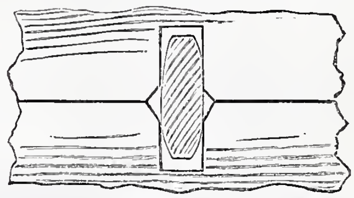


Fig. 2.—Dowelled Joint improperly made.

it would interfere with the close contact of the two boards. A small quantity will not matter if the joint is to be completed at once, and any there may be in the widened mouth of the hole may stop there. It can't do any harm even if it does no good. When the dowel is driven home saw it off, or rather saw off the excess, leaving the projection from the wood just the length of the corresponding hole in the other piece, or as nearly as possible so. In practice it is usual to cut a trifle short, for the obvious reason that if only a trifle too long the edges of the two boards could not come into close contact. All the holes are dowelled in the same manner in one of the boards, and the projecting ends rounded off by means of a file or a special dowel end rounder. Hammering naturally cannot always be so conveniently done on the second end. Perhaps some might like to know what the appliance for rounding the ends referred to is, but there is no sufficient reason for its description, as, unless a large quantity of dowels are to be trimmed off, a rasp will do just as well. I ought, perhaps, to insist on the necessity of the dowels being thoroughly dry before they are inserted, so that they will not shrink subsequently and, in so doing, lose their "grip." It now only remains to glue the edges of both pieces of wood, one of which, at least, should be warmed before doing so, and, of course, glue the holes which are not yet filled. All being ready, the boards are brought together and clamped up, when they should be left till the glue has set. Perhaps, by way of conclusion, the two illustrations may be given as a kind of summing up of all the foregoing. Fig. 1, given above, shows a properly-made dowelled joint, while Fig. 2 shows the joint, or, rather, the various faults which are most to be guarded against.

SOME FORMS OF BITS AND DRILLS FOR THE LATHE.

THEIR USES AND HOW TO MAKE THEM.

BY OLLA PODRIDA.

The D-Bit, Rose-Bit, and Enlarging Drill.

When a number of similar holes or boxes have to be prepared, a considerable saving of time and cost is effected in the long run by making special tools for the purpose. To this the increased accuracy of the work must also be added, which in itself should compensate for any extra cost involved in the preparation of the tools. The writer proposes dealing with a few of the simpler forms of these, so that their construction and use may be made clear to those unfamiliar with the subject.

Commencing with the D-bit, this tool is peculiarly adapted for boring long or deep true holes of diameter too small to permit of their being bored by means of an ordinary bar or tool. Fig. 1 is an elevation, Fig. 2 a plan, and Fig. 3 an end view showing the cutting part. The general shape in section is semicircular, from whence the name of D-bit. The tool is made out of a piece of square steel, forged down to form the cutting part, at which end it should be, when forged in the rough, of the form given in Fig. 4, a small projection being formed in the middle to accommodate the lathe centre in turning. The material should also be worked up at the corners or sides as shown in Fig. 4, so as to permit of its being gauged or callipered to size. After being forged, the tool must be softened to permit of its being turned and filed up. The softening process is accomplished by heating the part to a cherry-red and burying it in fine ashes or quicklime until cool, when it may be manipulated with comparative ease. In the case of a half-round forging the turning can only be accomplished with the assistance of a slide rest. If, therefore, hand tools only are available, it will be necessary to forge the cutting end circular in section and form the flat part afterwards, and this in the case of a moderately large tool would be tedious. In turning the tool it is carried between the lathe centres in the usual way and driven through a carrier fixed on the square end. The turned part must be made nicely parallel and finished smoothly. The end may be roughly faced to assist and guide the act of filing up the front rake or clearance, as shown in Fig. 1. Not more than three or four degrees, rake or clearance should be given, as the tool works steadier the nearer the front cutting edge is kept square to the axis of the tool. This edge must also be slightly slanted or bevelled, as shown in Fig. 2, and whatever radius is given to the cutting corner, as shown in plan, must be slightly increased as the corner is followed round so as to make sure of its clearing itself. The top side must be filed down to the centre line, and this will be facilitated by drawing a line across the end for guidance. For cast iron and brass, the upper surface forming the cutting edge may be left straight, as shown by the full line in Fig. 1, but for wrought iron the cutting angle should be reduced by filing the relief shown by the dotted curve.

The tool having been carefully finished to size and requirements, it must be tempered. This is done by first heating the cutting end to a bright or cherry-red heat, and immersing it in lukewarm water to a depth of about one inch gradually, and then plunging it in bodily for a moment, withdrawing it and immediately brightening the end with a piece of sandstone so that the colours may be noted as the heat from the partially cooled shank spreads back to the end which was gradually immersed at first. The temper should vary according to the material to be operated upon. For brass and cast iron a dark brownish straw colour will stand well, but for iron or steel it should be somewhat softer—say purple, or dark blue tinged with red. Always remember that the lighter the straw colour the harder the tool, and as the blue tints become paler so the temper softens, making the tool more unfit for resisting fatigue. In any case, immediately the colour is reached the tool must be plunged into the water and finally cooled. If possible, use the tool while slightly warm, and if the material is hard it will stand better if used without grinding.

The method of using D-bits is as follows:—Suppose the work to be operated upon is set and fixed in the chuck, the first thing to be done is to bore a short distance at the mouth of the hole to the exact size of bit. A distance of about half an inch will be sufficient or just enough to cover the bevelling on cutting edge, and ensure a fair bearing for the bit to start upon. The tool should be held in the slide rest by the square shank, but it must be very carefully set to agree with the lathe centres. It may be used supported and fed or advanced by the poppet head, the centre in the end of shank being utilised for this purpose, and the tool kept from revolving under the pressure of the cut by means of a spanner held in the hand or a carrier fixed on the shank and supported by the T or slide rest. In all cases the tool must be kept thoroughly well lubricated from start to finish, and this in small deep holes will be readily accomplished by the aid of a syringe or "squirt." Before leaving this form of bit, it should be noted that the turned half round part should never be less than two or three diameters in length, and it should never be allowed to become rusty or be otherwise neglected.

Fig. 5, the next in order, and Fig. 6 give profile and end view respectively of a very useful tool, specially adapted for accurate work or where interchangeability is necessary.

Fig. 1.—D-Bit: Elevation.

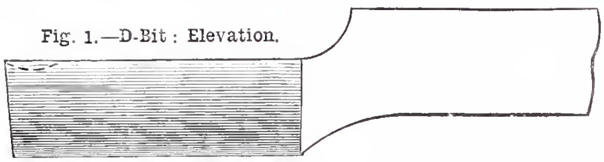
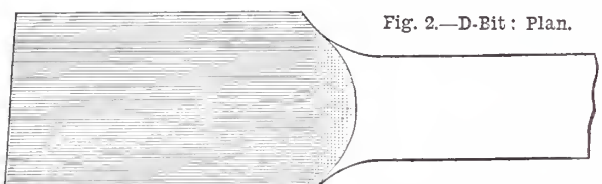


Fig. 2.—D-Bit: Plan.



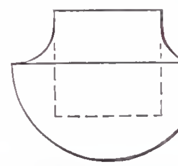


Fig. 3.—D-Bit, End View, showing Cutting Part.

Fig. 4.—Working of Material.

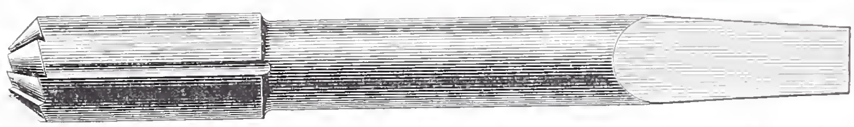


Fig. 5.—Rose-Bit: Profile.

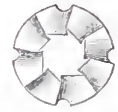


Fig. 6.—Rose-Bit: End View.

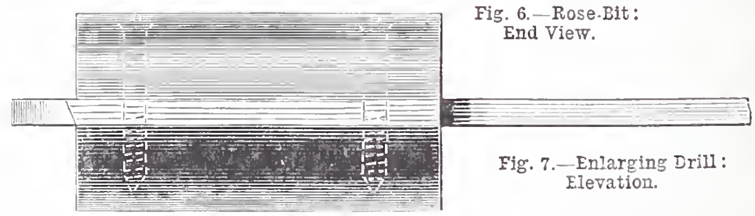


Fig. 7.—Enlarging Drill: Elevation.

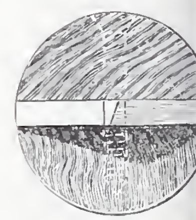


Fig. 8.—Enlarging Dril[l]: End View.

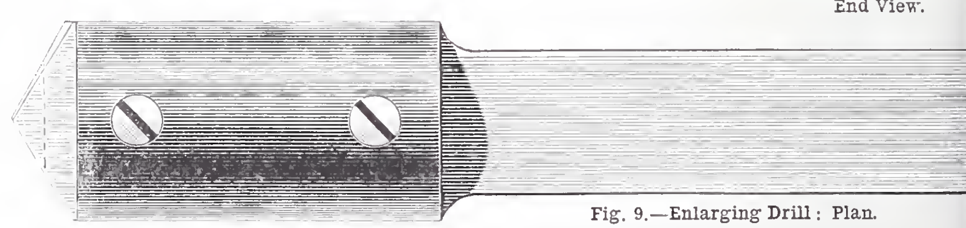


Fig. 9.—Enlarging Drill: Plan.

is not suited for heavy cutting, and i[s] therefore, chiefly employed for finishi[ng] holes which have been rough drilled [or] bored within a slight fraction of the finish[ed] size. The rose-bit, as this tool is com[-] monly called, is better adapted for ve[r-] tical work, such as in a drilling machin[e] than for the lathe, on account of the dif[fi-] culty of lubricating it sufficiently while in [a] horizontal position.

The making of a tool of this descriptio[n] is a simple matter. It is only necessary [to] obtain a piece of steel of suitable size [to] allow for turning. The end may be tapere[d] and squared, as shown in Fig. 5, to fit th[e] spindle of drill if it should be required [to] use it in a dual capacity. This done, an[d] the material softened all over, according [to] the directions given above for the D-bit, [it] must be turned up to the required size an[d] nade just easy to the callipers or gauge. he gauge part, which is cleared to the hank by a shoulder, must be made quite arallel; in fact, it is safer to make the utting end a shade larger than the other nd of the gauge part to ensure against amming. The conical part, out of which he teeth are formed, must also be turned, nd the centres should be left in both ends f the tool for future convenience. The rooves shown running along the gauge part re for lubrication, and may be conveniently ut in the lathe by fixing a round-nosed tool n its side in the slide rest, and traversing he rest or saddle by hand. The teeth are ormed by filing, and care must be taken hat they are all truly cut to the cone. The quare taper part must be well fitted to the lrill spindle, as nothing injures a socket nore than a badly-fitting shank. For such urned tools as this, the square should be preferably replaced by a turned taper secured by a key or setscrew; it is a matter of difficulty to get a square driven bit to run true. The tempering of this tool may be carried out exactly as described for the D-bit. All scale must be cleared off, and the bit polished after tempering to secure a smooth hole. It must not be used at a high speed, especially for deep holes where expansion from heat might prove troublesome. When this tool is used in a lathe, it is held as described in the last case of the D-bit, namely, by means of the poppet head.

A very handy and cheaply made form of drill is that given in Figs. 7, 8, and 9, being elevation, end view, and plan respectively. It is more suitable for enlarging holes which have already been bored, but it is a serviceable substitute for the more expensive D-bit. This tool consists of a piece of flat steel of suitable length and thickness, the latter being proportionate to the width or diameter of hole, say about one-fourth of the width. The cutting end is formed like a common drill, but it need not be brought to a point; the dotted line would give enough cutting edge. The tool is turned on the edges for a portion of its length, and pieces of hard wood fastened on each side, and also turned to the size of hole required. The duty of the wood is to keep the drill central and steady while cutting. These pieces are secured by screws passing through the bit as shown. Where a heavy cut has to be carried, it may be necessary to cut clearance for the chips through the wood; but this is very detrimental to the latter, and it is therefore better to withdraw the tool and clean out the hole at intervals. This tool is held up to its work in the manner described for the D-bit. The procedure of tempering is also precisely similar, except that it should not be made quite so hard on account of its being thin, thereby rendering the corners liable to give under a heavy or sudden cut. The centres should be left in the ends of this tool to facilitate the mounting of fresh wood packing from time to time.

The tools described above will be found extremely useful, and no metal worker will experience much difficulty in making them. This, of course, is said chiefly for the encouragement of amateurs, as all professional workmen are well accustomed to manufacture special tools to meet the exigencies of certain special work that frequently demands their attention. Indeed, even when a tool suitable for the work in hand may be purchased, it has been found to save time to make the tool rather than to waste it in waiting until the purchased tool has been brought or sent home according to order.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

Fitting and Erecting—Plate and Angle Iron Joints—Rivets and Rivetting.

THE material having passed through the general processes already described, the next stage is fitting and erecting. This may be for temporary or for permanent purposes, the former applying to large work which is first put up and tested, and then taken down again for shipment abroad; the latter course being adopted for home work, for the execution of which, if of sufficient magnitude, workshops are frequently erected adjoining the site of the proposed structure. It sometimes occurs that a considerable number of girders of one pattern are required for foreign and colonial railways, and in such cases it is desirable to have the parts interchangeable, as this is a great convenience in re-erecting; and in such cases the great advantage of pressing, over hand smithing, angle iron knees, and similar details, becomes manifest.

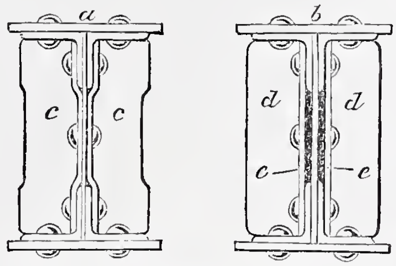


Fig. 9.—Joggled and Packed Stiffeners.

The staging upon which the girder is to be erected must be made with the proper camber, usually a central rise of one inch for every forty feet of span, which is given in order that, under its full load, the girder shall not deflect below the horizontal line connecting its extremities. This allowance is ample, as it is generally considered that in well-designed and properly-constructed girder work the deflection under a full load should not exceed one inch in every hundred feet of span.

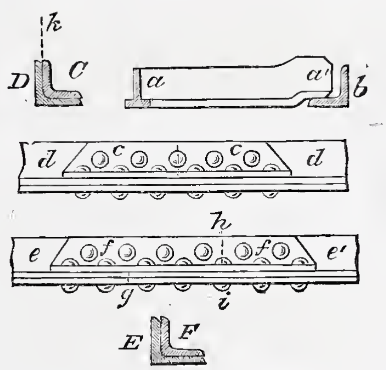


Fig. 10.—Angle and T Joints.

I should feel inclined to lay especial stress upon the necessity of employing great care and very experienced hands in the fitting and erecting department but for the fear of detracting from the importance of the preceding manipulations, and they are really all of such character that negligence is not to be risked in any branch of the work, otherwise it will not be brought to a satisfactory completion. The erection of the structure is always a test of the accuracy with which the material has been prepared, and will be straightforward work if the templates have been properly made and accurately worked to, but, otherwise, it will be involved in much trouble and difficulty. At this stage, too, will the character of the joints become evident, and show whether the details have been properly considered.

When the girders are built up before rivetting, the parts are held together by bolts called service bolts, of which a sufficient quantity is used, passing through the rivet holes, to hold all the parts in close contact. The plates, having been properly planed, should come together without any trimming, but the ends of angle bars may require some chipping to make good joints, and the knees, if hand-smithed, may require easing off at some of the bends. In some instances, the emery wheel may be found a useful adjunct in this work. All knees, stiffeners, angle pieces, and gussets should be made to fit truly, as upon them the general squareness and freedom from twist and winding will depend. If it is found that any piece falls short of the surface it should touch, it should be thrown aside, and not worked in by the aid of packing, which should never be used unless it is a part of the design. Packings, generally speaking, are to be avoided as much as possible; they add to the weight without increasing the strength of the girder, and impair the solidity of the work; but in some cases it is convenient to use them to avoid joggles. As shown in the sections Fig. 9, *a* and *b* are cross sections of plate girders stiffened by T irons, *c*, *c*, in one case, and *d*, *d*, in the other. The T irons, *c*, *c*, are shown joggled over the angle irons. When the girder is of considerable depth there is no inconvenience in this; but in shallow girders the joggles come very close together, and neater work may be secured by using packings as shown at *e*, *e*, of thickness equal to that of the angle iron. Unless the girders are more than fifteen inches deep it will be best to use packings.

It sometimes happens that errors occur in the shop which may be made good without wasting material, but where this involves any alteration in the construction, however slight, it will be necessary to obtain permission of the engineer in charge of the work to make it, hence this course will only be pursued when the quantity of material at stake is considerable. A mistake of this kind came under my own cognisance some years since: the flange plates of a heavy plate girder (108 ft. long by 8 ft. deep and 2 ft. 6 in. wide) were planed too short; in fact, through a change of foremen the plate ends were planed twice, and, therefore, when erected, failed to meet by half an inch. In the bottom flange, where the joints are in tension, this gap would not signify so far as strength is concerned; but in the top flange, which is in compression, it is highly important that the joints should butt fairly together. In this case steel wedges were made with a very slight taper to fit the spaces between the plate ends, and solidly driven in. The result was highly satisfactory, and the bridge, when tested, showed a higher degree of stiffness than is usual in such structures.

In the case just referred to, there could be no doubt that the joints did in reality butt, but in the ordinary run of work it is impossible to find out, after rivetting up, whether the plate ends are in contact or not throughout their width, and that is why in English practice compression joints are made with a full complement of rivets sufficient to carry the whole strain from one main plate to the next, but every care should be taken to make all joints, in whatever position, butt as truly as possible, in order that the girder may not become distorted during rivetting, and also to assure solid work. To this end, also, all the parts should be drawn together to true bearing by the rivets to avoid the occurrence of unnecessary cross strain. When a plate girder is completely riveted up, and supported through its whole length on the erecting stage, it is evident there ought to be no strain upon any part of it of a transverse character, but if the details do not fit together properly, all sorts of strains may be set up by the contraction of the rivets in cooling.

In Fig. 10 are shown some angle and T iron joints. *a a'* is an elevation of the end of T iron stiffener which beds upon an angle iron, *b*, shown in section. The end, *a'*, which is removed a little from the angle iron, *b*, that its form may be clearly seen, is shaped to fit the curve in the root of the angle iron against which it bears, so that the rivet may bring the two solidly together; ends such as this may be chipped to form, and smoothed off when necessary on an emery wheel.

Angle iron joints are usually made square as shown by the ends of the bar, *d, d*, which are butted and joined by the angle iron cover *c, c*, the joint of the angle irons being indicated by the dotted lines. *D* and *C* are the main and cover angle irons shown in section; the cover is rolled with a round back, which fits close into the root of the main angle bar. It is, of course, necessary that, if the full strength of the angle iron is to be carried through the joint, the sectional area of the angle cover shall be equal to that of the main angle iron, and, therefore, as it measures less upon the sides its thickness must be greater; thus, if the main bar is $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. thick, its sectional area is $3\frac{1}{4}$ square in. thick. The cover bar for its edges to lie flush with those of the main bar will be 3 in. by 3 in. on the sides, and, therefore, to have a sectional area of $3\frac{1}{4}$ square in. must be $\frac{5}{8}$ in. thick. This gives an excess to the cover, but it is the nearest size commercially obtainable above that found by calculation. This additional thickness sometimes causes a difficulty with the rivets. Setting out the rivet centres, as described in No. 8, p. 117, those in the section *D* will be $1\frac{1}{2}$ in. from the surface, *k*, of the main angle iron, and deducting $\frac{5}{8}$ in., only $\frac{7}{8}$ in. from the inside of the cover, *C*; this is very little room to make up the head of a $\frac{3}{4}$-in. rivet in. With the view of using thinner covers, the angle joints may be placed where from necessity the strength of the main angle irons is in excess, and thus greater facility for good and neat workmanship will be given. It is, of course, impossible, practically, to make the section of the girder in exact proportion to the strain at every point in the length; the excess in the flanges of a well-designed plate girder, including cover plates, amounts to 10 or 11 per cent. of the theoretical weight. This excess necessarily existing, it should be taken advantage of wherever opportunity occurs so to do.

The next sketch shows a more complicated angle joint, which I once encountered in some colonial work. It is certainly a very bad form, about as bad as can be, but it was insisted upon and accordingly worked to. *f, f*, is the cover plate, the only peculiarity of which is that it is much longer than is necessary when the ordinary joints are used. The end, *e*, of one bar is cut off square at *h i*, and then has its horizontal table cut away from *g* to *i*; in like manner the end, *e'*, is cut off square at *g*, and the vertical limb cut away from *g* to *h*. Between *g* and *i* the contact of the angle bars is the same as in a mitre joint. *E, F*, show a section of this joint, and it will be seen that from *g* to *i* the root of the angle iron is cut through, so that, regarded as an angle iron, all strength is gone from the main bar, and its duties are transferred to the cover, *f*, which, being further off the work connected, is less efficient in securing its solidity. There is no compensating advantage in this arrangement, and the metal cut away is wasted.

The ends of bars and the joints having been properly fitted, the work is to be firmly secured in position by the service bolts, which should fit the rivet holes with sufficient accuracy to ensure that of the positions of the different component parts, which will then be ready for rivetting up. Sometimes bolts with cotters are used to hold the work together, but this is a practice to be discouraged, as cotters are never so reliable as nuts.

We now come to the rivetting of the girder together, and, in order to appreciate the care required in the conduct of this operation, it is necessary to consider the duties of the rivets and the way in which they are carried out. Some engineers allow a considerable percentage of rivets for defective work, but this should certainly not be necessary, especially if the manufacture is properly inspected by a competent and honest official appointed for that purpose.

The strain upon the rivets may tend to cut them across, or to pull the heads off, and in any case there is this latter tendency during the period of their cooling after the heads are made, so that in any case the rivets should be so proportioned that they are at least as strong to resist the heads being stripped off as to withstand tearing asunder through the body. The working strength for iron rivets in tension is five tons per square inch of sectional area taken square to the length. The cross sectional area is equal to the circumference multiplied by the diameter divided by four, and the circumference is equal to the diameter multiplied by $3\frac{1}{7}$, therefore the resistance to tearing across is equal to the square of the diameter in inches multiplied by four very nearly, this giving the working load in tons with sufficient accuracy for practical purposes. The resistance to pulling the centre of the rivet out of the head is four tons per square inch of the surface stripped, and that surface is equal to the circumference of the body of the rivet multiplied by the thickness of the head in line with the body; therefore the working resistance to stripping is equal to the diameter of the body multiplied by $3\frac{1}{7}$ and by four times the thickness of the head, and this must be equal to the resistance to tearing—four times the square of the diameter; therefore the thickness of the rivet head must not be less than the diameter multiplied by 7 and divided by 22, or, as a practical rule, the thickness of the head must not be less than one-third of the diameter of the body of the rivet.

The action of the rivets in drawing the plates together in cooling will cause such frictional resistance to their sliding one upon another as very materially to aid in the strength of the joints, but, as the amount of such resistance is not accurately ascertainable, it is not relied upon, but goes as margin. Its outside value, taking the friction of the plates to be one-fourth of the pressure pressing them together, in tons, will be twice the total sectional area in square inches of all the rivets in the joint, as the pressure due to the rivets cannot exceed the elastic limit of the metal, which is about eight tons per sectional square inch, and it probably is much less.

The rivetting up is almost exclusively done now by hydraulic riveters, hand rivetting only being resorted to where the hydraulics cannot be brought to bear. It is much better, as the rivets are more quickly closed, and the jarring effects of the hammering are not brought upon the work, and this must, where it occurs, tend to derange the positions of the parts put together with service bolts. As it is obvious that the rivet will expand when heated, the rivet rod used in their manufacture must be somewhat less than the rivet holes, which are made the size of the finished diameter of the rivet. One-sixteenth of an inch is usually allowed; so rivets that finish three-quarter inch are made from $\frac{11}{16}$ rod. The rivets are supplied with one head made, and there should in their length under the head be allowed, in addition to the thickness of plates passed through, $1\frac{1}{2}$ diameters to make the other head, which is formed by a die called a snap fixed in the jaw of the rivetting machine; or in hand rivetting held by an assistant on the rivet end after the head has been roughly knocked up by the hammers. Plenty should be allowed for the rivet head, and should it be a little in excess and form a collar round the base of the head, it should not be cut off for fear of damaging the plate beneath.

BASINS, BATHS, AND BATTERIES.

BY GEORGE EDWINSON BONNEY.

BARIUM—BARIUM CHLORIDE—BARIUM SULPHIDE—BAROMETER SCALES—BASINS—BATH—BATH BRICK—BATTERIES.

Barium.—Chemical symbol Ba. Combining weight 137. A mineral found in heavy spar and witherite. It combines with oxygen, chlorine, and sulphur to form various salts, only two of which are of interest to us here.

Barium Chloride.—$BaCl_2$. Is prepared by dissolving witherite (Barium Carbonate) in hydrochloric acid. Its solution is used to detect the presence of sulphuric acid and sulphates in solution. These decompose barium chloride, and the free sulphuric acid unites with barium to form sulphate of barium, which falls as a white crystalline precipitate insoluble in water and in dilute acids.

Barium Sulphide.—BaS. This salt has been employed by Mr. A. Watt to give a warm bronze tint to clean copper articles. The solution employed was made with four or five grains of this salt to each fluid ounce of water. The articles to be bronzed are immersed in the solution, and allowed to remain in it until they acquire the desired tint. All the salts and solutions of barium are more or less poisonous.

Barometer Scales.—These, together with thermometer scales, and the metal dials of clocks, are silvered by the simple silvering process, or silvering by simple immersion. See notes on *Silvering by simple immersion, Whitening Clock Faces*, etc.

Basins.—Porcelain basins are handy adjuncts to the plater's plant of tools. Small quantities of solution for experiments can be readily made up and used in them with safety. They can also be safely used as dippers in dipping out solutions of all kinds from cisterns and vats. Earthenware glazed basins of the common sorts cannot be trusted to hold acids or strong solutions of salts for any given time, as the glazing soon gives way, and the ware is then speedily pierced by the solution. Acid-proof stoneware bowls and basins can be obtained from Messrs. Doulton, Lambeth Potteries, London.

Bath.—This name is applied by electro-platers to all solutions used in the workshop in which articles are immersed to be cleaned or to be plated. It is also meant to cover the name of a solution and the vessel in which it is contained ; hence, when we hear a plater speak of his gold or silver baths, it means the vats and their solutions as they stand. In this series of notes, the various "baths" will receive attention under the several heads of *Gilding Solutions*, *Plating Solutions*, *Pickling Solutions*, *Dipping Solutions*, etc. See also notes on *Copper*, *Gold*, *Nickel*, *Silver*, etc. The various vessels to contain the solutions will be described under the note headed *Vats*.

Bath Brick.—Finely-powdered and sifted bath brick is used in cleaning the surfaces of articles intended to be left "dead" or "frosted." It is not suited for the preparation of articles intended to have a smooth surface when finished, except as a first scouring material to be followed by more finely abrading powders. The powdered bath brick should be used dry, and brushed over the surface of the articles whilst these are being held in a scouring tray.

Batteries.—The word battery, as applied to electrical apparatus, belongs strictly to a collection of Leyden jars charged with static electricity. These discharge their store of force in a violent manner, totally unlike the equable flow of current obtained from collections of voltaic or galvanic cells. French electricians speak and write of such generators under the name of "Piles," doubtless in deference to the form of the first voltaic generator of electricity made—the pile of metal discs invented by Volta. English electricians apply the word battery to all apparatus in which electricity is generated by chemical decomposition, and also to those forms of storage cells known as accumulators and Leyden jars.

A list of the batteries in use by electro-platers is given in the annexed table, which will also show at a glance those most suitable to the work to be done.

The Fuller might be added to this list, but should even then be regarded as a make-shift should none other be available. The Wollaston is also used in some workshops. Each battery has its own peculiar characteristic which renders it fit or unfit for the work to be done. Thus, the Bunsen battery, as ordinarily constructed, is the best for nickel-plating and copper-plating in alkaline solutions, because its electro-motive force is high, enabling the current to push through high resistances. But even then we must not use small cells except we are doing small work, that is, plating a small number of small articles. This battery, however, is not suitable for the work of silver-plating, gilding, and electrotyping, because its high E.M.F. causes the metal to go on too fast and in a granular condition. In all these operations the Daniell will be found to be the best because its E.M.F. is lower than that of the Bunsen, and its current equally constant in volume. The Smee, and also Walker, are eminently useful cells for giving a current suitable to the work of electro-gilding small articles of jewellery. Batteries with a high E.M.F. cause gold to go on too fast, and give the deposit a high colour. The French gilders and platers make up the Bunsen with sulphuric acid in the porous cell with the carbon, and thus get a constant generator with a lower E.M.F. This form is also less troublesome to keep in working order than the ordinary Bunsen, and it has the merit of being free from noxious fumes. Nearly all the batteries given in the list may be altered and modified to suit the wants or conveniences of the operator. A modification of the Bunsen has just been noticed. It may also be noted in the table of batteries, that I give various strengths of acid solutions to be used in the zinc compartments of the batteries. These suggest other most important modifications, the E.M.F. of the battery varying with the quantity of acid used. For instance, the E.M.F. of the Bunsen charged with a solution of one part sulphuric acid to eight parts of water may give an E.M.F. of 1·95 volts, but when charged with a solution of one part sulphuric acid to 10 or 12 parts of water the E.M.F. may fall to even less than 1·80 volts. The Daniell, Smee, and Walker may be modified in like manner. Mr Smee, in writing about his own battery, says :—

"The liquid generally adopted to excite this battery is a mixture of one part by measure of sulphuric acid and seven of water, which will be found amply strong for all purposes. The electro-metallurgist will frequently find it advisable to use dilute sulphuric acid, only containing from $\frac{1}{10}$th to $\frac{1}{16}$th of the pure acid, and adding some acid when the first is exhausted ; taking care, however, that the quantity of acid never exceeds the $\frac{1}{4}$th of the original water, for any excess above that quantity will be useless, as the liquid will then become saturated with the sulphate of zinc." Still further modifications may be made in the battery by enlarging or diminishing the size of the negative or the positive element, or both of these, and in altering the size of cell containing them. As a rule, the enlargement of elements and cells tends to an increased output of current, because the internal resistance of the battery is lowered, and there is, consequently, more available force for the outer circuit. Enlarging the negative element will frequently bring about the desired result of lowering the internal resistance of the battery and increasing its volume of current. This is specially noticed in the Daniell, Smee, and Walker batteries.

Large cells (holding from one to 10 gallons each), and large elements to suit them, become a necessity when articles of a large size have to be plated, or when a large number of articles have to be plated at the same time. This necessity may be partly met by employing a great number of small cells coupled in multiple arc, but small cells thus coupled up soon run down, because, being placed on short circuit, their charges of acid soon get used up. The best work is generally obtained when the elements of the battery present a slightly larger surface to the liquids within the battery than that of the anodes to the solution in the vat.

Lastly, the current obtainable from a battery may be modified by the manner in which the cells are coupled together. If the E.M.F. is too low, we may couple the cells up in series until the required E.M.F. has been obtained ; or, on the other hand, if the E.M.F. is too high, we may take off cells and thus reduce it. It is never good practice to couple two or more cells of a different style of battery together to obtain the needed E.M.F., as the weak cells always pull down the current to their own level, and the current from the stronger cells will heat the solutions in the weakest, thus impairing the efficiency of the battery.

TABLE OF BATTERIES USED BY ELECTRO-PLATERS.

Name of Battery.	Negative Element and Solution.	Positive Element and Solution.	E.M.F. of Cell.	Approximate Resistance of each Cell.	Work for which it is most Suited.
Daniell.	Copper in saturated solution of sulphate of copper.	Zinc in sulphuric acid solution, 1 to 12 or 15.	1·079 volts.	2 to 5 ohms.	Electro-gilding, silver-plating, and electrotyping.
Smee.	Platinised silver in dilute sulphuric acid, 1 to 10, 15, or 20.	Zinc in dilute sulphuric acid, 1 to 10, 15, or 20.	0·47 volts.	0·5 ohms.	Electro-gilding, silver-plating, and electrotyping.
Walker.	Platinised carbon in dilute sulphuric acid, 1 to 10, 15, or 20.	Zinc in dilute sulphuric acid, 1 to 10, 15, or 20.	0·66 volts.	0·4 ohms.	Electro-gilding, silver-plating, and electrotyping.
Bunsen.	Carbon in nitric acid.	Zinc in sulphuric acid solution, 1 to 15 or 20.	1·7 volts.	0·8 to 0·11 ohms.	Nickel-plating and copper-plating in alkaline solutions.
French Bunsen.	Carbon in strong sulphuric acid.	Zinc in sulphuric acid solution, 1 to 15 or 20.	1·6 volts.	0·11 ohms.	Electro-gilding, silver-plating, copper-plating in alkaline solutions, and nickel-plating.

Batteries for electro-deposition are fast giving place to dynamo-electric machines, the current from these being in every respect more suitable to the work of depositing metals than that from the best batteries. They are also more cleanly in working, less costly, and more easily managed. See notes on *Dynamo-electric Machines*. For information on amalgamating the zincs of batteries, see notes on *Amalgamation*, *Zinc*, *Mercury*, etc. For information on how to connect cells together, see notes on *Binding Screws*, *Clamps*, and *Connections*. See also notes on *Bunsen Battery*, *Daniell Battery*, *Smee Battery*, *Walker Battery*, *Wollaston Battery*, etc.

A TRAY FOR LOOSE LETTERS, WITH INK-BOTTLE.

BY E. BONNEY STEYNE.

THE penny post is, of course, a big blessing, and although in England, the home of its birth, we are yet not so thoroughly well served, at once so cheaply and expeditiously, as, say, Belgium, for example, yet a good many of us get even more letters than we want. Now the future storage of these is not an easy matter, if they are to be at once tidily put away, and yet available for immediate reference.

There is a very true proverb that says if you want a thing done, the most busy man of your acquaintance is more likely to do it than the laziest; and, in similar fashion. the man who has dozens, or it may be a number reaching at times to hundreds, of letters daily, is tolerably sure to have some system in force. But the average private correspondent is reduced to a survey of his wardrobe and to start an expedition as amateur pocket-picker on his own coats (or dresses, if it be a she, hanging up like Bluebeard's wives). Such a way is, however, more suggestive of a student of the Jew Fagin's academy than a respectable letter writer,

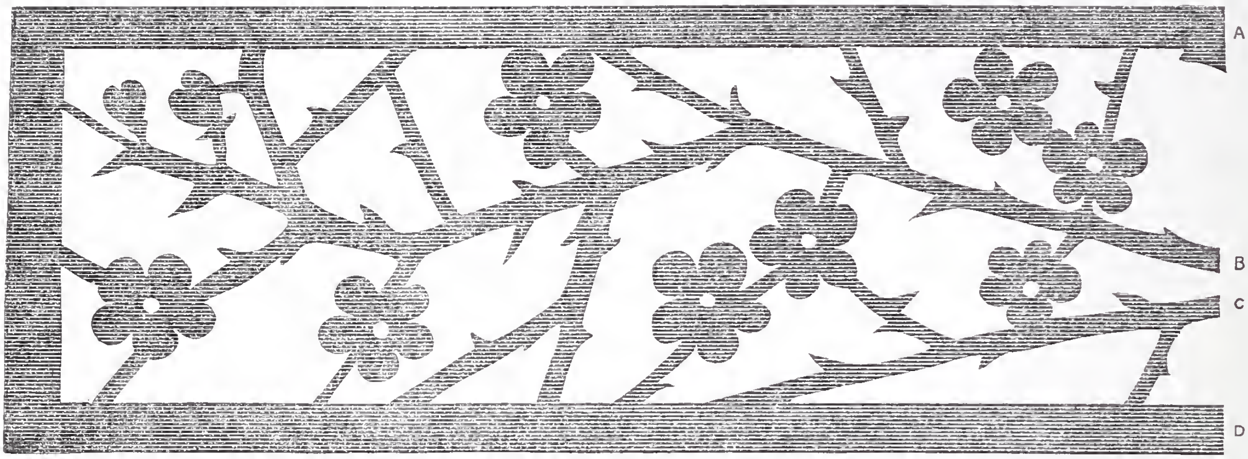


Fig. 2.—Left-hand Part of Side of Paper Tray—Cut Two; A, B, C, D show Points of Connection with Fig. 2a.

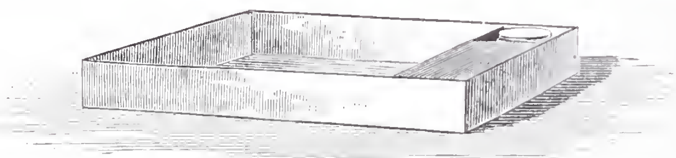


Fig. 1.—Rough Design of Paper Tray Fitted for Use as Inkstand.

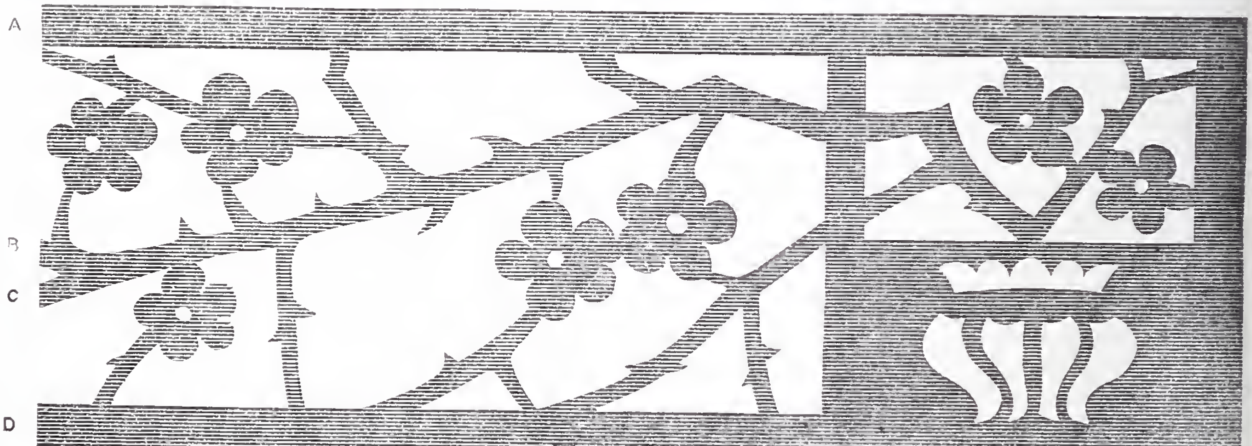


Fig. 2a.—Right-hand Part of Side of Paper Tray—Cut Two; A, B, C, D show Parts of Connection with Fig. 2.

who finds suddenly an important address, or a question needing reply, has escaped his memory, and lies dormant in some mislaid missive.

The first few minutes after reading a letter is generally the crucial time for its future chance of existence in a definite locality, and the majority of those received must needs be immediately disposed of; yet while, of course, a certain class of correspondence is never open to public perusal, save in the deplorable event of an action for breach of promise, there are a great many purely formal ones that are in no way "private and confidential," which may be at once placed on the writing table for consideration at a convenient season.

But a writing table specially set aside, with needful appointments, is not in every room of a middle-class house. In fact, the presence of such a table for real workaday use, and not merely of the "elegant davenport" order, is a sure sign that the household has intellectual tastes, or is intimate with the usages of what the old novelists called "polite" society.

For the ordinary house, or bachelor's apartments, a tray to contain invitations, business letters of no great importance, and the usual missives awaiting reply, is a great advance upon the frame of the looking-glass, or the hundred and one odd corners where such things are banished.

If this tray has an inkstand and receptacle for pen-holders, sealing-wax, etc., it is doubly useful, for then it converts any table into a writing table for the time being when placed upon it.

Such an one is shown in the design now given. Fretwork has been selected for its ornamentation, because it is the most available method for many who like to make useful little additions to their surroundings, or suitable presents to their friends. But the idea is often to be seen in shop windows, made in leather and various other materials.

The baskets so largely used for MSS. are, no doubt, the same things practically, but the addition of an ink-bottle makes this more convenient for private use.

The wood should be polished each side, unless, as in the case of oak, it is left entirely plain. Bearing in mind the foregone certainty of blots near an inkstand, it would be best to stain the wood with ebony stain before polishing, using the proper French polish for black finish.

In such work as this, it is best to fit all the pieces together with neatly dovetailed or tongued joints, as the skill of the worker is able to command, before the actual sawing of the design is undertaken. See also that the wood is brought to a fine, smooth surface before pasting on the design, as after use of sand paper is apt to dull the sharp outline of the fret cut line. The bottom of the tray should be lined outside with cloth or baize; inside with leather Japanese gold paper, or some other substance, to give it a finished appearance.

As small covers, if left loose, are generally lost or broken long before the article to which they belong is worn out, it would be as well to hinge the lid to the pen-holder compartment—which plan keeps that receptacle free of dust, a distinct gain to the majority of careless writers who do not wipe their pens after use.

The given size, 12 by $8\frac{3}{4}$, is fairly useful, but enlarged to about 15 by 12 it is more so, as then the compartment for papers admits quarto and cut foolscap, and the pen division takes full-sized holders. But for private use the size shown is, perhaps, large enough.

Such a thing ought to sell well at bazaars, or be a most acceptable present to any adult. It is easy to construct, and displays all the work expended upon it well in sight, an important item to the amateur, who naturally likes his labour to yield its full effect. With little more work in its construction than an ordinary fret-sawn bracket or photograph frame, it may claim to be of really practical use, and form a thing with reason for existence evident and provable.

Some parts of the designs, it will be noticed, are shown in black on white, while others are the reverse. This is not a merely fanciful alteration to give variety to their ornament, but has a practical reason. Figs. 1 and 4 are for the end that provides receptacles for the ink-bottle and for pen-holders. Fig. 1, it must be noted, is worked in duplicate, since it supplies the end pieces of the tray and the division between the part to take loose papers and the other. Note also that Figs. 2 and 2a (really one piece divided for mechanical reasons imposed by the necessities of space) must be traced twice and cut in reverse. That is to say, the right hand end of the one piece must be the left-hand portion of the other. Then the solid part of the design explains itself, for all those parts enclosing the bottles and holders are treated in this fashion to exclude dust, so far as is possible in fretwork. Fig. 4 is the cover for the pen-holder compartment, intended to be hinged to the division piece, Fig. 1. A piece of plain wood to partition off the ink-bottle space is, of course,

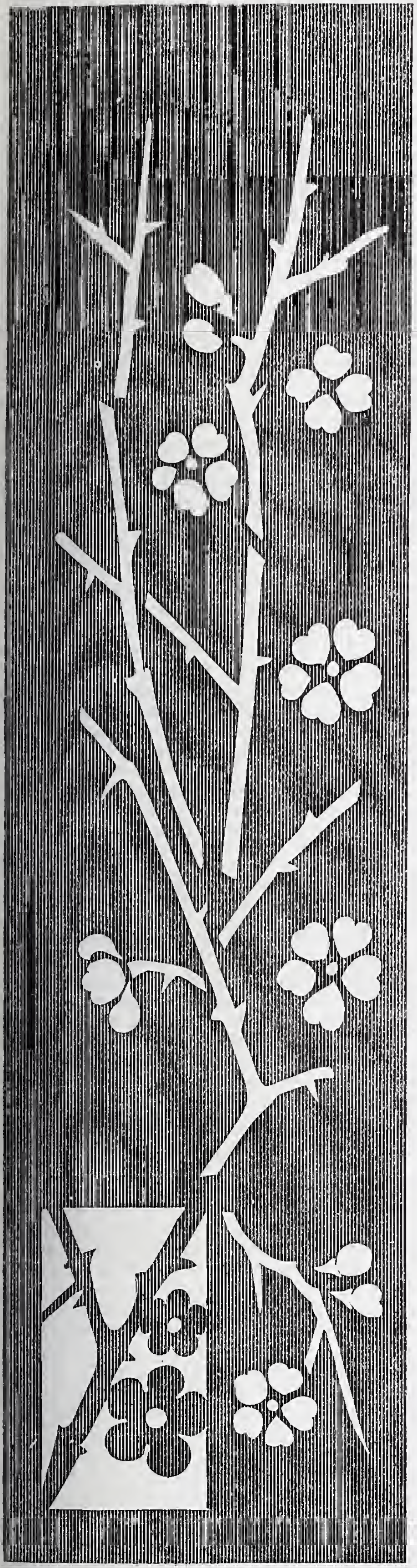


Fig. 3.—Inkstand End and Division of Tray—Cut Two.

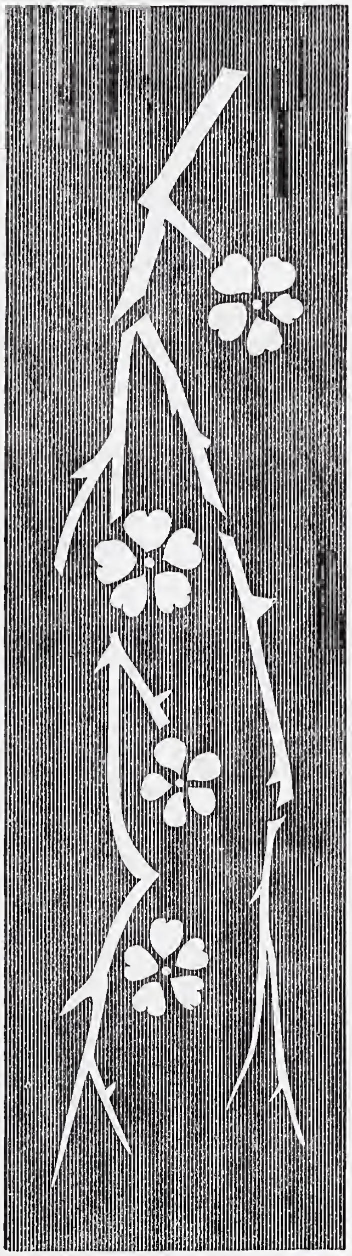


Fig. 4.—Cover of Pen Box, hinged to the Division Piece—Cut One.

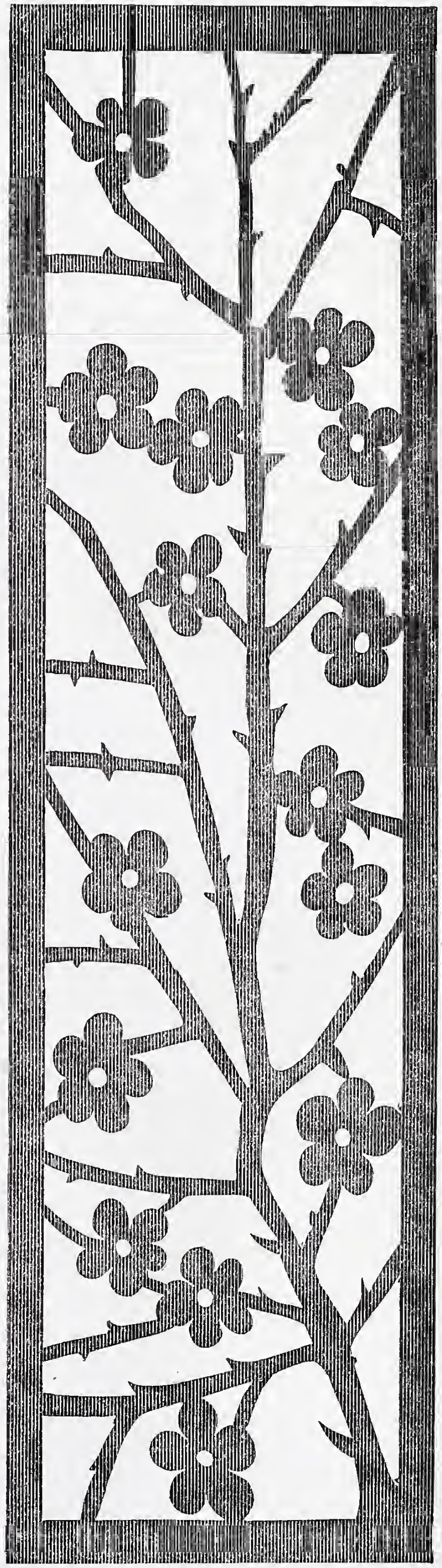


Fig. 5.—End of Tray, opposite to Inkstand, etc.—Cut One.

also needed, likewise a piece to catch the lid as in ordinary boxes. It is easy to say all these petty details should be apparent to the meanest intelligence; but taking my own as the average—the very mean average—I feel that the extreme difficulty of explaining these things briefly, yet clearly, is yet not so appalling as the labour of translating such attempts into actual handiwork, for words are at best variable things.

Here I must leave the further consideration of the designs to each reader, who must determine for himself whether or not he will take them in hand. I will content myself with suggesting that the patterns may be so adapted and manipulated as to make glove and handkerchief boxes, which will be both pretty and useful.

VENEERING.

A CONSIDERATION OF THE OBJECTIONS URGED AGAINST IT AS A SHAM.

BY DAVID ADAMSON.

PROBABLY no operation or mechanical detail connected with cabinet making has been more unfavourably commented on, even when it has not been utterly condemned, than that known as veneering. This, as almost every one is aware, consists in covering a piece of wood with a thin layer of some choicer wood, the latter being the veneer. Perhaps before explaining how to veneer it may be well, in order to remove prejudices, to glance at some of the objections most commonly urged against veneered surfaces, and see whether they are valid or not. Personally, as one who has given considerable attention to the subject, I can unhesitatingly say that I see no objection to it when properly done, and in this I imagine I shall have the support of all practical cabinet makers.

One reason which is sometimes brought forward against the process is that veneering is a sham, and therefore degrading in its tendency both to the workers and to the public, the users. No more mischievous assertion than this could be made, and it is one which it is difficult to think could ever be seriously urged. Were veneering generally practised with the intention of deceiving there might—nay, indeed would—be strong grounds for condemning it, but can any one with the slightest practical acquaintance think for a moment that veneer is put on with the intention of implying that the substance is the same throughout its entire thickness? I only now refer to those who have some knowledge of both material and construction, for it may be conceded that others occupy a somewhat different position, and their views may for the present be disregarded. To the cabinet maker therefore, whether professional or amateur, who may not have any definite ideas on the subject, a few suggestions are offered for consideration. They may help the former class of worker especially in enabling him to refute any assertions which may be made by customers and others against veneering. Perhaps in this latter sentence I may seem to the fastidious amateur to be talking too "shoppily," but while there is no wish to tread on his toes, I may say that I am only too familiar with the frequently absurd notions of the public —that is those whom I have classed as "customers"—not to be desirous of giving sound argument, or rather by suggesting how some of these notions may be combated. In the pages of WORK we meet on neutral ground, where those who know what they are talking about in practical matters can state their views without any fear of being misunderstood as to their motives. For example, were a cabinet maker in the ordinary course of his trade to inform a customer prejudiced against veneer—I use the word prejudiced advisedly—that his or her objections were unfounded, that customer would probably, or let me say possibly, go elsewhere. The cabinet maker may make a mild explanation about the propriety of veneers, and with a reasonable person may succeed in carrying conviction, but the chances are his explanation, in the great majority of cases, would be put down to personal interest. This can hardly sway any one writing for WORK, so, however wide my views about veneering may be from those of some readers, please remember that did I think the process immoral I should have no more hesitation in condemning it than I have in upholding it.

As has been stated, no cabinet maker could long be deceived, even were he momentarily so, by veneered wood. As a rule a very slight inspection, a cursory glance, shows him what the construction is; therefore, so far as he is concerned, there is no deception. To him veneering simply offers a ready way of decorating a plain wood, and to employ a well worn simile it is no more deceptive than the gilding on a picture frame. No one would, because this looks like gold, ever imagine that either the maker or owner intended to imply that it was formed throughout of the precious metal. But, it may be urged, gold and wood are not analogous materials, that no comparison can be drawn between them—the one being of such extreme value, and the other common enough. This is correct to a certain extent, and only so, for though gold and wood are not of the same value, it is only the choicer kinds of the latter which are generally used for veneers, either because they are too costly to be worked up solid, or, as is the case with some of them, because they cannot be used in the solid form. On examination we find that similar processes are practised in almost every branch of manufacture and art. If we are to be logically correct according to those who object to veneering, we cannot stop short at this form of decoration. We must not only denounce it, but every other method of surface or superficial adornment, for they are all to the same extent debasing and false. We might varnish our front doors, for instance, just as a preservative, but paint them, oh dear, no, because that would be done with the intention of persuading passers-by—perhaps in time deceiving ourselves—that the humble pine of which they are made is a nice olive green throughout. Does, for instance, the æsthetic individual who paints his woodwork ivory colour do so with a thought that possibly some one may be deluded into believing that it is actually of ivory? If that is his intention, he certainly is not less blameworthy than the cabinet maker who is so unhesitatingly found fault with for decorating his plain wood. In the one case a thin coating of paint is used; in the other a thin coating of wood. Where the difference in principle lies I for one cannot conceive, the distinguishing feature between them being that one is laid on in a liquid, the other in a solid form. Of course the æsthetic individual, be he professor or other man of light and leading, would indignantly repudiate any intention to deceive, but none the less he is quite ready to impute all sorts of bad intentions to the wicked tradesman who dares to adorn a piece of, let us say, American walnut with a piece of choice "burr." Oh, the ignorance of such would-be teachers, who have unfortunately, however, got the public ear by virtue of their position, for admiring this self-same wood or variety of wood, burr walnut; they would say, "It ought to be solid, else is it a sham, and we will have none of it." How many of them are aware that it, and many other woods, amboyna, thuja, and others, *cannot* be used in the solid form. They are merely superficial decorations, the same as the aforesaid ivory paint, and could not by any possibility be used structurally more than it.

If veneering with wood is wrong in principle, then also is coating a surface with paint or other adhesive covering for the purpose of rendering it more pleasing to the eye. To allege this latter is, of course, ridiculous, but it may well be asked, is it any more so than to say that veneering is wrong? It is difficult to know where to draw the line between the false and the true in art, and no attempt is made to do so in these remarks, which are merely made to explain what one can only suppose are erroneous conclusions, founded on an inaccurate and imperfect knowledge of the process and intention of wood veneering.

Even Ruskin, if I remember rightly, does not object to thin sheets or veneers of marble being used for the adornment of buildings in Venice, and surely what is permissible in them there, can hardly be wrong in furniture in this or any other country. The materials are different, but the principle is the same. If it is not proper to cover a base wood with a more valuable one, it can hardly be right to cover a common stone with a choice marble. But this brings us very near to the adornment of brick buildings with an outer coating of more or less ornamental stucco; and it may be asked if this also is to be considered as a veneer, and to be advocated for the same reasons. Such a question is a very natural one, and is not lightly to be dismissed, though to discuss it at length would lead far from the present subject. It will be sufficient to suggest that properly applied veneers on furniture, and stucco on buildings, are scarcely the same in character any more than in material. The object of both is the same, viz., to render a surface more pleasing to the eye by external finish than it would, to the majority of people, be without it. Here, so far as our present purpose is concerned, the resemblance ends.

Undoubtedly, one great reason why veneering is regarded with disfavour is on account of the faulty manner in which it is sometimes used, and the facility with which it may, by unscrupulous people, be taken advantage of to hide defects in work or material. I am far from saying that all veneer is correct, either in application or intention, for unfortunately this cannot be affirmed with accuracy. It must be admitted that sometimes one finds veneers used in a manner which cannot be justified, but at the same time the whole blame must not be attributed to the workman or the manufacturer, for if certain classes of the public did not demand articles at impossible prices, the production of low class furniture would, to a very great extent, cease.

When veneer is used on an unsuitable wood, or otherwise improperly, it is, of course, not to be commended, but might not the same be said of any other operation? It is not the veneering itself which is wrong, but the mode of work which is at fault. Even when furniture is made without veneer, it is quite possible for it to be defective; but no one on that account would say that it is wrong to make it solid, *i.e.*, without finishing it with veneer. The remedy lies in seeing that all the work is properly executed, not in abandoning a process. Taking a further and usual mode of finishing furniture, French polishing, it might with equal justice be urged, that because this is occasionally badly done, therefore no polishing is to be regarded with anything but feelings of reprehension. It will be observed that nothing is said about personal likes or dislikes of brightly polished surfaces, as that does not affect the comparison. I only want to show the unreasonableness of utterly discarding a process which is commendable, or, at any rate, allowable and useful, simply because it is sometimes abused.

OUR GUIDE TO GOOD THINGS.

73.—The Smallest Thing out in Planes.

A correspondent has called my attention to what may be called the smallest thing out in planes, and has sent me a specimen for testing. The body of the plane, which is of iron apparently nickel-plated, is barely $\frac{7}{8}$ in. long, a little over $\frac{1}{4}$ in. wide, and a little less than $\frac{1}{4}$ in. deep. The interior is cut away from the top, so that the hollow thus formed has a **V** shape, the sides being inclined to one another at a right angle. There is a slot at the bottom to allow of the projection of the edge of a tiny cutter, about $\frac{3}{16}$ in. in width, which is attached to one of the sloping sides of the interior by a small screw. At one end is a split ring, by which the plane may be worn on the watch chain. The cutter is made of the best steel, and being sharp and capable of being sharpened at pleasure, the plane, small as it is, may be used to take off the fine edges in delicate cabinet work, or to sharpen pencils. I am told the price of the plane is 1s., and that they can be purchased of Mr. E. Walker, 20, Legge Street, Birmingham, of whom any further information respecting them can be obtained.

74.—The "Firm and Safe" Step Ladder.

The step ladder shown in Fig. 1 of the accompanying illustrations shows the best form of this useful household appliance that has yet been introduced. The old make of step ladder, for use chiefly in the dwelling-house, was similar, it is true, in general appearance to the "Firm and Safe" Step Ladder, but it will be remembered that the only means whereby the back was kept from spreading out to too great an extent from the front was by a couple of pieces of cord, which permitted the extension of the steps just so far as their length would permit, and no farther; and sometimes if the cords were not fully extended, the ladder might sometimes slip under the weight of the person who was going up the steps, and a serious fall result from the slipping. This step ladder, however, is fitted with Gibson & Glazier's Patent Locking Stay in lieu of cords, and it is in this fitting that its firmness and safety are found; rendering it the means of supplying to perfection a long-felt want, namely, a thoroughly well-made and absolutely safe article, both for domestic and trade purposes: for the Patent Locking Stay gives strength and stability where it is absolutely required, thus rendering the step ladder under notice the best and most reliable article in the market.

The form and nature of the Patent Locking Stay is shown in Fig. 2, in which it is represented when the ladder is being closed. It consists of two parts, a straight bar, one end of which works in a socket, screwed to the bottom of one of the steps in the front of the ladder, to which it is secured by a pin riveted without the socket at each end. The other end also works on a pin passing through the straight bar, which is placed between two curved bars, which work on sockets screwed to a rail across the back of the ladder. When the ladder is closed, the straight bar is erect, and drops into a notch cut for it in the step to which it is attached. The curved bars are also erect, or very nearly so, and are in the framing of the back above the rail to which they are attached. When the ladder is opened, the bars gradually descend until they come into one and the same plane, forming a rigid extension between the front and back of the ladder. When in this position they are locked and prevented from moving by a brass bolt or button shown at A, which is clamped to the straight bar and travels along it. When this is withdrawn, the locking stay can be lifted, and the step ladder closed.

In addition to being secured in this manner, the step ladder itself is also well and stoutly made of good, sound inch timber. The steps are grooved into the sides and securely nailed, and under the bottom step and second step from the top, a turned wooden pin, $\frac{3}{4}$ in. in thickness, is placed, which, it is claimed by the manufacturer, makes a much sounder and stiffer job than iron pins, or even tenons, on the ends of one or two steps. The top rail of the framing which forms the back is purposely kept below the uppermost step but one, so that when the step ladder is open it will not be in the way of the feet of any one when standing on that step. Moreover, this arrangement permits pulling through a scaffold board on that step, which is frequently required by painters, decorators, whitewashers, etc., for whom a couple of sets of step ladders will serve as admirable trestles for forming impromptu scaffolding. For the use of tradesmen, such as those just mentioned, larger ladders are made, somewhat heavier, and it is absolutely impossible, on account of the rigidity afforded by the stay, for the back legs to wriggle or twist about, as is the case with steps that are fitted with cords. The ladders have a nice appearance, being stained

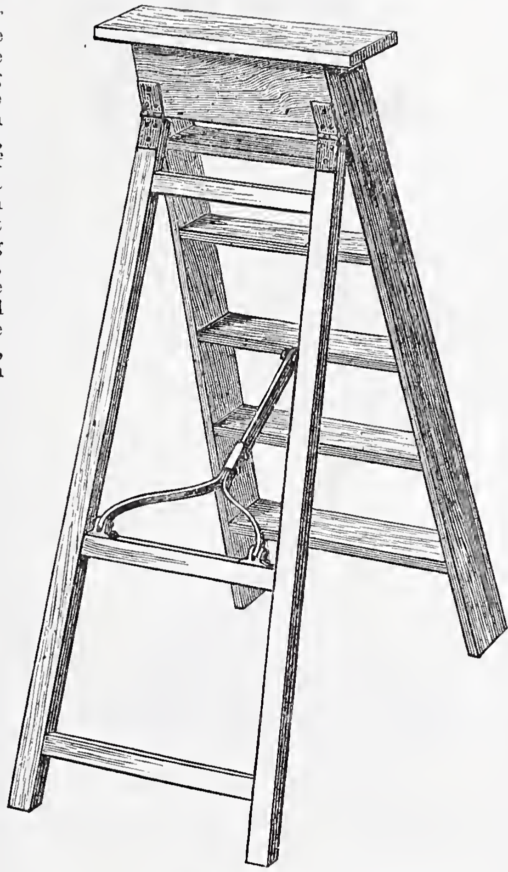


Fig. 1.—Step Ladder Opened and Locked for Use.

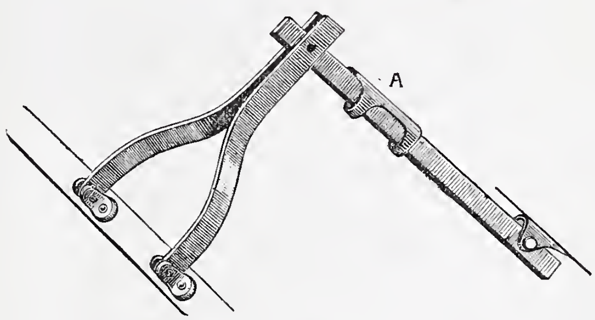


Fig. 2.—Position of Stay when Ladder is being closed.

and varnished before being sent out. I can speak favourably of them, having had one in use in my own house for some few weeks in order to test it thoroughly, and the result is that the old steps with cords have been turned out to make room for the new comer. I should say that the "Firm and Safe" Step Ladder is manufactured and supplied by Mr. William Glazier, 97, Tulketh Street, Southport, Lancashire. The price of each ladder depends on the number of steps of which it consists, the price per step being 1s. 3d. The locking stays are supplied for fitting to any make of ladder, in three sizes, sold respectively at 18s., 21s., and 24s. per dozen. I strongly recommend carpenters and joiners who are in the habit of making these appliances for sale, to provide themselves with a supply of Gibson & Glazier's Patent Locking Stays, and to send out no step ladder without it; and upholsterers will be wise to add the "Firm and Safe" Step Ladder to their stock, and exhibit its decided advantage over the old steps with cords to all customers who may be in search of such an appliance for home use.

75.—Vevers' Registered Plate Lifter.

Mr. C. C. Vevers, 12, Market Street, Briggate, Leeds, sends a new edition of his "Practical Amateur Photography," which is sold at 6d. This handy little book is divided into two parts, in the first of which the different processes in the art of taking a photograph, from the operation of taking the negative to the finishing of the point, are described in clear and simple language, calculated to make each step intelligible to the amateur beginner. One formula only is given for each operation, which is beneficial in enabling the learner to avoid the uncertainty, both of mind and action, which invariably sets in when a number of recipes are given at the same time, without any indication of the best for the beginner to take in hand and test under particular circumstances.

The second part of this *brochure* is more advanced, and therefore better suited to those who have mastered the rudiments of the process, and are ready to proceed beyond the beaten path described in detail in Part I. Thus the second part contains directions for working the Celluloid and Eastman films, for carrying out the carbon, platinotype, gelatino-bromide, and other printing processes, with formulæ for various developers and toning formulæ.

The "Registered Plate Lifter," sent by Mr. Vevers, looks very much like a thimble without a top, with a piece of metal extending from one side of the finger-socket for about 2 in., in the form of an elongated finger nail. The plate lifter is placed on the top joint of one of the fingers, and the plate is lifted from the bath by means of the metal projection already referred to. Of its utility or advantages I am unable to speak, but Mr. Vevers states that an enormous number have been sold since the time that he first introduced them, which was only a few months ago. Some, however, consider that its use would be detrimental, inasmuch as the plate might be scratched by the point of the metal. Be this as it may, it would certainly keep the tips of the fingers clean if it did nothing more. It is right to add that at the end of the book a set of chemical labels, printed in bold type on paper gummed at the back, will be found. The photographer will find these extremely useful, as they can be detached when required by the aid of a penknife or scissors, and attached to the bottles containing corresponding chemicals or solutions, relieving the owner from the trouble of preparing written labels for the purpose of distinguishing the contents of the bottles on which they are placed. Among other new matter will be found notes and remarks on the new platinum process and the hydroquinone development. A frontispiece is also added, which affords a good example of flash-light photography, reproduced in photographic zinc etching. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

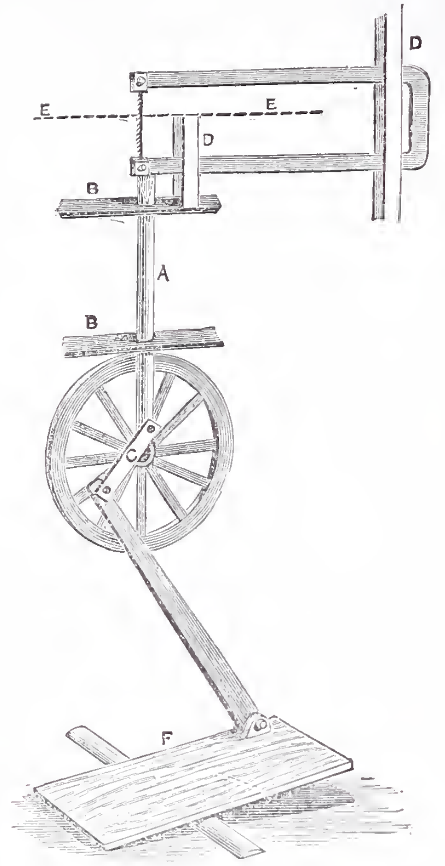
I.—Letters from Correspondents.

Pit Frame Saws and Paste.—G. W. (*Bournemouth*) writes:—"Is same inserted in No. 15 simply to fill space, or to give some superannuated wheeler a lift? His construction may do for a coster's wheel or perambulator. How about wheels, say, from 2 to 6 in. tyre? Had he taken the trouble to look in any good London wheelwright's shop he would see the *pit* is a necessity, and not confined to the country. If it is meant for amateurs it is merely waste of valuable space. If for pro.'s they will simply 'smole their smile,' as not one in 500 will undertake such laborious ill-paid work as wheeling. Should they feel like it, let them apply your tip. French prepared wood may now be bought (at less cost than English stuff in the rough) ready to put together. The cost of putting together machine stuff is for labour only from 6s. to 16s. per pair; barrow wheels, 1s. each. You will see it is about as useful as teaching how to make a hatchet. How does the set stick work? Is mortise cut long? The way of securing the nave weakens the frame, causing it to spring at every blow. Could send you simple, cheap, secure fastening (sketch of). J. H. seems to know something of saws. Some amateurs may not be able to procure a set. To them I would say push on with what you have. I made three carriage bodies with nothing but a piece of hand saw. If a sharpener is not handy, do it yourself. If for hard wood sharp, with square points, or not quite so pointed as J. H. recommends—that is, where only one saw may be at hand. J. R. will be answered, no doubt, in your papers on coach building. I much doubt whether paste will answer for office work, being too long drying."

Advertising and Advertising.—Handel St. Clair writes:—"Your note to hand regarding advertising plans for cottage. You misunderstand me. I only sent the design for the benefit of your readers, and to let them know that they can obtain full drawings of same for small sum, as all are invited to do in *Illustrated Carpenter and Builder*. As to its being an advertisement, what are all these lathes, etc., that you exhibit and recommend for the Britannia and other companies, but advertisements? Be that as it might, I do think you should try to introduce plans for houses. You might do worse than follow one of your correspondents' advice—to give prizes for best designs. I am certain it would prove an interesting study for everybody, and be something practically useful instead of filling your periodical with fretting, carving, embossing, repoussing, and such like rubbish, fit for none but professional amateurs who have more time than talent, and more money than sense."—[When you asked me to publish designs for cottages, and acquaint readers that they can obtain full drawings of same for small sums, you simply asked me to advertise your designs in Work, and I wrote, telling you to apply to the advertisement department, who would give you terms, etc. The notices that I give in "Our Guide to Good Things" are not advertisements. Makers and dealers invite notice of their goods in precisely the same way that publishers invite notice of the books they publish in newspapers and literary journals. Everything is reviewed on its merits, and whenever you like to send me any article you have invented or made for general sale, I shall be happy to do the same for you as I do for others.—Ed.]

Scribing Wheel.—J. W. (*Burton-on-Trent*) writes:—"I beg to ask your opinion of what I think would be an advantage or improvement in compasses. Sometimes in scribing skirting down to a floor with the ordinary compass, the leg marking the wood is apt to follow the grain, unless great care is used, thereby causing wood to be cut away where it is not wanted. What I would suggest is that one leg should have a small revolving wheel, instead of the ordinary point, the wheel to be ground to a fine edge, and toothed. I think it would then run over the surface of the wood without following the grain, and it would answer quite as well as the ordinary compasses for describing circles, or any other purposes to which they are put. If you will kindly reply in 'Shop' and tell me what you think of my suggestion I shall feel greatly obliged. You need not put it so that any readers of Work would understand it, as I should like to have the advantage of it if there is any."—[I give your letter in full. I need only add that your idea is correct in theory, and will be found so in practice. It is the principle of Barrett's improved combination roller gauge described in No. 13, page 203, to which I may refer you. In this the ends of the bars are fitted with revolving wheels, which will leave a mark even on the hardest knot.—Ed.]

An Easily-Made Fret Machine.—W. R. S. writes:—"The fret machine here illustrated claims to possess the following recommendations to the amateur:—A vertical stroke, easily constructed, and can be made for a few shillings. The parts required are as follows:—A wheel 12 in. in diameter; two pieces of bar iron ½ in. × 1 in., the frame of an ordinary iron hand fret saw (one with a spring in the back will be found best), costing 1s.; and 2 ft. of ½-in. brass gas-pipe. First fix the wheel about 18 in. from the ground; above this place the two pieces of bar iron, B, bored with a half-inch hole in the



An Easily-made Fret Machine.

A, Piece of Brass Gas-pipe. B, B, Pieces of Bar Iron, with half-inch hole bored in the centre of each, to take the Shaft, A. C, Treadle Crank. D, Slide for the Frame to run in. E, Table. F, Treadle.

centre, placed a foot apart in these holes; insert the piece of gas-pipe, A, having previously bored a hole, and flattened the end nearest to the wheel. Great care should be taken to see that the pipe comes exactly over the centre, as the successful working of the machine will depend upon this. Drive a piece of beech, or any similar hard wood, in the other end, and in this strongly fix the iron frame. The far end of the frame and the part under the table should have two slides, D, made of mahogany; this will steady the frame when running. The treadle can be made in the ordinary way; of course the throw of the machine will be double the distance from centre to centre of the piece marked C. I have tried to make the description as lucid as I possibly can; but should any difficulty be experienced by the reader, I shall be happy to answer queries through the columns of 'Shop.'"

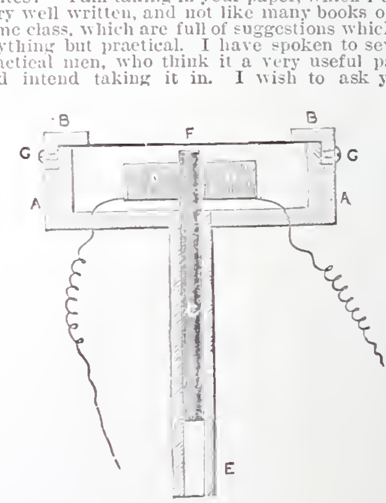
Elizabethan Twist in Lathe.—W. P. W. (*Newport, Mon.*) writes in reply to C. C. E. (see page 109):—"C. C. E. still believes there is no lathe in existence in which the spiral can be cut and finished by the tool. He says it might be fairly done by a complicated apparatus in ivory or hard wood. But he will be surprised to know it can be done in any wood. I have a piece cut in yellow pine 1½ in. pitch, with only the cutter, and I believe sand-papered afterwards. There is no costly or complicated apparatus required for this work; any lathe having an overhead gear, and any means (whether screw cutting or not) to determine the pitch, is equal to this task. My own lathe is a 4½ in. centre screw cutting with overhead gear. With this I have no difficulty in making a 'convex curve die into a concave without a break,' as easily as shelling peas. If C. C. E. was referring to me when he said 'he had found such men as you referred to, but could never run them to ground,' he will have no such difficulty with me. You are welcome to give him my address, and I am willing to show him my tools, or, as I promised before, he can have a specimen cut."

Back Numbers.—X. M. T. C. C. (*Belfast*) writes:—"Having had the good luck to fall in with No. 14 of your very valuable little paper, I am determined to take it constantly, as I find a great deal of good information in it. But I am sorry to say that I missed the first number of it, so that is what is making me write this miserable letter to you. I want you to let me know, through the medium of 'Shop,' if you could supply me with Work, from Nos. 1 up to 13, as I have got 14 and 15. If you have them, please let me know the cost of sending them to Belfast, and I will send name and address. Hoping that you may have all the numbers of Work that I want, I wish you every success with your undertaking."—[Nos. 1 to 13 of Work can be had by order of any newsagent, or the publishers can send the thirteen numbers free by post, on receipt of your remittance for 1s. 3d.—Ed.]

About Work.—A Well-wisher (*Dover*) writes:—"Being an amateur workman, I have often wished for a book that would be useful, but have always found them beyond my means, with the exception of one or two works with which I had to content myself until I first saw your valuable publication, Work. I should like to thank you for your endeavours to meet the requirements of such as me. I cannot tell you how valuable Work has been, is, and I trust will be, to me; nor how I long for Wednesday to come round that I may get the next edition. I have not yet made the overmantel nor the bureau, but I am making a cornice similar to the one given in Work. 'Shop' is a proper corner of tit-bits for every one."

Enlargement of Work.—Kildonan (*Inverness*) writes:—"Permit me briefly to enter my dissent from the suggestions of F. A. C. (*Bradford*), and others, as to the enlargement of Work, and its consequent increase in price. Personally I should be quite willing to pay 3d. weekly for a larger paper, and would not feel it a very heavy tax on my resources; but what about the hundreds, it may be thousands, of young workmen, apprentices, and poor working men with large families and small wages to whom the present cheap and good publication is a great boon, if the price were raised? It may be a paltry sum for well-to-do tradesmen, and others in comfortable circumstances, the extra 4s. 4d., or 8s. 8d. annually, but it is not so to many an artisan, and I think it would be opposed to the traditions of the great house of Cassell & Co. to place their publications beyond the reach of the working classes. I am speaking, of course, of the poorer sections. I have no doubt the publishers know their business quite well enough without outsiders like myself poking our noses in and offering suggestions as to what should or should not be done; but it occurs to me (and I offer the suggestion in all humility) that when the volume is bound the advertisements on the last leaf of each number will not be pleasing to book lovers generally. If a coloured (or any) wrapper were issued with each number, would not the advertisements pay the outlay arising therefrom? This would throw open two more pages of Work for the editorial staff (N.B.—No *pook* meditated here), while the cover would be valuable in keeping the numbers clean while being read or used from week to week. I do not by any means wish it to be understood that I would not like to see Work enlarged; but I hold that it is an excellent pennyworth as it is, and knowing from past experience the scarcity of pennies with many lads learning their trade, I think it would be a pity to raise the price. I have not noticed any one taking this side of the question, and seeing so many advocating the extension in size and price, I have taken the liberty of glancing at the other side."

Telephones.—J. W. C. (*Clapham Common*) writes:—"I am taking in your paper, which I think very well written, and not like many books of the same class, which are full of suggestions which are anything but practical. I have spoken to several practical men, who think it a very useful paper, and intend taking it in. I wish to ask you a



few questions on telephones. I see in Work for June a note in 'Shop' in reference to this subject, from which I am led to infer that it will be put off for an indefinite period. I wish to make telephones that would not cost more than 5s. not including the batteries, and that would be strong enough to work a distance of about 50 ft. of wire between the two telephones. The sketches on slip enclosed will show my idea of what might be done. A A, B B, might be a tooth-powder box and cover; what size? C, bore of iron wires to coil; what diameter? D D, coil; what kind and quantity of wire? E, a wooden cylinder with hole drilled through centre to admit end of core, and to fix it, and then glued into a hole at bottom of A A. F a vibrating plate of some description; what made of? same size as edge of box to snap on with cover; or if that is not firm enough, a small screw to hold it on the cover as at G. The circular hole in cover to extend nearly to inside edges of A A. What batteries would be required of Leclanché's pattern? This is something similar to a sketch I saw eight or nine years ago."

II.—Questions Answered by Editor and Staff.

Mechanical Drawing.—R. R. W. (*Glasgow*).—If you are unacquainted with drawing, you cannot do better than join the local school of art in connection with the Science and Art Department, South Kensington. You will at least get the rudiments then; but if you wish to teach yourself you can hardly have more reliable guides than Cassell's Popular and Technical Educators. You must not, however, think that you can get much practical knowledge without experience under a competent draughtsman in the special line you wish to study. By all means try and get into an office as soon as you have acquired a slight knowledge of what is required and have a general idea of what to do. Your scholastic and practical training might very well be pursued together.—D. A.

Hammering Saws.—Tancred.—You wish for a practical paper on striking a buckle out of a hand saw, and say that there is hardly one joiner out of a hundred that can do it. I quite agree with you in this. The difficulty is in determining precisely where each successive blow should be delivered, so as to take out the buckle and bring all the atoms of iron that form the blade into one and the same plane, relatively speaking. Each blow tends to alter the position of certain particles, and to drive them one way or the other, and the percussion must be continued until a proper distribution of the atoms is once more brought about. I doubt the possibility of dealing with such a subject otherwise than theoretically, for I feel sure that every buckled saw blade would require different hammering, so to speak, and it is only an expert who has been long accustomed to the work who would at once recognise where to strike and how hard a blow to deliver. By my reply I have given publicity to your inquiry, and if any reader can, and will, give us a paper on the subject, I shall be glad to receive it, and produce it in Work at the earliest possible date.

Clay for Making Earthenware.—Potter.—Devonshire and Dorsetshire furnish most of our clays for this art; much depends on the mixing and preparing; and it will probably be best to buy clay ready prepared from a pottery. At such an establishment as Messrs. Doulton's, Lambeth, we imagine that almost any variety desired would be procurable. The exact speed of the potter's wheel we cannot tell; the rate is not uniform, but constantly varied according to the requirements of the "thrower" (the workman who shapes the vessel), and in obedience to his directions.—S. W.

Protecting Papier-Mâché Boat from Sea Water.—Bofin (*Galway*) may protect his papier-mâché boat from the action of salt or other water by painting it with a solution of gutta percha or indiarubber. As he may find a difficulty in buying such a solution at the shops to which he has access, he may make one by dissolving gutta percha in naphtha and adding a little shellac; the consistency should be that of thinnish paint.—S. W.

Electric Gas Lighter.—H. (*Brighton*).—You evidently refer to Clarke's patent gas lighter. I cannot give you detailed instructions, or how to make one of these instruments. I do not consider the price at all prohibitive. There is much fine and exact work in one of these little instruments. They are really miniature cylinder machines for producing static electricity.—G. E. B.

Electric Belt.—Tinman (*Homerton*).—"A medical galvanic belt" may be made by linking 1-in. discs of lozenge-shaped pieces of zinc and copper to each other alternately. Two of such chains should be sewn in a flannel belt with a piece of flannel between the chains; the alternate links of each should form galvanic pairs. When the flannel is moistened with vinegar or with sweat, a current of electricity will pass on joining the ends together. But what good purpose will this serve? Will such belts cure or alleviate pain or disease? I have never known them to do so.—G. E. B.

Wood for Engraving.—Tom.—The wood on which woodcuts are engraved is boxwood—a yellow wood, hard and close in texture. Letters for printing may be cut in apple or pear wood. I cannot tell you where evening classes are held, if held at all, at which the art of wood engraving may be learnt. Were it not good for trade, I should be sorry to hear you have already lost Nos. 2, 3, 5, and 7 of Work. All numbers are kept in stock, and can be obtained at any time through a bookseller or newsagent who also supplies serial publications.

Arts and Crafts Exhibition.—E. S. (*Salisbury*).—For regulations for exhibitors and form of application for entry, apply to the secretary, Mr. Ernest Radford, 45, Great Marlborough Street, London, W. I shall be happy to give publicity to all forthcoming industrial and other exhibitions, in order to bring them under the notice of workmen, professional and amateur, who may be readers of Work.

Cutting Bevelled Recessed Mounts.—W. A. R. (*Hanley*).—A professional mount cutter when cutting cushion, oval, dome, or any fancy shapes, depends upon his eye and steady hand, after marking out in pencil size and shape requisite. In cutting straight bevel or square openings for water colours, photographs, etc., I use a cardboard bevel edge as a guide for regularity of bevel, which is made by cutting a slit in a long piece of card, thus:—

Tools for mount cutting:—Steel straightedge, for marking straight lines; knife blade and handle; one pair dividing compasses; black lead pencil; eraser (piece of indiarubber); lining pen for making gold lines; 3-ft. rule; cotton and pins for marking ovals; oilstone; one set square; one bevel slot; which are not usually sold, as there is a certain amount of jealousy against the amateur. There is no book published, that I am aware, of practical utility to frame makers, etc. The City Frame Company is willing to supply any article for frame making, mount cutting, etc., and show amateurs their works.—G. R.

Papier-Mâché.—Fairflax (*Dartmouth*).—We see no reason why ordinary brown paper should not do for pasting panels, if porous; though so far as we are aware nothing so stout has been used in the trade. The glue is put into the paste by guess; it is hard to name an exact quantity, but for such stout paper ¼ oz. to the half pint would probably not be too much. At any large tool shop, a curved rasp may be got; or an ordinary rasp, which any blacksmith can bend to shape, will answer the same purpose. Black japan (black tar polishing varnish) may be got at Thornley's, 8, Snow Hill, Birmingham, at about 3s. 6d. per gallon; but Fairflax can doubtless obtain current price by writing to that address.—S. W.

Wood for Suite.—J. A. (*Castleford*).—A good deal depends on the kind of suite you want to make, but from your reference to table I presume you mean one for a bedroom. If so, red pine free from knots would do for cheap work, but ash is more suitable, and is frequently used for light bedroom furniture. Birch is another favourite wood for the purpose, though not so much used as formerly. Speaking generally, any of the lighter-coloured woods are suitable for your purpose.—D. A.

Picture Moulding Sellers.—L. S. B. (*Stepney*).—I should think if you apply to City Frame Company, 29, Basinghall Street; they supply every requisite for frame making and mount cutting at most reasonable prices, and undertake to supply at a special discount subscribers to Work. As an example, they would supply your glass in 300 ft. cases, picture quality, at 1½d. per foot, ⅜ best washable gold moulding, from 5d. per 9 ft. length, or 4s. 6d. per dozen, etc. etc. If you write or call, they will supply you a set of samples and prices of anything you may require.—G. R.

Regilding Looking Glass. — B. N. (*West Ham*).—Firstly, take your frame without the mirror, and thoroughly dust it; take a bowl of warm water, and wash the old size off, leaving gold but clean. Apply a thin coat of japanners' gold size with a soft brush, and then put the gold leaf on with a gilder's tip, and wipe off with cotton wool, so as to make it smooth when dry, then apply a coat of clear vellum size, which adds softness to the gold, and keeps it much longer.—G. R.

Patents.—W. H. W. (*Liversedge*).—(1) The £1 you refer to is the Government stamp for a provisional protection, which is generally a preliminary to applying for a patent. The provisional protection extends for nine months, but has not the entire advantages of a patent. (2) You can apply for your complete patent any time within nine months from the date of the application for your provisional protection. (3) The Government stamps in all for both these matters are £4. The address of the Patent Office is 25, Southampton Buildings, London, W.C.—G. H. R.

Brickmakers' Clay for Modelling.—W. G. C. (*Sudbury*).—The clays used for brickmaking vary widely; that of which fire bricks are made is very good for the purpose; but most ordinary brick clays are impure, and not sufficiently plastic to work well. Still, if W. G. C. cannot readily get Devonshire pipe clay, or any other comparatively pure clay, he may make shift with the clay nearest to hand by thoroughly well tempering and beating it up, and sifting in some fine sand to render it more plastic. As regards instructions, he will soon see all he wants in Work. Comprehensive articles on modelling, by a professed figure modeller, are already written, and will appear shortly.—S. W.

Electric Lighting.—T. P. (*Hull*).—This subject will be taken up and thoroughly dealt with in time. As I have had occasion to say before, it is beyond possibility to handle every subject at once.

Right and Left of Drawings.—R. H. H.—On the stage, right and left is according to the position of the actor as he faces the audience. R, signifies to the actor's right hand; C, the centre of the stage; and L, to his left hand. In drawings, however, the convenience of the person who is looking at them is consulted, and that part or side of a drawing which is opposite to his right hand is spoken of as its right, and that opposite to his left hand as its left. I trust this will make the directions already given perfectly clear.

Beaton's Pocket Technical Guide.—P. J. (*Doncaster*).—The price of this handy waistcoat pocket volume, published by Messrs. Crosby Lockwood & Co., Stationers' Hall Court, London, E.C., is 1s. 6d.

Alleged Mistake.—B. S. T.—Your letter having neither name nor address might be disregarded as anonymous, which, when an assertion such as yours is made, should not be. However, *pour encourager les autres*, I give it attention. Of course, if the article you comment on were made according to the diagram you send, the result would be as you say; but it is nowhere stated by the writer that both pieces are to be of the same length. The hinder one must naturally be shortened at the free end sufficient to give clearance, and in writing the description it was taken for granted that readers would understand this, especially as the illustration, Fig. 1, shows that one support projects further than the other. The drawing being in perspective, you have probably overlooked this. If you object to this formation, you can easily adapt supports which are of equal length, by hingeing in the same line and meeting in the middle. When extended, they will project equally, but will not afford the same stability, and for that reason are hardly so suitable. I think you will now see that there has been a mistake, but not where you suppose, and that if you had made up the work you would have seen that the objection you urge, if it be one, is entirely theoretical. I am always pleased to help inquirers, so that if you meet with any further difficulty you may write again; but if you will re-read the paper referred to now, I have no doubt you will find everything quite clear.—D. A.

Battery for Alarum Clock.—A. E. B.—The Leclanché battery is one of the best for this purpose. If, as you say, the battery soon runs down, the fault is not so much in the battery as in the other arrangements. Your connections or line wires are faulty, and so badly constructed or set up as to cause leakage of current. In this way the battery is at work day and night always, and no battery will long withstand such usage without running down. The wires leading from the battery to the clock, from the clock to bell, and from bell back to battery, must be well covered with cotton or silk, and two *wires must not be run along together* under one staple. The battery must not be kept on a wet shelf. On the clock, the little trigger that sets the alarum going must be insulated from the rest of the clock. The whole must be switched off in the daytime. Attend to all these matters, and don't let the alarum ring for more than five minutes at a time; then your battery will last from two to three years. If this don't mend matters, ask again.—G. E. B.

Bichromate Battery for Electric Lighting.—Electricity (*Middlesborough*).—(1) The bichromate battery in its ordinary form is not suitable for electric lighting, because it polarises so quickly after the circuit is closed. But when the cells are used with chromic acid in solution, instead of bichromate of potash, they give more satisfactory results. The solution is made up in a similar manner, and with similar quantities of ingredients, using only the chromic acid instead of bichromate of potash. The number of cells required will depend upon the resistance of the lamp. Find out this, and allow one cell or one pair of elements for each 2 ohms resistance in the lamp, and then one cell to overcome resistance in the wires. (2) A 3½-in. (diameter) ring armature will be quite large enough for the gramme dynamo. You have not mentioned the other parts. Is this all you wanted to know about?—G. E. B.

Electro-Motor. — J. W. (*Handsworth*). — The bobbins for an electro-motor should be wound in opposite directions—one from left to right, and the other from right to left. The outside or finish end of one coil should be connected to the inside or commencing end of the other, so that winding of one coil should be to the other as the lower part of the capital letter S is to the upper part. In connecting the wires, proceed as follows:—Connect one end of a bobbin coil to a binding screw connected with the battery. The other end of the other bobbin coil must go to one of the commutator springs (or brushes), as they are named. The two ends of the armature coil are to be connected to the two sections of the commutator. The other brush or spring must be connected to the opposite pole of the battery. The bobbins may be of brass if the wire is well insulated; but boxwood or ebonite is preferable for bobbins on small machines. In referring to back numbers, please quote title of article and page on which the article is printed.—G. E. B.

Telephone.—J. W. C. (*Clapham Common*).—The telephone sketched by you in your letter is an old form of this instrument brought out by amateurs several years ago, and then named the "pill-box telephone." The wooden pill or tooth-powder box may be anything from 1¾ in. to 2½ in. The core may not be of iron wires, but must be a round bar magnet held in the wooden handle, and protruding into the box far enough to hold a bobbin filled with wire, and with its end close to, but not touching, the diaphragm, as shown in your sketch. The diameter of bar magnet may be from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. The steel must be hard and well magnetised. The bobbin should be of boxwood or of ebonite, and the reel ends from $1\frac{1}{4}$ in. to $1\frac{3}{4}$ in. in diameter, to suit the size of box. The bobbin must be filled with No. 36 B.W.G. silk-covered copper wire wound on in regular layers. The ends of the wires should be run through holes in the handle to two small binding screws at the sides for convenience of connecting to the line wires. The vibrating diaphragm, or disc, must be of very thin charcoal iron plate, or the ferrotype plate used by photographers. It must be pinched tightly between the edge of the box and cover all round equally, but free to bulge in and out in the middle. The cover may be held on with three fine screws. It must be hollowed on the outside from the edges to centre, or to edges of $\frac{3}{4}$-in. hole in the middle, as you suggest. No battery will be required, as this is a magnetic telephone, worked by current from the magnet. The lines should be of No. 18 or 20 copper wire well insulated and supported on insulators. It must also be kept away from the rear neighbourhood of telegraph wires and electric bell wires. The range of action in this telephone is limited, but I think it is effective up to fifty yards. Of course you must have a pair of these instruments—one for transmitting, and one for receiving the sounds.—G. E. B.

Folding Chair and Table.—A. J. B. (*Dover*).—Your combined folding chair and table seems to be a compact arrangement, but has the disadvantage that the user once in the chair will require an attendant to bring anything he may wish to put on the table, unless he first puts all he may require on the ground beside the chair before shutting himself in.—F. C.

Binn's Endless Blind Cords. — J. J. M. (*Leicester*).—This is not a new invention. In fact it is so old, I think, that the patent rights must have expired. I do not know the maker, or if made still; but Pitman, Son & Co., Wells Street, Falcon Square, E.C., are, I should say, the most likely people to get it from. It is quite impossible to give answers in "Shop" until a few weeks after they have been received.

Terra-Cotta Figures.—E. P. W. (*Stratford*).—Terra-cotta figures may be bought in Piccadilly, London, at Bellman & Ivey's (37), or at F. Ahrend and Co.'s (165). Plaster figures would, however, look as well when bronzed, and would be much less costly.—M. M.

Index to WORK.—W. H. R.—As it has been already stated, an index will be prepared for each volume of WORK.

Electro-Motor for Steam Launch.—ELECTRO.—In reply to your request for "a paper or two on the construction of an electro-motor accumulator, etc., to drive a small launch about 20 feet long, for up-river work, my object would be to get the greatest amount of power with the lightest possible accumulator." I can only say that the subject will be taken in hand as soon as an opportunity occurs.

Silver-Steel Hand Saw.—G. B. P. (*Birmingham*).—Messrs. Spear & Jackson, Ætna Works, Sheffield, send out their saws in quarter dozens, so that you might get one for yourself direct from the manufacturers, if you can prevail on two of your friends to take the others. I am astonished to learn that you cannot get the saw noticed in No. 8 of WORK, page 124, in Birmingham, at any dealers in hardware. If you give the order to any retail dealer, I imagine he would procure a quarter dozen, and take his chance of selling the other two. Of course, R. Melhuish & Sons would get one for you, but what a roundabout way of getting a thing in Birmingham from Sheffield, *viâ* London!

Serial Papers in WORK.—H. W. (*Edinburgh*).—Various things are under consideration, which, if adopted, will in all probability commend themselves to most readers of the Magazine, and that which you mention in your communication will receive attention. Your other question is answered elsewhere.

Map Mounting.—H. G. (*Brentford*). — Map mounting as an amateur has always been more or less a failure, so far as I am concerned; but the least unsatisfactory result was with a coarse, white muslin, which is so open that it allows the parts to work through freely. I paste the map well, and then lay the muslin lightly over it, waiting until it is nearly dry to fold it, with white paper inserted between the surfaces, and then press it under a light weight.—E. B. S.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Bronzing a Gun Barrel.—LANCASHIRE JACK (*Preston*) writes:—"As an anxious reader of your valuable paper, I beg leave to ask for a recipe how to bronze a gun barrel."

Distempering Wood.—BELL asks:—"Can you give me directions for distempering wood?—a process often used, I believe, for decorating plain deal dressing tables, etc. I understand the mixture is useful to give articles a coat with previous to painting, as it fills up knots and the edges of a cut across the grain."

Mechanograph. — H. M. (*Oldham*) writes: —"Would you please tell me how to make a mechanograph, as I cannot buy one in our town—Oldham? There are two sorts, one that is made of five or six sticks, about 6 in. long, and the other of a piece of wood the shape of an egg, with a wire hoop, at one end a piece of string."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Bevelled Cog Wheels.—B. F. (*Liverpool*) writes in reply to POTTER (see page 222):—"POTTER does not state size. I have seen small ones about 1 in. diameter, or less, for 6d. each, in a tool shop near Lord Street, Liverpool; they are to be got at most of the watch tool shops in many towns, where the clockmakers go for what they require, also the model makers, Bateman, London, and others; and I often see them in brokers' shops, second-hand machinery dealers, etc., Booth & Co., Park Lane, Liverpool; or if you require bevel helical spur or double bevel the maker of every sort for the trade is Urquhart, Lindsay, & Co., Blackness Foundry, Dundee. Write for price list, and say size required."

Books on the Power Loom and Weaving.—J. W. C. (*Liversedge*) writes in reply to D. B. (*Perth*) (see page 253):—"One of the best books on weaving and the power loom is 'Weaving,' by T. R. Ashenhurst, of the Bradford Technical College, and may be had from Messrs. Emmott and Co., New Bridge Street, Manchester, 12s. Also a good book is 'Cloth Manufacture,' by Mr. R. Beaumont of the Yorkshire College, Leeds; and can be had either from the author, or Messrs. G. Bell and Sons, York Street, Covent Garden, London, 7s. 6d. I enclose my card, and any further information in any branch of the textile trades I shall be glad to supply you with. I am a weekly reader of WORK, and wish you success."

Marbling Washstand Tops.—F. P. (*Newport, Mon.*) writes in reply to W. H. J. (*Stratford*) (see page 222):—"If W. H. J. is a practical man, understanding the nature of the ordinary pigments and vehicles of painting, I should think there must be something very special, either as to time given for marbling or the style of imitation required, in the work mentioned for such a question to be submitted. Most cheap furniture work is got up and grained in distemper; but assuming the top to be paint, and a cheap finish only required, a coat of quick-drying white lead painted (mixed with equal parts turpentine and japanners' gold size) can be spread and marbled upon with willow charcoal at once; soften the veins by lightly drawing a brush over them, and in a couple of hours it could be varnished. If cheap imitation of sienna is desired, paint first with quick white, and when dry, marble with the usual tools and pigments, using equal parts turps and gold size for the wash—that is as water is used in water-colour painting. Any further questions would be cheerfully answered by F. P."

Flat or Dead Black.—F. P. (*Newport, Mon.*) writes in reply to OPIFEX (see page 218):—"Without wishing to question the practical value of the recipe given for making the above, a line on the subject from one who has prepared and used, professionally, gallons of such liquid may be acceptable to some readers. Purchase the 'drop' black (ivory drop black is the correct name), already ground in turpentine, thin with more turpentine, and add sufficient of japanners' gold size, about one-eighth part weight or bulk, to 'bind' the black. Any copal oil varnish will answer the purpose equally well, providing too much is not added, as the more varnish or gold size used the more lustre the black will dry with. Black japan and pestle and mortar are quite unnecessary; such round-about recipes as we sometimes get on similar subjects might well give place to the results of practical and professional experience and usage."

Gear Wheels for Lathe.—C. J. W. (*Beccles*) writes in reply to C. E. H. (*Warrington*) (see page 254):—"Messrs. Lloyd & Co., Steelhouse Lane, Birmingham, supply wheels in rough so cleanly cast as hardly to require any finishing beyond boring. The following are about prices in rough; any number of teeth, odd or even:—

15 to 24 teeth	... ...	4d. each.
25 ,, 30 ,,	... ...	5d.
31 ,, 40 ,,	... ...	6d.
41 ,, 45 ,,	... ...	7d.
46 ,, 51 ,,	... ...	8d.

And so on in proportion. I should say these are of 14 pitch for 3-in. centre lathe, but no doubt these pieces will be a guide to C. E. H."

Flour Paste Souring.—BING writes in reply to J. R. (*Skerries*) (see page 238).—"One pennyworth cobblers' paste, thin with warm water; when cold add one teaspoonful methylated spirit; well mix. I have used this for same purpose, and it will keep for a month."

IMPORTANT PRIZE COMPETITION.

THE Editor of WORK has the pleasure to offer his readers Prizes to the value of

THREE GUINEAS,

to be distributed for Competition for Designs for a small Bookcase, to contain the Volumes of

CASSELL'S NATIONAL LIBRARY,

FIRST PRIZE ... One Guinea and a Half.
SECOND PRIZE ... One Guinea.
THIRD PRIZE ... Half a Guinea.

Full particulars of the Scheme will be found in WORK No. 17, page 254.

Trade Notes and Memoranda.

THE Fifty-seventh Annual Exhibition of the Royal Cornwall Polytechnic Society will open at Falmouth on Tuesday, 10th September, 1889. Medals and prizes are offered in special exhibitions of domestic lighting, mechanics, chemistry and electricity, fine arts, photography, natural history, and "Lander" competition. Lists of prizes and all further information may be obtained from the Secretary, Edward Kitto, F.R.Met.S., the Observatory, Falmouth.

THE South Wales Art Society and Sketching Club will hold its second annual exhibition in the Public Hall, Queen Street, Cardiff, on or about August 21st, as will be hereafter announced. Works will be received at the Public Hall, Cardiff, on Wednesday and Thursday, August 14th and 15th. The committee are prepared to receive the following for exhibition:—Recently-executed pictures, drawings, and sketches in all mediums, and on all materials ordinarily in use. Sculpture and modelling, carving in wood, stone, and other material efficient for the purpose. Metalwork, inlaying and mosaic in panels. Small articles of furniture or fittings, etc., which display artistic design or workmanship.

ALTHOUGH we have been building steel steamers for ten years past, the first Canadian steel steamer has only recently been launched for active work. The name of the pioneer vessel is the *Manitoba*, constructed on Lake Superior for the Canadian Pacific Railway Company to run between Owen Sound and Port Arthur. Her carrying capacity is 400 passengers, and 73,000 bushels of wheat.

WORK

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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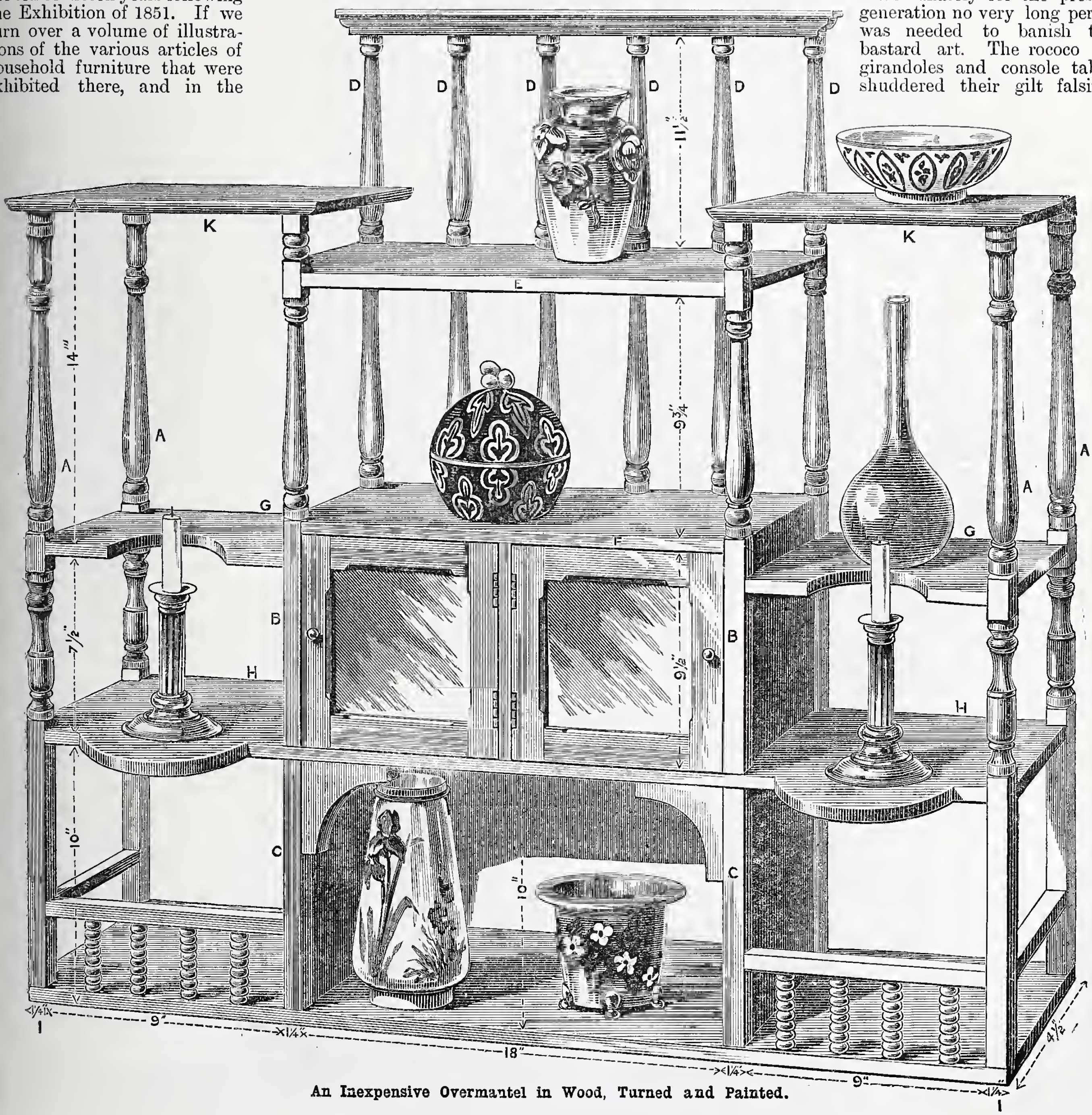
AN INEXPENSIVE OVERMANTEL.

DESIGNED FOR MORNING ROOM OR BED-ROOM.

BY J. W. GLEESON-WHITE.

Probably the national taste in domestic matters never touched a lower ebb than in the ten or fifteen years following the Exhibition of 1851. If we turn over a volume of illustrations of the various articles of household furniture that were exhibited there, and in the succeeding show of 1862, we are struck by the cheapness and vulgarity of the idea in their designs. A new attempt to beautify the surroundings of ordinary people was evidently beginning, but its first result appeared to be to oust all the merely solid and useful furniture of old form, ugly but fit, and to replace it by designs not one whit more beautiful, but overladen with tricky ornament. This practice of endeavouring to atone for commonplace and ungraceful shapes by applying lavish decoration, itself poor in quality, was even worse than what it aimed to improve upon.

Fortunately for the present generation no very long period was needed to banish this bastard art. The rococo gilt girandoles and console tables shuddered their gilt falsities



An Inexpensive Overmantel in Wood, Turned and Painted.

away quickly, but none too soon, and the bare meanness of their native composition became evident. The capital C's in violent agony stuck all over unmeaning curves of sideboard backs and sofas, shone in glittering varnish for awhile, and they too vanished into the great darkness. Into the night have gone one and all of these things; no longer gold and white wall papers chill us with their vapid flat surfaces; only third-rate apartments at the seaside, and such places, keep the frightful legend of their triumph; in every decent home they are gone, let us hope for ever.

But hardly had these things lost their popularity ere a new taste set in, growing suddenly into favour. Domestic Gothic, so-called, had almost overmastered us. A fierce faction fight between Gothic and all other styles seemed ending in favour of the former. Long considered the only suitable style for ecclesiastical use, it was rapidly invading our homes. From the modest and spiky Oxford frame, to the enormous monstrosities of the followers and imitators of Eastlake and Pugin, we were nearly in the bondage of Victorian Gothic. Our teachers, not content with proclaiming its infinite adaptability and inexhaustible resource, embodied in their creed a crusade against shams of all sorts. This movement in taste was preached with the fervour of a religion; an awful purity was insisted upon as necessary to artistic salvation. Nothing was to pretend to be other than it seemed to be. Nay, it was to exaggerate its honesty and be offensively obtrusive in setting forth that lately acquired virtue. Brick walls were to show their interior surfaces of bare brick; plaster was hardly less a deadly sin than stucco; plain paint (which surely is as honest as the plain wood) was scouted, with imprecations only less rigorous than those against the deadly artistic sin, the crowning of all wickedness—a grained imitation of oak. Rabid fanatics scarcely allowed varnish to preserve the surface and give a finish to the bare wood. In construction also, honesty was to be had at any price; joints were to be shown boldly; if any mortise was used, a protruding piece of wood, with a peg stuck through in full evidence, was to proclaim itself. Ceilings were forbidden to hide the rafters of the roof; padded chairs and sofas were to be replaced by hard wood seats with movable cushions. The motto was, "Perish comfort, appearance, everything, but simple honesty." This was excellent in theory, but in practice the result was as full of incongruities as the old mongrel style. It was out of place to imitate the vein of marble or the grain of wood by paint, or to line a plaster surface to suggest stonework; but to use a solid beam capable of carrying a roof for a small work-table, or to model a crusader's tomb in parian and adapt it as a match-box, were permitted things. It was held a pretty conceit to decorate tea-cups with raised sprays of the tea flower, to embellish marmalade jars with oranges, to decorate a night lamp with the deadly nightshade. To make a sideboard simulate a high altar, or a piano reproduce a reredos, was a noble aim; but to employ classic detail, however fitly, or use turned wood in place of a chamfered bar of rectangular form, put the artist outside the pale of sympathy.

No doubt such failures to embody workable every-day principles are natural incidents in a new search after beauty. The taste so long dormant had lost its fundamental rules, and the caprice which led its knight-errants upon such strange quests, was nevertheless an instinct groping in the dark after the right way, and vaguely and tenaciously trying almost any path save those lately trodden, which might bring it to the goal of beauty.

But it would be wearisome to multiply instances of the vagaries of the new Gothic and Vandal. When his havocs are fully known, it may be the period that saw the restoration of our old cathedrals and a revival at last of real domestic art, will be found in its course to have done damage irreparable, and beyond the worse neglect of the Georgian indifference. But just as Gothicism was triumphant, a small body of young men experimented in a free classic style, chiefly Dutch, that for some mystic reason they called Queen Anne; and straightway the elaborately built-up system of the new Gothic went to pieces. This fresh movement, by its adaptability and extreme catholicity, certainly did a few very wild things, but side by side with the so-called æsthetic movement, and the real art produced by men of the stamp of William Morris, and others, a new style arose. Some decorative artists to-day have done work worthy of placing beside that of any epoch, and if, as we hope, beauty is now to be found waiting for any who will welcome it to their houses, to all such in their different ways the good influence may be traced.

The Queen Anne school revived the banished art of the lathe, and in its desire to reassert that honest and entirely legitimate use of wood has, in the hands of its imitators, somewhat ridden it to death, chiefly, it would seem, by using an infinity of small balustrades and spindles; for even yet the influence of the Gothic craze rather shirks the employment of massive turned work, such as held sway in the Jacobean period. Yet, at its very worst, this fashion is not quite so absurd as the shapelessness of the unmeaning walnut and green rep period, or the huge timbers of the style known in America as Eastlake, and with us church milliner's Gothic.

Turnery is an ancient art, and well deserves all praise, for it is excellently proper in its treatment of wood, reducing for purposes of ornament the superfluous material, with very small loss of strength; and in its subtle shadows giving more pleasure than the angular framework of the Gothic period when used without the lavish carving which is a needful part of that style.

In saying so much in praise of turned work, and then recommending the purchase of machine-turned wood, I feel I am likely to gain opposition.

The amateur of feeble attainments is looked down upon by masters of the craft. They actually prefer the best solid carving to inferior ill-designed fretwork, and really choose inlaid marble pavements, rich with mosaic work, in place of cheap oilcloth. Excellent people! to have such splendid virtue, and such well-filled pockets! But the amateur workman may neglect such wise counsel, and do his best with what tools and skill he possesses to please himself. The want of a good lathe powerful enough to turn large work is often felt, for cost and skill are not the only items that prevent it. Time and space are equally exacting, and defeat too often his desired end.

A year or two since, at one of the exhibitions, the steam turnery on view was a fascinating exhibit; and looking at the display of specimen balusters and newels, at a price less than the raw material itself would cost a private buyer, it seemed a good idea to endeavour to utilise them in home-made furniture.

Painted chairs and tables in bright decided colours were then uncommon, but while this long-delayed notion has been waiting for time to set it forth, painted furniture has taken great hold of the public, and the apology then necessary is now needless, since every upholsterer's window has its strawberry-ice colour milk stools, its sealing-wax red five-o'clock tea tables, and its art-colour brackets. Art colour—that terrible compound work is enough to condemn anything. Is not any colour an art colour if you have the art to use it rightly? And cannot magenta itself, the most difficult of all, be used by a master wisely and well? But as some colours naturally come well together with less care in grouping, and the secondary and tertiary subdued peacock blues, citrines, and dull yellows, may be thrown together almost hap-hazard and yet be harmonious, these and similar are dubbed art colours. Yet ignorant nature uses the crudest to be found, but uses them so deftly that her un-art colours beat your best attempts hollow. If you are uneducated in colour, how can you be expected to compose a colour scheme, any more than write a symphony with no knowledge of music, or solve an astronomical calculation ignorant of the simplest rules of arithmetic?

But the painting is the last item of the work, and will be returned to later on. The article under notice to-day is the first experiment in the use of these cheap turned balusters mentioned above. Messrs. M. C. Duffy and Co., 66, Storks Road, London, S.E., at the International Exhibition, 1885, had a splendid exhibit of machinery and work turned out by them. On a price list they issue, a hundred designs of these wonderfully cheap balusters will be found illustrated. When the cost ranges from 1s. 6d. a dozen, cheapness promised by the title of this paper, may be claimed to be secured. The same patterns in pitch pine cost almost double the price. For some of the larger scale designs the cost is a trifle more, so, too, the more elaborate spirals and intricate designs are naturally somewhat dearer; but even the most expensive are absurdly cheap set against the time, skill, and plant required to produce their equals at home. For our purpose, in this first chapter, but two designs in 1¼-in. deal will be required; these, at the minimum price of three halfpence each, will suffice for constructing a really useful, and in its way artistic, piece of furniture.

Before proceeding to explain the construction, it is as well to note the novel points in this design. It is the result of an attempt to make, first of all, a more really useful adjunct to the toilet, and a desirable addition to the ordinary fittings of a bedchamber.

The cupboard, itself useful for keeping odds and ends out of sight, serves the purpose of a toilet glass more thoroughly than usual, since its doors opening at any angle give a reflection of each side of the face. For shaving purposes, or the magic art of putting on a bonnet, this is no mean gain. But as daylight is not always available, special efforts to gain the utmost light from a couple of candles are also within the purpose of the design. It is claimed that, by the arrangement of shelves here shown, a strong light is cast upon the face (as I can speak from actual use), and thereby assists the delicate operation of the amateur barber, or the manipulating legerdemain of he culminating touch on the coronation of a iew bonnet, with no small gain of ease and omfort.

The glass doors are set at a height likely o be useful to most people; but as mantel-ieces vary a little, and personal stature even nore, may be the maker will find other level he most pleasant. This must be found in-lividually; at present it suffices to say that he size given answers its purpose tho-oughly. To harmonise with its surroundings t is finished in pure white enamel, has on ts shelves old blue and white china and orass candlesticks, and in its place would iever suggest its humble and economic rowth, but appears like a fairly expensive onstruction that would cost a few pounds o acquire.

The overmantel here set forth and de-cribed, was primarily intended for a bed-oom, and has particular features designed pecially to be useful for purposes of the oilet. But after the work was finished, hese said features presented no outward ign of their purpose, and it was debated vhether it should occupy the position in-ended, or be placed in a study. Before ointing out the object in view, it might be s well to remind the reader that, in spite f nearly a hundred patterns in these cheap alusters available from designs kept in tock, yet only comparatively few are so lanned to be useful for furniture, as those atterns which have no square stops, where he features of the turning give way to the lain wood, are not so suitable for the pur-ose, nor capable of being explained away n the design. Therefore, if the design here iven is not carried out literally to the direc-ions, the trouble of modification will be reater than it appears. This, of course, pre-umes that the amateur has not the power f turning his own spindles to order, but re-ies solely on Messrs. M. C. Duffy's stock, or he marketable produce of some kindred irm to provide the turnery of his work.

The chief hindrance in planing this piece f furniture was to group the uprights that he shelves would not be carried across the vhole façade at the same level. For in hat case the effect would be merely that of piece of ordinary shop-fitting. To avoid his disfigurement was much less easy than t seems, and only secured by arranging the ctual balusters themselves, a quantity of vhich the makers kindly placed at my dis-osal for practical experiments. As the alusters have each their own number in the rice list, it will suffice to indicate them o, as in each case I shall give a duplicate ketch of the piece itself as it stands upon he makers' pattern sheet.

This overmantel will require eight of No. 1 ($1\frac{1}{4}$ in.) and four of No. 50, also $1\frac{1}{4}$ in. ection. The few spindles used for the bot-om rails were turned specially for me by he makers, costing, if I recollect rightly, fraction under one penny each, by the ross. They are most useful; a gross nd a half disappeared in a very short ime; but when I look at the many at-ractive pieces of painted furniture of vhich they are the sole decoration, I feel hat a more useful and inexpensive ally has ardly ever been brought within reach of he non-lathe-possessing amateur before. The only materials required beyond these alusters are a few pieces of ordinary wood, leal, pitch pine—any, or every sort it matters ot, since all will be covered with enamel —and the two looking-glass panels of the loors. If the mirrors are of ordinary silvered glass, the expense is but a trifle; it vould greatly improve the whole to use thick bevelled squares; the cost of these, for the size given, was, if I remember rightly, 5s. 6d. or 6s. the pair. As, however, it was rather a trouble to get them sent to me, I used ordinary glass, but feel that the improvement gained by the bevelled plates would well repay the difference in the price.

The four No. 50 uprights, A, at the outer angles of the erection, are used with the waste wood at their base exactly as they came from the makers; planed and sand-papered of course, and otherwise made ready for painting. But the two No. 1 that are in the central portion of the front, B, start from the shelf, H, which runs right across the mantel and forms the floor of the cupboard. To keep the line of the upright, pieces of wood, C, cut off, the other balusters used against the wall were fitted below the shelf running down to the base-piece. In the design this explains itself easily. At the back of the whole, six of No. 1 are planned to carry the shelf, E, and form, as it were, the motive and central idea of the whole design. These might be limited to two, but from experience I strongly advise the use of the number shown; it is just this comparatively lavish use of the balusters that gives a certain character to these designs, and in the finished work takes away a poverty-stricken effect they would otherwise be likely to offer. As this thickly-set railing is intended to be the feature of all the designs in this series, it is needful to emphasise its importance. The whole design may fail to please many; in that case I would say discard it entirely; but if you work it, at least try, by a preparatory rough fitting together of the several parts, the effect of the work as illustrated in the sketches, before attempting to be economical in the use of the turned rails, which are the characteristic element of this group.

It will be seen that the two uprights, B, are cut off at a height corresponding with that of the outer pillars, A. As what was cut off at A is waste wood, it explains itself, but at B a part of the baluster itself is sacrificed. The way I managed it was to cut from the upper feature of No. 1 all the pear-shaped portion, and use, as it were, the base of the upper half and its capital, without the pillar itself. Consequently the upper part of B is in two pieces, but for so short a support, carrying no particular weight, this matters not, the gain to the eye in making the level line of the top shelf being more than enough to reward the maker for the slightly increased trouble. The six rails, D, carrying a top moulding, are so clearly explained in the diagram, that more need not be said.

Now concerning the shelves, it will be enough to note that the shelf I at the base runs across the whole width, so too does the shelf H, but at its either end it has half circles of the same thickness added, for reasons explained elsewhere. In the short shelves, G, at the sides, a corresponding piece is cut out, not necessarily corresponding in size, but both the added curve and the cut out are exactly over each other, to allow a candlestick placed on H to keep clear of the shelf, G, and avoid setting fire to the upper shelf; the shelves, K, at the top of the sides are too far off to be dangerous in this respect.

The shelf, F, above the cupboard, is placed almost close to where the square wood of the upright yields to its turned portion, the space thus offered being closed by two doors, *hinged upon a central upright*, between shelves H and F. These doors are mortised frames of ordinary design, chamfered but not otherwise decorated; the panels of looking-glass are let into a rabbet like an ordinary picture frame, and backed with plain thin wood. Of the small bracket-pieces below the cupboard, and the low railing at the foot of each side compartment, it will be needless to speak.

The balusters themselves decide the right position of all the other pieces, and the measured diagram shows clearly when they fit with regard to the adjacent parts. Looking at the finished structure, I feel that a photograph of it, were it possible, would show a much more tempting article than my sketches suggest.

If used for some apartments, ebonising might replace enamel. Personally, I think the scale too heavy for black finish, and would rather use a peacock blue or scarlet enamel, but that is after all a mere fancy of the owner. Varnished pitch pine would look clean and wholesome, and match the popular bedroom suites in that material. But to each person who is interested in it, a different finish will probably suggest itself, so that to-day we may leave it, and in our next try other pieces of furniture made from the same materials, or with the addition of others equally inexpensive.

THE MICROSCOPE: HOW TO MAKE IT.

BY O. B.

INTRODUCTION—GENERAL METHOD OF FOCUSSING—MODE ADOPTED BY WRITER—FOCUSSING ARRANGEMENT—FOCUSSING SCREW—STAGE—ARM—STAND—POWER TUBE—OBJECT GLASSES—EYE PIECE—MIRROR—FINISHING INSTRUMENT.

OF all instruments employed in physical research, there is hardly one of such universal interest as the microscope. To all thoughtful, cultured men, a telescope is of great interest; but even cultured men cannot command "the clouds and the rain," and the number of nights available for astronomical work in a year is fewer perhaps than most people would imagine, or, at least, in our country, so remarkable for its fogs and rain.

Electrical apparatus are also of great interest when used with a certain amount of previous knowledge, but little else than amusing to the uninitiated, or, at most, wonderful. But the microscope is equally interesting and instructive, even to a child, and objects are everywhere abundant. To be able to bring invisible forms of life into view; to reveal the marvellous decorations which are so wonderfully lavished on multitudes of minute organic forms, is at once an education and an enjoyment. But a good microscope is an expensive instrument. No doubt a great deal is paid for appearance and finish, yet it must be understood that to a great extent the value of the instrument is in proportion to the amount of labour expended on it. Apart from the optical part, its value depends on its steadiness and smoothness in use. Its moving parts must be accurate in their adjustment. Every tremor or shake becomes magnified, and unless the stand and adjustable parts are rigid, but little satisfaction can be derived from its use.

Most people have seen street vendors with little globes of glass filled with water sold for the universal penny. The writer remembers, when a boy, seeing with wonder, by the aid of such a magnifier, such creatures as eels in paste and vinegar.

Years after he tried his mechanical skill in making a microscope by the aid of tinplate and pasteboard. It was a rough affair, but by its means he was able to trace the circulation of blood in the tail of a tadpole, and which sight was esteemed as a fair equivalent for the labour bestowed. Since then he has tried his hand on many an optical instrument, but perhaps the pleasure derived by using his microscope with a tin tube and pasteboard stand was as genuine as any derived at a subsequent date by the use of more finished instruments.

The instrument which I have designed, and which I propose describing for the readers of Work, is, as far as I know, original in its construction, and will be found not only as easy to make, but in some respects more efficient than some of the ordinary types as far as its focussing arrangements are concerned.

The general method employed to focus is that of the rack and pinion, either acting directly on the power tube or through a bar in the stand, the latter method being employed in the more expensive instruments. Another plan is that of a chain instead of a rack, but I have not seen many of this type. But these methods are simply for coarse adjustment; for high power something far more delicate is required. This finer adjustment is obtained generally by a screw operating on a lever.

In the arrangement I have designed I have done away with the rack and pinion, which, unless well made, is a constant source of trouble; and also with the lever. A fine cut screw acts directly on the focussing bar, so that an object may be focussed to any degree of fineness, depending on the number of threads to the inch on the focussing screw. It can thus be used for measuring thin films up to, say, from a 2,000th to 4,000th part of an inch thick. If due care is observed in working out the details, a good and substantial instrument will be the result. I assume that my reader can use a few tools, and has in possession a lathe, and can cut a screw. If he cannot do the latter, then in most towns there are brass finishers, who, for a small consideration, would do all the screw cutting required. Besides this, there is nothing that an ingenious worker cannot do except the few castings in brass.

The principal parts of our instrument are, first, the focussing arrangement; second the stand; and third the optical tube. As the first part mentioned is somewhat more complicated than the others, we will commence with it. Procure three lengths of brass tubing, one piece $5\frac{1}{2}$ in. long by 1 in. diameter, one piece 5 in. long by $\frac{5}{8}$ in. diameter, one piece $3\frac{1}{4}$ in. long and large enough to slip over the smaller of the two tubes; whilst it will admit the tube there must be no shakiness. In Fig. 1 the tubes are lettered *b*, *c*, *d*. Tube *d* must have a ring of brass $\frac{1}{2}$ in. wide, soldered at one end as shown in Fig. 7. Before driving on the ring, file the inside bright, also the outside of the tube. If too tight put a fine saw cut in the ring, and spring it on. Moisten the parts well with the soldering fluid, and then with a hot bit cause solder to flow in the joint. By making the brass hot, the solder will run through the joint and the work will be solid. If a gap is left where the ring was cut, a thin slip of brass must be soldered in it.

Now take $\frac{1}{2}$ in. of tube, *c*, and having cleaned it on the outside insert it in the same end, and solder it; cut out roughly a disc of brass $1\frac{1}{4}$ in. diameter, and solder it to the end. Put the tube in a chuck and turn down the collar, chasing a thread on it, and turn down the end with a central hole $\frac{1}{4}$ in. diameter. When this is done, draw a line down the tube with a sharp point; be careful that it is parallel with the axis of the tube, as if it is not our whole action will be imperfect; the reason of this will be seen as we proceed. With a saw or file slot down the tube to the collar. If a circular saw for brass is attached to the lathe, there will be no difficulty in cutting the slot correctly, which must be, say, $\frac{1}{8}$ in. wide.

We must now proceed with tube *c*. Each end of this must be plugged with a short length of tubing. We will suppose it rather too large to work smoothly in *d*; we will therefore put it in the lathe and true it up, and bring it to such a size that it will work without a shake. Cut a strip of brass 3 in. long, and, say, $\frac{1}{4}$ in. wide and $\frac{1}{8}$ in. thick;

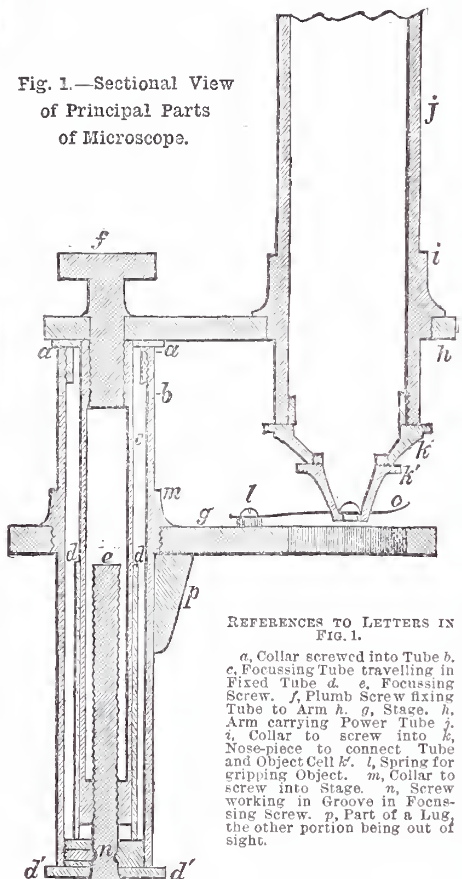


Fig. 1.—Sectional View of Principal Parts of Microscope.

References to Letters in Fig. 1.

a, Collar screwed into Tube *b*. *c*, Focussing Tube travelling in Fixed Tube *d*. *e*, Focussing Screw. *f*, Plumb Screw fixing Tube to Arm *h*. *g*, Stage. *h*, Arm carrying Power Tube *j*. *i*, Collar to screw into *k*, Nose-piece to connect Tube and Object Cell *k'*. *l*, Spring for gripping Object. *m*, Collar to screw into Stage. *n*, Screw working in Groove in Focussing Screw. *p*, Part of a Lug, the other portion being out of sight.

draw a line down the centre and file down to it, leaving three pins as represented.

On the lower half of tube *c* draw a line parallel with its axis; bring the strip just made to the bottom, and mark where the pins come, and drill holes to receive them; this must be soldered to the tube. When filed up, it must just fit the slot in tube *d*. A thread must be chased in each end as shown. We will now take tube *b* in hand. One inch and a half from the top a ring $\frac{1}{2}$ in. wide must be soldered, and over this another $\frac{1}{4}$ in. wide. The tube must now be chucked in a lathe, and the rings must be turned down as in Fig. 1, with a thread chased on it. A thread must also be cut in each end—the lower end to take the collar of tube *d*.

To a ring $\frac{1}{2}$ in. deep, and too large to enter the tube *b*, a disc must be soldered; this must be turned down, and a thread chased on it to fit *b*. In the centre of the disc a hole must be turned large enough to admit tube *c* without shake.

We now must make our focussing screw *e*, Fig. 1. This may be made either of steel rod, with a brass head cast on it, or entirely of brass; if the latter, we can either have it cast, or we can make it of $\frac{3}{8}$ in. brass rod, and screw and solder a disc $1\frac{1}{4}$ in. to it. This, of course, will be a little less expensive, but will not look quite so well. It must be turned up true, and a thread cut on it to within $1\frac{1}{4}$ in. of the head.

The number of threads per inch on this screw is a matter of consideration; 25 will be a desirable number, for reasons to be dealt with afterwards. Place the tubes one in the other as shown, and insert the screw, screwing it as far as it will go. In the collar of *c* drill a hole and tap it, and make a screw to fit, with its end rounded off; insert a scribing point in the hole and mark the focussing screw, and either with a rat-tail file or in the lathe, cut a hollow, as shown, to receive the end of the screw in the collar. It will now be seen that when the focussing screw is engaged with this little bolt and turned around, the tube *c* will be forced out of the larger tube. The bar in *c* travelling in the slot of *d* will prevent the tube turning around, and in proportion as our work is good, so will be the smoothness of the motion. By turning the head once round, the tube will travel $\frac{1}{25}$th of an inch; by turning $\frac{1}{4}$ around we shall regulate it to $\frac{1}{100}$. But any definite degree of motion can be obtained by the screw—thus: when the screw is in the lathe, mill the edge of the head, then turn the edge of the head off square, so as to show the milling like the cogs of a wheel. With a magnifying glass count off, say, twenty teeth, and with a fine-pointed graver cut a line from the edge to the centre. When they are all marked off they can be again divided into tens. With small steel punches the lines may be numbered, say, by twenties. We will suppose there will be 200 serrations on the milled head. If we turn the screw from 0 to 10, the tube will be moved through a space equal to the 500th part of an inch; or if we move it to the extent of one degree the movement will be the 5,000th part of an inch. I admit that great accuracy in working must be observed to arrive at such results, but with care and skill it can be done. If this idea is carried out, an indicator with a needle point should project from the lower part of the tube, to come almost in contact with the head.

Our next business will be the stage. For this purpose we shall require a piece of brass $4\frac{1}{2} \times 3\frac{1}{4} \times \frac{1}{4}$ in.; it may be either cast or worked out of sheet—the latter will, perhaps, be the easier plan. Fig. 2 shows both the under and upper sides. In A is shown the position of the lugs; these must be $2\frac{1}{4}$ in. apart. First of all, finish the stage as far as its outline, seeing it square and true. Fix upon the centres for the holes, these centres being exactly $2\frac{1}{2}$ in. apart. Mark with a compass the curved outlines, and file down to the line. The top side of the plate must now be filed dead level. In the absence of a better tool, a piece of plate glass will be a good substitute to test its surface. Rub a little grease on the glass, then press the stage on it, when its inequalities will be made manifest. These must be scraped or filed down till the stage shall touch the glass on its whole surface. The holes should be cut in the lathe; fix them in the face plate, and push the head centre forward until the point touches the stage. Move the stage until the punch marks are opposite the centre, and clamp the stage in position. Be sure by measurement of the size of the rear hole, as it must fit, when chased, the collar in Fig. 1. On the under side mark off two lines equidistant from the centre, and with a square determine the position of the lugs. These must be made of sheet brass of the form showed at Fig. 10; two pins must be left on the top edge, as shown by dotted lines. They should be filed up together so as to be exactly alike; it would not be amiss to fasten them together by a touch of solder. Whilst joined, drill the bolt hole. It is of the utmost importance are perfectly square and true with each other. If the pins are a good fit, and the soldering is good, the lugs will be just as strong as if they were cast. B shows the top of the front part of the stage; three holes must be drilled at e, f, f', and carefully tapped.

Two pieces of thin steel must be bent, as shown in Figs. 1 and 2. Any watchmaker will supply a broken watch spring for the purpose. Take out the temper, drill two holes, and bend to shape as shown; harden, polish, and then temper again. These will of the hole in the stage e and a, and then drawing a circle on the revolving diaphragm. This circle will then indicate the position of the centre of each opening. A short tube must be soldered to the under side of the plate, around or in the largest opening, as shown in Fig. 11; the use of this will appear further on. The stage can now be screwed to the tube collar, Fig. 1.

The arm, Fig. 3, now claims our attention. This may be cast or worked out of $\frac{1}{4}$-in. sheet. The centres of the holes must be

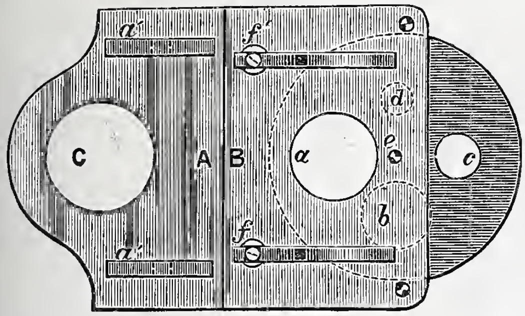


Fig. 2.

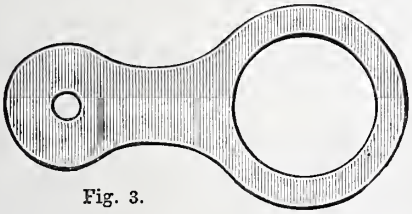


Fig. 3.

Fig. 4.

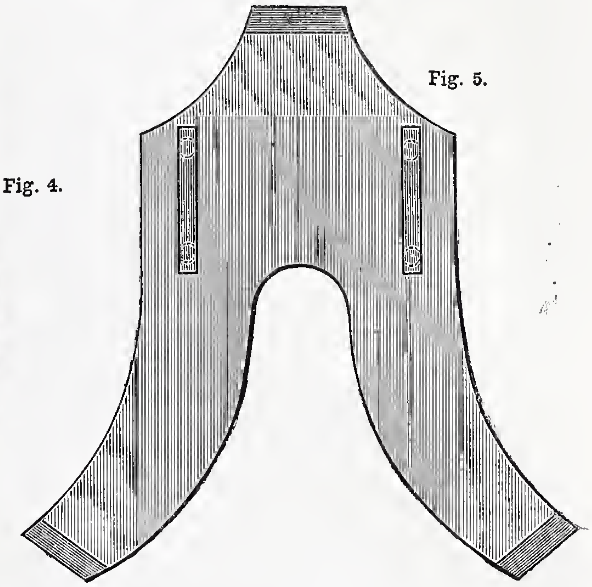


Fig. 5.

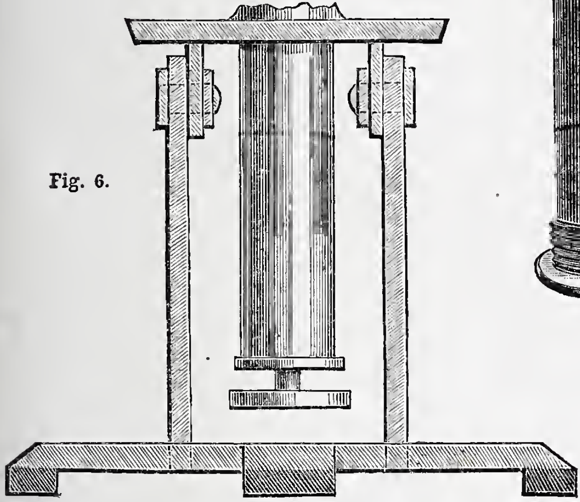


Fig. 6.

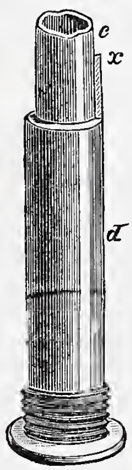


Fig. 7.

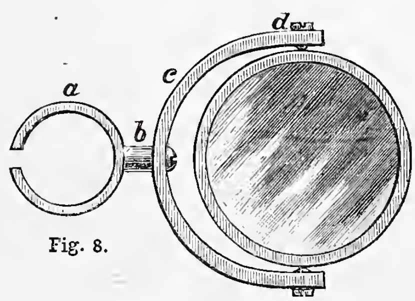


Fig. 8.

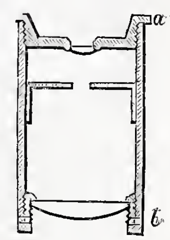


Fig. 9.

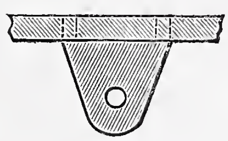


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 2.—Stage Plate, showing Half Under Side (A) and Half Upper Side (B)—a', Position of Lugs; a, Opening for Objects; b, c, d, Position of Holes in Diaphragm; e, Hole for Pin of Diaphragm; f, f', Springs. Fig. 3.—Arm for Carrying Tube. Fig. 4.—Standards. Fig. 5.—Top View of Stand. Fig. 6.—End View of Instrument, showing Nuts and Bolts securing Stage to Stand. Fig. 7.—Focussing Arrangement—c, The Live Tube moving in d; x, The Guide Bar moving in Slot in d. Fig. 8.—Mirror. Fig. 9.—Section of Eye-Piece. Fig. 10.—Lug to Stage Plate. Fig. 11.—Diaphragm Fixed to Under Side of Stage Plate. Fig. 12.—Section of Casting of Cell to carry Field Lens.

that these should be coincident when they are filed up to proper form; the sides must be made perfectly true by the same means as have been employed for the stage. Place a lug on the stage by the lines marked, and see where the holes for the pins have to be drilled. Let these be $\frac{3}{16}$ in. deep. Now file the pins so that the lug will bed dead on the plate. With a square test it so that it shall stand perfectly square and true. Run soldering fluid around the joint, and with a hot soldering bit run solder well into the joint. See that there is plenty of solder, and that the tool is hot. Now treat the other lug in the same way, being careful that they be screwed in position as shown, with brass washers under them. Cut a circle of $\frac{1}{16}$ in. brass $2\frac{1}{2}$ in. diameter. Make faces true—it will be better if the edge is milled; it must have a centre hole to take a small bolt, by which it is to be screwed to the under part of the stage as shown, with a washer between. Four holes must be drilled: a must be the same diameter as the opening in the stage; b, c, and d must graduate smaller, as shown by dotted lines. Care must be taken that the centre of each hole is coincident with the centre of the opening in the stage. This can be secured by measuring the distance between the centres $2\frac{1}{2}$ in. apart. The form should be marked out with the compasses, carefully marking with a centre punch the position of the holes. The arm must be finished off with care, and be dead true. The holes should be turned in a lathe. It must be bolted to the face plate, and its position found by the aid of the dead centre. The large hole must have a thread chased in it; the small hole must be large enough to admit a headed bolt f, Fig. 1, which screws into the live focussing tube c. The head of the bolt must be milled.

Our next work will be the stand. Now, an essential quality of a stand is that it shall be heavy and steady on its feet, as the least unsteadiness is fatal to microscopic work. We shall now, I am afraid, be compelled to seek the aid of the brass-founder, so we must prepare our pattern. Out of $\frac{1}{8}$-in. well-seasoned wood, say mahogany, cut a pattern as Fig. 5, but $\frac{1}{8}$ in. less all round. From heel to toes 6 in., across the toes 6 in., across the sole $3\frac{1}{4}$ in. Cut strips of pine $\frac{1}{4}$ in. and $\frac{1}{8}$ in., boil them, and whilst hot, spring them to edges of the pattern; it will be advisable to cut them a little wider than $\frac{1}{4}$ in. so as to allow for dressing off. The wood can be easily bent to all the curves except in the circular part between the toes. Perhaps the easiest plan will be to turn a piece out solid, as a disc $\frac{1}{4}$ in. thick to fit the curve, cut across the diameter and fix by glue, and then with chisel and round file work it out.

The toes and heel must be finished off $\frac{1}{2}$ in. deep, as shown in Fig. 6; when finished off perfectly true, black-lead it and take it to the brass-founder. The casting must be accurately filed up and trued as before described. The edge at toes and heel should be filed off as shown by the shadings. Two standards must be cut out as Fig. 4, 4 in. high, and $1\frac{5}{8}$ in. wide at the base. Two pins must be left as shown. These, like the lugs, must be worked up together and the bolt holes coincident. Measure the exact width outside the lugs on the stage; this must be the measure of the distance between the standards. Find their position on the stand by the method described for the lugs, and drill holes for the pins, which, in this case, may go through the plate; be sure the standards are true with the foot and with each other, as accuracy here is everything. In this case more care must be observed in soldering than with the lugs, as now we are working on the top of the plate. The plate should be soldered first where the standards are to come as well as the bottom of the standards and pins, and then sweated together. If, when put in position, a hot bit is brought close to the joint, the solder will melt and allow the two pieces to come together. It will be done best as a three-handed job, as care must be taken that they are perfectly square with each other.

Two bolts and nuts must be made as shown in Fig. 6, by which the stage and the stand may be fastened together. Observe—no thread must be cut on the inside end of the bolt which goes through the standards, and the hole must admit the bolt freely.

The next matter for our consideration is the power tube. For this, we shall need a tube 8 in. long, and, say, $1\frac{1}{2}$ in. diameter; $1\frac{3}{4}$ in. from the lower end solder a ring $\frac{3}{4}$ in. wide, and over that another as described before. Chuck the tube in the lathe, and turn down a collar with a thread chased on it to fit the arm already made.

Although for convenience in writing I have referred to the arm before the tube, yet in actual work it will perhaps be best to make the tube before finishing the arm. Whilst the tube is in the lathe, a thread must be chased on the inside of the lower end. A small casting must be made as K, Fig. 1., as a nose-piece to screw in the tube, and to take the object glass tube K′.

I will not recommend an amateur to mount his object glass, at least, if it is a good one; the better plan by far will be to send the nose-piece to a practical man, and get such object glasses as are desired mounted on tubes to fit the nose-piece.

The object glasses I would recommend are, to begin with, a 2 in., 1 in., and $\frac{1}{4}$ in. It is a great mistake to suppose that the higher the power the more any one can see. The fact is, the eye needs a lot of training before a high power can be used with great advantage. Beside which, with a high power a very small portion of an object is seen at once, which to the unskilled would be meaningless; whilst with a low power a large field is presented and a moderately large object can be taken into view at once, which to the amateur microscopist is both more interesting and instructive. Even a 3-in. object glass is a useful power with some objects.

We must now proceed with an eye-piece. These, like object glasses, are of different powers, known generally as A, B, and C. An optician would supply the power needed. We need $1\frac{3}{4}$ in. of tube that will slide easily into the power tube. If it is slightly too large, it can be turned down; on the inside of each end a thread is cut.

We shall now need two castings. Fig. 12 gives a section of the cell for the field lens. At *b* is seen a small ledge or gallery; this is for the lens to rest on; this need not be more than the 32nd of an inch thick. At *a* the brass must be turned away until it will bend easily. Chase a thread on the outside and inside; the thread on the inside is for the purpose of attaching a polariscope to the eye-piece. When the cell is finished, it should be large enough to take the field lens without pinching. Chuck the cell with *a* at the right hand, place the lens in position, some one steadying it with the end of a clean finger, turn the lathe slowly, and with a burnisher turn the edge over on the lens, as shown in Fig. 9. The cell for the eye lens must have a slight increase of thickness around the hole; this is to allow of a bed being turned out for the lens. The brass will be turned away so as to allow a ring to stand around the lens for the purpose of bezelling it. In the focus of the eye lens a stop must be placed as shown, with a central hole two-thirds of the diameter of the lens.

The next work will be to fix a mirror. Fig. 8 will give a plan of this. A mirror in a cell can be purchased from 2s.; it would therefore be unwise to buy simply the mirror and make a cell—it would not be worth the labour. Still, if one purposes doing so, proceed as follows:—Cut off a ring $\frac{1}{2}$ in. wide from a tube large enough to admit the mirror, turn the ends true and cut a thread on the inside of one end, and solder a bottom to the other, letting the edge of the bottom project far enough to mill it. A ring with a flange must be made to screw into the cell; the flange edge must be milled. Place a little cotton wool in the cell on which to lay the mirror, and screw on the ring. In the diameter of the cell two small hollows must be made with a fine-pointed centre punch.

A collar must be made to slide on the focussing tube *b*, Fig. 1. This can be made of tube that will hardly go over the other; put a saw cut in it. The spring will now allow it to go on, and at the same time will grip it firmly. The clip should be $\frac{1}{2}$ in. wide. In the centre, as at *b*, Fig. 8, a small stud must be screwed and soldered; this may be made of small brass tubing.

A circular arm, *c*, must be made; it should be $\frac{1}{2}$ in. × $\frac{1}{4}$ in. in the centre, tapering at the ends. A screw fastens it to the stud. A washer should be placed under the head of the screw. Screws pass through the ends; these are pointed, and enter the centres which have been provided for them in the cell.

The mere mechanical part of the work is now finished. The various parts must be polished with rottenstone and oil; not a trace of a scratch must be left, the whole being lacquered. This is a difficult job for an amateur; a hint or two perhaps may be helpful.

After they are polished they must not be fingered, as finger marks will show when the lacquer is laid on. They must be heated as hot as the hand will bear with comfort; rather vague directions truly, but practice alone can give the requisite degree of heat. The lacquer must be put on with one stroke of the brush; no painting, as the brush marks will show.

If care is employed in carrying out these details, the result will be an instrument equal to any work which the average student will be called upon to do. It is a well-known fact that practical men, as a rule, do not employ instruments elaborate in their mechanical arrangements; these are left for wealthy amateurs, who are fond of exhibiting costly toys.

In constructing the eye-piece, I have calculated field lens 2-in. focus, and eye lens 1 in.; these are separated one-half their combined focus, that is, $1\frac{1}{2}$ in.

PHOTOGRAPHIC TRANSPARENCIES.

BY DAVID ADAMSON.

AMONG my acquaintances are some who go in for photography. As is not unusual, they are "photographic mad," a common complaint amongst amateurs; or, stated in other words, they are enthusiastic votaries of the art of photography. Strange and wonderful attempts some of them make in the higher branches of the art before they have mastered the rudiments. They want to make beautiful transparencies before they can manage to take a decent negative. Occasionally they get one which is fit to be seen, and when they can make two or three good ones in succession they want to go ahead. Far be it from me to dissuade any beginners from their laudable desires to make progress; only I think they would often get on better in the long run by remembering that we must creep before we can walk. It is no doubt a strong temptation to many of us when we read of the beautiful results obtained by skilled workers to try and do likewise, but experiments run away with both time and money needlessly, when undertaken without sufficient experience to warrant a reasonable prospect of their being successful. However, this has not much to do with the subject of the present article, though it all leads up to it, and transparencies made on the ordinary albuminised paper may well be recommended for the consideration of those who are as yet not equal to the task of producing them on glass. Nothing more than ordinary negatives and the common paper which every photographer uses more or less, and beginners solely, for printing purposes are required — of course, with the necessary chemicals as well. To produce such transparencies no difficult manipulation, requiring great nicety in application, is called for. They can, in fact, be produced by any one who can take an ordinary photographic print, no more skill or expense being necessary for one than for the other.

As every one who has given his attention to even the smallest extent to transparencies knows, on glass they must be much more dense than an ordinary negative, and for this reason special plates for transparencies are made and sold. The same rule holds good with regard to silver print transparencies. The print may be quite right seen in the ordinary way; it may even be a trifle too deeply printed; but on rendering it translucent, and viewing it by transmitted light, it will be found wofully thin and poor-looking. However well it looked before, it does not do as a transparency. This thinness, I take it, is the chief reason why the plan of making transparencies of silver prints has not found more favour among amateurs who wish to adopt easy methods of work, which, without being so good as the processes which in skilled hands are found the best, shall yet afford fair results.

I do not know that the process by which dense silver prints may be obtained is any novelty. For aught I am aware, it may be a well-recognised plan, though it can hardly be called a well-known one. So far as I am concerned, I found it out accidentally. One day, inadvertently, a piece of paper was put in the frame with its unprepared side in contact with the negative. On examining it in due course this mistake was discovered. On the sensitised side a print much as usual, only fainter, showed itself on the other—the side next the glass. The print was also distinctly visible, but details were not well defined. The effect was peculiar, and not altogether pleasing. However, the print being partly formed, it was left for further exposure to see what the result would be, more from curiosity than from any other motive; though at the same time I thought possibly dull prints could be got in that way. I have since seen it mentioned somewhere, I fancy, by my old friend—Henry Sturmey, of cycling celebrity—that dull or matt prints can be obtained in this way; but without disputing the dictum of so well known an authority, it may be said that the want of detail is objectionable. At least, in my hands they have never shown much detail, though for broad effects they are admirable.

If I may venture on a comparison, they may be said to bear a similar relationship to prints taken in the ordinary way that a charcoal drawing does to an engraving, or a picture of the impressionist school to a minute Dutch painting.

Mentioning painting, reminds me that photographs printed on the wrong side of the paper are admirable as a groundwork for colouring, either in water or oils; but this branch of work cannot be enlarged on at present. I hope, however, to refer to it at no very distant date; so, in the meantime, attention may be confined to transparencies.

In due time the print above mentioned was toned and finished along with a batch of others. It could not be called satisfactory either on one side or on the other, though on both the picture was distinctly visible. On holding it up to the light, however, I was struck by its density. If I had been on the look-out for a dense print to serve as a transparency, the result could hardly have been happier.

With this there is little more to be said, for the way by which silver prints may be made available as transparencies has been clearly indicated. All that is required is to "make a mistake" in putting the paper in the frame. Printing takes a good deal longer than in the usual way, but it must not be so long continued as to form a really good picture on what is now the reverse, the albuminised side. It is possible to get this, but then the print is too dense as a transparency. A few trials, however, will soon show the extent to which the printing should be carried, and be of more practical use than pages of instruction.

It will be understood that the prints are to be fixed and toned in the usual way, after which they are rendered translucent and mounted.

Perhaps the best medium for rendering them less opaque is Canada balsam, thinned down with a little turpentine. I find it a very good plan to soak the photos in the latter, and then to rub them over with the balsam, leaving the print for a few hours between a couple of pieces of glass (old negatives) till the balsam has thoroughly incorporated itself with the turps and soaked into the paper. The only object of the glass is to prevent the balsam and the turps drying before all the tissue of the paper has become saturated. If they do, opaque spots soon show themselves, and do not add to the beauty of the transparency, which, when well done, should not show any granulation. Instead of Canada balsam, which is a nasty sticky stuff to handle, any of the preparations named in the recent articles on crystoleum painting may be used; and melted wax or paraffin is not to be considered as by any means the worst medium for rendering the prints transparent. Perhaps it is the most durable of the lot, though rather more troublesome than some of the others in its application.

When the transparency is ready, it may be preserved between two pieces of glass; old negatives again come in very conveniently. These are joined at their edges in the manner described by Mr. Beckerlegge in his articles on crystoleum—already referred to—and then mounted in a suitable frame. This, of course, should be the same on both sides, if it is visible from the outside of the house; for, however beautiful a transparency may be when seen from the inside of a room, the ordinary picture frame is hardly presentable as an object of beauty both in front and behind. To describe the construction of frames is, however, hardly within the scope of this paper, which, having described a process of easily making transparencies by novices in photography, has served its purpose.

It has frequently occurred to me that such paper transparencies might be made available as a magic, or, to give it its high class, first "chop" name, optical lantern; but on this point I cannot speak definitely, as I have not much acquaintance with this kind of work, or, should I say, scientific amusement? Possibly, to some of those who do, the hint may be of service, and induce them to give fellow-workers the benefit of their experience.

In the meantime I may, however, just suggest that the paper will form a pleasanter ground on which to paint than the glass on which magic-lantern slides are usually prepared. Of course, transparent colours only are permissible, and in considering the effect to be thrown on the screen, the colour to which the photograph has been toned must be taken into account; for example, with a brownish tone it must be remembered that strange pranks will be played with the blues and the greens with which the photograph may be tinted. This refers only to coloured transparencies, or, as they may perhaps be called, lantern slides; and it need hardly be said that if left in the plain unpainted state that they will be better than if badly coloured. While proposing the use of these paper transparencies for lantern purposes, the obvious saving in weight may somewhat counterbalance disadvantages.

PAPIER-MÂCHÉ.

How to Mould It, and how to Ornament It.

BY SYLVANUS WARD.

DECORATION (*continued*). FINISHING BUILDINGS ON PEARL—FLOWER AND FRUIT PAINTING ON PEARL—FIGURES IN PEARL—ORNAMENTS IN PURE PEARL ON COLOURED PEARL GROUND—SCRAP PEARL WORK—BRONZE WORK—STENCILLING AND DUSTING-IN.

OUR attention must now be directed to finishing subjects inlaid with pearl by painting.

Buildings in Pearl.—There are different methods by which pearl buildings may be finished; we will describe two applicable to buildings which are supposed to be in a perfect state, and a third which is considered most effective for the treatment of ruins.

In all cases, the main features of the building have first to be sketched in, and in doing this, the T-square and set-square will be found useful accessories. We will suppose this done, with the structure to be finished by our first method, and we have now to give our high lights to those parts on which the light in our picture falls most strongly—such as string courses, the fronts of buttresses, etc.; and this is done by gilding those parts with pale gold. The shadows have next to be broadly put in with transparent varnish colour. For this purpose, although the effect produced by it cannot be called a natural one, purple has been the favourite colour. The purple used is compounded of Prussian blue and carmine; or, instead of carmine, the cheaper crimson lake may be employed. After this the darker shadows are put in with a deeper shade of the same. For shaping out windows or other architectural details of the parts in shade, a little black may be added to the purple. On those parts of the building which are in light, a mere line of purple will usually serve to bring out a pilaster or any similar feature. It will thus be seen that, according to this method, pale gold serves for the high lights; the pearl itself for the middle tones; and purple for the shadows.

Or, secondly, in place of gold, flake white may be used for the high lights, life and variety being freely given to it by occasional tints and minute touches of such colours as a legitimate water-colour painter would suppose to exist in the stone, and would give to it. Instead of purple, a grey may be employed for the shadows, this also being enlivened by a little bright transparent colour, so as to give a variety of warmer or cooler greys. By this method a less showy, but a more natural and artistic, representation of the building is obtained.

With ruins it is found better to deal somewhat differently; but before describing the manner of doing so, it will be desirable to make some supplementary remarks on the actual inlaying of work of this kind if it happens to be on any considerable scale. The Gothic window, Fig. 37, will serve as an example. The masses forming the arch having been cut out in pearl, and fitted up on those which form the walls, the knife-saw must be used to cut strips of suitable width for mullions. Some of these strips, cut shorter, will also serve for those parts of the tracery which approach straight lines. Other strips, divided into small pieces, will also serve for the circular parts of the tracery, if cut and arranged, as shown in the diagram, like stones forming an arch. Cusps (the little triangular projections in Gothic tracery) are afterwards put in with pearl colour at the beginning of the painting process. These cusps are for distinction shown black in one-half of the figure. The angular lines of the tracery are changed into curved ones in the painting process. All this applies to Gothic windows of considerable size only; if small, they are laid in solid, and the tracery is formed by blacking out between.

To return to the method of finishing ruins. The older plan was to light with gold and shade with purple, as mentioned above; but this was abandoned for a better. Owing to their unsheltered exposure to weather, ruined walls become much more covered with mosses, and such like vegetation, and acquire much more varied colour than those which are protected by roofs. Hence it has been found that more characteristic effects are to be produced by painting in the high lights with flake white warmed up with different tints, somewhat as in the process last described, and painting the other parts with patches of varied transparent colour, blended into each other. In the half-tones these tints will, of course, be very sparingly employed, the pearl being left as much as possible to produce its own effect. It will be in the shaded parts that most colour will be used. Such pigments as verdigris, Italian pink, carmine or crimson lake, Prussian blue, or mixtures of these, are fitted for this purpose. Tube colours will doubtless be used, but they must be sufficiently diluted with varnish and turps. Ruins thus painted are best lined out with a mixture of crimson lake and vegetable black, which will form a kind of dark purple. This will not have to be confined to the shady side of the work; on the light side also a line of it occasionally, as down a pillar or the recess of a window, will be equally necessary.

Ivy or other foliage growing on such ruins may either be done in bronze powder (of which mention will be made further on) mixed with varnish, the high lights and shadows being expressed by stronger or weaker touches of bronze, and afterwards stained with transparent colour; or it may be merely painted with varnish colour. The worker has a like choice in the treatment of trees, etc., which may surround his ruin, and of the ground on which it stands.

Mention has just been made of "varnish colour." This is supposed to imply ordinary tube oil colour mixed with varnish; but the old practice of japanners was to use colour ground in turpentine, varnish about equal

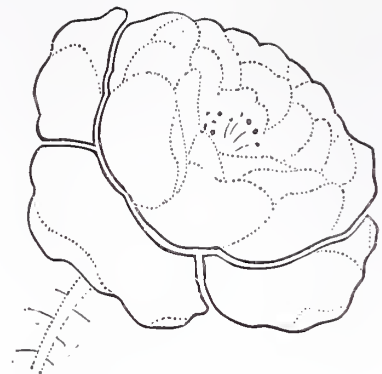


Fig. 38.—Flower Painting on Pearl.

in quantity to the bulk of the colour being afterwards added, and the whole well mixed with the palette knife. This sets more quickly, but involves much loss of time in hand-grinding.

Flower and Fruit Painting on Pearl.—In representing such natural objects as these on pearl, it is usual to introduce leaves but sparingly, and to confine the work as much as possible to the actual flowers and fruit.

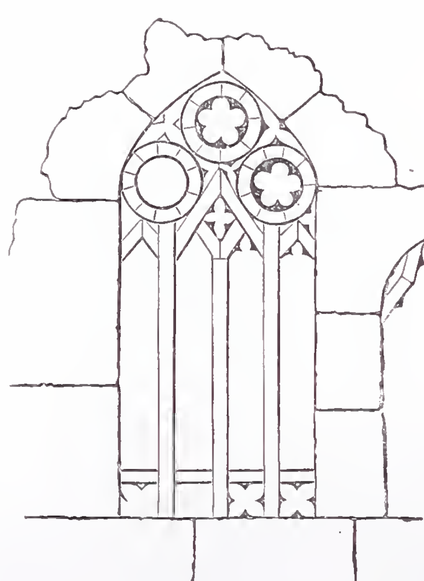


Fig. 37.—Pearl Inlaying: Gothic Tracery in Pearl Ruins.

Before inlaying, the pearl is cut with the scissors so as to suit the forms of the different parts of the group as far as may be. Flowers and fruit need but a very slight sketching-in of their more prominent features with the black-lead—indeed, a skilful workman is contented to do the sketching almost entirely with his brush as he goes on. If, as is frequently the practice, the leafage and stems are to be in gold or silver, this gilding or silvering should be done first.

We will assume that we have a flower group to paint, in which is a rose (red), a horn-poppy (yellow), and a convolvulus (blue). Our flowers have been cut out and inlaid in pearl, as may also probably be a leaf or two, to make the composition balance, for in work of this kind the pearl asserts its importance, and first and chiefly strikes the eye. The balance of pearl in a composition has therefore to be duly considered. Our stems and leafage generally have been gilt. Our less important buds we may perhaps

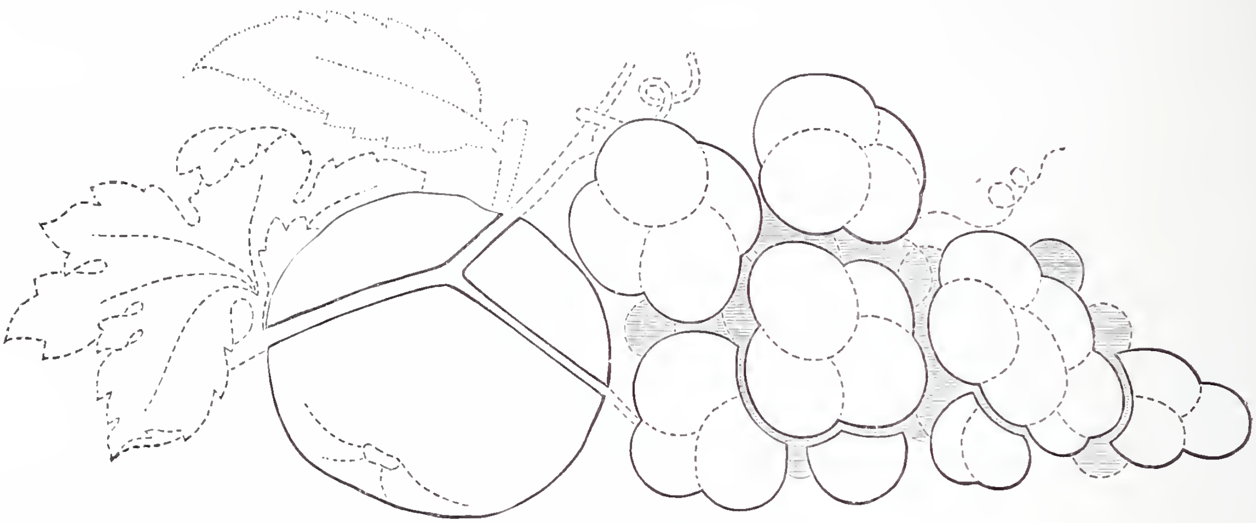


Fig. 39.—Fruit Painting on Pearl.

have laid in with silver, but we shall probably content ourselves, as regards them, with flake white only.

But here it should be noted that if, for want of sufficiently large pieces of pearl, our rose or other flower has to be inlaid in more pieces than one, the divisions should be made to coincide with the outlines of the petals, as exemplified in Fig. 38. To render the joinings as little apparent as possible, paint them over with pearl colour, or, what is still better in flower or fruit work, before beginning the painting process, go over the joints with varnish, in which a spot of oil is mixed, and stump over with white bronze.

But to proceed with our painting: beginning upon our rose, we take a brushful of thin transparent varnish colour, and put in a broad wash for the middle of the flower, letting the colour flood towards the centre where the greatest depth is required. With the same colour we go over the under part and other portions which are in shade. Then we slightly define those petals which are in light. Mixing ultramarine with our varnish, we now paint in the convolvulus to the same stage; and that done, with Italian yellow (usually called Italian pink) we make like progress with the yellow poppy, and such parts of the convolvulus as may require this colour.

While the flowers dry we shade down the gold stems and leafage till they appear to recede into their proper places. For the stem of the rose we shall use burnt sienna, with perhaps a little crimson lake added, and vandyke brown for the deepest shades; while the leaves will require verdigris, Italian pink, burnt sienna, and vandyke brown.

When the flowers are sufficiently dry, we shall proceed to paint them up, using a drier colour and one of deeper hue than before. A firm line or touch of flake white tinged with crimson lake, if used in finishing, will be found to bring up the high lights effectively without interfering with the brilliancy of the pearl.

The treatment of fruit on pearl is much the same as that of flowers. As may be done with flowers, the stems and leafage may either be inlaid, or gilded, or merely painted, as best suits the composition and the taste of the worker. Some of the difficulties of fruit inlaying are dealt with in Fig. 39. It will be obvious that an entire bunch of grapes would be too large to be formed of a single piece of pearl, and the usual method of procedure is that shown, the pieces of pearl being marked out by a continuous line, whilst the individual grapes are bounded by dotted lines. Some two or more grapes adjacent to each other, or perhaps single grapes if they come near to the eye, are inlaid with separate flakes of pearl, whilst more distant grapes—shown as shaded in the diagram—are merely painted in with pearl colour in the intermediate spaces. The apple is also so large a fruit as to present difficulties. One way of meeting these is that shown in the diagram, where a grape-stem is brought across it, so as to conceal the joinings of the three pieces of which it is composed. Another way is, in a streaked apple, of hiding the joining by a streak. These joints have, of course, to be covered with pearl colour or white bronze, as mentioned above in connection with the rose. A third way is by inlaying so much only of the apple as will serve for the half-tones, and trusting wholly to painting for the high lights and shadows.

Greek and Etruscan Figures in Pearl.—Statuary and the flat figure compositions on antique vases are well suited for treatment by pearl inlaying. The figures are cut out in the pearl, the outlines being afterwards corrected with black, whilst black lines are introduced to indicate the features, drapery, etc., wherever needed. Groups of flowers and fruit have sometimes been treated in a similar manner with black lines only, the finer stems, etc., which are too delicate to be cut in pearl, being merely laid in with paint.

Ornaments in Pure Pearl on a Coloured Pearl Ground.—Such ornaments are most readily produced by painting over the whole surface of the pearl with the grounding colour, which may be purple, yellow, or any other which is desired, a little oil being added to the varnish with which the colour is mixed, to make it set more slowly. On this, before it is thoroughly set, and as soon as it is dry enough to work upon, the required ornament is painted in *oil* flake white laid on freely. This is allowed to stand so long as will suffice to soften the ground colour beneath, and is then wiped off with a little pad of cotton-wool, the pad being tightly squeezed together, so that no fluff may come off it. The flake white brings with it the grounding colour, and the ornament is thus left in pure pearl, as desired.

Scrap Pearl Work.—The scraps of pearl which accumulate from inlaying may occasionally be used to good purpose for filling formal spaces in ornamental designs. The method is to fit them in quite at random, and then to stain them with different transparent colours. Simple as is this work, it has a very pleasing effect. Scraps of pearl may also be used for foliage of trees, in connection with inlaid ruins, connected and worked up with gold dotting or pencilling; or in other cases with dots of green or autumnal tints.

Bronze Work.—We now come to a highly-interesting method of decoration, and one which, in the hands of an ingenious decorator, is applicable to many other materials than papier-mâché, and that is by bronze powder. Somewhat more than half a century ago, bronze powders were extensively employed in the decoration of papier-mâché; not in the rude and hasty way in which we now see them applied to iron goods, but in ornamentation of a higher and more elaborate character, by means of a kind of stencilling and dusting-in process. The bronzes used were chiefly pale gold, deep gold, copper, flesh, orange, green, and silver bronzes. Landscape and figure subjects were sometimes carried out in this work, and these required in addition a "pencil bronze," *i.e.*, bronze mixed with copal varnish into a kind of paint, and applied like paint with a brush. The bulk of the work in bronzing was, however, done by stencilling and dusting-in—a process requiring no particular skill or knowledge, only care and exactness.

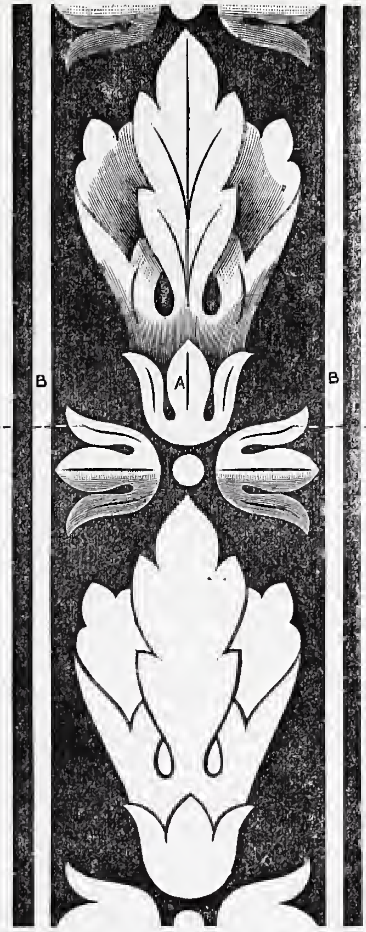
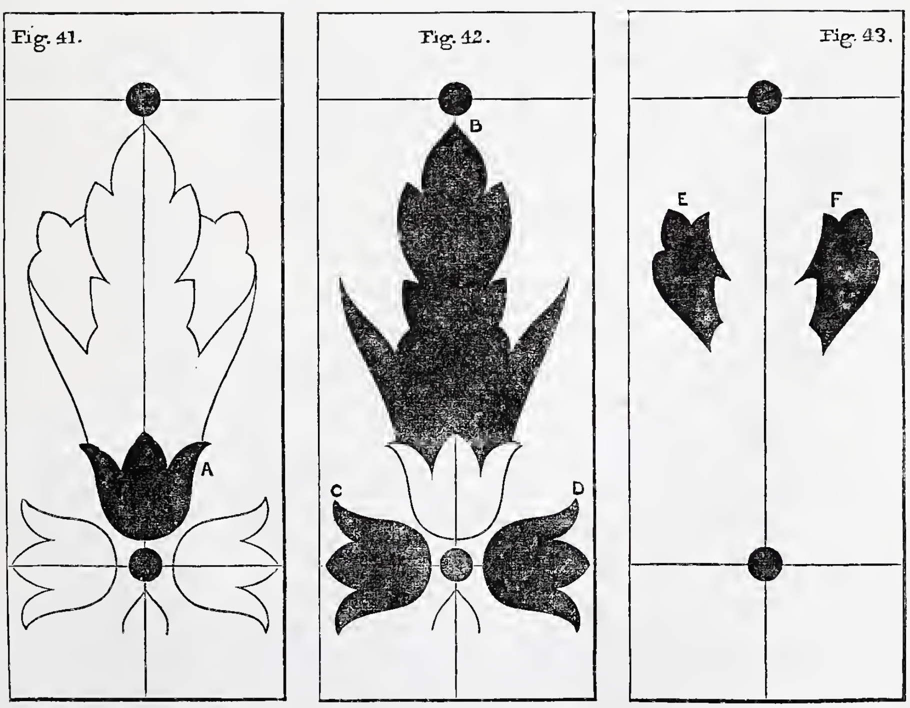


Fig. 40.—Bronzing.

Fig. 40 is a design for this work, and the first step towards carrying it out will be to cut from stiff, but not thick, paper three stencil plates, as shown in Figs. 41, 42, 43, where the portion to be cut away is given in black. These will, of course, be traced for cutting from the design. A band as wide as the design extends has then to be sized with gold size on the black ground of the article, and allowed to get nearly dry, much dryer than for gilding, for the slightest tackiness suffices to hold bronze powder; and if the sizing be not dry enough, the stencil plate is apt to adhere and make difficulties.

The part intended to be solid bronze will have to be first dusted in through the stencil plate. This will be the husk A in Fig. 41. And here it should be noted that when two forms are close together on one plate, as are this husk and the round dot, it is not necessary to stencil both with the



Figs. 41, 42, 43.—Stencil Plates for Bronzing.

same bronze. One of them, in this case the dot, may be masked with a piece of paper; the mask being afterwards moved, and the second form dusted with a different colour. In the present design the husk will be solid copper, and the dots solid gold bronze. It should also be explained that the dots are cut through in *all* the stencil plates, that they may serve as a "register" or guide by which to lay the different plates with accuracy upon the work. Thus the first plate being done with, the second plate (Fig. 42) is adjusted so that the dots already laid in shall exactly appear through the openings which correspond to them; but the operation now to be performed is somewhat different from the first. The bronze is not now to be laid in *solid*. A very little gold bronze is taken up with a *dry* hair pencil and dusted on, beginning nearly solid at the top of the form (B), and growing gradually less solid towards the bottom by diminishing the quantity of bronze in the brush. This will produce a sort of shading, dying away towards the solid husk A. Then, changing the hair pencil, we take up a little copper bronze, and in like manner dust in the two husks C and D, which are to be made nearly solid at the points C and D, but shaded off below. Then removing this second stencil plate, and, instead, adjusting the third, Fig. 43, we make the dots register as before; and with a third bronze—say, orange or green—dust in the parts marked E and F, shading them as before, as is indicated in Fig. 40. The pattern is now complete, except as regards the two straight lines which bound it. These have to be drawn in, after the stencil work has been well dried, with gold size—by hand if the worker has the requisite skill; or, if not, by stencilling, and rubbed in solid with bronze; if drawn by hand, these lines are generally gilded.

After the whole of the bronzing process is completed, the black fibres and lines necessary to complete the pattern have to be put in. A person skilful in the use of the brush will do this with his "etcher" and black oil paint mixed with varnish. One who has not that skill may adopt instead a process known as "scratching up." This is done with a sharp-pointed piece of steel, by which the bronze and gold size may be removed, and the black ground exposed wherever a stroke is taken. This should be done before the work is quite dry. For the advantage of the little-skilled worker, it may be observed that "scratching up" may also be used in connection with dead gold and silvering; the effect, however, is never so good as that of lining with the brush point.

It will be seen that this bronze-work is a process far too valuable to be allowed to sink into oblivion. Its simplicity recommends it to the attention of only moderately skilled workers, and bronze offers a considerable variety of colours, each of which may be dusted in so as to form shading of the most delicate character. There are many purposes to which it might be applied beside papier-mâché work. Cabinet work suggests itself to the writer as one such purpose, the decoration being there applied on a black ground.

Thus far I have ventured to carry the reader in the preparation and decoration of papier-mâché work, and another brief paper will bring my instructions to a close. I can only hope that what I have said will prove suggestive in other ways for the ornamentation of household furniture.

"TIPS" FOR TYROS.

BY OPIFEX.

Bushing worn Wood Chucks.

Sometimes a wooden chuck which may be a favourite becomes so worn that it cannot grip the nose of the mandrel. I have found the following plan work admirably, and although it may not be new, I have never known of its being done, and give it for what it is worth. Heat the inside of the wooden thread with a hot iron, and give it a rather thin coat of cycle cement; now cut a piece of thin sheet brass, as used for covering curtain poles, etc.—*i.e.*, about as thick as stout paper—and sufficiently large to cover the inside of the hole in the chuck, and allowing about ¼ in. over. While the cement is hot press the brass in, and screw on the chuck tightly into its place; unscrew in a few minutes, and you have a perfect bushing of brass in your thread. Wipe off any cement which may adhere to the surface of the metal, and you will find that your chuck will have obtained a new lease of its life.

Colouring Brass.

Repoussé workers, etc., should know that they may colour their own work, and thus save themselves the trouble of having either to hunt up a professional or do without colouring at all, in which latter case the appearance of even the best work is spoiled.

The brass must be perfectly free from grease of any kind. To ensure this, wash well in very hot water with plenty of washing soda and a stiff brush, and rinse in clean cold water; drain off, and when dry dip the metal for two or three seconds into a mixture of two parts nitric acid, one part sulphuric acid, adding a very small quantity of common salt. Remove quickly, and plunge into a large vessel of clean water; rinse well, and dry in hot beech, or boxwood, sawdust. A tin biscuit-box, etc., suits well for keeping and heating sawdust in. When the brass is placed in the sawdust move the box about until the metal is dry, when it will be found to possess a beautiful, rich gold colour.

Avoid touching the brass with the fingers, as the least taint of grease will spoil the after process of lacquering.

The operation of dipping should be carried out in the open air, or in a specially ventilated room, and the fumes of the acids should be avoided, as they are most injurious; but if ordinary care be observed, there is not the least danger to be apprehended.

Brass wire, or a brass tongs, should be used to hold the article while dipping, and there must be no stint of water in the rinsing.

In case acids are not available, a fairly good gold colour may be imparted by boiling in a strong solution of pearlash, or even washing soda, care being taken to plunge the work into water before it has time to dry, *i.e., instantly* upon taking it out of the pearlash, etc., otherwise it will become stained.

Should it be desired to brighten any portions of the work by burnishing, this should next be done, a piece of clean paper being kept between the metal and the worker's hand.

Lacquering Brass.

The object of lacquering brass work is not to improve its appearance by imparting lustre, but to retain as much as possible of the lustre it already possesses.

In fact, the process detracts from the appearance of the newly-coloured work, as every worker knows who can appreciate the beauty of the metal as it comes from the water after "dipping," or from the sawdust when dry. But it is "too fair to last," and if exposed to the atmosphere for any length of time, would become dull, and finally black. However, a thin coat of spirit varnish, or "lacquer," will serve to protect the surface from the air, and the result is that the metal preserves its colour and lustre for years.

"A thin coat of lacquer!" how simple it *sounds*, yet there are few things harder to do—at least to do well; and many an amateur, and professional worker too, has experienced heart-burnings, as well as finger-burnings, in his attempt to acquire the art of lacquering.

The work, when finished and coloured, is slightly heated by placing it on a hot metal plate. It is then given an even coat of lacquer, using a broad camel's-hair brush, and being careful not to go over the same spot twice, but beginning at the top of the work and holding it so that the lacquer, supplied and guided by the brush, shall run down and over the metal. This requires practice, as owing to the brass being hot the volatile varnish quickly dries, and if the brush passes a second time over a spot where the lacquer has, even partially, "set," the result will be a brown seam, which, in a most provoking way, invariably appears upon the most important part of the work.

When this operation is satisfactorily accomplished the metal is heated, considerably more than before, until the lacquer is dry, but the amount of heat should never be greater than can be borne by the hand—applied to the back of the work—else the lacquer will be burned.

The brass is now let stand until quite cold, when it may be handled with safety.

The above is the usual method of lacquering, and, as before observed, appears a simple process *on paper*, but it is far from being so in practice; and the present "tip" consists in this, that as the chief difficulty lies in the fact that the metal being hot the lacquer dries very quickly, this difficulty may be obviated by applying the lacquer to the *cold* brass, allowing it to dry spontaneously, and then giving another coat. Do not mind if the first coat becomes milky, but, having applied the second, subject the metal to heat, as before directed, when it will dry bright and clear.

Utilisation of Old Negatives.

Amateur photographers often don't know what to do with old or spoiled negatives, and sometimes need a greater number of printing frames than they possess.

The connection between these two facts consists in this—that the old negatives may very easily be turned into printing frames, or rather printing contrivances, for there is no frame needed; but we will call them frames for convenience.

To make a printing frame for half-plate photos, we only require two old quarter plates. Cut a piece of strong black linen a little larger than two quarter plates placed side by side, and paste them down securely in that position to the linen; place this on a flat surface, and lay a heavy book, etc., upon them until quite dry; then trim off the linen to the exact size of the glass with a sharp knife.

Next procure four spring clips, as used for fastening clothes on a line, and the printing frame is ready for use.

To make a print, place a piece of sensitised paper of the required size upon the ɔgative, and then a piece of white blotting ıper, half-plate size, upon the back of the ·int. Next lay the quarter plates hinged ith black linen, glass side down, upon the lotting paper, and secure with the four ips, placing two at each side of the frame, ɔ that each half of the folding back shall be rmly held in position. The print may be xamined by removing the clips from one nd and raising the half, as in the case of an rdinary printing frame.

For carte-de-visite size, a quarter plate cut ıto equal parts, and for printing from /hole-plate negatives, two half plates, backed /ith linen as above, may be used; for the ırger sizes eight clips will be required in ɪrder to ensure perfect contact between the ɪrint and negative.

OUR GUIDE TO GOOD THINGS.

76—Gaseous Fuel: Its Production and Application.

Readers of Work who are interested in the production and application of gaseous fuel, including water gas, will derive much information on the subject from this little volume, which is the reproduction in book form of a lecture delivered at the Association Hall, Peter Street, Manchester, on March 29th, 1889, by Mr. B. H. Thwaite, C.E., author of "Our Factories, Workshops, and Warehouses: their Sanitary and Fire-resisting Arrangements;" "Liquid Fuel: its Advantages for Steam-raising Purposes;" "Mill Engines," etc. Opening with strictures on the national waste involved in the consumption of solid fuel, the writer calls attention to the vast subterranean stores of natural gas, whose discovery and application to various manufacturing purposes for which coal is now used in this country has transformed the black and smoke-stained region of manufacturing industry in Pennsylvania into one almost as pure as those parts in which agricultural pursuits predominate. This is followed by a brief reference to the Aspheron Peninsula and other places in which natural gas has been discovered and utilised, the chemistry and composition of natural gas, known to miners as firedamp or marsh gas, its origin and geographical location, the method of drilling a natural gas well, and the distribution, transportation, and application of the gas itself.

Space forbids any attempt to summarise the contents of the volume throughout, and it must suffice to say that it is brought to a conclusion by a statement of the author's project for distribution of gaseous fuel produced and distributed at the different coal fields of the United Kingdom, the supply for the metropolis and the midland towns being derived from three gaseous fuel-producing installations—one in South Wales, one in Staffordshire, and one in South Yorkshire.

"The coal," says Mr. Thwaite, "would be converted into gas at the coal fields, and delivered to the distributing mains under great pressure by means of compression engines, and could be distributed in the towns in the daytime for heating purposes by the ordinary mains, and by means of special incandescent burners the gas could be utilised for illuminating. The saving in cost of fuel by this system in its application to the metropolis will be understood from the fact that, in the year 1887, 12,055,000 tons of coal were delivered into the London district. The total cost of this coal at the coal fields would be fairly estimated at £3,013,750; the amount paid by the London populace for this coal would be about £12,657,750 per annum. The difference between cost of fuel at the source of supply and at the place of use is, therefore, £9,644,000. This amount is absorbed in cartage, merchants' profits, railway carriage, and London Corporation dues. Assuming one third of this amount represents the reduction in the price of fuel to the consumers, this would leave a balance of £6,429,324 to pay for cost of generating gas and interest on capital invested on plant and pipe lines and maintenance. There is little doubt but that the net profit would justify an expenditure of fifty millions sterling in gaseous fuel installations and distributing pipe lines.

"The advantage to the metropolis by the general distribution and application of gaseous fuel would be a colossal one. The increasingly heavy and dangerous fogs, which are greatly due to the condensation of the aqueous vapour on the atoms of unburnt carbon and sulphur, would soon disappear. The splendid architectural monuments of modern Babylon would be relieved from their dirty covering, and London would be metamorphosed, and might rival Paris in the clearness of its atmosphere, after allowing for the different climatic conditions."

Such are the writer's views of the economy of the substitution of gaseous fuel for coal in all large towns and its results, as applied to London. Nothing could be more desirable than the removal of all products of combustion, or rather, of non-combustion, which permeate the air in all manufacturing towns and large areas, overspread with buildings and dwelling houses, closely packed together and extending their serried ranks of streets for miles and miles towards every point of the compass as in London. Whether they can be, or ever will be, realised, remains, in all probability, for a future generation to determine, as there seems but little inclination at the present time to move in the direction indicated.

It only remains to say that an appendix shows the value of ammonium sulphate, which could easily be recovered for utilisation as a valuable manurial agent, if the fuel now used in the form of coal was converted into gaseous fuel at the coalfields, to be conveyed thence for heating and illuminating purposes, instead of being burnt in furnaces, stoves, and open grates. He also gives analyses of chimney gases, resulting from tests and trials of boilers, heated in the one case by ordinary steam coal, and in the other by gaseous fuel, the results in the former showing a solid carbon percentage, by weight of smoke, of 4·18 per cent., while in the latter they showed absolute immunity from combustible or unburnt gases and smoke. The superiority of gaseous over solid fuel in the metallurgic operations is also shown, and some valuable notes on water gas are added. In these the relative thermic values of producer gas and water gas are shown and contrasted, and it is clearly shown in what point the real value of water gas is to be found—namely, in its high thermic character per unit volume, the ratio of thermal units in any given equal volume of producer and water gas being as 60·8 to 277 in favour of water gas. This portion of the appendix is doubly interesting at the present time when public attention is being called to water gas, and its merits, in point of cheapness of production, are being strongly urged. The book, it should be said, is published by Messrs. Whittaker and Co., 2, White Hart Street, Paternoster Square; but the publishers have omitted to state the price, which should always be named, whether in the case of book or mechanical appliance, as it is useful in assisting the reader to determine whether to buy or not to buy.

The Editor.

SHOP:

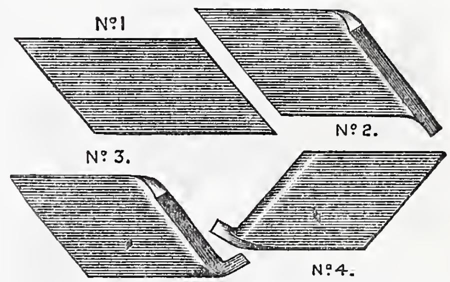
A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

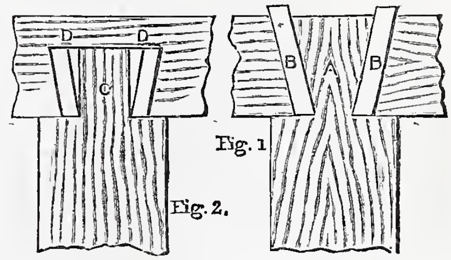
A Warning Note.—Thomaso writes:—"Your 'Shop' is increasing in size remarkably quick. If it goes on increasing at the present rate, we shall have nothing but 'Shop;' and it will probably become necessary at no very distant date, to commence that important section of Work about the middle of the previous week. As to the quality of the 'Shop' talked, well, it seems as if somebody had 'cribbed' the editorial trumpet, and taken it on a provincial tour. This surmise receives a certain amount of confirmation from the fact that you do not perform on it yourself; the loss of the instrument probably accounting for this. It is quite clear that it has not fallen into good hands. Some toot away at it until they get quite light-headed, and write hysterically, a style of composition which makes any man of feeling blush—for the writers. Others blow so gently, that one quite marvels at their taking the trouble to write at all. Then there is the 'toot patronising;' the writer graciously intimating that he is 'pleased' with Work. This class of correspondents is obviously composed of those to whom adulation is unpleasant; but I suppose they feel bound to conform to the prevailing custom, and may even labour under the impression that an answer to their query will not be forthcoming unless they use a little soft saponaceous matter. Absurd! There is just one thing more I wish to refer to—*i.e.*, the enlargement of Work. Now, it is a striking circumstance, and one by which I justify this letter, that the 'tooters' are practically the only persons who clamour for an enlargement! Therefore, hearken unto me, ye disinterested trumpeters! When you write, have less to say about 'admirable magazine,' 'brilliant staff,' 'lucid style,' 'just what was required,' and other platitudes, however appropriate they may appear. By so doing, several columns weekly might be saved. Come, now! don't you think you have had a good innings? Give the Editor a chance of adopting a really practicable plan for the enlargement of Work."

Glazing Without Putty.—Delta writes:—"Take 5 lb. sheet lead, cut into strips $\frac{3}{4}$ in. wide, then with shears clip into slips like No. 1; next place about $\frac{1}{2}$ in. in vice; bend over and hammer into shape No. 2 with a light hammer; take out of vice, and with pliers bend point down as in No. 3; trim point with shears to thickness of glass, punch hole for tack ($\frac{3}{8}$-in. copper preferred) with sharp-pointed awl—that known as a saddler's awl I use—and the



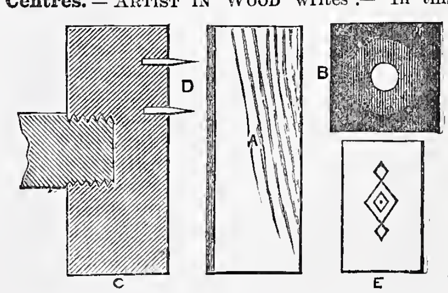
clip is complete. No. 4 goes through the same process, but is bent in the vice in the opposite direction for other side of bar. Two of these clips are sufficient for sheets of glass 12 in. by 18 in.; the top of last sheet in glazing is, as a rule, let into a groove in the ridge board. The bars may be prepared for glazing either with a bed of soft putty or a coat of very thick white lead paint. A dozen of these clips might be knocked out while writing this description, and one square foot of sheet lead will turn out about three hundred clips."

Firm Joints for Woodwork.—Artist in Wood writes:—"I send you two sketches of firm



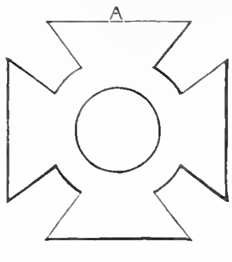
joints for woodwork. Fig. 1 is the dovetail tenon, A the tenon, and B B straight wedges. Fig. 2 is the dovetail mortise. The taper wedges are placed in the end of tenon, and driven in by coming against the bottom of the mortise."

New Machine Tool for Making Inlaid Centres.—Artist in Wood writes:—"In this



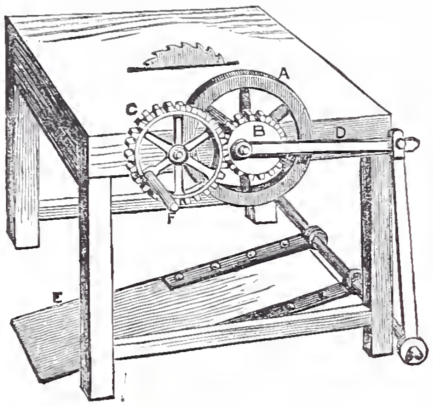
machine tool, B is the inlaid centre, and C and D constitute tool for making it; A is a block of wood with veneer pasted on it ready for cutting. In E is shown the way of using the inlay for centres of panels. File the cutters thin, and to a bevel point, cut just through the veneer, and no more, having three sorts of wood, and change the colours."

Machine Tool for Working Beads, etc.—ARTIST IN WOOD writes:—"The following sketch of a machine tool that I use for working beads and mouldings in hard, cross-grain wood, is made



from a solid block of best tool cast steel. The part marked A is filed to fit the form of mould required; they are very useful for grooving to receive inlaid lines; they are just the thing for art furniture makers."

Powerful Rip Saw.—ARTIST IN WOOD writes:—"I send you a sketch of a powerful rip saw; it will cut very easy up to 2½ in. thick. A is a fly wheel, 50 lb.: B, cog wheel, 7 in.; C, cog wheel, 19 in.; F, handle; E, treadle; D, rod, to fit pin on B wheel. A and B wheels fit on saw spindle; crank pin on B wheel is 2½ in.; if wanted for heavy work,



A, wheel, may be 60 or 70 lb. The treadle has only about half the rise and fall of the common treadles; a 10-in. saw is the best size to use for light work; C, wheel and handle, will not be wanted. It should be made so that it will take off."

Denham Bros.' Patent Filler, etc.—J. W. M (*Halifax*) writes:—"I have great pleasure in recommending a remedy for sweating in French polish to your correspondent, T. A. (*Belfast*), whose inquiry appeared in WORK for June 1st, but which I failed to notice at the time. I am a practical cabinet-maker, and in common (I suppose) with all others, have had more or less trouble with sweating. For some years past I have had my polishing done by the firm whose circulars I enclose, and since they began to use their patent filler—about two-and-a half years ago, I believe—there has been no sweating whatever, in any part of the work they have done for me. The printed matter enclosed will sufficiently describe the preparation, and I need only add that I have no interest whatever in the matter, beyond a desire to act on Charles Kingsley's advice of 'Helping when we meet 'em, lame dogs over stiles.' I am much pleased with your new venture, upon the whole, and wish you every success. Your article on 'Circular Saw Rigs for the Lathe,' was particularly helpful, as I was just at that time rigging up a saw for some special work. In the course of my efforts I evolved one or two notions all out of my own head, which, I think, might be of use to your readers, and if you will allow me I will try to write a supplementary paper on the subject on approval. Messrs. Denham inform me that their preparation can be bought in Belfast."—[Reference to Messrs. Denham, Bros.' patent filler has been made in the present No., page 350. I am glad to find that the paper on "Circular Saw Rigs for the Lathe" was useful to you. I should like to have the paper you propose, on approval.—ED.]

About WORK and Watches.—DEAN FOREST (*Mitcheldean*) writes:—"I beg to thank you for the answers to the questions I asked some weeks ago on hard soldering, which were answered in the 'Shop' column of WORK. I may say I had tried to obtain the one or two 'tips' which AUROLECTRIC gave me in his answers for a long time and in many ways, but unsuccessfully. I would, therefore, say that WORK has my best wishes as well as it has of those who have already paid it so many compliments, and given it so many good wishes. But I should like to see it enlarged, so that we might have a larger supply of 'good things' every week. In Nos. 16 and 17 I notice with pleasure the paper on 'An Overmantel Clock Case,' written by J. H. Moody, and I trust that many may profit by it, as I am sure they will. But if you will allow me, sir, I will take a step more than J. H. M., and advise any of my fellow-readers of WORK who are in the possession of the movement of an old verge watch to try and turn it to good account by making it into a timepiece, which it is very possible for anyone who can work a little in metal as well as wood to do. Of course it would be somewhat more difficult than our friend J. H. M.'s construction, but nothing worth the mentioning to those who are used to overcoming difficulties. I give this suggestion to any who may care to act upon it, because, having one in my possession at the present time, and knowing that a verge movement when put to such a use will often prove a fairly good timekeeper, I think that this would be putting it to a better use than it is put to when, through being unable to compete with our modern watches as a correct timekeeper, it is, as it were, thrown out of the race, and gets cast aside either to be practised upon by one of those persons who seem to be in possession of a faculty for taking constructions (mechanical and otherwise) to pieces to see 'how they are made' (after which that which might have been made useful is often made useless through various of the works being bent, broken, or lost), or else to be sold for a small sum to a watchmaker. I therefore throw out this hint to those who will receive it, knowing that even in the construction of a small timepiece like what I refer to there is plenty of scope for the exercise of some of the talent possessed by many of WORK'S readers in construction and ornamentation."

Protection of Wood and Metal from Weather.—J. C. K. (*Paris*) writes:—"Mr. Heald, of San Francisco, is like the man who went to Greenwich for the first time: he claimed that he had discovered Greenwich. Mr. Heald has found out what has been known for ages, ever since turps was mixed with pigments for paint to protect wood and metal from the weather. One part linseed oil, three parts turps and red-lead, white-lead, sulphate of copper, or any powder of minerals, is the common priming coat of paint everywhere. Mr. Heald should remember the old saying, 'If you don't know, ask.' I ask the painter."

Hollow Metal Work.—TINNER (*Stockton*) writes:—"Being a reader of your weekly paper, WORK, I noticed under the heading of 'Hints on Hollow Work in Sheet Metal,' in which you say plumbers and silversmiths are interested; you do not mention tinners, who have all kinds of hollow work to do, such as kettle tops and lids, pan lids, and copper balls for cisterns. This is only hammered on polished heads to be planished, or to be made hard; it is hollowed on a block of wood with a rounded hammer, called a blocking hammer, and can be annealed afterwards if required. The way you describe will be a very long and tedious job, and will require a lot of practice before it can be done properly. The other will be found the quickest and easiest way for an amateur. I wish you every success with your valuable paper."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Parts of Lathe.—J. K. (*Richmond*) writes:—"I hardly know how to commence, but the fact is I have, or rather had, been, looking out for a practical paper for the amateur, but I had no idea of dropping across one which has already proved itself a great boon to me as an amateur carpenter, and I am sure it has to a great many others. Now what I want to get is a small rough lathe. I have a nice little workshop, I have made my own bench, and have got a good bench vice, iron vice, iron drill bits, etc., and, in fact, almost every sort of tool for ordinary carpentry or rough ironwork, and I have made some very good furniture, and I have some in progress from your designs. Now, what I want you to tell me, through WORK, is how I could make myself a small lathe for wood, to turn, say, uprights for whatnot, or such like. I have every opportunity for getting that done, I mean in the shape of ironwork, which I could not manage myself; the wood part I can easily get over. I have made the dog-chuck you gave in No. 2, so if you could kindly give me a few hints to help me, you make will greatly oblige me as well as help me, for I small things in my spare time, and sell them to add to my funds, and I find myself greatly in want of a little lathe. I don't want to buy any more of it than I can help, so if you can give me the hint you will greatly oblige me."—[I give your letter in full so that all readers may be aware of your inquiry, and what you are doing to help yourself. Supposing that you can make the wood frame of your lathe, the headstock, wheel, and crank could be obtained in Clerkenwell Road, late Wilderness Row, E.C., at any of the cheap tool shops that are to be found therein, and I would suggest a visit to Messrs. J. and S. Miller, 66 and 68, Clerkenwell Road. Anything less that a 5-inch centre lathe would be more of a boy's lathe, and not by any means a practical tool, especially to an amateur. A plain fly wheel and crank, headstock, mandrel pulley, and poppet head of a 5-inch centre lathe would cost you from 25s. to 30s.—G. E.]

Tobacco Pipes.—SMOKE.—The manufacture of clay tobacco pipes will not be treated in WORK. I am not acquainted with any book on the subject. The material used is a fine clay, well worked. They are made in moulds, and the perforation of the stem is effected by means of a wire.

Battery, Porous Cells, Accumulators, etc.—F. TUCKER (*Bristol*).—(1) I cannot find any reference to the battery named by you in Watt's book, latest edition. When copper forms the negative element in a solution of sulphuric acid it speedily becomes coated with a film of hydrogen, and the battery becomes polarised. This means a serious loss of power. In the Daniell cell this gas is absorbed whilst copper is being deposited. The cost of working a Daniell is less than that of the battery named by you, since the deposited copper is a valuable commodity. (2) In the earlier edition of Watt's book he may have given a recipe for making porous cells from plaster of Paris, but he does not repeat this in his last. The reason is obvious. That the game is not worth the candle you have now proved for yourself. It is one of the last things I should think of doing whilst porous cells of good quality can be obtained so cheaply. (3) Just think for a few minutes on the prime or first cost of accumulators (not less than £1 per cell), then the cost of acids for charging them, then the cost of the battery needed to form the plates, and then remember that you will only get about 80 per cent. of the power back again as electric current—that is to say, it will cost you 20 per cent. more to get the same current by the way you propose (leaving out cost of accumulators) than by using current direct from a primary battery. Where does the economy come in? Some day I may write on the subject, but it won't be just yet, for other more important subjects claim attention. (4) I do not clearly see what you mean by giving information in WORK in "a piecemeal fashion." The article on the Bunsen battery did not promise you a number of "glorious experiments" to follow, therefore I cannot see how you could expect them. The article was meant for *work*, not for play. You, and those who wish for it beside yourself, will have enough to occupy your hands, and minds too, shortly, in a series of articles dealing "exhaustively" with the way to make "electrical apparatus." I do not aim at pleasing my readers with a variety of subjects, but form a purpose and go ahead with it. I have not forgotten the fable of the "Old Man and his Ass," nor the lesson taught in it. This you will learn as you become better acquainted with WORK. Your complaint respecting "gigantic advertisements" is uncalled for. Neither the Editor nor any of his staff is in any way interested in a pecuniary manner with the things recommended in WORK, or in the firms whose names are mentioned as vendors of the goods named. *You* may not be interested in knowing where to get a good lathe or a good tool, but the information may be welcome to hundreds of other readers. In this we must study to please or serve the majority.—G. E. B.

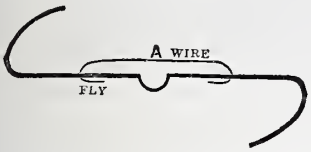
Venetian Blinds.—J. A. H. (*Chepstow*).—A paper on this subject will appear shortly.

Repairing Chloride of Silver Battery.—CHLORIDE (*Plaistow*).—Your Gaiffe battery has failed because the chloride of silver has become exhausted. You must, therefore, coat the silver plates with fresh chloride of silver prepared as here directed. Place half a wineglassful of nitric acid mixed with a teaspoonful of rain water in a saucer or a cup, and put on a warm hob in the chimney corner. Add to this as much old silver as the acid will dissolve. This done, pour all into a basin two-thirds filled with rain water, and add common salt until all the silver has been thrown down as white chloride. Pour off the liquid, and wash the chloride with clean water, by pouring in the water and allowing the white powder to settle. Do this several times, then drain off all water, and dry gently in a saucer. When dry, spread a layer of it over each silver plate, and warm over a spirit lamp until it seems to melt and run over the plate, forming a dirty grey coat. This is horn silver, or fused silver chloride. Coat each plate in this way and then restore them to their places in the battery.—G. E. B.

Whitening Brass.—NIMROD (*Birmingham*).—Articles made of brass or copper may be whitened with a coating of tin or of silver as may be required, by boiling them in either one or other of the following solutions:—(1) Dissolve as much cream of tartar in boiling water as the water will take up, then add to it a little chloride of tin. Previously well clean the articles from all grease and corrosion; immerse them in the above solution together with a handful of grain tin, and stir all well together, whilst still boiling, until the articles are well coated with tin. Well wash in warm water, and rub in hot bran until bright. (2) Mix together 80 parts of cream of tartar, 80 parts of common salt, and 1 part of chloride of silver. Dissolve the whole in boiling water, and boil the articles in this solution, treating them as directed above. The deposits of tin or of silver from these solutions are very thin, and not so durable as coats of the same metals electro-deposited.—G. E. B.

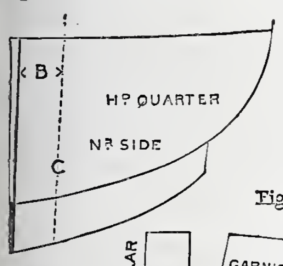
Air-tight Joints in Wood.—H. W. (*Edinburgh*).—To make joints in wood air-tight, you can plough the meeting edges and tongue with hoop iron, or with wood secured with white lead.—J.

Clockwork Model.—SUBSCRIBER (*Sandbach*).—The only thing I can suggest is to make a fly long in shape, as long as the rest of the works ill allow, if working in the frame; if working outie the frame, of course, you may not be so recricted for room. Make it from very thin brass or i, and then bend the shape of letter S, the bent irt pointing the way the fly goes. See that it is cely balanced, that is to say, that when perfectly rest the arms are horizontal, not vertical. To sten to the arbor of pulley, make across the intre, the short way, a hollow, so,



o fit the arbor; now, about half an inch each side f the hollow, and in the centre, make a small hole, nd pass a piece of fine brass or iron wire, A (as ketch above), and in the arbor make a little groove o fit the wire; this will act as a spring, and keep y tight to the arbor and in its place. The longer our fly the slower its action; the width does not natter so much. Try this; if no better, and you ike to pack up and send to me, enclosing cost of eturn carriage, I will see what I can do, free of harge, unless very much is wanted. Perhaps your pring is unsuitable, that is to say, too strong when vound up, not properly or evenly tempered; try another, or fit stop-work to it, only using a few of he centre turns of it. In any case, let me know he result. You can find me through the Editor, if you want to send it to me.—A. B. C.

Cranked Hinges in Carriage Building.—Young Bodymaker.—I assume you mean not how to fix, but how to find the exact position in which the hinges (better known as outrigger hinges, in the coach trade) should be fixed, to ensure the proper and correct working of the outrigger, and also the concealed hinge above it, as if only slightly out of "true" with centre pin of the concealed hinge, the door, whether of a brougham, landau, or any other carriage upon which it may be fixed, could never be made to open or close properly, to the intense annoyance and disgust of all concerned, in that particular door. I will now try and explain the best method I know of, for the finding centre, and then briefly state one or two generally adopted methods of fixing the hinge to the door and body. As outrigger hinges are most generally used at the bottom of landaus and other carriages with equally short doors, with only one concealed hinge above, and that one fixed with the upper



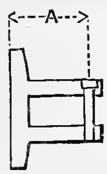
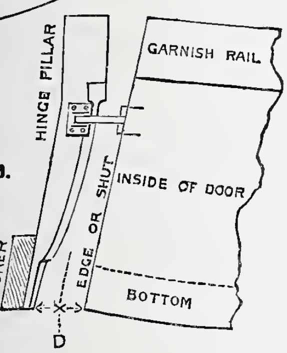


Fig. 1.

Fig. 2.



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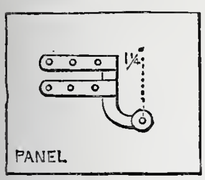

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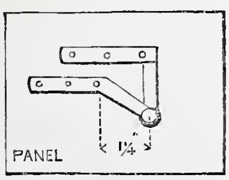

Fig. 5.

edge of its brass flap directly under the elbow line joint, we will take as our subject a canoe, or boat-shaped landau. Assuming you have already let in and properly fitted concealed hinge—we will suppose the size to be what is called 1¼ in.—take the exact distance from *shut*, that is, brass plate of concealed hinge, to the centre of pin on which hinge turns. Thus Fig. 1 A, with rule, or still better, a pair of dividers, place one leg of these exactly on edge of panel at the rabbet, and mark a point on the panel with the other leg, as at Fig. 2, B, from which point drop a perpendicular line, square down to the bottom of body, C, Fig. 2., that is, the centre of bottom hinge from door rabbet. Now fix hinge to door, and fix brass flap with door attached to hinge pillar; open the door as far as it will come out, square with body, support door so as to take the dead weight of the concealed hinge, and measure the exact centre of the open space, between outside of body where the outrigger is to be fixed, and the edge of door, as in Fig. 3 at D, that is, the centre of bottom hinge from outside of body. Now, if the bottom of body at that point is square across, it will be a good place to fix the hinge, so tack a piece of ½-in. pine on bottom of rocker just under the centre just found, keeping it parallel with horizontal line of body. Mark the centre on the top side of this piece of board; also mark outside of rockers, and around bottom of hinge pillow, and outside of body to this centre; now shut the door, and mark along outside of door at bottom, also up to centre; take off the piece of board, and mark off outline of hinge enclosing the centre before mentioned, like Fig. 4 or, again, like Fig. 5. In either case, if the door bottom is level with bottom of rocker, you must have the bottom half of hinge cranked up, or the top half of hinge let into bottom of door, to allow flaps of hinge to bed on to their respective places, and close over each other; the spaces in between flaps of hinge on Figs. 4 and 5 is the clearance to allow door to close without touching at those points—*i.e.*, edges of flaps. Fig. 4 shows the hinge with back edge of flaps level with door rabbet, Fig. 5, with bottom or body flap coming square out from centre line, and the top or door flap level with door at rabbet, but outer or neck piece cranked or curved to meet that centre. Care must be taken that the centres of both hinges exactly correspond, both perpendicularly and at right angles, and as the bottom of door and body are curved, the smith, when setting the hinge, will arrange to have the knuckle arranged as described. Now, as to the best place to fix: some coach builders place this hinge immediately under the bottom side, when it projects far enough out from the rocker piece below it; personally I consider this a wrong position. Firstly, being too high up, too near top hinge, and consequently causing a loss of steadiness; and secondly, as being rather unsightly, and breaking somewhat the easy and graceful flow of the bottom line of moulding; it has, however, two advantages, a much shorter hinge is necessary, and is not so liable to vibration; but, again, is likely to wear out the bolt and holes in the knuckle quicker; this is a decided drawback. Now, if the extreme bottom of body is made level across, and not bevelled on outer edge of rocker and door bottom, I consider that the best place for fixing the hinge, the only drawback being that a longer and stronger hinge is required, to come out far enough to reach the centre. At that point, the upper and lower hinges being much farther apart, they are a much steadier support to the door, do not wear out so quickly, and what is of great importance, are vastly easier to fix or to repair when disarranged by use or accident. I fear this will appear rather a long instruction to Y. B., but he will know that almost any part of coach-making requires minuteness of detail, if it is to be properly understood; and if I have not made this sufficiently clear to him, I will endeavour to do so in reply to his queries in "Shop." The question, as he gives it, certainly does him credit, being somewhat difficult to impart so as to be thoroughly understood, except by personal supervision, and yet very easy of accomplishment when required by actual practice, at least it has been found so for years past by Phaeton.

Curling Iron Stand.—M. K.—The cost of the provisional patent for nine months is £1, and by deducting this from the amount asked by the patent agent, you can see how much would go to him as his remuneration for work done. I am afraid there is not much to patent in the invention. It is only an old article put to a new use. The idea is certainly good, but I scarcely dare venture to tell you to go on with it, because you have no means of pushing a sale when you have had them made. It will cost you £1 to get provisional patent for nine months, and at the expiration of that time you will have to pay £3 more for complete patent. It will not be difficult to find a man to make the articles, but you will find it difficult, and perhaps expensive, to promote the sale of them. If you accept the offer made by the patent agents, it may be that they will sell it for you, that is to say, sell the right to someone to manufacture the article. I cannot say anything with regard to the probability of your making money by it. Ask the patent agents plainly if they can manage to sell the invention for you, and at what price. If they can, so much the better for you, on the bird-in-the-hand-worth-two-in-the-bush principle. Failing this, write to the Editor of the "Girls' Own Paper," and see if he will accept a description of the thing itself, with illustrations, and pay you first. This is all I can suggest, but if you prefer to obtain protection, and want to know a person capable of making it, I can, and will, give you the name of a trustworthy person who could make the stands: but whether he will or will not do so is more than I can say.

Designs for Fretwork.—J. A. J. (*Stratford*).—I am sorry to learn from you that an accident which has caused injury to your spine prevents you from ever working at your trade as a carriage maker again. I know it must give you the heartache to be compelled to drop out of the ranks, and do but little when you would fain be doing much, and you have my sympathy to the utmost. You say you have taken to fretwork to earn a little, but cannot get good patterns, having tried many who advertise designs, only to meet with disappointment. Have you tried Mr. Henry Zilles, 24 and 26, Wilson Street, Finsbury; and Mr. G. Busschotts, Park Lane, Liverpool? These dealers supply continental designs, and some are extremely good. Indeed, I do not know any dealer that has not good things amongst his designs; and, I think, if you procure the miniature sketches that most dealers send out, you will find among them something to your mind. With fret cutting, I should also try wood carving. Again, if you are fortunate enough to be able to expose articles for sale, either at your own residence, or in any shop kept by a friend, you might find it of advantage to make models, games, doll's furniture, etc., all of which would be light work that you could manage without much fatigue. There will be some pretty designs for fretwork from the pencil of Mr. J. W. Gleeson-White in forthcoming numbers of Work, but it is difficult to give full size patterns without large sheets, which are very costly. Among other things, if you cannot draw with ease by all means study drawing, and see what you can do in the way of ticket writing, for which you will derive assistance from Mr. Benwell's paper on "Sign Writing and Lettering." You ask me to help you, and it seems to me that I can best do this by the hints and suggestions that I have endeavoured to place at your disposal.

Building Construction.—Pixie (*Granite City*).—It takes some time to get on to such a subject as building construction, and possibly it may be found needful to hold it over for another volume. "Monumental and Stone Carving" is a subject on which it is very difficult to find a writer. I was speaking the other day to a man who was accustomed to cut letters on granite, and apparently a first-class hand at the work, but he could not write himself, nor could he tell me of any one who could.

Fret Sawing Machine.—J. F. W. C. (*Hull*).—The best fret sawing machine at present in the market is the Britannia Company's No. 8 machine. If you will write to the Company, Colchester, you will be supplied with all particulars. It is intended to construct a small lathe to be used in combination with this machine, and any requirements on your part with regard to fittings could be easily satisfied.

Wood Screw Cutters.—J. H. E. (*Shepherd's Bush*).—The screw boxes and taps for cutting screws in wood are illustrated in page 64 of Messrs. Peugeot Frères' catalogue, or, rather, price list, and prices are given according to the index in page 50. On turning to this to give you the information you require, I find that my price list is imperfect, pages 47 to 50 being missing. If you write to Messrs. Alex. Von Glehn & Co., 7, Idol Lane, London, E.C., the prices, I am sure, and the sizes in which the screw boxes are made, will be at once supplied.

American Saddlers' Tools.—W. O. (*Rochdale*).—I am not aware that there is any difference between the tools used by American saddlers and those in use among English saddlers. The tools comprise punches of different sizes, creases of various kinds, cutting gauges, head knives, round knives, bridle cutter's knife, edging irons, pliers, pincers, saddler's palm, punch pliers, screw punches, etc., stuffing rods for making collars, awls, and other articles, all of which can be procured through any ironmonger or hardware merchant. If you cannot get them at Rochdale, write again, and I will give you the address of a London dealer who can supply them.

Violin Tools.—J. W. (*Battersea*).—The fine-toothed veneer plane, which, like the tool you describe, bears an upright blade, will do all you require for reducing veneers to the proper thickness. As you say, some of the trade purfling is certainly "rubbish." I do not know any one except myself who has the black veneers. To make good mitres it is not necessary to use three separate strips. First cut your mitre to fit, and then bend the purfling over a warm iron. It is rather awkward to give instruction as to colouring a varnish to match without seeing the original, but I have an impression that the varnish you mention is not a *coloured varnish*, but a spirit varnish over a wood stain. The violoncello sound-hole punches you can buy at Lafleur's, Green Street, Leicester Square; all the others you can get from Withers & Co., 51, St. Martin's Lane.

Japanese Patterns.—Miner.—Books of Japanese Pattern are not easy to obtain. Mr. B. T. Batsford, 52, High Holborn, W.C., has them now and again, and Messrs. Liberty, Regent Street, W. They range from 9d. to 5s. or 10s., but the cheap ones are more useful for ordinary purposes.—G. W.

French Polishing and Veneering.—T. A. (*Glasgow*).—Articles on these subjects are in preparation, when all that relates thereto will be fully dealt with.

Amateurs and Wood-buying.—F. W. H. (*Upper Tooting*).—A paper on this important matter is being prepared for the advantage of all readers.

Papier-mâché Panel.—A. L. W. (*Aberystwyth*).—Messrs. McCullum and Hodson, Summer Row, Birmingham, will, doubtless, supply the article required.—S. W.

House Painting and Graining.—W. H. F.)—Our correspondent asks us to give "the certain proportions for mixing oil colours" for the above purposes. This is a question which would involve more than the entire weekly space devoted to "Shop" to answer fully. In the first place, in mixing ordinary white lead and oil paint, there are no certain proportions. The amount of each article used in its mixing does, or certainly ought to, very materially depend upon the work undertaken. Independent of preparation—which is a very important item in good house-painting—the nature of the paint should be very different when painting, on the one hand, new woodwork, and on the other new parian, or plaster walls. Of the four coats each should have, the proportions of lead, oil, etc., would be different each time in both cases—that is, if painted by a tradesman who knew his craft. To speak of colours and graining in this answer is quite out of the question, as our correspondent makes only a general, unlimited inquiry. If W. H. F. has any pressing and particular object in view in making this inquiry, we would endeavour to aid him if he writes and states particulars. Beyond this we must advise him to carefully peruse the pages of WORK, when he will be rewarded by finding a complete and exhaustive treatise of the subject of our head line, which is now being specially written by an experienced London decorator.—F. P.

Imitation Lead Lights.—H. W. H.—These are generally known as "window transparencies," being a class of transparent, oiled papers, and which, when properly affixed to the glass of windows and door panels, form a very durable and decorative substitute for painted and coloured lead light glazing. There are several makes, I append two—W. E. Tuker & Co.'s, "Die ae Note," and M'Caw, Stevenson & Orr's patent "Glacier" decoration. Hinde Bros. (London and Birmingham) are, I believe, the wholesale vendors of the first named; M'Caw & Co. are the patentees and manufacturers of the "Glacier." The latter is, I think, that most used, and an article which I can personally recommend, and can be obtained direct from the makers, Linenhall Works, Belfast, Ireland. Perry & Co., the pen makers, Holborn Viaduct, are still, I believe, the wholesale London agents for "Glacier." Most established stationers are also agents for one or another maker of transparencies, where drawings and designs can usually be seen, and through whom our correspondent could doubtless get all he requires. Directions for use usually accompany the article, but I would advise that the glass should be very carefully cleaned, and the design then arranged so that it can be readily fixed. The glazed or bright side of the transparency is then wetted with water, or the glass can be wetted, placed in position, then all bubbles smoothed out with soft cloth or sponge, working from the centre to the outsides. It must then be left for not less than twelve hours, to allow the water to evaporate and the article to get firmly fixed and hard. Although the process appears very simple, care and patience are necessary to make a good job, and it is advisable to watch that, whilst drying, the transparency does not blister up from the glass. When properly fixed and hard, coat the transparency with best light copal varnish; it will then be thoroughly protected both sides.—F. P.

Covering Plush Frames for Terra-Cotta Plaques, etc.—J. C. (*Aberdeen*).—No preparation of the wooden frame is necessary; all that is wanted is some good strong glue for sticking down the plush. Supposing the frame to be circular or oval, the plush is best cut in a single piece large enough to overlap the wood every way, and it must be nicked or snipped on the inner edges that it may wrap over without creasing. The wood has then to be glued, the plush stretched carefully over it, and well pressed down with a clean cloth or duster. Small square frames are covered in the same way. In covering large square frames it is usual to economise plush by cutting a separate piece for each side, and mitring them at the corners. The joining has to be hidden by a piece of silk cord glued over it. Round and oval frames are sometimes covered in this latter manner with small pieces of plush, the joints being corded; but the best and safest work is made with the single piece. For an answer to his other query (preparing canvas) J. C. is referred to our reply to WAITING (see page 285).—M. M.

Photographic Camera.—T. R. C. (*Ashton-under-Lyne*).—The manufacture of appliances for photography will not be neglected, but their making will be work for the winter rather than for the present summer.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Solidifying Petroleum Oil.—OX GALL (*Manchester*) writes:—"If your correspondent, P. W. S. (*Poplar*), or any other correspondent, will kindly tell me how to solidify petroleum oil, I shall deem it a great favour. I have no objection to stating for what purpose I require the oil solidified.

Water Floats. — REYNARD (*Leeds*) writes:— "Will some of your scientific readers kindly inform me what size piece of circular cork will sustain a man of 12 stone above water? Also what size tin cylinder will do the same?"

Carpet Fitting.—M. G. (*Belfast*) writes:—"If any readers know of a book which would assist in measuring and fitting carpets, etc., would he be good enough to let me know?"

Photo Camera Lens in Magic Lantern.—PALETTE writes:—"I have read that a photo-camera lens can be very successfully used in a magic lantern. I should like a verification (or otherwise) of this statement, with instructions."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

French Polishing.—JACK H. sends the following in reply to T. A. (*Belfast*) (see page 174):—"Denham Bros.' patent 'filler' is said to be a guaranteed cure for the 'sweating' of French polish. It is now in daily use all over the United Kingdom, and is acknowledged to be one of the best inventions ever introduced to the trade. It has long been admitted by all practical men that there is a great necessity of improvement in the old system of polishing, and a demand for a substitute for raw linseed oil, but yet a substitute which will answer the same purpose in bringing up the figure or grain of the wood, without any of the after-injurious effects of oil which, as is well known, is one of the greatest difficulties the trade has to contend with. This difficulty has been entirely and most successfully overcome by the invention under description, the claims of which no person in the trade—in these times when there is a great demand for good work—can afford to disregard or overlook. Firstly, it does away with oiling or 'fatting' over the work previous to polishing, and answers as a 'filler' at the same time, without any extra labour. It is a certain preventive for what is commonly known as 'sweating out of the oil' after an article has been finished two or three months. It is easily worked, and keeps down the grain as no other 'filler' does; saving both labour and material. It is transparent, and does not show white in the grain. It is made in seven different colours, to suit all kinds of wood—namely, white for ash, pitch pine, light oak, satin wood, maple, and all light woods; black for ebonised woods; dark oak for brown or pollard oak; walnut, mahogany, dark mahogany, and rosewood; also birch mahogany, specially prepared, stained ready for all hard woods, such as birch, beech, elm, etc., which are usually stained to imitate mahogany. There is nothing in its composition which will eat or burn away the polish; or which is in any way injurious to health when working it. The 'filler' is specially suitable for bobbin manufacturers, in place of sizing, thus preventing cracking of the varnish, and also keeping down the grain, without any extra labour. It may be had from all wholesale chemists and druggists, oil merchants, French polish and varnish makers, or from the sole patentees and makers, Denham Brothers, Hall Street, Halifax, Yorks.

Joints in Indiarubber.—P. P. (*Withington*) writes in reply to W. P. (*Grangetown*), (see page 190):—"Bicycle tires are made in a mould complete, and are not jointed, as W. P. imagines. They can be mended when broken by putting a piece of hot wire covered with cement into a hole made in both ends, and bringing the rubber together, the joint forming a kind of dowel. Indiarubber is vulcanised with powerful machinery and steam."

Facsimile by Electro Process.—E. L. writes in reply to ELECTROTYPE (see page 190):—"Get some good beeswax, and melt it, then pour it into a shallow metallic dish. When sufficiently hard to prevent the wax sticking to anything brush it over lightly with plumbago, also the article to be reproduced; then press the letter or block into the wax, being sure that it is pressed level all over, then take away the block, and you have the mould. If the mould is satisfactory, put a bright polish on it by using black lead and a very soft brush, and it is then ready for the battery. The battery itself is made with about 4 parts acid to 1 of water, with a silver plate and zinc one facing each other. The tank in which the mould is suspended by a metallic connection is made up of 3 parts water to 1 of sulphuric acid, and a small proportion of sulph. copper. The mould should face a sheet of copper; and, if properly connected, in about twelve hours there will be a copper shell on the mould. To get the shell off, the best way is to pour boiling water on the mould, and the shell will come off by a little gentle easing. After the shell is off it should be tinned with solder by placing it on a hot plate, previously putting some spirits of salts on to make it run, allowing the solder to melt, and when it is melted it should be backed up with metal. Of course, if ELECTROTYPE wishes to do electrotyping for amusement and experiment, the above directions will do very well; but if, on the other hand, he wants it for business purposes, I should strongly advise him to take it to an electrotyper's, and have it done. The cost would be less than 1½d. an inch."

Glaze for Finishing French Polishing.—W. H. B. (*Peterborough*) writes in reply to W. H. B. (*Redditch*) (see page 174):—"I beg to forward receipt for glaze as asked for: Take 1 oz. of gum benzine, ½ gill methylated spirits, thoroughly bruise the gum, mix, and shake the bottle occasionally for three days; strain through fine calico. Also ox gall for brown oak, 4 oz. vandyke brown, 1 pint spirits of ammonia, 1 oz. bichromate potash. By experimenting on a plain piece of wood you will get what shade you require by one or more coats, then brush over with French polish (not varnish) thinly."

Cleaning Oil Paintings.—A. F. (*Falmouth*) writes in reply to L. S. (see page 190):—"Seeing that L. S. wishes to know how to clean an oil painting, I may say that I have done them very satisfactorily in the following way:—Take a raw potato, peel it, and cut it in two, then dip the end in water, and rub it well over the painting; afterwards sponge it with clean water, and then dry it with a cloth. If A. F. tries this method, the end he has in view will be secured.

Trade Notes and Memoranda.

IN a paper on the traffic in London, recently read by Mr. J. S. Jeans, before the Society of Arts, he says that the number of passengers annually carried by railway, omnibus, tramcar, and river steamers, was some 470,000,000, being nearly twelve times the present population of the United Kingdom. Another fact which he mentioned was that, within twelve years, the increase in the number of passengers carried on the six metropolitan railways that deal chiefly with local traffic has been about 72,000,000, or, including season ticket holders, probably about 100,000,000.

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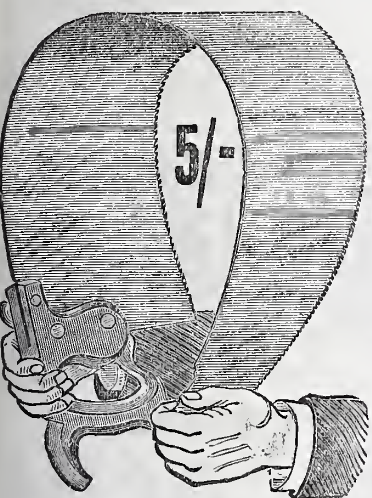

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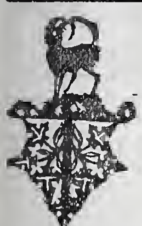

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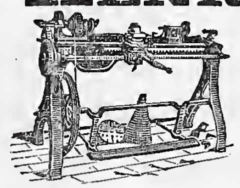

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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THREE USEFUL GARDEN CHAIRS.

BY G. LE BRUN.

A Hammock Chair—A Folding Reclining Chair—A Fixed Reclining Chair.

Although summer is almost over, yet out-door life is still so very pleasant it may be useful to give a brief description of three very simply made articles, that will well repay the trouble of making in the pleasure to be derived from their use in the garden or on the lawn during the fine days that are yet to come. Two (Figs. 1 and 2) are in general use in the eastern States of America, but I have never seen them in this country, although folding chairs of a similar nature are common enough. The material used should be good straight grained ash or oak, free from knots, as the toughness of these woods allows of good strength with a comparatively light scantling. The pieces of a given size can be had cut out at the wood-yard at a slight extra cost, but I think it is desirable, if the worker is not afraid of the hard work of the rip saw, to select a board of the requisite thickness and cut out the various pieces to the sizes required, as there is always so much more satisfaction from the reflection that the whole of the work is your own.

To begin with the hammock chair, as shown in Fig. 1, the pieces required for its construction are as follows:—

Two pieces for sides of back, 2 ft. 4 in.; two pieces for sides of seat, 1 ft. 2 in.; two pieces for arms, 11 in.; two connecting pieces under seat, 9 in.; two front legs, 1 ft. 5 in.; two upright pieces at front of arms, 1 ft.; two pieces for ends of foot-rest, 6 in.; one front piece for foot-rest, 1 ft. 6 in.

All the foregoing pieces are $1\frac{1}{2}$ in. wide and $\frac{7}{8}$ in. thick, and besides them there will also be required three rails, 1 ft. 4 in. in

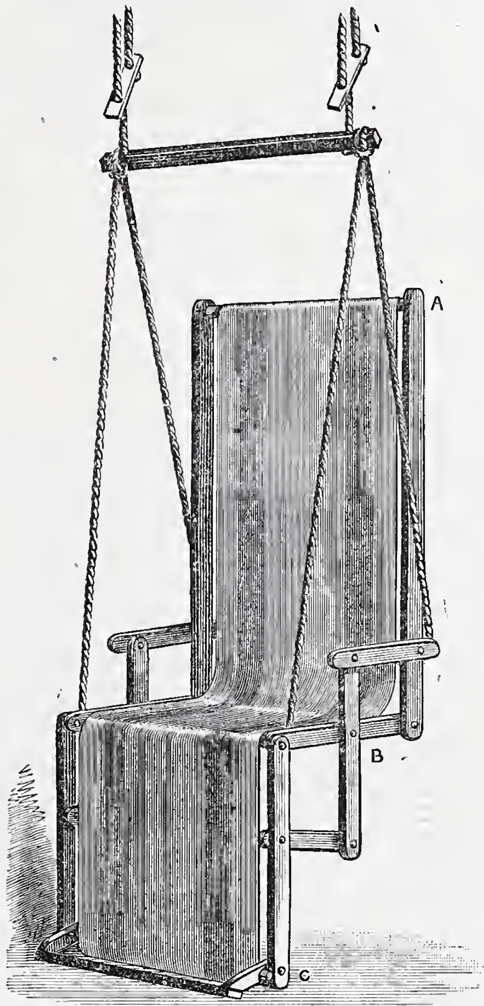


Fig. 1.—Hammock Chair.

length. These rails may be either turned in a lathe or rounded with a plane, whichever way is the most convenient, and should be 1 in. in diameter; they are shouldered at the ends and a square tenon cut on them, in which put two saw cuts for wedging up. These rails are not, when finished, all of the same length, the front one at the edge of the seat being shouldered $1\frac{3}{4}$ in. shorter than the other two, the reason for which will at once be apparent by examining the illustration. The two longer rails are mortised into the side pieces at A and B. A fourth rail is necessary; it is placed at the foot of the legs, going through the pieces that support the foot-rest, and preventing their falling down from the horizontal position by its projecting ends bearing against the foot of the legs, C. This piece is $\frac{7}{8}$ in. in diameter.

The wood for the chair framing (with the exception of the rails described) is planed up all round, and the ends of each piece rounded to a half circle; $\frac{3}{8}$ in. holes are then bored to receive the rivets that hold the chair together, the position of which holes can be ascertained by a reference to the drawing. The rivets used are of copper and have a washer on each end. Insert them from the outside and rivet the ends over the washer on the inside of the framing with a small hammer; put in the rails with glue and wedge up tightly, then the chair is ready for covering. The cloth used for covering may be of any strong material—canvas will do, or a piece of stair carpet can be utilised, if handy.

A hanging bar, 2 ft. 3 in. long and $1\frac{1}{2}$ in. in diameter, is now made from which to suspend the chair, which is hung from it by sash cord, which should be of the best quality procurable, and is attached to the chair framing by boring holes at the positions shown, and, after passing the cord

Fig. 2.—Fixed Reclining Chair.

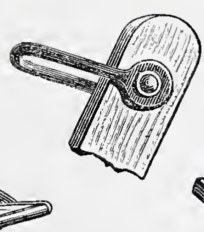


Fig. 4.—Enlarged Sketch of Loops in Fig. 3.

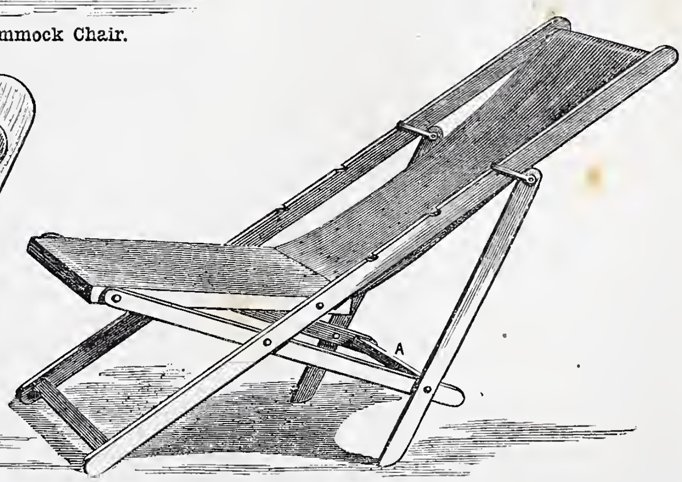


Fig. 3.—Folding Reclining Chair.

through, knotting the ends. The cross-bar may now be hung from the branch of a tree, or any other suitable support, by means of the arrangement shown, in which one end of a cord is attached to a wooden cleat, the other end passing through a hole in it, and then attached to the cross-bar. This method of hanging permits of an easy adjustment when put up on a branch or any support that may not be level. With the hanging of the chair is the end of the labour, and the maker can now enjoy his well earned rest in it while we go on to describe the other piece of garden furniture, which takes the form of a reclining chair, and the labour of making, which is not greater than that involved in the construction of the piece of work just finished.

For this chair then we require :—Two pieces for sides, 4 ft. 2 in. ; two pieces for sides, 3 ft. ; two pieces for seat sides, * 1 ft. 6 in. by 1 in. by 1 in. ; two back legs, 2 ft. ; two seat rails, * 1 ft. 4 in. by 1 in. by 1 in. ; three turned rails, 1 ft. 4 in.

The scantling of these pieces (with the exception of those marked thus *, which are $1\frac{1}{2}$ in. square) is the same as in the previous job, viz., $1\frac{1}{2}$ in. by $\frac{7}{8}$ in. ; they are planed up and rounded at the ends, except the bottom ends of the back legs, the position of the rivet holes being got from the drawing, Fig. 3. The seat is framed together by means of mortising and tenoning, and the turned rails put in in the same manner as those of the hammock chair, the lower rail at the back, A, being $1\frac{3}{4}$ in. shorter than the other two between the tenons. A visit to a blacksmith must be made for the purpose of getting the two loops that connect the top ends of the back legs to the sides of the chair, and allow of the legs being moved backwards or forwards to raise or lower the chair as required. These hoops are made of $\frac{1}{4}$ in. round iron, and are secured to the legs by $\frac{3}{8}$ in. rivets, that pass through holes in the ends. A series of three or four cuts is made on each of the sides of the chair to slip these loops into, which cuts should be about $\frac{1}{2}$ in. deep, and of sufficient width to allow of the loops being easily slipped in and out. An idea of the shape of the loops is given at Fig. 4, the length from the centre of the rivet hole to the inside of the closed end being $2\frac{1}{2}$ in. The chair is covered, in the same manner as the previously described one, with whatever strong material may be handiest, and the work is finished.

The various pieces of these chairs should be polished before being riveted together, as the operation is much easier than that when the parts are in position, and much vexation and trouble will be saved by doing so.

In addition to being useful in a garden, both of the chairs described are of much service on shipboard ; the reclining chair can there be used as a deck chair, and the hammock chair can be slung up, in fair weather, to any suitable part of the ship's rigging ; in fact, an amateur carpenter of my own acquaintance made two of these very articles recently for a lady friend of his who was going to New Zealand in a sailing ship from London, and has just received a letter in which the writer expresses much gratitude for the comfort afforded during the voyage by the use of his very suitable presents.

Both chairs can be set to any required angle, and one can either sit upright, recline, or lie, with much ease and comfort.

There is another and very simple form of chair, of which a drawing is given at Fig. 2. Ash, elm, or any tough light wood will do to make it. The framing, with the exception of the rails, is cut out of $\frac{7}{8}$ in. board, and planed up all round. The following are the lengths of the various pieces required, which are $1\frac{1}{2}$ in. wide :—Two back legs, 4 ft. 9 in. ; two front legs, 2 ft. ; two sides for seat, 1 ft. 6 in. ; and two arms cut to a segment of a circle. Three rails are also required; they can be either turned, or rounded with a plane. The framing is halved and screwed together, and the rails mortised through the sides. The covering of the seat and back may be of canvas, but a piece of light-coloured carpeting is more pleasing to the eye. This chair is a fixture, and cannot fold up. This renders it not quite so portable as the other two described ; but it has the advantage of being easily made, and requires no great skill to put it together, while its appearance, when nicely polished or varnished, is quite as pleasing as either of the others, and it excels them in the matter of rigidity.

SOLDERING IN REPAIRS OF SHEET METAL UTENSILS.

BY R. ALEXANDER.

TEA POT—TIN TEA KETTLE—IRON TEA KETTLE—COPPER TEA KETTLE—SOLDERING SOFT METAL—SOLDERING ZINC—GALVANISED IRON.

I WILL commence this article with a few simple examples of soldering in the way of repairs, none of which will present any great difficulty, and which will require very few tools beyond those already mentioned (p. 257). Let us suppose, for example, that we have the following articles brought us to repair—tin tea pot, tin tea kettle, coffee pot, saucepan, iron tea kettle, copper tea kettle. The first thing is to examine them, and find out what is the matter with them ; on holding the tea pot up to the light and looking in the top a small pin hole is seen in the bottom ; we put it down that that is the faulty place, make a ring round it with a bradawl and put it on one side. Taking up the tin kettle, and treating that in the same way, we are unable to discover any holes in it, and, on farther examination, no sign of a leak is discoverable. So it must be tried with water ; we then find that the water oozes out at the side of the spout ; mark it with the bradawl, and try coffee pot. On treating this in the same manner, nothing seems wrong with it, but as the knob is missing we will put it down that a knob is what it requires ; the saucepan we find to have the same fault as the tea pot, viz., a hole in the bottom ; the iron kettle we find to leak all round the spout, and the copper kettle has a crack about $1\frac{1}{2}$ in. long at the angle where the bottom and sides meet.

Tea Pot.—Now to remedy these defects. Take the tea pot and, with a scraping knife, scrape a clean place round the pin hole about the size of a sixpence. While mentioning the scraping knife, I may as well say that an old razor driven into a file handle makes about the best scraper you can have, though for some things a more pointed one is required, but for all ordinary work the razor will be found sufficient. Have all your soldering tackle handy, iron, solder, spirits, spirit brush, and piece of solder ; heat the iron, hold the tea pot in the left hand, dip the spirit brush in the spirits, rap it against the sides of the jar to remove superfluous liquid, and apply a little to the place you are going to solder. Then take the iron, dip it in the spirits to clean it, apply it to the piece of solder, and try to pick a little up with it ; you will probably find this a little difficult at first, the solder seeming to take a delight in running all over the bench instead of clinging to the iron. The way to do it is this :—Hold the iron in a nearly horizontal position, and, in applying it to the solder, do not dig the point of the iron into it, but lay the side of the iron on it lightly near the point and draw the iron toward you ; then, keeping the iron as near horizontal as possible, bring the point of it with the solder it has picked up to the hole in the bottom of the tea pot. As it touches the leaky place lift the handle of the soldering iron, and the solder will flow off at the point ; move the iron just round the hole and the solder will run all over it. Take the iron away, and allow the metal to cool (blowing on it will accelerate the cooling), and the tea pot is done. Try with water to make sure that it is sound.

Tin Tea Kettle.—The next job is the tin tea kettle. A few words will suffice for this. Dry it thoroughly, scrape it well a little farther each way than the leak extends, hold it in the most suitable position for soldering, which will be on its side, spirit it and solder as just described, laying the angle of the iron in the angle formed by the spout and body. The coffee pot knob is also a very easy job. Simply place the new knob in the hole (after scraping, of course), and with the iron melt a little solder and the end of the knob together, letting the knob rest on the bench whilst soldering, and taking care not to keep the iron on it too long or it will melt the knob away and spoil it ; a little stud is usually punched out and soldered over the place where the knob is fixed to give it a neat appearance.

Iron Tea Kettle.—The iron tea kettle next demands attention. Most wrought iron kettles are tinned outside as well as inside before being japanned. If on scraping the black off this proves to be the case, and it has not been in use very long, the scraping knife will be all that is required to clean it for soldering, but if old and rusty round the spout, say, through having been put by when the leak was discovered, instead of being sent to be repaired at once, then the file will be required ; a 10 in. half-round is about the most useful for these jobbing operations. Carefully clean all round the spout till you are sure there are no dirty places or rust spots. When sufficiently clean, apply the spirits as before mentioned; heat the iron to a good heat, apply the solder by holding a strip of it in one hand and melting a little on with the iron held in the other ; holding the kettle with your body against the bench, draw the iron round the spout and the solder will follow. Let the iron rest on the work, as it must be got hot before the solder will unite to it properly ; a strong job cannot be made unless the parts to be united are as hot as the metal that is to unite them. For example, supposing the kettle we are just supposed to have done had been coated with fur to the depth of half an inch all over the inside, you would have found that you could not have got it hot enough for the solder to flow freely, on account of the wet fur robbing the heat from the iron as fast as it was communicated to it, and although you might have managed to stick a little solder round the spout, it would not have been a good sound job, but if the fur was cleaned out the difference would at once be felt. This remark about fur applies, of course, to patches on bottoms or sides.

The next job on hand is the saucepan. This having only a small hole in the bottom, may be treated the same as the tea pot, especially if a small one and of little value, but a better and a more workmanlike way will be to put a piece on it; people would also rather pay a little more for a patch than if only a "dab" of solder were put on, though a patch soldered on is very little, if any, better than mending it with solder, as far as utility goes, for this reason, that if by any chance the saucepan should be left on the fire without any water, the patch would melt off as easily as the solder. But as a patch looks better and the customer will be better pleased, let us put a patch on by all means. Cut a piece of tin about an inch square, snip off the corners, lay it on the bottom of the saucepan just over the hole, mark round it with the bradawl, scrape clean all the inside of the square thus marked, and $\frac{1}{4}$ of an inch all round the outside of it; or in other words, if the patch is 1 in. square scrape a clean place $1\frac{1}{2}$ in. square. If the saucepan is in good condition and scrapes nice and clean, it will be ready to solder; but in case the bottom is eaten by fire and rust it is difficult to get clean, and after scraping and cleaning it as well as you can, you must "tin" it to make sure of the solder flowing under the patch. To do this, simply rub the soldering iron over it with a little solder, applying spirits to make it tin easily. When this is done, lay the patch on and solder it, drawing the iron first round the edges and then all over it, holding the patch down with something to prevent its shifting, the solder flows underneath, and the patch is what we call "sweated" on. The description of putting on a patch applies equally to other article such as tea kettles, coffee pots, fish kettles, etc. With the exception that a large patch need not be sweated all over, but simply soldered all round the edge of the piece, letting the iron rest mainly on the piece that is put on rather than on the article, this is to draw the metal underneath.

Copper Kettle.—The next and last example of the batch we are at present considering is the copper kettle. This, as we have seen, is supposed to be cracked along the edge of the bottom about $1\frac{1}{4}$ inch. This must be repaired by putting a patch on the bottom and turning it up on the side. Scrape clean a place on the bottom 1 in. wide, and extending a little each side of the crack, scrape up the side $\frac{1}{2}$ an inch in the same manner, tin the places as described previously in speaking of the saucepan; now take a piece of thin copper $1\frac{1}{2}$ in. by 1 in., clean it both sides and tin one side with the soldering iron, it will then be ready to put on. I always fix such a job as this in the vice by the handle, as that leaves the hands at liberty, and place the piece of copper, tinned side down, on the bottom of the kettle, leaving about $\frac{3}{8}$ of an inch overlapping to turn up on the side. Solder the piece on to the bottom, cut the overlapping piece to the same sweep as the sides, and with a light hammer rap it close up to the side, and then solder round that part; clean off any superfluous metal that may have run on to the patch with a file or scraper, and if thought necessary, colour the solder with a little solution of sulphate of copper, more commonly known as blue vitriol or bluestone. Crush a small crystal of the sulphate, dip a small brush (not the spirit brush) in water, and with it touch the powdered sulphate and then draw the brush over the solder; this will give it a copper colour, but, of course, not lasting. The half-dozen jobs that I have described will serve as a model for all of a similar class. In fact, if I were to describe fifty such jobs, they would all amount to the same thing, that to make a good job you must get the place to be repaired or the surfaces to be united perfectly clean and bright, or you cannot solder them properly. If this is carried out and the iron is properly tinned and cleaned, and the solder all right, everything else is sure to be, always supposing the worker to possess the proverbial "grain of common sense."

Soldering Soft Metal.—I will now say a few words on soldering soft metal. This will require a little more skill and practice to master, and I should advise learners to get an old metal tea pot or two and practise on, before attempting to perform on the family plate. One or two things need be observed to ensure success. The metal must be scraped bright, because a tea pot or coffee pot looking clean is no criterion that it is clean enough to solder properly, next a light soldering iron should be used, as you dare not rest the iron on the work as you would in soldering tinware, or the result would be disastrous. So the weight of the iron being all on the wrist, I say use a light one or you will not be able to hold it steady.

Thirdly, the iron must be just the right degree of heat. If it is too hot, the chances are that a hole in the metal will be the result of its application, and if not hot enough the work looks botchy. Try to hit the happy medium, the old tea pots will be good practice. Let us suppose one leaks all round the spout. If it has been in use just lately, the first thing to do is to dry it out thoroughly, or on applying the iron the solder will splutter about and bubble up instead of flowing nicely. Having dried it well, the next thing will be to scrape it, the large blade of a penknife is a very good thing for this, then take some very fine running solder, and have ready some resin and oil for a flux; apply it round the spout with a little brush, heat the iron, apply a little solder to the tea-pot spout, and gently draw it round with the iron, scarcely letting it touch the metal of the tea pot. The heat of the solder will melt the metal as you draw it round; if the iron is fairly hot, do try not to make the solder run round too far, but keep picking more up and reheat the iron when you find it hang. Supposing that you have got safely round the spout, the next thing is to clean off the job so that it can hardly be seen where it has been repaired. A small half-round file about 6-in. long will be the best thing to use. Work round the job lightly, taking care not to file the sides and spout of the tea pot more than you can help, and when you have got it fairly level and smooth go round it with emery cloth or a scraper; the scraper must be round-ended, if pointed like a penknife blade it would make more marks than it took out. After this use a steel or agate burnisher and a capital job is the result. The first try may not be a success; but I have found out by experience that our failures teach us as much as our successes.

A very ticklish kind of work is the repairing of the rims and covers of china tea pots, and hot water jugs. These covers and rims are extremely thin, and made of a very soft and fusible metal, and therefore they require very great care.

The parts to be soldered must be carefully scraped, no streaks of uncleaned metal should be seen, very little flux should be used, and a very steady hand is required. If these directions are attended to, there is little fear of failure or spoiling the work. I have never yet spoilt, or even had an accident with any work of this kind, even in my 'prentice days, and there is no need for my readers to do so if they take pains with their work and use care; but if you attempt to do such work as the last two things I have mentioned, as I have seen some do, with a dirty iron, tin nearly all burnt off, the work half cleaned, and using common solder, it will not be strange if failure is the result.

Soldering Zinc.—This is a difficult metal to solder smoothly and well, even when new and clean; and when old, such as guttering that has been fixed a long time, or old kitchen utensils, it is much worse. In soldering this metal, the strong or raw spirit of salt must be used, and the worker must try and keep the spirit to the part to be soldered, and not let it run all over the work; and after the seam joint, or whatever it may be, is soldered, the spirits should be wiped off as soon as the work is cold, as the spirits have a very corrosive action. Soldering zinc is not a very pleasant job for the olfactory organs, as the smell caused by applying the acid to the zinc is, according to most people's idea, "something awful;" however, use is second nature, and I don't mind it much myself. You will also find that the solder does not flow very well on zinc; this is because a certain amount of it mingles with the solder and deteriorates it, and you will find that it will cling to and get hard on the iron like a lot of dross. The iron will require to be cleaned at intervals if much zinc is being soldered; a light touch up with a file all round, and a rub on the sal-ammoniac with a little solder puts it all right again. Old zinc will require to be got fairly clean with a scraper or file before attempting to solder — use spirits freely.

Zinc is not a soft metal like pewter, but it will melt under the iron if thin and the iron is very hot, so use care in this respect; practice will soon show the right degree of heat to work with. Smooth the soldering where rough with file and scraper. The ordinary plumber's shave hook is a good tool for cleaning off zinc after soldering, especially on long seams such as would occur in joining two sheets together.

Galvanised Iron.—The treatment of this is very similar to that of zinc, strong spirits being used as the flux. I would also advise that anything in zinc or galvanised iron that is to contain any liquid, should be very carefully tried before passing it as done, as though you may fancy that it is all well and truly soldered, yet both zinc and galvanised iron are such treacherous things to solder that it is almost impossible to say with certainty whether it is sound or not, and nothing is more discreditable to a workman than to have his work returned leaky, solely for the sake of a little extra trouble, to say nothing of the inconvenience that might be caused.

The directions given above for the repairs of ordinary metal utensils in common use, will be found sufficient for the renovation of all articles of this description. Although the articles themselves may differ in form, the mode of going to work to mend them is the same in every case. So that although but few articles have been mentioned, the instructions given apply similarly to all that are made of the plain and tinned iron, copper, and soft metal. If any workman can make a good job in one case, he may depend on being able to arrive at the same result in all others of a similar character.

MAKING BOLTS AND SCREWS FOR MODELS.

BY OLLA PODRIDA.

ALTHOUGH such small work may be purchased cheaply, it is nevertheless not always convenient to do so for several reasons which should be obvious. First, there is the delay, which—when the model maker is, as such people generally are, in a fever of impatience—is a very important matter. Then there is the difficulty of obtaining just the right length and size for particular cases, and this may involve alterations, and, consequently, more lost time and patience. All this goes far towards balancing the bother of making such small goods oneself. I know from experience that model bolt-making isn't a very congenial occupation; in fact, it may be considered a necessary evil, but then there is the satisfaction that you are making exactly what you require.

Some years ago, while suffering from a severe attack of model mania, and having a large number of very small screws to make, it occurred to me that some simple means might be devised whereby the labour of turning such small articles might be greatly reduced. An idea suggested itself, and was immediately put into practice with very satisfactory results. The device then employed is now reproduced and illustrated herein. It has at least one merit, that of simplicity both in manufacture and use, and I trust it may be of service to those interested in WORK.

Tool for Making Bolts and Screws for Models.

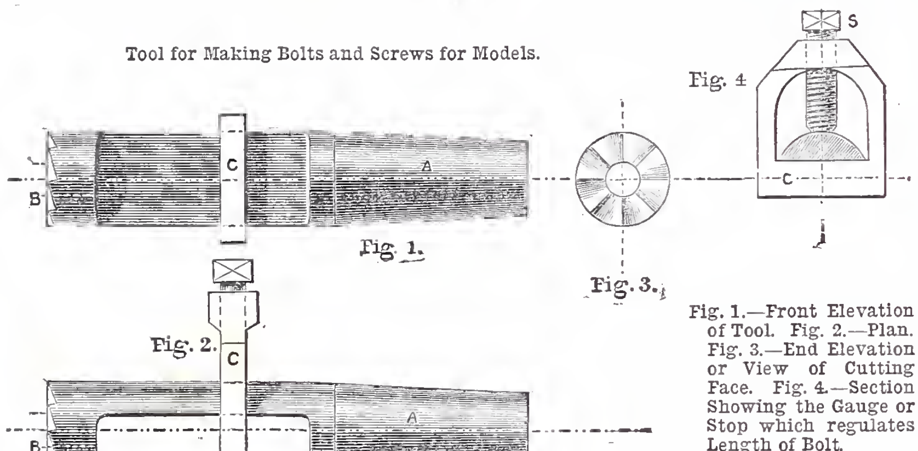


Fig. 1.—Front Elevation of Tool. Fig. 2.—Plan. Fig. 3.—End Elevation or View of Cutting Face. Fig. 4.—Section Showing the Gauge or Stop which regulates Length of Bolt.

Fig. 1 shows a front elevation of the tool; Fig. 2 is a plan; Fig. 3 is an end elevation, or view of the cutting faces; and Fig. 4 is a section shewing the gauge or stop which regulates the length of bolt. The tool is made entirely of steel, and for this purpose a worn-out round file may be economically used up. A separate one is required for each size bolt to be made, but, if desired, this may be avoided by making the body of iron and boring the end out larger, so as to accommodate a series of steel cutters with different size holes as required, these cutters being held by a small set-screw so that they may be changed when desired.

In making a tool of the form given herein, the first thing is to get a piece of steel of suitable size, and soften it for turning. The softening may readily be done in the kitchen fire, by heating it to a blood-red heat, and burying it in fine ashes or quicklime until it cools. It is then centred truly and turned to the required size, the tapered part at A being made to fit the poppet cylinder. The centres should be left in for—at least, in the case of the cutting end—convenience in boring the hole to size of bolt. In the illustration this is given for bolts $\frac{3}{16}$ in. in diameter, and the outside size of tool is $\frac{1}{2}$-in. The hole is best drilled by means of a running drill held in a chuck, the tool being fixed in and advanced by the poppet cylinder. The hole need not be made deeper than just to clear the solid end, say $\frac{3}{8}$ in. deep. A nice smooth hole is required, so as not to injure the body of the bolt. The next thing to be done is the filing away for the flat part to clear the hole, as shewn in Fig. 2 and in section at Fig. 4. This having been done, the cutting faces may next be formed. There are eight of these equally divided. They are formed by filing, and must be finished smoothly. Their formation will be facilitated by making them deeper on the outside, or by slanting the file so that it shall clear the opposite edges at first, and afterwards finishing by short strokes with the point of file. Care must be taken to bring the sharp cutting edges quite true and square to the axis; this, if the end has been nicely faced in the first place, will be comparatively easy.

The tool must now be tempered as follows:—First heat the cutting end to an even blood or cherry red heat, and plunge quickly into lukewarm water. Next brighten the outside of the cutting end by means of a piece of sandstone or brick. Then heat red hot a piece of iron—one of the domestic box iron heaters will suit admirably—and lay the tool upon it, turning it meanwhile to equalise the heat, until it assumes a dark straw colour tinged with blue, when it must be immediately cooled in lukewarm water as before. The tool is now, with the exception of the stop, ready for use. The stop may be made out of a small piece of flat iron, and the hole in centre should only just be large enough to clear over the cutting end. It can by means of the set-screw, S, be fixed in any required position, according to the length of bolt, but, although convenient, it may be dispensed with.

The method of using the tool is as follows:—Wire of suitable size having been obtained, it is held in a chuck so that sufficient projects to enable one bolt to be made and parted off. The wire must be large enough to form the head, and the chuck may be an ordinary "pod" or drill chuck. It should be capable of accommodating sufficient wire for making a number at a time. The tool is, as has already been observed, held in the poppet cylinder, and the poppet head fixed in a convenient position for advance and withdrawal of the tool. The gauge stop having been set, the wire must be pointed and rounded slightly to enable the tool to start fair and give a finish to the point of bolt. The tool is then advanced steadily by hand, and kept well lubricated with soap and water, or oil. When the stop is reached the tool is withdrawn, the head turned up, and the bolt parted off with hand tools and tee-rest. If a hexagonal or square head is desired, the sides can be filed up, and the angles or corners chamfered before parting off. The process of screwing or threading the bolt should follow the turning, and before forming the head, so that in case of stripping of the head a minimum of trouble may be met. The lathe should be run at a smart speed during the operations except for screwing, which must be done by hand, the die or screw plate being held in one hand and the work gently pulled round by the cord with the other.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

VI.—THE SIGN WRITER'S OUTFIT—ITS CARE AND TREATMENT—MATERIALS AND COLOURS.

"A BAD workman always complains of his tools;" so runs the old proverb, but it is nevertheless true, that to do good work we require the best of tools to do it with, and, also, that the result of using bad tools is indifferent and unsatisfactory work. I am, therefore, now going to describe the best and most durable tools required by the sign writer, and also give a few hints and directions as to their proper use and care when lying idle. This latter point must never be neglected, but always attended to immediately the tools are done with, otherwise the pencils will soon become worthless; at least for doing good work, besides causing an unnecessary outlay for new ones. Badly kept tools are also a sure sign of the owner being a slovenly and lazy workman; so I would strongly urge the apprentice or young workman, at the very commencement of his tuition, to take a pride in keeping in workmanlike condition and business order what will through life, perhaps, prove his best friend, his bread winner and his trade mark, viz., his "kit of tools."

I would not advise, under any circumstances, the purchase of cheap and badly made tools; those of the best quality only are always the cheapest in the end, both as regards wear and tear and the turning out of good work. This remark applies specially to camel-hair and sable pencils, and the colours and vehicles used in sign writing.

If the reader will, however, only follow the advice contained in this chapter, on procuring a complete outfit for sign writing, he will, I feel sure, never have to complain of his tools, even though, through his own negligence, he may become but a bad or indifferent workman. The brushes and pencils first demand our attention, so I will dismiss them with a few but weighty words.

The hair pencils used by sign writers are made in various sizes, and the student will do well to obtain a complete set as soon as he can afford it. He had better, however, commence with a few good pencils in preference to a host of common rubbish. I need hardly say that the student must choose his brush or pencil according to the size or nature of the work he has in hand; the small pencils being used for fine and delicate work, and, the larger sizes for large lettering. The

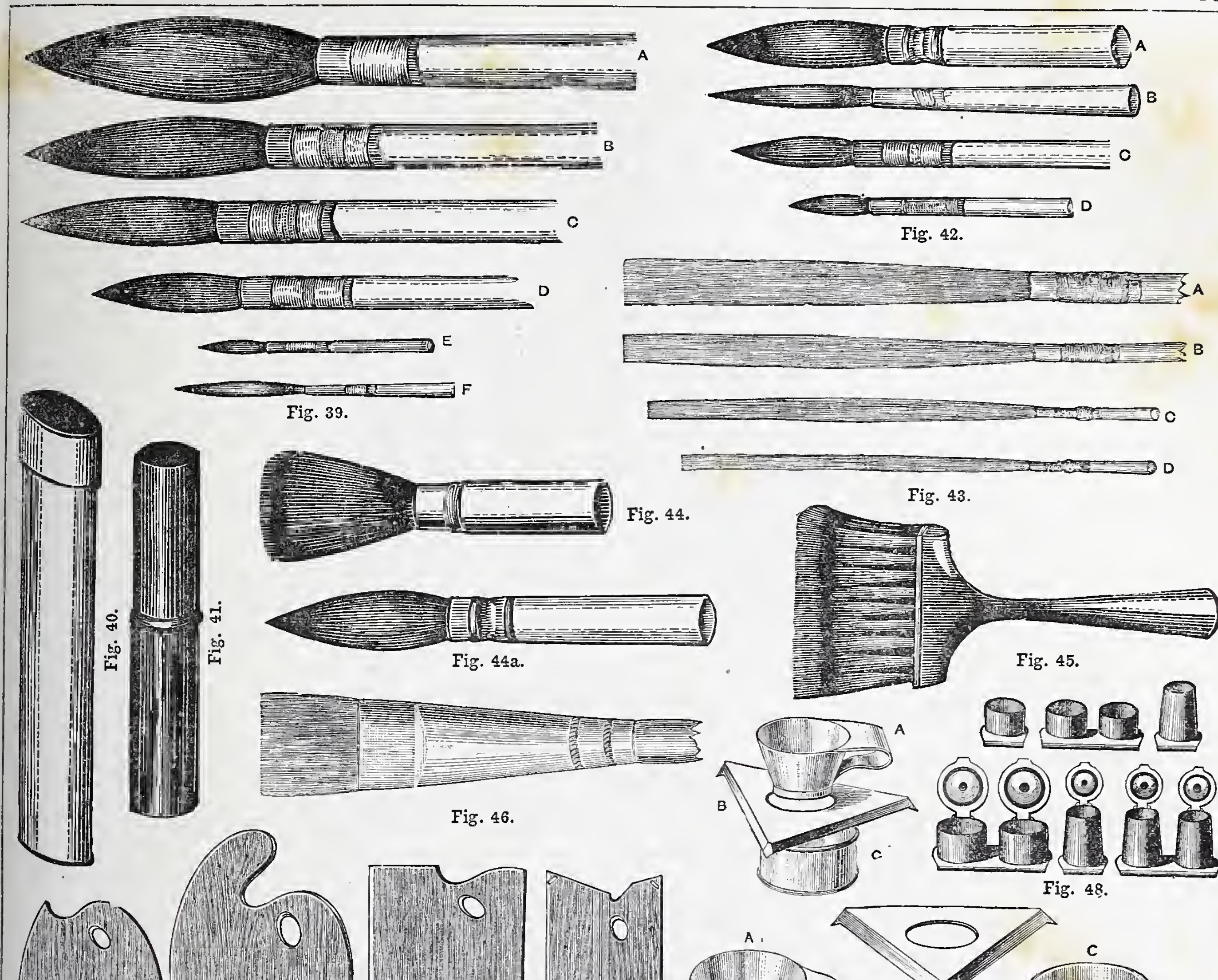


Fig. 39.—Writers—A, Large Swan; B, Small Swan; C, Goose; D, Duck; E, Lark; F, Crow. Fig. 40.—Oval Pencil Case. Fig. 41.—Round Pencil Case. Fig. 42.—Riggers—A, Goose Short Pencil; B, Duck Short Pencil; C, Crow; D, Lark. Fig. 43.—Liners or Tracers—A, Goose; B, Duck; C, Crow; D, Lark. Fig. 44.—Short Hair or Filling-in Brush. Fig. 44a.—Filling-in Brush with Tin Ferrule. Fig. 45.—Badger Hair Softener or Blender. Fig. 46.—Writer's Sable Blender. Fig. 47.—Mahogany Palettes. Fig. 48.—Dippers, Single and Double. Fig. 49.—Sign Writer's Paint Strainer—A, Strainer; B, Stroddle; C, Water Dish. Fig. 50.—Palette Knife. Fig. 51.—Divider and Compasses. Fig. 52.—Jointed Mahl or Rest Stick. Fig. 53.—Sign Writer's Candlestick with Shifting Reflector. Fig. 54.—Brodie and Middleton's Sign Writer's Complete Outfit in Japanned Tin Box. Fig. 55.—Tube Colour for Sign Writer.

pencils are made in the following sizes, viz.:—

Lark or Miniature.	Goose.	Small Swan.
Crow.	Full Goose.	Middle Swan.
Duck.	Ext. full Goose..	Large Swan.

The most useful sizes will be found illustrated in Fig. 39.

Camel-hair writers are, of course, the cheapest, and for some work they may be used without inconvenience; but when heavy colours are used they are useless, as the colour by its weight causes them to droop or "sagg," so that it is next to impossible to get a sharp, clear outline. Sable pencils are, therefore, the best (although more expensive), the hair being stiffer than camel-hair, whilst at the same time it is just as pliable and considerably more durable. To last even a short time, however, they must always be kept to perfection, and at once cleaned on the completion of a job. This is best done by first rinsing the pencils in some turpentine, then washing with some soap and warm water, and finally dipping the points into some sweet oil, and putting away in a tin case (Figs. 40 and 41). Most workmen merely grease them, for which purpose they have a little compartment in the tin box for holding a small supply of grease, and some keep them always in a little sweet oil at home. It is always best though to thoroughly clean them, as experience will teach. A very good receptacle for the pencils is a long tin box which has contained wax vestas. The sixpenny size is the most useful, and as these can be picked up almost anywhere, the young workman may soon possess as many as he requires. The wooden handles should be removed before putting the pencils away. The writer will eventually require some "riggers," or short hair pencils (Fig. 42), some "liners" (Fig. 43), and some full, short hair or "filling in" brushes (Figs. 44 and 44a), the use of which will be described in a future chapter. The badger-hair softener (Fig. 45) is used for blending two or more colours on any large surface, and the sable blender (Fig. 46) is used for the same purpose in shading letters and blending their colours.

We next come to the wooden palettes, which are held in the left hand, and are used for mixing and working the colours upon. They are made in various shapes and sizes, as shown in Fig. 47. The last (A) is a folding palette for the pocket, etc.

A few tin dippers are very useful appendages to the palette (Fig. 48). They are made with a flange for sliding on to the edge of the palette. Dippers are used for holding small quantities of tube colours, oils and turps, so as to have them close at hand.

A small paint strainer should be possessed by every sign writer, and the most useful one that I know of is illustrated at Fig. 49. It is named Thomasson's Improved Registered Paint Strainer, and is made by Crowden and Garrod, Southwark, S.E. This strainer is designed to meet the wants of the sign writing trade; the triangle stroddle will rest over any sized paint pots, and there is a water dish for keeping the strainer in water when out of use. It is made of stout zinc, with brass wire gauze, and, having used one for some time, I can say that they are durable, easily kept clean, and cheap. The price for the medium size is about 2s. 6d.

One or two palette knives (Fig. 50) will be needed, and their price ranges from a shilling upwards. The dividers (Fig. 51) are used for many purposes, such as measuring out spaces and describing arcs, circles, ovals, and scrolls.

One of the most useful and handy appliances ever brought out for the sign writer is the "jointed" mahl stick, as made by Brodie and Middleton, of Long Acre. It has three or four divisions, and takes to pieces after the manner of a fishing-rod, so that any number can be used, and the stick brought to any desired length according to the nature of the work (see Fig. 52). When taken to pieces it will go in the baskets, box, or pockets. The same firm also make two specialties for the sign writer, one is a candlestick, and the other a complete outfit in a tin box. The candlestick (Fig. 53) is furnished with a shifting reflector, so that the light can be thrown on any particular spot. It is also fitted with a flange for attaching to the palette. This article is very useful when working after sunset awhile in order to complete a job, or for evening practice on the black board.

The guinea sign writer's box (Fig. 54) is made of japanned tin, and it is really a most useful servant to every sign writer. It is fitted in a very complete manner, and contains every requisite that can possibly be required. There are a series of compartments, with tightly fitting lids, to contain the colours, so that there is no danger of their getting accidentally mixed and spoiled, as is often the case when they are carried loosely in a basket. There are also bottles, with screw lids, to contain oils, turpentine, varnishes, and other diluents; spaces for gold leaf, brushes and pencils, and a palette. The spaces for the whole of these articles is so nicely adjusted that there is a maximum of convenience with a minimum of bulk. I need hardly say, how very superior such a "multum in parvo" must be to the cumbrous baskets which writers and grainers ordinarily carry, to say nothing of the superior cleanliness of the japanned box over the old method.

The young workman will also require some sticks of pipe-clay, a chamois leather, a good sponge, cotton wool, and a chalk line and reel, all of which may be obtained from Brodie and Middleton, besides the pencils and the colours; a list of which I now append.

TUBE OIL COLOURS USED BY SIGN WRITERS.

Verona Brown.	Cologne Earth.
Yellow Ochre.	Yellow Lake.
Caledonian Brown.	Purple Lake.
Roman or Golden Ochre.	Indian Lake.
Brown Ochre.	Lake.
Raw Sienna.	Ivory Black.
Burnt Sienna.	Lamp Black.
Prussian Blue.	Blue Black.
Antwerp Blue.	Terravert.
Indigo Blue.	Verdigris.
New Blue.	Flake White.
Pale Ultramarine Blue.	Cassell Earth.
Deep Ultramarine Blue.	Blue Verditer.
Permanent Blue.	Zinc White.
Magenta.	Crimson Lake.
Mauve.	Scarlet Lake.
Olive Green.	Vermilion.
Sap Green.	Mineral Grey.
Emerald Green.	Royal Yellow.
Green Lakes 1, 2, 3, and 4.	Blue Cerulean.
Malachite Green.	French Ultramarine.
Indian Red.	Gamboge.
Light Red.	Oxide of Chromium.
Venetian Red.	Mars Yellow.
Red Lead.	Strontian Yellow.
Bone Brown.	Indian Yellow.
Cappah Brown.	Lemon Yellow.
Vandyke Brown.	Cobalt Blue.
Pale Naples Yellow.	Scarlet Vermilion.
Deep Naples Yellow.	Madder Brown.
Extra deep Naples Yellow.	Mars Orange.
Patent Yellow.	Sepia.
Chromes Nos. 1, 2, 3, and 4.	Pink Madder.
Raw Umber.	Madder Lake.
Burnt Umber.	Rose Madder.
Mineral Green.	Veronese Green.
Mummy.	Carmine.
Bitumen.	Violet Carmine.
Asphaltum.	Cadmium Yellow.
Dutch Pink (yellow).	Madder.
Brown Pink.	Madder Carmine.
Italian Pink.	Aureolin.
Neutral Tint.	Mygulph (Mastic).
	Mygulph (Copal).
	Sarum or Dryers.

PLOUGHED AND TONGUED JOINTS.

A THIRD FORM OF JOINTING UP.

BY DAVID ADAMSON.

HAVING given a description of the two most usual and useful forms of jointing up boards, as promised in the preceding chapter of this short series, the ploughed and tongued joint may now be briefly considered. It is probably the strongest of the three, but as the dowelled joint is sufficient for ordinary purposes, and is more easily made, tongueing is comparatively seldom resorted to in cabinet work. The reader will please note that only jointing up in order to get required width is referred to. Still, there are occasions when it may be more appropriate than either of the others, as, for example, with pitch pine boards, and if only for the sake of letting the novice know of its existence it must be mentioned. As may almost be inferred from its name, a groove is cut or ploughed along the edge of one or both of the planks to be joined, and the space so made is filled by a thin strip of wood. If both planks have been ploughed this strip is separately made, and half its width inserted in each. When, however, only one has been prepared this way, the other is planed down to leave a projecting ridge, which fits in the ploughed groove. It is almost needless to say that the former is the stronger of the two, and that it is the one almost invariably used in the finest work, *i.e.*, of course, when tongueing is preferred to dowelling. For amateurs, especially, it will be preferable, as only one plane, beyond the ordinary smoothing planes, is required; while in the other form a pair, one for cutting the grooves and the other for the tongue, will be necessary. Let us take the best form first, and see how it may be made properly and efficiently. The edges must be shot perfectly true as for a plain joint, for this is a *sine quâ non* in joints of all kinds. The plane, *i.e.*, the "plough" plane, must then be set so that the iron cuts the groove about the middle of the edge of the plank. I presume it is not necessary to describe here how the plane is to be set, as those who possess a plough will have no difficulty in understanding how to regulate the fence, which, by being pressed or kept in contact with the surface of the wood, causes the iron to cut in the same straight line. It will thus be seen that in working a plough two pressures, as they may be described, are required, one of them downwards and the other sideways during the whole of the forward thrust. One caution may save the novice the annoyance of being taught by experience, to wit, that if the iron is not set to cut exactly in the centre of the wood, the groove must be run equally on both pieces, the distance from the face being taken, with due regard to the grooves corresponding when the edges are brought together. A little thought will show the necessity for this caution, which, having been given, may seem a slight on the novice's common sense; otherwise, were he to make a mistake, for his consolation it may be stated that it would not be the first of the kind. The work with the plough having been completed, the boards are ready for tongueing. That this part of the work may be done in two ways—one of them being wrong, or, if that is too strong an assertion, without much stability in the joint, and the other correct, both theoretically and practically—may seem a superfluous observation. It would be were it not that the weaker method is sometimes practised by those who ought to know better, and the novice especially is warned against it. As has been stated, the tongueing is a strip of wood glued in both the ploughed grooves. Now, if this strip is cut so that the grain is coincident with that of the boards to be connected by it, it is evident that the strength cannot be so great as if the grain were at right angles with that of the board. In other words, the grain of the tongueing must be end on to the bottom of the grooves. This is the key to the proper way of making the tongued and grooved joint, about which, that there may be no possibility of a mistake, Fig. 1 is given, clearly showing the direction of the grain in the tongueing and in the boards to be joined. Possibly the novice may be told by some practical workers that the way the tongueing is done is not of much consequence, and that the insistence on one being better than the other is all moonshine. If so, hear his reasons, for a practical worker's reasons, when he has any and does not work only by routine, are always worth listening to by beginners, even though one may not at once see their force. If the argument in favour of this method of working seems sound, by all means try it, and don't dispose of it simply because some one else has told you that the work must be done in such and such a manner. I merely tell you what I consider the best method, and if there is a better way of getting at the desired result do not hesitate to adopt it. "Prove all things; hold fast to what is good," and always be on the look-out for better methods of work. Finality has hardly been reached yet in joinery, and, so long as new and improved tools and appliances are brought out, never will be. But, perhaps, it may seem much easier to plane up a length of tongueing with the grain than across it. It is; in fact, it would be absurd to expect to plane up a long cross-grain piece. Don't see it? Well, supposing a 6-ft., or even 3-ft., length of tongueing is wanted, where, in the first place, will a board sufficiently wide to get this off it be got in a general way? Boards of this width are not often met with. If they were, any hints on jointing up would scarcely be necessary, for the simple reason that none of this kind of work would be required in cabinet making. Of course, a moment's reflection will show that there is no occasion whatever for the tongueing being all in one piece, so that all that it is necessary to do is to cut pieces of the required width and thickness from the end of any boards. This piece of wood from which the tongueing is got will be prepared by planing before the pieces are cut off, so that the necessity for the awkward job of getting them to the right thickness is afterwards done away with. When prepared, the tongueings are to be fixed in with glue and the boards cramped together; but after what has been said about this part of the operation in connection with dowelling, no further directions can be needed.

But, it may be asked, are these the only methods of jointing up which are employed in carpentering? If so, a wide field is opened up for joinery or carpenters' work, which includes many branches, each having special modes of working. The one with which we have been concerned in these articles relates to the cabinet making only. Were it not so, other forms of jointing might have been mentioned, but the three, viz., plain, dowelled, and tongued joints, which have been dealt with, are those principally in use in all kinds of joinery. Those, therefore, who want to joint up for almost any purpose will know what to do, and, in conclusion, it is hoped that these few hints may have given the novice an insight into operations which can hardly be described in detail, while directions for making up a particular piece of work are being given. In succeeding articles various other joints, including dovetailing, will be explained.

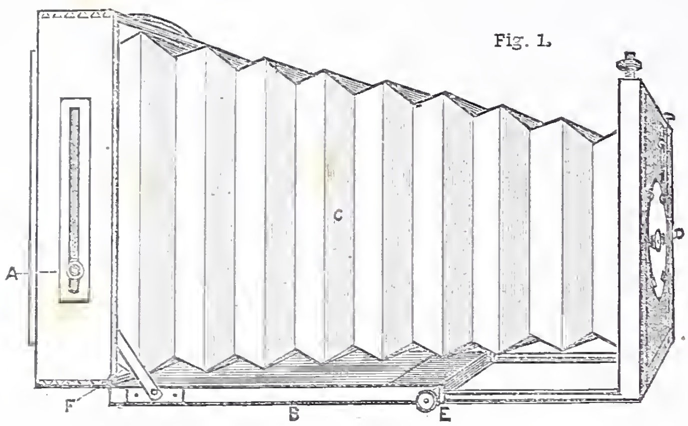
A WHOLE-PLATE CAMERA:
HOW TO MAKE IT.
BY AN OLD HAND.

PHOTOGRAPHY in the present day has become one, if not *the* most popular of our art sciences, affording, as it does, healthy exercise both for mind and body, and opportunity for cultivating those artistic and æsthetic tastes that are innate in most of us. Opportunity is also provided for those of a mechanical bias, for exercising their talents of constructiveness, to aid which will be the special purpose of the following articles. If the instructions given are carefully followed and intelligently worked out, the amateur will not only be able to take a photograph, but have the additional satisfaction of knowing his pictures are veritably his own work, *ab initio*. In the next few papers we propose to put before the reader diagrams of all the necessary apparatus for making a photographic print, with plain instructions for their construction. The article of the first importance is the camera, or camera box as our Transatlantic friends put it, which is in reality a small portable dark chamber, at one end of which is fixed the lens and at the other the sensitive plate. This simple dark box has from time to time been added to and improved, till, from the crude apparatus of its inventor—Baptista Porta—in the second half of the sixteenth century, it has become the elaborate and ingenious contrivance of the present day. It goes without saying that all wood used in the construction of the camera must be of the best quality, and thoroughly well seasoned; the manufacture of this instrument being very high class cabinet work, all the precautions and devices used in cabinet work come into play. In making the camera, wood of close fine grain is to be selected. Mahogany, both Spanish and Honduras, has long been the favourite. Spanish is much heavier and harder than Honduras, and, having a fine grain, is generally preferred for *studio* cameras; but for outdoor work, where weight is a great consideration, the Honduras kind answers every purpose on this account, and being easier to work, it is better for the amateur to use. Very serviceable instruments have been made of teak. Ottewill, an early maker of cameras, used it freely for large-sized apparatus, and I can bear witness they will stand an immense amount of hard work with impunity.

Many other materials have been pressed into service, inclusive of paper, ebonite, and metals, the primary object being to have a tough, rigid, and light material, impervious both to moisture and light.

The camera of which Fig. 1 is a drawing has been selected as comprising all the necessary qualities, with as simple a form as at present devised. It was first introduced by Mr. G. Hare in this special design, but numbers of makers, appreciating the advantages of the pattern, have adopted it, preserving the principle but modifying the form. It will be noticed that the back is made to swing from the bottom, a plan to which some take exception, preferring the centre as the fulcrum; but for all practical purposes it answers very well, and is very convenient in use. A corresponding strut on the opposite side of the camera to that shown keeps the whole firm, the inclination of the back being secured by aid of the milled head screw nut, A, the screw itself being attached to the strip of metal, F, which works on a pin on the side of the baseboard, B. The bellows, C, extends to about 23 in., and closes up to about 3½ in., making it suitable for either long or short focus lenses. In place of the usual plan of raising or lowering the lens, a revolving disc is fitted to the front, working in a rebate, and kept from falling outwards by four small metal plates. The milled head attached to a pinion is for the purpose of shortening or lengthening the bellows. Fig. 2 shows the camera closed for carriage.

We will now proceed to construct a camera, having a supply of well seasoned ½ in. and ¼ in. mahogany. Begin with the baseboard, which it is necessary to make firm and strong, not only as a platform on which to build the body of the camera, but as that part by which it is attached to the tripod, and, of course, subject to greater strain than the rest of it. In the drawing given, Fig. 1A, the baseboard is carefully framed and clamped, in order to prevent the slightest warping, which would seriously interfere with the working of the sliding frame, which regulates the length to which it can be drawn out. In cheap, common cameras the baseboard is merely made of the right dimensions and clamped at each end. Fig. 1A shows the underside of the baseboard, with the framing and small brass screws, about 1 in. apart, which attach the strips shown in diagram Fig. 4, that form guides for the sliding frame, Fig. 2A. The dimensions being given with the diagrams, it is scarcely worth while to repeat them here. Fig. 2A represents the sliding frame, on the upper side, the inside edges of which are bevelled for appearance' sake. Two brass strips, B B, ½ in. wide and $\frac{1}{16}$ in. thick, are screwed to the frame along each outer edge, projecting ⅛ of an inch, and act as runners, so that the racking in or out of the bellows may be smooth and even. The ends of the strips near the hinges, C C, are slightly rounded, and small pieces more of the same are continued over the ends of the hinged bar, D. Fig. 3 shows the underside of the sliding frame and the two brass racks, A A, that when put in place engage with the pinion, F, in Fig. 4, actuated by the milled head at the side, Fig. 4, G. The screw plates, H H, are for the purpose of attaching the camera to the stand; the reason of two being made is that a better balance is obtained by using either one or the other, as the camera is used with long or short extension. Fig. 6 shows the side view of the sliding frame, with the curved joint, to permit easy folding of baseboard when closing the camera, X. The kind of hinge used, Fig. 7, represents the back frame of the camera, A, a metal plate with a slot in the centre, in which a pin attached to the brass strut, Fig. 7A, works. The notch, B, is useful to indicate when the back is a true right angle to the baseboard. The pin resting in this shows that the plate-holder is in its proper place. When a swing back is not required, it saves a considerable amount of trouble in adjustment. The frame, E, Fig. 7, is for the purpose of getting true register with the focussing screen and dark slide; it is sunk a ¼ of an inch below the outside frame, and has strips of black velvet glued on its face. Two small brass plates, C C, retain the slide and framing screen in close contact at the lower part, and two hinged catches, D D, at the top do the same for the upper part, and merely have to be turned back to remove or replace the frames. F F are small notches cut in the frame, bound with brass plates, for use when the dividing screen, Fig. 11, is required. This consists of two strips of wood, B B; on one side of each is a strip of brass, A A, projecting a quarter of an inch beyond the wood, to do duty as buttons. These are connected together by a screen, folded zigzag, made of two thicknesses of black calico, with a core of brown paper pasted together. D D D D are elastic cords on each side of the folds to keep them from bulging when not stretched to their full extent. Fig. 8 is the reversing frame, one of the most useful modern additions, permitting an oblong plate to be used either lengthways or upright without altering the camera. It consists of a light frame made of $\frac{1}{2}$ in. wood, to which the focussing screen is attached by folding hinges. The usual plan is to have the hinges at the top, and lift up the screen to insert the dark slides; but I prefer to reverse this, and have the hinges at the bottom; the focussing glass is more out of the way than with the other arrangement. The position is, however, optional. C C are small brass strips to retain the focussing glass, B, in its place; a shred of cork is placed between the strips and glass to prevent movement. The folding hinges, A A, by projecting a little over the glass, answer the same purpose on the opposite side. Fig. 9 is a side view of the reversing and focussing frame; the projecting fillet, B, is for the purpose of making the frame light-tight. C C, the part of the frame that fits in behind the plates, C C, in Fig. 7. Fig. 10 shows the front of the camera. The frame, C C C, is made of $\frac{1}{2}$ in. wood, E E being $\frac{3}{8}$ in. Two pins, B B B, pass down a groove in the back of the uprights, C C; a small plate attached to the end of the pin fits into the groove formed by brass strips at the bottom, and is pinched tightly by the nut, F. E E is the front, in which a circular hole has been cut with a rebate, in which works the flanged disc, A, Fig. 10. For convenience the rebate may be formed by building up the front of two thicknesses of $\frac{1}{4}$ in. wood, the circular hole in the inner one being a little smaller than the outer. E E is lined at the back with $\frac{1}{4}$ in. wood; a smaller aperture in it than in the front piece forms the rebate, and covers the groove cut in C C, boxing in the pins, B B, and to which the narrow ends of the bellows are fastened with strips of wood, glue, and a few small screws. The bellows, Fig. 12, are fastened to the inside of the frame, Fig. 7, in the same manner, as near to the front as possible. The disc, A, Fig. 10, is provided with apertures for three lenses. This gives an opportunity for using two small lenses for stereo or lantern pictures, or a larger one for the whole size of the plate; also, by using a lens in one of the side apertures, a quarter turn will raise or lower the lens at will, or if the front containing the disc is made to work in grooves in the uprights, C C, a slot and F, a screw, will permit the front to be raised without altering the central lens. Of course caps must be provided for all the lenses, those not in use to be kept covered. The bellows, Fig. 12, is made of leather, over which black lining has been pasted. Each fold is $1\frac{1}{4}$ in. deep. There should be only one corner to join; an inch extra in the width will provide for the overlap. In making the bellows, a piece of leather of sufficient size, or as many as may be necessary, should be pasted firmly down on to the black lining. Cut to shape, then with a chalk pencil rule lines $1\frac{1}{4}$ in. apart across it from end to end; also draw lines from corner to corner, making allowance for the overlap; damp the leathers and fold them fanwise, and well press, so that the creases remain. Let them get nearly dry under pressure, then fold on the lines drawn from corner to corner and diagonals, the leather being outwards; bend them into the proper shape, glue the overlap edge, and put under pressure, folded until dry. It is now ready to be attached to the frame of the camera. All the woodwork of the inside of the camera blackened with lampblack ground up in *thin* shellac varnish, all the visible outside parts nicely French-polished, and the camera is completed. One other important matter is the dark slide, Fig. 13. To make a good folding dark slide almost more skill is required than for any part of the camera

Fig. 1.


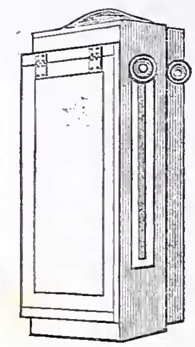


Fig. 2.

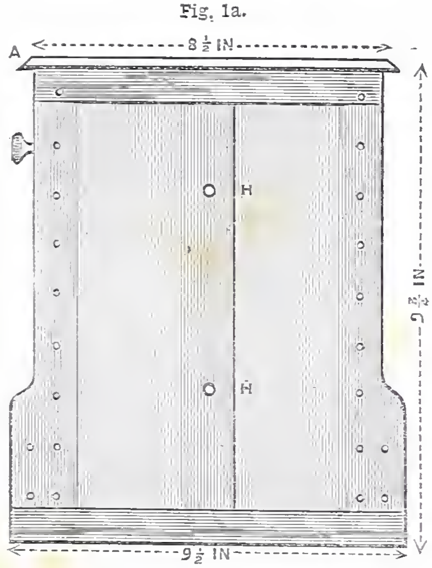
Fig. 1a.


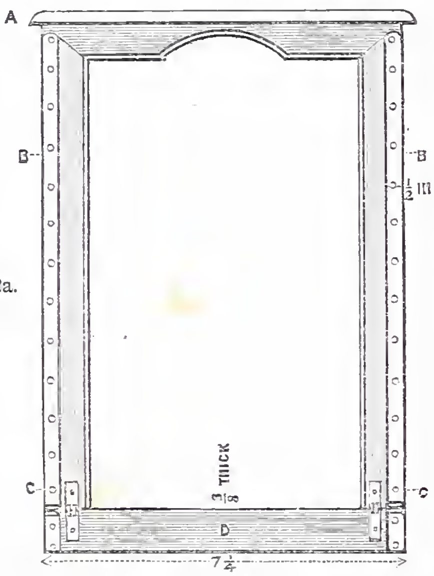
Fig. 2a.


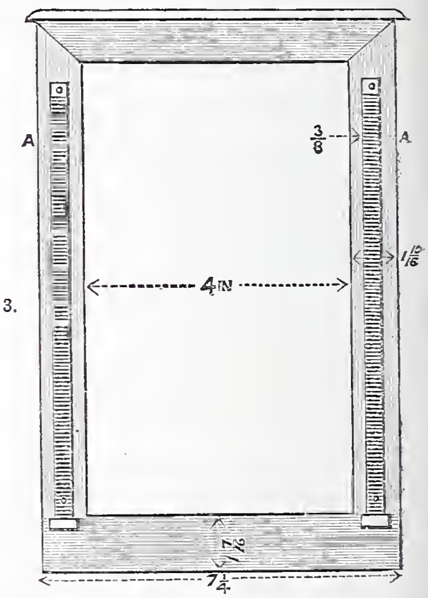
Fig. 3.


Fig. 1.—Camera Complete: Open. Fig. 2.—Camera Closed. Fig. 1a.—Underside of Base Board: A, Cap to Sliding Frame. Fig. 2a.—Sliding Frame of Base Board: Upper Side—A, Cap. Fig. 3.—Underside of Sliding Frame.

Inscription to Figures in page 361.

Fig. 4.—Upper Side of Base Board: A, Section of Base Board. Fig. 5.—Side of Base Board. Fig. 6.—Side of Sliding Frame: Width of Rod $\frac{5}{16}$ in. Fig. 7.—Back Frame of Camera. Fig. 7a.—Brass Strut. Fig. 8.—Reversing Frame and Focussing Screen. Fig. 9.—Side View of Reversing Frame. Fig. 10.—Front of Camera. Fig. 11.—Dividing Screen. Fig. 12.—Camera Bellows Extended. Fig. 13.—Dark Slide. Fig. 14.—Side of Slide. Fig. 15.—Cap of Frame. Fig. 16.—Section of Frame. Fig. 17.—Section of Top Frame of Slide. Fig. 18.—Shutter. Fig. 19.—Fire Screen. N.B.—Measurements in Diagrams are given for Whole-Plate Camera. To make Quarter-Plate Camera take one-fourth of Principal Measurements given.

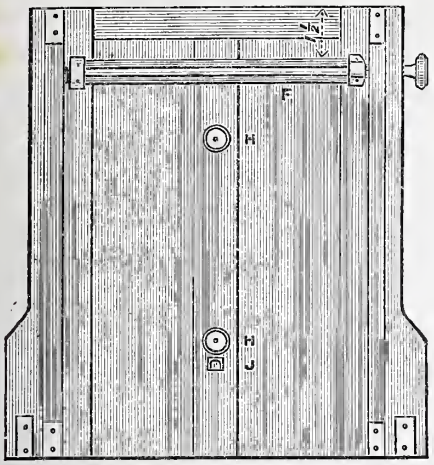
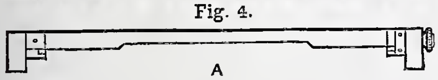


Fig. 4.



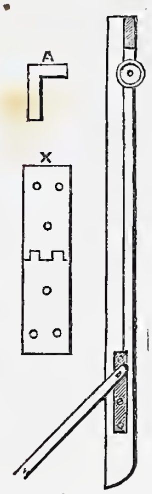


Fig. 5.

Fig. 6.

Fig. 7.

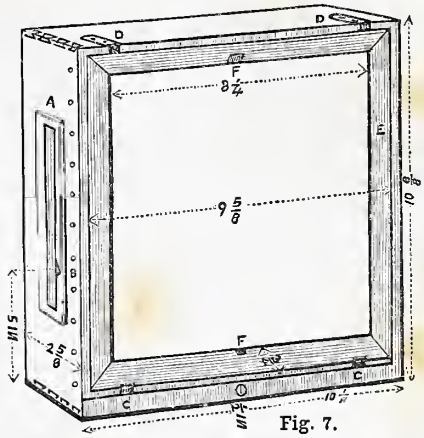


Fig. 7a.

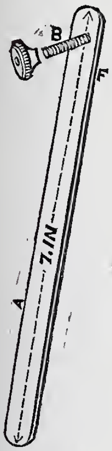


Fig. 8.

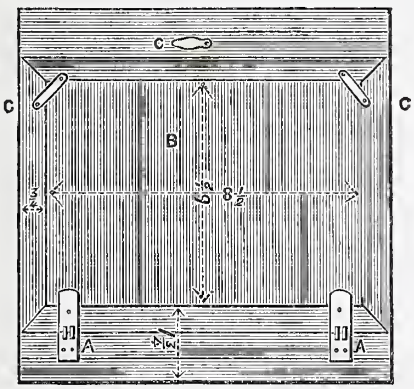


Fig. 9.

Fig. 10.

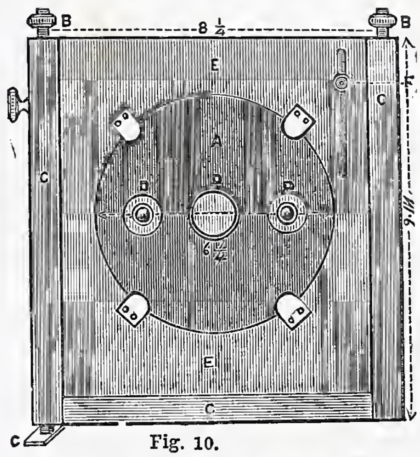


Fig. 11.

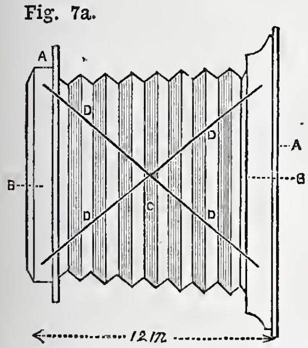


Fig. 12.

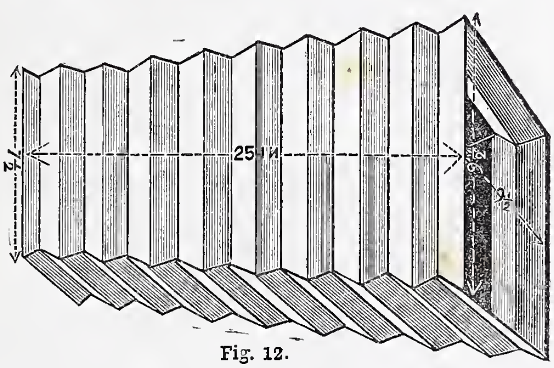


Fig. 13.

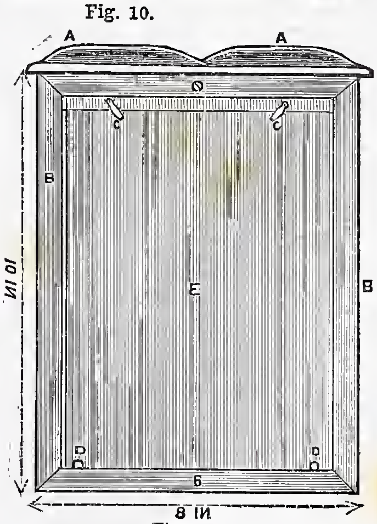


Fig. 14.

Fig. 18.

Fig. 19.

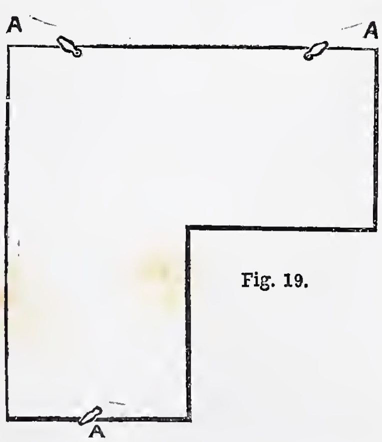


Fig. 15.

Fig. 16.

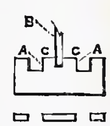


Fig 17.

For Inscriptions to Cuts above, see page 360.

proper; but as the American pattern answers equally well, and is much more easily made, we have selected this as a model, and, personally, prefer it, as being less liable to admit light than where hinges have to be dealt with, or cause imperfections on the plates by the materials used for the hinges—a very common complaint. Fig. 13 represents one of this class of slide. It consists of a frame made of ½ in. wood, B B B, containing two grooves, as shown in section Fig. 16, very carefully mitred at the corners. Fig. 14 will show a side view of the same. The groove at the bottom, Y, is ¼ in. wide, leaving two flanges ⅛ in. each, which will take the position of the focussing screen when in use. Fig. 16 shows a section of the slide; A A are grooves $\frac{1}{12}$th of an inch wide, in which the shutters work, Fig. 13, E. Fig. 15 shows the cap of the frame outside; Fig. 17 a section of the same. It will be seen to be constructed of several pieces, a truer fit being obtained in this way; and it is of vital importance that no light should find entrance. Just below the central bar are two light strips of wood, Fig. 17, E, attached with a strip of any flexible material to the bar above; a small bent wire, F, is passed through the top of the strips, projecting slightly on one side into the groove. The effect of this is, when a shutter is withdrawn, the spring of the wire causes the strip of wood to bar the passage of light from the empty groove, and when it is returned, and the other shutters withdrawn, it closes that side in its turn, thus making an efficient light trap. Inside the grooves, A A, a strip of velvet should be glued, as a further protection from adventitious light. A small L-shaped piece of stout wire, with a thread on one end, should be screwed into the middle bar, Fig. 15, at C, to turn over the end of the caps of the shutters, to prevent them being inadvertently drawn out. A division of wood, Fig. 16, B, ⅛ in. thick, isolates the plates from each other, on which are glued strips of wood $\frac{1}{10}$ in. thick, whereon are fastened two small brass buttons, C C, Fig. 13. Two small pins at the bottom, close to the edge of the shutter groove, D D, provide for the plate being in proper register. The shutter itself may be made of three thicknesses of veneer, one laid opposite way of the grain and sandwiched between the other two to prevent warping, glued and dried under pressure with a capping of wood, as in Fig. 18. The projecting part of the cap is to permit the withdrawal of one shutter without interfering with the other, and is arranged as in Fig. 13. Ebonite may be substituted for veneer, but is rather heavier. The ends of the cap project slightly, in order to cover the groove into which they slide. The measurements given are for a whole-plate camera, as being the most useful of any size. By means of a screen, Fig. 19, made of thin zinc blackened, and one-fourth removed, with small buttons, A, fastened in front of the frame of Fig. 7, any quarter of the plate can be exposed without interfering with the rest. This is useful for lantern slides. To make a quarter-plate camera of this pattern, it is sufficient if the *principal* measurements are one-fourth of those given. Lighter brass work may be used, but ¼ in. wood is sufficiently thin. The circular front is not required, the screw and slot movement being better for raising the front, if a rising front is thought desirable.

In my next paper I shall give an account of the method of making a Tripod Stand, and Stand for Camera in Studio.

BEAKERS, BELL METAL, AND BELTS.

BY GEORGE EDWINSON BONNEY.

BEAKERS—BEER—BEESWAX—BELL METAL BELTS —BENZINE.

Beakers.—These are tumblers made of very thin Bohemian glass for special use in the laboratory, where small quantities of acids and other liquids are employed at high temperatures. Tumblers made of ordinary glass would soon break in pieces, but these thin glass beakers will bear boiling water being poured into them, or will hold acid whilst it is being boiled in them over a gas stove. They are also useful in analysis of solutions, as the clear glass enables the operation of precipitation to be observed whilst the operator holds the beaker away from his face, and thus enables him to avoid breathing the deleterious fumes. Glass beakers are also easily cleaned by rinsing them in clean water. If discoloured, the stains can generally be removed with dilute nitric or hydrochloric acids, or with liquid ammonia. They should always be cleaned and rinsed with clean water after each operation or experiment, and placed upside down on a shelf to drain dry. They are made in sizes to hold from 1 to 40 or more fluid ounces.

Beer.—Stale beer is used as a lubricant for scratch-brushes whilst scratch-brushing electro-plated or electro-gilt articles. Unless this, or a similar lubricant is used, the brass of the brush wire gets worn off as fine dust and becomes embedded in the surface of the plated article, rendering it more or less brassy in appearance. A tea made of marsh mallows, and also weak linseed tea has been recommended to those who may object to the use of stale beer.

Beeswax.—This substance, collected by common bees from flowers, is found to be an excellent material for making moulds on which to electro-deposit copper for electrotypes. Mr. A. Watt says of it: "This is a very useful material for moulding, and may be applied either in the form of virgin or white wax, or the ordinary commercial article—yellow beeswax." Since this substance, however, is very commonly adulterated, it may be useful to know something of its natural characteristics. At the temperature of 32° Fahr. beeswax becomes brittle, at from 80° to 90° it becomes soft and plastic, and it melts at about 155° Fahr. Mr. B. S. Proctor says: "It becomes plastic or kneadable at about 85° Fahr., and its behaviour while worked between the finger and thumb is characteristic. A piece the size of a pea being worked in the hand until tough with the warmth, then placed upon the thumb and forcibly stroked down with the forefinger, curls up, following the finger, and is marked by it with longitudinal streaks." Its ordinary adulterants are resin, farina, mutton suet, and stearine; though more ponderous substances, such as plaster of Paris, have sometimes been detected. White wax is very commonly adulterated with spermaceti, sometimes to the extent of two-thirds of the latter to one of wax. These sophistications, although not necessarily fatal to the preparation of good moulds, are certainly objectionable, inasmuch as it not unfrequently happpens that a wax mould splits or cracks, not alone from cooling too quickly, but owing to the presence of foreign substances which impair its toughness.

Bell Metal.—The bell metal used in gongs is composed of four parts copper to one of tin. This alloy, when first cast, is very brittle, but the casting can be annealed by heating to redness and quenching in cold water. The gong, when turned to form, may then be again heated and allowed to cool slowly, when it recovers its tone and elasticity. Gongs to be plated should be treated as brass, but must not be roughly thrown about, as they are brittle enough to be broken by a sharp blow.

Belts.—Various kinds of belts have been used from time to time for the purpose of driving machinery, but all must yield the palm to leather, for there seems to be "nothing like leather" as a material for driving-belts. As it is most important to have the best belts for driving dynamo machinery, the plater should know something about the choice and care of driving-belts. The best belts of all those I have had to do with are made of raw hide, with seamless joints, manufactured by an American firm, and sold by Messrs, T. C. Andrews and Co., 137, Commercial Street, London, E. The joints are made by cementing the long champfered edges of the leather together under pressure. These are sometimes made stronger with a flat leather lace embedded in the leather. The joints are so neatly made as to present no additional thickness, and very little difference in suppleness, from any other part of the belt. The leather is sent out oiled ready for use, and, therefore the belts will retain their suppleness for many years whilst working in ordinary temperatures. Oiled belts take a better grip on the pulleys than dry belts, and, therefore, need not be run so tight as the latter. This lessens the strain on the grain of the leather and conduces to the long life of the belt. Dry belts are apt to slip on the pulley, and the friction on the leather, caused by slipping, causes it to heat and thus "burns the life" out of the belt. Belts should always present a clammy side to the pulley. In dry situations, such as in an engine-room or hot workshop, the clammy state of the belt should be kept up by giving it a dressing of dubbing and a coat or two of boiled linseed oil at least once a year. Always choose a belt wide enough to do the work without undue tightness. There is economy in using moderately wide belts running slightly slack, as against narrow ones put on as tight as they will bear. Run the flesh side of the leather next the pulley, and the grain side outside, because experience of the both has shown that a belt run this way lasts longer than one run with the grain side next the pulley. It is also the natural bent of the leather. Small belts working light machinery run fairly well with butt joints linked with double tee brass links (Green's patent belt fasteners) inserted in the leather, but these are apt to tear out if the belt has to do heavy work. These joints have the advantage of being easily and quickly made. Sewn lap joints should be used for heavy driving-belts. Laced lap joints with the laps well thinned down and the laceholes punched in diamond-shaped rows do fairly well. All lumps accumulating on the pulleys or the inside faces of the belts should be promptly removed as soon as discovered, as they overstrain the belt and cause jerks in the machinery.

Benzine.—Chemical symbol C_6H_6. This is a thin, limpid, colourless liquid, of agreeable odour found in the light oils obtained by distillation of coal. It boils at a temperature of 176°, and solidifies to a white crystalline mass at 32° Fahr. It is used to free woodcuts and copper plates from printer's ink before they can be copied by the electrotype process.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

77.—The "John Bull" Pocket Gauge.

The handy little waistcoat pocket companion which is distinguished by the appellation of "John Bull" Pocket Gauge presents a number of useful features which should commend it to most, if not all, wood and metal workers, and especially to engineers and machinists. It is said to be "the cheapest, best, and most useful ever offered to the trade, serving three times the purposes of any other." That it serves a multiplicity of purposes may be seen by inspection of the annexed illustration, which clearly shows its form and the various purposes to which it may be put. Its price is 2s. 9d., and on receipt of this amount it will be sent post free to any address in the United Kingdom by the manufacturer, Mr. George H. Bruce, mechanician, 10, Helena Street, Smethwick, near Birmingham. It may be useful to our professional readers to add that agents are wanted everywhere for its introduction and sale, and that for terms of agency a stamp should be sent to Mr. Bruce. It is claimed that it can be used as a rule, a straightedge, a centre gauge, two screw-cutting tool gauges, two squares (inside and outside), two hexagons (inside and outside), and five useful drill and wire gauges. It can further be utilised for setting the tools for screw cutting, and as an angle gauge for grinding the points of drills. The drill and wire gauges, as will be seen from Fig. 1, provide for diameters of $\frac{1}{8}$ in., $\frac{5}{32}$ in., $\frac{3}{16}$ in., $\frac{7}{32}$ in., and $\frac{1}{4}$ in. Its utility as a rule, however, is not sufficiently indicated in the illustration, for in the subdivisions of the 2-in. measure, engraved on its lower member, thirty-seconds, sixteenths, eighths, quarters, and halves of inches are shown, whereas on the gauge itself, sixty-fourths of an inch are indicated as well. As a gauge for squares and hexagons, it may be as well to point out that the angle, A B C, affords the gauge for the outside of a hexagon, and the angle, B C D, for the inside hexagon, or rather for a hexagonal hole cut in any material. In like manner, C D E forms the test or gauge for an inside square, and D E F for an outside square. As a straightedge, the bottom of the appliance or edge just below the graduated 2 in. measure is used. The centre gauge and gauges for screw-cutting will be found in the angular indentations on the right and left hand of the drawing. The gauges are made of fine steel, the greatest care being used in their manufacture, and every gauge sent out is guaranteed to be true. They are, at the same time, strong and durable, although light and small, and they have been introduced by the maker to supply the want of such an appliance that has been long felt in every branch of mechanical inquiry.

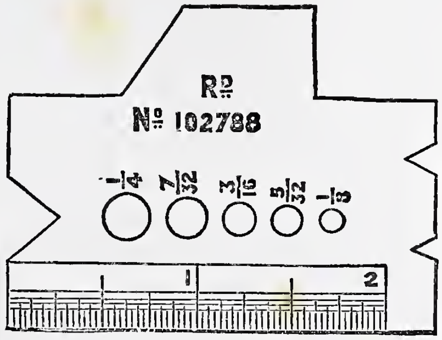


Fig. 1.—The "John Bull" Pocket Gauge.

78.—Patent Potato Raiser.

The Patent Potato Raiser, manufactured by Messrs. Powell Brothers and Whitaker, Wrexham, appears to be a very valuable addition to the agricultural machinery now in use in this country, and although it has not been long in the market it is certainly highly appreciated by farmers who have used it, as affording the means of lifting potatoes from the soil at from one-half to three-fifths the cost incurred by the usual mode of raising the roots by forks, while the potatoes are all cleared and thrown on the surface of the ground without injury in the form of bruises and cuts often caused by bringing the points of the fork into violent contact with them. It may be said that it gained the first prize of the Royal Agricultural Society of England, awarded at Newcastle, October 4th, 1887, when exhibited in competition with other machines of the same class, exhibited by leading manufacturers; the gold medal awarded at the Wirral and Birkenhead Agricultural Show, September 14th and 15th, 1887; and four silver medals in 1888, at the meetings of the Shropshire Agricultural Society, the Cheshire Agricultural Society, the Manchester, Liverpool, and North Lancashire Agricultural Society, and the Altrincham Agricultural Society.

The form and nature of the machine and the mode in which it operates is sufficiently shown in the accompanying illustration (Fig. 2), in which the only thing to which I can take exception is that the seat occupied by the driver apparently proceeds from the left-hand driving wheel, one of those accidents that will sometimes occur in engravings of machinery, but which, in the present case, can be very easily altered in the wood block.

The main part of the machine consists of a heavy strongly-constructed central frame or body, to which all other parts of the machine are attached, from the bars to which the horses that draw it are yoked to the fork wheel and accompanying gear in the rear. Below the body is the axle, on which the driving wheels with their broad tires and projecting points are set, being self-cleansing and adjustable on the axle, so as to suit the width of the ridges, which, as a matter of course, is not in all cases the same. The fork wheel, by which the potatoes are raised from the soil and which enters the soil transversely to the length of the furrow, is flatly conical in shape, so as to admit of the forks being set on it at an angle, thus leaving more soil behind the machine to work with less power than when spread with an ordinary straight wheel, and is less liable to cover the potatoes. It is constructed to work with six, eight, or twelve forks, and is adjustable forwards or back, for heavy or light soil. To the right of the Patent Digger is a revolving wheel or cratch, which turns the potatoes back when thrown against it, thus preventing them from spreading too far, allowing the soil to fall through first, and entirely protecting them against being covered with dust or light earth. This cratch is turned by the force of the soil thrown against it from the fork wheel, which saves the potatoes from being bruised.

The gearing, as the makers explain, is entirely enclosed, and is of improved construction. The speed is gained by spur and bevel wheels, so that the fork spindle is raised above the main axle to give the fork wheel the proper angle, and allows of a large bevel pinion wheel to be keyed firmly on the spindle. The bevel wheel has a bearing on each side, which ensures an easy and perfect running gearing. It is fitted with a pole which entirely prevents the machine from running askew and cutting through the potatoes on one side of the ridge. It is claimed that it is the only machine that can dig one ridge after another without picking all up. A seat, to which I have already alluded, is attached to the pole so that the driver can regulate the depth of the share whilst at work, and to lift it clear from any obstruction without a second lever. It is provided with a simple arrangement to throw it in or out of gear. The machine, it is said, is shorter than any other, can draw out on an ordinary headland, and can raise from three to four acres of potatoes per day. It is made of the best material throughout, and the bearings are fitted with brass bushes and oil cups. Lastly, the share is screwed firmly to the frame, and is without any joint to work loose. The cost of the machine is soon saved on a large farm by the reduction of expenses incurred in raising the tubers by hand.

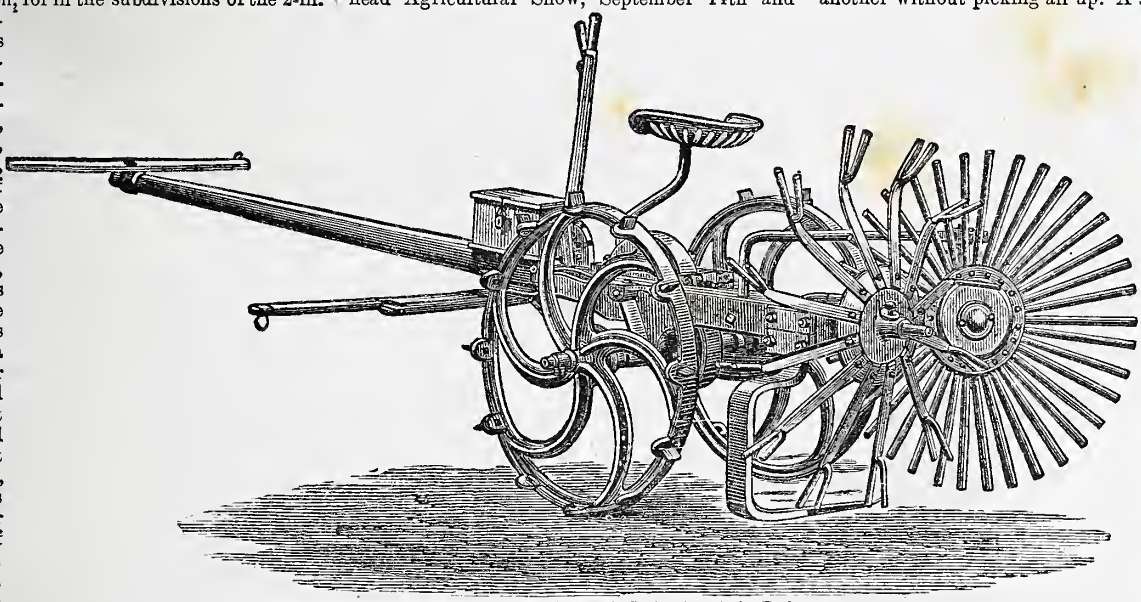


Fig. 2.—Powell Brothers and Whitaker's Patent Potato Raiser.

Whether or no it will ever become popular among English agriculturists remains to be seen; but there is much in it to recommend it to notice.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Artistic Domestic Metal Work. — FITTER (*Huddersfield*) writes:—"Would you be so kind as to let me say a few words in 'Shop?' I have taken all the numbers of WORK, and I am well pleased with it, for it is a great blessing to such as me, and I hope it will long live to do its duty to working men in England and elsewhere, as I am sure it will do, if working men will only appreciate it. Will some reader of WORK be so kind as to give a few papers on making what I call artistic domestic metal work, both for ornament and use. I mean such things as fireirons, fenders, coal-boxes, ribs, kettle stands, iron stands, and toasting machines for toasting bread without holding it in the hand. I have a toasting machine which I have made, and if it will be of any use to you I will give you a description of it. It sold for 6s. at a bazaar, so you may guess it is not a plaything. I cannot make a good drawing of it, but I will do the best I can, as I am not a draughtsman."—[Working men, I am glad to say, do appreciate WORK. There are a few who practically tell me that they could manage and edit it far better than I do, but when I remember that there are those who think they could have fought Waterloo much more judiciously than F.M. the Duke of Wellington, and could have knocked Napoleon into a cocked hat into less than half the time the Duke took over it, I rest content under the animadversions on my own shortcomings. You appreciate WORK at precisely its right value. It is not intended absolutely to teach a workman his trade, but to help him to a better comprehension and appreciation of the work he is doing daily. The young workman and the apprentice cannot fail to learn much from it, and all, whether skilled or unskilled, will be helped to the adoption of a hobby, in the prosecution of which he will certainly find amusement and recreation, and perhaps profit as well, in the approaching future; for I have known many a man begin with the practice of an art or craft as a hobby, and end by becoming a proficient in it, and making a good living out of it. By all means send the description and sketch of your toasting machine. WORK is essentially a working man's paper, and as a working man myself—I may say a hard working man—I wish the thoughts of working men, whether on paper or in the more tangible form of things made and done, to find a place in WORK. I am in thorough sympathy with working men, and I covet nothing better than to be in thorough touch with them.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

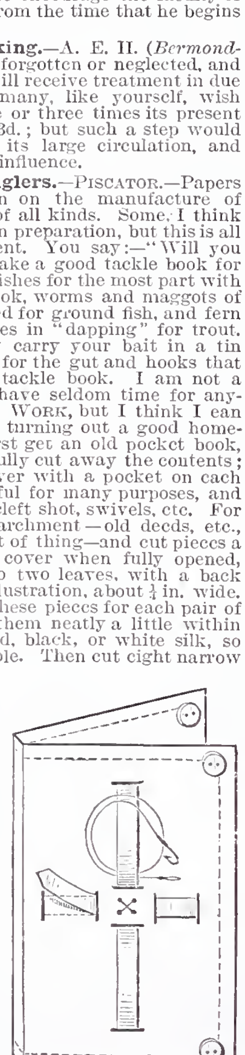
Greenhouse Sashes. —SIGNALMAN (*Southport*).—The best way to find the *exact* sizes of the sashes required for the greenhouse is to erect the framing first and get the sizes from the openings, as any variations in the scantlings of the wood used in the framing will cause an appreciable difference. If, however, the wood is of the sizes given in the description then the sizes of the four side sashes would be—height 3 ft. 8 in., length, 5 ft. 7 in.; the two sashes for the closed end are the same height, and are 3 ft. 7 in. wide; those for the door end are 2 ft. 6 in. If the roof is made as shown in Fig. 9, the sashes are each 5 ft. 10 in. long, and 6 ft. 2 in. wide. The length of the end rafters is 5 ft. 9 in. To get the level of the lower ends draw a square, then draw a line diagonally across it from corner to corner. This gives you the level, which is the angle of 45 degs.; the top ends are square, and dovetailed as described. As to the size of the glass, I would divide the side and roof sashes into five panes, those of the closed end into three, and the door end into two panes respectively. As to the making of the sashes and door, they are mortised and tenoned in the usual manner, detailed instructions for which would occupy several papers. As to the kind of glass, 15 oz. sheet would be sufficient unless you are liable to have heavy hailstorms in your locality, when that in the roof could be 21 oz. The sizes of the triangular sashes in the ends of the house you had better get after the framing is put together. You can then, having got the exact sizes, either draw them down full size on a board, or make a thin wooden mould to fit the openings, from which you can work. All the sashes, with the exception of those of the roof, should be made ¼ in. less than the given sizes. This will save trouble in fitting them, and facilitate their easy removal when taking the house down.—G. L. B.

Stencils.—G. S. (*West Ham*) means the stencil plates used for marking sacks, hop pockets, and such things. I can inform him that I used to cut a great many of them for farmers and hop dealers, and the only tools I used were as follows:—A smooth cast iron plate 12 in. square or larger, a light hammer, three chisels, ⅛ in., $\frac{3}{16}$ in., and ¼ in. in width; a 6 in. half-round file, a 6 in. flat file, and a 4 in. or 5 in. square file. I mark out my letters, taking care to mark the ties that are to be left in; then chop them out, using the narrow chisels for the curves, and the wide for straight lines. I then rap down the burr with a mallet, and file up. The stencils such as used by decorators, &c., are very much thinner, and can be easily cut with a knife. Any ordinary sharp-pointed knife will do, but one with a fixed handle is preferable. Lay the plate on a piece of smooth, hard wood or plate glass; cut slowly, and frequently sharpen your knife. G. S. will see by this that there is no need for any special tools, and anything mentioned here can be got or made at any tool shop, and the price is a mere trifle.—R. A.

Designing.—E. S.—An architect may be a designer, but it by no means follows that designers are architects. You say you are a cabinet maker, serving your time at the trade, and that your "fancy is a little inclined towards designing furniture." Before you can design, you should be able to draw correctly and with ease, and to this end you should attend the school in your neighbourhood where evening lessons are given in drawing, and study to pass the South Kensington examinations and gain your certificates for freehand drawing, geometry, etc. etc. It will be useful to you to obtain and study a work recently published in two volumes, 6s. each, by Messrs. Cassell & Company, Limited, entitled "Hand and Eye Training." In this work it is sought to encourage the faculty of designing in a student from the time that he begins to learn drawing.

Picture Frame Making.—A. E. H. (*Bermondsey*).—No trade will be forgotten or neglected, and picture-frame making will receive treatment in due course. I know that many, like yourself, wish WORK to be made twice or three times its present size, and sold at 2d. or 3d.; but such a step would only tend to diminish its large circulation, and therefore its utility and influence.

Tackle Book for Anglers.—PISCATOR.—Papers will certainly be given on the manufacture of fishing tackle and gear of all kinds. Some, I think I may say, are already in preparation, but this is all I can tell you at present. You say:—"Will you kindly tell me how to make a good tackle book for anglers?" The angler fishes for the most part with a bait impaled on a hook, worms and maggots of various kinds being used for ground fish, and fern webs and bluebottle flies in "dapping" for trout. You must of necessity carry your bait in a tin box or a bottle, and it is for the gut and hooks that you really require the tackle book. I am not a fisherman myself, for I have seldom time for anything else but work and WORK, but I think I can put you in the way of turning out a good home-made tackle book. First get an old pocket book, not too small, and carefully cut away the contents; this will give you a cover with a pocket on each side, which will be useful for many purposes, and the stowage of hooks, cleft shot, swivels, etc. For the leaves get some parchment—old deeds, etc., come handy for this sort of thing—and cut pieces a little smaller than the cover when fully opened, but enough to fold into two leaves, with a back as shown in annexed illustration, about ¼ in. wide. There must be two of these pieces for each pair of leaves. Sew or stitch them neatly a little within the edge, with coloured, black, or white silk, so that the leaves are double. Then cut eight narrow slits through each leaf, as shown, and through the four central slits pass slips of cardboard, or some tougher material, if possible, as drawn, and secure them in the centre by stitching. The ends of slips must be cut to a point, so that each end may be easily passed under the parchment through the slit opposite to that from which it has issued. One slip is shown outside the slit in the illustration to show my meaning clearly. When a slip is released it can be passed through a coil of gut with hooks attached, and then put again through the slit from which it has been withdrawn. A small disc of cork, rather less than ⅛ in. in thickness, should be sewn to the outer corners of each leaf to keep the leaves fairly apart. The leaves should then be sewn into the pocket-book cover along each crease that has been folded to form the back.



Celluloid.—J. P. (*Glasgow*).—The British Xylonite Company, Limited, 124, High Street, Homerton, London, E., are makers of this.—P. W. S.

Safes and Safe Doors. — F. G. (*Brighton*). — Thanks for the extract you forwarded.—ED.

Designs of Drawings.—G. C. (*Drayton Park*).—By all means let me see the designs you wish to submit.—ED.

Glass Printing.—C. D. (*Bethnal Green*).—You cannot patent an idea; but you can patent a process or a machine required to carry one out. You should in your case consult a patent agent.—F. C.

Shell Rabbit. — A. S. (*Euston Road*). — The specimens of shell rabbit that you send have been recently offered for sale in the streets of London at 1d. each, and are curious from their marked resemblance at a little distance to the animal they are intended to imitate. The shell forms the body of the whelk, cleansed, probably by the application of a little hydrochloric acid. The head and fore feet—there is no tail other than that supplied by the lower end of the shell—are made, I should say, of putty, to which white lead has been added in order to make it harden quickly. The material is applied to the point of the shell, and moulded to the shape of a rabbit's head by the fingers, for on one side of the head of one of the specimens sent you can see distinctly the impression left by the ridge-and-furrow skin of the thumb. If you look at the inner side of the top joint of your own thumb you will see what I mean. The ears are first pinched up into one long point, which is divided by a knife, the blade being turned first one way and then the other to make the ears slope outwards. This, as far as I can determine, covers the manufacture of the shell rabbit in every particular. The fore feet are merely two little dabs of the same material rounded off in front; they serve to keep the shell steady, and prevent it from rolling about.

Burnishers for Brass.—A. R. (*Edinburgh*).—A file with the teeth ground out and polished makes as good a burnisher as anything, or good tool steel will answer the purpose equally well. Beer is a good liquor, or water with a little vinegar.—J.

Papier-Mâché.—R. W. (*Manchester*) omits to name the precise purpose for which he wishes to prepare his papier-mâché, which makes it less easy to advise with precision. There are various ways in which paper may be made to resist water and insects. Pasted papier-mâché can, of course, be made bent to any angle. The thorough saturation with linseed oil which it undergoes gives it great water-resisting power, and various coatings may be given it—the solution of gutta-percha in naphtha with a little shellac, recently recommended to BOFIN (page 301), would be a good one. Or, a mixture of paper dust and black japan might be made, which would have the desired qualities, and might be bent whilst yet soft. With regard to procuring papier-mâché pulp in large quantities, R. W. is referred to Messrs. McCallum & Hodgson, Summer Row, Birmingham.—S. W.

Wood Carving in the Round.—MAC O'RONEY (*Nairn*). — Plaster casts will be found the most available patterns from which to carve in the round, as practice for a beginner; and these are to be bought in most towns, though perhaps the largest and best stock in Great Britain is at Brucchiani's, Russell Street, Covent Garden, London. But M. O'R. is strongly advised to practice modelling in clay as a means of making prints and photographs available for his purpose, and still more as a means of embodying any designs of his own, which he may wish eventually to carve in wood. He will shortly be able to learn all about modelling from WORK.—M. M.

Coating Bare Places in Covered Wire.—V. R. (*Liverpool*). — The bare places in your 24 silk-covered wire may be coated with india-rubber cement; but I should prefer covering them with silk. Get some soft silk (floss, tram, or woven silk will be best), never mind the colour, providing it will lie close to the wire. (Sewing silk is too hard and wiry, and will not cover well.) Fix the wire firmly on both sides of the bared spot, and then wind the silk around it, taking the thread of silk direct from the reel, and passing this round and round the wire until covered. Then rub a piece of paraffin wax all over the newly-covered spot for the double purpose of fixing the loose ends, and making sure of the insulation.—G. E. B.

Batteries for Electric Lighting.—NEW BEGINNER (*Manchester*).—Very little in the way of electric lighting can be done by means of primary batteries—that is, electric batteries which have to be charged with acid to produce a current of electricity. The lamp and battery you saw in a shop at Manchester was, probably, a four-cell chromic acid battery supplying current to a five-candle power lamp. The light from this when compared with that from a No. 3 gas burner, or the light of a shilling paraffin lamp, is a mere glimmer. You would require four such lamps to light a moderate-sized room in a private house. Such lamps do fairly well as attractive advertisements for shop windows, or glimmer lamps for small rooms on summer evenings. It will take at least 5-quart Bunsen cells to properly light up a 5 c.p. lamp, and the cells will require fresh charges of acid every nine or ten hours. I will try to go thoroughly into this subject soon, and give the results to the readers of WORK in a separate article.—G. E. B.

Tinning Iron Wire.—H. G. (*Liverpool*).—The proper way to secure an even coating of tin is by drawing the wire as it comes from the tinning bath through a burnished steel die fixed near the bath, and kept warm by an atmospheric gas jet burning beneath it. The die being exactly gauged so that the wire only just passes through, insures an even coating, and being burnished gives it a polish. The winding arrangement should be far enough away to allow the wire to cool after leaving the die, the hole in the dye is rounded off so as not to cut the wire. I expect that H. G. would hardly think it worth his while to go to the expense of a steel die, so I will first suggest something that I think will answer very well, at any rate far better than the corks. Take a 1 in. gas socket and two plugs for same; drill a hole through each side of the socket, say ⅜ of an inch diameter, or larger, file off the rough hurr on the inside, and trim up the outside a bit smooth, in case the wire should rub against it; screw one of the plugs into the socket, about two threads only, then hold the socket in a vice by means of the square on the plug, and pack it tightly with good tow or finely dressed hemp. When packed as tight as you can get it, screw in the other plug a few threads, and the bottom one a little more, then draw your wire through this instead of the corks. You might use two of these arrangements, if so, I should grease all the packing of the first one with tallow. I think this plan will answer every purpose, and shall be glad to know if it is of service to you.—P.S. The top plug is to adjust the pressure on the packing, as you find it necessary.—L. L.

Printing.—T. S. B. (*Shrewsbury*).—Blanket, fine cloth, linen, thin oilcloth, glazed hoard, or paper, may he used for covering the cylinder of a printing machine, and each possesses advantages (or disadvantages) according to the materials to be dealt with and the quality of work to he produced. For rough work, newspapers or broadsides, or where the type is old, it is advisable to use a blanket; but if good work is required, the harder the cylinder is packed the better will he the effect, in the hands of a skilled workman.—J. F. W.

Laying on Picture Frame Gold.—Jumbo (*York*).—Proceed as in answer to B. N. (see page 333), and when thoroughly dry with a camel hair brush, apply good mastic varnish with care, that no dust gets upon it during drying; probably cost 7s. 6d., if you do not waste the gold, and you have all the tools.—G. R.

Gladstone Bags.—Jumbo (*York*).—I have done the same myself, and found best Berlin black evenly laid on with a good painter's sash tool renovate them well; but if you also give it a couple of coats of French polish, and good vegetable black well mixed, this answers admirably.—G. R.

Book-case.—Alpha and P. M. M. (*Epsom*).—You will have noticed that a good form of bookcase was given in No. 15, page 231. Others will follow.

Index to Work.—P. M. M. (*Epsom*).—Indexes will he furnished for Work. I agree with you when you say:—"I think no one intending to buy the Magazine would object to pay for an index if you thought well to issue one."

Photographic Exposure Tables.—W. P. J. (*Aberystwith*).—I shall he very happy to see your tables, as of course till I have had an opportunity of testing them no definite opinion can be expressed. Glad to hear you like Work.

Bookcases.—S. A. (*Homerton*).—In No. 15 of Work you will find some instructions on bookshelves, which will, no doubt, be useful to you. An article in the artistic furniture series of papers will also shortly appear, describing the construction of a bookcase. As the design for this is for an "enclosed bookcase"—*i.e.*, one with cupboards, it is probably just what you want.—D. A.

Bureau Bedstead.—H. G.—An article describing and illustrating the construction of a cupboard bedstead, will appear very shortly. You will find it very useful.—D. A.

Stand for Overmantel.—C. S. (*Brighton*).—The overmantel, when supported in the way you propose for yours, will virtually form the hack or upper portion of a cabinet. An article descriptive of a cabinet is in the list of subjects to be treated in the series "Artistic Furniture," of which the overmantel was the first. Thanks for good wishes.—D. A.

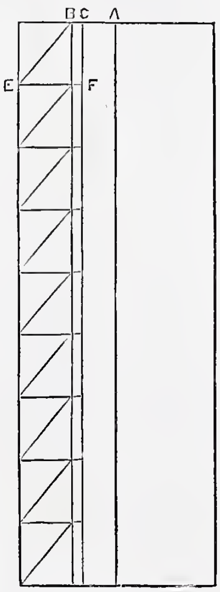
Model Beam Engine.—A. Y. (*Leeds*).—As your engine is only 2 in. stroke by 1½ in. bore, I should not advise you to try to make it condensing. You might do so no doubt, but a little engine of this size ought to run fast, and pumps will not work well unless they go slowly. A turbine runs fast because the water runs through continuously; but in an ordinary pump the water has to be set in motion and brought to rest at every stroke. Take a glass syringe, and, putting the spout in water, draw up the plunger suddenly. You will see the water does not follow immediately, but seems to think about it, and then comes unwillingly, only half filling the barrel. Draw up slowly, and you get the barrel full. Draw up suddenly, and as suddenly press down the piston, and you get no water at all, because the piston comes down before the water has had time to move. You will gain no power by adding a condenser to such a little thing, because all the power gained by the vacuum will be expended in working the air-pump. If you must have a working model condensing engine, have a cylinder 4 in. by 2 in., use a fly-wheel of large diameter, and don't let it run over about sixty revolutions per minute. You could probably make your engine of type metal. I have seen one made so, but I would not expend trouble on such material. I strongly advise you to make a high pressure engine first, of a useful size, and leave the condenser for the present.—F. A. M.

Bamboo Furniture.—E. L. (*Portland Place*).—Yes, articles on this interesting subject have been arranged for, and will appear in due course. Mr. Fred] Westhury, 183, Great Dover Street, holds the largest and best stock of bamhoos suitable for your purpose. You can obtain any quantity from him, but of course you cannot expect wholesale prices for small quantities. Owing to the enormous circulation of Work, we go to press very nearly three weeks before publication.—D. A.

Work Bench.—D. B. (*Perth*).—Yes, the subject will be treated, and in due course. I hope to place before readers of Work designs and instructions for making a bench, both to contain tools and work at. Meanwhile, it may interest you to know that an article describing the construction of a small folding bench is in hand. Your scoldings for destroying the kitchen table may speedily be stopped by your putting a board on top of it, in other words, have a wood cover, and work on it.—D. A.

Polishing Bookcase.—Amateur (*Openshaw*).—You will find it easy to stain your bookcase a mahogany colour; but being inexperienced in staining it is very doubtful if you would be able to match the colour to that of the existing furniture. If you are inclined to try you must first stain and then polish. I hardly think it would be worth your while to French polish, and probably you would get a better result by varnishing. Between staining and polishing or varnishing apply a coat of size. If you decide on French polishing proceed in the usual way.—D. A.

Step Flashing.—A. B. (*Barking*).—To set this out proceed as follows:—Cut your stuff the length required, the width will depend upon how much is to lap on the slates. See sketch, which shows the marking out of a piece 3 ft. long 12 in. wide; draw line, A, down the centre, draw a second line, B, 2½ in. from A, and a third line between the two ½ in. from B. Now obtain the bevel of the roof—that is, the angle formed by the two sides of the roof; take a rule and lay one arm edgeways on the slates, bend the other till it comes parallel with the joints in the brickwork. This will give you the bevel to mark off the flashing with. Before marking these, however, set off lines, E F, from the edge of the stuff to line C, 4 in. apart. The joints in brickwork are 3 in. from top of brick to top of brick; but the flashing laying in a slanting direction, requires to be marked an inch more—that is, supposing the roof is a square mitre, or 90 degrees of angle. Now lay the bevel on line B, and mark off the diagonal lines; now cut the straight lines as far as line C, and the diagonal ones only as far as B. This gives ½ an inch to turn back into the joints. I presume A. B. knows how to fix, and trust this will give him the information he wants. If not clear on the subject, write again.—R. A.



Mahogany Top.—T. R. H. (*Birmingham*).—No doubt the sweating, as it is technically called, of your table is owing to your having used too much oil. You seem to have saturated the wood with this. Only a small quantity of oil is required well rubbed in. In fact as you seem to have an idea that a large quantity is needed perhaps the best way of conveying to you what is wanted is to say that rubbing with an oiled rag is almost sufficient. This, you will see, is very different from a good coat of oil every night for a week, by which one may infer that the wood has been saturated. You must have misunderstood your French polishing friend, as no practical polisher would recommend such a procedure as you have adopted. All you can do now is to let the oil sweat out, and if you keep on rubbing with a dry rag daily you will soon have a good surface, which though not so brilliant as French polish will withstand heat from plates, dishes, etc. The more you rub the better the polish, and you will not require to use wax polish, as by the time your table is done it will be "oil" polished, and quite as brilliant as if you had used wax. Work is seldom oiled before waxing. A simple refrigerator will appear in "Shop" very shortly. Much obliged by your kindly remarks about the articles by Opifex, and your good wishes for Work.—D. A.

Saw Belts Slipping.—"A Reader" (*Skipton*).—As a temporary expedient, a little powdered resin will assist the adhesion of a belt. But belts are very apt to slip on circular saw pulleys, hecause the pulleys being small, the arc of the circle embraced by the belt is small. Hence they require frequent tightening. Do not let the belts become dry, but preserve their suppleness with castor oil. Belts inclined or horizontal drive better than vertical ones. Long belts drive better than short ones, and short ones require to be tighter than long ones. Short belts are a mistake. As a last resource, use a leather-covered pulley, or employ a hinder or tightening pulley to the slack side of the belt.—J.

Dulcimer for Home Use.—"Musician" (*Dublin*).—An experienced hand is preparing an article on Dulcimers for the readers of Work.

Dulcimer.—T. C. B. (*Birmingham*).—Kindly read the above, which answers the questions you are good enough to put.

Prints Transferred to Wood.—J. G. (*Manchester*).—Without precise knowledge of the nature of the process used to produce the prints you mention, I should say, as far as my experience of lithographic and copperplate printing goes, that it would be quite possible to print them upon wood from stone from transfers previously made from copper plates. The wood (sycamore or maple) having been procured of an even thinness throughout, and also planed very smoothly, the scraper of the lithographic press should be set to suit the substance of the wood, and in pulling the impression the putting down and lifting up of the lever should be carefully manipulated to obviate breaking the stone. Articles hearing views of the particular locality are best known at the more frequented seaside resorts, where they furnish an inducement for the unlucky visitor to part with his spare cash in the purchase of them as mementoes or presents for his womankind. Imitations also are sold, which are simply prints mounted upon wood and varnished, and for most purposes they are as good as the real thing. If you do not possess a lithographic press, perhaps you may appreciate the counterfeit as quite within the limit of your powers.—J. H. M.

Cylinder to Geneva Watch, etc.—Watchmaker (*Stoke*).—To put in a cylinder see instructions given to Country Watchjobber, on page 302: tools required, a pair of turns, conical pivot file and burnisher, graver, and gauges, bow and ferrule, wax for ferrules, half resin and half beeswax. To solder, make a close fitting and clean joint, use very little solder, and use powdered borax for flux for all hard soldering joints; boil out or let it stand a time in a solution of sulphuric acid, 1 part to 19 parts of water, then polish off. To make silver solder, melt together 2 parts silver and 1 part brass wire; or a very easy-running solder, but not so strong, may be made from equal parts of silver and tin, melt the silver first. Gold solder, 18 carat gold, 12 parts; silver, 2 parts; brass wire, 1 part; for lower qualities of gold articles use the same standard as the article to be soldered, adding the same proportion of silver and brass. I should strongly recommend all watch and clock jobbers, professional or amateur, to get "Britten's Watch and Clock Maker's Handbook, Dictionary, and Guide," price 5s., containing 384 pages of useful matter relating to nearly everything in the trade, with a host of illustrations of tools, etc.—A. B. C.

Bookbinding.—J. T. H. (*Inverness*).—Papers on bookbinding in the orthodox way will appear shortly, and from these you will learn how to make the nice round back and straight edge that we see on all books, from the professional binder.

Wire-thread Fret Saw.—J. T. H. (*Inverness*).—I can only repeat that the wire-thread fret saw is not yet on sale in this country. As soon as it is so I shall be told of it, and will mention the fact in "Shop."

Bird Stuffing, etc.—W. T. (*Maybole*).—Taxidermy will not be forgotten, but I can say no more than this at present.

Kaleidoscope.—Pica (*Old Brompton*).—The first part of the description of the new kaleidoscope is in my hands, and will soon see the light.

Parkesine.—J. B. (*Oxon*).—Parkesine, xylonite, or celluloid are identical, and are made from nitrocellulose [$C_{12}H_{14}O_4(NO_3)_6$], more commonly known as pyroxiline or "gun cotton," which is cotton or other celluloid substance treated with nitro-sulphuric acid which renders it soluble in various chemical agents, such as alcohol and other hydrocarbons with or without camphor oils, and in some cases, gums and resins. This interesting substance was discovered by Mr. Alexander Parkes, of Birmingham, who, more than forty years ago, being impressed with the necessity for the introduction of a substance to take the place of certain natural productions, such as ivory, tortoiseshell, etc., set himself to discovery such a substitute, and with this end in view, made many thousands of experiments, till at length his ardent search was rewarded by the "epoch-making" discovery that by combining gun cotton with various other substances he could produce such an article as he had heen so long in quest of. In 1855 Parkes took out the first patent, but being at that time engaged with the firm of Elkington, Mason, & Co., he was unable to give his unremitting attention to the subject, and so it was not till the London Exhibition of 1862 that he succeeded in gaining much attention to his product. Though the specimens there exhibited were made in a rough manner by himself without the suitable appliance used in the various trades, he received the silver medal. By the time, however, of the Paris Exhibition, 1867, the matter had made such progress that his exhibit was judged one of the most remarkable specialities shown. Up to this time no name had been given to the new product, and in honour of the invention one of the French papers called it "Parkesine." On his return the Parkesine Company, Limited, was formed, into which the inventor threw his patents and took common lot with the other shareholders. The speculation was not, however, a financial success; and its collapse left poor Parkes minus his outlay of money and his patent rights, and with nothing but the medals he had gained in London and Paris, and the satisfaction of knowing that he had been the discoverer of what is admittedly one of the most important substances applicable to the arts and manufactures ever discovered. A second company followed the first; and this latter was succeeded by the present British Xylonite Company in England, while the Celluloid Company flourishes in America. About ten years ago, Mr. Henry Parkes, who has been associated with his brother in most of the latter's inventions, took out some important patents, and founded at Birmingham the "British Celluloid Company," but I am not informed as to its success or otherwise. Of course, the details of the manufacture vary according to the purpose to which the product is to be applied, and by proper manipulation (mainly by variation of the solvent used and any amount of pressure applied) any required degree of hardness or flexibility can be secured. It can be made, for instance, as hard as ivory, or in so soft a condition as to be capable of being spread in layers over textile fabrics, much in the same way as paint is used. The product is waterproof, acid-proof, and airproof, and may be made, if not fire-proof, at least, non-inflammable. It can be worked in the liquid, plastic, or solid state. It can be pressed and stamped, planed, turned, sawn, carved, woven into fabrics, and, as first seen, applied as a varnish. It can be made transparent or opaque, and of any desired colour. I shall be glad to send any further information at my command on learning your precise requirements; but I have no doubt a letter addressed Messrs. Alexander and Henry Parkes, Inventors of Celluloid, Birmingham, would reach the inventor himself, who would be able to advise you fully.—R. W. S.

Enlarging Camera.—F. C. (*Trefechan*).—I do not know what process you refer to. There are many ways of making crayon enlargements, the easiest of which is to make an enlargement on bromide paper, and work it up with crayons. This process is mostly worked in black or sepia; but if you want to use coloured crayons, then you must develop the image faintly on the paper, so that the black tone may not spoil the colouring. Of course, it requires considerable artistic skill to work up a crayon enlargement and keep the likeness; and, unless you possess such skill, the result of your labours will be disappointment. If you care to try the experiment, you can make an enlargement on Eastman's A paper, develop well out, then soak in castor oil until quite transparent, and colour from behind as in crystoleum. Use oil colours. A very good effect can be got this way with care. The lens you mention would do quite as well for enlarging from $\frac{1}{4}$-plate negatives.—G. Le B.

Advertisement Pages.—GRAHAM (*Perth*).—Kindly see reply to AD FINEM, in No. 16, page 253.

Pump and Pressure Gauge for Model Engine.—W. N. (*Birmingham*).—If the boiler of your engine is only 7 in. long by 3 in. diameter, the feed pump will be very tiny, and will very likely cost you as much trouble as to make the whole engine. You might make it $\frac{1}{4}$ in. diameter and $\frac{1}{4}$ in. stroke. I once had one, that worked, of $\frac{1}{4}$ in. diameter and about $\frac{1}{4}$ in. stroke. It is useless to "fiddle" over such a little thing, nevertheless I send a sketch of mine used with a 1-in. cylinder, 2-in. stroke. Fig. 1: A is the body, screwed and then

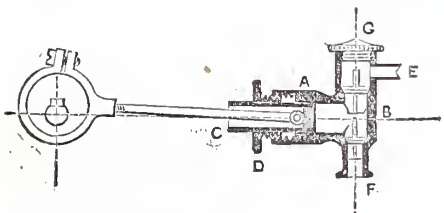


Fig. 1.—Force Pump and Eccentric for Model Engine.

soft soldered into B, the valve-box; C, the plunger, with an eye—the eccentric rod is first fitted, and then the eye is soldered in; D, the gland with milled rim, for screwing up with fingers; E, the delivery pipe, is also screwed and soldered in; F is the suction, and receives an india-rubber tube; G is the cap screwed down on a bit of soft thread: it also acts as a pet cock when slightly released to let out air. The valve-box is drilled first, with three sizes of drills, the middle size being not less than the diameter of plunger; then make the small valve on the end of a bit of brass rod, so that you can push it up the hole and grind it to its seat while the box is running in the lathe. The guide under the valve must fit the hole of F so as to keep it straight, and when ground, it is to be filed with three sides, to form passages for the water. Then turn the little stem above the valve and cut it off. Now fit the upper valve in the same way, making the guide come within $\frac{1}{32}$ in. of the top of the lower valve, so as to limit its lift. It should lift about one-eighth its diameter. Similarly the cap screws down to within about $\frac{1}{32}$ in. of the upper valve. The most important thing in these little pumps, as in large ones, is to leave no pocket for air inside. Put the delivery valve on the highest point, then the air will be driven out first. I have seen many sections of feed-pumps in different papers I feel convinced would give endless trouble, if they worked at all. When you have made this pump, make a $1\frac{1}{2}$-in. cylinder-engine and apply it to that. It will keep it well supplied. You ask, secondly, how to make a steam gauge. Models of the size of yours are not usually furnished with one, and it would be difficult to make one small enough of the ordinary description, and if you could succeed it would probably be worth two or three times as much as the boiler! Fig. 2 shows a kind of steam gauge I made with some bits of $\frac{1}{8}$-in. glass tube, a very little mercury, and a bed-room candle, when a boy of seventeen. A, the tube, held in the candle and gradually bent as seen; the upper end was sealed with a blowpipe made with another bit of tube, partly closed by being held in the flame. The bent end is slightly enlarged to take a short length of india-rubber tubing, which will do to make the connection at low pressures, especially as you can easily renew it if it swells. B is a bit of board to which tube is wired, and on which divisions are marked. A very small quantity of mercury is introduced, as shown; by warming the tube and then holding the mouth in the mercury you can make it suck it in. When the mercury stands at a convenient height, C C, make the mark C on the board after first making sure the tube is cool; then mark at D the end of the hole in the tube. Now C represents atmospheric pressure, say 15 lbs. above vacuum. Halve C, D, and you get E, which will be 30 lbs. from vacuum, or 15 lbs. per square inch. Probably that is as much as your boiler should carry, but you can continue the subdivision, halving E, D at F, and marking there 30 lbs. above the atmosphere, etc., etc.—F. A. M.

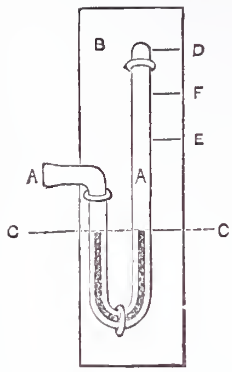


Fig. 2.—Mercurial Steam Gauge for Model Engine.

Damp Floor in Fowl House.—T. G. L.—Fowl houses will be dealt with if opportunity offers, and the subject is in demand. It is a difficult matter to determine, without seeing the place, why the floor of your house is always damp, although the roof is perfectly water-tight. Perhaps as good a plan as any to overcome this drawback would be to dig out the earth to the depth of 12 in. or 18 in., and fill up with brick-bats and coarse gravel, with fine gravel and cinder ashes on the top. This would afford means of drainage if the soil is naturally damp. Give your fowls plenty of old lime if you can get it. Calcined oyster shells, beaten to fragments, and sand, especially sea sand, are also useful.

Basket Making.—J. T. H. (*Inverness*).—Yes, instructions will be given on basket making; but I have not yet succeeded in getting hold of a literary basket maker who can write on his trade.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Insurance of Workman's Tools.—J. K. (*Oxford*) writes:—"I am writing to ask you whether you could tell me (a journeyman cabinet maker), or find out through WORK, if there is an insurance office anywhere to insure tools kept at a workshop. I have tried to insure my tools in other offices, but have failed. I hope this is not out of the range of your column for 'Shop.'"

Tools.—G. P. (*Edgeley*) writes:—"AN AMATEUR would be glad to be advised what tools (carpentering) to get to commence, so as not to get too many, nor go to great expense, and where best can be got at lowest cost—say, for building greenhouse, etc."

Moulders' Pattern Making Tools.—E. R. (*Halifax*) would be glad if some reader would, through the agency of your paper, WORK, give him a list of tools that are used, and the cost of each, in moulders' pattern making.

Walking Stick.—G. W. M. (*Westbourne Park*) writes:—"Can any reader of WORK give me the name of a London turner who would supply me with a lignum vitæ walking stick?"

Blue Prints.—PHOTO (*Chester*) writes:—"I have been much pleased with the instructions for preparing the sensitised paper for taking blue prints, and have succeeded in taking some fine copies. There is, I believe, a process for taking copies of engineering tracings, giving a black line on a white ground, the bath being gallic acid. Would any reader of WORK kindly give me the mixture and the proportion for preparing the sensitised paper for this process?"

Finishing Brass.—S. H. D. (*Newtown*) writes:—"Could any brother reader of this valuable paper inform me as to what method is pursued to put that finish on brasswork so that when it is handled it does not tarnish?"

Removing Ink Stains.—LITTLETON (*Worcester*) writes:—"Will a reader kindly say how best to remove ink stains?"

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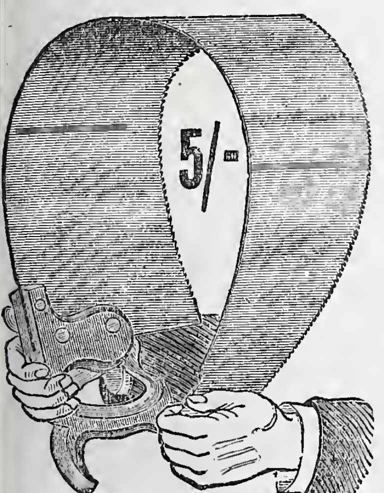

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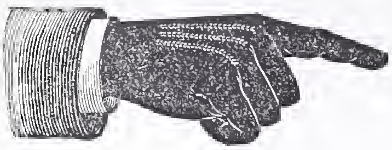

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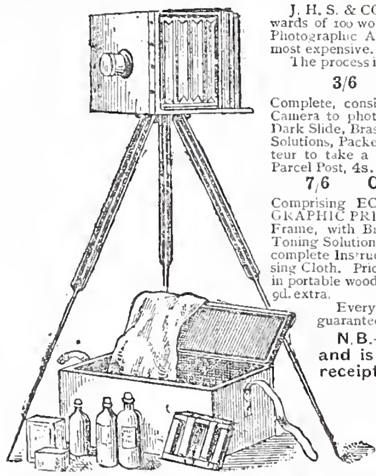

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BY FRED MILLER.

I WILL commence by stating that the accompanying design is a free adaptation of a very good and well-preserved specimen of a seventeenth-century mirror frame, that is well worth the attention of all skilled wood carvers, whether professional or amateur.

Work of this character, it should be said, is difficult, and should only be attempted by those who have passed the initiatory stage. The "carving" must be executed with precision and crispness, and, at the same time, there must be a freedom and springing quality about it, in order to give the sensation of the lines flowing from a common centre and being continuous throughout. Broken-backed curves and disconnected lines ruin the entire effect. If you examine good specimens (and almost all specimens are good) of seventeenth-century Italian carving, you will see what I mean by continuity. One can imagine the craftsman taking a soft, yielding material, and by dexterously guiding his tools, executing the long flowing curves that make up the design in a few sweeps of his gouge. *This* effect we know is obtained by time and labour, and yet when we look at the finished work we should feel that it was wrought in the first freshness of the day, when the nerves are vibrating and the energy is elastic. There should be no feeling of labour about wood carving. Merely the result of infinite pains and a cycle of days depresses one; and though good work requires both patience and time, you should get that nervousness into your carving which makes one feel that the work was wrought in a happy moment, when the interest is undiminished and the hand unwearied.

What has this, I can imagine some one saying, to do with wood carving—this transcendentalism? Everything, I reply: for it is the *spirit* in which you executed your work that gives it its feeling, gives it life. The letter only it is which kills. And so much modern wood carving is wholly deficient in *esprit*. It is commonplace and mechanical in execution if not in design, and depresses rather than exhilarates the beholder. It might have been turned out by a machine instead of executed by the hand of the cunning worker. Therefore, before putting in hand such a work as that figured, charge yourself with feeling, and let the artist triumph over the mechanic.

If the work is for gilding, good pine will do to execute the design in. But if the wood is to show the American walnut, oak or mahogany is better. The thickness of the wood depends upon the amount of "undercutting" you intend to put into your work. This class of design does not look well in too low relief. The effect is largely due to the different planes (or depths) in the work, and the back scrolls that support the front ones should be, say, $1\frac{1}{2}$ in. thick, and allowing for the parts in highest relief the wood ought to be about 3 in. to $3\frac{1}{2}$ in. thick. Two pieces $1\frac{1}{2}$ in. thick when planed might be glued together, the lower piece for the back scrolls and the oval frame itself, and the upper piece for the work in highest relief.

Mirror Frame in Carved Wood. Example of Italian Renaissance, Seventeenth Century.

Make a careful enlargement of the design as far as the main lines go (for it would serve no practical purpose to indicate much undercutting), and paste this down on the wood; be careful to strike the oval correctly. The wood should first of all be pierced, and if your design is accurately enlarged, it might be worth going to the expense (not a considerable one) of having this done by a steam fret cutter. By piercing the design you are helped in the execution of the work, as it gives you a clear idea of the general scheme. The outside or outline of the design should also be cut round; now "ground out" to the depth of the back scrolls. If you have glued two pieces together, this will be to the depth of the upper piece. This gives you a very fair idea of the "masses" of the design. But so far the difficulties have been purely mechanical. The real difficulties begin with the carving itself, and about this little that is helpful can be said in writing. This is so largely a matter of feeling. I have endeavoured to indicate by light and shade the general disposition of the principal curves, and your own intelligence and artistic perception must do the rest.

The scrolls resting on the oval frame should be, say, ½ in. deeper than the frame itself, that is the full depth of the wood through where two pieces are glued together. I said the lower piece should be for the frame and back scrolls. But where the wood is solid the oval frame itself might be 2 in. in depth, the back scrolls 1½ in., and the foremost ones the full depth, 3 in. This gives you three planes, and you can introduce subtler gradations as the work progresses, so that one plane looses itself or sinks into the one below it, for it should not be apparent how many planes there are. The completed work should have subtle qualities if it is to be worthy the notice of the readers of this paper.

A few visits to the South Kensington Museum during the progress of the mirror frame would materially help one, as there is a good collection of wood carving there, and one can always get help and inspiration from looking at good work.

HOME-MADE POLISHING WHEELS, ETC.

BY OPIFEX.

EMERY wheels of various sizes and degrees of cutting power are almost indispensable to a well-stocked workshop, and, as they are rather expensive articles to buy, it may prove a boon to many amateurs to know that it is quite possible to make very serviceable wheels oneself. Besides, there is the pleasure of making them, and the satisfaction which every genuine mechanic (I mean amateur genuine mechanic, not genuine amateur) feels at having supplied his own wants. Many amateurs who live near a good tool shop, and are possessed of plenty of means, have their workshops crammed with everything that the heart of workman can desire, but I doubt if they enjoy their work half so much as he who makes his own tools and appliances. It is much to be able to say of some piece of finished work, "I made it all," but much better to be in a position to say, "I not only made *that*, but the tools with which it was made are my own manufacture also." Now my idea of WORK is that it aims at providing its readers not only with instruction as to "what to make and how to make it," but that it strikes at the root of the matter of success in all mechanical work by showing us how to be thorough-going and therefore independent workers.

It is with the hope that I may help to carry out this latter object that I contribute my "mite" in the shape of some hints upon the making of polishing wheels and artificial whetstones.

I do not pretend that they are as good in every respect as those manufactured by the trade, but they have stood me in good stead in many a job, and I may say that I never knew what comfort, with respect to edged tools, was until I had supplied myself with these home-made articles.

I shall begin with directions for making a coarse-grained wheel for rough work, such as grinding chisels, etc., etc., and here it may be asked, "Why not use an ordinary grindstone?" But that is just my point, and my answer is that I find the artificial stone, driven in a small machine (something like that shown at page 119 of Melhuish's catalogue, only a little heavier, and which carries all my wheels), answers better than any ordinary stone, except, of course, for large tools.

Such a wheel as just mentioned should be about nine inches in diameter, an inch and a half wide, and may be composed of emery or sand.

If of the former, what is known as grinding emery should be used; and here it may be well to point out the different names by which emery powder is known:—1. Corn emery; 2. Coarse grinding emery; 3. Grinding emery; 4. Fine grinding emery; 5. Superfine emery; 6. Coarse flour emery; 7. Flour emery; 8. Fine flour emery; 9. Superfine flour emery.

No. 3 will suit best for our present purpose, but as the grain of this powder is coarse, it will be necessary to add some fine powder in order to supply "body" to the mixture of which the wheel is to be composed; in other words to fill up the chinks which occur between the grains of the coarse powder. The other ingredients required are shellac, resin, and a small quantity of cycle cement. The proportions of these ingredients are as follows:—No. 3 emery powder, 3 lb.; emery flour, washed, 1 lb.; shellac, 4 oz.; resin, 1 oz.; cycle cement, 1 oz.

The flour emery should be washed by mixing well in water, allowing the coarser particles to subside, and pouring off the water. This is necessary because the fine dust would absorb more than its share of the shellac in the after process of melting. The shellac is pulverised as finely as possible in a metal mortar, or, failing this, it may be powdered by tying it up in a closely woven cloth, and beating it on a block with a heavy pestle or mallet. Whichever method is employed it must be reduced to powder which will pass through a fine wire sieve.

The resin and cycle cement are treated in the same way, and if a small quantity of emery powder is mixed with the latter while pounding it will expedite the operation, otherwise it is rather a difficult substance to reduce to powder; but I find it admirable for supplying *toughness*, and much more workable than vulcanised rubber.

When the shellac, etc., have been pulverised and passed through the sieve, all ingredients are well mixed together.

A suitable mould must now be prepared; this should, of course, be of the exact size of the proposed wheel, and I have always used the bottom portion of some tin vessel for the purpose; for the smaller-sized wheels an old lobster tin, etc., but for this large size it is not always easy to find a suitable vessel. I use part of a drum in which soft soap is sold, which is 8½ in. in diameter, but the reader will provide for himself; whatever is used it must be perfectly round, about 1½ in. deep, and as free from dents as possible.

Paint the mould all over the inside with an even coat of blacklead mixed with beer, etc., and when dry it is ready for use.

A considerable degree of heat has now to be applied to the mixture, and great care will be necessary lest the shellac, etc., be burned. A good vessel to use is a small cast-iron frying pan, *not* a thin sheet iron one on any account, or the result will inevitably be failure.

Place the pan upon a hot, clear fire, and stir the contents with an iron spoon, etc., scraping the mixture from the bottom of the pan as it melts, and removing from the fire if it shows any sign of burning. It should not be heated sufficiently to smoke, and the heating should only be continued until the mass has become thoroughly incorporated. Do not expect it to melt in the sense of becoming fluid, but when it has become thoroughly heated, turn out into the mould as quickly as possible, and ram well so that there may be no breaks or flaws. As this mixture keeps its heat for a considerable time, especially in case of a large quantity, it will be safe, in this instance, to cover the bottom and sides of the mould with a thick coat, and when this is well pushed in, fill up with composition from the pan, which should be kept hot during the operation.

When the mould is full, or when the required thickness is obtained, the upper surface should be smoothed over, and the edge made compact, so that when the wheel leaves the mould there may be no flaw or gap at the corners of the cutting face. This smoothing should be done with a broad, pliable knife, or "spatula."

The packing of the mould is one of the most important parts of our subject, as unless the composition is well pushed in there will be flaws on the under side and edges of the wheel, and also the operation has to be so quickly performed, in order that the surface may not have time to cool, so that the second application may merge in the first.

Any one who has watched workmen laying down "val de travers" or any asphalt roadway will have a good idea of the consistency of this emery composition, and also the method of working it, as the substances and their treatment are very much alike. When the mould has become cold, the wheel may be easily turned out, and the next step is to make a hole through the centre for the spindle.

Find the centre on each side with a pair of compasses, and bore with a red-hot piece of round iron, of a suitable size—that is, something smaller than the spindle. Be careful to make the hole at right angles to the sides of the wheel; and when made, but still hot, press the spindle through and screw up.

The wheel may now be run in the lathe at good speed, and trued up with a red-hot iron.

If the mould has been right, and the hole has been carefully bored, the wheel will be fairly true, but it will be necessary to have it perfectly so.

Use a rather thick iron which will retain heat for a considerable time—an old large-sized flat file is what I always use. While red-hot hold it to the sides of the wheel until the surface becomes slightly melted, when, by applying the edge of the tool, any unevenness may be easily removed.

Owing to the speed of the wheel, there is great danger of the hot particles flying into the face of the operator, and this should be guarded against by watching the effect of the hot iron through a piece of glass, which may be held in the left hand or by another person.

The face is then made true by the same means, and our first wheel is made.

Thus far, at the risk of being thought tedious, I have entered into all particulars, however simple, knowing from experience that there are few things requiring more careful manipulation than the subject in hand. Remembering many failures resulting from ignorance of these details, I give them in the hope that any reader who makes the attempt may be spared much trouble and disappointment.

Another good wheel for rough work may be made of sand, two parts, powdered glass, one part; the other ingredients in the same proportion as in the wheel already described.

The sand should be what is known as "silver sand," and must be well washed, thoroughly dried, and allowed to become cold before mixing with the other ingredients.

The glass may be composed of any fragments of broken decanters, dishes, etc., usually to be found about a house. It must be pulverised in a metal mortar, and passed through a fine wire sieve.

In Spon's "Workshop Receipts" the direction is to melt the shellac and stir in the sand, etc., but I do not think this practicable, as the shellac is so small in bulk compared with the other ingredients, that it would be impossible to incorporate, say, two pounds of sand with two ounces of shellac, unless the two substances were thoroughly mixed while cold and in powder.

It must always be borne in mind that we should aim at using a minimum of shellac, resin, etc., otherwise, whilst the forming of the wheel will be comparatively easy, its efficiency will be lessened, as the excess of resinous matter causes the pores of the composition to clog; in fact, this is the great difficulty to be overcome with all wheels of the kind, and the only preventative, even in the case of the best, is to keep up a constant and copious supply of water during use; either running the under side of the wheel in water, like an ordinary grindstone, or by a constant drop from a small cistern of some kind above the wheel.

So far, I have given directions which are only the expanding of receipts obtained from such sources as Spon's books, etc. If there are any other published instructions on this subject, I have never been fortunate enough to come across them; but although this method works well in the case of such rough wheels as above described, I have not found it satisfactory for those of a finer make. My experience of shellac is that it is very difficult to reduce to a very fine powder; and that even when finely pulverised, it is rather unmanageable in combination with such substances as those which form the other ingredients in polishing wheels, etc. When mixed with these ingredients in a dry state, and then heated, it is apt to become absorbed by them, and the mixture therefore refuses to bind; if heated to excess in the least degree, the same result ensues; if insufficiently heated, the gritty and resinous substances fail to become thoroughly amalgamated, and the mixture is honeycombed and crumbles when cold; whilst if the shellac is at all in excess, the wheel, etc., as mentioned before, will clog in use, and is therefore worthless. Encountering these and other difficulties, I was led to adopt another method which proves most satisfactory, and is, as far as I know, unusual. The process is briefly as follows:—In the first place I dissolve the shellac in methylated spirit, forming it into a thick paste, and then, heating the dry emery, etc., I mix the whole, working it thoroughly until all the gritty particles are incorporated in the shellac.

To reduce shellac to a thick paste, put, say, three or four ounces into a small vessel, and pour about a wineglassful of methylated spirit upon it. Boil water in another vessel something larger than that which contains the shellac, and, when boiling, place the latter in it. The shellac will soon melt, and the boiling point of spirit being much lower than that of water, the gum will quickly be reduced to a thin liquid, which, upon cooling, will become a paste.

If, however, it remains liquid when cold—the consistency should be that of thick treacle—place it again in the boiling water until more spirit is evaporated, and by this means the proper consistency may be obtained.

The next step is to prepare the other ingredients. For each ounce of shellac, Spon recommends a piece of resin the size of a walnut. This I think a little in excess, and use twice this quantity to three ounces of shellac.

Powder the resin in a mortar, and then take the same quantity of cycle cement, and melt it in some small metal vessel. When melted, add the resin and a small quantity of the shellac paste. When well mixed, this should be added to the proportion of shellac required for the work in hand, the whole being again melted and thoroughly mixed.

Now heat the emery powder and other grit in some metal vessel. I always use home-made copper bowls for all these operations, and find them more satisfactory than iron pans, ladles, etc., as the heat takes effect so much more quickly, and may be more easily regulated, which is a very important consideration in all these processes. For the method of making these copper bowls, see my "Hints on Hollow Work in Sheet Metal" in No. 18, page 282.

When the emery, etc., is quite hot, apply heat once more to the shellac, and, having placed the powder upon a metal slab, which should also be moderately heated (a piece of sheet iron fixed above a spirit lamp will serve in the absence of a thicker slab, which would retain the heat), with a strong knife or small trowel work up the powder and shellac, when the latter, being partially diluted with spirit, will thus be equally distributed through the mass, and will coat each particle of the powder.

The mixture is next returned to a metal vessel, and subjected to a strong heat, great caution being necessary not to burn it. This will drive off the excess of spirit, and more thoroughly melt the shellac, and when this object is accomplished, turn out the mixture as quickly as possible into the prepared mould and proceed as before directed.

The following are some of the substances which I have found most useful for the finer wheels, etc.:—1. Fine emery, 2 parts; washed flour emery, 1 part. 2. Finest emery, 1 part; washed flour emery, 1 part. 3. Fine emery, 2 parts; very finely powdered glass, 1 part. 4. Washed flour emery, 2 parts; Oakey's Wellington knife polish, 1 part. 5. Fine powdered glass, 1 part; fine powdered pumice (washed), 1 part. In each case shellac, resin, and cycle cement in the proportions before directed.

All of these mixtures when moulded in flat cakes also make excellent artificial whetstones and slips, which will be found most useful for various purposes; and the ease with which they may be grooved, or made to assume any desired shape while hot, renders them peculiarly suited for sharpening carving tools, etc. etc.

I strongly recommend all workmen to adopt my plan of making polishing wheels at home. It is not work that presents any special points of attraction in itself, but it has the eminent merits of being useful and practical although not ornamental.

LOCK REPAIRING AND KEY FITTING.

BY THOMAS WILSON.

REPAIRS OF WORN KEYHOLE—COMMON BACK SPRING LOCK—DESK LOCKS—MORTISE LOCKS—PADLOCKS.

MOST of the locks that are made now are bushed at the keyhole with a small extra plate to avoid wear, but the lock shown in the last paper and a few others are made without a bush, so that occasionally the keyhole is worn away, and the key works loose in the lock. Fig. 3 shows covering plate of lock with worn keyhole. If it is only slightly worn, it can be remedied by making a number of centre punch marks with a centre punch, as shown in Fig. 2; but the keyhole of lock case cannot be done in this way without removing the bridge ward, which is rather a troublesome job. The best way to bush a lock is to cut out a small brass plate with keyhole, and solder or rivet it over worn keyhole, but as this is rather a difficult matter for an amateur, I will describe another plan, which, although it may not look so well, will answer the purpose. Every one is familiar with the iron washers used for putting under the heads and nuts of bolts. Buy two of these at an ironmonger's, of a size to fit over the pin of the key—about $\frac{5}{16}$ in. will be required for a key similar to that shown in the sketch of lock which appeared in the last article—and file one side of them bright; now scrape or file the keyholes of lock bright, and lay the washers on them with the bright parts downwards. Procure a pennyworth of spirits of salts (muriatic or hydrochloric acid), pour it in an old cup or gallipot and put some scraps of zinc in it—if you have not any old zinc get a pennyworth of zinc nails. When it has done boiling, put a little of the spirits on the washers and keyholes, place a small piece of solder on the top of them, and hold them in the flame of the gas or over a clear fire until the solder melts, then lay them on one side to cool. They will now appear as shown in Fig. 4, and after the part marked A is filed away they are completed. The collar of the key will probably require filing back to allow for the extra thickness of the bush. A soldering fluid called "Solderine" is sold by most ironmongers. This preparation is ready for use, and does not require "killing" with zinc before being used. A stick of blowpipe solder can be bought for a penny or two, and the washers at a penny a dozen.

Fig. 1 shows the interior of a common backspring lock. The cheapest way to repair these is to take them off, buy a new one and throw the old one away. A lock of this description can be bought for 4d. or 6d., so that it will be seen it does not pay to repair them.

The old lock should be taken as a pattern when purchasing a new one, so that the new lock may fit in the same place. It is sometimes difficult to get a new one of the same pattern as the old, and then it becomes a question whether it is better to repair the old one or to cut the woodwork for a new one. If it is decided to repair the old it will probably be found that the spring is broken. This can be easily remedied by cutting off a piece of a stout feather spring, and fitting it in the slot of the bolt at B. To get the bolt (A) out, bend back the rim gently at C, afterwards bending it into position when spring is fixed. If a new pin is required, a piece of wire must be used considerably larger than the pipe of key, and filed down so as to form a shoulder as shown at A, Fig. 5. The pin must then be held in the vice at C, and the part marked B rivetted into the lock.

In small locks, such as desk locks, the bolt is sometimes broken. These cannot be repaired, as any extra thickness at the place where it is broken would prevent the bolt from working, but it is comparatively easy to make a new one. The broken pieces should be filed bright on one side, and laid on a piece of brass of the same thickness, and soldered on as described in bushing a lock. Now file away the brass plate around the old bolt, hold it in the gas to melt off the old pieces, and you will have your new bolt. (Fig. 6).

Before finishing with warded locks, it may be as well to say a word about mortise locks. If these are out of order, it will usually be found to be either the spring or the follower that is wrong. To repair or replace these the lock must be taken off, and,

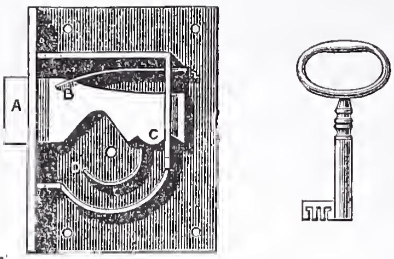


Fig. 1.—Interior of Common Back Spring Lock.

Before taking leave of warded locks, I may mention that when a new key is required it is not always necessary to get a blank and cut the wards. All ironmongers keep a large stock of keys with the wards ready cut, and one can generally be found that will fit the lock with a little alteration. As these are the same price as blanks there is nothing gained by taking a blank if a key can be got instead.

In lever locks, which I shall take occasion to describe in the next paper, keys *must* be cut from blanks. It would be useless to enumerate all the patterns of warded locks in use, as it would fill several numbers of WORK, and would serve no useful purpose, as the directions for cutting the key to rim lock, as described in No. 21 of this Magazine, are really applicable to all warded locks. But should any difficulty arise, I shall be pleased to answer any correspondent who may stand in need of assistance through the medium of "Shop."

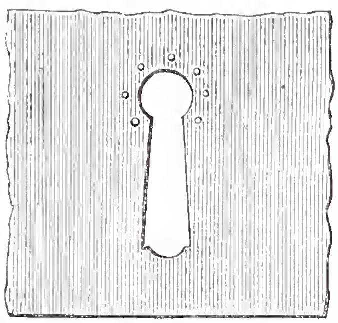


Fig. 2.—Mode of Repairing Worn Keyhole by Enlarging Hole.

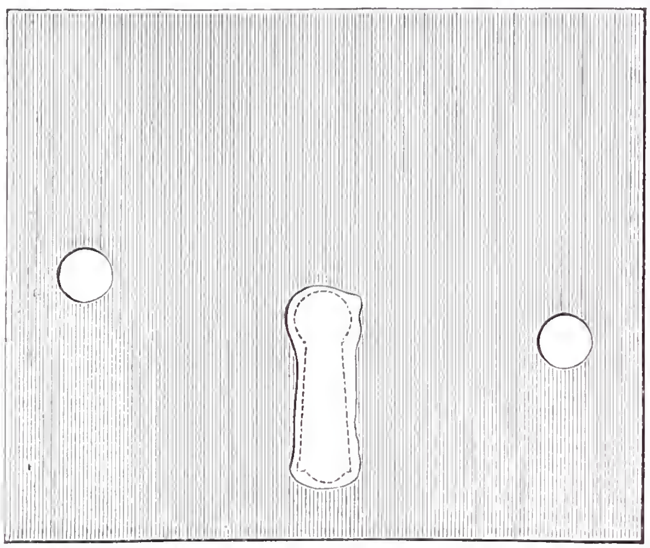


Fig. 3.—Covering Plate of Lock showing Worn Keyhole.

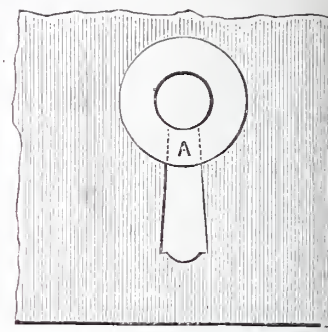


Fig. 4.—Mode of Repairing Worn Keyhole with Iron Washer.

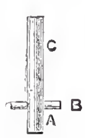


Fig. 5.—Mode of Repairing Pin.

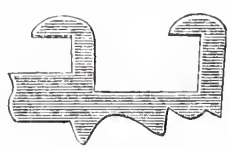


Fig. 6.—Shape of Bolt of Drop Lock.

although this is a simple matter, it may be as well to describe how it is done.

Fig. 7 shows the edge of a door with mortise lock fixed. To take it out remove the knobs and spindle, then take out the screws of face plate A A, under this will be found two other screws. These must be taken out, then if the screw-driver is inserted in the keyhole, and the lock pushed forward, it will come out sufficiently to be grasped by the hand and pulled right out. If the follower is worn out, a new one must be fitted. Those for mortise locks (Fig. 8) and indeed for most rim locks, are not riveted in as described in my last paper, bu work between the two plates of the lock The old one should be taken as a pattern in buying a new one, but it will probably require a little alteration before it will fit. The spring is pretty certain to be a feather spring, and a new one can be bought for a penny, as mentioned in my last paper. The screws of face plate are very short, and liable to be lost; should this be the case the plate can be fixed by ordinary screws, long enough to reach the woodwork.

Keys to padlocks must be fitted by examining the wards, as far as possible through the keyhole, or by blacking the blank as previously described. Warded padlocks, however, can be instantly picked, by holding the lock on one side and raising the tumbler with a pick, when the bolt will drop back by its own weight.

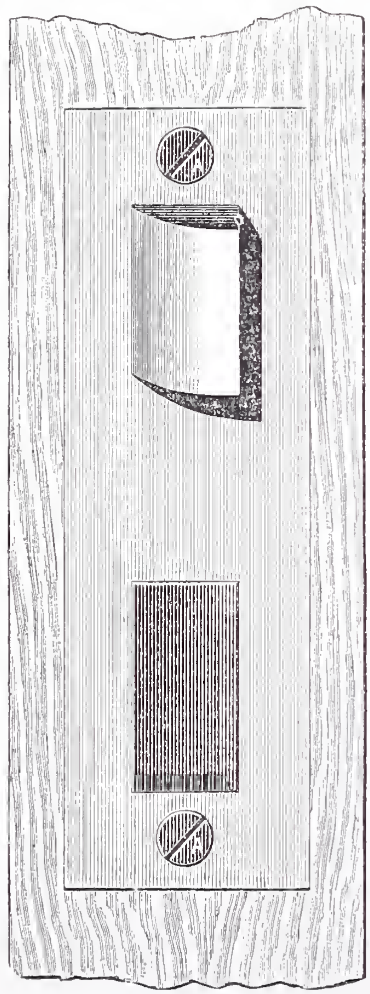


Fig. 7.—Edge of Door with Mortise Lock Fixed.

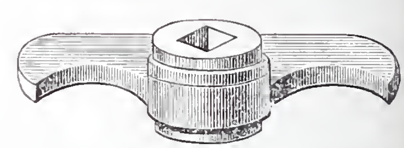


Fig. 8.—Follower in Mortise Lock, showing Form, etc.

A FEW WORDS ABOUT SCRAPERS.

BY A CABINET MAKER.

IN a recent article in WORK, called "Friendly Hints to Amateur Wood Workers," by D. Denning, the writer alluded to the use of the scraper. At the time, I must confess the necessity of calling attention to such a well-known tool did not occur to me, or rather it occurred to me as being superfluous. "Surely," thought I, "everyone must know about the scraper without being told," and I wondered why the writer did not tell us about something we did not know of. The utility of mentioning even the ordinary tools of one's own trade, soon however, became evident to me, for a customer, who is hardly an amateur in his own calling, dropped in and referred to WORK, speaking of the article above referred to from an amateur woodworker's point of view. I know he does a little bit in the cabinet making line, and one thing leading to another, he said he would like to know something more about the scraper which he had seen mentioned. He had heard of it before but did not think it much use. Was it really important to use it? How was it made? and a good many other questions besides. Not that I minded being asked them, for the querist is a pleasant young fellow, who does not come bothering about, interrupting and hindering one at his work with all sorts of silly notions, leading one to suppose that he thinks he is conferring an honour or, at the least, condescending very much to ask opinions from a tradesman. Amateurs like that can't be much surprised if they get a rebuff, but if they will be content to ask without pretending to teach, they will not often find that an artisan is afraid to let them into what they call trade secrets. Herein, if I may express an opinion which is not immediately connected with scrapers, this Magazine will do a great deal of good. It concerns itself with both amateurs and professionals, who will by it be more drawn into contact with each other. The result can only be beneficial to both. All this, however, is rather a digression, which I have been drawn into through noticing the stand-offishness of some gentlemen amateurs, and the rather extraordinary way in which they sometimes meet the artisan. Personally, I never object to tell anyone what he wants to know if he will come and say straightforwardly what it is, or if it is any matter I don't feel myself at liberty to speak about I tell him so. When, however, he comes as though he were afraid to ask, and, as it were, tries to worm the desired information out of one, then I "dry up." If he thinks he will be so clever in extracting my supposed trade secrets from me, then I am vain enough to think he shall not. Now, no doubt, some adopt this course through diffidence or fear of intruding, and this feeling of reticence on their part cannot be blamed, as a tradesman's time means money to him. When, however, a good practically-minded amateur is willing to learn, I don't think there are many men who are such churls as to refuse to tell him what they can. There are a few, but there are not many, and in my own experience I have rarely come across one. There is one kind of amateur who won't get to know much; I mean the man who does not care to lie under a supposed obligation, but wishes to pay for lessons. A very praiseworthy wish on his part, but he sometimes spoils the effect when terms come to be spoken of. A case in point occurs to me, and will show very well what is meant. A wood-carver among my acquaintances, one who is always willing to tell anything he can while going on with his work, was asked to give some lessons at the pupil's residence. Said would-be learner was willing to pay—listen, brother craftsmen, and amateurs too, for future guidance—the fabulous sum of sixpence per hour. The offer was, of course, indignantly refused. Committees and such-like self-promoted bodies for the spread of fine art labour have been known to fall into similar mistakes. Now I hope no amateur will take these remarks amiss. I don't think they are couched in offensive language, and I think sensibly-minded men will give me credit for wishing to put them on the right tack for getting over any little difficulty they may encounter in their pastime.

With regard to the scraper, very likely there are others, besides the reader I have referred to, who would like to know something about it. Certainly it is much easier to tell and show anyone how to use it than to explain on paper; still the thing is so simple that no doubt I shall be able to make myself intelligible. It is difficult to know exactly what a man who is quite unacquainted with a tool wishes to be told about it. It all looks so simple to one who has been in the habit of using it, that he is apt to condense his information when asked to explain how it is used, and tell his inquirer to do so in "the usual way." Correct enough, no doubt, but hardly specific enough to enable one who has never seen the tool to use it effectually. Perhaps in this instance I cannot do better than incorporate the questions and answers on the occasion referred to.

To begin with, the scraper is a thin bit of steel of any convenient size, say about 5 in. long by $2\frac{1}{2}$ in. wide. I don't know the exact gauge of the metal, but $\frac{1}{8}$ in. would be too thick. Scrapers are to be bought for a few pence each, but they may very easily be made from a piece of a broken saw. The edges, after the piece has been separated with a cold chisel, must be filed down

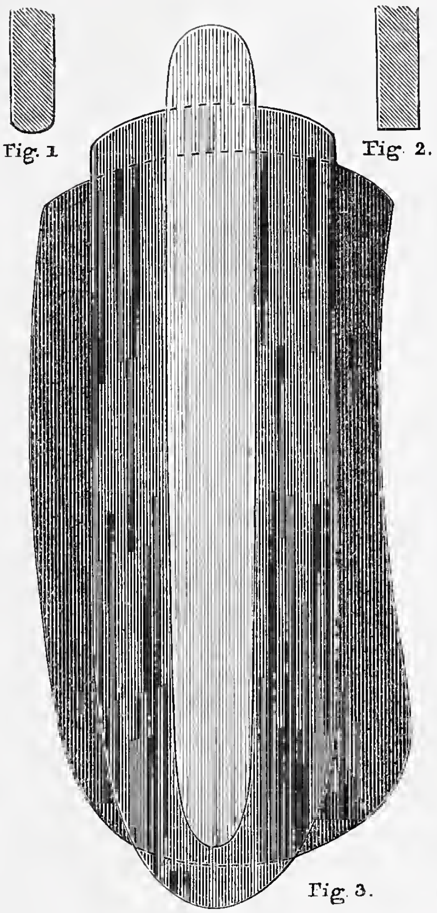


Fig. 1.—Edge wrongly formed. Fig. 2.—Edge rightly formed. Fig. 3.—Outlines of Shaped Scrapers.

straight and square. If it is to be a scraper for flat work, of course it is necessary that one side at least must be perfectly true. This can easily be made by running the file lengthways along the edge, which must afterwards be smoothed down by a rub or two on the oilstone, just enough to remove the file marks. It is necessary to be careful not to round the edges like Fig. 1, but to keep them perfectly square like Fig. 2. Both these illustrations, of course, are given in section on a very much enlarged scale to prevent mistake. The edge, it will be seen, is not a cutting one, but scraping in its action. Such an edge as shown in Fig. 2 will certainly scrape, but the operation would be so very tedious that the tool would be practically worthless. To sharpen it properly is not a difficult operation, but it is one that requires a certain amount of knack, which, however, is soon acquired with a little care and attention. It is not so much sharpening that is required as turning the edge over to form a kind of burr on each face of the steel. A properly-sharpened steel can, apart from its action on the wood, easily be told by holding the plate between a finger and thumb of one hand and moving it with the other, when a very perceptible burr should be felt. A suitable piece of steel does not require much sharpening; a few strokes with the sharpener is all that is necessary. The sharpener may be any hard bit of steel, but perhaps there is nothing to beat the "currier's steel." This is a thin steel rod set in a handle, and, I believe, can be obtained at most tool shops, but instead of it any hard, smooth piece of steel will do almost as well, the rounded back of a gouge for instance. To sharpen the scraper, support it firmly on the bench with the left hand, the edge to be treated being perpendicular. Then draw the sharpener with a smart firm stroke along the edge a few times. Don't rub it up and down irregularly, but take vigorous sweeps with even pressure from top to bottom. If the sharpening is too prolonged, it may have a contrary effect from that intended, as the burr may be scraped away. As I said, to do the sharpening properly requires some knack, though it looks so easy and really is. If the novice can't manage to acquire it after a few trials, he will do well to ask some one to show him how, or better still, let some competent man see how he does it. The chances are that he will detect some fault at once.

When the scraper is properly sharpened, the next thing is to learn how to use it effectively. Scraping is rather laborious work, but when a really finely-finished surface is desired, it is not well to avoid the drudgery. Both hands are used, the thumbs bearing a good deal or most part of the hard work. To show the action of the scraper and the way to hold it is easy enough, but to describe it without fear of being misunderstood is another matter. However, I don't think any one can go far wrong if he will attend to the following directions. I may as well say that it is chiefly on large flat surfaces that the scraper will be found most beneficial. From this it follows that one of the long edges is mostly in requisition. This being so, grasp the scraper in both hands, the thumbs being on the inner or nearer side, and pretty near the centre, and the other fingers so disposed that they have a good grip. Now incline the top edge of the scraper away from you, the lower edge being pressed on the wood. Then scrape, the motion being always a pushing one, with the steel held at an angle to the wood. The sharp edge will scrape off the surface and leave it smoother than any plane almost could do. Of course, discretion must be used not to apply the scraper too much in one part to the exclusion of others. It will be noticed that the pressure of the thumbs causes, or ought to cause, the scraper to bend forward a little in the centre, so that sharp corners are kept from digging accidentally into the wood. It is for this reason that steel $\frac{1}{8}$ in. thick would not do. A certain amount of pliability is essential. As soon as the edges refuse to bite properly it is time to sharpen them again, and if in course of time they get rounded off, a rub with the file or on the oilstone will soon put them all right again.

Scrapers need not be always rectangular, as this shape is only required for flat level surfaces, but their edges may be curved to fit any special surface. For instance, here are three outlines of scrapers in actual use, given in full size (Fig. 3). They are not often required; still they come in handy sometimes, and when a special curve is wanted it can easily be filed down. There is no fixed size for such fancy scrapers, as everything depends on the work they are intended for.

With these remarks the subject must be closed. I don't think any material point which the ingenuity of the worker can't get over has been omitted. If it has, no doubt inquiries will be duly answered in the "Shop" column, and as I see WORK has a very extended circulation in the town where I reside, I don't offer to tell all and sundry who might call on me for lessons on scraping. Hence I merely subscribe myself a "cabinet-maker." As an excuse for the crudeness of my style, I may further say I am "one in the white," *i.e.*, without "polish," but so long as the "stuff" is right, that is only a secondary matter. Good furniture is recognised more by the material than by the polish, which is, like this concluding sentence, only a "finish."

SOME ARGUMENTS IN FAVOUR OF VENEERING.

AN EXAMINATION OF SIR CHARLES EASTLAKE'S OBJECTIONS TO VENEER.

BY DAVID ADAMSON.

ONE objection that often operates against veneer in popular opinion is its alleged want of durability. I say in popular opinion, because those who are most capable of judging, that is the people whose business it is to be in constant contact with furniture, know perfectly well that veneering is not a source of weakness, even if it does not increase the strength, as it is sometimes considered to do.

The question of strength is, however, of secondary importance when compared with durability, and on this score there may possibly be some objections of rather more weight than some of the others which have been alluded to. It must not, however, be inferred from this that furniture when veneered is not quite as reliable for ordinary purposes as when solid. It is only less so when constantly exposed to a moist, warm atmosphere, such as that of some tropical regions during the wet or rainy season. In this country veneers may be used without fear of their not remaining in good condition, always presuming, of course, that the articles of which they form part receive fair usage, and that the veneer itself is properly laid on a suitable foundation; we do not require to make furniture as if it were to be constantly exposed to all the changes of weather. It must be made with due regard to its subsequent use and position, and if this be done, it is a very questionable argument to urge against veneer, or any other method of construction, that it is not adapted for furniture. It would be reasonable to say that veneer is not fit for the external parts of buildings, and it may fairly be supposed that architects when decrying veneer sometimes, overlook the fact that furniture is not exposed to hail, rain, and storm. It is well known that architects are seldom successful designers of furniture, and this may be, altogether apart from their not understanding its construction, to a great extent attributable to the apparent impossibility of freeing their minds from ideas of the larger structures they are commonly called on to devise. I am aware that these remarks may not be altogether palatable to members of the architectural profession, who commonly suppose themselves to be capable of designing, not only furniture, but anything else connected with the house; without, however, in any way wishing to cast reflections on their skill, it must be said that they are not the most competent people to express an opinion on domestic furniture. Some few of them may be acquainted with the subject, more or less, according to the time they have devoted to it, and their opportunities of studying it practically. They then are equal to the furniture designer who is a specialist, in fact they have qualified themselves to design furniture. Among such, the late Bruce Talbert may be instanced, and, to a smaller degree, Sir Charles Eastlake. To both of these, by their work in connection with furniture, much of the improvement which has taken place within recent years, may be ungrudgingly attributed. Eastlake, however, as is shown by more than one remark in his admirable book, "Hints on Household Taste," was only partially acquainted with furniture, or rather (should I say?) with the furniture industry, with its commercial or £. s. d. aspect; without a knowledge of which no man can be thoroughly competent to correctly judge of the capacity of cabinet-makers to design and manufacture sound artistic furniture.

As Eastlake is by many regarded as a thoroughly reliable authority, it may be well to see what he has to say about veneering:—

"Veneering has been so long in vogue, and is apparently so cheap and easy a means of obtaining a valuable result, that it is always difficult to persuade people of its inexpedience. Veneering has been condemned by some writers on the same grounds on which false jewellery should, of course, be condemned. But the two cases are scarcely analogous." Then after referring to the practice of silver-plating, which he states is "too universally recognised to be considered in the light of a deception," he continues, "I do not see exactly how veneering is to be rejected on 'moral' grounds." Further, the impracticability of using walnut wood, by which it may be presumed *burr* walnut is meant, in any other way than in veneers having been admitted, he states that when, "for instance, in piano cases the leaves are so disposed as to reverse their grain symmetrically, the arrangement is not only very beautiful in effect, but at once proclaims the means by which that effect is attained. There are, however, many practical objections to the mode of veneering in present use. To cover inferior wood completely in this fashion, thin and fragile joints must be used, which every cabinet-maker knows are incompatible with perfect construction. The veneer itself is far too slight in substance, and even when laid down with the utmost nicety is liable to blister, especially when used for washing-stands, or in any situation where it is exposed to accidental damp. It is never worth while to buy furniture veneered with mahogany, for a little additional cost may procure the same articles in solid wood." He next refers to a "substantial oak table," which he had made from his own design "at a price which was much less than I should have paid for one veneered with rosewood or walnut." "The most legitimate mode of employing veneer should be in panels of not less than a quarter of an inch in thickness, and, if used for horizontal surfaces, the inferior wood should be allowed to retain a a border of its own in the solid."

I have ventured on this fairly long quotation in order that both sides of the vexed question of veneering may be presented to the reader, and Eastlake's remarks are fairly typical of some of the more commonly urged objections, though it must be admitted he writes in a more unprejudiced manner than some of those who have discussed veneering. Some of his remarks having already been disposed of, others may be taken and examined. In the first place, he refers to it as a cheap and easy means of obtaining a desired result. Now this, I think, most cabinet-makers will dissent from, for they all know that veneering increases the cost of any article, and that it is not what may be considered easy. About the cost I shall have something more to say shortly, but this seems a suitable place to make a few remarks about the "easy" part of the work. I don't mean to say that it is really difficult to an expert artisan, or that the physical toil is great, but for all that, if by easy we are to understand that it can be managed properly without skill and experience, then it must be acknowledged the term is incorrect. To lay veneers thoroughly tests the skill of the worker, and is a constant tax on his general intelligence, so that one who can manage veneering is by no means a mere mechanic. He must have brains and be able to use them as well as his hands. Perhaps the qualifying word "apparently" should be looked on as an admission that this is the case.

The observation about walnut veneers proclaiming the means by which the effect is produced when laid in a particular way, bears out to some extent what has been previously said about veneers not being deceptive. Of course, when laid in the way Sir Charles admires, any one can see that veneers have been used, but in any case the practised observer is very rarely at a loss to tell when wood is veneered. The deception then is only in degree varying according to the perceptive powers of the beholder, and seldom depending only on the way in which the work has been done.

The statement that thin and fragile joints must be used whenever an inferior wood has to be covered with veneers will be news to most practical men, at least to those who have not read "Hints on Household Taste," and one almost wonders how its talented author can have been led into making such an extraordinary assertion. That bad joinery may be concealed by veneer is, no doubt, incontrovertible, but that fragile joints are by any means necessary or usually connected with veneered work is, fortunately, not correct. In practice the jointing used in any piece of furniture is the same whether the surface is veneered or plain. It may be good, bad, or indifferent, according to the worker's skill, but the veneering, *per se*, makes no difference whatever, so that this objection, which might carry weight, may be dismissed.

Were it not that silence about the statement that veneer is too slight in substance, might be construed into an admission that it is so, that expression of opinion would be passed over for what it is worth. Beyond custom there is no arbitrary limit to the thickness of veneer, and without knowing what thickness Sir Charles Eastlake had in mind when writing, it is rather difficult to say that it is too thin. It is sufficient for us to know that veneer as ordinarily cut is quite substantial enough for ordinary usages. Something more will be said later on about thickness of veneers, meanwhile it will be sufficient to state that wood one quarter of an inch in thickness would hardly be regarded as a veneer in the ordinary sense of the word.

That veneered surfaces, to pass on to the next objection, are liable to "blister" is not to be denied, though the liability is not so great as an inexperienced person might suppose on reading the quotation in which it is mentioned. Indeed it is so very small, when veneers are properly laid with the utmost nicety, that it may almost be regarded as non-existent. Blisters generally indicate bad workmanship, and they are so well under control that where they are found it is generally safe to infer that they depend more on careless manipulation and supervision, or subsequent improper usage than on any inherent defect in the form of construction. Occasionally an apparently causeless blister will show, but very rarely. If any rise after the article has left the workshop, it may generally be taken for granted that damp has been the cause. Of course, no one could defend the use of veneered tops for washstands any more than he would advocate the employment of brown paper bags for toilet basins. Marble is so commonly adopted for washstand tops that it seems almost needless to suggest that these are sometimes made of wood. It will be observed that in the quotation from the "Hints" no mention is made of any special part of a washstand, but I infer the top is meant, as no other part is liable to come in contact with any exceptional amount of water. So far as accidental damp is concerned, it may be said that few articles of furniture will stand much of it whether they be veneered or not. If we are to discard veneers for this reason, we must go a little farther and refuse to admit any upholstered piece of furniture into our houses—nay, let us go the whole hog at once, and have nothing about us that will ever wear out or that can, by fair or foul means, accidentally or designedly, be injured. Then, and not till then, may we consistently say that we object to veneer because it might be injured by accidental exposure to damp. We have only got to act up to the idea of getting absolutely imperishable things to land ourselves on the heights of absurdity (wherever these may happen to be situated).

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

CONNECTIONS AND BEARINGS—EXPANSION JOINTS AND BEARINGS.

APART from the joints in each distinct part of a structure, such as cross and main girders, there remain to be considered the connections of these parts with each other, and also their bearings upon each other, and upon other places of support. The bridge flooring itself may be carried by cross girders, by cross girders supporting longitudinal girders or bearers, or by main longitudinal girders only. I shall take for example the most complete form, that in which longitudinal and cross girders both occur in the flooring, the latter being carried by the main girders. The covering of the floor will be separately dealt with subsequently.

In those cases where one girder rests upon the top of another, there is no question of load upon the rivets or bolts used, their duty being then confined to keeping the supported elements in their proper positions, and preventing them from being displaced laterally, or lifted during the passage of a load. In other positions, the load carried by the girder, together with its own weight, will come upon the connecting rivets, and it is always safest so to arrange the attachments, that they shall be in shearing stress, as we are more absolutely certain of their strength in that direction, than when relying upon the resistance of the head which, unless the workmanship is unimpeachable, may be open to some amount of doubt. The cross bearers in light foot bridges are commonly riveted up to the undersides of the main girders, but upon these the load is small, and the margin of strength very ample. On a foot bridge 10 ft. wide, with cross bearers 4 ft. apart, the maximum load would not exceed three tons, and the bearer would be held up by not less than eight rivets, which, allowed to be as little as $\frac{5}{8}$ in. in diameter, would show a *working strength* of more than twelve tons. When, however, we have to deal with the heavy traffic of road and railway bridges, the case is very different.

In studying the connections now under consideration, it must be remembered that at present we are dealing with plate girders only, in which the web, being continuous, can receive the load of the cross girders at any point in the length of the main girders without putting any bending strain upon either top or bottom flange. I call attention to this because a different state of affairs will sometimes occur in lattice girder structures.

In Fig. 11 is shown a method of connecting longitudinal with cross girders, the tops of the girders being made flush to receive the floor covering. A, A are the ends of two longitudinal girders in elevation, being nearly the same depth as the cross girder, B, B, to which they are connected; they are shown deep enough for the bottom flange plate of the longitudinal to run under that of the cross girder, in order to give continuity of structure. It, however, very frequently occurs that the cross girders are much deeper than is necessary for the intermediate longitudinals, as shown at D, D, ends of longitudinals attached to the web of the cross girder, E, E. Additional rivets are here introduced into the junction by means of the brackets, G, G, the ends of which rest upon the angle iron of the bottom flange. In the first figure, the joint is chiefly made by the angle irons, C, C, and in the second by angle irons, F, F, and brackets, G, G; E, E are the flanges of the cross girder. Below is shown a horizontal section of such a joint. H, H are the ends of the longitudinals; I, I, I, I the connecting angle irons; and K, K the cross girder.

It is very desirable in such a combination as the above, to take the load as fully as possible directly from the supported girder to the web of that carrying it, as by so doing the tendency to twist the cross girder on the passage of a load is much reduced, and an undue stress on the horizontal angle irons obviated. Terminating the top flanges of the longitudinals at M assists in this, and secures a flush top to the girders. As shown, the angle irons which connect the flanges to the webs of the longitudinal girders, are turned round at the corners, so as to form a solid continuous frame throughout; but when the girders are of considerable depth, say, 2 ft., the angle irons may be cut through, as shown at N, N, but the corners should be kept solid to protect the ends of the webs from diagonal shearing stresses. In setting out these girders, sufficient depth should always be allowed to admit of a comfortable joint being made, one that can be properly got at by the riveters so as to ensure good workmanship. This is a point that it strongly behoves the manufacturer to examine before commencing the work, for should the room available at these connections be insufficient, a bad and ricketty joint must result; and this being constantly made worse by vibration, the structure must in the end become shaky, and very likely, positively unsafe.

The next connections to be examined are those between the cross girders and the main girders. If it be necessary to place the former beneath the latter, they should be so suspended that shearing stress only is brought upon the rivets; this may be effected most conveniently when the main girder is of box section.

Box girders have two webs connected with the flanges by angle irons, as in single web girders. In order, however, to allow of the attachment of suspending pieces for the cross girders, the angle irons joining the webs to the bottom flange must be put inside the webs, as shown in Fig. 12, where A, A represent the lower parts of the web plates, and B the bottom flange, in vertical section. It is obvious that this form is only suitable for large girders where there is space between the webs to get at the rivets. The cross girder end, C, must also be of a form suitable for the attachment of the straps, D, D, by which it is carried, and of which four will be required, two on each side. The required form may be obtained by stopping off the central web of the cross girder at L, L, and there connecting it by angle irons with a strong diaphragm, and therefrom to the end, making it of box section, as shown at H, H. The side plates are joined to the flanges by angle irons, and stiffened by rigid internal frames, G, to afford a substantial hold for the lower ends, F, F, of the suspending straps; E, E is the bottom flange of the main girder, shown in vertical section on the dotted line, B, B. Referring again to the upper view, the straps, which are made of angle iron or steel, are fastened to the cross girder by the rivets, I, and to the webs of the main girder by the rivets, K. Both in these and the connections previously described, great strength is required on account of the concentrated nature of the loads to which they may be subjected; thus, in a railway bridge, the longitudinal girders and the cross girders receive the concentrated load on the driving wheels of the locomotive, and on ordinary road bridges that occurring in a heavy traction engine, or steam road roller.

When the main girder is single webbed, the cross girders cannot be thus suspended, and in any way that they may be attached to the bottom flanges of main girders, the load must, at length, hang upon rivet heads, if it is only on reaching those that fasten the bottom flange to the main angle irons. It is therefore necessary to fasten the cross girders to the main girder webs above the bottom flange, if we want a thoroughly reliable job; such a joint is shown at Fig. 13, where A, B is a vertical section of the lower part of a single web plate girder; C, the end of a cross girder fastened by rivets at D to the web of the main girder. The bottom flange plate of the cross girder is stopped at F, and the angle irons and web run on as shown, the former being fastened to the bottom flange by rivets, of which one is seen at G. N is one of the ordinary tee iron cranked stiffeners, and I an inside stiffener turned up at the bottom, and fastened to the cross girder by the rivets, E; thus the effect of the stiffener, I, is continued to the bottom flange, B. It is to be remembered, that to get the best result there should be enough rivets at D to take the whole load on the cross girder in shearing stress, and no pressure should come upon the flange, B, nor drag upon the rivets at E; then this connection, when properly fitted, makes a very solid piece of work.

Another arrangement is shown where the end, K, of the cross girder is placed higher up the web, and clear of the bottom flange. It is fastened to the web, N, by the rivets, L, and its position further secured by means of the brackets, M, M, placed above and below. An objection to this is that the bottom flange loses its stiffener on one side. In both these forms of joint, if the cross girders do not fall on the stiffeners, the web of the main girder must be supported by a plate on the other side through which the rivets holding the cross girder will pass, as the webs are generally too thin to be subjected

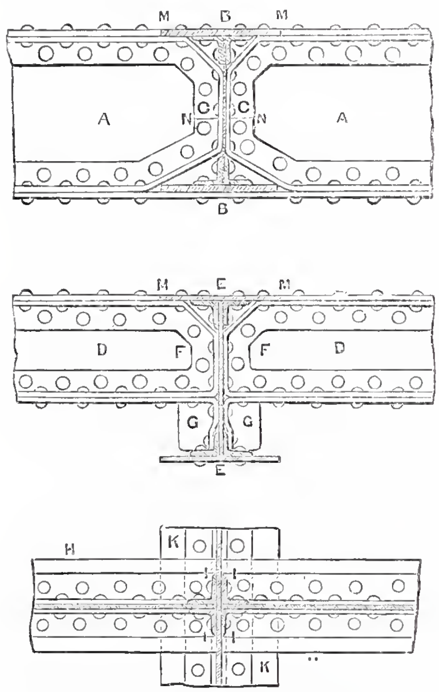


Fig. 11.—Connection of Longitudinal Girder with Cross Girder.

to the possible drag upon the rivets, due to the vibration set up by a heavy passing load, such as 15 tons, moving at a high velocity; and this will constantly occur on railway bridges, and on those carrying a double line of way there will sometimes be this on each end of the cross girder.

The expansion and contraction of the metal that occurs with change of temperature must, of course, be provided for when the work is of any magnitude; this variation of length amounts, in the English climate, to 1 in. in 150 ft. between summer and winter, and is provided for either by sliding or rolling bearings. If this expansion were not met, a great stress, equal to about 6 tons per sectional square inch of the metal endeavouring to expand, would be set up; and to me it seems curious that it has not been customary to provide for the lateral as well as the longitudinal dilatation of the material, for although the lateral movement will be less in distance than the longitudinal, it will be equal to it in intensity. The expansion bearings should evidently be arranged to move in a diagonal direction instead of in one parallel to the length of the main girders.

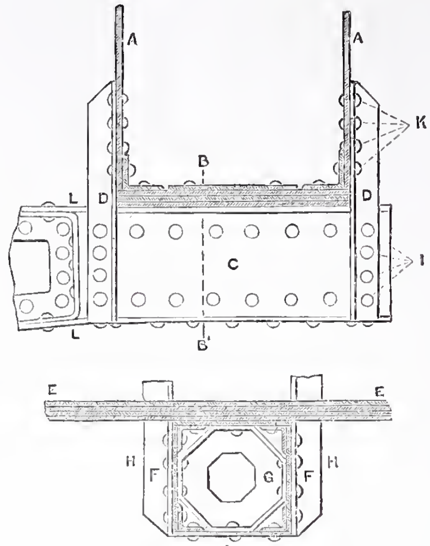


Fig. 12.—Connection of Cross Girder with Box Main Girder.

When the piers supporting the work are in themselves solid and stable enough to withstand the horizontal resistance of the friction of sliding plates, these may be used; but if there is any doubt upon this point, the girders must be put upon rollers. Where a number of consecutive spans follow on, if it is desired to connect them together, expansion joints must be introduced at intervals, and the same course pursued in regard to the flooring.

The expansion joints between the girders may be conveniently made by connecting them together by means of bolts passing through india-rubber washers of sufficient thickness to allow of the necessary expansion; such joints have been made with blade springs instead of the india-rubber washers, but such work is clumsy and would not be found in structures designed by men of experience.

There is another movement in the ends of the main girders that in large spans requires to be provided for, it is that caused by the deflection of the girders under a load which

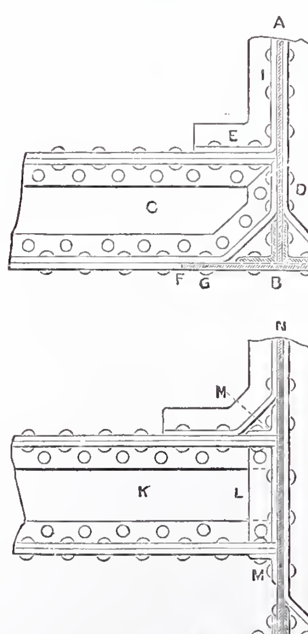


Fig. 13.—Connection of Cross Girder with Single and Main Girders.

will tip up the extreme ends. In short spans this movement is accommodated by bedding the girders on some slightly yielding material, such as felt; but in larger ones, a rocking bearing must be used, so that the load may be distributed equally over the surface of the bearing, otherwise the pressure will all fall on its inner edge. A side view of a rocking bearing upon rollers is shown in Fig. 14; A, A is the bottom end of the main girder, and to it is bolted a casting, B, B, preferably of steel. The upper surface of this casting is planed and fitted to the bottom of the main girder. This is done on an ordinary planing machine, the work being secured to a travelling plate which moves backwards and forwards under the cutting tool. On the under side of the casting is a hollow cylindrical surface, truly worked in a shaping machine, and this is fitted to rock upon a cylindrical saddle, C, forming the top of another casting, D, D. By this arrangement the angular movement of the girder end is accommodated, and the pressure is always uniformly distributed over the lower surface of D, D, which is planed to rest upon another planed surface, such as E, E, or upon rollers, F, F, interposed between them. These rollers are to be accurately turned all of exactly the same diameter,

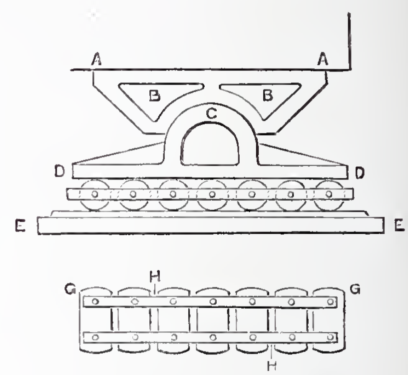


Fig. 14.—Expansion Bearings.

otherwise the bearing upon them would be taken only upon the larger ones. The axis of the saddle, C, must be at right angles to the length of the main girder, or it will jam in rocking, and if the rocker does not act, all the load will, when the bridge deflects, come upon the front roller. The lower or bed plate, E, E, is secured to the pier or abutment by holding-down bolts. If these bed-plates are carried on a transverse girder, they will accompany the girders in the lateral expansion of the bridge, but if firmly fixed to masonry, the girders must slide slightly upon them. At the ends of the rollers are pins which pass through holes in the side bars of a light frame, held together at the ends by distance bars; the rollers are thus placed in their proper relative positions, and prevented from running together while the girders are being adjusted upon them.

The larger the diameter of the rollers the better bearing will they afford, but the more space will they take, and thus increase the total length of the bearing to a perhaps inconvenient degree. To obviate this difficulty, parts of rollers are used, as shown at G, G, their relative positions are secured by the side rods, H, H, at each end, and the arcs are made of sufficient length to amply allow for the movements accruing from change of temperature. Metal, as I have said before, is liable to expansion in hot weather and contraction in cold weather; and this alone accounts for the use of roller bearings.

A Small Sideboard for the Dining-Room with Drawers and Cupboards.

A SMALL SIDEBOARD WITH DRAWERS AND CUPBOARDS.

ITS ARRANGEMENT AND GENERAL DESIGN.

BY ALEXANDER MARTIN.

In a dining-room, the article of furniture which exerts the most influence in the general appearance of the room is, undoubtedly, the sideboard; and it is not, therefore, surprising that cabinet-makers and house furnishers have devoted a very great amount of time and attention to its design and manufacture. For moderate-sized dining-rooms, a 6 ft. or a 6 ft. 6 in. sideboard is considered large enough now, although a few years ago the sizes were generally 7 ft. and 7 ft. 6 in. But if the length of the sideboard top has been curtailed, the height of the back has been increased; and this, along with the fashion of dividing the back into three, five, or more panels, has entirely changed the style of design. The under part must of necessity have the usual drawer and cupboard accommodation, but even this has been changed considerably in the arrangement and decoration.

In a smaller room, however, which can scarcely claim the dignified title of "dining-room," but must be content with the more humble designation of "parlour," there usually is a chiffonier which takes the place of the sideboard, and serves for such, both in its useful and in its ornamental capacities. Now it has been noticed in the furniture trade, that sideboards of a size between the chiffonier and the ordinary sideboard are finding a ready sale; and in order that the many readers of WORK may be kept well to the front in all that is going on in this direction, this paper has been written.

The usual chiffonier measures along the top, 4 ft. or 4 ft. 6 in., while the ordinary sideboard is 6 ft. long; so that a small sideboard with a top 5 ft. long comes in between these sizes; and in a small dining-room or in a moderate-sized parlour, it is much more imposing than a chiffonier, with its usual two cupboard doors, and one drawer under the top. One of the latest styles of these 5 ft. sideboards is that shown in our illustration. It will be seen to consist of, in the lower part, two cupboards and three drawers, with an open space in the centre for a jar or other ornament: and in the upper part there is a shelf extending right across the back, with three bevelled mirrors above it. A novel feature is the roof over the centre plate; it lends importance and dignity to the whole article. If any readers object to the extra work entailed by this arrangement, let them read right on, and they will by-and-by find various suggestions given, and it will be strange if they be not satisfied with one or other of them.

The important matter of what wood our sideboard is to be made of must be decided before much can be done. Oak is the fashionable wood for a dining-room, American walnut coming next in the race for favour; Spanish mahogany will, however, always hold its own as a furniture wood; and it is frequently used for the dining-room by those who want something different from what they see elsewhere. This wood has the additional advantage of attaining a splendid rich tone of colour in the course of a few years. But as it is wholly a matter where taste is allowed full play, there is no need to say more about it here.

As the illustrations of the details of the sideboard will occupy the greater part of two pages of the Magazine, it has been judged better to reserve the whole of them for the next number, in which the different parts and their construction will be fully described.

At present any intending maker will do well to look up some sound well-seasoned wood, either oak or American walnut, or Spanish mahogany, as he may choose. It is desirable also to study carefully and thoughtfully the design of the sideboard given in figure, so that the workman may fix in his mind its general appearance and form, and the relative position of the parts of which it is composed. Time thus spent will be found not to have been thrown away when the work of construction is commenced in earnest.

MAGIC PHOTOGRAPHS: HOW TO MAKE THEM.

BY WALTER E. WOODBURY.

AT the present time there are being sold in Paris a large quantity of so-called magic photographs.

A piece of white paper mounted on pasteboard is all that they appear to consist of, yet by dipping one into water, the portrait of some popular actress or celebrity soon makes its appearance.

I feel sure that a great many readers of WORK, who dabble in photography, will be glad to know that the method of producing these pictures is a very simple one.

Take any negative suitable for the purpose. The quality of the negative is of little importance. Make a print from this negative on a piece of ordinary chloride of silver paper; it can be obtained from any dealer in photographic materials.

Without toning in the gold bath, place direct into the fixing bath composed of a ten per cent. solution of hyposulphite of soda.

This will cause the print to assume a dirty yellow appearance, and it is then necessary to wash carefully in several changes of water until the hyposulphite is entirely eliminated. This is the most important part of the process, as unless every trace of the hyposulphite is removed from the film no invisible image can be made.

A bath is next prepared containing a five per cent. aqueous solution of bichloride of mercury. In this the pictures are placed, and if watched the image will be seen to gradually fade away, until it finally disappears altogether.

When no trace of the image can be detected, the prints are again subjected to a good washing, and afterwards laid across a pole or hung up to dry.

Ordinary cheap photographic mounts, or even pieces of pasteboard, will do to mount these pictures on, but before mounting we have another part to prepare.

In a strong solution of hyposulphite or sulphite of soda dip a few pieces of stout blotting paper, so that it becomes thoroughly impregnated with the soda; then hang up to dry, and cut into small pieces the size of your photo that we have left ready for mounting.

In mounting, one of these pieces of the saturated blotting paper is laid between the mount and the photographic print. It is only necessary to paste round the edges. As these prints have to be dipped in water, however, it is preferable to use a waterproof mount, such as shellac dissolved in alcohol, or india-rubber dissolved in benzole. This will prevent the print from leaving the mount, as it would be apt to do if made to adhere by any substance soluble in water.

When mounted, your magic photographs are finished. To obtain the image, all that is necessary is to dip in water, which apparently acts as a developer, but the following is the actual chemical change that takes place.

The chloride of silver paper is composed of silver and chloride, which form chloride of silver, which, when exposed to the light, assumes a darkened colour due to the "reduction" of the silver. When this is placed in the bichloride of mercury solution, which is a corrosive sublimate, chloride of silver and calomel are formed. Both these substances are colourless, hence the disappearance to the eye of the image. But in the presence of hyposulphite or sulphite, another transformation takes place—the image again becomes dark, and owes its colour to the formation of sulphide of mercury, and probably sulphide of silver also.

Therefore, the real developer is the piece of saturated blotting paper placed between the print and the mount. In its dry state no change takes place, but when the water soaks through the print, attacking the blotting paper and dissolving the sulphite, which immediately acts upon the latent image, development is at once the result.

Prints made after this manner and not mounted can be developed with water, to which a few drops of ammonia have been added, or tobacco smoke even. This latter method of development was the one first used by the Parisians; the pictures were made to fit into the tube of a suitable cigar or cigarette holder, and in smoking the development took place. That this description of the method of making magic photographs may afford some amusement and instruction, if not profit, to some of my readers, is the earnest wish of the writer.

NON-SLIPPING WOOD PAVEMENT FOR ROADS.

BY J. CHARLES KING, AUTHOR OF "ROAD-MAKING AND HIGHWAY LAW," ETC.

IT seems strange that so excellent a paving for roadways as wood is made so as to be a curse as well as a blessing—for its quietness and cleanliness constitute it a blessing to the inhabitants of the houses of the streets in which it is laid, and also to the riders over it. Yet it entails a great amount of suffering to horses that have to travel on it, by its being made so smooth and its joints and surface so slimy, that it is a source of constant accidents to horses, drivers, and vehicles.

This non-gripping surface is moreover rendered more costly by too rapid wear, superinduced by the manner of laying it.

Let me describe the usual plan of procedure in London and other cities, for there is little difference in the way wood-paving is laid. The roadway is cleared of its old paving, and gangs of men are set to work to dig into the hard sub-surface of the road, from which the old paving had been removed. This is done to the depth of from six to twelve inches or more, and the stuff is sifted, the rougher and larger stones are barrowed about without much sense or method, and eventually pitched somewhere on the roadway, raked level, but left loose, remember; then some of the finer siftings are barrowed about and pitched on the top of the loose stones, and raked level and gauged down smooth with templets to the convexity of the intended road. Here at once is a bad foundation, the loose material being unequal in its depth of density—some parts being loose for six inches, others loose for twelve or more inches deep—so that the settlement will be unequal, and the wood-paving above it will in a short time present that billowy appearance of surface which marks the wear of wood-paving.

On this loose surface is laid a coat of lime concrete and gauged level. Now comes the wood blocks, which too often reveal more sap than should be. This is a cause of decay and quick wear under heavy traffic.

There are two systems of fitting the wood blocks together: one close, the other with space between the side fitting.

When laid, the tops of the wood blocks mostly have a coat of gas tar poured over them, which finds its way down between the joints, partially saturating the sides and ends of the blocks. Now comes a dressing of river drift or fine shingle and sand, sometimes mixed with lime and water. This is supposed to afford a bite for the shoes of horses. When done it looks as nice and level as a country taproom floor.

The contractor's unscientific job of mischief is done, and the ratepayers settle by local taxation a costly and deceptive job—too soon to be repeated and again paid for. It would have been less trouble and cost to have done the work properly and the right way, and ensured a more durable wood-paving upon which the slipping of horses would be materially lessened in wet weather.

The senseless digging down and breaking up a hard sub-surface of road was the reverse of what should have been done.

It should have been gauged for convexity and mended where too hollow with concrete and granite, and rammed or rolled level and hard. No other sub-surface is needed. The wood blocks selected from wood free from sap, should be saturated with gas tar—as is usually done with the best work—and the blocks dried and weathered with this coat of tar. Then they should be laid with $\frac{3}{8}$ of an inch space between the sides, and $\frac{3}{8}$ of an inch between the ends forming the joints of the blocks. Into these spaces granite of *not less than a $\frac{1}{2}$-inch polygons* should be rammed tightly, after the manner of caulking a vessel—not with the contractor's unscientific broom—and the wood pavement is complete. No need to sand and lime the joints and surface to make slime, to make the pavement more slippery. These interspaced ridges of granite would be the grip for the horse shoes, and not being concreted together would, as they wore, break and form a grit for the surface to aid the horse's foothold, saving the cost of sanding it constantly, forming so much more slime when worn and churned up with the rain, or water from watercarts to lay the slime dust.

The paving should be watched, and more granite polygons rammed in to any open joints.

Breaking up roadways to cut off gas or water should be prevented. It is a common error to suppose that wood-paving is easier for horse draught of vehicles than granite pitching. It is so only at first; when it becomes unlevel it is much harder for draught than the rough granite pitching. This estimate of draught is with iron tires to the wheels.

OUR GUIDE TO GOOD THINGS.

79.—Watt's Electro-Metallurgy.

At the present time, when so much interest is shown in every description of work in which electricity is pressed into the service of man as an agent or motive power, the volume now under consideration will be welcomed as a serviceable addition to the many technical treatises on subjects in which electric action plays the principal part which have been already issued, or are still issuing from the fruitful press. "Electro-Metallurgy Practically Treated," to give it its full title, is by Mr. Alexander Watt, author of "Electro-Deposition," "The Art of Leather Manufacture," "The Art of Soap-making," etc. It says much for its popularity and utility when it is said that it has reached the ninth edition, having been subjected to considerable enlargement and revision, furnished with additional diagrams and illustrations, and brought down to date by the incorporation of the description of the most recent processes in metallurgy that have been introduced of late years. It forms No. 135 of Weale's Rudimentary Series, and is published at 3s. 6d. by Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. The book itself is divided into two parts, of which the first deals with Practical Purposes, and the second with Practical Notes. The first of these is subdivided into several sections, whose subject matter deals separately and in order with the following subjects, namely, the various batteries now in everyday use, the electro-deposition of copper, the electro-deposition of silver, the electro-deposition of gold, and the electro-deposition of brass and bronze, platinum, lead, nickel, tin, zinc, cobalt, and various alloys of metal. The second part comprises a variety of notes and recipes for various processes, and a clear and succinct description of the methods to be followed in effecting a very large number of things which the working electrician is called upon to do every day in connection with the work of electro-deposition. Among these are the whitening of silver articles, the whitening of brass dials, of timepieces, colouring gold articles, coating engraved plates with iron, and much else which it is not possible to dwell on in detail. At the end of the book will be found a copious list of articles required in electro-plating and gilding; a list of requirements for nickel plating on a moderate scale; a comparison of the relative values of Centigrade and Fahrenheit thermometer scales from freezing point to the point at which mercury boils; a table of weights and measures and tables of the electro-chemical relation of elements; the qualities of metals, showing at a view which are the most and least malleable, the most and least ductile, and the most and least tenacious; the conductivity of metals; the relative weights of different metals in cubic inches; the new legal standard wire gauge; the composition of common alloys; the weight, size, and surface of copper and brass tubes 10 feet long; and a table of high temperature, showing the different characteristics of each: thus the characteristic or description of 980° Fahrenheit is a red heat, that of 1,700 an orange red heat, and that of 3,000 a white heat. A good index of eight pages well completes the volume, and adds much to its value.

80.—Humphries & Co.'s Illustrated Catalogue of Photographic Apparatus.

This is an illustrated catalogue and price list of the photographic apparatus and appliances kept in stock, and supplied by Messrs. W. H. Humphries & Co., wholesale, retail, and export manufacturers, 268, Upper Islington Street, London, N. It is sent post free to any applicant on receipt of threepence. The cameras named and priced in Messrs. Humphries & Co.'s catalogue are all of their own design and manufacture. The principal specialty of Messrs. Humphries & Co. seems to be the "Drayton," a new long focus camera, which is shown closed and open in the accompanying illustrations.

The manufacturers claim that—

"The specialities of this camera are its compactness, portability, strength, and rigidity. It is free from loose parts, and can be set up in a few seconds, and comprises the following movements:—long and short focus; rising and falling front, with double swing; falling base board; double swing to back; rack and pinion side swing, and revolving adapter with check action, which cannot overturn, and is warranted not to stick; leather bellows.

"The improvements introduced into this camera are the easy working of all its parts; the special arrangement for revolving the adapter in metal rings instead of wood, which renders it free from climatic changes; and the stop action to the same when in position.

"The revolving adapter being always in position, the camera is ready for use at any moment, and obviates the old method of turning the camera on one side or taking off the reversing back, this being done by simply releasing the spring catch and turning the back round as required.

"There is also an improvement in the vertical swing to back in the means of pivoting, by which wear and tear is lessened, and perfect rigidity is maintained, and in the special arrangement for clamping the front side swing in position and the easy working and manipulation of the same, also in the clamping of the rising and falling front, which enables the operator to do so with one hand while focussing.

"The rack and pinion side swing to the back is an innovation for the sharping of distances.

"In introducing this camera, the chief aim has been to make it as complete as possible, both in construction and workmanship, for all classes of work. Classing together the extra conveniences and improvements in this camera, it will be found to be an instrument simple, compact, light, and capable of standing great wear and tear, perfectly rigid when erected."

The sizes in which the "Drayton" camera is made range from $4\frac{1}{4}$ in. by $3\frac{1}{4}$ in. to 15 in. by 12 in., and the prices from £5 for the smallest size or £5 12s. with extra double dark slide to £14 10s. for the largest size or £16 6s. with extra double dark slides. The cameras can be supplied with less than three dark slides if desired.

In addition to cameras and the different appliances that are needed by the photographer, Messrs. Humphries & Co., keep a large and varied stock of magic lanterns, suitable for all classes of exhibitions. The lenses are said to be remarkably good of their kind, and are fitted with rack and pinion, and with telescopic draw tube, which gives increased focal length. The condensers are composed of two plano-convex lenses of 4 inches in diameter in brass cells, and the lanterns are furnished with 3-wick or 4-wick refulgent lamps as may be desired. Smaller lanterns range in price from £1 10s. to £8, but the triunial lanterns range from £16 to £80.

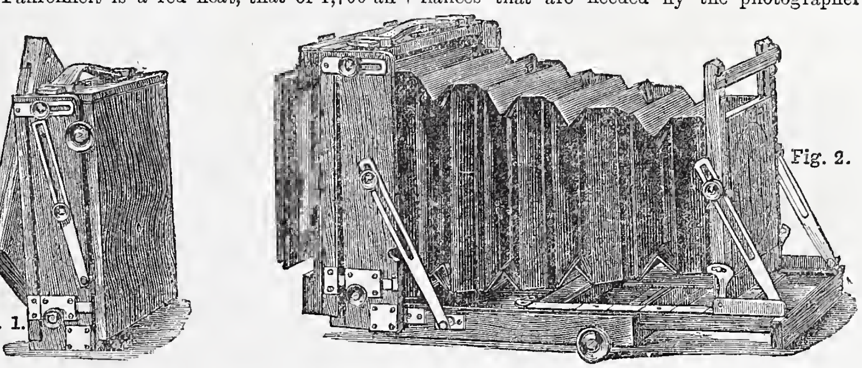


Fig. 1. Fig. 2.

Fig. 1.—Drayton Camera closed, with Revolving Back partly turned round. Fig. 2.—Ditto open.

81.—The Waterbury Watch.

One would imagine that the Waterbury Watch has been so widely and efficiently advertised that everybody must know all about it by this time. The Waterbury Watch (Sales) Company, Limited, 17, Holborn Viaduct, London, E.C., however, seem to think differently, for a specimen watch has been sent with a request for a notice in "Our Guide to Good Things," and perhaps this is so, for whereas as when the Company's leading specialty was first introduced for sale there was, if I remember rightly, only one kind, there are now four, distinguished as the L, E, F and J watches. Of these the E watches are supplied at 10s. 6d. each, the F at 15s., and the J at 17s. 6d. It is claimed for these watches that they are keyless, reliable, durable, and accurate. The long time occupied in winding up will be reckoned an objection, perhaps, by some, but it should be said that in the more expensive watches, *i. e.*, those sold at 17s. 6d., the wind is short and they are jewelled and dust proof. Every watch is guaranteed for two years, and the cost of repairs is but trifling.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Screen Secretary.—G. F. W. (*South Kensington*) writes:—"I have been a subscriber to Work from its commencement, and, I must say, am very much satisfied with every item of its contents. I am a joiner by trade, and some little while ago I was positively longing for some sort of a standard work on the lines of 'artistic furniture,' as described by David Adamson. I am always getting out designs for odd pieces of furniture and ornaments, such as cannot be bought in the ordinary way; but still I wasn't quite satisfied, I wanted to know other people's ideas, and when I saw the first edition of Work I said to myself, 'That is the very thing I want.' I have succeeded in obtaining six subscribers towards it, and shall never lose an opportunity to get some more, because I think that it is something which will become useful to mechanics and amateurs alike, and as such must not be left to go wrong, and so slip through our fingers. Now in Work No. 10 there is a screen secretary by David Adamson. It is a very useful thing. But there is one point which I should like to point out, and try to improve on it, which is this: In Fig. 5, the lid or flap is shown thus, Fig. 1. Now, sir, I

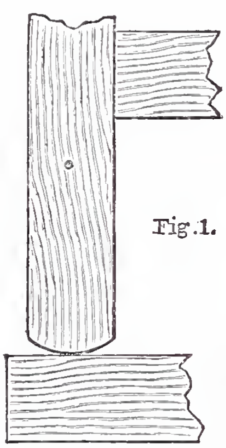


Fig. 1.

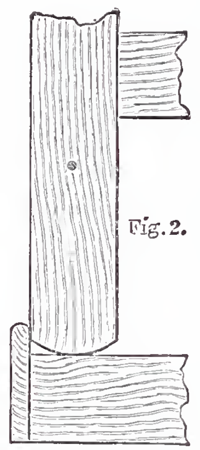


Fig. 2.

think it would be an improvement if it were shown like this, Fig. 2. You see that by planting that bead on that under shelf it completely hides the ugly joint which must otherwise be seen. The bead is at the same time flush with the front edge. because the lid stands back just that thickness."

Hollow Metal Plate Work.—Practical Man (*London, S.W.*) writes in reference to Opifex (see page 282):—"His method of hollowing metal hemispheres, or saucers, etc., I do not agree with. In the first place, stamping half balls cannot be done in one blow. To stamp a half ball would require five or six blows from a drop press (not a fly press); it would not pay a master to do them under five blows. Of course each blow would be a different tool starting from one only a little hollow till it is got to the right shape. Spinning can be done in one operation. The next way is hollowing the way by which all practical men work tin, iron, zinc, copper, brass, nickel and silver. If given to me to get to a required hollow, I would do it by this method which is the easiest, cheapest and quickest, and best. (1) You want a block of oak or any hard wood exceedingly dry, and use it the grain up. Well our blocks are exactly the same as a butcher's block, only they are solid instead of having legs. (2) You want a bullet hammer—a cast iron one will answer well. We have three or four in the factory now in constant use; one with a face about $1\frac{1}{2}$ over on the smallest side would be a convenient size. These can be procured at any tin plate warehouse. (3) The metal: I think tin plate will be the best to start on. If you go to a tin plate warehouse, and ask for a sheet of one cross 20 by 14 charcoal prime. Of course if you ask for this you will get the metal that will work, which will not cost more than 5d. Now for work: get your compasses and score a 5 in. circle, cut this out with a pair of snips; now draw a circle about $2\frac{1}{2}$ in. just to give you a guide to the hammering. Now you will want a little hole or hollow made in the wood block about 3 in. over and $\frac{3}{4}$ in. in the centre or deepest part. Now with the stuff in the left hand, hammer in the right, proceed to hammer on the edge of your metal and on the edge of your hollow in the wood, and gradually go in towards the centre; and the greatest advice any mechanic can give is join your blows, the more you join them the smoother your work will become. This way your work will not require to be annealed. Excuse me for taking so much of your valuable space, wishing Work every success. This is correct you can be sure, as I am a practical man."

II.—Questions Answered by Editor and Staff.

Making Silver-plating Solution. — W. H. (*Pollokshaws*).—When a silver-plating solution is made up as you describe it—namely, by dissolving old silver in nitric acid, throwing down the silver as a chloride with salt, and dissolving the chloride paste in cyanide of potassium—you get chloride of potash in the solution, and this is bad, for it has a tendency to cause the silver to go on loosely, and thus strip under the burnisher. The solution will also give up yielding a good deposit sooner than one made up of cyanide of silver alone. If you must use old silver, adopt the following plan:—Dissolve as you do now, and convert into chloride, and well wash the chloride; then immerse in the wet mass a quantity of scrap zinc, and stir occasionally. After a time the whiteness of the chloride will disappear, and leave nothing but a dirty grey powder. This is finely-divided pure silver. Agitate the wet mass in water with the zinc until all traces of the silver chloride have disappeared; then well wash the grey paste in hot water to dissolve out all the chloride of zinc. Take out the zinc scraps, and add a little sulphuric acid to dissolve any little bits of zinc remaining; stir up a few times, wash until clean as you do now, then dissolve the whole in nitric acid. After this, evaporate off all the acid and convert the solution into pure nitrate of silver crystals. Dissolve these in distilled water, add cyanide of potassium solution until all the silver has been thrown down as silver cyanide; well wash this, and dissolve in cyanide of potassium solution to form the silver plating bath. I prefer buying the silver nitrate to making it myself. To prepare articles for silver plating, well clean them, dip in acid pickle to remove loose specks of dirt, then quick them in a solution of nitrate of mercury, and finally rinse them in clear water. This will be thoroughly dealt with in my "Notes for Electroplaters." If you meet with any special difficulty in preparing the articles, please write and let me know exactly what it is, when I will try to help you out of it.—G. E. B.

Silver Plating. — W. H. B. (*Leicester*). — You cannot use a better solution for silver plating than one made up of the double cyanide of silver and potassium in distilled water. Dissolve the nitrate of silver in distilled water, precipitate the silver as silver cyanide, well wash the precipitate, then dissolve in a solution of cyanide of potassium in distilled water to form the plating bath. If you wish for details of the process, together with weight (per gallon) of ingredients to be employed, please write again and let me know the class of work to be plated. For ordinary trinket work, one Bunsen cell will do fairly well; but a large Daniell or Smee is best for spoon and fork work, since the current is not so intense from these as from the Bunsen. (2) The length of time an article should be kept in the solution depends upon the quantity of silver required, and the volume of current passing through the solution. Now, one ampère of current passing through a silver-plating solution will deposit sixty-one grains of silver in an hour. This current will be obtainable from a large Daniell cell charged with sulphuric acid (one acid to twelve parts water) in the zinc compartment, providing the slinging wires are of No. 16 copper, the connections are clean, and the anode not too far from the work. You must, therefore, calculate the area over which this deposit has to spread, and you will then get a tolerable idea of its thickness. This must guide you in determining whether the coat is thick enough or not. (3) Clean the hoop well as for plating, then wipe dry with a clean soft linen rag. To the inside apply with a soft brush some good copal varnish tinted with red lead or with ultramarine. Allow this to get quite hard in a dry, warm room, or dry it in a lacquering stove before putting it in the plating solution. The "stopping" may be afterwards removed with rags moistened with warm spirits of wine. Many thanks for your kind appreciation of Work, and for your suggestion, *re* banjo. Can't you just write and tell us how you made your banjo?—G. E. B.

Goat Cart.—F. E. B. (*Landport*).—A paper on how to make one is being prepared.

Bird Cage.—Miner (*Dykehead*).—An article on bird cage making is in preparation.

Cornpike.—J. P. (*St. Keyne*).—I do not know the implement termed a cornpike, but suppose it is a kind of fork. If so, it is not the practice to temper tools of this kind. They are made of cast steel, untempered.—J.

Loadstone.—W. L. (*Sheffield*).—Orme, of Barbican, London, can supply you with a piece of natural loadstone. You would only get a small fragment for 5s.—J.

Lantern (*Dartmouth*) asks:—"What advantage is gained by the use of cardboard carriers?" If the slides are properly mounted and marked with white spots or white line on the top front edge and carefully placed in boxes prior to exhibition, a carrier sufficiently long to hold three or four slides, $3\frac{1}{4}$ in. square, one in each lantern, so that when the last slide is placed in the carrier the first is pushed out, is all that is needed. A properly mounted slide has only a paper binding. Slipping and mechanical slides, of course, require exceptional arrangement.—E. D.

Size of Pulleys.—F. A. (*Islington*).—The diameters of the pulleys on the engine shaft and on the driving shaft of the machine, must be inversely as the speeds. Suppose, for instance, you have an engine running at 60 revolutions per minute, and you want to drive a machine at 200 revolutions, the ratio of the diameter of the pulley on the engine shaft to that of the pulley on the machine shaft must be as 200 to 60 — that is, the engine pulley diameter will be $3\frac{1}{3}$ times that of the machine pulley. To state this as a general formula applicable to all kinds of machinery, let D=diameter of driving pulley and N its number of revolutions per minute; and d and n, the diameter and number of revolutions of the driven pulley, then,

$$d = \frac{D \times N}{n}.$$

In the above case let the engine pulley be 50 inches in diameter, then

$$d = \frac{D \times N}{n} = 50 \times \frac{60}{200} = 15 \text{ inches.}$$

This formula will also apply for calculating the diameter of toothed wheels and chain wheels.—F. C.

Yellow Piano Keys.—J. A. (*Salford*) has a piano, the keys of which have turned yellow, and wishes to know how to bleach them. I presume the keys are ivory, and not celluloid. If you will kindly see reply to H. W. (*Sheffield*), on page 317, you will find full details for restoring keys. To bleach try the following:—After taking the polish off with fine glasspaper, take a pennyworth of spirits of salts, and dilute with two-thirds cold water. Now rub over the ivory which is very yellow, and allow it to remain a few moments, and watch the result, not allowing it to remain too long, as it will burn it; when you see an improvement remove the surplus with a cloth damped with methylated spirits and fine paper and polish, in the manner described to H. W. Caution, do not spill the spirits of salts on your clothes.—T. E.

Electrophorus.—R. G. (*Preston*).—Charge the tray of your electrophorus with a mixture of eight parts resin, one part shellac, and one part beeswax or Venice turpentine. Mix well, melt together, and pour into the tray. The cake thus formed will not be so liable to crack as one of pure resin, and may be excited by rubbing with a piece of fur, flannel, or silk. The upper plate or cover may be made of sheet metal or of wood coated with tinfoil. If you make a new one of wood you should well dry the wood by baking in a slow oven before you make it up, but any sheet metal may be used for a cover, and this will not warp. The handle must be of glass or of wood well baked and then soaked in melted paraffin wax. Unless wood is thus treated it absorbs moisture, and becomes a conductor, whereas you want an *insulated* handle. A phial bottle may be used as a handle. Embed the neck in a boss of baked wood fastened to the upper plate. You may varnish the back of the plate, but must not varnish the face nor the tinfoil if you use this.—G. E. B.

Testing Platinum Contacts.—A Reader of Work (*Chepstow*).—When nitric acid is applied to platinum it has no action whatever on the pure metal, but should the speck of platinum be slightly coated with solder (and this may happen accidentally), the acid would leave a black stain on the solder. Nitric acid will stain with a dark spot such alloys as pewter, solder, Britannia metal, and steel. It will also leave a dark stain on iron and on silver. By adding one part of chromic acid to six parts of diluted nitric acid, another testing liquid may be made which will leave a blood-red stain on silver, a brown stain on German silver, a black stain on Britannia metal, but have no effect at all on platinum.—G. E. B.

Telegraph Instruments.—H. D. (*Haverfordwest*) writes:—"I am delighted with Work. It is really an excellent paper for amateurs, and has given me great pleasure to recommend it to all my friends at home and abroad. The articles by Mr. Bonney, especially, are not only practical, but are singularly clear and interesting. Work may not be great in point of circulation or popularity, although that must surely follow when it is more widely known; but in its aims and objects, in its usefulness and comprehensiveness, in the ability and courtesy of editor and staff, the paper is without a rival. Accept, then, my heartiest wishes for its success. I have determined to try and make a telegraph instrument for my own use. Could you tell me where I could get a book upon the telegraph and telegraphy? I should like one that would describe the different kinds of instruments; and shall go in for the study of the subject. But, nevertheless, I shall eagerly wait for a description of the instrument from your able pen."—I thank you for your encouraging words in both of your letters, and your efforts for increasing the circulation of Work. If all our readers worked as you do, our circulation would soon be great indeed. When I can find time to deal with the subject, and can make sure of having the line clear to run my train of thought, I hope to fully illustrate and describe a telegraph instrument such as you can make yourself. Meanwhile, perhaps, you may be assisted in your studies by reading Mr. E. B. Bright's book on "The Electric Telegraph," price 2s. 6d. There are several books published on the subject, such as "Telegraphy," by W. H. Preece, price 3s. 6d.; "Electricity and the Electric Telegraph," by Geo. B. Prescott, 544 illustrations, price 18s. From any of these you will get a tolerably general idea of the various telegraph instruments in use, but they do not give detailed illustrations of the various parts composing a telegraph instrument.—G. E. B.

Subscription to Work.—W. A. D. (Government Land Surveyor, Vredefort, Orange Tree States, South Africa).—The particulars have been sent you by post to save time. Thanks for your letter.

Polishing Fretwork.—N. M. (*Norwich*).—The "easiest and best" way to polish fretwork is to clean and polish the wood before fretting, but as I gather from your inquiry that it is now too late for you to do this with the piece of work you are engaged on, it will be satisfactory for you to know that fretwork is generally polished after it is cut. The polishing is done in the ordinary manner, except that the grain is not filled, for the simple reason that the filling gets in the corners and is difficult to remove—in other words, the filling is more trouble than it is worth. It is not possible to get the best results of which French polish is capable without filling. This can easily be applied to the plain wood, and hence the reason why it is best and easiest to polish before fretting. You are, I presume, acquainted with the process of French polishing, so these remarks are given merely about polishing fretwork. If you polish the wood before cutting, you will understand the work must be touched up afterwards, and that it is necessary to scratch away polish at any joints to be glued together. If you have already done the cutting it may be useful for you to know that the pieces of fret should be polished separately before finally fixing them together. To minimise risk of breaking points let your rubber be small and firm. Don't attempt to polish inside the cuts, and carefully scrape away any polish which may accumulate as the work proceeds at their edges.—D. A.

Polishing.—A. B. (*Lower Edmonton*).—The three varieties of wood mentioned by you require different treatments so far as darkening them is concerned, the stains employed being different for each. These stains you can buy ready made, at a low price, at any oil shop where polishing materials are sold. If the stains as bought are too dark, dilute them with water. Walnut is seldom darkened by staining unless it is ebonised. From your mentioning this wood with the others I think you may have mistaken the slight darkening by oiling for staining, and if I am right in this supposition omit stain and simply use oil in its place. Prepare the wood by cleaning it up thoroughly with glasspaper. Rub in a little raw linseed oil, but do not saturate the wood with it. Allow the work to stand for a time, then fill the grain of the wood by rubbing in either some filling which you may buy, or one composed of whitening made into a paste either with turpentine or with a mixture of linseed oil and polish. Clean off superfluous filling and polish. The polish itself you had better purchase, but if you prefer making your own, dissolve some shellac in methylated spirits, say 6 oz. to 1 pint. Get a piece of soft rag and cotton wool to form a rubber, moisten this with the polish, apply just a touch of oil to the surface of the rubber, and go over the wood to be polished, with an even motion, covering every part equally. When the work has been bodied in with polish finish by spiriting off. This consists of using a rubber with methylated spirits instead of polish, just sufficient to remove the smears left by bodying in. Finishing with glaze is not nearly so difficult, but it is not as durable, and should never be resorted to for first class work. Glaze can be bought so cheaply that it will be hardly worth your while to make your own. If you determine to use it, omit the spiriting off, and go over with a rubber moistened with glaze. Such is a brief outline of the process which will be fully treated in a series of papers on polishing as soon as practicable. Meanwhile I hope the foregoing will be of assistance to you.—D. A.

Polishing Oak Overmantel.—J. K. (*Bethnal Green*).—To darken the job to the extent you name I think you will find that it will only be necessary to oil the wood and use brown polish, but, of course, a good deal depends on the colour of the oak as it is "in the white." Even if it may seem too light at first, remember that oak is a wood which soon darkens. Should a stain of some sort seem desirable use a very weak one of bichromate of potash and water. Put this on with a rag, but don't use too much of it. To avoid risk of spoiling your overmantel by making it too dark, finish up a small piece of wood of the same kind as that used in its construction. If this test piece is too dark, subsequently, you will see that you have used too much staining; while, on the contrary, if too light, more stain will be required. Do not on any account varnish your overmantel, but polish it in the usual way. For further remarks on polishing see above answer to A. B.—D. A.

Bending Rolls.—J. G. (*Wirksworth*).—You should place the centres of your bottom rollers about 9 inches apart, the rollers being 6 inches in diameter. To bend your heaviest iron cold will require a pressure of about two tons on the rolls; the top one being made adjustable.—F. C.

Papier-Mâché to Resist Water and Insects.—R. W. (*Manchester*).—The queries which R. W. repeats have been already answered. In his laudable desire for information, he forgets that with the heavy demands upon "Shop" space time must elapse between the receipt of a question and the publication of a reply to it.—S. W.

Fountain.—J. C. (*Hull*).—An article on the construction of self-acting fountains is in hand, and will be published as soon as possible. It would be impossible to give sufficient details in the columns of "Answers."—C. M. W.

Automatic Carriage Brake.—H. A. H. (*Diall Stenness*).—In my opinion your invention is ingenious and thoroughly practical, and its extreme simplicity precludes its getting out of order, and is a guarantee for durability. There should be no difficulty in getting the invention taken up, but you should obtain protection (it only costs £1) before showing it in the trade.—F. C.

Wheel for Lathe.—A. P. S. (*Heaton Chapel*).—A wheel of 20 in. diameter, and weighing 21 lbs. in weight would be too small and too light for a lathe of 6 in. centres; whether for wood or metal makes no difference. Such a wheel is only fit for a sewing machine or fret saw. For a lathe of 6 in. centres to be driven by a man, you require a wheel of at least 2 ft. diameter, and weighing about 70 lbs. For a boy's lathe, of 4 in. or $3\frac{1}{2}$ in. centres, a wheel of about 22 in. diameter, and 45 to 50 lbs. in weight, would suit well. Two wheels like yours might do pretty well for a $3\frac{1}{2}$ in. lathe.—F. A. M.

Cheval Screen Escritoire.—P. P. (*Blisworth*).—The drawings of the screen escritoire were to scale. Unfortunately I have mislaid the actual size, but if you take the ordinary height of a table for writing, as your ascertained measure, there will be little trouble in finding the rest, especially as the actual dimensions are not important to an inch or so.—J. G. W.

Cabinet in Fretwork.—A SUBSCRIBER FROM THE BEGINNING (*Slough*).—Your pen name is a favourite one I know, but is it not a "leetle" premature to adopt it yet? After No. 1,000 it will be a nice one to swagger; but seriously I am pleased you like WORK, and appreciate the real efforts of the contributors to aid its readers. The partitions of the cabinet should go right through—the depth to be about 4 in.—the width is, of course, the full size, as shown in the working drawing. If fret cut, the drawers may be white with the casing of the whole thing black. For inlaying full instructions were given.—J. G. W.

Cement, etc.—ONE IN THE DARK writes:—"Wanted to know how to make an inexpensive cement or compound, which will possess the following properties:—It must be capable of being used in a body as thick as a man's arm, to set hard in a few hours, with little shrinking, to bear a nail 2 in. long, being driven in when hard, and not to cause cracking or flawing, and to stand a moderate amount of heat without injury. The colour is no object."—To this the reply is:—[A mixture of plaster of Paris, with twice its bulk of plasterer's putty, and water, will set in a few hours; can be moulded, and will bear a moderate amount of heat. If too brittle for driving nail in, add more putty, or use Paris white and thin glue, instead of putty and water.—E.]

Violin Purfling Tools.—G. E. B. (*Hampstead*).—One kind of purfling cutter is sold by Withers & Co., 51, St Martin's Lane, London, for 4s. 6d.; another style is sold by J. Schecrer, Covered Market, Leeds, the price of which is 5s. 6d.—B.

Lithography.—APPRENTICE.—A tint such as you describe often results from using retransfer ink too strong; the remedy is to mix lithographic printing ink with it until the tinting disappears. You must be sure also, that your gum sponge and damping cloth are perfectly free from greasy matter, as want of care in that direction will cause you much annoyance, and contribute to failure.—J. H. M.

Photo-lithography.—PEN AND INK.—It is not competent to fully describe this process in the pages of "Shop," but as you say you are both photographer and lithographer you will, no doubt, be able, from the outline that I here give, to arrive at the necessary information which you lack, concerning the combination of those two arts, but I warn you to summon to your aid all the skill that you are master of. In the first place the lens in common use will not do for the purpose, as the picture it gives suffers a distortion at the edges that in some subjects is very disagreeable; you must, therefore, provide yourself with a lens that is free from this vagary. The detail of the copy to be reproduced must be clearly expressed by stippling or lines, and a glass negative is taken in the ordinary manner. A sensitive paper is used, the coating of which consists of equal parts of bichromate of potash and gelatine, thoroughly dissolved in $7\frac{1}{2}$ times their combined weight of water. The coated paper is dried in the dark room. After a print taken on this paper has undergone exposure, the duration of which experience must decide, it is evenly and entirely coated with transfer ink by pulling through a litho press over a stone that has been previously covered with transfer ink. The print in this state is sponged with gum, and washed repeatedly in warm water, and this operation ought to effect the clearing away of superfluous ink, and develop a transfer that may be dealt with in the usual manner of litho printing.—J. H. M.

Japanese Cabinet.—CLERICUS.—It is the keenest pleasure to hear that any article one has written has been of the least use, and one that, although not absolutely without precedent, can never lose its original pleasure. I like the idea of red enamel for the cabinet, but should use for that no carved work, but gold Japanese paper, or gilded lincrusta for the panels. Liberty, of Regent Street, was selling recently, bundles of odd lengths of the former at 1s. and 1s. 6d. each; these are most useful. There is a gold over red pattern (not gold on a crimson ground, which is quite distinct), that would look extremely well, could you get it. C. Hindley & Sons, Oxford Street, W., also cut lengths of the Japanese-gold paper. For other purposes a new wood carving (Spurr's patent) that is to be shortly introduced in England, will probably satisfy you, as, save the cost, there is nothing to distinguish it from the finest hand-wrought work. If you could get at an oriental warehouse damaged lacquer tea-trays cheaply, they would come in splendidly for the panels of the cabinet.—J. W. G. W.

Enlarging.—W. P. (*Wisbech*).—A camera bellows is one of the things that cannot very well be described at length in "Shop," and would require a paper to itself. The *modus operandi* is somewhat as follows:—Make a box, the outside measurement of which is the same as the inside of the bellows. Procure enough black silesia to go round the box in two thicknesses, and lap, say, about a third over; paste a sheet of strong brown paper between the silesia, and form your bellows, fold by fold, round the box, pressing each fold as it is made, close up to the preceding one; leave on the box till quite dry. This may give you an idea how to go about the thing, or perhaps you can persuade the Editor to give you a paper with diagrams.—G. LE B.

Book Marbling.—T. W. W. (*Mold*).—The process of transferring the pattern from marble paper to the edge of a book is a comparatively easy one, although a considerable amount of dexterity will be required in the manipulation. Have ready at hand the following articles:—Some hydrochloric acid (spirits of salt), a broad camel's-hair brush, some strips of marble paper, a little broader than the edge to be operated upon, a few sheets of scrap white paper and a hammer. Place the book in the lying-press between pressing boards, and screw it up as tightly as possible. Take up some of the acid in the brush, and pass it quickly over the edge, lay on a strip of marble paper, over this place a sheet of paper, and tap gently but firmly with the hammer over the entire edge. Lift off the paper, and the pattern will be found to have been transferred to the book. It requires a good deal of practice, and not a little patience to make a good edge by this method. I hope bookbinder will succeed. The book will require to be flat and very smoothly cut. The marble paper must not be very highly glazed, in fact there is a special paper sold for this purpose. It can be had from Berry & Roberts. I will be pleased to know how you succeed with this.—G. C.

Milling Cutters.—KEYWAY.—You can obtain milling cutters for cutting keyways in shafting at any large tool maker's: send to J. Buck, 56, Holborn Viaduct, for price list. If you mount the cutter between centres of lathe you will have some trouble to fix and adjust the height of shaft. Another way would be to use a slot-drill in the drilling spindle, mounting the work between the centres; but this requires a driller and overhead motion. The size of cutter to use in a small lathe, is very vague—say, 2 in. diameter. The speed the cutter should run, if well oiled, would be about the speed you would use if it were of brass and you were turning it.—F. A. M.

Lettering in Gold.—T. E. T. (*Kingsland*).—I am pleased to see that you have been successful in binding your own books, and am also very pleased to give you the information you ask in regard to lettering in gold. Begin by washing the leather cover with paste water—*i.e.*, water with a little paste mixed in it. If the cover is of calf, rub it well over with paste to fill up the pores previous to washing. When this has become dry give the title and parts to be gilded two coats of glaire—white of eggs beaten until as thin as water—allowing the first to dry before applying the second. When perfectly dry, rub it over with an oily rag kept for the purpose. I don't mean a rag dripping with oil—there must be very little in it. Spread out the gold on the cushion, and cut it to the sizes required. To make the gold adhere until the lettering is finished, rub the parts where the gold is wanted with hog's lard or olive oil. For calf, use the lard; for all other leathers use the oil, and use both sparingly, as leather can be easily stained by these substances. Lift the gold from the cushion with cotton wool, and press it firmly on the book. The tools are heated in a gas stove, and must be warm enough to "bizz" when touched with the wet finger. The hot tool causes the gold to adhere, and whether it is an ornament or a letter it will be firmly impressed upon the book. To letter, you will require guiding lines to keep your letters even. This is done by drawing a fine thread over the gold. When the lettering is completed, the surplus gold is rubbed off with the oily rag mentioned above.—G. C.

Gold Vein in Marble Papers.—DESIROUS (*Dundee*).—This operation is a very difficult one. It requires no small degree of skill and dexterity. I did not think that an amateur or small tradesman would have attempted it, because of the cost and trouble connected therewith. The gold vein does not always adhere even on the London marble papers, for the simple reason that instead of gold powder metal bronze is used. When you ask for gold powder, see that you get it (as they say in advertisements), as herein lies the secret. Metal bronze is too heavy, and requires lithographer's varnish to make it stick. The substance used to make gold powder stick or adhere to the paper is prepared with white of egg and spirits of wine in equal proportion and two parts of water, beating all well, and leaving it to clear. Mix a small portion of the gold powder with the liquid, and use a camel's hair pencil. I hope our friend will succeed. Of course, it is much cheaper to buy the paper already prepared, and far better, for the designs are much prettier than it is possible to make them in a small way.—G. C.

Ticket Writer's Ink.—H. T. J. (*Newport, Mon.*). —The colours should be bought in a dry state. Always use the best, such as lamp black, vermilion, royal green, and ultramarine. Mix your colours with a thick solution of gum arabic, and grind them well with a palette knife on a piece of glass or marble. To make colours lighter add flake white until of the required tints. There are other recipes. —H. S. B.

Watch and Clock Oil.—AMATEUR REPAIRER (*Kent*) cannot possibly do better than use Ezra Kelley's oils for watch or clock, at least, that is the conclusion I have come to after eighteen years at the bench. For coarse, heavy watches I sometimes use Windle's chronometer oil. To cement stones use very best and new plaster of Paris, mixed with water. With clear settings a little coaguline is a good cement.—A. B. C.

Instrument for Enlarging Drawings. — INVENTION (*Liverpool*).—The "instrument" you refer to is doubtless that known as a pantagraph. If this is not the thing you saw, a pantagraph will serve the same purpose, as it is commonly used for enlarging drawings. I do not, of course, know in which shop you saw it; but if you are a "down town" man very likely it was at Matheson's tool place. You will also be able to get one at several shops in Whitechapel. As the Dinglet omnibus passes his door, perhaps you will find Jeffery, the artists' colourman, at the top of Renshaw Street, the most convenient for you; but you can hardly walk along the streets without noticing the pantagraph in many shop windows. The construction of a pantagraph will be explained in WORK in due course.—D. D.

Colouring Oak Overmantel.—J. K. (*Bethnal Green*).—A good deal will depend on the natural colour of the wood as to the amount of stain required to darken your overmantel to the tint required. You can best ascertain by experimenting on small pieces of waste, and you will probably find that by oiling before polishing and using ordinary, not white, French polish, you will not require any stain. If you should find this necessary you can buy a small quantity at many shops in your neighbourhood, or make some by dissolving a little bichromate of potash in water. To prevent the oak being stained too dark, be sure and add plenty of water; but if you try the result on waste, as suggested above, you are not likely to spoil the job. Of course, you know the stain must be put on before the polish.—D. A.

Carpenter's Bench.—J. F. R. (*Nottingham*).—Your want has been partly anticipated, as an article describing a small bench is now in hand and will shortly appear. I have said "partly anticipated," as the bench described is of rather an unusual kind, and while it will be useful to a very large number of readers it may not be just what you want. If so, I may say that the construction of an ordinary bench will be given ere long; and surely you do not need to be told that in order to render your bench easily removable you can put the parts together with screws. Criticism, as you suggest, is not objectionable when fairly given; and opinions are often valuable, though many of them may suggest alterations which are impracticable. Still, they all receive attention. With regard to advertisement pages and wrapper, it must suffice to refer you to remarks which have already appeared thereon in "Shop." Your good wishes are appreciated.—D. A.

Rough Frame. — G. S. B. (*Rotherhithe*). — The rough gilded frame, I confess, is beyond me. I hear it is done in the usual way, but fear that will be little assistance to you. It seems rather more than an amateur can attempt.—E. B. S.

Cheval Screen Hinges.—C. M. J. (*Limavady*). —The long elbow hinges I got at a country ironmonger's, whose name and address I forget, but Churchill or Melhuish would be sure to be able to supply them.—E. B. S.

Books on Estimating and Measuring.— L. G. (*Cambridge Road*).—The following are good books for measuring work connected with the building trades:—"Laxton's Builders' Price Book," 4s. (G. Wilson); "Laxton's Builders' Tables," 5s. (Spon); "Horton's Complete Measurer," 4s. (Lockwood).—J. H.

Heating Greenhouses with Oil.—SIGNALMAN (*Lancashire*).—My experience with heating apparatuses generally leads me to give the preference to a stove outside the house and hot water pipes within it. If the wick of the oil lamp rises—and sometimes it will rise — above its proper height, the result is the discharge of copious showers of soot, which will spoil everything, or almost everything, in the house. There are many oil heaters, but I give my preference to the "Tower" heater, of which you may ascertain all particulars by writing to Mr. John Waller, Arabin Road, Brockley, London, S.E. The hand-light to which you refer is an invention of my own, not of Mr. Le Brun. It is not yet patented, and, therefore, I cannot describe it at present. It is unfortunate that your soil is so sandy, but the remedy—namely, the admixture of plenty of good loam and humus, or leaf mould—would be worse than the ailment, on account of the expense. I should recommend you to try to do more with greenhouse work and growing in tubs and boxes. I have a fine display of geraniums in fancy boxes on walls, and grow cucumbers and marrows in tubs, training the former over the roof of the greenhouse, and the latter on trellis work and along the top of a wall. Results from work of this kind will compensate for the hungriness of the soil, in which, by the way, you ought to be able to get first-class carrots.

Garden Frame.—J. H. H. (*Sydenham*). — Sash lights are not suitable for garden frames. You should make your own frames, and this, I think, you may do from Mr. G. Le Brun's instructions for making lights for the roof of his "Tenant's Greenhouse." If you want more detailed information, write and say so, and you shall have it.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Billiard Slates. — CEMENT (*Cork*) writes:— "Would some kind reader give me a recipe for a cement for the filling up of chipped billiard slates? I have used resin and beeswax, and find in the ironing it is inclined to stick to the cloth."

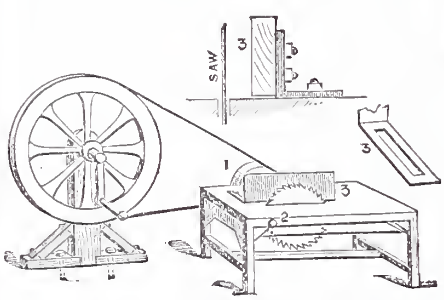
Lathe Work.—A READER OF WORK (*London, N.W.*) writes: — "Would any brother-reader of WORK that's well up in lathe work kindly tell me how to adjust compound rest on lathe, to give the right taper for male and female tapers, also the right place to drop nut into lathe screw in cutting odd threads per inch as 7, and broken threads as 4½ in. saddle taken back by hand at every cut for starting again, lathe screw ¼ pitch?"

Screwing Machine.— INQUIRER asks:— "Will some reader kindly tell me the names and addresses of the latest screwing machine manufacturers?"

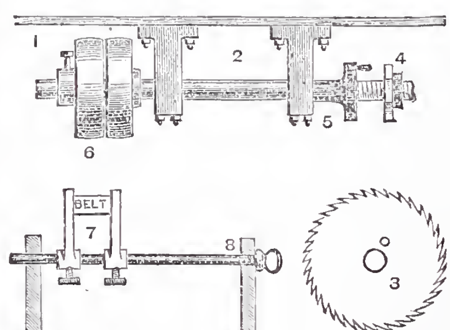
Blacking Hooks and Eyes.— H. R. (*London*) writes:—"Should be thankful to any of your numerous correspondents who could acquaint me with the process of blacking hooks and eyes, and the like."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Hand Saw Bench.—B. F. (*Liverpool*) writes in reply to G. H. L. (*Hull*) (see page 222):—"I send sketch of hand-saw bench as required. It does not want much explanation. He will find it hard work; the heavier the driving wheel is the lighter it will be to turn saw when it gets on a swing; the smaller



1, Fast and Loose Pulley. 2, Knob for Moving the Strap Back and Forward. 3, Fence to be Moved as required for the Cut.



1, Collar. 2, Spindle. 3, Saw. 4, Nut to Tighten Saw. 5, Place for Washer. 6, Pulley. 7, Belt. 8, Fork to Move the Belt.

the pulleys are the greater the speed on saw, but the larger they are the less power. I should say about 8 or 10 in. diameter, the driving wheel not less than 5 ft. There is another way, by having an extra driving shaft; but the above I fitted up and worked to cross cut firewood; it worked well, but required a strong man to turn it, and keep up the speed, cross cut planks, etc., also ripping 2½ in. boards."

Tobacco Pipe Making. — A PIPE MANUFACTURER writes in answer to SMOKE (see page 222):— "I wish to inform him that there is no book published on the above trade, that I am aware of; but if SMOKE wants to know anything concerning the same, I have an essay on pipe making which treats on all subjects, from the clay to the churchwarden or imitation meerschaum, etc, and which I will submit to the Editor if I may do so."—[I shall be glad to see the article on approval, to which you refer.—ED.]

Trade Notes and Memoranda.

OUR contemporary, *The Engineer*, recently gave illustrations of an automatic pill-picking machine, the joint invention of a practical chemist and of a practical mechanic. The machine can be set to reject any pills which are in the least degree above or below the standard size, or which are not perfectly round, while for commoner qualities of goods it can be arranged to reject only those pills which are conspicuously defective in either of these respects. The machine is already in extensive use.

AN immense engine for rolling steel rails is being erected at the works of Palmer's Shipbuilding Yard, Jarrow. It will be capable of exerting 10,000 h.p. The crank shaft is 21 in. in diameter, and the forging for the shaft weighed over 40 tons. The weight of the entire engine is over 300 tons.

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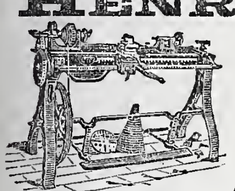

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 25.] SATURDAY, SEPTEMBER 7, 1889. [Price One Penny.

GESSO WORK.

A NEW MODE OF DECORATION IN LOW RELIEF.

BY E. C.

A fresh kind of art work is interesting since the love of novelty and of research is inherent in most natures. Artists, and workmen of the more intelligent sort, enjoy finding out what effects they can secure with any new materials or tools they may have at command. Amateurs especially delight in the latest inventions, and many even cannot resist the temptation of trying each novelty in the way of minor arts as it is brought out, thus making it a foregone conclusion that they will be proficient in none until they cease to play the part of "rolling stones." Still, I do not consider such flitting from one occupation to another as altogether deserving of the scathing condemnation bestowed sometimes upon it. If only at last the butterflies will settle down in earnest to a congenial pursuit when they discover it, they will be none the worse for the smattering of knowledge they have gained. It is not always the case that we can find at once our own nook in the midst of the labourers; having done so, let us fill it to the best of our ability.

As I have been asked to write for this Magazine a paper on "Gesso Work," I am pleased to do so, because I am sure that the art as applied to decoration has a future before it, and those who become by practice competent to execute thoroughly good specimens, will have a pretty safe chance of earning something better than a mere livelihood.

Now I cannot claim for gesso work the charm of novelty since it is ages old, but it is tolerably new to us (last year, I think, the first examples were exhibited in England) as regards its adaptability to furniture and house decoration. Here is the opportunity for those who enter the lists to make their mark; and women may succeed quite as well as men.

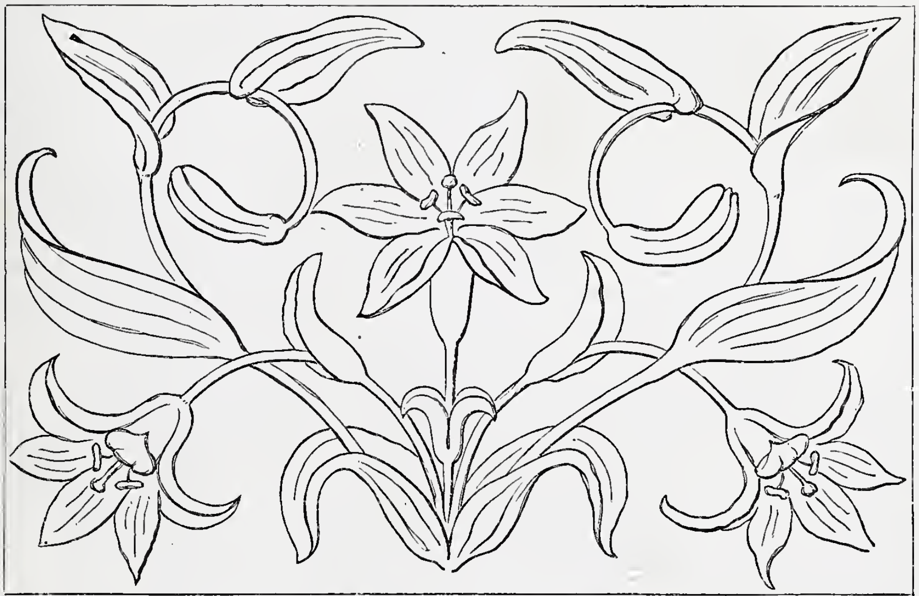


Fig. 1.—Panel for Piano Front in Gesso Work.

Gesso is composed of the finest plaster of Paris and glue. The mixture, which should be of the same consistency as cream, is laid on the surface of sized or lacquered wood with a brush. Two or more coats may be applied to bring the decoration into higher relief, and whilst still soft the composition can be modelled with the brush. It can also be left flat, when it forms a good white ground for painting on. A composition for gesso work has just now been brought out by the Society of Artists, 53, New Bond Street, W. This is prepared so that it will not harden too quickly to allow of its being carefully modelled. It takes about half an hour to dry. Gesso is difficult and troublesome to prepare at home, and it takes up a considerable amount of time, so it is far better for learners, at least, to use the ready prepared composition. Hogs' hair and camel hair brushes are used for the work, and often the gesso is laid on with the palette knife where a high relief is desired.

To gain some conception of the appearance of a piece of gesso work when completed, we can imagine a plaster cast, such as is employed for teaching drawing in schools of art, decorated with silver and gold, and tinted with metallic colours. The effect, when the work is well executed, is rich and harmonious. It is quite possible, of course, that instead of being harmonious it may be garish and vulgar; but this is the case with all work if artistic feeling is not brought to bear upon it; the worker alone is to blame if a pleasing harmony is not secured.

I will describe a few of the different methods of gessoing that will be of practical use to those attempting it for the first

Fig. 2.—Decorative Frieze for Drawing-Room in Gesso Work.

time. Take a panel of wood, and lacquer it green. The term lacquer is rather freely applied in our day. Metallic colours, when sized and varnished, are called lacquers. On the green ground model the design in gesso; let it dry, then silver it, adding touches of gold to bring out the pattern. Or the design may first be sketched on the panel, the gesso laid and modelled, then the background laid in, and, lastly, the gesso silvered and gilded. This is one of the simplest styles of panel that can be executed.

Workers will find that they can get good ideas for designs from some of the best Japanese papers. Large scrolls, arranged on decorated backgrounds, are effective. Beginners should avoid falling into the common error of designing in a finicking manner. Let the treatment of the subject be broad, and free, and strong. Gesso is not fitted to the carrying out of minute details. Still, the decoration can be far more elaborate than that which I have suggested for a first trial. Here is another hint to be followed when a little experience has been gained.

Get a panel of wood, and cover it all over with gesso. Rapidly sketch the design. Now model on the background a set pattern in low relief, after the style of old illuminations or pictures of saints. Next fill in the design with gesso in higher relief and let the whole set. The gesso composition will take the colours more easily if it is sized, but this is not indispensable always. Silver the background, gild the set pattern, and tint the design, which is in high relief, with emerald or serge blue, relieving it with copper gold in parts. If it is desired to get a bright effect, size and varnish the panel; if not, the gold alone can be sized; this renders it more permanent. Nothing more is required in the way of finishing, so it will be understood how easily and quickly gesso work can be accomplished—a great desideratum in these days of hurry and bustle.

Metallic colours are sold, ready prepared, in small tins at 1s. each. A number of extremely beautiful tints are made. Amongst them may be found an exquisite salmon hue, serge and forget-me-not blue, lilac, emerald and bronze green, reds, and a peculiar parrot green. Then there are silver, gold, and copper gold; the latter is particularly effective on a gesso design that has a silvered background. In using the colours, pour off some of the liquid, turn out on to the palette as much of the colour as is likely to be required, then put the rest of the liquid back into the tin; this keeps the colour in good condition.

The white powder and the composition must be well mixed; if too much of the latter is added to the powder a high relief cannot be secured. The brushes and palette are cleaned with turpentine.

The worker has it in his power to obtain charming effects by shading his backgrounds from silver to blue, or by graduating the tints from light blue to dark blue, or from salmon to bronze. A background again may be entirely gilded, or silvered, or coloured any desired shade. When the gilding or silvering is chosen, the ground may be the plain wood or the gessoed wood. It is unnecessary to gesso the panel for gilding or silvering unless a decorated background is wanted; in the latter case the decoration is first moulded, or incised, on the gesso ground, and the whole is then coated with gold or silver.

The design in its turn may be silvered, copper gilded, or gilded. The indentations may be accentuated with colour. Yet again the design may be tinted with one or more colours relieved, or not, according to the artist's fancy, with gold or silver, or copper gold.

It can be seen from the above that a gesso worker is able to produce greatly varied effects, and the decoration, consequently, is well worthy of study. The objection of its costliness will keep it from becoming common, but there are many who will be disposed the more on this account to pay a good price for artistically executed specimens.

The amateur worker is likely to fall into the error of attempting to secure too high a relief. This he should guard against. For a frieze a high relief is desirable; for a panel intended for piano, low relief may be infinitely preferable. Some artists do not model the gesso at all, but lacquer, silver, or gild it flat; others, in certain portions of their decorations, introduce cotton wool, sometimes for the purpose of securing higher relief, and sometimes to obtain a particular effect. For example, Mr. Walter Crane employs cotton wool in his frieze panel, "St. George and the Dragon," in representing the texture of the dragon's wings with excellent result. The wool is dipped into the preparation and laid on the work, slightly modelled or not as the case may require.

One more suggestion to the worker. Try the effect of a gesso design, lacquered or silvered, or both, on a stained or polished wood panel. Those who are clever at drawing or modelling figures have great facilities here for showing their skill, and the draperies afford opportunities of composing rich harmonies of colour.

Pieces of furniture, caskets, ornaments, flower boxes, photo frames, are some of the articles that can be beautified with gesso work. I could add a long list were it not wearisome to read such, but hundreds of things will suggest themselves to readers as appropriate for gesso decoration.

Before executing the illustrated frieze, it is necessary to know the scheme of colour of which it will form a part. As this, however, is an impossibility for me, I will describe how it can be carried out, and workers must substitute other colours for those I mention should they not harmonise with the scheme proposed for the room decoration. We will suppose, for the sake of making the directions as clear as possible, that the scheme of colour chosen is tawny orange, with two shades of blue, the woodwork is painted white, the walls covered with white and gold Japanese paper. The frieze should be treated after this manner. First gesso the ground entirely over, then model the design and bring the grotesque creatures into much higher relief than the foliage. Use the palette knife freely in laying on the gesso, as it saves time. When all the frieze is so far prepared, set to work to colour it. A coat of size will be advantageous, as the gesso will then take the colours easily. There are several ways in which the frieze might be tinted. I should colour the creatures serge blue and gold, the foliage gold and copper gold; then silver the background. Or the ground might be forget-me-not, foliage gold and copper gold, and creatures silvered. The draperies employed with this scheme should be tawny gold plush, the carpet two shades of blue (Wilton), the chair coverings silvery grey, ground with blue and gold in the design. A few touches of red will be required to complete the harmony.

As gesso work is by no means an inexpensive decoration, I strongly advise those who wish to turn the art to practical account only to execute one portion of the frieze (it should include the entire design), as a completed sample is all that is necessary to submit to decorators.

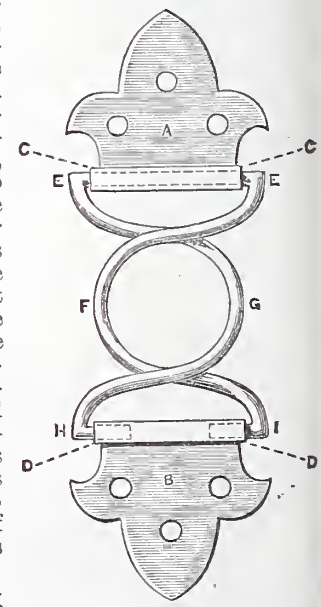
The "Lily" Panel is very simple, and most suitable for a beginner to try his hand upon. The design should not be in at all high relief, although well raised and well modelled. The lily may be painted white and the foliage green on a gold background, or the flower may be silvered, the foliage gilded, and the background tinted emerald or blue. But here again, if it is being done to fill a particular position, the surroundings must be taken into consideration. For my part I prefer the second suggestion for colouring the panel, as gesso work should be as conventional as possible to be truly decorative. Naturalistic effects are not desirable.

A NEW FASTENING FOR LETTER-CASES, ALBUMS, ETC.

BY INVENTOR.

In the district where the writer lives there is a constant demand for novelties in the way of "fancy cases," and it has been part of his vocation to supply models of these to manufacturers. In very many instances a new fastening is asked for, but to invent anything novel in this direction being a great tax upon the brain, it is seldom obtained.

In the course, however, of trying to devise a new means of readily fastening and unfastening a needle-case, the writer invented the clasp shown in the annexed illustration, and, though too large for the purpose for which it was required, he thought it would be very suitable for letter-cases, albums, and other articles, and as such it is presented to the notice of the readers of Work.



New Fastening for Albums, etc.

The construction of this clasp is simple enough, and the model was made by a person possessed of only the ordinary tools which a workman might be supposed to have in his own house. The top part, A, and the lower part, B, were cut out of sheet brass, each long enough to allow of the rolling over of their straight side into a tube, as shown at C C and D D.

Before forming these tubular portions of the clasp it was necessary to bend a piece of wire in the manner shown at I F E E G H. The tube, C C, was then folded over the part of the wire marked E E, and the tube, D D, formed in a similar manner to receive the ends, H I, of the wire.

By an inspection of the illustration it will be perceived that the clasp is there shown as fastened, and it is equally apparent that a slight pressure of the thumb and finger upon F, G, will cause the ends, H, I, of the wire to be withdrawn from the tube, D, D, and the clasp will be unfastened.

This clasp has the advantage of not by its form showing to every one the mode of unfastening it. In fact, to all who have seen it for the first time it appears to be not only a clasp, but an ingenious puzzle.

PAPIER-MÂCHÉ.

HOW TO MOULD, AND HOW TO ORNAMENT IT.

BY SYLVANUS WARD.

DECORATION (*concluded*)—SKY AND WATER EFFECTS IN BRONZE WORK—FANTASTIC CHINESE ROCKS AND RUGGED GROUND IN BRONZE—INTERIORS IN BRONZE—PAINTING IN POWDER COLOURS — PAINTED ORNAMENT RELIEVED WITH GOLD AND BRONZE—SPANGLING—PAINTING, GRAINING, AND MARBLING—FINISHING.

Bronze Work (*continued*).—There is another way in which bronze powder may be applied—by a stencilling process which is the converse of that already described. To effect this, the ornament is not, as in the former case, cut through the stencil plate, but is left remaining, whilst the other parts are cut away. The plate thus formed is laid on the work, and the bronze powder is dusted upon those parts which are not protected by it, and shaded off till it dies away in the general ground. In this work a white bronze is used, and afterwards stained with some transparent colour. The ornament is thus left black; and purple, which harmonises well with black, is a good colour with which to stain the bronze. The result is a rich velvety effect.

Fig. 44 shows the principle on which a stencil plate for this kind of dusting-in should be cut, which, it will be observed, is very much that of fretwork. The form given may either serve as a "repeat" in a running pattern, or as a quarter of a quatrefoil. The dots would be pierced, and would show on the work as solid bronze.

Sky and Water Effects in Bronze.—By bronze work something of the glowing effect of evening skies is to be attained in a much more rapid manner than by colours. In that part of the work where the light is supposed to be most brilliant—that is to say, in the lower part of the sky—the bronze powder is first dusted-in pretty solidly. In depicting such skies, the sun himself is not usually shown; but if he does appear, he must be put in quite solid—indeed, gold powder is best for the luminary, put in with a "stump." The brilliant variations of hue seen in sunset or sunrise skies are readily reached by using different bronzes, the brightest touches on the sunlit clouds being put in last of all with gold powder and a "stump."

It may, perhaps, be well to explain the "stump" used for this work, which has nothing in common with the little roll of wash-leather used by the ordinary draughtsman, and called by the same name. The japanner's stump is a small camel-hair pencil (say, of the same size as that previously mentioned as a "sprigger") which has been cut off almost close to the quill—as near, perhaps, as the tenth of an inch—and which has then been rubbed down to a rounded, or rather convex, shape on a pumice stone. It will be found useful for many purposes in bronze work, besides those of which we have spoken of.

By using a white bronze an approximation to the effect of water may be produced in much the same way, and the resemblance increased by adding a bluish shade with transparent varnish colour.

Fantastic Chinese Rocks and Rugged Ground in Bronze.—Fantastic rocks of the type shown in Fig. 45—forms derived, like the art itself, from the far East—have been of frequent occurrence in japanned work, and they are produced by first pencilling-in with gold size, and then dusting with bronze. Sharpness and decision are afterwards given to the masses by touches here and there of pencil bronze. In Fig. 45 the dark strokes denote this pencil bronze work; and as the example before us is necessarily on a *white* instead of a *black* ground, the greatest depth of shade in it represents what would be the lightest part of the actual bronzed work. This will equally apply to Fig. 46. Throughout these articles the fact that papier-mâché gives a *black* ground, whereas the printer's paper gives a *white* one, has been a serious bar in the way of efficient illustration.

Rugged or broken ground (Fig. 46) is worked in bronze by first sizing over the space with gold size; then a piece of paper is taken, and cut to an irregular outline, something after the fashion of Fig. 47, for use as a stencil plate. This is first laid at the bottom of the work, and bronze is dusted on, thickly just at the edge of the paper, but it is allowed to die away beyond. Then the stencil plate is moved a little higher, and the process repeated; and this is done again and again till the required space has been covered. The desired effect is thus easily attained, and a few bold strokes with pencil bronze showing as blades of grass on the summits of some of the irregularities, etc., gives an amount of conventional completeness to the representation. This, like the rocks, is Chinese in its origin; the Willow-Pattern Plate shows vestiges of it.

Interiors in Bronze.—Interior views of buildings, and more especially of such buildings as Gothic cathedrals, are capable of being made highly effective in bronze work. The proper mode of procedure is first to lay in the light side of the interior pretty solidly with bronze powder in the usual way, and to shade off to the darker side. If the pillars stand out in light, they should be stumped with gold powder or pale bronze. At this stage a thorough drying in the stove is desirable.

The details will now have to be sketched out with approximate accuracy, and, as in work of this sort straight lines are sure to abound, the straightedge will of course be freely used. The blacklead pencil will be found to mark well on the bronze, which has that sort of roughness commonly spoken of by workers as a "tooth." And now, where rays of sunlight streaming in through the windows make brilliant patches on pillars, walls, etc., such patches should be laid in with gold size and gilt with pale gold. If, as is most likely the case, our interior is that of some Gothic minster, one of its most striking features will doubtless be a stained-glass window. This, with the means at our command, can be rendered highly effective. The lights—the glass portions, that is—of the window we lay in with gold size and cover with silver leaf, which will enable us by-and-by to colour them most brilliantly.

Our window, being that feature of the composition which most catches the eye, will be the one on which to work first, the other parts being afterwards brought up to and made to harmonise with it. The mullions and tracery should first be put in to serve as frames for our representations of stained glass. These, which will show quite dark, must be put in with black paint, in which is a mere touch of bronze powder, just sufficient to preserve its affinity with the surrounding bronze work. The figures or other designs of the stained glass can then be painted in with transparent colours on the silver leaf. The scale will, of course, rarely be one to allow more than mere indications of such designs to be brought in; but slight as they may be, the effect produced will be one of much richness and beauty.

Figures in rich vestments are sometimes introduced, and these can also be laid in with silver leaf, and stained with transparent colours as above; but these can never be made to arrest and delight the eye like a window.

But to return: our glass being stained, the parts of the structure immediately surrounding our window will next have to be worked upon with a mixture of bronze and some little transparent colour. The parts in light are then proceeded with, bronze paint being used—that is, bronze powder mixed with copal varnish, and applied just as paint might be. In some of the light parts (such as those pillars which are to the front, and being in light show most prominently) the bronze will have to be laid in quite solid, in order that it may as nearly come up to those parts which are gilded as is demanded by artistic effect. On the more receding pillars, etc., the bronze will have to be so reduced as to allow them to recede into their proper places; either using less bronze, or mixing the bronze with transparent colour, will enable the decorator to effect this.

Painting in Powder Colours.—Our remarks on bronze work may properly be followed by some information as to the methods of using colours which, like the bronze, are in a powdered state. Papier-mâché decorators have chiefly used powder colours for two purposes:—Firstly, for groups of flowers, in which the effect has been almost wholly dependent on this process; and, secondly, for views of interiors, in which this process has served as little more than a preparation and background on which the finished result has been attained by other means.

As an illustration of flower painting in powder, let us suppose that the object to be represented is a red rose. There are three ways in which we may set to work:—

1st. The block form of the flower is laid in with tube oil colour (flake white) to which a little varnish has been added to make it dry more quickly. On the ground thus formed a single petal is pencilled-in, and powdered colour is dusted upon it—it being applied most thickly in those parts where most colour would appear in the natural petal. This has to be dried. A second petal is then coloured in the same manner, and also dried; and so on till the rose is completed. This was the older process. It was necessarily a slow and laborious one, but no other process equals it in softness and beauty of effect.

2nd. With tube colour (flake white) mixed as before, the whole rose is painted in so as to have somewhat the appearance of a white rose, and upon this powdered lake is dusted. The parts most strongly painted in white will appear to come forward, and the others to recede. The finishing is done with brush and tube colour.

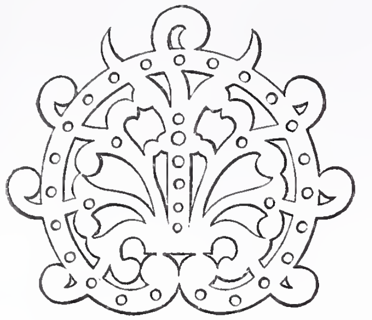


Fig. 44.—Bronze Work: Ground Stencilling.

3rd. The rose is solidly blocked in throughout with the white paint, and on this the dust is then placed and shaded down with the brush. A dead representation of the flower is thus obtained.

Powder colours give a softness of effect not attainable by any other process of painting, and they can be used expeditiously.

With regard to the application of this process to interiors, not many words of explanation will be necessary. The whole has to be painted in with the tube flake white mixed as above, and powdered colours are dusted on. It is afterwards finished when dry with moist colours. Silver leaf is sometimes introduced in interiors thus painted, as it is in those done in bronze. Indeed, dusting-in with bronze and colour may be said to be really one and the same process, the material only being varied.

Painted Ornament Relieved with Gold and Bronze. — A method of decoration sometimes adopted on large articles is to paint the ornament in colour—usually a brown (burnt umber) or a bronzy green—and to give brightness and variety by relieving it in parts with gilding and bronze. Fig. 48 may serve as an illustration of this kind of ornament. In this figure the simple tint represents the green or brown ornament, and the shaded parts those which are bronzed. On these latter, after the colour painting, the bronze powder is dusted in the usual manner, and a drying in the stove or otherwise is necessary. The ornament is then almost wholly outlined and lighted up with gold, as shown in Fig. 48, where gilding is represented by black. A considerable amount of gold sprigging around or in connection with the ornament is often added with good effect. This is also exemplified in the illustration.

Spangling.—Among the showy methods of decoration used on papier-mâché is the employment of gold spangles. These the decorator readily makes for himself by following the ensuing directions :—

Take a glass bottle, and, having made sure that its outside is thoroughly clean, gild it wholly or in part, according to the quantity of spangles required. The gilding will be done with leaf gold and isinglass size, in the manner recommended for bright gilding on papier-mâché. After burnishing as directed in connection with that process, varnish the gold all over with copal varnish, and dry in a stove or warm room. When the varnish is quite set, fill the bottle with cold water, and let it stand for a night in a cool place. By this the varnish will be rendered brittle ; the bottle should then be held aslant and scraped upwards with a knife, which will cause the varnish to fly off in small flakes, bringing the gold with it. The spangles thus formed will be of a brilliancy not to be surpassed ; and should they be too large for use, they may be reduced in size by rolling and crushing under the thumb in a piece of paper. There are many purposes, apart from the decoration of papier-mâché, to which such spangles may be applied.

On papier-mâché they are thus used :—The space to be spangled is gone over with copal varnish, to which a little oil has been added, and this should be laid on carefully and evenly. Spangles, in order that they may adhere properly, demand, it should be remembered, a much more moist surface than is required by gold leaf ; the ground must, therefore, be only partially dried ; and when it is ready, they are to be dusted freely on with a camel-hair brush. The dry brush will readily remove those which do not stick, which will be none the worse for future use. Nothing more is required except drying in the stove or otherwise.

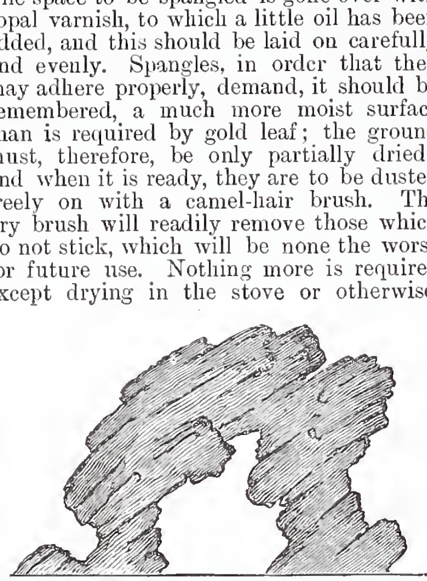


Fig. 45.—Fantastic Chinese Rocks in Bronze.

Fig. 46.—Rugged Ground in Bronze.

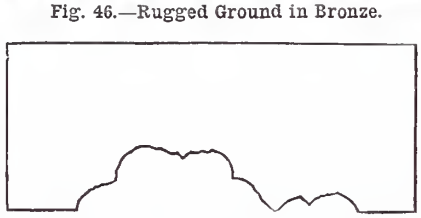


Fig. 47.—Stencil Plate for Working Rugged Ground.

Spangles thus used have a rich sparkling effect.

Painting, Graining, Marbling, etc.—For painting in the ordinary manner with ordinary colours, papier-mâché forms an admirable ground, though those brighter and more showy methods of decoration which we have described, and to which it lends itself so readily, have ever been more in favour for ornamenting it. This is not the place in which to give any treatise on ordinary painting, and there are no special points in regard to its relation to our material to be noticed. Nor need much be said here with respect to graining or marbling, both of which have been practised on papier-mâché. In the matter of marbling it may, however, be observed that the spangles named above will be found useful, sparingly used, in giving imitations of lapis lazuli, as furnishing the sparkle of the natural stone. Malachite, like the foregoing, has been a favourite stone for imitation on papier-mâché, and in passing we may mention that the dark rings which distinguish it may most readily be produced by applying the finger end and turning it round ; withdrawing it abruptly will then form the dark spot which occupies the centre of the ring.

Associated with graining is a way of imitating inlaid woods which first came under the writer's notice in connection with papier-mâché work, though he has since seen it applied to other purposes ; this also may be worth a passing word. The space is first grained all over with graining of one kind —say, maple—and, when this is dry, those portions of it which are to appear as inlaid are painted over with a kind of paint made with finely-powdered rotten-stone mixed with treacle or sugar. On this, when dry, a second entire coat of graining is given to the space —say, this time, of walnut. If, when this is set, the article is damped, the saccharine paint will come off and bring with it that coat of graining which lies above it. The result will be that the space will appear as of walnut, with inlaid ornaments in maple.

Finishing.—Whatever mode of decorating the papier-mâché may be adopted—whether pearl-inlaying, gilding, bronzing, painting, or a combination of any or all of these—the decorations will finally, with a single exception, have to be covered and protected with a coat of varnish. The solitary exception is when the decoration consists of broad surfaces of natural pearl not painted or otherwise embellished. These need no varnish, and indeed, if put over them, the varnish will be liable to peel off under changes of weather ; it is the painting, etc., upon the pearl which binds varnish firmly to it.

If the decoration extends over much of the surface of the papier-mâché the better plan is to take a broad brush and lay an even coat of varnish over the whole. If, however, the decoration is confined to detached portions, it is best to pencil the varnish over the ornaments only, leaving the ground untouched. And for this reason the black japan varnish of the ground takes a finer polish than is to be got on copal, and therefore the more of it that can be left uncovered the better.

When the varnish is thoroughly dry, it has to be polished. First, to remove any slight irregularities, it is lightly gone over with a bob and wet rotten-stone ; and after this has been swilled or wiped off with a clean wet rag, with powdered dry, hard rotten stone ; then with whiting powdered very fine and sifted through muslin. The dr

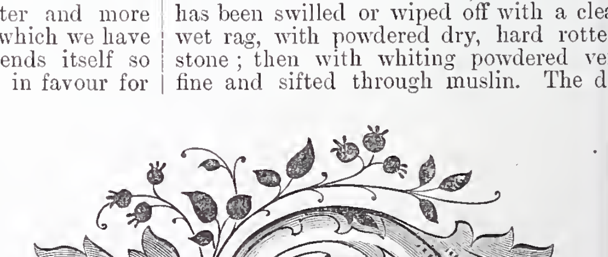


Fig. 48.—Painted Ornament Relieved with Gold and Bronze.

tten-stone and whiting should be carefully eaned away with a silk duster. Lastly, brilliancy not to be attained by any other eans is given by friction with the palm of ie hand lubricated with a spot or two of veet oil. A woman's hand only is capable doing this properly, and a hand of which ie fingers can be bent well back.

The perfect brilliancy of surface reached y these means on well-finished papier-iâché is one of the distinctive beauties of ie material; and when the article is in ousehold use, this brilliancy should be preerved by wiping or dusting it only with a oft old silk handkerchief.

POLARISATION OF LIGHT AND POLARISCOPES.

BY O. BECKERLEGGE.

POLARISATION OF LIGHT EXPLAINED.

HE subject which I have set before me to iscuss for the readers of WORK is one eset with unusual difficulties. First of all, n the part of the reader, a great deal of reliminary knowledge is required in reerence to the theory and physical properties

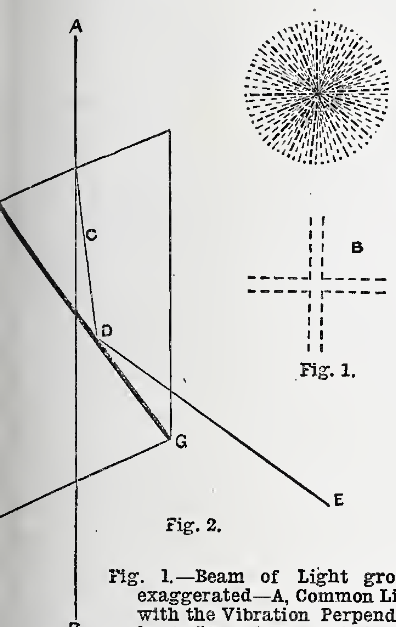
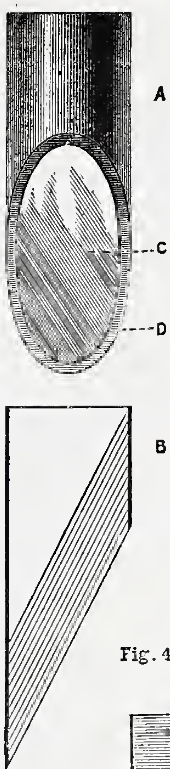


Fig. 2.

Fig. 1.

Fig. 1.—Beam of Light grossly exaggerated—A, Common Light with the Vibration Perpendicular to Line of Transmission; B, ay Polarised, in which it is split into two, ach Ray Perpendicular to the other.



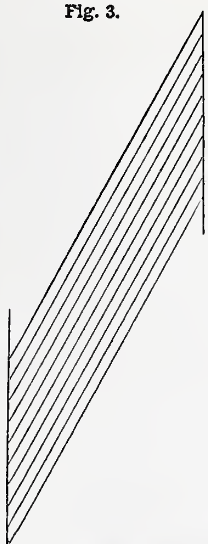


Fig. 3.

Fig. 4.

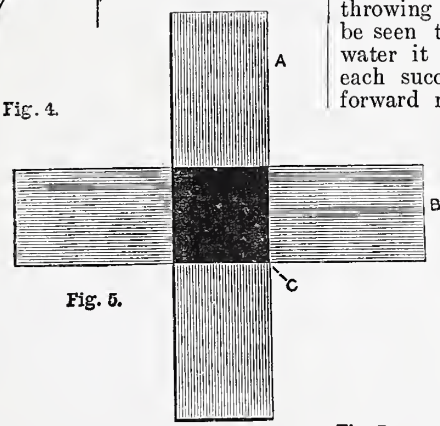
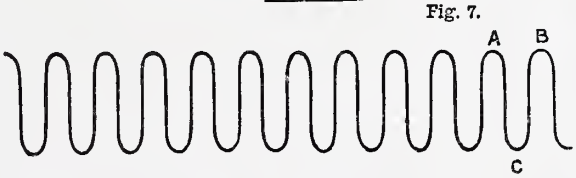


Fig. 5.

Fig. 7.



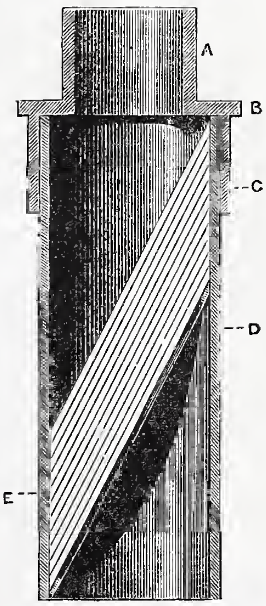


Fig. 8.

Fig. 8.—Diagram of Polariser for Microscope; A, Tube to put into Diaphragm of Microscope; D, Tube Carrying Films of Glass, E.

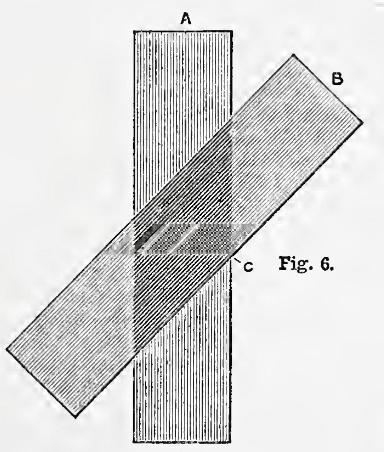


Fig. 6.

f light. On the other hand, there are but ew—the present writer included—who eem able to grasp the subject so as to ay it before the reader in a manner easy to e understood. It is a difficult subject. But it should be remembered that the scienific or philosophical instrument maker, as a ule, is not held responsible for the theory r its explanation, only so far as demonstraion and the application of his instrument o the theory may be concerned. I, thereore, shall have no more to do with the heory than will be necessary to obtain an ntelligent view of our work, my object eing principally practical—to furnish hose who wish to study more advanced reatises on the subject with the means of emonstrating by the use of instruments, nd especially in conjunction with the nicroscope.

By polarised light, we understand light hat has undergone some change by which it resents two distinct and opposite conditions

Fig. 2.—Rhomb of Iceland Spar made into a Nicol Prism—A, Direction of Ray of Light; B, Extraordinary Ray; C, Ordinary Ray refracted at D to E by Canada Balsam at Juncture F G. Fig. 3.—Diagram of Plates of Glass at Angle of 26°. Fig. 4.—A, Analyser; B, Section of Polariser; C, Thin Plates of Glass; D, Ledge to Support Glass. Fig. 5.—Two Plates of Tourmaline, showing the Light intercepted at C. Fig. 6.—The same, showing the Light Fading when partly turned. Fig. 7.—The Vibration of Ether grossly exaggerated—A B, The Length of the Wave; B C, the Amplitude.

or sides, the term being a figurative one, borrowed from the opposite ends or poles of a magnet.

It will be admitted that light is the result of an imponderable medium known as ether, thrown into a state of vibration. This medium pervades all space, and envelops every atom of matter. In the transmission of a beam of light, there is no forward motion of ether, but simply a progressive wave.

For example, in looking over a corn-field a wave will often seem to pass over it, occasioned by the breeze. A row of corn is slightly depressed for an instant, but as soon as the pressure of wind is gone it regains its upright position. The falling and rising succeed each other with great rapidity, and the eye takes cognisance of a forward motion, not of the corn but of the wave—the corn has simply moved in a perpendicular manner.

Another, and a familiar, illustration is the series of rings on water caused by throwing a stone into it. Now, it will be seen that if a straw is lying on the water it will simply rise and fall with each succeeding wave, but will make no forward motion, as it would if the water advanced. Light then is the result of the undulations or vibrations of ether. When these vibrations are conveyed to the brain through special nerves, we see. In ordinary light the vibrations take place in all planes perpendicular to the ray, Fig. 1, A. It may be further added that intensity of light is as the amplitude of the wave, or distance from the crest of one wave to the sinus or hollow of the next, A C, Fig. 7. The colour of the light depends on the number of vibrations. All are aware that in a ray of white light there are combined the three primary colours—red, yellow, and blue—and that they vibrate at different rates. Imagine a ray of light approaching the eye, if one may so say, end on, with the vibrations perpendicular to its path; this is common light. Let us now, by some means, split the ray into two, and cause one ray to vibrate perpendicular to the other. We shall find that whilst to the unaided eye there is no difference whatever, yet, when viewed under certain circumstances, there is a marked difference, Fig. 1, A B.

There are various means by which a ray of light may be brought into this condition. The means most generally employed are by refraction and reflection. Almost all crystals of the rhombohedron class will polarise, whilst those crystals belonging to the cube system, such as common salt, will not. Of all crystals belonging to the former system, Iceland spar, a transparent form of carbonate of lime, is the best, Fig. 2. If a black line is viewed through it, it is doubled; viewed in a careless manner, they seem to be just alike, but in reality they are very different and obey different laws. Thus, one is called the ordinary, and the other the extraordinary ray. Now, if the crystal is turned on its axis, the lines will come together until there is but one visible; continuing to turn they will again divide, until crossing the crystal at an angle they reach their widest divergency. Now let us substitute a black spot for a line, and we shall find something more has transpired than we were aware of, for now, instead of the spots receding and coming together, we find that one spot is stationary, whilst the other travels round it. Of course, the difference between this phenomena and the last, is only the difference between a point and a continuous line; the line simply revealing the horizontal but not the perpendicular displacement. But another difference may be observed. If we view the divided lines through another piece of spar, we shall find that in causing one piece to rotate, one of the lines will disappear at each quarter of a revolution. But the same appearance and disappearance may be observed in a very striking manner by viewing the lines through a bundle of thin glasses, Fig. 3.

This latter fact leads us on to another subject. Although Iceland spar is for many reasons preferred, yet other substances have the power of polarising transmitted light. Let us make two tubes like Fig. 4, with the ends cut off at an angle of 26°. In each tube must be placed a number of plates of glass. Common window glass will answer our purpose if we make the tubes large; but if we purpose using small tubes—say with a microscope—then the thick glass will not afford much light. In practice, I have found the thin glass used as micro covers by far the best. Now if we look through the tube B, we shall find no change visible in the light transmitted, yet a change has been effected of the most striking kind. This piece we call the polariser, and the light is polarised, although so far we can see no difference. Let us now look at the transmitted light through the second tube, A, which we call the analyser. Let the angle of the tubes lie in the same plane, still no alteration takes place. If now we turn one tube round so that the angles shall be perpendicular to each other, A, B, Fig. 4 —that is to say, let the tube be turned one quarter round—we shall find that the light has gradually disappeared, until, if there be several films of glass, the light is extinguished. Continuing to turn the tube the light will again be transmitted, gaining in intensity until the tube is turned half-way round. Passing on to three-quarters the light is again quenched, but gradually restored as we gain the starting point. We now arrive at a very important point, which is this—that the ray of light transmitted has two distinct sides or poles, and that in one position the films of glass offer no resistance to the ray, whilst in another position, a perfectly transparent medium refuses to allow the ray to pass. It is evident, therefore, that the ray of light is not in an ordinary condition, as the glass offers no impediment to ordinary light.

We are now led to make this inquiry: What is the optical condition of the medium through which the ray passes? The answer is this—that the ether surrounding the atoms of which the crystal is built up is in unequal tension in opposite directions, and vibrates at different rates. A sheet or film of ice is a familiar illustration. In the act of crystallising, the molecules arranging themselves according to a definite plan, render the ether less at liberty to vibrate in one direction than another. Between the horizontal and perpendicular there is an unequal tension. It will now be easily understood that a ray of polarised light—that is to say, a ray which has been split into two, and one half stands at right angles to the other—if it is transmitted through such a medium, will meet with difficulty in one direction, consequently the ray in that direction will be retarded. When tourmaline is cut in thin slices it will transmit a ray of light, but if cut in a certain direction it will allow the light to pass only in one plane, the ether being at liberty to vibrate in that direction only. Now let us suppose ourselves to be looking at a ray of light coming towards us, with the vibrations at right angles to each other, or polarised, B, Fig. 1. If the ray be viewed through a slice of tourmaline, those rays which are in the same plane with the line of transmission will freely pass, but those which are at right angles to that line will be retarded. If we cause the plate to revolve, there will be neither diminution nor increase of light, for as it gradually stops out the perpendicular rays, it will also gradually admit the horizontal.

Let us now place a second slice of tourmaline over the first with the plane of transmission coincident with the first; no change will be perceived, beyond a slight decrease in transmitted light occasioned by a portion being absorbed. If we now turn one plate round, Fig. 6, the light will grow fainter until the plates stand at right angles to each other, when there will be an utter extinction. Why? For this reason: The light being polarised, is transmitted in two planes perpendicular to each other. Thus the first film allowed but one set of vibrations to pass. The second being placed at right angles to it, cut this off, as the first cut off the other, the result being that no light at all is transmitted, and the centre of the crossed films is black, Fig. 5. Proceeding to turn the film round still further, the light increases until they are coincident. We have thus in a revolution two positions of transmitted light, and two positions of darkness. Instead of the films of tourmaline, we may use a Nicol prism, called after its inventor, which is a rhomb of Iceland spar, cut as indicated by the thick line F G, Fig. 2. The surfaces are polished and cemented together by Canada balsam. Now, as the refractory angle of Canada balsam is different to that of the spar, and as the ordinary ray is refracted at a different angle to the extraordinary ray, we can throw the ordinary ray outside the prism altogether, and so have the polarised ray only in the field of view; A B is the extraordinary ray; C D is the ordinary ray obeying the ordinary law of refraction; at D the ray impinges on the cement, which having a greater refracting angle turns it to E, and thus it fails to reach the eye. Let us now take two such prisms, the polariser and the analyser, or two bundles of glass, and place them at right angles, and so cut off all light. If now we pass a thin film of certain crystalline material between the polariser and analyser, we shall find that light is again transmitted. Indeed, it seems, as one has remarked, as if the film pushes away the darkness. Thin films of mica have this property, but that which is most commonly used in microscopic work is selenite, a transparent form of sulphate of lime. But many other crystals will do the same. In viewing thin sections of crystalline rocks, the writer has often seen the same phenomena. Certain crystals in the rock having this property lying at a definite angle transmit the light; whilst other crystals equally transparent to ordinary light refuse to transmit any whilst the analyser stands in that position; but when the analyser is turned round, the first crystals become dark, whilst others transmit the ray. We have again to inquire, how is this? Certain crystals are so built up that the ether can vibrate but in two directions perpendicular to each other. Now, it will be readily seen that if such a crystal be placed obliquely between, say, two tourmaline films, it will pick up some rays belonging to each side and transmit them; whilst if the planes of transmission stand coincident with the plane of transmission of either plate of tourmaline, no light can be transmitted.

Thus we see that so far we have come in contact with three systems of transparent crystalline substances; one, as common glass that vibrates in all directions; a second, as tourmaline, that vibrates but in one direction; and a third, as selenite, that vibrates in two directions perpendicular to each other. There is a further phenomenon yet to be explained, if possible. In using thin films of mica or selenite, we not only discover the phenomena just now referred to, but another and beautiful one—that of colour. Dependent on the thinness of the plate, so will be the colour, which will be of the richest hue; further on, turning the analyser or polariser, we find the colour fade, but instantly change to its complementary. It is understood that all light *under similar conditions* travels at the same rate, but that the length of wave, that is, the distance between the crests of the waves, A, B, Fig. 7, is different for each colour. Let us make a mental picture of two differently coloured rays of light, and we shall find that though they pass through the *same space* in the *same time*, yet the length of their wave is different.

"The shortest waves of the visible spectrum are those of the extreme violet; the longest, those of the extreme red; while the other colours are of intermediate pitch, or wave-length. The length of a wave of the extreme red is such that it would require 36,918 placed end to end to cover one inch, while 64,631 of the extreme violet waves would be required to span the same distance." *

We see from this, then, that there is a difference between the length of wave in the violet and red amounting to nearly one-half.

Taking an inch as a unit, then the distance between two waves of red light would be $\frac{1}{36918}$, and between two waves of violet, $\frac{1}{64631}$ of an inch. We have already endeavoured to explain the fact that certain crystals retard a ray of light in proportion to the angle at which it is transmitted and the thickness of the plate. Now, let us imagine a

* Tyndall, on light.

ay of light traversing a crystal in such a lirection that no obstacle is presented, then t is evident that all the vibrations will be ransmitted, and white light will be the esult; but let us now turn the crystal so hat the power of transmission shall be coincident with certain rates of vibrations nly; the result will be that the colour nswering to those vibrations will be transmitted. If the light is retarded so that only vibrations the 36,918th part of an inch in length can pass, then the light will be red, and so on for every separate colour. On turning the analyser the complementary colour is transmitted, or that portion which has been quenched, which, united to the first, constitutes white light; so that, in revolving the polariser or analyser, the whole of the light is transmitted, but in two amounts—the balance due on the first is transmitted on the second.

In splitting off a film of selenite, somewhat as an amateur would do, a variety of colours will be visible, arising from the fact that the film is of unequal thickness. Sometimes they are so purposely arranged, that they shall make a kind of picture, say, of a flower—the leaves and flower alternating in colour as the analyser may be turned.

I think little more need be said on this part of my subject to help one to an intelligent comprehension of the use of the instrument I purpose describing. For more exhaustive details I must refer the reader to such masters as Tyndall, Spottiswoode, etc.

A SMALL SIDEBOARD WITH DRAWERS AND CUPBOARDS.

ITS ARRANGEMENT AND GENERAL DESIGN.

BY ALEXANDER MARTIN.

Construction and Details.

Before doing anything to the actual making of the sideboard, the design should be drawn out full size on a board, from which drawing all the sizes—lengths, breadths, and thicknesses—of the different pieces of wood may be obtained. This is the plan adopted in large establishments, and it is found to be the most convenient in every way; it saves time, and everything may be seen at a glance where it has to go, and how it is related to its immediate surroundings, so that nothing need be done haphazard or by guess. There is, therefore, far less chance of a mistake being made which may cost hours of work to put right; not to mention the waste of materials at the same time. In describing the drawings required to be put on a board, it may be advisable to state, first of all, that an end elevation of the sideboard shown in Fig. 1 (p. 377) is given in Fig. 2. This end elevation is drawn to a scale of 1 in. to 1 ft., or one-twelfth real size. All the other figures are drawn exactly one-half full size, so that to get the real size of any moulding, simply double the measurement it has on the paper. The detail drawings, from Figs. 3 to 15, are arranged—as regards numerical order—in the way the different parts would come under notice, when one begins at the top pediment and carefully examines the design downwards until he reaches the turned feet in Fig. 15, Fig. 3 having been the section of the moulding used in the pediment.

The size of the top measures 5 ft. × 1 ft. 10 in. Draw on the board then, as the first operation in the horizontal section through the cupboards, the half of this top—2 ft. 6 in. × 1 ft. 10 in. It is unnecessary to draw more than the one-half, as the other half is exactly similar. Next draw in the positions of the posts under the top. As the top projects $1\frac{1}{2}$ in., the posts must be kept that distance in on front and ends, but not at back, as the top does not project there. These posts are $1\frac{3}{4}$ in. square, and the two front ones have three beads scratched on their face, as shown in Fig. 13, where is also seen a section of the door stiles, rebated for the planted moulding, which again forms the rebate for the carved panel. This door measures 15 in. across to the division or centre gable, $\frac{3}{4}$ in. thick, and beaded as shown in Fig. 14. The position of the division between the two top drawers should be indicated, and it is also beaded on face as in Fig. 14. The outside gables are framed up with two rails and a panel, the latter being $\frac{1}{2}$ in. thick, and grooved into rails and posts as shown in Fig. 13. The back to the cupboards may be plain pine, *i.e.*, not framed up; but the back to the centre open space must, of course, be made of the wood the sideboard is made of. That completes the horizontal section through the cupboards.

A horizontal section of the back should now be drawn; and in order to save confusion, it is better to draw it on a different part of the board, or on another board altogether. Keep the outside posts of the back right above those underneath. The posts in the top part are $1\frac{1}{4}$ in. square, and have three beads scratched on their faces. They are also rebated for the side glasses, and the panels underneath them. In Fig. 6 is shown a section of one of the centre posts, showing it rebated for the side glass, and also showing the framing and planted moulding round the centre mirror. This mirror is 24 in. wide, so the daylight size inside the moulding should not be more than $23\frac{5}{8}$ in.; this allows for the necessary cover over the edge of the glass. Placing this size on the board in the centre of the space at command, the remaining space at each side will regulate the width of the side mirrors. The panels under the shelf are exactly similar to the glasses above, except that the side panels have a moulding similar to that put round the centre glass planted round them. The shelf is shaped on the front as indicated in Fig. 1, and is 9 in. wide at its broadest part and $5\frac{1}{2}$ in. at its narrowest, which is at its extreme end, where it is supported by brackets $\frac{3}{4}$ in. thick, see Fig. 2. The edge of the shelf is moulded, as shown in outline at the top of Fig. 10, where also will be seen the distance from the edge which the turned pillars are to keep. These pillars supporting the roof are placed right in front of the centre posts of the back.

Now upright sections are required. Begin with the top of the under carcase. It is 3 ft. 2 in. from the floor, and is moulded as in Fig. 11. This whole figure should be drawn exactly as it is, but double the size, of course, on the board. Under the top is a large moulding; then the drawer and its fore edge; then the door top rail, which is much wider than the door stile is, in order to receive the pediment which is glued on its face. The thickness of this pediment is shown to be sufficient to make it project slightly beyond the panel moulding. It has a hollow run out of it near its bottom edge, and the height of it at each end is indicated by a line across it about midway up. The centre is carved after the style of the carving in the pediment. Now, working from the floor up, the front part stands $2\frac{3}{4}$ in. clear of the floor, and turned feet are put on separately. These feet are drawn in Fig. 15. The bottom rail is placed 5 in. from the floor to its under edge, and it has three beads scratched on it, as shown in Fig. 12. In that same figure is given a section of the bottom rail of the door—broad as the top one was, and for the same reason—to receive the moulding and shaping on its face. For the carcase back there is a broad rail at the back of the depth of the drawer fronts, and also another back rail of same size as the bottom rail at front, and in the same position. Both rails may, of course, be pine, as they are not seen at all. Just indicate the position of the bearers for the centre drawer, which is lower than the other two, and this section will be finished.

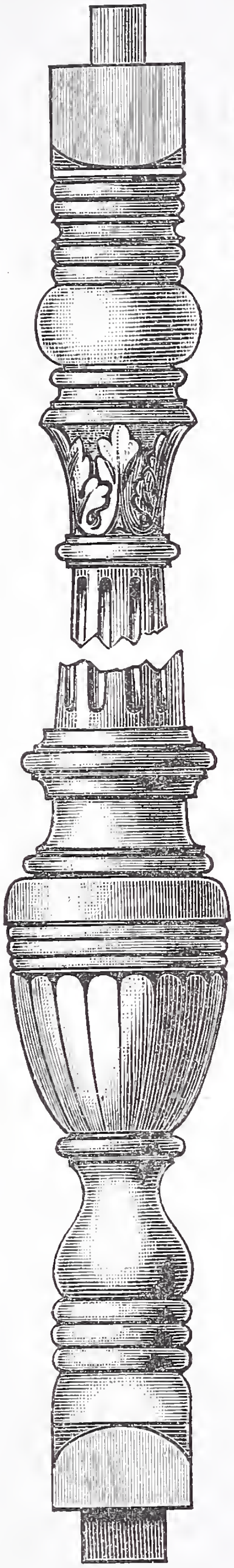
An upright section is also required through the centre and through the side glasses; draw the centre one first. The shelf, 9 in. broad, is $9\frac{1}{2}$ in. high, and the glass is 22 in. high—that means a daylight opening of $21\frac{5}{8}$ in. The framing round glass and panels below shelf is similar to that already drawn in the horizontal section of the back. Note to make the rail behind shelf broad enough to show the proper margin above and below the shelf when it is put in position. The cornice is made separately, and rests on top of back framing and the two turned pillars in front. A section of it is given in Fig. 4, showing it built up of three pieces. The shaped pediment, $\frac{3}{4}$ in. thick, rises above that again, and has a moulding planted on it, a section of the moulding being given in Fig. 3. The upright section through the side glasses is exactly the same as that already drawn until the shelf is reached. Above the shelf the rail projects $1\frac{3}{4}$ in.; it has a plain margin of 1 in. wide, then a bead is run. On the top edge is formed a hollow and a rebate for the glass similar to that in the top rail which is above the glass. The side glasses are 10 in. high—$9\frac{5}{8}$ in. daylight size—and the rail above is shown in section in Fig. 5, the shaped bracket, $\frac{3}{4}$ in. thick, being above that again.

If any one think these directions and explanations are too fully given, it must be remembered that the drawings must be accurate, or they are useless, and these remarks so fully explain the design that the less remains to be said.

A list of the different pieces of wood required should now be made after this fashion:—

No. of Pieces.	Description.	Wood.	Length.		Breadth.		Thickness.
			Ft.	*In.*	*Ft.*	*In.*	*In.*
1	Top	Mahogany	5	0	1	10	$\frac{3}{4}$
2	Posts, front	„	2	$10\frac{1}{2}$	0	$1\frac{3}{4}$	$1\frac{3}{4}$
2	„ back	„	3	$1\frac{1}{4}$	0	$1\frac{3}{4}$	$1\frac{3}{4}$

The first column is for the number of pieces required; the second for the name of the pieces; the third for the wood—mahogany, oak, pine, cedar, etc.; and the others for the sizes. From this list every piece of wood required may be sought out and cut. The different pieces requiring jointing—as, for instance, the top and gables—should be shot and glued up. The outside gables are framed up, the panels being grooved in, and the posts mortised for front and back rails and fore edges. The inner gables are prepared to receive the bearers of the centre drawer, and are themselves pinned into the bottom rails and drawer fore edges. The bottom—which is in three pieces—is now put up from below; the centre piece of the bottom, being seen, must be of show wood; the other two pieces may be of pine. The mahogany and pine should be half checked underneath the inner gables and screwed to them, as shown in Fig. 19. Here



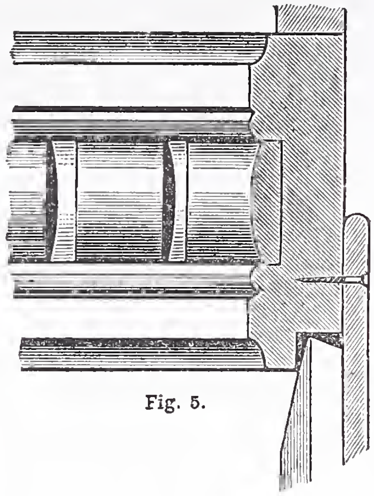


Fig. 5.

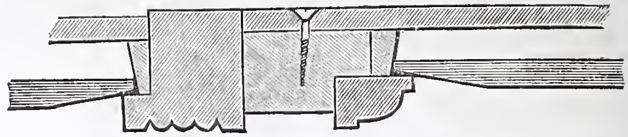


Fig. 6.

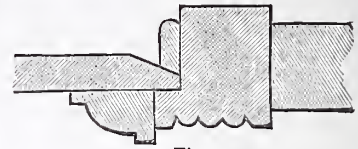


Fig. 7.

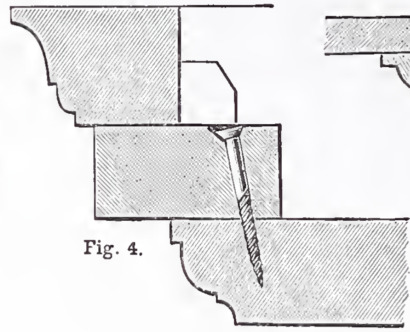


Fig. 4.

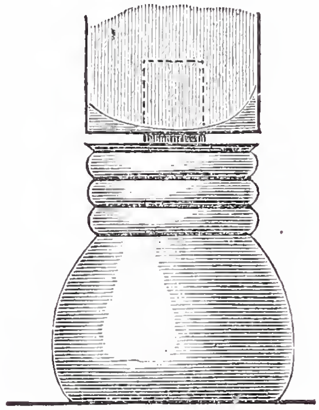


Fig. 15.

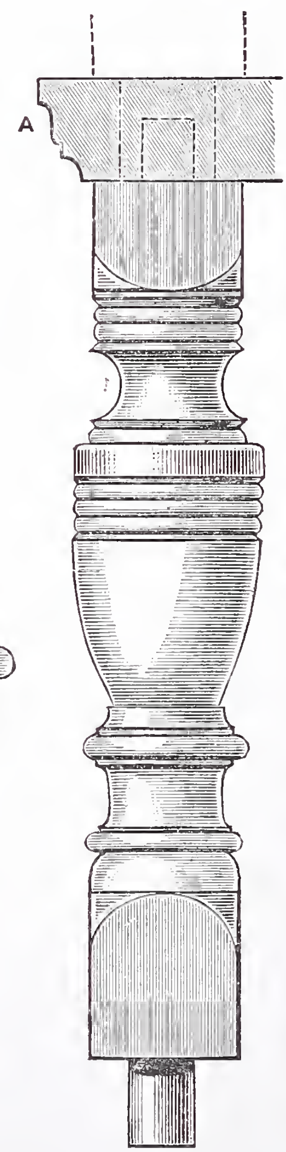


Fig. 3.

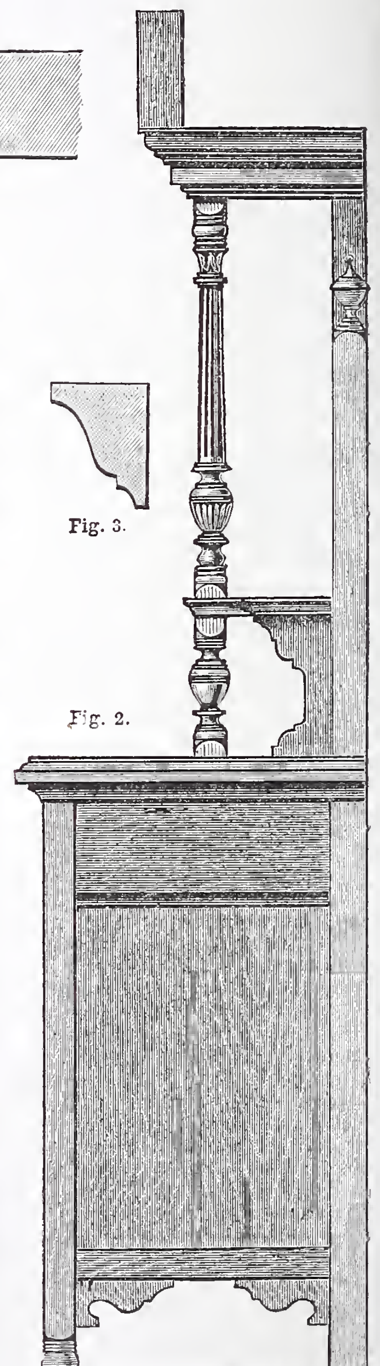


Fig. 2.

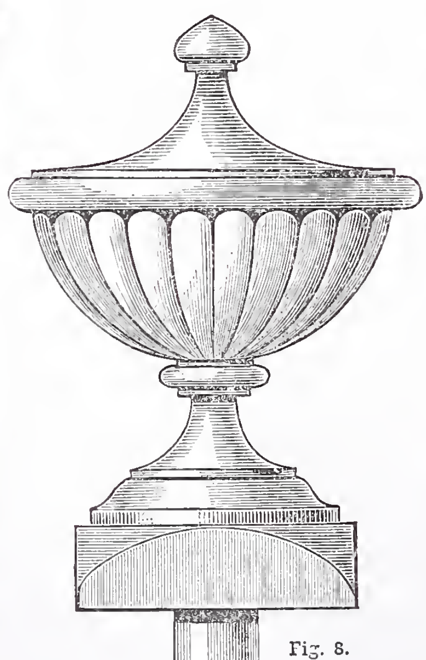


Fig. 9.

Fig. 8.

Fig. 10.

Fig. 2.—End Elevation of Small Sideboard: Scale, one-twelfth size, or 1 inch to 1 foot. Fig. 3.—Section of Moulding used in Pediment. Fig. 4.—Section of Cornice. Fig. 5.—Rail above Side Glasses in Elevation and Section. Fig. 6.—Section of one of Centre Posts, etc. Fig. 7.—Section of Post and Side Panel under Shelf, with Planted Moulding. Fig. 8.—Turned Finial in Centre of Pediment, and Pattern for Turned Knobs above End Posts. Fig. 9.—Turned Pillar supporting Roof and resting on Shelf. Fig. 10.—Turned Pillar supporting Shelf—A, Moulding of Shelf. Fig. 15.—Turned Foot for Cupboard.

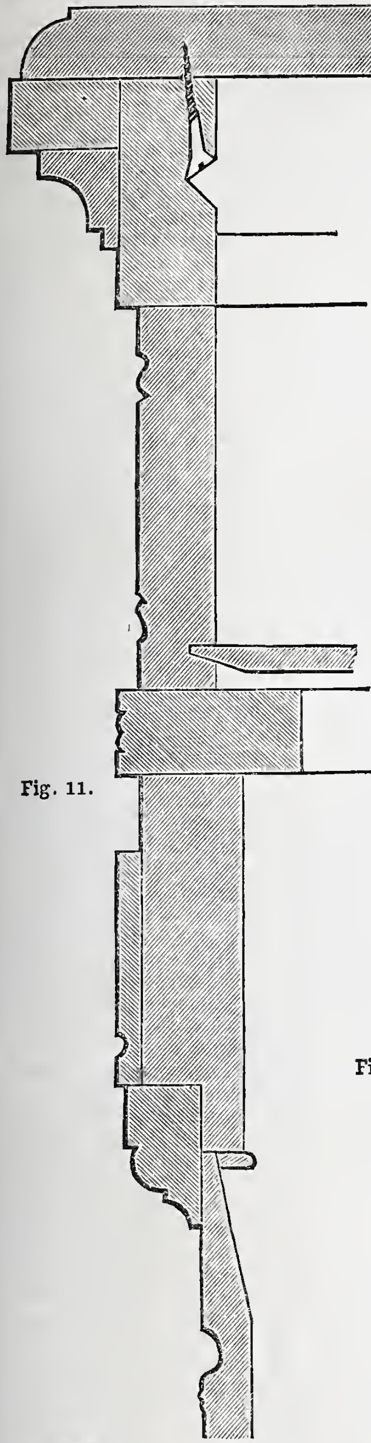


Fig. 11.

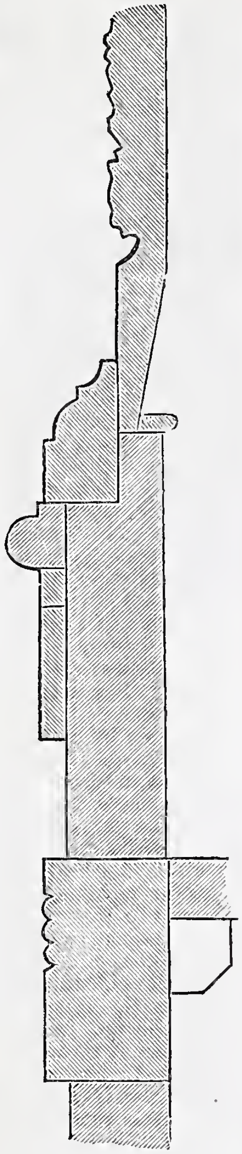


Fig. 12.

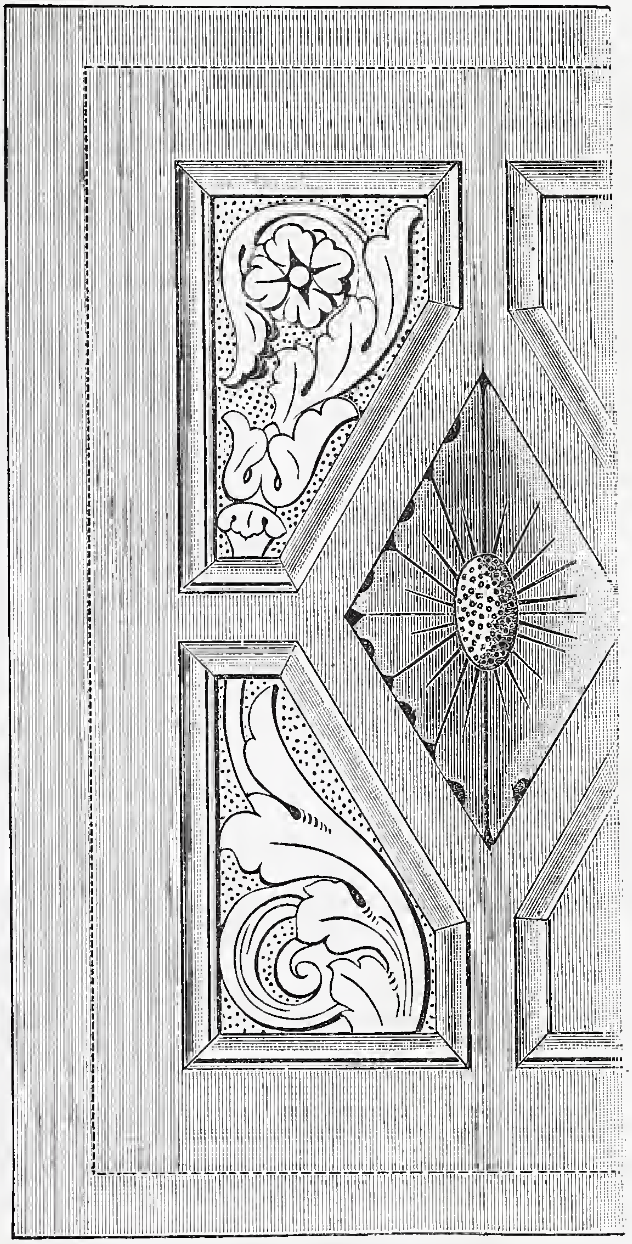


Fig. 18.

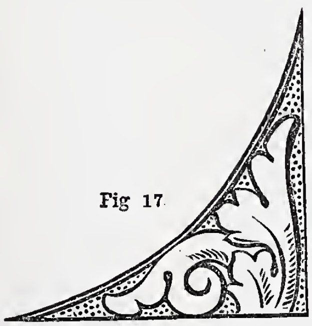


Fig 17.

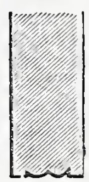


Fig. 14.

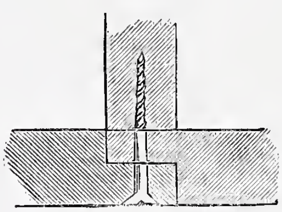


Fig. 19.

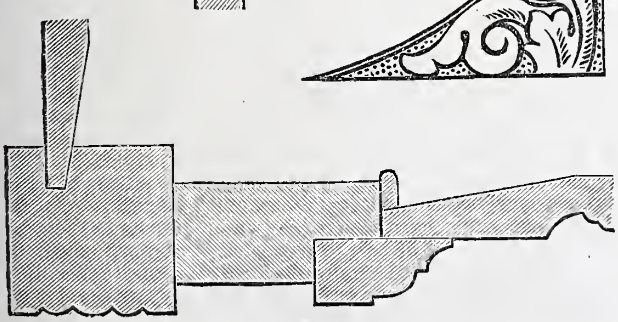


Fig. 13.

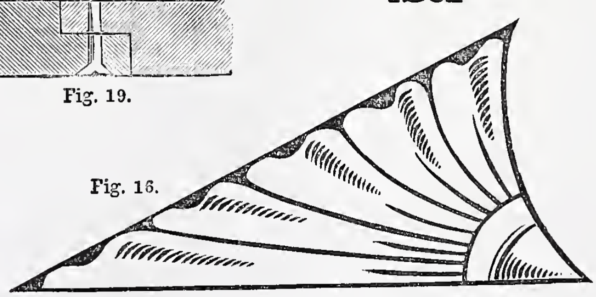


Fig. 16.

Fig. 11.—Upright Section of Upper Part of Under Carcase of Sideboard. Fig. 12.—Section of Lower Part showing Bottom Rail of Door, etc. Fig. 13.—Section of Post and Door Stile rebated for Planted Moulding. Fig. 14.—Section showing Beading on Face of Divisions between Cupboards and Recess and Drawers. Fig. 16.—Carving for Side of Pediment. Fig. 17.—Carving in Bracket above Rail over Side Glasses. Fig. 18.—Cupboard Door, showing Panelling and Carving. Fig. 19.—Diagram showing Half Checking of Mahogany and Pine under Inner Gables.

notice that the right-hand bottom is the mahogany one, and the left-hand one the pine one. If they be reversed, the edge of the white wood bottom might be seen if the joint were the least bit open; the other way it cannot. The bottom is blocked at front, back, and ends, where it had better also be secured to the end rails. The earcase backs may now be put on: mahogany again at the eentre; pine at the sides. The drawer bearers and guides are put in their places, and the drawers made. The doors may now be framed up and moulding planted, as indieated in the sections in Figs. 11, 12, and 13. The pediment and lower base moulding and shaping to panel add some little work to the door; but it is time well spent, as it forms quite a feature in the design. If, however, it be thought that there is enough work without this extra amount, it is easy to make the top and bottom rails of same width as the stiles are, making the carved panel, of course, a little bit longer. This carved panel is the principal part of the decoration of the door, but the extra mouldings and shapings above and below it have a great influence in effectively placing it before the eye. The brackets under centre drawer, and also those under bottom rail, are $\frac{3}{4}$ in. thick, and have the little scroll carved on them to carry out the line of shaping to a suitable termination, at the same time decorating the bracket. The turned feet, it has already been mentioned, are put on separately to the post. This is to save wood, as the feet are thicker in diameter than the post (see Fig. 15); and mark that the corners of the square posts are rounded away where the turning commences. For the carver's guidance, the door panel is drawn in Fig. 18, the reverse side being, of course, similar to that shown. The dotted line indicates the margin that is covered by the panel moulding when the panel is beaded into the door.

The upper part has not nearly so much work in it. The four posts are mortised for the cross rails, and rebated for the panels and glasses, and moulded on faces, as already described and shown in Fig. 6. The top rail is an important feature in the back, having part of the moulding "dentilled," as shown in Fig. 5. This "dentilling" may readily be done with a chisel, and eonsists in cutting a channel through the convex moulding to the depth shown by the dotted line in section in Fig. 5. It forms a capital enrichment obtained by means of a very little work. Above this rail is fitted a shaped and carved bracket, which is blocked into its place. A sketch of the earving is given in Fig. 17. The frame for the centre glass is mortised together, and dowelled between the posts. Notice that the frame goes from top to bottom, the shelf being placed against it. The rail behind the shelf is made broad enough to show the proper amount of margin both above and below it. The end posts have a turned knob at top, which is turned like that shown in Fig. 8. This figure illustrates the turned finial in centre of pediment, and is much larger than the other knobs should be; they should only measure about $2\frac{1}{2}$ in. high and 2 in. over their widest parts, in place of 6 in. high and $4\frac{1}{2}$ in. wide. The two centre posts are taken only to the underside of the cornice, it being made separately, as previously mentioned. The foundation of the cornice is a solid roof, over which the other members are placed, as shown in Fig. 4. This solid roof had better have cross ends put on it, mitred at front corners, so that end wood may not be seen in any part of the cornice. The pediment is fixed above top moulding of cornice, and is carved at sides, as shown in Fig. 16; and in the centre, under the turned vase, it has three flutes cut. This turned vase, finishing the centre of the pediment, is earved too, as shown in Fig. 8. The pediment being only $\frac{3}{4}$ in. thick, and with the addition of the moulding $1\frac{3}{4}$ in., it will be seen that this vase cannot sit on that narrow surface. It should be placed 1 in. back from the face of the moulding—*i.e.*, having its front surface exactly in a line with the surface of the pediment; and another piece of wood may be put in behind the pediment to receive the vase. This cornice rests on the back, and is supported by turned pillars at front. The shelf is screwed from behind, as also are the brackets at its ends. There should be a dowel in the bottom edge of the brackets near their outermost corner, to enter the top of the sideboard, in order to keep them securely in their proper positions. The pillars supporting this shelf are shown in detail in Fig. 10, and the larger pillars supporting the cornice in Fig. 11. In this latter instance, the long, straight shaft of the pillar is broken off to save space, but all the rest of it is shown. Notice that, as the shelf is rather thin to receive a pin from both top and bottom sides, as these pillars require, it is better to make the pin of one pillar stouter than usual, so that it may be bored to receive the pin of the other. This is indicated by dotted lines at the topmost end of Fig. 10. Blind backs must be provided to protect the backs of the mirrors. These are usually not more than $\frac{1}{4}$ in. thick, and are screwed to the back of the framing. (See Figs. 5 and 6.)

It is advisable, when all is finished, to take as much of it apart as possible, in order that the polishing may be the more expeditiously performed. The doors should be taken off, the panels taken out, the pillars, shelf, and cornice removed, and the brackets and pediment unfastened. If made of mahogany, it should be polished in its natural colour, allowing it to darken through exposure to the atmosphere. If, however, that be thought too slow a process, it may be stained dark at once. The same remark—about staining—applies to oak, if that be the wood used; and it may darken through age, but very slowly indeed. Walnut needs no staining, but the inside of the job will need it, at any rate where white wood has been used, whether oak, mahogany, or walnut be the chief wood.

The glass should, of course, have bevelled edges; there is scarcely any other used in furniture now. The handles should be nice brass mediæval ones; they are to be had readily. Handles are sometimes put on the eupboard doors, but they are not considered indispensable.

The interior fittings have been purposely left unmentioned till now, because they depend so much on individual requirements. One might want quite a different kind of accommodation from another. For instance one tray might be wanted in a cupboard, where there would be room for four; or a shelf in each cupboard might be deemed ample. By most people, however, a cellaret drawer would be considered necessary. This is usually put in the right-hand cupboard, and consists of a deep drawer—about 6 in. deep inside—with cross divisions in it, dividing the space into so many divisions, each to contain a bottle. This drawer, in good work, is lined with lead or zinc; but often it is only lined with green baize, and if the bottles be only moderately carefully handled, this should be quite enough. A shelf may eonveniently be put in above this drawer, just so high as to leave sufficient room for the bottles to stand in the cellaret drawer. In the other, or left-hand, cupboard, a shelf placed about half-way up is perhaps sufficient; or a tray might be put in close to the top of the cupboard, and the rest of the space left elear. Whichever drawer or tray may be intended for holding spoons, knives, and forks, etc., it is a good plan to line it with baize.

Now that this sideboard has been described from beginning to end, it may be well to make several suggestions, in order that it may suit the greatest possible number of our readers. You know we want to please, not a few, but a great many; and the more successful we can be in this way, the more satisfied shall we feel with the results of our labours. Beginning, then, with the lower part, if a thrifty housewife, on being shown this design by her lord and master, take exception to the open base, as being likely to allow dust, etc., to gather underneath, it may be made a close one very easily. In that case, the base, moulding on top edge included, should not exceed 5 in. in height, and in this way the eupboard will be $2\frac{1}{4}$ in. higher—that being occasioned by the bottom being placed lower down and in a line with the top of the close base. The open centre might also be wished closed with a door, either retaining the drawer as shown between the cupboards, or making the door the same height as the others are. It might also be of the same design, with different carving in the panel; or it would be better to make it quite different, as then it would make the side panels more distinct. This latter plan could be carried out by forming four panels in the door, the outer framing showing a margin of $1\frac{1}{2}$ in., and the inner framing of $1\frac{1}{4}$ in., with mouldings mitred round panels as on other doors. These panels should also be fielded on their face side, and may either be plain or carved. In the writer's opinion, plain panels would, in this instance, be preferable.

In the upper part several alterations may readily be suggested. The projecting cornice may be removed altogether, and the mouldings and pediment be made flat against the wall. This is the usual method of making a sideboard back, and might be preferred by many. Then the shelf might not run from end to end, but might be underneath the side mirrors only, in which case they had better be shaped so that they are of the same width at each end—not broader at one than at the other, as they are in the present instance—and be supported by two brackets each, or by two pillars each; either way will do. The centre mirror might then be made to come right down, instead of having a plain wood panel there, with no apparent reason for its existence. This plan of having the glass in the centre extending from the top of the sideboard upwards is undoubtedly by far the commoner method, perhaps because it reflects anything placed in the centre of the top in such a magnificent style.

No one will deny that matters of taste, or liking, vary very much indeed. Every man is entitled to his own opinion as to the amount of beauty possessed by any one or any thing—including sideboards; and hence, though each reader may form his own opinion of the merit pertaining to the various suggestions I have brought before him, I feel sure he will, in eommon fairness, allow me to state that, taking all things into consideration, the design, as illustrated, appears to me to be the most attractive and useful of all.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

82.—Rowe and Smith's Patent Automatic Indicator.

It has frequently happened that passengers have met with accidents, often of a most serious nature, through leaning on or against the door of a railway carriage, which has been pushed to or has swung to, but whose handle has not been turned so as to prevent its opening by pressure from within. In such cases there is only one handle to the door, and that is on the outside, and this state of things prevails in railway carriages generally, although occasionally, and notably on the Metropolitan District Railway, there are handles within the carriage as well as without, from whose position it may be known whether the door is properly closed or not. However, as it has just been said, in the great majority of railway carriages there is only one handle, and as that is hidden from the view of those within it is absolutely impossible to determine whether the door is latched or not without trying it. This fact, and the mishaps occasioned through it, induced Messrs. Rowe and Smith, 3, Hawthorn Place, New Wortley, Leeds, to think out a plan whereby the state of the door might be always indicated, and the result of their joint labour was the production of the Patent Automatic Indicator, which is shown in position on the door—or, rather, the framing of the door—of the carriage in Fig. 1, the two conditions of the indicator itself and the means by which it is actuated being exhibited in Figs. 2 and 3.

The following is the description of the apparatus as given by the inventors and patentees:—

"The indicator consists of a rod working in the groove of a casting which is affixed, not to the carriage door, but to the framework (*lintel*), into which the iron tongue of the lock, bolt, or catch engages when the door is fastened. Attached to the upper end is the indicating slide, on which are the words 'Open' and 'Shut' *or their equivalents.* The rod, A, is acted upon by the tongue, catch, lever, or bolt, C, of the handle or lock, and when the handle is completely turned, the door being closed, exhibits the sentence, 'THIS DOOR IS SHUT,' as in Fig. 2. Directly the handle is turned to open the door, a spiral spring causes the rod, A, to return to its normal position, and the warning, 'THIS DOOR IS OPEN,' appears as in Fig. 3. Should the door be closed, but the handle not turned, this warning still remains, thereby cautioning the passengers against leaning on the door, and continues to be exhibited until the handle is completely turned and the door secure. As the rod which works the indicating slide is fixed in the socket, it can be clearly seen that it can only work when the tongue, catch, lever, or bolt, C, enters or leaves the socket, and that, consequently, no matter how apparently secure a door may be, unless the tongue, C, of the handle is properly and fully inserted, the indicator invariably shows the warning, 'THIS DOOR IS OPEN,' the word 'Open' being in white letters on a red ground; the colour of the slide itself indicates danger."

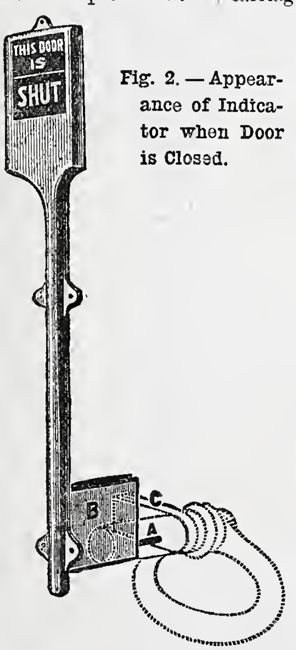


Fig. 2.—Appearance of Indicator when Door is Closed.

There are many points in favour of the adoption of this invention by railway companies. Firstly, there would be no longer any cause of complaint that there is nothing within railway

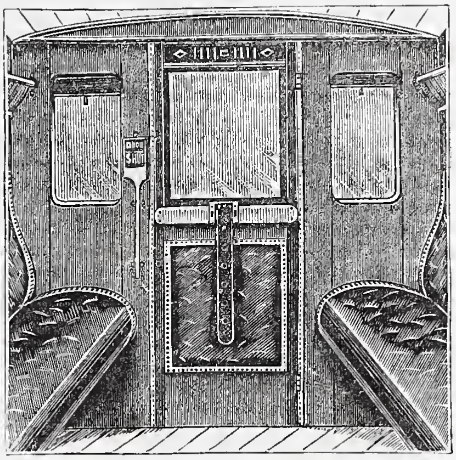


Fig. 1.—Rowe and Smith's Patent Automatic Indicator.

carriages, or coaches as they are called by all railway officials, to show in what position the handle on the outside may be, and the position of the indicator on the framing of the door inside the carriage renders the announcement that it conveys so conspicuous to all within the carriage, that any may see at a glance whether the door is properly closed or not, without having to open the window and feel for the handle outside, as at present, to find out the actual state of affairs. Secondly, it is simple in construction, and, therefore, not liable to be thrown out of working order, and it is easily affixed to any existing carriage; and, thirdly, if any one met with an accident by falling out of any carriage or compartment of a carriage to which the indicator had been affixed, blame would attach to the person thus falling out, and the Company would be relieved of all responsibility and claims for compensation, inasmuch as on their part all would have been done to prevent accident that could be done or could be reasonably expected by the travelling public as a safeguard. And this last point would be manifestly in favour of the railway companies, and should operate upon them as a powerful inducement to have all their coaches fitted with the indicator.

83.—Pitman's Carving Tools.

Mr. P. Pitman, Aubrey Road, Mauldeth Road, Withington, near Manchester, has sent me for inspection and testing a very handy little set of eight wood-carving tools, which he supplies for 7s., with strop and stone for sharpening the tools, specimens of carving, patterns and instructions, and some wood to practice on, so that any would-be beginner has it in his power to provide himself with a sufficient outfit and materials, and can commence operations at once at no greater outlay than the sum named. The set, as it has been said, comprises eight tools, of which three are chisels $\frac{5}{16}$ in., $\frac{1}{4}$ in., and $\frac{3}{16}$ in. in width; two gouges, $\frac{5}{16}$ in. and $\frac{3}{16}$ in. in width; two skew tools—one a chisel and the other a gouge—and one small V-tool or veining tool. The tools are of good quality, and will be found to be enough to make a beginning with, although when the wood carver begins to make progress he will find that a very much larger set is not only desirable, but absolutely necessary. For this Mr. Pitman makes provision by supplying a complete set of tools at 7d. per tool, if I read his letter rightly. The specimens of carvings sent with the tools are intended, as he says, to show the different stages of carving from commencement to finish. He has not sent me these on the plea that they are bulky in the first place; and, in the second place, would be uninteresting to me. With regard to the latter assertion I can only say that they would by no means have been without interest, and that a look at them would have enabled me to judge how far they would be useful to beginners, and to have given an opinion with regard to them.

Mr. Pitman also sends some instructions for the use of the tools. He does not say whether or not they are the instructions sent to beginners; if so, they are useful as far as they go, but do not amount to much. They are as follows:—"I give below a few instructions, which the pupil will do well to follow. The tools as they leave the workshop are not so sharp as they can be made, but the pupil must learn to sharpen the tools to suit the different woods with which he has to work. Place the tools on bench in order, and with the handles towards you. Keep the tools very short (*sic.; query* sharp). Learn to work with left hand in sharpening on the strop; the tool is pressed only on being drawn towards you. Amongst the tools will be found a V-tool, which is difficult both to sharpen and to use, so that beginners had better master all the other tools before trying their hand on the delicate V-tool. Practise on a piece of soft pine (like best pattern makers'), and work the tools with a wedge-like action—that is, cut all round your wood so that it falls away in chips, and do not *lever* it up or *break* it off, or you will ruin the tools. First try the chisel, and then learn the tools in order, the easiest first (*i.e.*, chisel), then gouge, skew tool, and V-tool. All questions sent to us are answered free."

There are three patterns of handles sent with the tools, one in beech, another in mahogany, and a third in rosewood. I prefer the rosewood handle myself, as the section lengthways may be described as an elongated oval, with the ends squared off and widest at about one-third of its length from the bottom. This form of handle is the most comfortable to hold, and affords the firmest grasp of the tool. Readers will kindly bear in mind that I consider the tools well worth the money asked for them, and the instructions useful as far as they go. I can say nothing about the specimens of carving sent out and the wood supplied for practice, as I have seen neither the one nor the other. It would be well if something were said in the instructions about the character and form of the wood-carver's bench and the means of fastening the wood down to it, for, in carving, it is half the battle to have the wood on which you are operating immovably fixed to a rigid bench.

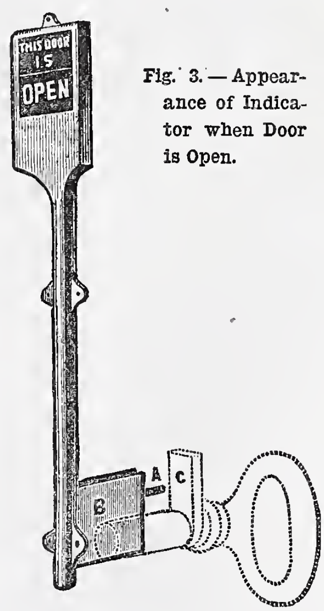


Fig. 3.—Appearance of Indicator when Door is Open.

The moderate price of the tools, etc., supplied by Mr. Pitman brings it within the reach of all who have an inclination to take up wood carving as a hobby to provide themselves with the necessary appliances in this respect. Few branches of the wood-workers' art are so attractive.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Subjects for Work.—H. G. (*Oxford*) writes:—"I must pay my humble tribute to the merits of Work. I have read it from the commencement, and feel that it is filling a long-felt want. I wish you every success, as you most certainly deserve. I have derived help from your many valuable suggestions on different subjects, which I have greedily devoured, which has spurred me on to more perfection in my work, and I am certain others that you 'wot not of' must be in the same position as myself—viz., compelled to recognise you as our benefactor. I have induced several of my friends to take in Work, and they one and all state that it is the best pennyworth they ever invested in. I think that every reader of Work ought to at least induce one, if not more, of his or her (as I hope you have many lady readers) friends to become subscribers to your work. I shall continue to do so. There are one or two things I have been on the point of writing about several times, but have put off again and again, hoping to see someone else write about the same subjects. In the first place I must tell you that I am a man who is obliged to get his living at work which I had no opportunity of learning anything about, but have had to form my own notions and judgment as to how things should be done, and have done it, and am afraid I do not do them the easiest or quickest way. I refer to tin and iron plate working, and general repairs in connection with that trade. I was very pleased the other week to see that you have a series of papers on the above subject nearly ready for publication, and shall anxiously await their advent. I hope the tools of a tinman, etc., will be specified. The other subject I wish to write about is 'Grinding,' how to grind razors, scissors, knives, etc. I do a good many, but never having learnt how, I feel at a disadvantage in not knowing the best way, so should feel very much obliged if you would allow one of your readers, through 'Shop,' to state what kind of stone or emery wheel would be suitable for different classes of work (I only use a 3-in. emery wheel, coarse, for everything, and am afraid I am wrong, as work does not look nice when done), and how to hold them on the wheel, and what kind of machine would be best (I have a small lathe with a wheel fixed on spindle). I think, Sir, this would be a topic of interest to some of your other numerous readers, so am inclined to think that it would not be lost to all the rest, and only a benefit to the one, but a good many would share in the benefit. How to make and mend umbrellas is a subject on which I should like to see a paper."—[You will have seen that papers on the tin plate worker's art have been commenced. The other subjects you mention will be treated in due course—even umbrella mending if any reader can write on it.—Ed.]

Circular Saw Rigs. — J. (*Twerton-on-Avon*) writes in reply to G. E. (see p. 284):—"Replying again to the criticisms of G. E., *re* my reply on p. 172, surely any amateur can use a collar plate to tap a thread. Certainly there is not so much difficulty in cutting a thread thus as there is in striking threads in wooden chucks, yet plenty of amateurs can do that. Again, the recess behind the screw is not necessarily 'turned out.' It may be cast in with the rough hole for the threads; but if turned, it is not 'superfluous,' or troublesome work, 'with small results.' G. E. has apparently a poor notion of amateur skill. Further, if G. E. objects to 'cutting a thread in a saw spindle,' it does not follow that others have the same objection. Neither is the spindle made in brass 'too soft to be of much practical service.' What of the numberless brass chucks in use? Besides, one would not use soft brass or yellow metal, but rather engineer's machinery brass or gun metal; and there are plenty of such chucks which have been in constant use for many years, perhaps eighteen or twenty. And what is the essential difference between cutting and fitting a chuck and a saw spindle? There is none. As to wood for spindles. If a piece of hard wood will not keep true for several years—and that depends chiefly on previous seasoning—it can be trued up like a wooden face plate, or can be renewed; and I know a turner who has such wooden spindles in constant use, and has had them in use for several years. Then my critic says, 'The amount of steadiness given to the chuck depends on whether the face is true and ground flat.' Precisely so, as in the case of any other chuck. But as I have already said, the spindle may be assisted by centring in the poppet. Finally, as to the table, that is matter of choice. I gave tables both simple and elaborate to suit all readers."

"Guide to Good Things."—E. G. C. (*Bristol*) writes:—"It was in my mind, and I imagine in the minds of others, that 'Our Guide to Good Things' was a paid-for advertisement. Now that you have affirmed otherwise, you have established confidence between Work and its readers, and conferred benefits on all concerned. With such editing there is no fear that Work will flag in interest or circulation. Its readers will all think of it as 'a friend in need,' when its editor thus dares to make it 'a friend indeed.' Sir, I thank you."

II.—Questions Answered by Editor and Staff.

Lathe Driven by Single Belt.—J. F. P. (*Darlaston*).—You ask if we have ever seen a lathe driven by a single belt from the top shafting which can be started, stopped, or reversed, without interfering with the belt at all, or with the engine which drives it. The answer is that lathes driven by power are almost always driven that way; there is never a second belt coming down on to the cone pulley on the mandrel; the reversing is managed by a counter-shaft and two belts above, which counter-shaft receives motion from the main shafting in one direction or the other, according as it is driven by the open or crossed one of the two belts. Get some mechanical friend to show you the arrangement—there must be plenty of power-driven lathes in your town. Perhaps, however, you mean that there must not be the usual counter-shaft with striking gear, but that the "one belt" comes straight from the main shafting down to the pulley on the lathe mandrel. Then I must answer that I never saw such an arrangement, though I imagine how it could be done. By means of frictional gearing it would be neater, perhaps, yet there are many who would object to add any unnecessary complication to the mandrel and headstock.—F. A. M.

Castings of Lathe. — Lathe. — You ask where you can procure castings for a lathe of $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. centres on which you can turn the inside work of the Egyptian trellis in No. 7, and stanchions for model yachts. Pray don't have such a small thing. I know of no lathes so small except for watchmakers. Don't have anything less than $3\frac{1}{2}$ in. centres. That size will be equally suitable for the work you wish to do, and infinitely more generally useful. You can buy castings of $3\frac{1}{2}$ in. and 3 in. lathes from almost any lathe maker. Go to your nearest ironmonger, and ask him to show you his price list. Possibly you can buy a finished lathe, second hand, for the same price you would have to pay for the castings, and if you are not a good workman having access to a good lathe this would be your best plan.—F. A. M.

Stereo Flong.—A Stereotyper's Apprentice.—Either a mangle or brush or both combined is proceeded with as follows:—Make a paste of 1 lb. of flour, $\frac{1}{2}$ lb. of whiting, 2 oz. of melted glue, and a very little alum. Mix with water so as to make a paste of the consistence of cream, and pass it through a strainer. Take a sheet of blotting paper and paste it thinly and evenly all over; cover this with a sheet of tissue paper, taking care to rub it all over with the hand in such a way as to prevent its creasing. Then add two more sheets of tissue pasted in the same way. Turn the flong over and paste a sheet of wrapper or sugar paper on the blotting. Then roll it flat with an iron roller or a wooden ruler, and let it stand for a few minutes, when it will be ready for use. The fault you complain of is probably owing to the use of too much paste, or to its being unevenly laid upon the paper, or to the paste being badly made. Prepared paste for the purpose is supplied by Messrs. Harrild & Sons, Fleet Works, London; and by Messrs. Richardson, Racquet Foundry, St. Bride Street, London.—J. F. W.

Magnet.—C. E. P. E. (*Ebbw Vale, Mon.*).—A permanent magnet should at least hold up its own weight of iron. It has been found possible to greatly exceed this by carefully selecting, hardening, and magnetising the steel bars, of which magnets are made. The capability of a magnet to receive and retain magnetism depends very much on the quality of the steel and its hardness. It will lose a very large portion of its magnetism if allowed to lie about in any position, or if exposed to extremes of heat and cold, or if jolted or jarred. To preserve a bar magnet, it should be kept free from bad treatment, and be kept lying in a position coincident with the direction of the earth's magnetic current. Two bar magnets may be made to preserve each other's magnetism by placing their opposite poles together, and placing a keeper of soft iron across both ends.—G. E. B.

Leclanché Battery Gone Wrong.—G. E. H. (*Oldham*).—The spasmodic action of your battery cells is probably due to hard work. A Leclanché cell will not furnish a constant current for any great length of time. It will ring a bell for a few minutes, and then it must have a rest to recuperate itself. If you give it a long spell of work, it will take a long spell of rest (perhaps a day or two, as yours does) before it will be ready to work again. This sluggish recovery is made worse by having the porous cells quite sealed over, because then the gases set free at the carbon plates cannot readily escape from the cells as they should. See to it that there are clear ventilation holes in the pitch seals of the cells. Perhaps the fault is not in the battery, but in the bell or in the pusher. The set of these will vary sometimes with the state and temperature of the weather, if not properly made, and will then require to be adjusted afresh. It is also possible there may be leakage of current between the lines on the battery side of the bell. It is impossible to reply to your letter the same week in which you write it.—G. E. B.

Ayrton's Practical Magnetism. — A. B. (*Middlesborough*).—This work is not yet published by Messrs. Cassell & Company, Limited.—F. J. C.

Books on Mill Work. — Lover of Work (*Shepton Mallet*). — Several good works on mill work are published by Messrs. Spon & Co., 125, Strand, London, but there seems to be no book specially on corn and grist mills.

Electric Bell Parts, Tools, etc. — Platinum (*London, N.W.*).—As you are living in London you can easily make up an electric bell, without the use of a lathe, by buying the various parts, such as magnet cores, bobbins, pillars, screws, and gong at a shop where they sell such things. Messrs. Dale & Co. (who advertise in this paper) will be happy to supply you with any parts you cannot conveniently make for yourself. It is not necessary to increase the size of the metal frame for each increase in size of the gong; but it is only reasonable to have this proportionate to the other parts. Respecting tools required to make an electric bell, these and their size will be naturally suggested by the kind of work to be done. For instance, if you have a $\frac{1}{4}$ in. hole to drill and tap, and a $\frac{1}{4}$ in. screw to cut to fit it, you must have a corresponding sized drill, stock dies, and screwing taps, making allowance always for the cut of screwing tackle. Some day I hope to go thoroughly into the subject of electric bell making, and then I will do as you suggest about a list of tools.—G. E. B.

Brazing Band Saw.—G. (*Salop*).—I have not had any practical experience in brazing band saws, but have seen the operation described. It may be done with a blowpipe or by means of a pair of tongs made white hot. First warm the two broken ends and scarf them down with a file until the lap does not exceed in thickness the other part of the saw. Get some brazing spelter, or some very soft yellow brass, or some tinned brass pins, and reduce a small quantity to filings. Then procure some borax, and grind a little on a slate to a smooth paste with clean water. Mix some of the brass filings with the borax paste in sufficient quantity to form the joint, and place this on the scarfed ends of the saw. Bring the teeth together in their proper places, and bind the joint firmly with iron binding wire. Clamp a pair of warmed tongs or pliers so as to bring pressure to bear on the joint to keep it from shifting when the brass runs with the heat, and then proceed to heat up the joint either with a blowpipe flame above and a piece of charcoal below the joint, or by means of a pair of heavy tongs made white hot. If the latter, clip the joint firmly until the filings melt into it, then release them, and grip the joint with a pair of warmed tongs for a few moments. If the blowpipe flame is used, the source of heat should be from a broad wick oil lamp in preference to gas flame, because the flame from coal gas ejected on steel is said to make it brittle. In either case make the joint sure by gripping it with a pair of warm tongs as soon as the filings run into the joint. When the joint is cool strip off the binding wire, and make all smooth with a file. Perhaps J. H. or A. R. (*Scorrier*) will oblige with their opinion on the proper method to be employed.—G. E. B.

Electric Bell Battery.—Amateur in a Fix (*Nottingham*). — The "white substance much like white lead" that seems to eat away the leaden head on the carbon plates of your cells is an oxychloride of lead, caused by the chloride of ammonia from the cell below creeping up through the pores of the carbon plate and dissolving away the lead. As this white substance first forms on the lead next the carbon plate it soon shuts the head off from being in direct contact with the carbon; the current then fails, and the bell ceases to ring. To remedy this you must take out the plates, melt the lead heads off, soak the carbons for several hours in hot water (changing the water during the last hour) to dissolve out the ammonia and lead salts, then well dry the plates in a hot oven. Whilst still hot, dip the ends intended to have the lead head in melted paraffin wax, and hold them in it until the wax has gone well into the carbon. When the plates are cool, drill one or two holes through each to form a holding for the lead, and then cast the heads afresh. The paraffin wax (solid paraffin, obtainable through any druggist) will fill up the pores of the carbon, and prevent the salts from creeping up under the lead cap. Whilst the lead cap is still hot, give it a coat of Brunswick black or other black varnish, and let this coat overlap on the carbon about $\frac{1}{4}$ in. This will protect the outside from the action of ammonia fumes. Retort carbon is the carbon scurf got off from the retort furnaces of gas works, and is a much denser, close-grained article than the carbon represented by the cokes used in a blacksmith's forge. These last are useless for battery plates. Porous cells of earthenware are more durable and look better than those made of canvas, but canvas bags make very useful cells; and, possibly, the reason you find them work best, is because they offer less resistance to the current than those made of earthenware. Thank you for your kind appreciation of Work. Try to increase its circulation by making it known to your friends.—G. E. B.

Walnut Stain.—Centrebit (*Tullow*).—Vandyke brown, mixed with a little liquid ammonia and then diluted with water to the necessary liquidity and strength, or rather weakness, makes an excellent walnut stain of any intensity. Whether it will be the best for your particular purpose or not I cannot say, as you do not mention the kind of timber you wish to stain. Other inquirers please note, and do not be afraid of giving too many particulars.—D. A.

Cement Floor Laying.—R. S. (*Edinburgh*).—The foundation should be rammed solid; if any filling up is required, it should be done with hard dry material, and no lime rubbish should be in it, as this has a tendency to swell, and lift the floor; a covering of broken stones to pass through a 2-in. ring not less than 3 in. thick should be laid over the floor, leaving 2 in. or more, if required, for the concrete. The concrete is mixed with 5½ cwt. of Portland cement to 1 ton of crushed bricks, limestone, or slag, that will pass through a ½-in. mesh. It must be well mixed, wetted, and turned over twice, then laid on the broken stones, and levelled by means of a straightedge from pegs, or a board laid level at each side. It must also be well beaten down with a hand beater about 15 in. by 10 in. with a handle on the back, till quite level and fluid on the top; it is then left for a few hours till nearly stiff, when it is smoothed over with a plasterer's trowel. If laid outside as footpaths, it should be in squares not more than 6 ft., or it will crack; the harder and more solid the foundation is the less likely it is to crack. The quantity named will lay about 14 or 15 super. yards.—E.

Preparing Vellum.—PUZZLED.—To describe this practically demands rather an illustrated article than the space available in this column; but your queries shall, as far as possible, be answered. (1) The skins used are those of calves, kids, and still-born lambs. (2) These are unhaired either by steeping with lime, by sweating—*i.e.*, by hanging in a smoke house heated by a smouldering fire till fermentation sets in; or by soaking with dilute acids. As you seek a cleanly method you may, perhaps, prefer the last. The hair, etc., is scraped off with a two-handed unhairing knife. After this the skin is stretched in a "herse" (merely a square frame of four sticks joined at corners); strings from the edges of the skin to this frame allow of its being made quite tight, and it is well scraped with a half-moon knife to clear away all fleshy particles, dirt, etc. Next it is ground. The grain side is merely ground over with a flat pumice-stone, but the flesh side is rubbed over with powdered chalk before grinding. The half-moon knife is now passed over the skin to drain it; this makes it look whiter. Fine chalk is then rubbed over both sides, and it is put to dry. It has next to be pared down to a proper thickness—probably about one-half—with a sharp circular knife, and then pumiced smooth where required. Lastly, it is glazed with albumen—white of egg. (3) Tools such as the unhairing knife, half-moon knife, etc., you can doubtless get at any good tool shop, such as Buck's, Holborn Viaduct.—S. W.

Music Stand.—J. H. F. C. (*Bermondsey*).—I am glad my music stand has been approved by J. H. F. C. In reference to its cost, I think the material was purchased for about 5s. as follows:—Mahogany, 1s. 6d.; brass tubing, 2s. 3d.; wood for bosses, 3d.; scrolls for feet, 1s. 6d.; wire for rods, 2½d. In reply to his second question, I could not undertake to make another in the way of trade. As a minister my time is pretty well occupied, and I only turn to mechanics or science by way of recreation and for the love thereof. I do not know, but I hardly think a man could afford to make it for much less than 12s. 6d. or 15s.; as a matter of fact I know there are stands sold for 21s. not nearly so handsome, useful, or substantial. But why does not J. H. F. C. make one? There is nothing in it except the turned work that a man with one eye and two hands, backed by will power, could not accomplish without any mechanical training whatever. I have found it possible by patient care to do what has passed muster for professional work.—O. B.

Furniture Polish Cleanser and Reviver.—C. H. W. (*Hastings*).—I cannot understand how you find any difficulty in preparing this, and the only explanation that occurs to me to account for the substances not mixing properly is owing to some ingredient in the polish. I daresay you are aware that other substances besides shellac and spirit are sometimes used in making French polish, and it is just possible that one of these may be the cause of failure. Suppose you try a smaller proportion of polish, which I presume you have bought ready made. Though it will not form so good a mixture, you might use methylated spirit and omit the polish altogether. I may say it is not necessary to enclose a stamp, as all inquiries are answered in these columns gratuitously, though none can be sent direct by post. Neither you nor any other correspondent who can be helped in any matter coming within the scope of WORK need think you are "troubling" us.—D. A.

Shorthand.—CUPID (*Castlejohn*).—Shorthand will not be treated in WORK. Full instructions, however, for learning this useful branch of education are contained in Cassell's "Popular Educator," a new edition of which is now being issued.

Bell Hanging.—J. S.—I am not acquainted with any book on bell-hanging in the old style—that is to say, by cranks, wires, and springs; but the subject will be treated in due time in a paper or two by a contributor who is accustomed to the work.

Tables, etc., for the Construction of Measures.—J. S.—I will obtain the American book of which you speak, and see what can be done towards the construction of tables showing the contents of vessels in imperial gallons, according to depth and diameter. I am obliged to you for your letter, and regret that when giving your name you should have omitted your address. Kindly let me have it, as it may be of advantage to be able to communicate with you.

Wooden Teeth in Iron Cog.—X. Y. Z. (*Orkney*).—You should have informed me by means of a sketch of the shape of the teeth of the iron wheel into which your wooden teeth have to gear. Had you done so I would have drawn at once the correct shape of the wooden teeth required. In the absence of this very essential information, I must take a somewhat circuitous course in order to show you how you can obtain the correct shape for yourself. I must assume, as is the case nine times out of ten, that the teeth you require are of cycloidal form, in which case you will proceed as follows:—Get a sheet of white paper and lay it against the face of the wheel into which your new teeth have to gear, and so take a rubbing of the tooth forms. Fasten this sheet of paper to a board with drawing pins; obtain and strike thereon the correct pitch circle for the wheel; make a templet, as shown in Fig. 1,

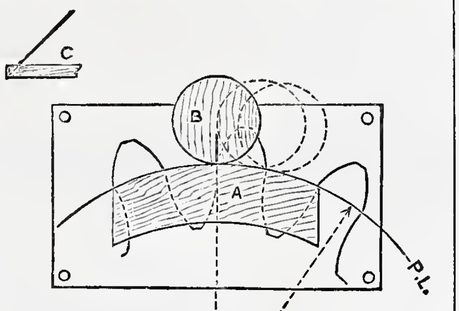


Fig. 1.

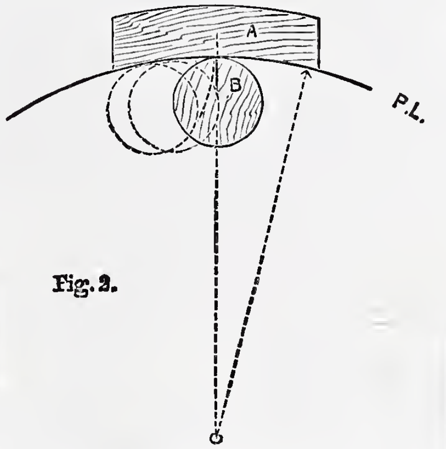


Fig. 2.

A, having convex and concave edges, each cut to the radius of the pitch circle. Place, say, first of all, the convex edge against the pitch line, as shown in Fig. 1. Prepare sundry circles cut from cardboard or wood, and of different diameters, ranging from perhaps 1 in. to 5 in., dependent entirely on diameter and pitch of wheel. Into the edge of each stick a needle diagonally (Fig. 1, C). Take one of the circles at random, placing the needle point against the pitch line and coincident with one of the tooth edges already taken by the rubbing, and roll the circle (Fig. 1, B) along the convex edge of the template, A, and note whether the needle point traces over the tooth curvature obtained by the rubbing. Probably you may have to try half a dozen different circles of different sizes before you obtain that one whose needle point will trace the exact curvature of the teeth of the old wheel; but when you have obtained it, that is the circle which, when rolled on a concave templet, cut to the curvature of the pitch circle of your wheel with the wooden teeth, will give the correct shape of the flanks of the wooden teeth—that is, of those portions lying below pitch line. Having thus at once found the proper curvature for the tooth flank, you can adapt a radius thereto by which to strike the planks of all the teeth in the wheel. To obtain the shape of the tooth faces—that is, of those portions lying above pitch line—you must place the concave edge of the templet, A, in Fig. 1, against the pitch line of the wheel of which you have taken a rubbing, and obtain the curvature of the tooth planks by means of a suitable rolling circle, precisely as you obtained the curvature of the faces, as shown in Fig. 1. Then the same rolling circle by which that curvature is obtained will, when rolled on the convex edge of the templet, A, in Fig. 2, give the shape of your wooden teeth above pitch line. There are other methods, more or less elaborate, by which tooth forms may be obtained, but there are none so suitable for workshop use, or so readily put in practice, as that which I have here given. It is founded on the mathematical principle of the cycloid curve, and the only departure from strict precision is the adaptation of a radius to the true cycloid curve obtained by the rolling of the circle on its base line. A cycloid curve cannot be struck mathematically true with compasses; but, excepting in the case of wheels of large pitch, the difference is quite inappreciable, and is not, in fact, so great as the slight inaccuracies inseparable from ordinary workmanship.—J.

Printing on Tin.—T. R. Y. (*Ramsbottom*) wants to know how to print upon tin and other hard substances, and asks me to mention some book on the subject. Books there are none, and every process for the decoration of metals has been patented, so I think T. R. Y. will get most information from the specifications themselves. These may be had from the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. Under the heading of "Letterpress and Similar Printing" are published abridgments of specifications of patents, which will guide the searcher to the full specifications as follows:—Part 1A, A.D. 1858 to 1866, 2nd edition, 2s. 9d. post free; Part 2, A.D. 1867 to 1876, 2s. 7½d. post free. These may also be seen at the Mechanics' Institute, Bolton, near which I think your town is situated. They can also be seen, free of all charge, at the Free Reference Library, Manchester.—N. M.

Hydroquinone Developer.—J. B. (*Brixton*).—I have read of such a deposit as you name being formed, but in my own experience it has rarely occurred. I do not keep notes of my developments, but I am under the impression that the grey deposit has only occurred with plates which have been under exposed and, consequently, forced in development, besides having been a long time in the developer. Mind, I only throw this out as a hint, as I am unable from my own knowledge to explain the defect you allude to, which, I take it, is somewhat analogous to the fog of ammonia. Perhaps if you were to try a different sample of the hydroquinone you might get better results, though, as you say the printing is not affected by the deposit, I hardly think there can be much wrong. You must be from what you say expert in the use of oxalate developer, so why change? It is a very good one, and as you have mastered it you will not find any others as easy till you have thoroughly familiarised yourself with their peculiarities. Thanks for good wishes.—L. I. P.

Polishing Rosewood Box.—J. S. (*Bradford*).—Without knowing exactly what materials you have used and how you have manipulated them when French polishing your rosewood box, it is impossible for any one to say positively why the polish always looks dull and greasy. I think, however, it is very probably owing to too much oil having been used either during the "oiling" or subsequent "bodying in" with polish. Rosewood, you no doubt know, is naturally an oily wood. If you will write again, detailing your process and describing more fully the appearance of the box, I will do my best to point out the cause of failure. The fault may possibly only be due to the natural "sweating" which is apt to occur on all newly polished work where oil has been used. Yes, the papers you refer to will appear as soon as practicable. They are in hand; but arrangements are made far in advance, and you know everything cannot be first. Meanwhile, any assistance I can render you in "Shop" is at your service.—D. A.

Door-Mat Method.—POWELL (*Londonderry*).—On reading your inquiry, another one, viz.:—
"Where can all this difference be
'Twixt tweedledum and tweedledee?"
occurs to me. If, as I gather, you are intending to make alterations, I am afraid you will find either of those you suggest to be more trouble than they are worth; but on this point you must be guided by circumstances. I would suggest that an easier way to manage is to cut the door at the bottom, so that it will clear a mat laid on the present floor and just under the door. Fill up the space or opening that has been made by cutting the door, by fastening a piece of wood to the floor. If practicable this will be the easiest way, and will save you the trouble of lowering the whole of your hall flooring. As for appearance of the two methods you ask about, it may be said that there is not much choice; and whichever you adopt, you are violating no canon of taste. This may not be so satisfactory to you as if I were to say that one plan is better than another; but were I to do this it would be only misleading you, as I should be entirely guided by many things which, without seeing your hall, I cannot know to offer a definite opinion.—D. A.

Window Blind in Turned Lattice Work.—C. E. P. E. (*Ebbw Vale*).—You write:—"Could you give me a rough sketch for a window blind of the ordinary size in turned lattice work? I only want the arrangement of the pieces, not to any particular pattern in turning, as I have a number of patterns in three panels." From this I gather that you want suggestions for the kind of blind known as a half blind—a blind that goes across the lower part of a sitting-room window on the ground floor to break the view of the interior to passers-by. You will find, I think, suitable arrangements in No. 7, page 98, and No. 18, page 281, for a half blind. A central panel within a border is the most fitting arrangement for a small window, but for a large window the central panel may be divided into three parts, or into a number of small panels like squares in a chess-board, the panels containing a different arrangement of pieces, so as to present a chequered appearance. Before beginning work you should construct a full size working drawing, and you can then arrange the border and panels to receive the decorative turned work in due proportions. I can only reply to you indefinitely as above, because you do not tell me the size of the blind you wish to make. Had you done so, I could have said something with regard to proportions of the various parts—border and panels; but it is no use assuming a size and replying hypothetically.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Boot and Shoe Making.—NITRAM (*Boscombe*) writes in reply to FARNWORTH (see page 284):—"Go to any shoemaker's grindery store or leather shop, and purchase the following articles, which will do to finish the edges of your boots: one black heel-ball, one white heel-ball, small bottle of ink, sheet of 1½ glass paper, ditto emery paper or cloth, shoemaker's knife (thin blade), shoemaker's rasp, ditto man's forepart iron with one bevel, ditto plough, ditto paring up hammer, and ditto scraper, and get the man in the shop to sharpen this last article for you if you have never done so before. If you have to finish the heels you will have to get at least a heel iron, or, as I have heard some northern Crispins call it, 'a brazer.' If you do not know how to use the above articles, I shall be but too pleased to give any information on the subject at any time, with sketches if required."

Saws Running out of Truth.—A. R. (*Scorrier Saw Mills*) writes in reply to ALPHA (*Grangemouth*) (see page 286):—"Your swage saw should be 19th gauge tight at point of teeth, and 10th gauge at centre, bevelled from about ½ in. outside of collar washer. The saw must be kept perfectly round, and the set very even; ⅝-in. boards are rather thick to be sawn off with swage saw, though we often cut ⅝-in. and even ¾-in. with swage. A swage saw is not adapted for cutting off boards above ⅝ in. or ½ in. If the deal is not even on side next to fence, the first board will be thick, but if the saw is in good trim, the next will be its required thickness. Care must be taken not to overfeed the saw, and to spread the board a little as soon as it passes back of saw. You must remember that more care is to be taken in the working and sharpening of the swage than with a saw that is of even thickness to get good work done. In fact, I know many sawyers that cannot work a swage saw so as to give satisfaction."

Gripping with the Vice.—SYER & Co. write in reply to CROSS-CUT (see page 222):—"One of our patent instantaneous grip joiner's vices would answer the purpose, as you can use 12 in., and instantly change to $\frac{1}{16}$th."

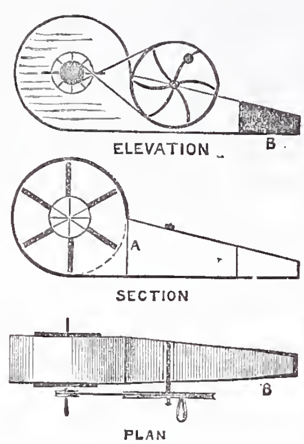
Colouring Photographs.—W. L. S. (*Walton-on-the-Naze*) writes in reply to EXPECTANT (see page 174):—"I have not had the chance to reply to the query of EXPECTANT (*Hull*), and I hope I am not too late. I shake hands with him in his profession, as I am presuming enough to style myself an amateur artist. Photos can successfully be coloured. A photo was shown me by a friend a few days ago of a group of lads four in number; it was a fairly sharp one, but a young gentleman of the number had a shadow somehow cast on his face, so as to give an expression about his eyes looking rather full, also of having one corner of his mouth drawn down. I was asked if I could remedy same, and tint the features, and button flowers, etc. I did so, my success giving satisfaction in such a degree as to have a set of half a dozen to manipulate with. I had but coloured one before, then I experienced some considerable difficulty in so doing. I reverted to a plan which I use when colouring cloth tracings, *i.e.*, rubbing my brush lightly on a piece of common yellow or mottled soap, the latter is the best, and then in the colour, and it will then flow freely and work easily on the photo. I should be greatly obliged if you, sir, would print my name and address with this small piece of advice, if you do not think it too useless, to enable EXPECTANT to communicate with me through your interesting and extremely valuable paper, especially 'Shop.' On oil or water colour sketches my experience is only of six months' standing, and self gained; but painting, as well as crystoleum painting, is a great favourite of mine, and a thing which I am pretty successful with, at least in my opinion and a few outsiders."

Blueing Steel.—W. P. (*Wisbech*) writes in reply to PALL MALL (see page 222):—"This is done in the tempering. It is by means of the colour that the temper of the steel is known. The colours run dark straw, light straw, crimson, dark blue, and light blue, after which the steel becomes quite soft, and requires hardening before anything can be done with it. The blue colour is almost too soft to cut wood, though quite hard enough for swords and daggers."

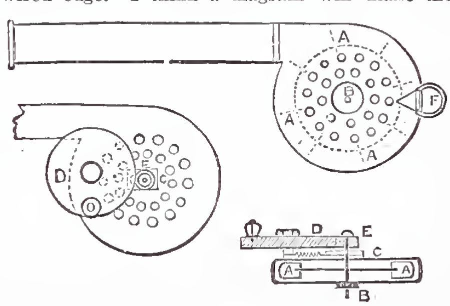
Flour Paste Souring.—X. M. T. C. C. (*Belfast*) writes in answer to J. R. (*Skerries*) (see page 238):—"To keep flour paste from getting sour, he might dissolve ½ oz. of alum to 1 lb. flour, which will make it keep for about a week. This is the only thing I know that will keep paste from souring."

Canvas for Painting.—H. R. M. (*Dover*) writes in reply to WAITING (see page 236):—"*Re* canvas for painting, I often experienced the same difficulties, which I at last got over by mixing a little flake white or even ordinary whiting with the size to the consistency of paint, and giving two or three coats according to texture of canvas, and allowing each coat to dry; well rub down with sand paper. It will then be smooth enough for painting."

Machine for Current of Air.—SCLATTIE (*Kemnay*) writes in reply to BELLOWS (*Gloucester*) (see page 190):—"With reference to how a machine can be made to give constant current of air, with rotary action, I submit the following sketch. Excuse the look of it, as it was done on the spur of the moment, after reading the number in which the question appeared. The machine is very handy to any one who would like to do any smith work at home, as with it light iron can be wrought, and even welded. The sketch, which is drawn to the scale of one-eighth to the inch, will explain itself, as far as size and general appearance go. Of the material, the sides may be of ½ in. deal to within 3 in. of nozzle, with a saw key run in where they bend. The top and bottom and round the blast should be of the thinnest of sheet iron; even tin would do, except at the nozzle, where it would require to be a little stronger. The journals and spindles are nothing but what a handy man might make himself. The pulleys the same."



Bellows with Rotary Motion.—G. E. S. (*Tonbridge*) writes in reply to BELLOWS (see page 190):—"I have one in my possession which works satisfactorily (but the worse for age in appearance only), and will try to describe it. It is made of tin plate, and measures 17 in. over all. The fan chamber is 6½ in. in diameter; the directing tube is 2 in. square where it joins the fan chamber, but changes to a circular shape about half way to the nozzle, the diameter of which is 1¾ in. Each side of fan chamber is perforated with two concentric rows of holes of ⅜ in. diameter, as near the centre as is compatible without weakening the plate. The inner circle of mine has eight holes, and the outer fourteen. The nozzle has a wired edge. I think a diagram will make the



driving arrangement more lucid than further description. The rim of the fan chamber is 1¾ in. wide; the sides are cut in one piece as far as the seam shown, and hollowed out a little. When fixed to the rim they make the chamber about 2 in. wide at the rim, and about 3 in. at the centre, on account of the hollowing out. A circular plate is notched to receive the vanes as at A, a brass bush is soldered on to take the spindle at B, a small bridge is made with a plot in the top for the spindle to be drawn into contact with the wooden driving wheel, D, which has a few fine grooves turned in its edge to better engage it with the small wheel at E, which is covered with leather, and is kept in contact with the driving wheel by a strong, cheap spring fastened to the spindle of wheel D, and also passing under the bridge to the spindle of wheel E. The loop, F, is for hanging up by when out of use."

Tuition in Carpentry.—A. L. O. (*Hammersmith*) writes in reply to AMATEUR (*Bayswater*) (see page 302):—"The gentleman (Mr. Robertson) whose circular I enclose can give the inquirer just the instruction he requires in his beautifully appointed workshop, 14, Augustus Road, Shepherd's Bush. I have only had twenty lessons from him, yet so extremely intelligent and intelligible are his methods of teaching that I have obtained a first-class certificate from Professor Unwin, of the City Guilds Institute, and have made a miniature bookcase 2 ft. 7 in. by 2 ft. for a collection of the various kinds of woods. AMATEUR could not do better, and moreover it is not very far from Bayswater."

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WHAT strikes the average American as one of the silliest of regulations at the Paris Exhibition is that which makes it an offence to make rough sketches of machines. Nearly all exhibitors, with the exception of those from England and the United States, take special pains not to show anything but the bare outside of their machinery, and to show that at as great distance as possible. Then the luckless fellow who tries his hand at sketching is warned of the consequences, his sketch destroyed, and, if at all persistent in his search after knowledge, he is marched to the police department, and perhaps off the ground. This for the first attempt. We are not sure what the punishment for the second attempt would be. There probably never was another exhibition of machinery in which so much effort was put forth, both to make a show and to avoid giving information.

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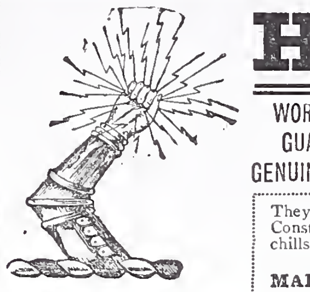

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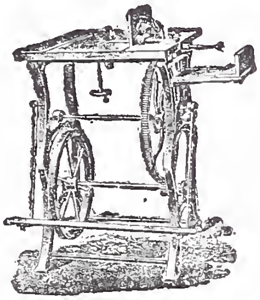

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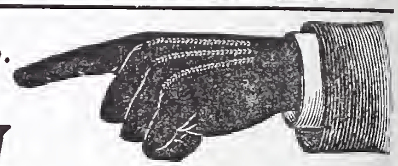

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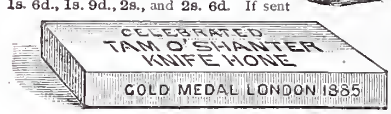

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 26.] SATURDAY, SEPTEMBER 14, 1889. [Price One Penny.

A COMBINATION BEDROOM SUITE.

BY J. SCOTT.

'Cleanliness is next to godliness." This s an acknowledged fact; but it is curious o note the relative proportion one bears o the other in the estimation of certain peoples. The Arab, for nstance, is noted for his godliness, and is equally noted for his dirtiness. Whether this is to be ac-counted for by the ab-sence of the—to us—necessary utensils in his possession, I will not venture to say. Certain it is that we have advantages over the Arab and his brethren, and this, I suppose, is one particular reason why we can boast that we are a cleanly as well as a godly people.

Fig. 1.—Section of Glass Door.

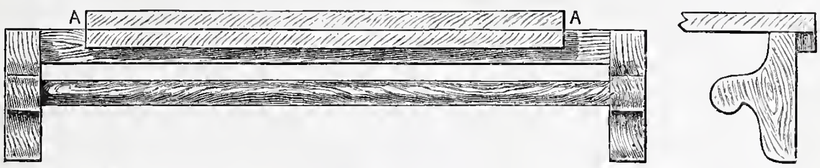


Fig. 2.—Towel Rail: Front Elevation (A, A, Flap) and Side Elevation. (Scale, 2 in. to 1 ft.)

The advantages above mentioned it is needless to speak of; my object in mentioning them was to show that there is at least one among us—and that is myself—who is not satisfied with even the present obtainable conveniences, for the reason that, being a bachelor, and having but one room, I have not sufficient space for a complete bedroom outfit.

As will be seen by a glance at my drawings, my aim is to combine all the uses of an ordinary bedroom suite in a

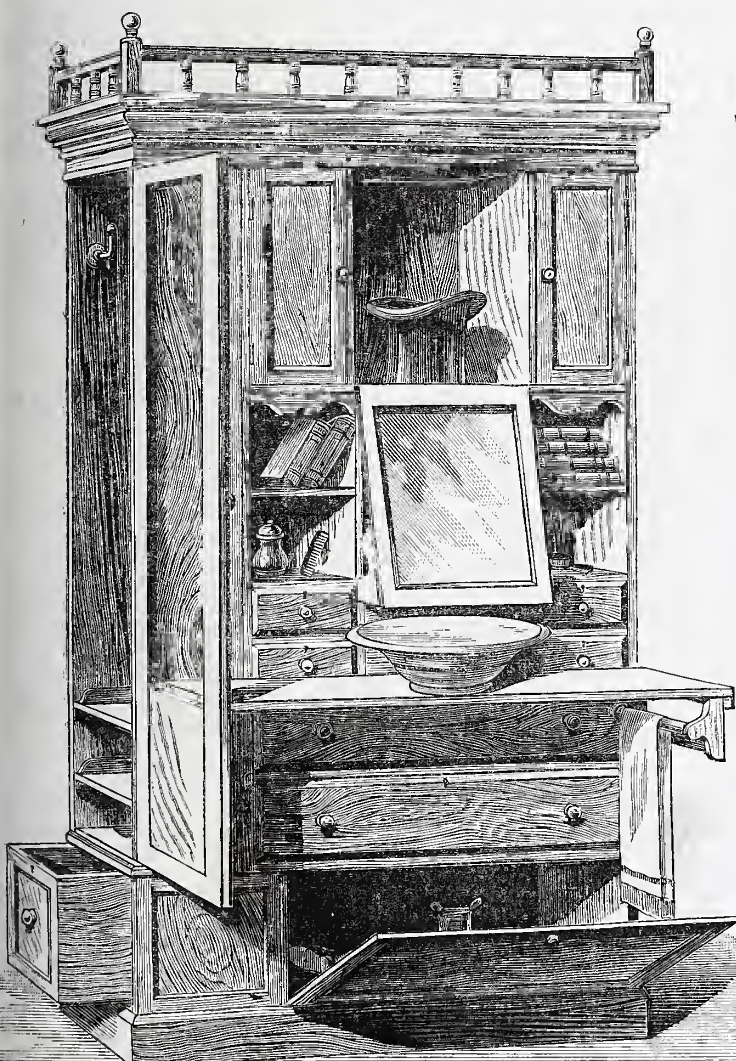


Fig. 3.—Suite Open.

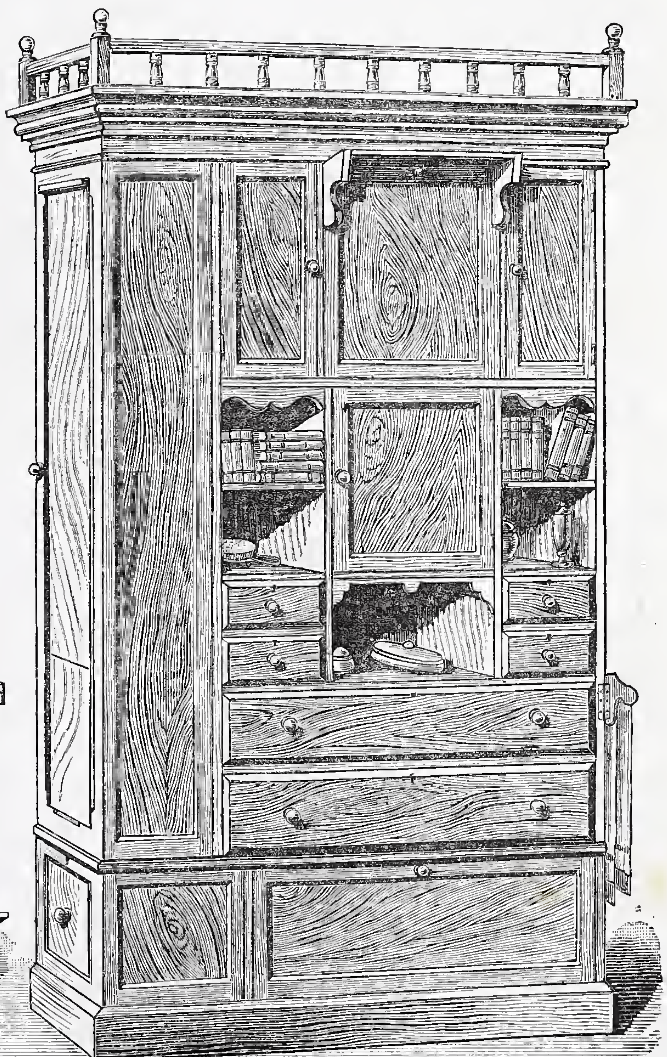


Fig. 4.—Suite Closed.

A Combination Bedroom Suite.

single article of furniture; and I think I may safely say that I have succeeded in doing so.

Presuming that I am addressing the amateur reader, I will now proceed with measurements. As I have drawn Figs. 3 and 4 to ¾ in. scale, professional workmen will know that that is sufficient for them. The job, when closed, occupies the space of twenty inches from the wall, and is 3 ft. 7 in. wide. Even in a very small room this will not be found inconvenient. When required for the purposes of a washstand, the long door on the left-hand side is opened, and the flap, which is part of the door panel, is let down; the towel rail is then brought round, and forms a support for the flap. Along the top of the flap is glued a strip of wood, which prevents it from slipping off the towel rail. The advantage of having the door and drawer to open at the side will be readily seen. Required as a dressing table, the door of the centre cupboard at the top is let down; and being fitted with a glass inside, and having a shaped piece of wood outside, to keep it at a slight angle, it forms a handy toilet mirror.

In making, care should be taken to get the pieces firmly joined together; and I should advise the amateur to get it cut out and fitted together before gluing, as it can undergo any necessary alterations, and can be glued up afterwards.

It is not my purpose in this paper to give any instructions on joinery, as I suppose that the reader has a sufficient knowledge of that craft. The wood should be ½ in. thick. Beginning with the plinth, *i.e.*, the bottom part, get two pieces of wood, each 3 ft. 7 in. long, and two pieces each 20 in. and 4 in. in depth; firmly join them together, and fix two or three thicker pieces in the space between at half an inch from the top to support the whole weight of the job. Very great care must be taken with this part, as the slightest mismeasurement will throw the whole job out of the square; or else prevent it from fitting exactly. It matters little whether the supports mentioned above are joined in lengthways or crossways, providing they are properly fixed. The edge all round the plinth should be canted slightly, as is shown in Figs. 3 and 4.

Proceeding with the side drawer and bottom cupboard, the top and bottom boards should be 3 ft. 6 in. long, and 19 in. wide; the two pieces forming the sides of the cupboard 12½ in. by 19 in.; and the piece in front, forming the side of the drawer, 12 in. by 12½ in.; whilst the back board is 3 ft. 7 in. by 12½ in. The drawer and cupboard door can then be made accordingly. A moulding should then be glued round the top, leaving half its depth free to receive the top carcase. When all is cut out, the bottom carcase should be glued into the plinth, thus hiding the thickness of the bottom board.

We now come to the top carcase. The back should be made up of boards firmly joined together; these separately may be of any width, providing that collectively they are 42 in. in width. A bottom and a top board, 19 in. by 33 in., should be fitted to the back board. Then a board, 58 in. long and 19 in. wide, should be fixed at the right-hand side, between the top and bottom; whilst another of the same dimensions is put between them at 32 in. distance from it towards the left-hand side. Next, the board forming the side of the long cupboard should be placed in its position. This board is 9 in. by 58 in.

We now have our top carcase ready to have its inside fed. We have four boards, each 32 in. by 18½ in., to fix. One at 7 in. from the bottom, another 6 in. above it, the next 9 in. above that, and the last 16 in. above that. These boards would be sufficiently firm, I think, if they were nailed or screwed in. The width of the top centre cupboard is 14 in.; the height 18 in. The two side cupboards are the same height, and 8 in. wide. The smaller cupboard underneath is 13 in. by 16 in. The jewel drawers should each be 4 in. deep.

I think I have now given sufficient measurements concerning the top carcase; the main thing is to get the big boards exactly fitted, the smaller ones can then be worked accordingly. If it is exactly joined and fitted it will now fit perfectly into the bottom carcase. These should not be glued together, as, in case of removal, it will be found convenient to have the job in two or three separate pieces.

The cornice is the next part to deal with. After having procured the moulding, mitre it up on three sides, to fit partly over the frieze, to which it should be glued. Proceed with the frieze in the same manner as with the plinth, using the same measurements, with the exception that the frieze is 2½ in. deep, taking care to get the inside cross pieces exact. A small beading might be glued round the bottom edge of the frieze.

If the Early English simplicity of the spindle rail on top is not admired by the maker, a pediment can easily be cut out to suit his taste, and should be glued along the moulding.

Having got the skeleton of our job together, the drawers and doors will next occupy attention. I need not say much of the drawers; they should have a beading glued round their fronts; otherwise, if they are bevelled, they will prevent the towel rail from carrying out its purpose.

Make all the door stiles 2 in. wide.

The full length of the side cupboard door should be 58 in.; the width 18 in. The movable panel must be 42½ in. long. This extra ½ in. allows for the strip of wood to be glued along the top, as before spoken of. The fixing of the towel rail (Fig. 2) should be left until the last, as it can then be screwed on at its proper height. It must be hinged on only to the front.

We will now look at the door containing the glass. I think an ordinary picture frame will explain the method to be adopted. Fig. 1 will give a sufficient idea of it. The glass, A, is fastened on B, the panel is then put in, and a moulding, C, is glued round the edges.

I have placed the cupboard on the left-hand side, so as to allow of a free movement of the arm of the person making use of the article as a washstand. If required, a cupboard could also be placed at the right-hand side; and I would be pleased to answer any inquiries concerning it through "Shop." Brass handles, or knobs, can be used. A handle must be placed somewhere along the flap, as shown, to keep it in its position as a panel of the door.

The two trays shown in the long cupboard should be made to slide in and out freely; and should each consist of a bottom piece 18 in. by 8½ in., with back and sides of 1½ in. depth.

Four pieces of wood should be screwed into the cupboard, two on each side, to allow for the introduction of the trays.

For finishing off the job I should advise it to be painted in some kind of enamel; there is at present in the market a very pretty and, I think, good enamel suitable for such purposes. Of course the inside parts can be stained. I think that if it were painted in some light colour it would relieve the heavy square appearance which seems to pervade it.

If my instructions are carried out, a firm and substantial article of furniture will be the result.

If any one should deem it worth a trial to make one of these wardrobes, I should be very pleased to hear of his success, through the ever-interesting columns of "Shop."

Such a job as is here described would, I think, be a very saleable article, especially at the present time, for the furnishing of small rooms at the seaside, etc., where space is important; and would, I think, repay the time and cost if one or two were made by a professional workman.

It will very likely be said by some of my professional readers that it is possible to purchase a complete bedroom suite almost as cheaply as it would cost to make one of these robes; but they must remember that space, and the convenience of putting it to the several uses named, was my motive for designing it.

Of course the back boards could be made of thinner stuff, and where the drawers fit in, a narrow framing would answer the purpose; but I should advise it to be made solid throughout, and of the same thickness.

It is quite unnecessary to have the backs, sides, and bottoms of the drawers as thick as the fronts—these could be made of much thinner stuff.

The method also that I have given of making the plinth and cornice varies also from the usual method, but made after the style that I have described they would be very firm.

I give no instructions as to panelling the doors and drawer fronts; I suppose this to be understood.

It will be observed that I have given all my measurements so as to allow for each board to be joined to its fellows in a strong manner. If it is the intention of the maker merely to nail the job together, he must first study my measurements, so as to reduce some of them accordingly.

POLARISATION OF LIGHT AND POLARISCOPES.

BY O. BECKERLEGGE.

THE CONSTRUCTION OF THE POLARISER.

IN constructing instruments, we may avail ourselves of more than one method, or material, without vitiating the results. For example, we may use reflected light for our analyser, and for the reflector we may avail ourselves of glass, crystals, polished wood—preferably mahogany—or the clear, blue sky; indeed, anything that will reflect light except metals. With any of these, we may use a Nicol prism for the analyser, or films or plates of glass, the result in the main being the same. On the other hand, we may use a Nicol prism for the polariser, and a reflector for the analyser. This latter arrangement, however, would present so many mechanical difficulties if applied to microscopic work, as to render it practically impossible; though for simple demonstration it might be used well enough.

In 1808, M. Malus, a young man of philosophical mind, experimenting with a piece of Iceland spar, directed it towards a beam of light reflected from the windows of the Luxembourg Palace, and, to his surprise found it to be polarised. Further experiment not only determined the polarising angle fo glass, but showed that each reflecting substance had its own particular polarising angle. In describing methods I shall have nothing whatever to say in reference to constructing a Nicol prism, beyond the fact that a rhomb of Iceland spar is cut in two in the direction already indicated. This must be done by a lapidary's slitting disc, or wheel. The surfaces are then ground perfectly flat, polished, and cemented together with Canada balsam. I confess that in my hands the polishing has been a failure. Others with more mechanical skill may certainly do it; but I would not advise an amateur who is fortunate enough to possess a piece of spar pure enough to make a prism to attempt making one. I believe small prisms can be purchased unmounted for about 10s. per pair. At the same time, it must be fairly understood that a pair of Nicol prisms will give better results than the mode I am about to describe. But there are other considerations. If one goes the right way to work, the glass method will cost nothing like the money which a Nicol would cost; and what to the young philosopher is of infinitely more value, *he can make it himself*. The writer's experience is, that far more pleasure and instruction are gained by working out details, grappling with difficulties, and overcoming them or finding the solution, than in purchasing an instrument, the construction of which is a mystery, and using it on lines laid down by some one else, the reason of which you do not see.

We will begin with the polariser. As it has already been stated, this may be made as a reflector. Make a cell similar to the one holding the mirror of the microscope, but at least 1 in. deep. Now, it is true that a single plate of glass will polarise light, but only a portion will be reflected; another portion will be transmitted. This being so, we must have several sheets, or plates; each one will reflect a portion transmitted to it, so that by employing, say, six or eight plates, we shall practically reflect the whole of the light under polarised conditions. Perhaps a larger number than this may be required. We must have the required number of plates cut out of the same sheet, which must be of the thinnest and whitest window glass possible, and free from specks and flaws. On the bottom of the cell lay a piece of black cloth, or velvet, and the plates of glass on it. Some experimenters recommend the plates to be separated from each other by bits of paper being gummed at the corners. I have tried the plan in experimenting, but I confess in my hands it made no perceptible difference. If a stout brass wire ring is sprung into the cell on the glass, the plates will be retained in their place; the cell can be japanned or lacquered, and be fitted to swing in the gimbal that usually holds the mirror. If there be a difficulty in procuring circular plates of glass, then let the cell be made square, and in any village a glazier can be found to cut glass square. When this polariser is used with the analyser, place a slide, mounted with selenite, on the stage, and turn the reflector at such an angle as shall produce the highest colour in the selenite; that will be the best angle to employ. A little practice will enable one to catch it very readily. It should be as near as possible 58°.

I will now describe the method for using transmitted light; and as the principle will be the same for both polariser and analyser, I shall simply describe the details of one.

In the eye-piece of the microscope which I described in WORK, it will be seen that I have drawn the cell containing the field lens to extend considerably beyond the lens. Now, if one is desirous of making the instrument as complete as possible, a thread should be chased on the inside of the projecting cell. Procure a piece of brass tube of the size that when a thread is chased on it, it will screw into the eye-piece. It can, of course, be made a tight fit, and so dispense with the screw. Next prepare a square block of wood, say 6 in. long, and of such a size that when rounded it will slip into the tube. On its two opposite sides draw a line at an angle of 26°. (See diagram Fig. 3.) Cut down to the line, and leave the wood as an acute wedge. The edges must now be planed off, and the wood rounded so as to slip into the tube. The end will now present an oval. Cut out of sheet brass or copper an oval of the exact size of the end of the wood. Cut out its centre, leaving it as a flat oval ring $\frac{1}{16}$th of an inch wide; or a ring may be made of brass or copper wire. Push the wooden mould into the tube, so that its end comes within $\frac{1}{10}$th of an inch of the end of the tube. Drop the metal ring in the tube, so as to lie perfectly dead on the wood, and solder it in its place. This can be done easily with a blowpipe, or even with an ordinary soldering tool. It need not be soldered all around, but only in such a manner that it shall be firmly held in its place. The tube need not be more than $\frac{1}{2}$ in. longer than the angle. Cut a pattern of the oval in paper, and send it to an optician—say, Mr. Lancaster, of Birmingham—and get a score of micro films cut to the requisite size. Ten or fifteen of these are put to lie on the ledge, which the ring in the tube makes, and can be retained in position by a paper tube cut to the same angle. When all are ready, the inside of the tube must be made a dead black, and each film must be carefully cleaned. This may be done without breaking the glass, by rubbing them between the folds of a silk handkerchief, held between the finger and thumb. This is now to be attached to the eye-piece, and placed in the tube, when it will admit of being rotated. For the polariser, Fig. 8, make or procure a tube, A, to fit into the tube attached to the diaphragm of the microscope described, and $\frac{1}{2}$ in. long. To one end solder a disc, B, $\frac{1}{2}$ in. larger in diameter than the tube, and with a central hole the same size as the tube. To this solder another tube, C, slightly less in size than the disc, and $\frac{3}{4}$ in. long. Turn the whole up true in the lathe, and mill the edge of the disc for finish.

A piece of tube, D, to fit tightly into this must now be used for the polariser, and made precisely on the same plan as the analyser already described. When made, films of glass must be procured to fit it. Of course it will be understood that both parts may be made of the same size. If so the same plates of glass will do for both; and perhaps it would be cheaper to have, say, forty films of one size cut than twenty of two different sizes. The number of films used will be determined by trial. What is wanted is the maximum of colour with the maximum of light. As the depth of colour is dependent on the number of plates, and as the decrease of light is in the same ratio, judgment must determine in each individual case, after experiment, when the loss of one makes up for the other.

Having got so far, we will put our instrument together. Place the selenite plate on the stage, and throw up the light by the mirror, and, just for a simple experiment, we will dissolve a bit of sugar in hot water to saturation. Put a drop or two on a clean slide, warm the glass until the sugar begins to crystallise, and place it on the stage, and focus the microscope. We shall now have an object worth admiring. Nothing, I think, in nature is more marvellous than to witness crystals being built up—here slowly, and seemingly by much effort; and then suddenly, in another part of the field, to see a crystal flash across the field of view too quick for the eye to follow, and all glowing at the same time with the richest colours, ever varying as we rotate the analyser or polariser. Such an exhibition as that will, if I do not miscalculate on the enthusiasm of the young philosopher and scientist, fully repay him for all his past labours in optics. Having finished our instrument, we must prepare our objects, both plain and polarising.

It will be understood that this is a wide subject. As I intend to prepare a brief paper treating on the various classes of objects and the methods of mounting them, I shall do little else in this place beyond indicating a few interesting objects and modes of mounting. It must be understood that each of the three great kingdoms will supply us with illustrations.

But in this utilitarian age of ours it may be asked of what practical use is the polariscope beyond being a mere instrument affording pleasure. The answer is that it imparts information relative to the structure of bodies; and although no great commercial advantage can at present be derived from it, yet it must be remembered that no true knowledge is valueless. The history of all human progress is the result and sum total of accumulated facts. The same substance when viewed by polarised light will always present the same appearance, as truly as the same elements give the same lines in the spectroscope. Hence in the hand of the chemist it is the means of detecting adulteration. For example, any substance added to butter will reveal itself. Or the starch of potatoes may be detected in corn flour.

As a variety, we may make up some slides of mineral salts. One of the most beautiful is crystals of nitrate of silver. A little should be dissolved, and then a drop placed on a slide and allowed to crystallise. Sulphate of copper, sulphate of iron, chlorate of potash are but a few to practise with.

We will now turn our attention to a few vegetable preparations. These, though equally beautiful, are much less difficult to prepare.

Cut a thin section of oak bark longitudinally, and plane with the tree. Soak it in turps to render it transparent, and mount with Canada balsam. Here we shall see the cells filled with star-like crystals. Sections cut from rhubarb, also from the onion, will show crystals. The hair-like substances under the shell of the chestnut are good specimens, mounted in dammar. Different kinds of starch, flour, potato, etc., are beautiful and instructive. Of animal substances, prepare a thin section of a corn from the foot section of whalebone, various fish scales, and white hair—human. These must be soaked in turps and mounted on balsam, and are really beautiful objects.

It must not be supposed that the subject of polarisation has been exhausted in this article. I have, in fact, but touched the skirts of the subject. And, indeed, it requires ability far greater than mine to bring the whole of this subject into such a form that it could be readily grasped by the scientific tyro.

LOCK REPAIRING AND KEY FITTING.

BY THOMAS WILSON.

Lever Locks: Their Construction, etc.

Before giving a detailed description of lever locks, it will be as well to commence with a general description of them. As I said at the commencement of these articles, backspring and tumbler, or warded, locks are really no protection at all against force or fraud, and as from the nature of their construction they are capable of very few variations, it follows that there are hundreds of a similar pattern in existence. Indeed, I have known instances where one street door key has opened half the doors in the street. It is, no doubt, very convenient to be able to borrow your neighbour's key if you have lost your own, but the advantage hardly outweighs the disadvantage.

Ordinary lever locks, however, though not absolutely unpickable, are sufficiently so for general purposes; and those made by Messrs. Chubbs, Messrs. Hobbs, and other eminent makers, with patented improvements, may be said to be absolutely unpickable. That Messrs. Hobbs and Co. consider theirs unpickable may be judged from the fact that at the exhibitions of 1862, 1867, and 1873, they offered a reward of 300 guineas to any one, skilled mechanic or otherwise, who could pick their locks; and it speaks volumes for their security when we find that no one attempted to do so, though they were examined and inspected by some of the best mechanics in the world.

The Barron lock, Fig. 4, although it can hardly be called a lever lock, may be justly considered the first foundation of the modern lever. It was invented in 1778 by Robert Barron, and, I believe, is still manufactured; at any rate, I frequently have them to fit keys to and repair.

This invention was a great improvement on the ordinary tumbler lock, as it has two tumblers, B, B, with two studs, C, C, which work in slots in the bolts, shown by dotted lines, D, D. The wards in this lock, too, are more intricate than in most warded locks; but they can, of course, be passed by a skeleton key, and as the bellies of the tumblers are nearly the same pattern as the key, they can easily be lifted to the right height by a skilled locksmith. To fit a key to this lock first cut the wards in the blank as described in page 322 (although, of course, a much finer chisel and file must be used); then cut the steps, F, F, in the key, so as to raise the tumblers to the right height.

Fig. 2 shows the ordinary lever lock. All the best modern locks are made on this principle, with additional protecting contrivances. No wards are used for these locks, except for arranging suites of locks with master-keys; and the single tumbler is replaced by a number of levers. Fig. 3 shows one of these levers with part of bolt. The lock shown in Fig. 2 has only two of these levers, but this is a very ordinary kind. Of course each additional lever adds to its security, and some of the best makes have as many as fifteen.

On looking at the illustration Fig. 3, it will be seen that the bolt, A, has a stump, B, affixed to it at right angles, and that the lever has a passage cut in it of sufficient size to allow the stump to pass through. In the illustration the lever is shown in the position it stands in when the bolt is locked. In unlocking the lock each lever has to be raised so that the passage comes exactly opposite the stump, and as each lever has the passage cut at a different height it follows that none but the original key will open it. That they are secure against opening with false keys may be judged from the fact that a seven-lever lock is capable of over four thousand (4,000) changes; or, in other words, it would be necessary to try that number of keys before there was any probability of succeeding in opening it.

In a paper read before the Society of Arts (Lord Grimthorpe in the chair) by Mr. Samuel Chatwood, the eminent safe-maker, he stated the manner in which his keys were cut by machinery. As this is very interesting, I will take the liberty of quoting it in full:—"A very important requirement in safe locks is that no two should be made alike, in order that there should be no possibility that the key of one safe should open another. The method in use in my works, and also, I believe, in some others, renders it absolutely impossible for two locks to pass, unless specially made to do so. The key consists of a number of steps corresponding to the number of levers—say, for example, eight. These are of different lengths. They are cut out of the key blank by eight circular saws of different diameters, placed in a pack on a mandrel. The key blank is held in a special vice fixed on a slide rest, and is brought forward against the saws by the screw of the slide rest. The saws thus cut out the steps. Each of the saws is numbered, and for the first key they are placed in the order 1, 2, 3, 4, 5, 6, 7, 8; for the second in the order 1, 2, 3, 4, 5, 6, 8, 7, and so on. The number of changes—*i.e.*, the number of different keys—which can be cut with a set of eight saws is 40,320, which may be extended almost indefinitely. To make a second set of 40,320, it is only necessary to alter the diameter of one of the saws, or to vary the depth to which they are allowed to cut into the key blank. Keys are made in this manner for store. When the locks are finished, with the exception of the cutting of the gatings, the locksmith receives keys from the store, and marks off and cuts out the gatings to correspond with them. The lock is made to the key, therefore, and not the key to the lock. A very beautiful machine was introduced by Mr. Fenby for cutting his key bitts by the use of one saw; but I prefer the plan of having a number of saws equal to the number of levers, each saw of different diameter from any other, and carrying its own number, and transposing the saws for each set of keys."

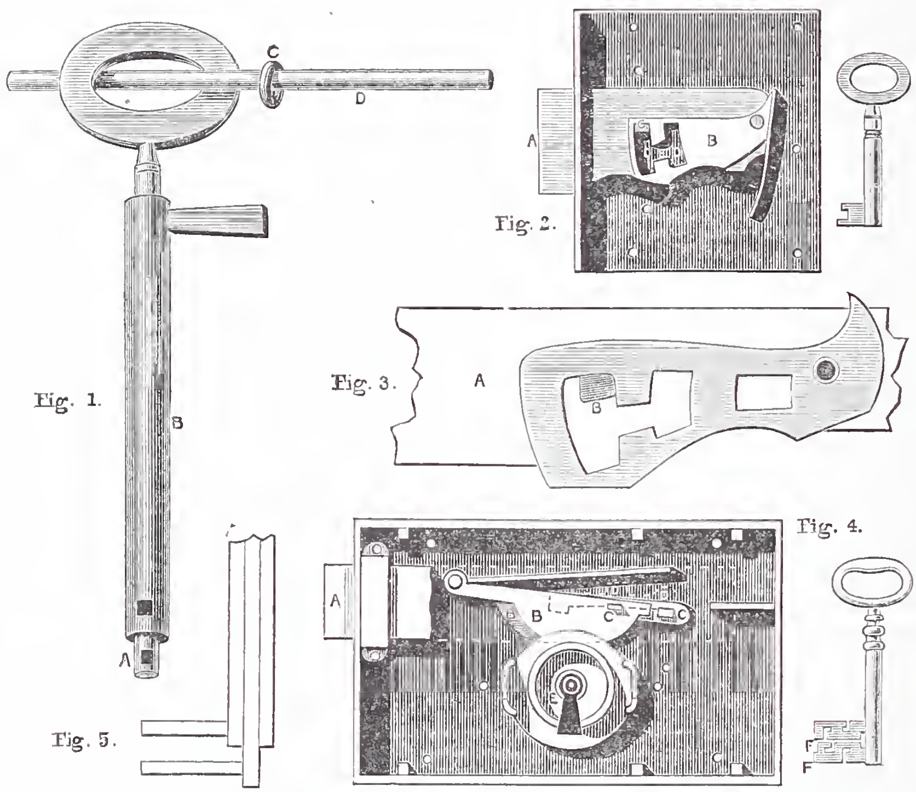


Fig. 1.—Instrument used for Picking Lever Lock. Fig. 2.—Ordinary Lever Lock. Fig. 3.—One of Levers in Best Lever Lock with Part of Bolt. Fig. 4.—The Barron Lock. Fig. 5.—Section of Fig. 1.

Though for a long time considered unpickable, it has been found possible to pick lever locks. Fig. 1 shows one description of instrument used for this purpose. A is a solid key with one step, used for engaging with the bolt, and B is a tubular key fitting over A, having a step for raising the levers. The weight at the end of A causes the bolt stump to be pressed against the face of the levers, and then by raising each lever in turn with the tubular key, B, the position of the passage or gating in the lever is ascertained by the difference in the friction when pressed by the stump, and when in position and no longer pressed by the stump. As each lever is raised the weight C is carried along the lever arm, so as to keep them in their position by the extra pressure, and when all the levers are raised the bolt slides back. Should the lock have a pin, as it probably will, the pin must be knocked out and a hole drilled in the plate to support the key, or two very thin tubular keys may be used, when it will be unnecessary to remove the pin.

But picking a lever lock is a very tedious operation, and can only be accomplished by a skilled locksmith, so that for general purposes ordinary lever locks afford ample security.

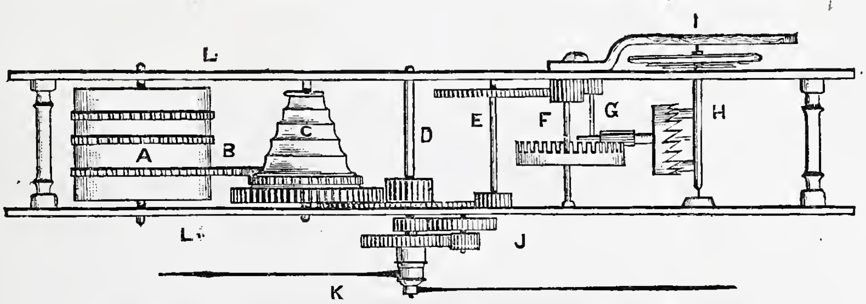
THE VERGE WATCH: HOW TO CLEAN IT.

BY A PRACTICAL HAND.

The old-fashioned or common verge, so dear to our ancestors, and even, in another way, to ourselves, is properly called the vertical, from the escape wheel being placed to turn in a vertical manner; this wheel is the one with saw-like teeth under the balance wheel; the wheel which turns the escape is the crown wheel, being in the shape of a coronet.

The amateur had best procure the following tools, etc.:—First, an eye-glass, costing 1s. 3d.; a pair of tweezers, 8d.; small tooth-brush, 6d.; small screwdriver, 3d. (a broken steel crochet hook, ground shape, makes a good substitute); a darning needle or large sewing needle driven into round piece of wood for handle, with the eye broken off and just touched up on stone for a push-pin; a piece of prepared chalk, 1d.; and 2d. worth of pure almond oil; this had best have two or three small slices of lead dropped in to allow the fatty matter to adhere to. In a day or two pour out the oil into a very small bottle for watches, and remainder will do for clocks. To the cork of the small bottle inside, fix a sewing needle with eye reaching into the oil; this is for oiling with.

Now place upon your table an oblong piece of clean white paper, say, 18 in. × 12 in., so that any small screw will easily be seen and not lost. Commence by taking the outer case from the verge, and open glass frame, notice, at 12 on dial, the hinge holding in the works; push this pin out with the push-pin (already mentioned) at the 10 o'clock side, thereby relieving the works from inner case. Now hold the watch movements in the left hand and study them well over—don't think it time lost—so as not to be at a loss how to put them together again. Now lift off the two hands at once, which is very easy in a verge. The blade of an old worn pen-knife is best to draw out the three dial pins, and be careful to hold it over your table in doing so. Lift off the two dial wheels, J, and then the steel one; it will be rather difficult; raise it gently all round with the knife point. The next is to let down the main spring. This is rather difficult for an amateur. First place a small bristle or piece of paper on the crown wheel teeth to lock it, and then unscrew the cock or cover of balance, holding the works very steady with left hand; lift off the cock with tweezers. You then expose the balance with hair spring attached; notice the square stud through which the end of spring passes and is so pinned in; make a small mark to where the end of spring comes, so that in replacing you can do so exactly in same position. This, of course, is only for amateurs; practical hands know how to place in beat at once, but amateurs cannot have it too clear. Now notice the way the pin is put in the square stud, and push it out with a screwdriver, and draw spring out with the tweezers, and be careful not to break the balance staff by lifting it out of its hole; place what you have taken out carefully on your paper out of the way of your work; now fix your winding key upon its square, and then lift out the bristle or paper. Immediately the wheels will swiftly commence to run down, but take hold of the key in your right hand and gently hold on until it is run down; be sure to do this, as some amateurs have lifted off the top plate before letting down—consequence, a broken pivot or two. Holding the movement still in the left hand by the finger and thumb, push out the four pins, one at each pillar, and then lift very carefully the top plate off. Now notice how the wheels are; you will find the escape wheel attached to the top plate, but at present we have to do with the others; and with tweezers lift out the crown wheel, then next small wheel, and now just turn the barrel or main-spring wheel (which every one knows) a little, and lift out the chain hook out of the fusee hole; now take out the barrel, and a small ratchet wheel will drop from it at the underside; be careful not to lose it, and then lift out the fusee wheel, next the centre wheel, and now all is clear. Unscrew the small screw holding the wheel in position upon the upper plate, and release that wheel carefully; put it separate with its stud and screw so as not to mix the screws; you may easily ruin a hole by trying to fix a wrong screw into it. Now all is to pieces, because very few ever take out the spring from the barrel; if they do it does not run long after until it breaks, which of course is good for the trade; why they break I need not explain. But notice a mark upon the barrel, another on the lid; these must be put together when you put it back; prise out the lid, brush out the old oil and dirt in every part, then just place the least drop of oil on the coils of spring, replace lid, the two marks together as stated before; now run the brush a few times over the prepared chalk, and holding the box betwixt a small square of clean soft paper, brush it quite bright, and place it under a wine glass (one whose shank has gone is best); now take the chain which was upon the barrel, and draw it a few times betwixt a small piece of wash-leather, and then draw it a few times betwixt a piece of oil paper; place under the glass. Take the fusee wheel, clean and brush the teeth crossways, be sure to leave no dirt or chalk in any part, add it to those under the glass, and so with the other wheels. Next the plates, but in brushing them be sure to use the brush in a circular fashion, or the brush marks will show. Now comes the most careful part—the balance. To clean and not to injure the spring, take a small piece of writing paper, size of half a crown, put a small hole in the centre, then from it cut to outer edge; slip this under the balance, but upon the hair spring; now clean the steel rim until quite bright, turn it over and dab the soft brush amongst coils of the hair spring, next clean the staff with its two pallets; place under the glass. Now brush the cock or cover of balance, and then clean dial and dial wheels; after this take a piece of hard wood (a restaurant tooth-pick does very well), make a fine point at the end, and with it clean all the jewel and other holes, also the cock hole and hole for end of balance at bottom. Now be sure all is clean; examine carefully with your glass, for one single particle of chalk or grit between a tooth will stop the watch, and cause you much trouble afterwards. Now see the holes are not worn oval, and the face of the pallets are clear of grooves worn in them by age; some people, actually watch repairers, profess to be astonished why steel pallets wear sooner than brass teeth of the escape wheel. The thing is quite simple: the two pallets receive all tappings of the escape teeth upon them, over a dozen taps for their one, every revolution of escape wheel.



The Works of the Verge Watch shown in Elevation on Enlarged Scale.

A, Barrel.
B, Chain.
C, Fusee.
D, Centre wheel, carrying minute hand.
E, Third wheel.
F, Crown wheel.
G, Escape wheel.
H, Balance wheel and pallets.
I, Cock or cover.
J, Dial wheels.
K, Hour and minute hands.
L L, Plates.

All being clean and in repair (repairs will be given in a future paper), now commence to put together. First take top plate and refix escape wheel into its place with the part that holds it there by the screw for that purpose; try if you have given it too much or too little end shake; it should spin easily around by the slightest touch, but not more perceptibly the other way; place one drop of oil on the watch glass; this will be sufficient to oil the whole movement. Amateurs always oil too much. Now from this large drop take the least particle and touch each pivot of the escape wheel; now take the lower plate in your left hand and lift the centre wheel into its place, the spring barrel; next the fusee wheel which works into the centre wheel, then next wheel, and now the crown wheel; put it into position, then carefully put on the top plate to fit the four pillars, and with your tweezers or the push-pin guide each pivot into its hole, and gently push down top plate. When all are near their respective holes this is not difficult, and do not damage or break a pivot by hurrying over the job; when all is right, and the wheels turn round, put in the pins to hold the top plate, using the two short pins for those pillars that will be covered by cock, etc. Now by pushing the fusee wheel all should run easily; if so it is all right so far. Now take the chain, and notice the two hooks; one is round and the other is flat; the last mentioned is for the main-spring barrel; be sure of this point. Now hook to barrel at the small hole and press it firmly in, then put on your key to the under square and turn gently until nearly all the chain is wound upon it; pass the other end hook under the pillar, and hook it into small hole with a centre bar in it; see you get it on to this bar, and the chain will lie in the first groove. Now tighten up the spring by putting on the ratchet and insert click; push the ratchet a little, passing the click in each notch with your thumb nail; give it a half-turn when tight, then wind up a little with key on fusee and see it runs all right.

We now turn to the balance. First touch each end with the least oil possible, also the two pallets; place it into the square hole to receive it, and see you get the bottom pivot to its hole; be sure of this (I want to be certain about this, as amateurs are always in a hurry). Now pass in the end of hair spring to the mark you made, and pin it secure and spring level, then drop last coil into the regulator pins, and now place on the cock and move it gently until top pivot goes into the hole; try it by seeing if the balance will vibrate; now screw down tight, put pressure on fusee, and the balance should work if all is right. Now wind up, but guide the chain first time into the grooves, and you will now hear it ticking away as of yore. With the remaining drop of oil touch each hole and pivot top and bottom. Now place it under the glass, face side down, and try it for a few hours, then if in full vigour, take up with paper and push on tight the steel wheel to centre pinion, under face, and push down tight; and now the brass one with small hole in centre to the pin near by, so that it works into the teeth of the steel wheel, and now place the remaining wheel on to the centre steel one so that it works into the brass one before mentioned. Now place on the dial and hold it firmly; turn over and pin it on safely; clean the cases with rouge and leather, and place in the movement; push in the large pin thin end first at the two o'clock side, and close the cases; put in the glass, of course, first, and the hands. Listen if it has an even beat; if not, see last paper for defects and their remedies.

We will now proceed with the well-known horizontal watch, which sometimes was called the anchor escapement, as the points of escape wheel are the shape of an anchor's points. The invention of this made a great change in the wearing of watches, as the price brought them within the reach of all, coupled with their accurate time keeping. The inventor of this escapement was George Graham, who also invented the dead beat in clocks. I have more faith in this make of watch than in many so-called cheap watches; they are reliable with fair usage, and are very durable, surpassing the verge in many ways, neat in appearance, weigh little, and cost 15s. to 80s., in fine silver cases. They are the watches to buy by those who have slender purses; some have more massive cases, and imitate the English lever in appearance.

To clean it, open the outer cases, inner dome, then the glass dome over dial; now turn it over, and with your eye-glass on look for a half-headed screw near the balance, cock, or cover, turn it half round, then push out the movement from the cases entirely, face side; take hold of them in your left hand, and lift off the seconds hand, and then minute and hour hands; now turn over and draw out the two pins which hold the dial (some dials have two small half-headed screws to hold them on); now take off the three dial wheels as described in last paper. Turn it over and place a small bristle in the escape wheel; now unscrew the cock or cover, and carefully take it partly off with the tweezers; you will see that the hair spring is pinned into a square stud at your right; lift out all together with tweezers. You will notice that balance wheel goes under centre wheel. Now, when all is free and clear of escape wheel, turn it over and lay that side up under glass; be careful of the balance part, as the cylinder is very expensive to replace, and liable to be broken unless every care is taken in handling it; 5s. to 7s. is sometimes charged for a new cylinder, which is little less than robbery in my opinion.

To proceed, put your key on the centre square, and now lift out the bristle and hold the key so as to let it gently down until spring is spent, then unscrew the small screws which hold the top and bottom plates together (but first draw out the centre square with small pliers), and you will find the barrel wheel will remain attached to top plate; now take out centre wheel and the next two, and place them so that you will remember which is which; of course, if they get mixed, you can easily see the two or three dots on the underside, which shows you plainly; next unscrew the small cover over the escape wheel. This wheel is a very delicate piece of mechanism; handle it with great care. It is considered the most wonderful piece in a watch, to be so finely made and so perfectly accurate. Now the movement is all to pieces, providing it is a skeleton movement, that is, each wheel is fixed by a separate cover and one or two screws (this make is easier for the amateur). Proceed by unscrewing the centre wheel at each side, then spring box, and next the two remaining wheels; now brush the plates in a circular way; clean the holes with peg wood, and with glass see that no jewels are broken or holes worn oval; if so, see last paper. Now brush with prepared chalk the various wheels, and be very careful with the fine steel escape wheel; notice how far the hair spring is through the stud, and make a mark as previously mentioned in the verge details; clean it same way; brush the cock well and polish the regulator. When all is clean, dial and dial wheels, take bottom plate in the left hand, place in the spring barrel, then the centre wheel; next two, and drop on the top plate and guide each pivot to its place; push down, and try if they turn easily; if so, screw down the plate and put in the centre square, and push down tight; next place in small particle of oil to each jewel hole of escape and balance wheel at bottom, and replace the escape wheel with its cover screw down, but be sure and try it to see if it is in the holes all right. Now oil all pivot holes. It should commence to tick by using a little pressure on large wheel; if it does, all is right; wind it up and place under your glass cover to try it for a few hours; should the beat not be equal you have not carefully replaced the hair spring; you can easily see if it is not so by gently holding back the centre wheel until the balance is at rest. Now notice one small dot on rim of balance wheel, and three small dots on bottom plate just under it; if the dot on rim rests opposite the centre dot on plate, it is in correct beat, if on either side it is out of beat, and you will have to take off cock and lift it and balance out at once, carefully. Of course, be sure to put in bristle to prevent movement running down. Now turn over the cock with balance attached, and partly push out pin holding hair spring, and move the hair spring the least bit the way that will place the dot on rim with centre one as before stated; pin it secure and try it; if not quite right move it a little more. You could do it without taking out, but for an amateur it is the safest way, as you might slip in pushing pin home, then the hair spring would be ruined. If you have the two dots right, screw down cock and take out bristle, and tick will be correct. You might touch the escape wheel two or three teeth with the least oil; some do and some do not; I think it is better. You can now replace the centre steel wheel under dial, pressing it firmly down, not too much, and place on the other two as mentioned in the verge instructions; place on dial, turn over and fix two pins to dial feet, or screws if they are used, clean the cases with rouge, and take the movement and replace in cases. Notice at one side three small studs on plate next to dial, and see that centre one goes to a notch in case rim, and then push down the other side, and twelve o'clock will be at its place under watch neck, unless it is in hunting cases, when three o'clock will be in that position. Now turn over and turn the half head of screw on to rim of cases to secure it; next put on the seconds hand and hour hand, press down to position so as to clear the seconds, and also give room for minute hand to pass over; now lay down the watch and press on the minute hand; sometimes it requires the least tap with small hammer to fix it tight, having the under square resting on your bench rivetting block; put the minute hand on 60 and the seconds hand on 60 also, when, if dial is correctly marked, they will always coincide. Do not turn the hand so much; many are continually forgetting to wind up regularly, so have to be turning hands frequently; this spoils the watch in time, requiring to be tightened up, etc.

Now, when in the cases, you can hear more distinctly if any rubbing sort of noise is going on; if so, see repairs in the last paper. If all right it will only require regulating. If it loses, touch the regulator point the least particle towards F and try it again; if losing still, move it a little more until it goes perfectly correct, or *vice versâ*; use your eye-glass so as to do it correctly; it is worth while timing it by a good clock or regulator. London is famous for some excellent timekeepers—Greenwich time. You may manage to time up to the minute a month, which some speak of their watches doing; if so, it will satisfy you.

A SIMPLE METHOD OF DRYING AND KEEPING WOOD.

BY R. W.

In an article that appeared in one of the early numbers of Work, entitled "Friendly Hints to Amateur Wood Workers," the writer speaks of drying seasoned wood. It struck me that an arrangement I have for keeping wood ready for working might commend itself to some of the readers of Work, who are put to the inconvenience that I was before I thought of this method, and who have the requisite features in their homes. These are a passage on the ground floor about 20 ft. long and easy accessibility from without.

I will first describe my own, and then, for the benefit of any who may adopt this method, suggest what experience has told me would be improvements. I had long felt the want of a place to keep boards, etc., dry, so as to have them ready for working. One day the following idea occurred to me: namely, to keep the wood on stages in a passage. I selected one in the basement, which was most suitable, as appearances did not matter, having only the kitchen, etc., leading into it.

This passage is about 14 ft. long, 3 ft. wide, and 9 ft. high, with a door at one end leading into the garden, by which I get the ood in and out. In it I placed a couple of ages, with about 6 ft. 1 in. head-room; hy I allowed so little will be explained ter on. No. 1 stage I placed about 4 . from the door, and No. 2 about 7 ft. om this. The uprights were made of in. × $1\frac{1}{2}$ in. batten, and the cross pieces r the wood to lie on were 2 in. × 4 in. laid at, which is quite strong enough for so hort a span. These frames stand on a oncrete floor that takes the weight, and re fixed by one or two nails into the walls, which are brick. If they had been lath nd plaster, I should then have used crews, and this would be quite steady nough. I now placed the cross pieces nd fixed them with small W. I. angle rackets, such as you can get at any ironmonger's; they are cheap, being only a penny or so each, and make a very strong job. I advise those who do not care to waste time on rough jobs, such as this, in making mortises, etc., to use brackets. I have a chicken house and run erected with them. Another advantage of using these is that they enable a job to be taken to pieces easily, quickly, and without damage to the different parts, being fixed with screws.

But to return to the staging: I have found by experience that a longer passage—say about 20 ft. or more if possible, so as to take floor boards, etc., without cutting—would be an advantage; also, if the stages had been closer together, say 5 ft. instead of 8 ft. between; and, in the case of a longer passage, more of them. The reason I allowed so little head-room was to keep the stage below the top of the doorway, allowing a space for the wood to be run in easily; but owing to its being so low, I found the top of the door when open fouled the ends of the boards. I therefore now have some pieces of wood, the required thickness, that I place under the boards when in position, to raise them up sufficiently to clear the door.

But this stage, I found, was not suited to keeping small pieces, such as ends 2 or 3 ft. long. So I decided to erect a second one; this I put in another passage against an end wall. I made the frames on the same principle as the others, but used stronger cross pieces, 3 in. × $4\frac{1}{2}$ in. batten, which I happened to have by me, as the span is 6 ft. instead of 3. This section is not too strong, if one wishes to keep a quantity of wood on it. One frame I placed 4 in. from the wall, and the other 3 ft. 6 in. from this, joining them with 2 in. × 1 in. laths laid flat, and 1 in. apart, so as to keep all sorts of odd pieces without any fear of them falling through.

This arrangement has the advantage of occupying nothing but waste room, is always easy to get at, and also keeps the wood in very good working condition, with no tendency to warp or twist, because the hot air from the kitchen and different gas brackets in the passages circulates all round, and therefore dries it evenly.

The following illustrates its efficiency: In the autumn of last year I brought in some matchboarding, $\frac{5}{8}$ in. × $6\frac{1}{2}$ in. × 10 ft. long—in all 8 pieces. They were thoroughly soaked, having lain in the open for some weeks; in fact, they were dripping when first brought in. These I placed on the rack on edge close together, and in about a fortnight they were fit for working; nor had they warped the least, being as straight as when cut. One would be inclined to think the wood would get too dry if on the rack long, but I do not find it so, for some pine after being there eleven months cut as clean and as sweet as possible.

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

AUXILIARY BRACING, FLOOR COVERINGS, PERMANENT SET AND DEFLECTION.

IN order to maintain the stability and properly corresponding positions of the different girders forming a complete structure, and secure them against disturbance from vibrations due to load and wind pressure, various kinds of bracings are used, which being accessory and forming no part of the structural design of the girders themselves, may be distinguished as auxiliary bracing.

This bracing will appear in the form of ties and struts passing from girder to girder in either a horizontal or vertical plane, the ties usually being placed diagonally and the struts at right angles to the lines of the girders to which they are attached.

In Figs. 15 and 15A two kinds of bracings are shown. A A and A′ A′ show in plan parts of two main girders lying parallel to each other, and connected by horizontal bracing between them to prevent lateral disturbance, and, therefore, sometimes called lateral bracing. This system consists of tie bars, B B′, B′B″, C C′, and C′ C″, the pull upon which is resisted by the struts B C, B′ C′, B″ C″. These struts must be of some rigid section, angle, T, or H, to oppose the compression to which they are subjected. The ties, if not very long, may be flat or round bars, but if of great length a more rigid section is desirable to prevent their sagging with their own weight. Where cross girders occur they will themselves act as struts. In 15A, F F and G G show in vertical section two parallel main girders side by side, assumed to carry the flooring upon the top, and secured from overturning by vertical cross bracing, D D′ and E E′, lying horizontally, and D E′, D′E, lying diagonally; these latter, as well as the former, must be of rigid section, as either of them may be put in compression or tension according to the direction of the disturbing force, which tends to distort the structure.

It is very evident that the utility of these bracing bars, other things being the same, will depend upon the correctness with which they fit into their places, hence the holes in one end only should be drilled in the shop, the holes in the other ends being marked off from the girders when they are put in position, and drilled at the place of permanent erection.

It very frequently happens that part of the section of the bracing bar has to be cut away at the end for a short distance to allow of the joint being properly made; in such cases the section of the bar should be made up by welding a layer on the end as shown at B, Fig. 16, which represents the thickened extremity of a T iron. It will be observed that as the vertical limb is cut away the horizontal table is thickened, and this is to be done to such an extent as to make the area across the rivet holes, after these are deducted, equal to the full area of the bar in its centre parts, so that it shall have equal tensile strength throughout. This thickening also enables us to secure proper bearing surface for the rivets or bolts. Suppose we have a T iron bar 6 in. wide on the table, and 3 in. deep vertically by $\frac{1}{2}$ in. thick, then its sectional area, found by adding the vertical web to the table, will be $1\frac{1}{4} + 3 = 4\frac{1}{4}$ square inches; the table alone has 3 in. sectional area, so where the web is cut away its thickness must be increased to $\frac{3}{4}$ in. This is making it a little full ($4\frac{1}{2}$ square inches sectional area), but is practically near enough. The bearing of a $\frac{3}{4}$-in. rivet will be (thickness of bar multiplied by diameter of rivet) $\frac{9}{16}$ square inch, hence eight rivets will equal strength of bar.

When round bracing bars are used, they can be tightened up by coupling boxes such as that shown at H; the ends of the box are drilled, and screw threads cut in them in opposite directions—one right and the other left-handed — to fit which corresponding threads are cut on the inner ends of the tie bars, G and G′; thus by turning the coupling box while the tie bars are prevented from turning, their ends are placed nearer together or farther apart according to the direction in which the box is turned. In order to keep the full strength of the bars, the screwed end, D, must be made larger than the run of bar C, so that the diameter of the screwed part at the bottom of the thread shall not be less than that of the body of the bar. These ends are usually made from larger bars and welded on to the tie rods. Round ties are usually connected up with bolts passing through eyes in the ends, and these eyes must be made equal in strength to the bodies of the bars. The proper shape for an eye is shown at E, F; the distance from the edge of the bolt hole to the end of the eye should be one and a half times the diameter of the bolt, the bolt being properly dimensioned to suit the bar as follows:—The end of the tie bar being held between jaws or clips, the bolt will be in double shear, and, therefore, its sectional area multiplied by four tons per inch—the working shearing resistance—must equal half the sectional area of the tie bar multiplied by five tons; the working tensile resistance, that is, the sectional area of the bolt, must be $\frac{5}{8}$ths of that of the tie, but the sectional areas vary as the diameters squared, therefore the diameter of the bolt must equal that of the tie multiplied by four and divided by five.

A good water-tight bridge floor has always been a desideratum, but the difficulties of erection militate against its acquisition, and as might be expected many different forms have been patented and put upon the market. For many years Mallet's buckled plates have been very largely used for flooring, and possess many considerable advantages over the earlier forms, inasmuch as they have great strength and are self-contained. Plain cambered plates require ties, and corrugated plates have no lateral rigidity to speak of.

In Fig. 17, A A is a section, and B B, a plan of a Mallet's buckled plate. It will be seen that it is dished, having a flat fillet left round the edge which forms a tension ring to the flat dome into which the plate is shaped. At M is shown a top flange of a girder carrying a flooring of these buckled plates riveted on to it. This rivetting must necessarily be done by hand, and under the disadvantage that the man "holding up" the rivet is unable to see his mate, who is on the other side of the plate.

At C is shown in section a trough-shaped flooring; the troughs are placed side by side and connected at the top by the joint plate D. These troughs act as cross girders as well as forming a covering, but being of limited depth necessarily involve the use of a greater quantity of metal for a given strength than is required when built-up girders are employed; the sides, too, which form the webs are much thicker than is necessary for strength if they are acting merely as webs. Another form of trough floor designed to remedy this last fault to some extent is shown at E E and F F. In this construction the bottoms of the troughs are rolled much thicker than the sides, and the bulk of the metal thus placed in a more advantageous position than in the previous form, but the same rivetting difficulties are present in both as occur with the buckled plate floors.

The latest form of floor plate patented is shown in section at G G. It consists essentially of a buckled plate, with the fillets, H, vertical, thus affording facilities for rivetting with a portable hydraulic riveter, and also saving half at least of the number of rivets required with the common buckled plates. I I is a plate girder; to the web of which floor plates are riveted as shown. This construction admits of making very close work with a minimum of labour.

When continuous plate floors are used, lateral bracing is not required, its functions being filled by the floor itself.

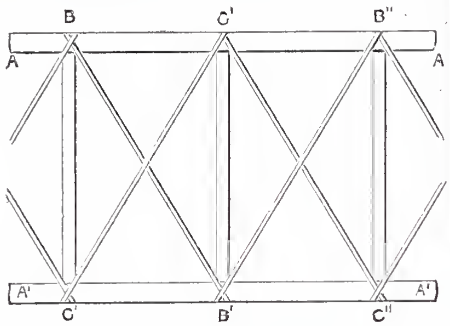


Fig. 15.—Horizontal Bracing.

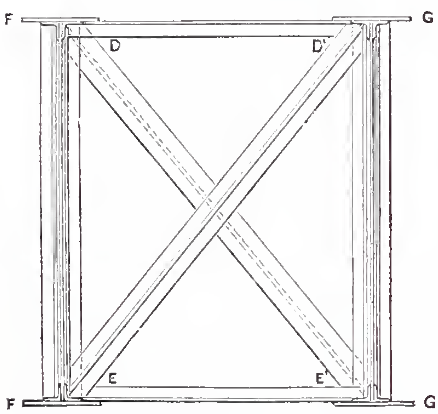


Fig. 15a.—Vertical Cross Bracing.

It is always advisable when girders are completed to test them, if not too large, previous to permanent erection, for although samples have been examined during the progress of construction, yet in the completed work some unexpected flaw may occur, or at some point the workmanship may be defective. It is from the deflection of the girder that its fitness for the purpose for which it has been designed will be judged. The deflection is divided into two classes, the permanent set under a test load, and the deflection which disappears on the removal of the load. In testing the solid metal itself before it is made up into girders, it may be found that on the first application of the load, a slight permanent elongation may take place without deteriorating the ultimate strength of the metal; this may arise from some want of uniformity of texture brought about by the exigencies of manipulation, and on repeating the test stress no further permanent elongation should occur, otherwise the material will ultimately break down under a stress much below its first breaking strength. At different times experiments have been tried to determine the effects of continuously repeating the imposition of stresses, and from them it may be generally concluded that so long as the applied load does not exceed one-fourth of the breaking load, it may be reapplied without danger for an indefinite number of times.

When a structure has been erected and all supporting scaffolding removed, a constant deflection due to its permanent load will occur and remain; on the application of running load, there will be some permanent set due to the joints settling to their bearings: beyond these there should only occur the temporary deflection due to passing loads. If the elasticity of the metal is known, the deflection can be calculated for any given girder. The value of the elasticity is the weight that will extend it a given proportion of its length, and the amount usually given is that load which, were it possible, would extend a bar one inch square to twice its length; this load is called the measure or modulus of elasticity. Although the supposed effect is not practically possible with iron or steel, this sum is convenient for calculation, as the extension and compression within the limits of elasticity vary directly as the stresses. The girder being assumed to have flanges of

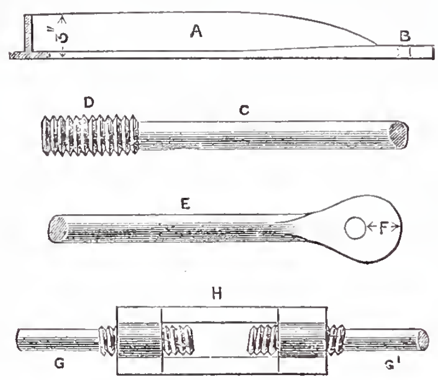


Fig. 16.—Ends of Bracing Bars.

equal length when unloaded, then on the application of a load the top flange will be shortened by compression, and the bottom flange lengthened by extension, and if the metal is so distributed that it is under the same stress throughout the length of the flange, for each square inch of cross sectional area, the central deflection will be found from the following rule:—The deflection of the girder at the centre will be equal to the span of the girder multiplied by the difference in length of flanges, and divided by eight times the depth of the girder.

The difference of length of flanges will be equal to the sum of the extension of the bottom flange and the compression of the top flange, and these lengths will be respectively equal to the strains per square inch of cross section on them, multiplied by the span and divided by the modulus of elasticity of the material. For example, let it be required to find the deflection at the centre of a girder 120 ft. span 11 ft. deep, having under a maximum load four tons per square inch compressive stress on the top flange, and five tons per square inch tension on bottom flange. The modulus of elasticity for good plate girder work is 8,000 tons; the extension of bottom flange will be 120 multiplied by 5 = 600, and this, divided by 8,000, gives $\frac{3}{40}$ ft. or $\frac{9}{10}$ in. The compression of the top flange will be 120 multiplied by 4 = 480, which divided by 8,000 gives $\frac{3}{50}$ ft., or $\frac{18}{25}$ in. These added together make the difference of the lengths of the flanges $1\frac{3}{5}$ in. (nearly). Applying the rule given above we have 120 ft. span multiplied $1\frac{3}{5}$ in. = 192, which divided by 8 times 11 ft. depth, gives $2\frac{2}{11}$ in. for the central deflection of the girder. It will usually be found that the actual deflection will be less than that calculated, because there is an unavoidable excess of metal in the flanges; should the contrary occur, therefore, it indicates the probability of a defect somewhere.

In measuring the deflection of a bridge its amount must be determined by deducting the depression at the bearings from that at the centre of the girders, for there will be some depression at the points of support during the passage of a heavy load.

The final stage of the work consists in painting or otherwise protecting it from external influences, and the choice of material

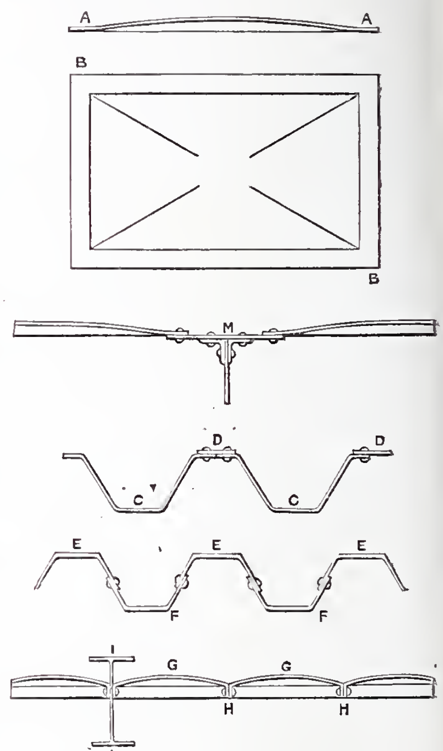
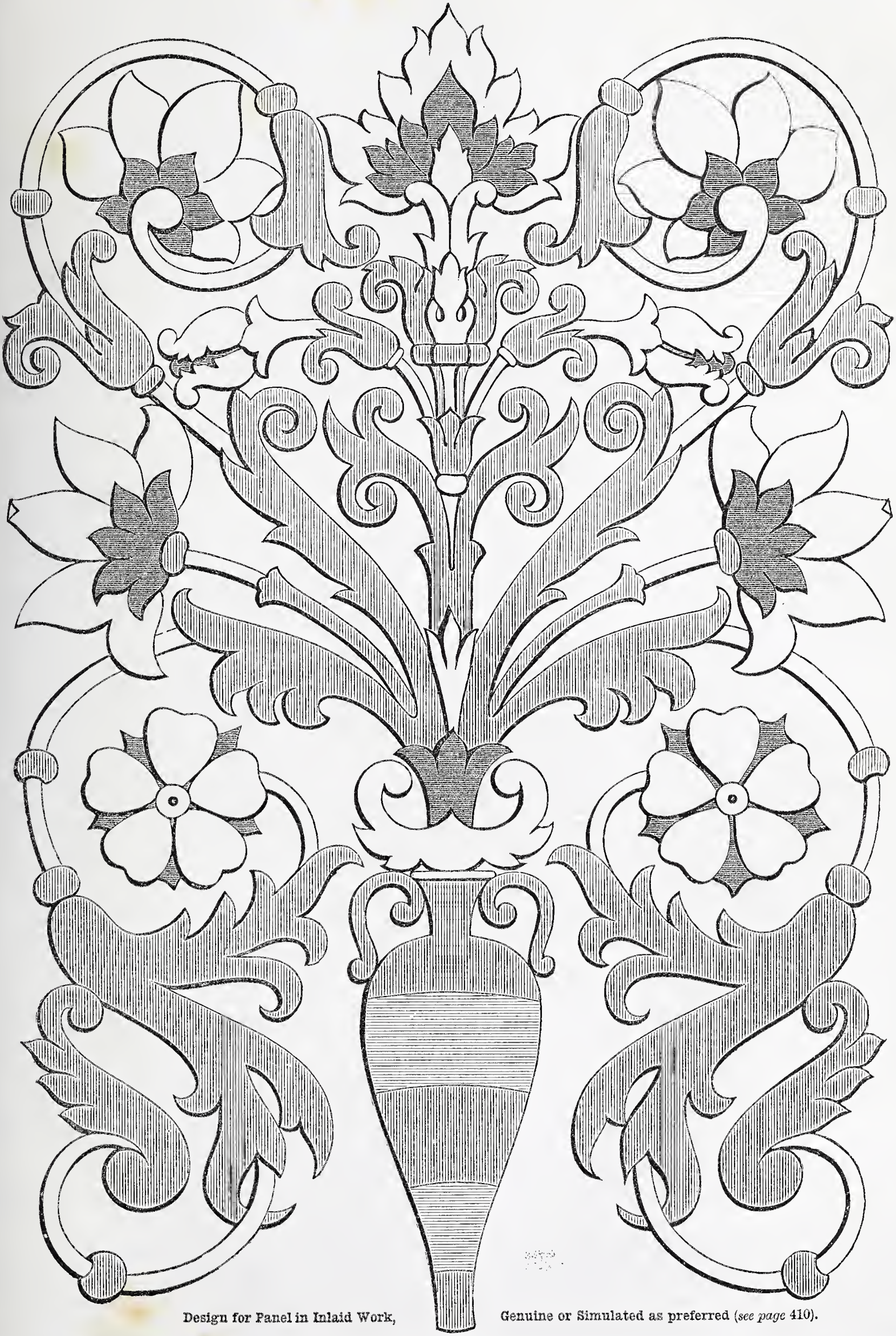


Fig. 17.—Forms of Floor Plates.

for this purpose is of considerable importance, for upon it the durability of the work is in some measure dependent. Paints made of iron minium have been much in favour, and the magnetic iron paints also have advocates; in all iron paints for iron work or steel work there is supposed to be the advantage over other metallic paints that dissimilarity of metals is avoided, and with it the risk of galvanic action being set up. A coating of iron rust, however, will not in itself protect the sub-lying metal from oxidation, but will even aid it to some extent, the corrosion eating into the body of the metal.

Looking at the matter from a purely practical standpoint, it would seem that the quality of the oil, or other vehicle carrying the colouring material, must be the criterion of its utility, as it is that which is in immediate contact with the work; it is, therefore, highly necessary to select a compound free from acid elements, and it must also be capable of resisting the acids and sulphurous compounds existing in the atmosphere.



Design for Panel in Inlaid Work, Genuine or Simulated as preferred (*see page* 410).

A PANEL FOR INLAYING.

BY E. BONNEY STEYNE.

REAL inlaid work—Marquetry, Buhl, Pietra-dura—all the varieties of the same idea, have been favourite modes of decoration in many countries and periods. And when employed with some reserve, used only to ornament the surfaces to which it is applied, and not to overload and conceal the natural wood thus treated. Inlay is a legitimate and effective wood decoration.

The genuine inlaid work presupposes a careful hollowing out of the solid wood for each separate detail of the design, and filling each space with its proper block of the chosen material carefully cut to fit the space. But this demands such absolute precision, and to some extent waste of labour, that the Buhl, or Boule, work, where veneers take the place of solid woods, and the fretsaw replaces the chisel, has been more largely used since it was introduced in France about 1680. But to fix a date for such work is misleading, as in Oriental work of fabulous antiquity the process is found to have been known in methods not unlike those now in use.

But modern substitutes have not stopped at imitating solid inlay by sawn veneers, and a variety of ingenious processes—one that by hydraulic pressure forces the material through the openings of a metal plate into the panel, some where printing simulates the real work, with many other modifications of these two—have replaced the real work with little loss of effect, however the lasting quality of the material so treated may have suffered.

To these there is a yet more simple substitute. It is to take a sheet of light wood, one with some natural grain, but not very distinctly marked pattern. Upon this, by means of the oily black carbonic paper, trace rather heavily, with an agate style, the design chosen. Then with a paint-brush fill up the pattern with various coloured wood stains and Judson's dyes, filling in the whole of the groundwork with dark brown or ebony stain. For a rough and ready decorative process that is almost mechanical, since not a single line of the design is drawn, but every detail traced from an existing pattern, this when well varnished or polished produces a fairly pleasant result.

The morality of all imitations is doubtful, but since they exist, it is better that they should be done as well as may be, and if the design to-day given has no peculiar charm, it is at least a possible one for practical work, and serves the purpose of a decorative centre for a larger panel fairly well. The parts left white are to be left untouched in the natural wood, the portions with plain shading to be in a darker tint, and those with crossed shading in a yet deeper colour. But the colours employed depend so entirely on their future surroundings that it would be folly to suggest them here.

HOW TO MAKE PHOTOGRAPHS ON BOXWOOD.

BY WALTER E. WOODBURY.

IT is many years ago since the first attempts were made to utilise photography as a means of producing pictures upon the box-wood blocks to be a guide to the wood cutter, but the results were found unsatisfactory. The reason of this was because, in the necessary manipulation the block was either spoilt by immersing in various solutions, or had to be coated over with a film of gelatine or albumen, which interfered with the work of the engraver.

The manner in which these blocks are produced at the present time is this. The drawing is first made by the artist direct on the wood in the same manner as if he were drawing upon an ordinary piece of paper, without regard to the effect of his block when printed from. This is the work of the engraver whose duty it is, as a rule, to break up the drawing into lines, dots, or stipple work, in order that the half tones or shadings will be truly represented, which they otherwise would not be.

So it will be seen that all that is necessary for the wood engraver is a picture of the desired subject as a guide for him to work upon, but it must in no way interfere with the surface of the wood or destroy its symmetry.

Those who are in possession of a camera and require to make printing blocks of landscapes, machinery, portraits, etc., for book or journal illustration, will find the following a far more simple and accurate method than employing an artist, besides being more economical.

We will presume you have the negative made of the subject you wish to transfer to the printing block.

First obtain a planished copper or zinc plate and scour it over with a piece of No. 2 emery cloth until it presents a rough appearance. Place it on a levelling stand on the hob of the kitchen fire, when there is a quiet fire burning. Get the plate quite level by the aid of the screws at the feet of the tripod stand and a spirit level. Then leave it to get warm, and prepare a solution of gelatine, 1 drachm dissolved in one ounce of water. Coignet's "gold label" gelatine will be found the best for this purpose. Dissolve, stir rapidly, and throw in gradually 5 grains of bichromate of ammonia. This quantity is sufficient for a half plate $6\frac{1}{2} \times 4\frac{3}{4}$; for larger sizes a proportionately larger quantity of course.

Now hold a thermometer two inches over the zinc plate, and when it registers 100° pour on the gelatine bichromate solution. If the zinc plate is properly levelled it will not run over, but can easily be spread evenly over the plate by means of a glass rod or strip of paper.

If the solution is found to contain any impurities it should be carefully strained through several thicknesses of muslin.

The zinc plate must not be too hot or all kinds of troubles will arise. When the coating is complete remove to a darkened room and allow to set and dry.

When dry it is ready for placing under the negative, but it must be remembered that it is sensitive to light.

If your negative is an ordinary glass one it will be necessary to make from it a reversed negative, otherwise your block when printed from will give reversed images, that is to say, objects to the right will be to the left, and *vice versâ*. In some cases this is of little moment, but generally it is necessary to make a reversed negative, unless the original is a film or paper negative, which can be printed from either side. These are invariably the best for this purpose.

The plate with the bichromatised gelatine film is then laid under a negative and exposed to light. The time required is a little less than would be necessary to produce an ordinary silver print. The exposure can be accurately gauged by the means of a photometer.

When the plate has been exposed to the light beneath the negative for the required length of time it is removed and placed in a bath containing clean cold water, and allowed to remain therein about ten minutes in order to wash out the bichromate which has not been affected by the action of the light.

Remove the plate from the water, and with a piece of soft muslin remove all the superfluous water by dabbing carefully over the surface of the gelatine. It will be noticed that portions of the gelatine film will be raised and others sunken to form the image. It has now to be inked.

Make an ink dabber by tying a few pieces of soft rags in a piece of soft muslin. A little letter-press or lithographic ink is taken on to a slab of glass, slate or metal, and with the rag dabber spread evenly over the slab. A very little ink is required, but it is necessary that it be kept evenly distributed.

The operation of inking is one that requires a little care and attention, though skill is not absolutely necessary. By taking up a small quantity of ink and dabbing on to the gelatine surface it will be seen that to some parts the ink will adhere; these are the exposed portions, while the unexposed parts will reject the fatty ink. The image will become visible, and it will be found that the inking can be well controlled by the pressure brought to bear upon the dabber; a heavy pressure deposits much ink, while a light one a smaller quantity.

When the plate is evenly and thoroughly inked the next operation is transferring the ink drawing from the gelatine to the wood block. For this we require a piece of bank post paper, or, better still, a sheet of Rives' or Saxe's paper. Place the sheet of paper between moistened blotting-paper in order to dampen. When sufficiently dampened it is laid on to the inky picture and contact established by means of a small wooden roller covered over with indiarubber tubing. Several sheets of blotting-paper are placed over the paper lying on the gelatine image, and with the rubber roller referred to carefully rolled until the paper adheres firmly to the gelatine film. With a moist sponge go over the back of the paper, and by taking hold of one corner and gently pulling the transfer paper will leave the gelatine, and will be found to have carried with it the fatty image. This transfer is now laid on the wood block, a few sheets of paper laid over it, and with the indiarubber roller well rolled into contact, and afterwards gone over with a piece of hard wood or the handle of a tooth-brush.

When the contact of the whole with the wood is thoroughly assured, strip off the paper by lifting from one corner, and the ink photograph will be found to have adhered to the wooden block.

This block is then ready for the wood engraver. In a future article I hope to give you a method of producing printing blocks by photography without the aid of either artist or engraver.

MEANS, MODES, AND METHODS.

A NOURISHING FOOD.

IT may not be generally known that the young leaves of the lime tree are excellent for food eaten as they are gathered, as salad, or boiled. Those leaves suitable are at the ends of branches or sprouting from the trunk of the tree, and have an amber tint.

hey are slightly sweet and mucilaginous, nd easily digested—more so than most raw reenery used in salad. I have, when out urveying, used lime leaves often as food ll I had a chance of getting a meal; and ly family have partaken of this refreshing iet as a food when obtainable in the spring f the year.

Remedy for Severe Cuts.

First stop the flow of blood as much as ossible by a ligature above the wound. If he cut be clean—that is, free from dirt or ag fibre—and the edges clean and level, se a needle and thread to draw the edges ogether, or stick pins—common ones will lo—lengthways with the wound into the dges of the flesh, and with any thread or tring draw the edges close by passing the tring from pin to pin fairly tight. Now ay over the wound a piece of cotton wool, nd pour on to the wool French polish till it is saturated; be sure to get the French polish well into the wool before the blood saturates it; now cover the wound with cloths, not too tightly put on. Keep the wounded limb or body resting as quietly as possible. If a ragged wound, as from a circular saw, apply a ligature above the wound, adjust the shreds of flesh as well as can be done, put on the cotton wool and pour on the French polish, then cover up from the air. If a finger be sawn off, do not throw the bit away, but see that the parts are clean, and put it back in its place, and bandage up in splints—any bits of stiff card or thin wood, about $\frac{1}{4}$ in. wide, will do, using enough to go all round the finger. It will grow, and be a stiff jointed one, but still useful, and more free from pain than a stump, and more quickly healed.

Treatment of Bruises.

If there is no fracture requiring surgical aid, pour on turpentine and rub in lightly; do not let the turpentine flow over the skin far and saturate the rag you cover the bruise with, as it may blister the skin beyond the bruise. Some bruises, as from the kick of a horse, are often best treated by the use of leeches round the edges of the bruise; wash the place with milk first; it makes the leeches bite; cover the place with a piece of washleather spread over with sweet butter or lard.

In such accidents the whole nervous system receives a shock. This should be allayed in the injured person by cheerful words of comfort, and the avoidance of exciting drinks or food. The following facts will attest the power of the nerves in influencing recovery from injuries. A lad was ascending a well eighty feet deep by the bucket, and was shouting in glee at the well-digging job being successfully completed, when just at the top the chain broke, and let the bucket and the youth fall to the bottom of the well. A new chain was obtained quickly, and a man lowered with a candle to bring up the dead body of the youth, as it was concluded he was killed; but to the surprise of the spectators he was alive, but with both legs broken off above the ankles, the bones protruding through the skin. The doctor saw it was a curable case if the nerves were strong, which seemed doubtful in so delicate a youth. So to cheer him he said, "Why, you have made a bad beginning at flying." The youth smiled wanly, and replied, "I did the flying right enough, but the settling was bad." The legs were set and soon healed, and he grew up a stalwart man and leader of men. In another case, in the backwoods of Canada, a lumberman was tree-felling, and his axe slid from the cleft of the tree he was felling and gashed through his stout leather legging down the shin of the leg. The man fainted at seeing a gaping, red wound. On recovering, he covered his leg up with a wrapper, and dragged himself to his sledge and hitched his horse to it, and galloped home. There he fainted again, and was put to bed. His wife, on his recovery, asked what was the matter. "My leg," he replied; "I have cut it through from knee to ankle." "It's all fancy," said his wife; "your legging was ripped open, but your new red stocking was not even cut." "I forgot I had put on those stockings to-day, and that is what I must have thought was blood," he answered. Even when sure he was not hurt his nerves were deranged for some time by the fancied injury.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

84.—Kendall and Cockcroft's Patent Screw Holdfast and Cramp.

I take the earliest opportunity at my command of advising my readers that the "Patent Screw Holdfast and Cramp," noticed and described in "Our Guide to Good Things," in No. 19 (page 299) of Work, bearing date, July 27, 1889, as "Lister's Patent Screw Holdfast and Cramp," should have been attributed to Messrs. Kendall and Cockcroft, Cabinet Works, Lane Head, Horsforth, the inventors, patentees, and sole makers of the appliance in question, to whom all orders should be addressed.

85.—The "Rigid" Folding Curtain Frame.

This Curtain Frame is a patent of Messrs. Gibson and Glazier, 97, Tulketh Street, Southport, the patentees of the Locking Stay of the "Firm and Safe" Step Ladders, recently noticed in these pages. The size of the frame is 4 yds. by 2 yds., the longer sides folding on a hinge placed in the centre and rendered rigid when opened out by a clip which slides over the joint when the frame is in use. The shorter sides or crossbars also slide in clips, which also can be moved along the longer sides, and which are also instrumental in keeping the four sides at right angles to each other, so that the frame is always square at the corners. Holes at regular intervals are pierced in all the sides so that the frame may be reduced in length and breadth at pleasure, so as to take small curtains as well as large. When the sides of the frame have been adjusted to the size of the curtain that is to be cleaned, they are held firmly by a thumb screw at each corner, which is inserted in the holes made for its reception in the sides, passing through both of the contiguous sides at each corner, and is then screwed up tight. There are points at short intervals along the upper surface of each side, on which the curtains are stretched.

These points are brass nails inserted along the inner and narrower surface of each side, at intervals of about one inch, and appearing in a deep groove cut in the upper surface to admit of this. It will be understood that they are in a direction parallel to the upper and under surfaces of the sides.

This Curtain Frame is confidently recommended for home use as the strongest, neatest, and best of its kind yet introduced. As a reason for its general adoption by families who wash at home, it is urged that curtains cleaned at home last much longer than those sent out to be cleaned. The price of the frame is 10s. 6d.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

A Correction.—S. K. R. (*New York*) writes:—"In No. 20 of your valuable Magazine, I see a notice of an 'Automatic Measurer,' of which I am the inventor and patentee. Your description and illustration are alike admirable; but may I ask a small portion of your space to correct a slight error in the title. It is printed 'Rolymeter.' It should be 'Polymeter,' a word of my own manufacture, and signifying 'many-measurer,' an 'universal measurer.' May I also point out that, besides the uses for it you have mentioned, it will measure *curved* surfaces with equal facility and accuracy, such as the inside or outside circumference of a glass shade, for example. Before closing, I must express to you my delight in Work. I have had it from the commencement, and am always in a hurry for Wednesday to come. My plan is to get a copy every week to read and carry around with me, and every month I buy the monthly parts bound up (6d.), which I put away till the first volume is complete, when I shall have them bound up. Any number having fretwork patterns in it (I am great on fretwork) I buy several copies of. I should like to personally thank Mr. Gleeson-White. His papers are invaluable to me, and could he see into my rooms, he would recognise more than one of his designs. May his shadow never grow less! I have a nine-light fretwork chandelier of my own design, which I should be pleased to describe at some future time should you consider it worthy of a place in your columns. I wish you a circulation of a million a week."

An Easily-Made Fret Machine.—Anxious (*Barnoldswick*) writes:—"No. 21, page 332, 'An Easily-Made Fret Machine.—W. R. S.' Please tell me how you would suspend the fly-wheel, and what with, and how long the bars of iron are to be, and if they both have to be fastened to a bench, or what. Please attend to it as soon as possible."

Plaster Modelling.—Clerk (*South Shields*).—Papers on modelling in clay will appear shortly; if, however, you refer to gesso work under the name of plaster modelling, an article on this subject appeared in No. 25 of this Magazine.

Hand-Saw Teeth.—A. R. (*Scorrier*) writes:—"In No. 20, page 317 of Work, J. H. writes:—'A. R. (*Scorrier*), before criticising an author, should ascertain his meaning.' Are we to suppose that an author cannot err as well as others? I think all are liable to errors, and shall be pleased at any time I make a mistake to be corrected. J. H. said, in No. 11 of Work, that Fig. 6 (see page 162) represents teeth used in cutting soft wood, but is unfit for general work; herein I think he admits his error. Again, in No. 20 (page 317) he says teeth to cut truly require a good deal of rake; but rake represented in Fig. 6 is unfit for general work. Does not this imply or indicate that it is fit for a certain class of work? and as J. H. wrote in reference to hand saws, I maintain that it is misleading, as such teeth in a hand saw are unfit for general or any other class of work. I hope J. H. will excuse me, as I mean no offence, but if possible would like everything to be made clear in Work."

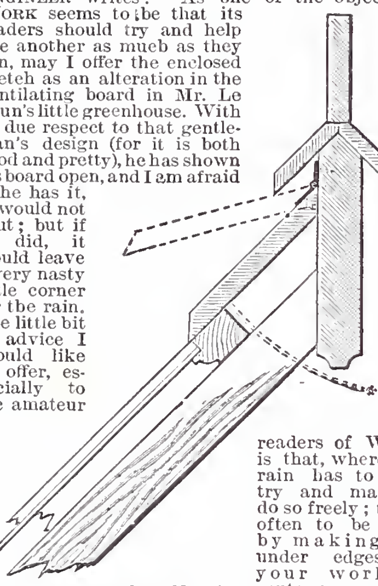
Powerful Rip Saw (*Highbury, N.*) writes in reply to Artist in Wood (see page 348):—"Being a reader of your paper I notice in No. 22, under head of 'Powerful Rip Saw,' a drawing of a small circular saw, and which I entirely fail to understand, I mean as to how it is to work. I say nothing about the saw itself or the wheels, etc., but what I fail to appreciate is, how is that treadle going to work that saw. The treadle is fixed to a cross bar at the bottom. I can understand that, but where is the necessary leverage coming in so as to make that fly wheel revolve? I mean the rod, D, how is that operated in order to make the necessary motion to this wheel? Taking the drawing as it is, you would think that when the treadle was pressed upon, that the rod, D, would be pulled down by the rod which connects D with the treadle, which rod has no name in your design. There was also another machine, a fret, intended to be of very simple mechanism, but which was as puzzling to myself and to several other parties to whom I showed it, as if it was one of the most complicated machines in existence; in fact it could not work, if the drawing produced in your paper was the correct one and not a mistake. These articles appeared in 'Shop' in your columns."—[You will oblige by sending a sketch of the machine as corrected by yourself.—Ed.]

Timber for Coach Building, etc.—Aye Work Awa' writes to make mention of Messrs. M. M'Neill and Sons, 24, M'Alpine Street, Glasgow, whose works are at Longford, Killarney, Enniskillen, and Sligo, and of whom North Countrymen may obtain hammer, pick, and shovel handles, round and oval, requisites for cart, coach, van, lorry, and barrow building, railway, pit and waggon wood, barrel staves and heading, home-grown timber, log or sawn scantlings, thread bobbins, or bobbin blocks, carpenter's wedges, oak crooks and bends, shafts, spokes, felloes, and naves for wheel-making, clog sole blocks, and rollers for washing and mangling machines.—[As it is possible that many readers may want one or other of the above-named articles, and not know where to obtain them, the above information may prove useful, and save many an inquiry.—ED.]

Easily-Made Fret Saw.—MANCUNIAM (*Manchester*) writes (referring to No. 21, page 332, a fret saw easily made):—"Will W. R. S. tell me, through 'Shop,' how C causes A to work vertical, as I cannot exactly see how it does with the wheel revolving?"

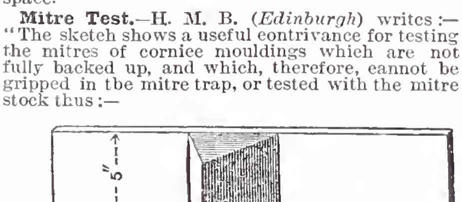
A Hopeful Subscriber.—R. Y. (*Canning Town*) writes:—"I have taken your paper, WORK, since the commencement, and hope to continue to do so for many years to come, in spite of the death knell which was rung by one of your subscribers, J. P. A., in your No. 12 issue; and being one of the spoilers, though not a clerk, I am sure there are many of those who will join with me in wishing you all success, and trust you will continue to publish your paper for our benefit when other readers fail. I am very sorry I can give no advice as to the way in which you should carry your WORK on; so knowing nothing about your business, I leave it to your own judgment, no doubt much to your loss and sorrow, hoping I have not taken up any space that might be made valuable, and that you will take these remarks in the spirit they are written in, and let WORK continue to live a long and vigorous life. If you should find anything in the above shaky, kindly put in a nail. This is my first attempt in writing for the press; please don't laugh."

Ventilating Board for Greenhouse.—CIVIL ENGINEER writes:—"As one of the objects of WORK seems to be that its readers should try and help one another as much as they can, may I offer the enclosed sketch as an alteration in the ventilating board in Mr. Le Brun's little greenhouse. With all due respect to that gentleman's design (for it is both good and pretty), he has shown his board open, and I am afraid as he has it, it would not shut; but if it did, it would leave a very nasty little corner for the rain. The little bit of advice I should like to offer, especially to the amateur readers of WORK, is that, where the rain has to drip, try and make it do so freely; this is often to be done by making the under edges of your work as acute as you can, as in the sketch I send. I trust these few remarks may be of use to some of your readers. I am another who has taken in WORK from the first, and let me wish it all the nice things I see others have wished it, which I will not repeat because of your space."



Arrangement for Ventilating Board.

Mitre Test.—H. M. B. (*Edinburgh*) writes:—"The sketch shows a useful contrivance for testing the mitres of cornice mouldings which are not fully backed up, and which, therefore, cannot be gripped in the mitre trap, or tested with the mitre stock thus:—



Mitre Test.

Two pieces of wood are fixed at right angles with each other, and a half of a square block cut through the diagonal line is fixed in the centre. After cutting the moulding in the mitre box, place the bottom edge of the moulding upon the sole, and keep the back of the moulding firm against the upright, and fit the mitred end close up against the centre block, after which it can be fixed on the job with the assurance of the returns intersecting accurately. The mitres of heavy gilt moulding can also be tested with it."

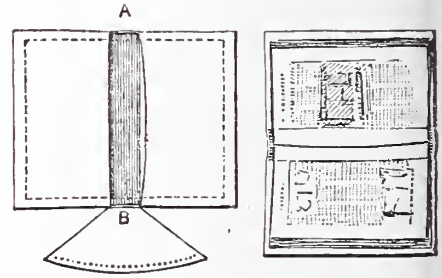
Weight of Fly-Wheel.—J. (*Twerton-on-Avon*) writes in reply to F. C. (see page 284):—"Mr. Campin's criticism of the formula for fly-wheels, given in page 189, is correct in theory. That formula is not strict in theory, neither is it given as fulfilling the requirements of theory, but as a working formula for rough-and-ready practice, and therefore suited for a book of workshop reference, like 'Molesworth.' Many rules in Molesworth, Hutton, and others would not fulfil the requirements of scientific engineering, but practical men find them useful because they give approximations sufficiently good for ordinary work. No one would think of designing the fly-wheel of, say, a mill engine, by such a rule, but it is correct enough for the common practice of makers of small engines used for general purposes—engines which are often run at very variable speeds. Only a few days ago a firm I know bought one of Hindley's engines, which was designed for a speed of 200 revolutions, but they ran at 60, altering the lead of the value to suit. But the fly-wheel is not altered, neither is it necessary to do so. Looking at Molesworth's formula, which is doubtless deduced from practice, and is still retained, in spite of criticism, in the latest, or 21st edition, as in previous ones, the factor N counts for little, because it is divided by 60, so that if the number of revolutions of the engine were 60, N might be struck out. The important factor in this formula is D, the weight varying inversely as D. Again I repeat this is not a perfect formula, but a good one. Because it is not perfect, I gave the correct theory at length in my reply on page 189. Molesworth—invaluable in the factory—contains a collection of rules largely empirical, but embodying good practice, hence the appreciation in which it is held. For nice calculations, requiring a strict adherence to fundamental principles, it is not intended, nor generally adapted."

Rustic Work.—A. R. (*Scorrier*) writes:—"In No. 16 of WORK, pages 248 and 249, there are designs of rustic work which, I am sure, should please all readers of WORK; not only so, but the very plain and able way the writer has given instructions how to proceed with the work is worthy of praise. In fact, I was so pleased with the writer's description of rustic work, that I read it over three or four times, and before I finished reading I had the porch and fence made without nails, hammer, or even a hand-saw, and felt only too sorry that I was not in possession of a good garden wherein to erect it. If everything in WORK is made so plain to the mind as the remarks on rustic work, the most simple may not err; and there will be no need of readers saying there is more talk than work in WORK. Again, I see some of our readers wish WORK to be enlarged, but there are two sides to everything; those that want a larger paper may have a lot of spare time, while many a working man, for whom I presume WORK is chiefly intended, will find there is quite enough in WORK at its present size to peruse in the little spare time he has in a week. Again, many an amateur and poor man will put a penny a week in a paper when they would not spend threepence. Therefore, I think it would be decidedly wrong to deprive the poor man of his little pleasure and instruction to oblige a few that have time and money to seek other pleasure after they have read the pages of WORK."—[There is not the slightest idea of raising the price of WORK. It is meant to be a poor man's pennyworth. Please send your name and address.—ED.]

Saws.—W. O. S. (*Manchester*) writes:—"I should be much obliged if one of your contributors could inform me as to the price of a saw suitable for comparatively heavy work such as sawing rough trunks of trees, either with or against the grain. The width of the key would not be a matter of much moment so that it cut rapidly. When I say tree trunks I don't, of course, mean large timber, but the trees which people frequently cut down for themselves in gardens where the size of the trunk is not, as a rule, over 8 in. or 9 in. Also the name of the maker, and probable price."—[The best saws for your purpose are—the one man cross-cut saw, 3 ft., 7s.; 3 ft. 6 in., 8s. 3d.; 4 ft., 9s. 9d.; 4 ft. 6 in., 11s. 3d. each; and the same perforated, to assist in re-gulleting, 3 ft., 8s. 9d.; 3 ft. 6 in., 9s. 9d.; 4 ft., 11s. 3d.; 4 ft. 6 in., 12s. 9d. Sold by Melhuish's, Fetter Lane, Holborn Circus, E.C.—ED.]

Subjects in WORK.—FRISBY writes:—"I have been a subscriber to your valuable Magazine, WORK, ever since it started, and as an amateur wood worker (or, as I have seen it put by one of your correspondents, wood spoiler) I have gained some valuable knowledge from it, and the simple practical way of explaining the work that is touched on in it has helped me much. While I have failed to find that those articles which are complained of by W. V. C. are written far above one's head, I have noticed that the writers of some of the papers have not followed out that simplicity in which Mr. Adamson set such a good example in his articles on the Screen Secretaire; for instance, the article on Soldering, in my opinion, might have been improved much by the addition of a word or two more in explaining Figs. 9 and 10—home-made gas stove and gas stove cover. This is only my opinion, mind. Of course you have to study economy in regard to space; and yet I see some are trying to intrude on our valuable space by inducing you to start a series of designs for a cottage first, and gradually go on to the mansion. Now, Sir, if I understand WORK rightly, it is to fill a gap, or, in other words, to treat that which other periodicals have never treated; and it cannot be said that designs for every class of dwellings, from the four-roomed cottage to the mansion, have lacked treatment or publication. Therefore, if WORK takes up this to oblige those few to whom it might be of some use, it would, in my opinion, be at once departing from its original purpose. Much might be said on both sides, no doubt, but it is needless, as the editor, to my mind, does not seem likely to yield too much to the opinions and advice of those who write to him, although he may seek to satisfy them, as far as he can do so, without abandoning his own opinion as to what may be expedient for the well-being and success of the Magazine."—[Your letter is precisely in accord with what I have been seeking to explain to my readers all along—namely, that if a paper be ever so good, there will be some to whom it may not appear entirely satisfactory. Everybody concerned in the production of WORK has done, does, and will do, their utmost to put forth in its pages that which will be generally useful and instructive. Of course every writer is pleased to know that his paper has given satisfaction, but most of them, I imagine, are like myself, tolerably pachydermatous, and very little disposed to be puffed-up with praise or depressed by strictures.—ED.]

Portfolio for WORK.—E. H. R. (*Edinburgh*) writes:—"In 'Shop' (No. 13) correspondence, I observe a portfolio for weekly numbers of WORK, which is very good, and I am glad to see some one as careful as myself in making something to preserve WORK, as it is well worthy of it. The way I have made my folio is simply this: Get two pieces of stout yellow straw board, 1 in. larger each way than your paper, that will give you ½ in. all round, which is plenty of protection, and a strip of American cloth, or as I have used, prepared artist's canvas 3 in. broad and 4 in. longer than your boards. Now use strong glue, and glue your piece of canvas all over on the unprepared side, laying it before you, glued side up; now attach your boards, taking ¾ in. of a catch, and you find 2 in. projecting at each end, which you will find of great advantage, as it is in these parts the strength of your work lies. Simply turn them in, and adhere them with glue. Now get another strip of calico the same breadth as your canvas or American cloth, and ½ in. less than the length of your boards for the inside of your folio; this strip of calico I would advise you to put on with strong paste, as it will make a cleaner job, and although it takes longer to dry it stands better, as it keeps the glue from cracking when you combine it with paste. This being done, having seen to everything being square, cut clean and well put together, lay flat out on a table, and put a slight weight on it overnight; next day take it out and have a look at it, when it will present a pleasing aspect. Now the next thing to be done is the way I have done my own, which is as simple as A B C, and of which



Portfolio for WORK.

I will draw you a sketch that you may understand it. As there will be fifty-two parts for the year we must make provision for them. The method I have taken is to get a needle and a ball of small but strong twine, and thread my needle with a very long double thread of it. Now I commence by dividing A and B into twenty-six equal parts with a pair of dividers, or what is often called compasses. As twenty-six is the half of fifty-two, and I have a double thread, so I set to sewing, passing my needle through the marks I have made with my dividers. I commence at A and go down to B, and from B back again to A, and so on, until I have completed my twenty-six double strings, and now my folio is nearly ready for its work. You will now see where your doubled parts of canvas are of use, as they contain all the stitches, and bear all the strain. Of course you might want your book to look better outside; but this I leave to your own good taste. I find this style of folio very useful, as it can be filled or emptied as you may want it. If Vol. 1 is completed send it to the binding, and your same folio is ready for Vol. 2. Another advantage is when you get your part before you can manage to read it it must be cut up, and by doing so every leaf is loose; to avoid them from being lost, many people stick a pin through the centre, which is not only ugly and marks the paper, but if not put with its nose inside, it is apt to prick your fingers, and suddenly reminds you that it's there. I require nothing of this kind: my folio supplies it, and keeps all together compact and neat, and I can have the full year's volume in my hand without inconvenience, if at any time I want to refer to anything in WORK or 'Shop.' The cuts given above will, I think, fully illustrate my meaning."

—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Banjo.—W. H. B. (*Leicester*).—Instructions in [ba]njo making shall be given at some future time, [bu]t they must be kept in abeyance for the present, [a]s you are just completing one you will hardly [re]quire them yourself, but you ask for them con[si]derately for the good of others.

A Clock that Never Requires Winding Up. —COTTAGER.—Thank you very much, but I really do [n]ot wish to see the diagram of the works of the clock [th]at will never run down. If your ideas were "both [fe]asible and practicable," you would have solved [th]e problem of perpetual motion, which has been [e]xercising the minds of many men from generation [to] generation for a long string of centuries. You [sa]y:—"If I receive no answer, I shall come to the [co]nclusion that this theory of perpetual motion is [a]lso a failure. Any advice you may be pleased to [g]ive will be thankfully received." I endeavour to [h]ave every query answered either by my staff or [m]yself, and to leave no applicant unanswered. The [o]nly advice I can give under the circumstances is [t]o turn from the impracticable to the practicable, [a]nd endeavour to use your inventive powers in [w]orking out something that will be really useful [a]nd helpful to those of your generation.

Barometer Tube.—W. M. (*Belfast*).—The air [b]ubbles got into your barometer tube whilst being [s]haken in process of removal. Although the tube was corked, this did not prevent ingress of air to the mercury, and the shaking caused some air to pass the agitated particles of quicksilver to the closed end of the tube. The tube will have to be removed, gently warmed, and shaken, as directed in my reply to BAROMETER, F.B., in "Shop," p. 158, No. 10.—G. E. B.

Magic Lantern.—J. H. J. J. (*Birmingham*).—The dimensions of a full size lantern are as follows:—Height, 13 inches; width, 6 or 7 inches; and depth front to back, 9 inches. These are about the measurements of Mr. Julian's lantern when turned on its end. To have it 11½ inches long is a disadvantage, as the light and reflector are too far away from the lenses, which should not be more than 6 in. focus, as longer focus will involve a loss of light, and shorter will endanger the lenses from the heat. Over the ventilating holes in the sides a false bottom must be soldered, which must be pierced with holes for ventilation. And it will be better if there is a sliding tray on the bottom (with a handle projecting through the back) to hold the lamp; by this means the lamp may be moved nearer to or farther from the lens without opening the door. Mr. Lancaster, of Colemore Row, Birmingham, will supply a set of lens, consisting of two for condensers, and two for the front. For anything like practical work not less than 3½ in. condensers should be used; these with front lenses can be had from Mr. Lancaster for 12s. 6d., or 3 in. for 8s. 6d. Measure the thickness of the two condensing lenses, and make a tin or brass tube large enough to take them easily, and ⅛ in. longer than they are thick. On the inside at one end solder a ring of wire (Fig. 1) to form a bed, against which

FIG. 1: A, cell for condenser; B, paper tube to keep lenses separate; C, C, wires to keep lenses in position.

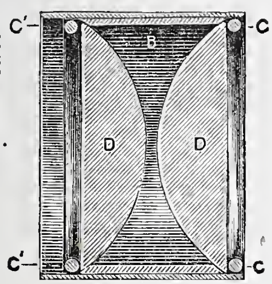


Fig. 1.

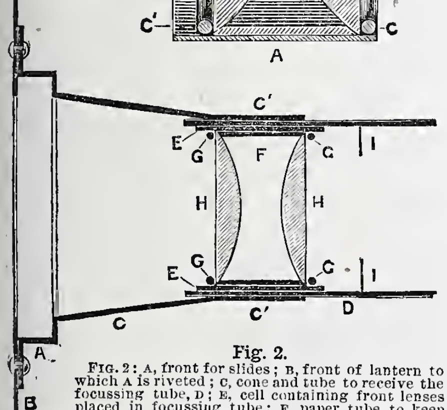


Fig. 2.

FIG. 2: A, front for slides; B, front of lantern to which A is riveted; C, cone and tube to receive the focussing tube, D; E, cell containing front lenses placed in focussing tube; F, paper tube to keep lenses separate; G, wire rings to keep lenses (H) in position; I, stop.

one of the lenses may rest. Now make a hoop, B, of stout cardboard to fit the cell, and to rest on the first lens, and of such a width that when the other condenser is placed in the cell they shall be separated about ¼ or ⅛ in. Care must be taken that the ends of the cell and paper tube are square and true, as the lenses must be perfectly parallel with each other. When they are properly adjusted a ring of stout brass wire, C, must be sprung into the cell, so as to keep the lenses in position (Fig. 1). Next a tube or collar large enough to take the cell, and hold it firmly, must be soldered on the inside of the front, or better still, if made with a flange and riveted. In fixing this collar great care must be observed, so that it be concentric with the opening for the focussing lenses. A cone must now be made to carry the focussing tube, which must be 4½ in. long, 3½ in. at the large end, and 2¼ in. at the small. It will be best to make a paper pattern first thus: On a sheet of paper strike an arc of 13 in. radius. Bring the pencil 4½ in. near the centre, and strike another arc. From the centre draw a line cutting the two arcs. From the point where the line cuts the larger arc, mark off 11 in., and from this draw another line to the centre. Cut out the piece between the two lines and curves, and we shall have a pattern of the cone. In cutting the tin plate leave ¼ in. on one side for overlapping the joint. If this is done properly we shall have a cone whose axis will be perpendicular to its base. Make a tube 2 in. long to C, fit the small end of the cone, and solder it perfectly perpendicular with it. The cone must now be soldered to the gallery for carrying the slides, and is known as the "front." A tube, D, 4 in. long, must now be made to fit the front, into which the front lenses must be fixed in a cell in a manner similar to that already described. These lenses must be ½ in. apart. Although for convenience of description we have mentioned this cell last, it must be made first and the tubes made to fit it. Sometimes amateurs find it convenient to procure parts already made. Mr. L. meets these cases, and supplies fronts with springs at 5s. I have overlooked the fact that a "stop" must be placed in front of the front lens with a central hole 1½ in. diameter (see Fig. 2). A lamp and reflector will, of course, be required. These are supplied for about 10s.; a treble refulgent patent lamp at 16s. 6d. When making the first attempt at exhibiting both the lamp and focussing tube will require adjusting. If the light is uneven move the lamp nearer to or farther from the lens to one side or the other, until the disc is uniformly illumined, and then adjust the focussing tube until the picture is crisp. It will be well to light the lamp for some little time before exhibiting, that the oil may be warmed, and so flow the better. The wick should not be turned up too high to commence with, else it becomes charred. With such a lantern certainly interesting exhibitions may be made; the inside of lantern and tubes must be blackened.

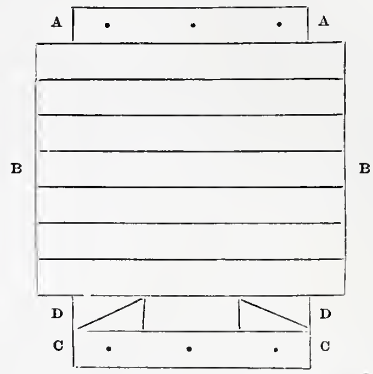
Enamel Paint.—W. H. D. (*Liverpool*).—I am afraid your difficulty in applying this must be owing to your having used an unsuitable brush. The paint being stiff you should use a hard brush. The less turpentine you use the better, though it ought not to change the colour. Of course, I am supposing that the turpentine you use is colourless. The wood should have been sized before painting, though four coats of paint should give a good ground. It is not necessary to rub down with pumice powder. The paint should dry glossy, and I can only suppose as it does not, and there is not sufficient body, that you have used too much turpentine. If you do not like the enamel paint you name, try the Falcon brand, which is made in your city.—D. A.

Gilding Fretwork.—W. H. D. (*Liverpool*).—You may do as you suggest, but it is not necessary. A better plan is to go over the parts to be gilded with one coat of gold size. As soon as this is "tacky," apply the leaf. Defects can then be remedied by going over any places to which the gold may not have adhered. A good deal, of course, depends on the kind of wood used. If the size is quite absorbed, you have no alternative but to repeat the sizing.—D. A.

Ebonising Wood.—W. H. D. (*Liverpool*).—Get your stain ready made, as you will do better than by preparing it yourself: Minton's, Manchester Street, is a good place. Wash the stain into the wood to be ebonised. When dry, if not black enough, repeat the operation; but remember that the stained wood when dry does not look so black as it will when polished. Proceed as in ordinary French polished work, adding a little gas black to the polish. Finish up as usual, and if "dull polish" is wanted, deaden the gloss by dusting on a small quantity of finest emery powder. Rub this on lightly with a brush or soft cloth, and take care that you rub evenly in the direction of the grain. Any wood can be ebonised. Bay wood, walnut (American), beech, and American white wood are generally used.—D. A.

Mounting Calendars.—AN OLD GLUER says:—"I am employed by a firm for mounting calendars, and each stick I have to glue one by one, and I have some thousands upon thousands in the course of the season. Could you kindly inform me if there is a machine for gluing the sticks, so as to save time and labour?"

[In reply to your appeal I can only say that I do not think there is any machine for the performance of work of this kind. If you could manage to place a number of the sticks—presuming they are flat sticks—together on a piece of board, so that the surfaces to be glued would form, as it were, one piece or plane, you might rub the brush over a good many at one and the same time. You would have to place the first stick against a fence or slip of wood screwed along one edge of the board, and then, when the last of the number was placed in position, tighten them up by a movable fence at the opposite edge actuated by a screw; or you might have both fences fixed, and tighten up by the action of reversed wedges. The annexed diagram will give



Contrivance for Gluing Calendar Sticks.

you an idea of my meaning:—A, A, is first fence fastened down to board; B, B, are the sticks; C, C, is the opposite fence, also fastened down to board; D, D, are two pairs of wedges driven in contrary direction, so as to clamp up the sticks, B, B.]

Choosing a Trade, etc.—EXCELSIOR.—To commence with, I think I had better give your letter in full:—"Will you kindly inform me if it is possible for a person to learn a trade without serving an apprenticeship—that is, by devoting three hours a day in working out the instruction given in books or journals like WORK? I am twenty-five years of age, and am very anxious to learn a trade, but I have not the means to apprentice myself, so I am taking the liberty to ask you, Sir, if you will kindly single out a trade which I can learn in the way that I have mentioned. What would you say about house painting or furniture polishing? Of course, I could practise these trades on my own house and furniture—but, there, I shall leave the matter in your hands, wishing you and your magnificent journal 'God-speed!'"—The difficulty, perhaps impossibility, of living while you are learning a trade apparently stops the way. To gain practice, you require to work at a trade from morning to night; but you can only devote three hours a day to practical work after the real business of the day is done. With regard to the choice of a trade, that must be left to yourself. If I could see you I could hear all you have to say, and advise you accordingly. I might suggest a trade for which you have a distaste—chimney sweeping, for example. I say this in order to show how difficult and even dangerous it is to attempt to choose for another without special knowledge of the person for whom the choice is to be made. You seem to gravitate towards painting and French polishing, which, roughly speaking, is decorative work. I see no reason why you should not follow this up if you have an inclination for it; but here a difficulty confronts you in the want of things to paint and polish. I myself should prefer carpentry and cabinet making; and my reasons are these:—(1) That if you have means of exposing for sale articles you have made, there are many things useful and ornamental which you could make at small cost during the three hours daily that you allot yourself for learning. (2) Carpentry is a clean trade, and can be put aside at a moment's notice; but this cannot be done in painting and polishing, or, at least, not done conveniently. But whatever trade you may choose, my advice to you generally would be, first to settle on a trade for yourself; then to make up your mind to devote your whole time and energies to the work, whatever it may be; and, thirdly, having done this, to seek some one in the same trade and endeavour to make an arrangement with him to pay you enough to keep body and soul together in exchange for your services while you are learning your trade. I can see no other way of bridging the gulf that lies between your present occupation and that which you wish to adopt. If possible, the tradesman to whom you hire yourself should be a friend, and one who would be in no way disposed to take advantage of you during the transition stage.

Coach Painting.—F. S. B. (*Bradford-on-Avon*).—A good practical work on coach painting, and things connected with it, is "Coach Painting," by Arlot, 6s., Spon & Co., 125, Strand, London, W.C. The subject, however, will be fully treated in the papers to appear in WORK on all branches of carriage building.

Plaster Casts.—J. S. (*Eastwood, Notts*) may obtain floral and ornamental casts, and, indeed, almost anything that is made in plaster of Paris, from Messrs. D. Brucciani & Co., 40, Russell Street, Covent Garden, London, W.C., at whose shop he will probably find the largest variety of such wares to be met with in England.—M. M.

Step Chair.—F. J. C. (*Brockley*).—A correspondent is at work on an article describing the step chair and its construction. You may rest assured that the index to contents issued with each yearly volume will be as complete as it is possible to make it.

III.—Questions Submitted to Correspondents.

Machine for Current of Air.—A. S. (*Liverpool*) writes :—"In respect to A. H.'s (*Wolverhampton*) reply to BELLOWS (*Gloucester*) in WORK for 27th of July, regarding a machine for current of air, I hope A. H. will be so kind as to give dimensions and diameter of pulleys to drive this machine that will answer for an amateur forge, and hints on constructing a cheap hearth for the above pattern of fan, and the mode of fitting water to run about the mouth of pipe that carries the air from machine to the hearth. Pardon me, Sir, in asking these particulars from you. Be as precise as you can, and plain, as I can see it is a good thing for amateurs. In answering questions of this description we can't be too plain."

Tondeur Photographic Developer.—E. L. H. (*Begbroke, near Oxford*) will be obliged to any reader who will give him the formula for the Tondeur Photographic Developer.

IV.—Questions Answered by Correspondents.

Paint on Leather.—T. C. C. writes in answer to J. B. S. (*Nottingham*) (see page 318):—"If the leather to be lettered is dressed with grease, the best way would be to scrape the surface with a pointed knife before applying the paint, or use turpentine, which will kill the grease; then the letters would not chip off."

Sheet Metal Book.—W. H. W. (*Seedley*) writes: —"I see in No. 20 of WORK that ST. MUNGO would desire to know the name of some book to assist him in sheet metal work. I, being a journeyman tinman, think that the book published by H. Warne, entitled 'Metal Plate Work,' would suit him, as it gives the patterns for baths and aquariums, the price being 10s. There is a very good one by J. Millas among the technical school series, price 6s. 9d., but Warne's would be the best for our friend. I suppose your correspondent will be able to manipulate the article after being shown the pattern, and having read Mr. Alexander's simple yet efficient paper on the metal plate subject."

Cleaning Oil Paintings.—H. G. (*Liverpool*) writes in reply to L. S. (*Lower Broughton*) (see page 190):—"Take the picture out of its frame, place it flat upon a table, face uppermost. Next provide two clean bottles, and a quantity of raw cotton wool. Place in one bottle sufficient spirits of wine of an ascertained strength of 58°, reduce by adding one-fourth part of spirits of turpentine; shake well, to thoroughly mix. Place in the other bottle a sufficient quantity of spirits of turpentine alone. Having the picture lying flat upon a table before you, and in a good light, proceed by taking in the right hand a small tuft of the raw cotton wool, slightly wetted with the mixture from the first bottle, which must be well shaken each time a fresh supply is required to moisten the cotton. Then take another tuft of cotton in the left hand, slightly wetted with the spirits of turpentine from the second bottle. Commence to clean by lightly rubbing the figure with a circular motion with the tuft of cotton in the right hand, examining the cotton every minute or so to see that none of the colour is being removed. When the figure is thoroughly cleaned, wipe it over lightly with the tuft of cotton held in the left hand and moistened with the spirits of turpentine alone. Repeat this process until the entire surface of the picture is quite clean. Care must be taken to change the cotton wool frequently, so that none but clean wool is brought in contact with the picture. When all the varnish has been removed the picture should be quite clean, and only requires to be revarnished. The greatest possible care must be used in passing over the shadows in the picture, which are produced by very thin painting and glazing, and if the tuft of wool in the right hand should show the slightest appearance of colour other than that of the varnish, which is usually of a faint yellow tint, the tuft of cotton in the left hand (moistened with the spirits of turpentine alone) should be applied at once, to prevent any further dislodgment of colour. If the picture in question is faded in any degree, it may be beautifully restored by being exposed to a strong sunlight for two or three months, when it may be revarnished with the greatest safety. To revarnish a picture, place a bowl or jampot in a bowl of boiling water. Pour into the jampot one-third of spirits of turpentine, and two-thirds of mastic varnish, mix thoroughly until a vapour arises from the mixture. Varnish the picture with this preparation as thinly as possible, applying the brush briskly until the entire surface is evenly covered with a very thin coat. This may be repeated two or three times, or until it gives complete satisfaction. Your correspondent should be recommended to consider well before he commences to clean his picture. None but those possessing a considerable knowledge of painting, and having considerable experience in cleaning, should attempt to restore or clean a work of any value. If considered of moment you may furnish your correspondent with my address, and I shall be very pleased to send him further information."

Dulcimer.—ALPHA writes :—"I see a CORRESPONDENT (see page 206) asks for a few hints on making a wooden dulcimer. I have one a wood frame, and strung with wires. I append a rough drawing (Fig. 1), showing general appearance and section. I hope it is what is needed. It is 1 ft. 3 in. long at top, and 3 ft. 2 in. long at bottom; the side is 1 ft. 8 in. long, and 3¾ in. wide by 4 in. deep; the top and bottom are made out of inch stuff 4 in. wide; of course, it is 4 in. deep all round, so the sides will be 4 in. by 4 in. The back is made out of 1 in. stuff; the middle piece put in to support the bridge is 1 in. thick, and the sounding-board rests on it; the sides have a slip of sycamore jointed to them 1 in. thick to hold the pins, and tightening pegs which are of iron; the

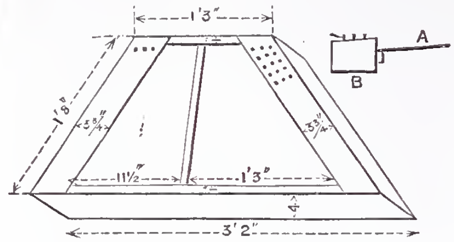


Fig. 1.—General Appearance of Dulcimer.

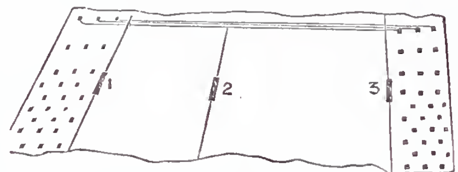


Fig. 2.—Pinning Wires and Placing Tuning Screws.

Fig. 3.—Construction of Bridge.

sounding-board is of mahogany ¼ in. thick. Fig. 2 represents how the wires are pinned and tuning screws are placed. There are fourteen notes of three wires each going over the bridge and seven going under the bridge. 1, 2, 3 are ⅛ in. wire, so that the sounding wires will not cut into the wood. Fig. 3 shows how the bridge is constructed. It is made of ebony an inch deep, about ¾ in. at bottom, and ⅜ in. at top: keep the sounding-board high enough so that the bridge will not touch the wires. It is all pine except what I have mentioned, which can be stained and veneered to suit.

Sloping Boxes and Hoppers.—B. A. B. writes in reply to X. Y. Z. and others :—"The directions given on page 173 give the angle of the edges, and of the mitre or butt joints drawn thereon, but the principal difficulty remains unexplained. It is, however, quite simple when studied for a little while. Let A B C in the figure be the angle as drawn on the elevation. We want to find the angle to cut our boards; we can obtain this in various ways. Let one be sufficient. From point B describe arc of circle having radius B C; then draw the line, D H, through the arc parallel to A B; from the line A B to the line D H is the width of the board required (after edges have been planed to the angle A B C); the angle can be had by drawing a line from C to E perpendicular; to line D H join E B. E B A is the correct angle for boards; this needs no proof, it is obvious. The

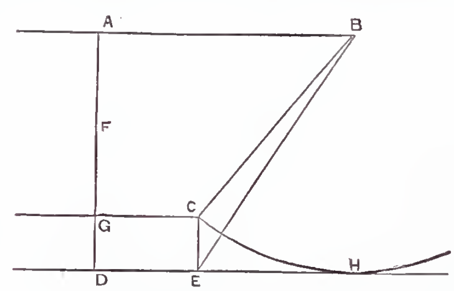


Diagram showing Mode of finding Angle at which to cut Boards.

side board being wider than the length of a perpendicular dropped from B to the base line, and it being as necessary for the bottom to be the correct dimensions, F must be equidistant, as C, from an imaginary perpendicular line—say F; therefore the angle A B C drawn on the elevation becomes the angle A B E drawn on the sloping sides. Let the querist draw on paper a parallelogram, or a square, representing the top of the box; at a distance equal to the width of sides, B C in the figure, and parallel to the representation of top, draw to same scale representation of bottom; draw centre line through both, cut out and fold, so that centre line lies in one plane, and he will at once understand the whole subject. In the diagram A B represents top edge of hopper, C G, the bottom edge, and B C, side, all in elevation; width of side B C is set off to H, as shown by arcs; draw line C E at right angles to G C; the angle to cut sides is then shown in E B A.

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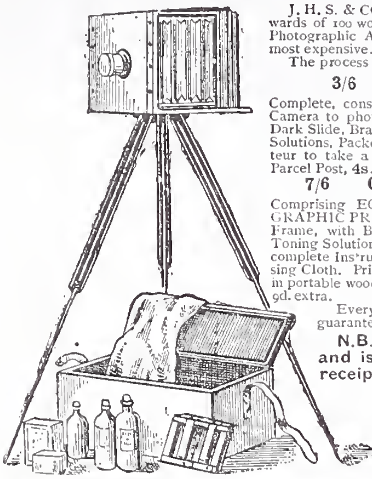

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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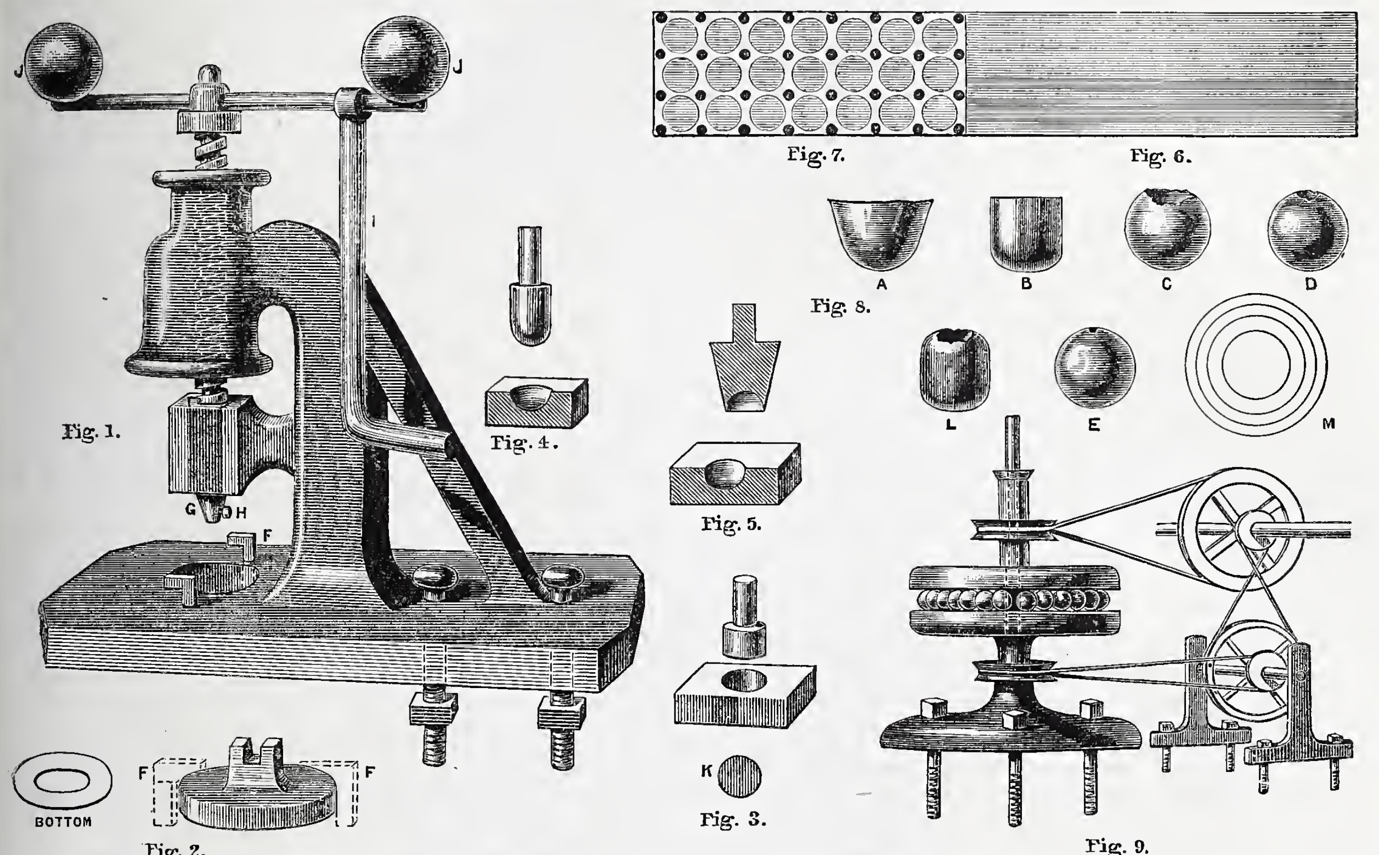


Fig. 1.—Fly for Stamping Metal Balls to be bolted to Strong Bench. Fig. 2.—Slotted Holder to carry Punch. Fig. 3.—Boss or Bed and Punch. Fig. 4.—Punch for Stamping Balls. Fig. 5.—Hollow Cup Punch. Fig. 6.—Sheet of Metal for cutting. Fig. 7.—Sheet of Metal with Places for Balls cut out. Fig. 8.—A, B, C, D, E, L, M, Shapes assumed by Metal at various Stages of Punching. Fig. 9.—Revolving Mill for Polishing Balls.

METAL BALL MAKING.

THE MODE OF STAMPING BALLS IN ONE SOLID PIECE OF METAL.

BY B. W. RAMSDEN.

Before giving a description of the way to make the balls, I will just say a few words to encourage young men not to give up in despair if they do not at first manage to make a success in anything they wish to do. The first thing a youth should learn is the value of small things. A very small thing to do is to carry a small book and pencil, and, as Dickens truly says, "when found make a note of it;" it is advice which I have always carried out, and I cannot tell the value it has been to me when in a difficulty, as I enter my notes in a large book indexed, which is a fine knowledge book. When a youth of sixteen, I saw some men making some cups, and from what I then entered in my book, I made these balls twelve years afterwards—that was in 1875. At first I made a failure of it, but after a few trials I managed to make some perfect, and this is how they are to be made.

They are made in sizes from $\frac{1}{4}$ in. to three inches in diameter, and are sold by Mr. Walter Walker, of Rockingham Street, Sheffield, tool piercer and stamper, from $4\frac{1}{2}$d. to 12s. per dozen, according to size. Three flies are necessary, according to size of ball required. A three hundredweight, a six and a twelve hundredweight, are the sizes mostly in use, as (Fig. 1) a very strong bench is required to put the fly upon so that it can be bolted fast, and a hole cut through to allow of the metal falling through when punched out by (Fig. 3) a tool called a boss or bed, with a slot and a hole in centre, so as to allow metal to fall out. When punches (Fig. 3) are used they are put in a slot (Fig. 2) and wedged tight with thin steel wedges, and are fastened down tight with the screw dogs (F, Figs. 1 and 2); then the top punch (Fig. 3) is fastened in the fly nose (G, Fig. 1) and screwed tight by H. The punches must fit very fine, or they will drag. Try them with a piece of good stiff writing paper, and if one side has a rough edge on screw up the boss a little on that side. When the tool is fixed get your metal; cut it in strips (as Fig. 6) 18 inches long by 12 inches wide, of No. 10, 14, or 17 Birmingham metal gauge. Put the metal under fly and pull handle (I, Fig. 1); for that work the balls (J) can be taken off, as they are not required, as very little pressure is needed. The metal when cut out will be like K, Fig. 3, and the sheet metal like Figs. 6 and 7, which show half cut out and half not. The little black dots show where smaller sizes are cut out so as to leave as little waste scrap as possible, as metal is 1s. 6d. a lb., and 10d. only is given for scrap. Having got all the blanks required, take out cutting tools (Fig. 3) and put in tools (Fig. 4): top punch in nose and bottom in boss. Do not take out the boss; just knock out the wedges. Take one of the round pieces of metal and put over the hole in bottom steel die, and pull on the handle. The first die being shallow, the balls will not yet be required. After taking all the pieces through put them on a stout sheet iron tray and anneal them by putting in a furnace or blowing upon them with a strong blowpipe; if with pipe and gas be sure not to make them too hot all at once. Commence very gently, and increase until the full heat is put upon them, so as to get them a good cherry-red but no more; then allow them to cool. Be very careful not to let any cold water fall upon them, or they will be full of cracks. When cold they are ready for the second punch (Fig. 8, A); then anneal as before. Put on bail to fly and use punch (Fig. 4), which will make them like Fig. 8, B. The process of annealing is again gone through.

A lathe, such as is advertised in WORK, must be brought into use. Chuck the metal cups (Fig. 8, B), which will be just like a thimble in shape. As lathes have been so clearly described in WORK, it is no use repeating it here. True the edges, and with a burnisher turn over the edges as Fig. 8, L; when in that shape the hollow cup punches (Fig. 5) are brought into use, which is just the same process as the other, only hollow top punches instead of round ones being used. When as round as can be got take them and put them in a revolving mill, as Fig 9, which has two pulley wheels, revolving the plates with balls top and bottom in opposite directions, which gives them a beautiful polish and even surface. A spring in the top part of the mill above small pulley presses down the top as they get into shape, thereby ensuring them being perfectly round. After first punch is used use plenty of oil; keep a pot of oil in reach, dip in your finger, and wipe top and bottom punches, which will ensure them leaving the dies easily.

If fancy balls are wanted the pattern must be cut in the dies, and the machine (Fig. 8) cannot then be used.

If any questions require answering, I will be pleased to receive them and give them my best attention in "Shop." If a hydraulic press is used the balls can then be done at once with only once lighting, as they will come out like Fig. 8, B, and by inverting in hollow cups after lighting would be like Fig. 8, E. I know of no firm in England which uses one in the silver plate trade; in America they are all made by that process.

PLAIN AND DECORATIVE HOUSE PAINTING.

A PRACTICAL TREATISE BY A LONDON DECORATOR.

INTRODUCTION.

AT no period of the Victorian era has there existed a spirit of more earnest inquiry for such knowledge as will enable the worker to know the true from the false in all matters concerning the application of art to industry than that which characterises the present time.

Since the year 1851, when the Great Exhibition in Hyde Park demonstrated to us so painfully, but, as it has proved, beneficially, our inferiority in the artistic aspect of our manufactures as compared with that of many other nations, a change has transpired which, although becoming but gradually apparent to the community at large, is none the less of a vital and extraordinary nature.

In no department of industrial art has this change and progress been more marked than in the design and production of decorative materials and wall hangings. As testimony to this, twenty years ago wall papers of purely home design and manufacture were but little used; to-day, however, we find British decorative hangings and fabrics able, not only to maintain their commercial position in our own country, but to compete successfully, both for artistic excellence and superiority of manufacture, with similar goods in foreign markets.

Although, by reason of the able editorial proclamation in which the general scope, aims, and ends of WORK were placed before the world of workers, any lengthy introduction of these chapters to its readers is rendered entirely superfluous, I will claim a short space in which to explain the mode selected for the treatment herein of this wide and comprehensive subject.

By a three-fold division of our theme, an arrangement is obtained whereby the compiler hopes to tender knowledge and practical assistance forthwith to all the various sections of workers, under one of which all house painters must come—to the apprentice, the improver, the amateur, and to the operative, wage-earning house painter. Believing in the importance of every craftsman and worker understanding the source and nature of that which he uses, ere he receives instructions how to use it, I purpose in the first part to treat on the elementary processes and materials of my subject, which will especially appeal to the young workers, both "amateur" and professional. In the second division will be taken such useful and decorative branches of house painting, known as graining, marbling, bronzing, gilding, hand polishing, etc., written for those operatives who are desirous of extending their capabilities beyond what is technically termed "brush work." In the third part the most advanced portion of modern decorative house painting will be both practically and theoretically considered. As being the most likely course to help the journeyman craftsman, this part will contain directions, accompanied by illustrations where necessary, for the decoration of a modern residence, with chapters especially devoted to the study of colour and its application to buildings. A consideration of the most useful and popular decorative materials and their treatment will here, appropriately, be placed before the reader; and, without dipping too deeply into the theoretical or philosophical aspects of decoration, the writer will endeavour to so ground the earnest worker in principles of decorative truth and beauty that he may himself be able with some degree of confidence to discriminate between the true and the false, and to be able to give a reason for the faith that is in him.

In these competitive days, when the much vexed question of amateur *versus* professional comes so often to the front, the operative painter may venture to inquire how far this giving of common technical instruction to both the two divisions of workers can fairly be justified. Our answer is this: That at such times as we live in, of advancing education and widely diffused literature bearing upon all trades and callings, the facilities of obtaining knowledge are, and should be, common to all sorts and conditions of men. That "a little knowledge is dangerous" in matters of decorative practice, every professional decorator, who has had dealings both with clients possessing that "little"—derived probably from the "art column" of a fashion paper, or a couple of terms at a school of art—and with those customers who lay claim only to the usual attributes of education, common sense, and observation, will fully bear me out. Again, that in consequence of the almost total decay of the apprenticeship system, in the great Metropolis particularly, there is a very urgent necessity for technical instruction in the higher grades, especially of house painting; and, although there exist at present various aids for the young worker, we have no hesitation in saying that these chapters in so cheap and popular a work will meet, to some extent, that very definite want of the painting trades. It is the writer's experience and belief that *decorative* supply will and does *create the demand*; and the more extensive the spread of knowledge on the subject, so will its practice and employment, therewith, proportionally increase. No apology can be needed if this knowledge and instruction is hereby extensively tendered to the so-called "amateur" class of painters.

John Ruskin, speaking on progress in life and art-workers generally, has expressed himself upon a very vital point somewhat in these words: "When," said he, "I hear of any young man as one giving promise of much success in his vocation, I invariably inquire whether he works hard and diligently at such profession or calling; for in the answer to this will be found the surest criterion of his future career."

Herein, therefore, will lie the success of the practically disposed reader of these chapters. Natural faculty and ability are of little avail unless supplemented by diligent and painstaking efforts. Technical instruction can but strive to point out the most direct way to the best ends, and, whether actuated by motives of direct profit or recreation, the results will very materially be governed by his own perseverance and application, in short, hard work!

Introductions, I am well aware, and preliminary disquisitions on the history that attaches to certain crafts are objected to very strongly by some readers, and I am of opinion myself that the pages of a magazine such as WORK are, perhaps, not the most desirable place for the ventilation of the latter. Nevertheless it is useful, and, indeed, necessary, for those who undertake to write on subjects that will from their nature occupy some considerable space in their treatment to foreshadow what that treatment will be that the reader may be enabled to comprehend in some measure what is to be placed before him. In my own case I have made my preliminary remarks as brief as possible, and in my next, I shall enter at once on the consideration of the sources, nature, and qualities of all materials used in house painting.

BURGLAR ALARUMS:

HOW TO MAKE, WORK, AND MAINTAIN.

BY GEORGE EDWINSON BONNEY.

THE BATTERY—THE LECLANCHÉ BATTERY—THE AGGLOMERATE BATTERY—THE GASSNER DRY BATTERY—ARRANGEMENT AND MAINTENANCE OF BATTERY—LAYING THE LINE WIRES.

The Battery.—Several types of battery have been used in ringing electric bells. These I hope to notice when dealing with the general subject. I now only describe the "fittest"—that is, the one in general use all over the world where electric bells are used, and its latest and most successful rival. It won't do, on a job like this, to employ an experimental battery. We must have one that we are sure of—one that has been tested by long experience. The battery must be reliable, ready to work at all times, and capable of maintaining its efficiency for long periods without attention. Some forms of battery choke themselves, so to speak, with crystals whilst they are at rest; others send up fumes or salts to corrode their connections, and cause failure just when the battery is wanted; others are soon exhausted, and do not recover their strength. It is clear that these will not do for electric alarums.

The Leclanché Battery.—This battery, invented by the late M. Georges Leclanché, has stood the test of many years' practice as the best battery for ringing electric bells. Each composite cell is made up of (1) a glass outer containing cell charged with a solution of sal-ammoniac, into which dips a rod of zinc to form the positive element; (2) a porous inner cell charged with a mixture of broken carbon and small lumps of manganese peroxide, surrounding a cube, or a plate of carbon, to form the negative element. The whole arrangement is shown at Fig. 37. The outer cell may be of any other ware, such as china, porcelain, stoneware, or glazed earthenware; and the pot may be of other shapes than that shown in the sketch. It is charged with a half-saturated solution of sal-ammoniac—that is to say, sal-ammoniac (ammonia muriate) is dissolved in warm rain water until the water is saturated; then it is diluted with an equal bulk of rain water. Ordinary well, spring, river, or pump water may be used; but rain water is best. The zinc rod is cast with a stout piece of copper wire projecting from its upper part to form a connection with the carbon of the next cell. This wire is coated with warm gutta-percha, or with tarred tape, from the zinc to within two inches of its other end, which is left bare and clean to make connection with the binding screw of the carbon. The whole, together with an inch of the zine rod at the top, is coated with Brunswick black. The inner cell is made of white porous earthenware. A prepared strip of carbon is set upright in the middle of the cell, and then closely packed with a mixture of equal parts by bulk of gas carbon, broken to the size of peas, and lump peroxide of manganese of the same size, all dust being sifted out of the mixture. The surface of this charge is covered with a thin coat of pitch to keep it in position, and two holes are made in this pitch seal after it has cooled, to allow the gases formed whilst working to freely escape. The strip of carbon is selected just wide enough to slip easily into the cell, and long enough to stand with its upper part about one inch above the top of the cell. This part is soaked in hot melted paraffin for some time; then allowed to cool. When cool, a few holes are drilled laterally through the paraffined top; a hole is drilled in the top near the middle to reeeive the end of a tang of a binding screw; the top part is inverted in a mould; and melted lead is poured in to form a head having a good contact with the carbon, and to hold the binding screw. The head, and a strip of carbon just below it, are painted with Brunswick black, and this, together with the paraffin, prevents the lead head being corroded away with the ammonia fumes formed in working the battery. The cells are made in various sizes, but most vendors sell three stock sizes, numbered respectively 1, 2, and 3. All do not agree in the sizes apportioned to the several numbers, but the following may be taken as generally correct:—

No.	Size of Porous Cell.	Size of Carbon.
1.	5in. by 2in.	6in. by 1¼in. by ⅜in.
2.	6in. by 2¼in.	7in. by 1½in. by ⅜in.
3.	6½in. by 3in.	7½in. by 2in. by ⅜in.

No. 1 will take about 6 ounces of the carbon mixture; No. 2 will take about 8 ounces of the carbon mixture; and No. 3 will take about 10 ounces of the carbon and manganese mixture to charge each cell. Manganese peroxide costs about 6d. per lb., and broken gas carbon about the same, if bought retail in London, but is much cheaper in some districts. The various parts of the battery may be bought and put together. Their cost may be nearly estimated as follows:—

No.	Porous Cell.	Carbon Capped.	Zinc.	Glass Cells.	Porous Cells charged.	Battery complete.
1.	4d.	1s. 0d.	5d.	0s. 9d.	1s. 8d.	3s. 0d.
2.	5d.	1s. 3d.	6d.	1s. 0d.	2s. 2d.	4s. 0d.
3.	6d.	1s. 8d.	8d.	1s. 3d.	3s. 0d.	5s. 0d.

Sal-ammoniae costs 1s. per lb.

With respect to the size and number of cells required to ring an electric alarum, we must be guided by the work to be done. If the bell is a large one, and wound with thick wire, or if several bells are connected to one battery, we should use No. 3, or largest size cells, to furnish a sufficient volume of current. No. 2 cells will ring a 4-inch bell fairly well, and three of these coupled in series will be all sufficient for an alarum system in an ordinary-sized house furnished with one bell only. If the bell has to be rung through a long line of wire, or through a line of fine wire, we must add more cells in series to overcome the extra resistance. All users of electric bells are agreed that it is false economy to stint battery power.

The Agglomerate Battery.—This is only a new form of the Leclanché. The porous cell is dispensed with, and the manganese and carbon mixture is made into agglomerate blocks by machinery, under enormous pressure. The usual capped carbon plate is enclosed between two of such blocks, which are kept pressed together by crossed rubber bands, the loops of the bands serving as a holder for the zinc rod, as shown at Fig. 38. When these were first introduced, they were thought to be superior to the old form of Leclanché, but it is now found that their sole recommendation lies in offering less resistance to the current. In practice they are said to be more troublesome than the old form.

The Gassner Dry Battery.—This battery bids fair to rival the Leclanché, and oust it from its long-sustained high position of being the premier electric bell battery. Each cell is complete in itself, instead of being a composite cell made up of inner and outer cell. There is no porous cell, nor any outer cell of glass, porcelain, or other breakable material. Each cell of the battery is made of thick sheet zinc, and this forms the containing case as well as the positive element of the cell. This case is nearly filled with a paste composed of zinc oxide and gypsum, moistened with a solution of zinc chloride. A capped cube of carbon, bearing a binding screw on its head, forms the negative element in the centre of the case, where it is surrounded with the conducting and exciting paste. The whole is sealed over with some dark composition resembling marine glue. It will thus be seen that there is no liquid to spill, nor any required, as the porous mass is moist enough to excite the zinc, and retains its moist condition for any length of time. The cells may, therefore, be laid on their sides in racks, as wine is stored; or turned upside down without impairing their working qualities. They may be placed in any convenient position, regardless of the temperature of the room in which they are located. As to power and constancy, they take their place cell for cell side by side with the Leclanché, doing equal work, and recovering their normal strength, in equal time. Here, however, they possess an important superiority. When a Leclanché cell is quite exhausted, we have to take it to pieces, clean, and perhaps renew the zinc, and renew the porous cell, with its contents. When a Gassner cell is exhausted, we have only to send a strong current of electricity (such as that from a battery of Bunsen cells) through the cell from carbon to zinc for about an hour to regenerate its contents and make the cell even more powerful than it was when first constructed. I hope to go into this part of the subject more fully when I treat of electric bell batteries. The battery has stood the test of nearly three years' practical work, and is fast growing in favour. The wholesale agents in London are Messrs. Mayfield, Cobb, and Co., 41, Queen Victoria Street; and the batteries are also sold by Messrs. Gent and Co., Faraday Works, Leicester. Fig. 39 shows the round form of cell used in this battery, and this is sold at 5s. per cell.

Arrangement and Maintenance of Battery.—Fig. 40 shows how an electric bell battery is connected up and arranged. It will be noted that one wire, A A, leads *to bell*, and this is connected to the carbon element of the battery. The wire leading from the zinc of this cell is connected to the carbon element of the next cell, and the wire from the zinc of this to the carbon of the last cell of the series. A wire leads from the zinc of this cell to the line wire, B B, *from bell.* This method of connecting cells to form a battery is called connecting in series, and is always the method adopted for electric bells. It is immaterial which wire is connected to the terminal carbon or zinc, for the bell will ring equally well whether we connect the wire coming direct from the bell to the zinc or connect it to the carbon. The path of the current is, however, from zinc to carbon.

I have shown the battery of three cells in a box; but it is not necessary to thus enclose them. It is, however, usual to place Leclanché cells in a box, for several good reasons. A box protects the cells from accidental blows, and from dust. It also serves as a check to meddlesome children and servants, for the box may be securely fastened, and the wires brought out through the back or side. I have not shown the cover and one side of the box. Both of these are hinged to each other and to the bottom, and the cover opens from the back. When constructed in this way, the cover and side fall down when opened, and allow free access to the cells for adjusting screws or seeing the condition of the battery. If made for a Gassner battery, it will be advisable to partition off each cell with a thin partition of wood to prevent accidental contact. Half-inch deal, or pine, or any other wood may be used in its construction, and the outside may be stained, painted, grained, or polished, as taste may dictate.

In arranging a suitable place for the Leclanché cells, it should be borne in mind that they work best and last longest when put in a moderately cool and damp room, such as a cellar, or in a washhouse. In dry situations the solution rapidly evaporates, and the salts creep up the sides of the cells and over the connections. The salts formed in a Leclanché cell by the union of sal-ammoniac with zinc have a tendency to thus creep up the sides of the cells. This may be guarded against by greasing the inside of the glass cell down to water line. Messrs. Gent and Co. have their glass cells made with a narrow channel around the top, and this is filled with a composition guaranteed to prevent the salts from creeping over. If the glass cells are allowed to get dirty on the outsides from this cause, or are left wet, or stood on a wet shelf, a part of the current will be lost by leakage. Cells must be looked to from time to time, and all such causes of leakage stopped; at the same time, the loss of solution from evaporation must be made good. It is not necessary to add sal-ammoniac when water is added to make good this loss. Use clear rain water if procurable.

Some makers do not amalgamate the zinc rods used in a Leclanché battery, but I have found that they work best when amalgamated. To do this, well clean them in hot water with some washing soda; then dip them in dilute sulphuric acid, and rub some mercury well into the rods, with an old rag as a rubber. If the zincs turn black soon after the battery has been set up, and there is a strong odour of ammonia from the battery, together with white specks on the porous cells, we may suspect a leakage either between the cells and elements of the battery, or in the outer circuit; this must be promptly detected and repaired, and the zincs cleaned up again.

it, so that he may be awakened at the first alarm, and be able to switch off the current as soon as he can after the alarm has been given, for the burglars may promptly decamp and be left uncaptured if the bell continues to ring for some time, and so alarm them with its din. The main line from the bell to the main-line battery should be of No. 20 copper wire, coated with indiarubber, and double cotton-covered. This may be had covered with any colour of cotton to match the painted woodwork or the ground tint of the wall-paper, at a cost of about 12s. 6d. per 110 yards. Run bells, the wires can be run along the tubes provided for this purpose, the old system wires being drawn out as the electric bell wires are drawn in. If different tints of cotton are used in covering the wires, one colour of covered wire should be used to go from the bell to the main-line battery, and from this outwards to the end of the line. The return wire should have a different tint, and thus the going and return wire can be easily recognised, a matter of importance in connecting them to the various contacts. Be careful, in driving the staples, not to cut through the covering, nor to abrade this when drawing the wires tight through holes or around corners. Let all be done neatly, out of sight as much as possible, and out of the probable course of the housemaid's broom.

From the main line, several branches will be thrown out towards the various points of contact. If each room is connected to a separate indicator, one of the wires will be connected to the outgoing main from the battery, whilst the other will go direct by a path of its own to the indicator and bell. Each point of contact must have its own two wires; one from the main battery

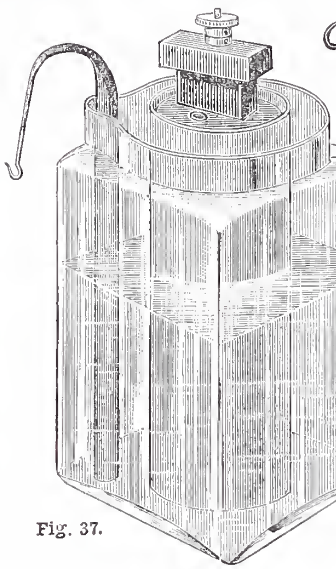


Fig. 37.

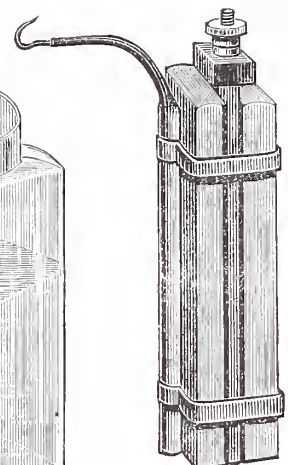


Fig. 38.

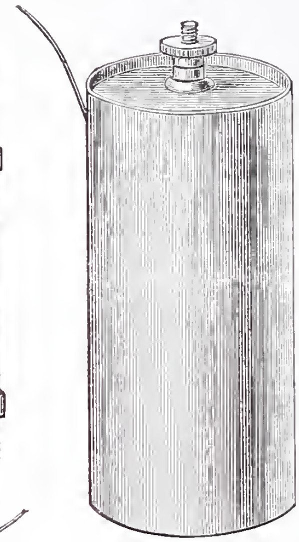


Fig. 39.

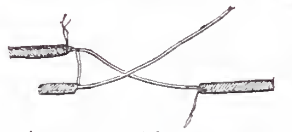


Fig. 42.

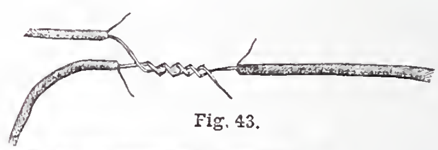
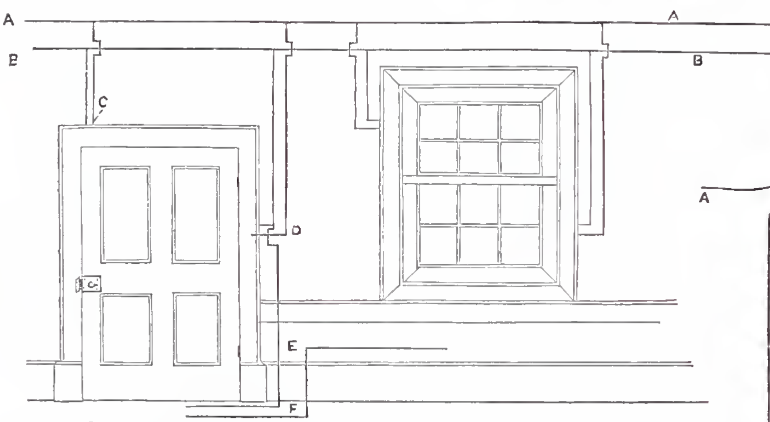


Fig. 43.



Door-Mat Contact.

Fig. 41.

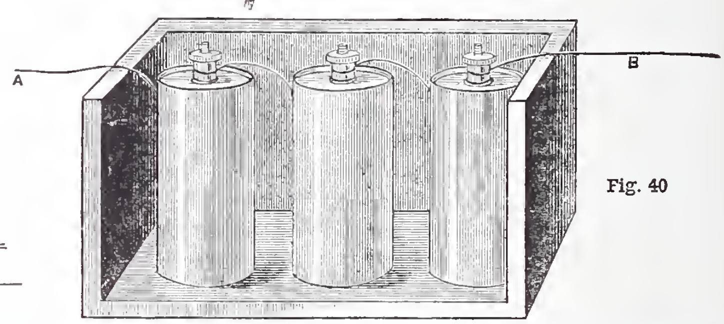


Fig. 40

Fig. 37.—Leclanché Cell. Fig. 38.—Agglomerate Block. Fig. 39.—Gassner Dry Cell. Fig. 40.—Three Gassner Cells connected in Series and placed in Box—A, Wire from Bell; B, Wire to Bell. Fig. 41.—Diagram showing how to connect Branch Wires from Burglar Alarum Contacts to Main-Line Wires of Electric Bell—A A, Main-Line Wire to Bell; B B, Main-Line Wire from Battery; C, Door Trigger; D, Door Post Contact; E, Special Line to Indicator; F, Door-Mat Contact. Fig. 42.—Sketch showing how to Strip Covering from Electric Bell Wires preparatory to connecting Wires together. Fig. 43.—Sketch showing how to Twist End of Branch Wire round a Main-Line Wire to form a Junction with it.

Laying the Line Wires.—Before laying the line wires, we must not only decide upon a place for the battery, but also a position for the bell. This may be on a wall, or in a cupboard in the master's room, or in that of a trusted man servant. The local battery, to work the bell through a relay, should be in the same room with the bell, and not far off from it. If a Gassner battery is used, the cells may be enclosed in an ornamental box of small dimensions, and the bell may be mounted on the same box. If the Leclanché is chosen, a cupboard near the bell may be utilised; or the wires may be brought through a wall or partition from a closet or other anteroom. The bell should be near at hand to the person in charge of the line wires along by the wainscoat, the skirting, or by any woodwork, in preference to pinning it against walls. If there is a chair rail around the room, one wire may be carried above, and the other beneath the rail. In no case should the wires be laid side by side together under one staple. In passing from room to room, pass the wires through the hind doorpost, where they will be least observed, boring the holes with a fine long gimlet. Secure the wire at intervals of about 18 inches or 2 feet with small staples. Messrs. H. Dale and Co. sell a hard, sharp-pointed staple for this purpose, which enters the wood easily, and does not readily bend. Where provision has been made, in building the house, for a system of line, the other returning to the bell or else back to the indicator. Several contacts in one room may be connected to one branch main, but in this case the indicator will only tell the room from which the bell was rung, not the particular door or window. Perhaps a clearer idea of how this is to be done will be gathered from the accompanying diagram, Fig. 41.

To connect a branch wire to the main line proceed as here directed. First lay bare about $1\frac{1}{2}$ inch of the covering of the main line at the point of junction by scraping it with an old knife. Clean the bare copper bright with a piece of emery cloth. Strip about 2 inches of the end of the branch line wire, and clean in a similar manner. Lay the two wires together, as shown at Fig. 42, and twist the end of the branch wire around the clean part of the main wire, as shown at Fig. 43. Drop a little melted composite candle, or a little powdered resin, on the joint; run a hot tinned soldering bit along the twisted wire to tin it; then follow with a drop of solder; wipe the joint with a rag to get off any trace of soldering flux remaining; cut the loose ends off close to the wire; and then cover the whole with a few strands of soft cotton dipped in melted paraffin.

In my next I will endeavour to show several forms of door and window contacts, and how to connect these with the bell and battery.

A CHEAP BELL CHUCK.

BY F. J. GOODACRE.

WHILST fully admitting that a row of chucks in burnished gun metal or brass has a very effective appearance, yet there are no doubt many of "ours" who are unable to pay the high price demanded for them. For instance, a 2-inch bell chuck made in gun metal is to be had at 14s., and is probably not dear if the actual cost of labour and material be taken into consideration. Iron chucks of this class may be made from castings, but there is then a considerable amount of labour involved in finishing them —labour which many persons have neither the time nor inclination to undertake.

Probably there are few persons who have not noticed, at one time or another, the "reducing sockets" used so extensively by gas and water fitters for connecting large pipes to those of smaller diameter. These may be obtained up to 6 inches in diameter at the large end, and with the other considerably reduced. These are just the shape for bell chucks, and being of wrought iron, and averaging about $\frac{1}{4}$ inch in thickness, are of very great strength.

Assuming that it is desired to fit up a 2-inch bell chuck, and that the mandrel nose is $\frac{3}{4}$-inch thread, a reducing socket of the size known in the trade as $1\frac{1}{2}$ inch by $\frac{3}{8}$ inch will be required. Mount this by the larger end on a face plate, or in a self-centreing chuck; or, if neither of these happen to be available, turn a piece of wood to fit the inside of the socket. Assuming that the piece now runs true in the lathe, the first operation consists in turning out the existing gas thread in the smaller end, thus enlarging the orifice until it is of sufficient size to permit of the $\frac{3}{4}$-inch tap being introduced. In tapping, it is as well to bring the back centrepoint up to the end of the tap, so as to ensure the thread being accurately cut. This having been accomplished, a small recess should be turned in the end, as shown in the illustration. (Fig. 1.) If the foregoing operations have been carefully carried out, on screwing the rough chuck on the mandrel, it should run truly and bed nicely against the shoulder. Set the lathe in motion, and with a graver or point tool mark two rings on the circumference of the chuck. Each ring is to be divided into six divisions. Drill and tap with $\frac{1}{4}$-inch thread each *alternate* division in the two rings, taking care that the three holes in one ring are midway between those in its fellow. If the divisions are marked with a punch, the back centre can be used, placing its point in one mark, when the one opposite can be drilled with a tool in the lathe, and so on until the three holes in each ring are completed. By this means the proper position of the holes is ensured, it being important that, when the screws are put in, each set of three should meet accurately in the centre. The chuck now only requires to be furnished with screws to complete it. It is hardly worth while for any workman to make these, seeing that they may be purchased at Nettlefold's at the very low price of fourpence per dozen. The heads require cutting off, and a square should be filed at the top of each one, the opposite ends being slightly coned, as shown in the figure. The screws should be made a medium fit in the chuck; neither tight nor loose; but so that they may be readily turned by the fingers. For light work a spanner is hardly necessary, but will be

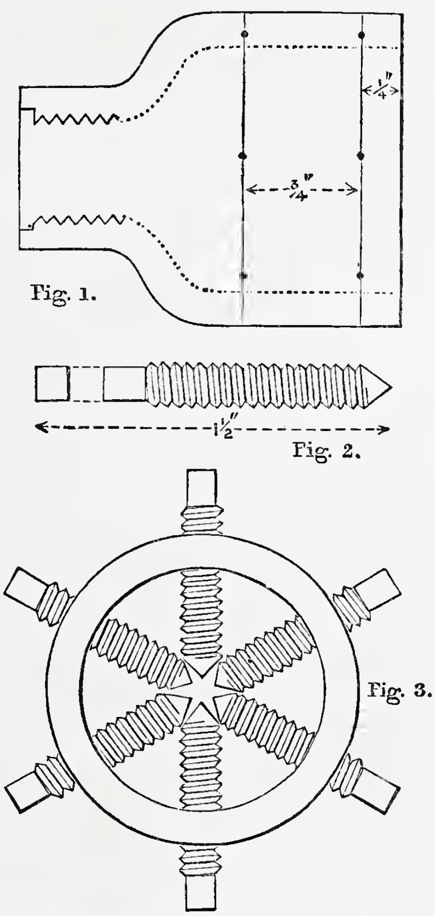


Fig. 1.—Socket Tapped for Mandrel and Marked for Screws. Fig. 2.—Screw. Fig. 3.—Front View of Chuck complete with Screws.

useful for heavy work, and can easily be made by drilling and filing a square of the required size in a small piece of iron or steel.

A shaving may be taken from the mouth of the chuck, and the body turned up bright and smooth, if it is thought desirable; but a very good plan is to give the outside one or two coats of black enamel.

If a 4-inch chuck, say, should be required, it will not be possible to obtain a socket small enough at its "reduced" end to fit the mandrel. It is easy to get over this difficulty, however, by plugging up the end entirely, and then drilling out afresh to the size required for tapping.

The total cost of this chuck (2-inch) should not exceed one shilling, exclusive of time and labour, and when finished it will be found of great value for holding many articles whilst being turned. For large drills it will be found even better than a self-centreing chuck, as with a little practise it can be adjusted to run dead true.

SOME FACTS ABOUT MAHOGANY.

BY DAVID DENNING.

MAHOGANY is a wood so well known, so generally used, not only by the cabinet maker, but by others, that we are almost naturally inclined to regard it without any particular interest. We take it as one of the common materials of daily household use, and looking round our rooms we can hardly conceive the time when it was unknown. Nevertheless it is to all intents and purposes a modern introduction, comparatively. Not till well on towards the middle of last century was it in anything like general use, although it was not unknown at the end of the sixteenth, when it is stated to have been brought to this country, not as part of the cargo, but as portion of a vessel which had "got into lumber," and had been repaired with it. To Sir Walter Raleigh is credited this first importation, and little could the great Admiral have imagined that the timber he found useful would one day be found to possess qualities which should lead to its general adoption as a furniture wood.

Evidently, at first it did not appeal to popular taste, or possibly while mens' minds were excited with the idea of discovering an Eldorado, whence gold in unlimited quantities could be had almost for the trouble of taking it, the notion of importing bulky timber may have seemed too ridiculous. If it was an age of strength it was also an age of rudeness, almost of barbarity, when domestic comforts as we understand them were little thought of. Going back in fancy to those "good old times" we can well imagine that any one who proposed to import mahogany because of its beauty would have been looked on as a man whose schemes were not worthy of serious consideration. Even were the wood appreciated, how could it be brought over in sufficient quantity to make its sale remunerative in the little vessels in which the navigators of those days sailed on their half-marauding, half-trading expeditions? Any cargo must necessarily have been such that it could be stowed in a small bulk. Whether a few logs may have been brought over from time to time or not, after Raleigh used the strange new red wood to repair his leaky vessel, it certainly was not much heard of in this country, though it is reported that the Spaniards employed it for ship-building purposes in the sixteenth century. It seems probable that Raleigh availed himself of this wood simply because it was handy and known to be suitable, just as, had the repairs been effected in Britain, oak would have been the most convenient wood. Truly these old seamen found an Eldorado, but not such as their greed-inflamed imagination suggested. By discovering the products of other lands—nay, by their discovering in the first place the other lands beyond the seas—they have done the world more good than had they only and solely come across the mythical golden city. They searched for gold, and in so doing paved the way for modern commerce in all its extended ramifications. Whatever the quantity of mahogany that may have been brought to this country during the seventeenth century, we seem to have few reliable details by which to trace its adoption till well on into the eighteenth, when we again meet with some tangible evidence of it during the reign of George I. A certain Dr. Gibbons, of whom I believe history is otherwise silent, had a brother engaged in the merchant service, by whom he was given in the year 1824 some pieces of mahogany, the gift being probably induced by the fact that the doctor was then having a house built for himself in King Street, Covent Garden. Whether they were handed to him with the intention of being used for decorative purposes, or simply because they were looked on as waste, is not known, but there is no doubt that they stood a very good chance of eventually becoming the latter, for the joiners refused to work it on the plea that it was too hard. Apparently the doctor had recognised its beauty, or it may have been that he only wished to have some trifle as a memento of his brother made from it. Whatever the motive, fortunately he didn't accept the builder's decision of its unworkableness as being final, for we find that he arranged with a cabinet maker named Wollaston that a candle-box—strange reminder of the primitive modes of illumination!—should be made from some of it. Wollaston also seems to have found fault with the wood on account of its hardness, from which we may reasonably infer that it was a piece of finely-figured Spanish—otherwise, had it been of the inferior bay wood, men accustomed to work in oak, the till then ordinary furniture wood, could hardly have complained of its being unworkable. Be this as it may, the candle-box when finished gave satisfaction to so great a degree that, as one writer says, "it outshone all the other furniture belonging to the doctor, who gave Wollaston the remainder" of the wood, though another writer distinctly attributes to Wollaston the credit of having "recognised the fine qualities of the material." However, without discussing whether to the doctor or to the tradesman is due the chief credit of sufficient discernment to appreciate the merits of mahogany, there is no doubt that, speaking from a commercial point of view, it is owing to their joint enterprise that the wood took at once a leading place as a furniture material. The story goes that out of the remainder of the captain's present Wollaston made two bureaus, one for Dr. Gibbons and the other for the Duchess of Buckingham. After this the demand seems to have increased, and Wollaston is supposed to have amassed a considerable fortune by the manufacture of mahogany furniture.

Within the next few years the importation of mahogany must have greatly increased, for even before Chippendale's time we find it extensively used, while the fact that Chippendale made most of his furniture from it is too well known to require comment. It is hardly too much to say that to the introduction of mahogany much of the change which took place in the fashionable styles is owing, an impetus having been given to the study of designs suitable to it; and whatever the opinions of the designs themselves, there is no question that Chippendale and his contemporaries made the most of their material. It was delicately worked up in a manner which conclusively proves that it was not regarded as a common material, but rather as one to be treated with respect. Other causes, no doubt, contributed to the improvements which took place, not only in furniture but in general household decorations during the last century, but there remains the fact that in mahogany the great designers and artisans to whom English furniture owes so much of its present position as a fine art industry found a congenial material. It may be interesting to note that mahogany, even in its commoner qualities, must have been a comparatively valuable wood, for it is not uncommon to find old articles of furniture veneered with it on a foundation of oak.

Later on, as inferior, *i.e.*, plainer figured mahogany, became a commoner commodity, the custom of veneering on it became more general, and it is rarely nowadays that one finds any other wood used for the purpose, except when for the sake of cheapness pine is used. No one, however, would think of laying mahogany veneer on oak.

Mahogany has remained, par excellence, *the* cabinet-maker's wood, although within the last few years it has fallen into comparative disuse for the best, or say the most fashionable, furniture. Various causes have contributed to this, among them the rage for the plain severe styles which for a time had sole sway, and the outcry raised in certain quarters against veneer. Unreasonable though it might be, this had great influence on public opinion, and ash, walnut, or oak, solid, or supposed to be solid, largely supplanted mahogany in popular favour. Nothing can be urged against these woods being unsuitable for furniture construction, except that in point of beauty they are not equal to mahogany. They are good enough in their way, but when it comes to be a matter of richness of colour and variety of figure, they are, to use a colloquialism, "not in it." We are, after having kept our eyes partially closed to the merits of mahogany, and sought more or less vainly to find the same qualities in other woods, just beginning to open them again, and to see that there is after all nothing like a handsome piece of mahogany furniture. Not that I would advocate its exclusive use, but do not let us remain under the impression that ash or walnut for bedrooms, walnut or oak for dining-rooms, is only to be employed if we want to have "art-furniture." This can be made in any and not necessarily the plainest wood, although there seems a certain amount of misconception about this sometimes. In mentioning the claims of mahogany it must be recollected that the style in which it was worked up, say thirty, or even twenty years ago, is not a necessary concomitant. It is not, however, all mahogany that is equally beautiful; indeed, there is hardly a wood with which we are acquainted that presents more variety than this, varying from the plain coarse Honduras to the richly variegated Spanish. It was in this latter that the Georgian cabinet makers principally worked, and when a fine piece of "city" wood can be obtained it is a thing to be valued.

The mahogany tree is found more or less abundantly in the West Indies, whence comes that known as Spanish. The best of this was formerly imported from San Domingo. Indeed, at one time, it appears as if this were the only port of shipment for, at any rate, the choicer varieties, whence the designation of "city" wood. Other islands were found to produce mahogany, some of it, notably that from Cuba, little, if at all, inferior to the old "city" wood, and from these we now import most of the Spanish. Mexican mahogany is also of good quality.

As regards figure and colour, Honduras mahogany, commonly spoken of as bay wood, is inferior, though otherwise it presents all the good qualities of the choicer kinds, *i.e.*, it is as reliable in work, and forms an excellent ground for veneering on. Most of the finest wood is cut into veneers which, according to the figuring, are known by various names, such as curls, feathers, and various fancy titles, not now so much regarded as formerly.

From what has been said about the extensive variety of qualities it will easily be understood that there is an immense range in price between the highest and the lowest. Fabulous sums have been given for choice logs, and though there are certain indications by which experts can form a fair opinion before cutting, the probable amount of figure cannot be accurately foretold. One may buy half a dozen logs supposed to be fit for choice veneers, and find them after all very ordinary stuff, while on the other hand a log from which nothing much might have been expected will supply veneers with the choicest markings. To give some idea of the high prices which logs have sometimes realised it may be said that they have sometimes reached four figures, or £1,000 per log. This seems almost incredible were it not that fine veneers are known to be beyond ordinary market figures, and to command "fancy" prices. However this may be, it has been stated on good authority that logs have been sold for the sum named. A well-known firm is reported to have given this figure for three logs, which, as was pointed out some years ago, would probably give a cost of from £5 at least per cubic foot.

It must not be imagined that all Spanish wood is finely figured, nor that all bay wood is plain, for though these are the general characteristics of the two kinds, instances are not unknown where the latter has been finely figured, indeed it is said that the three logs above referred to were Honduras. Spanish mahogany is sometimes spoken of as though the name alone would be enough to support its claim for figure, the fact being often overlooked that the stuff may have very slight markings, as most that shows any fine variety is used up in veneers. As Spanish is supposed in every instance to indicate a fine wood, so Honduras is taken as being very plain, and undeservedly so, for the quality of the timber depends very much on the situation in which the tree has grown. That from the low marshy districts in the south of Honduras is mostly plain, while that from further north approximates more closely to the genuine Spanish. In addition to American mahogany—including that from the West Indies—there are at least two other kinds, viz., the African and the East Indian varieties. These, however, even if they can be classed as true mahoganies, do not enjoy the same repute as the others, as the timber is inferior in many respects. It is also probable that other varieties from different parts of the world, closely resembling the real mahogany, find their way into the market, and are sold under its name, for we find that the natural order of plants which produce similar timber is very widely diffused in tropical and sub-tropical climates. Among them may be mentioned the West Indian or Barbadoes cedar, which is often used for making Havana cigar boxes.

Perhaps a glance at the subject from a botanical point of view may not be uninteresting, though it must be confessed that for workshop purposes it may not help us much; however, if it does nothing else, it will at any rate help us perhaps to understand how and why there are, for example, an East Indian and an African kind, and how it is they differ, although generally spoken of as mahogany.

The real stuff from the West Indies and America is from the tree *Swistenia mahogani*, one of the natural order of *Cedrelaceæ*. Its growth is slow, and from the immense size of some of the trees, which often reach 80 to 100 feet in height, with a trunk 6 feet thick, it has been calculated that many of them must have been growing for approximately 200 years. As has been incidentally mentioned, those grown on low swampy ground produce inferior timber. Perhaps owing to the great difficulty of transportation from the place of growth to the port of shipment, there is an increasing tendency to deterioration in quality. The best accessible trees have been felled, and as distance from the coast increases there is less possibility of picking and choosing; the trees instead are taken as they come.

East India mahogany is produced by the *Soymida febrifuga* or Rohuna tree; as its name almost implies, it, or rather its bark, is occasionally used medicinally as a febrifuge. The bark of the mahogany tree has also been used for the same purpose.

African mahogany is the produce of the *Khaya Senegalensis*; West Indian cedar, or, as it is often familiarly called, though erroneously, mahogany, is supplied by the *Cedrela odorata*.

All of them belong to the natural order *Cedrelaceæ*, which includes many other kinds of woods, that best known perhaps being satin-wood, which, apart from its distinctive colour, bears a very marked resemblance to mahogany in figure and general marking.

Every one who is accustomed to handle it knows that mahogany is a reliable wood—pleasant to work, and susceptible of a high degree of finish. It is obtainable in large planks clean and sound, *i.e.*, free from knots and shakes. One sometimes hears that really fine mahogany is difficult to procure nowadays, or even that it cannot be got. This, however, is hardly correct, for there is no doubt whatever that by care and the payment of sufficiently high prices, mahogany of the very finest figure is still to be purchased. Naturally, it will not have the fine dark colour of old mahogany, but that will come in time, unless, indeed, the stains which, at the request of ignorant purchasers, are so freely used to give an artificial appearance of age have a prejudicial effect. Stains may produce a pleasing appearance on new wood, but it may very reasonably be supposed that the benefit is only a temporary one, and that instead of improving as time goes on the colour will be anything but agreeable. If any mode of artificial darkening be resorted to that by ammonia vapour is the least harmful, and gives a nearer approach to the colour of old mahogany than any other process. Of few woods can it be said that they improve with age, but mahogany is certainly one of them; but to let old Father Time have fair play the wood should be simply oiled, or at most French polished without any staining. Of course, I do not refer to that very inferior wood, which hardly deserves the name of mahogany, so largely made up into furniture in the East End of London, and either coloured a fiery hue, or, if it is made up into "second-hand stuff," a dirty brown. The natural colour of such wood ean hardly be spoilt, but on the other hand the practices that prevail to give it a good colour, or what is supposed to be such, cannot be spoken of in terms of commendation.

Very much more might be said about mahogany, and there can be little doubt that the intelligent worker would occasionally derive more pleasure from his work—or from his materials—did he know a little more than is commonly the case about them. By way of a few suggestions on mahogany in this direction the foregoing remarks are offered to those who take some interest in knowing all—or at any rate something—about everything they come in daily eontact with

It is not, however, only as a furniture wood that mahogany is useful, though naturally the choicer varieties are reserved for this purpose. Its use in ship-building has already been referred to, though, notwithstanding the fact that its durability is so great, it does not receive the highest class at Lloyd's, a fact which may be accounted for by the best sorts not being employed for the purpose.

BICYCLE PLATING, BISMUTH, AND BLOODSTONE.

BY GEORGE EDWINSON BONNEY.

Bi.—The prefix "bi" means two, and is synonymous with the prefix "di." Thus dioxide and binoxide have the same meaning, viz., two atoms of oxygen.

Bicarbonate of Potash. See *Potash.*

Bicarbonate of Soda. See *Sodium.*

Binoxide of Mercury. See *Mercury.*

Bisulphide of Carbon. See *Carbon Bisulphide, etc. etc.*

Bicycles.—New bicycles are usually sent to the plater in pieces, fresh and clean from the maker's hands. The various pieces are cleaned and treated as pieces of steel to be plated.

If the spokes of the wheel are sent separate, they should be slung together with stout copper wires so as to form a ladder of spokes, and these hang in the dipping and bath solutions. The rim of the wheel is plated in sections when the bath is not large enough to take the whole wheel. These sections must be so arranged in the bath as to cause the deposit on one section to overlap the ends of the other section. Old bicycles must be taken to pieces. Every part that can be unscrewed must be separated and cleaned separately. Clean first with emery, then with a leather buff charged with Trent sand, and polish off with Sheffield lime. As high polish as can be obtained should be given to each part, and then they should be transferred to a strong potash bath to remove all the grease. It is sometimes advisable to brush the pieces in the potash liquor, then rinse them and scour by hand. They are then again rinsed, placed in the acid dip, well rinsed in clean water, and transferred at once to the plating vat. As it is not always practicable to take the wheels to pieces, these may be plated entire. When the parts are plated they are rinsed in clean hot water, dried, and finished with lime, that is, well polished with Sheffield lime applied on a dolly revolving in a lathe. The wheels are polished by hand with chamois leather.

Detailed information on this subject, illustrated with diagrams, is given in Mr. A. Watts's book on "Electro-deposition," to which the reader is referred.

Bismuth.—Chemical symbol Bi., combining weight 210, specific gravity 9·8. A reddish-white metal of a highly crystalline and very brittle character, found with the ores of nickel, cobalt, copper, and silver. It melts at a very low temperature, 507° Fah., and expands so much on cooling as to occupy $\frac{1}{32}$ more space when cold than it does whilst in its melted state. When strongly heated, it burns with a blue flame and forms an oxide of bismuth. It dissolves freely in nitric acid. Bismuth is an important ingredient in the composition of fusible alloys and soft solders, its presence contributing largely to their fusibility. See *Fusible Alloy*, *Stereotype metal*, *Type metal*, *etc.*

Bismuth is electro-positive to eopper, silver, mercury, platinum, iridium, osmium, gold, antimony, and carbon. It is electro-negative to tin, lead, cobalt, nickel, iron, zinc, manganese, aluminium, and magnesium. Plates of bismuth, I must not omit to say, form the positive element and plates of antimony the negative element in some thermo-electric batteries.

Bisulphite of Carbon. See note on *Carbon Bisulphite* and *Brightening Solution.*

Bloodstone.—The name given to the stone used in the manufacture of best quality burnishers. It is generally supposed to be a variety of a native oxide of iron. Mr. Bloxam in his book on metals, says: "*Red Hæmatite* has been so called from the Greek word signifying *blood*, on account of its dark red colour, and is sometimes erroneously called *bloodstone*—the true bloodstone being a dark green variety of silica (*heliotrope*) with red spots. In appearance it is the most striking of the ores of iron sometimes appearing in rounded masses, having externally a liver colour with considerable lustre, and internally made up of layers having the appearance of the thick shell of some huge fruit, or of bundles of fibres which look like petrified wood. The specific gravity of this variety is about 5·0. Such specimens are, in general, remarkably hard, and are useful for burnishing metals."

The lumps of this substance that are used for burnishers are held in the ends of metal tubes by solder. See remarks on *Burnishers.*

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

THE COMPOUND KALEIDOSCOPE.

THE engravings which accompany the present article illustrate a new type of kaleidoscope, combining in one instrument many important properties, which may be briefly stated as follows:—

In the simple form a defect was referred to which mars the symmetry of the picture, caused by the interposition of a blank space at the junction of each direct and inverted image, equal to the thickness of the glass of which the mirror is composed. In the present case this is obviated by silvering the first surface of the reflectors in place of the posterior surface, so that each image merges directly into the adjoining one, forming, when the reflectors are placed at any angle which is an *even* aliquot part of a circle, a series of sectors arranged with beautiful regularity round a common centre; the number of sectors being always equal to the number of times that the angle formed by the junction of the mirrors is contained in a complete circle, or 360 degrees. The reflectors are so mounted that the angle can be varied at will, and clamped in any position, within a limit of 72 degrees, by means of a pair of milled heads (A and B, Fig. 5) at the back of the instrument, which actuate a pair of pinions sliding in vertical slots, and working in racks attached at each end to the inside of the case. The mirrors recede from each other at their upper edges on turning the head (A) in the same direction as the hands of a clock move or clockwise, and approach each other when the head is turned contra clockwise. One of the reflectors is shown at the extreme limiting angle in Fig. 2. In order to produce annular or arched and rectilinear pictures, the reflectors are moved apart at their lower edges by a motion the reverse of the preceding, and of which it is quite independent, viz., by turning a milled head (C, Fig. 5), which is secured to a pinion rotating in bearings at each end, and moving in opposite directions a pair of racks attached at their ends to the arms (K), which support the reflectors. A second milled head (D) acts as a clamp. The reflectors can thus be separated to a distance of 2 inches, and parallel to each other, as shown in Fig. 1, any intermediate position, either oblique or parallel, being obtainable on turning the heads A or C as required. The whole instrument is capable of being rotated through an arc of about 170 degrees, the rings shown at X (Figs. 1, 2, and 5), secured to each end of the instrument, being supported by the uprights (V), the upper ends of which are hollowed to fit the rings, thus

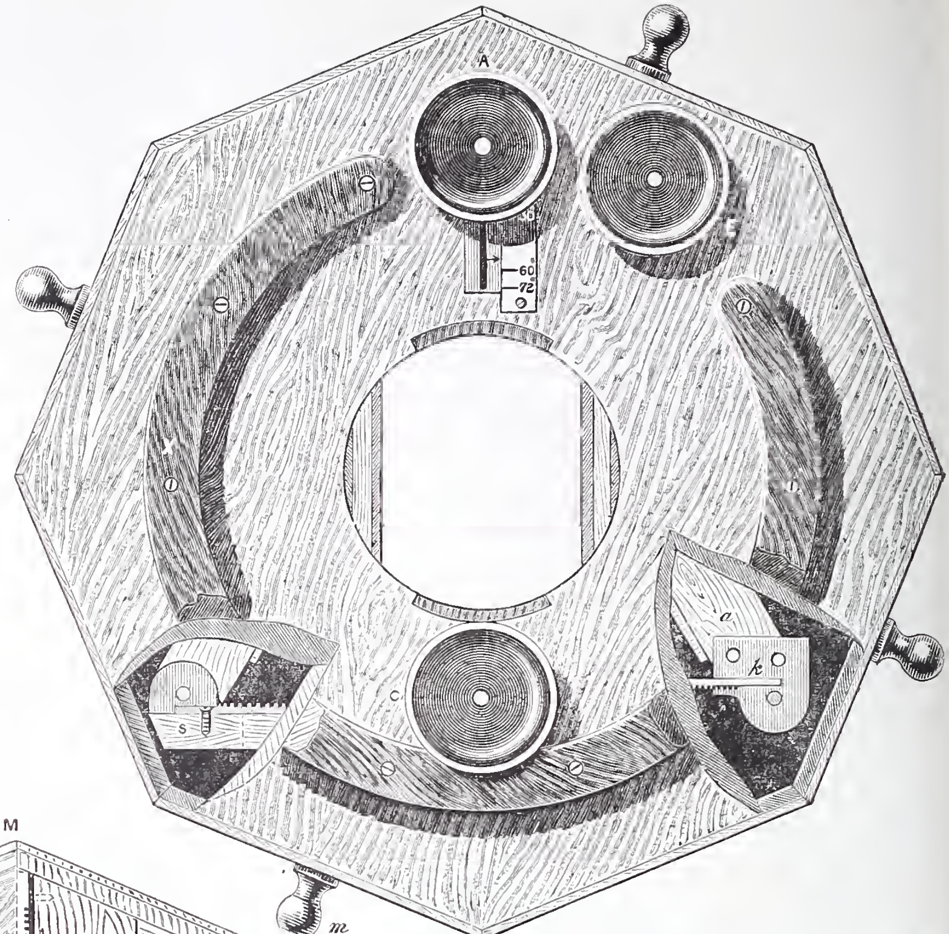


Fig. 1.—Elevation of Eye End of Compound Kaleidoscope, showing Mirrors parallel to each other, with Portions of the End Plate removed to show Method of attaching Rackwork and Slide to the Arms which carry Reflectors. (Scale, half size.)

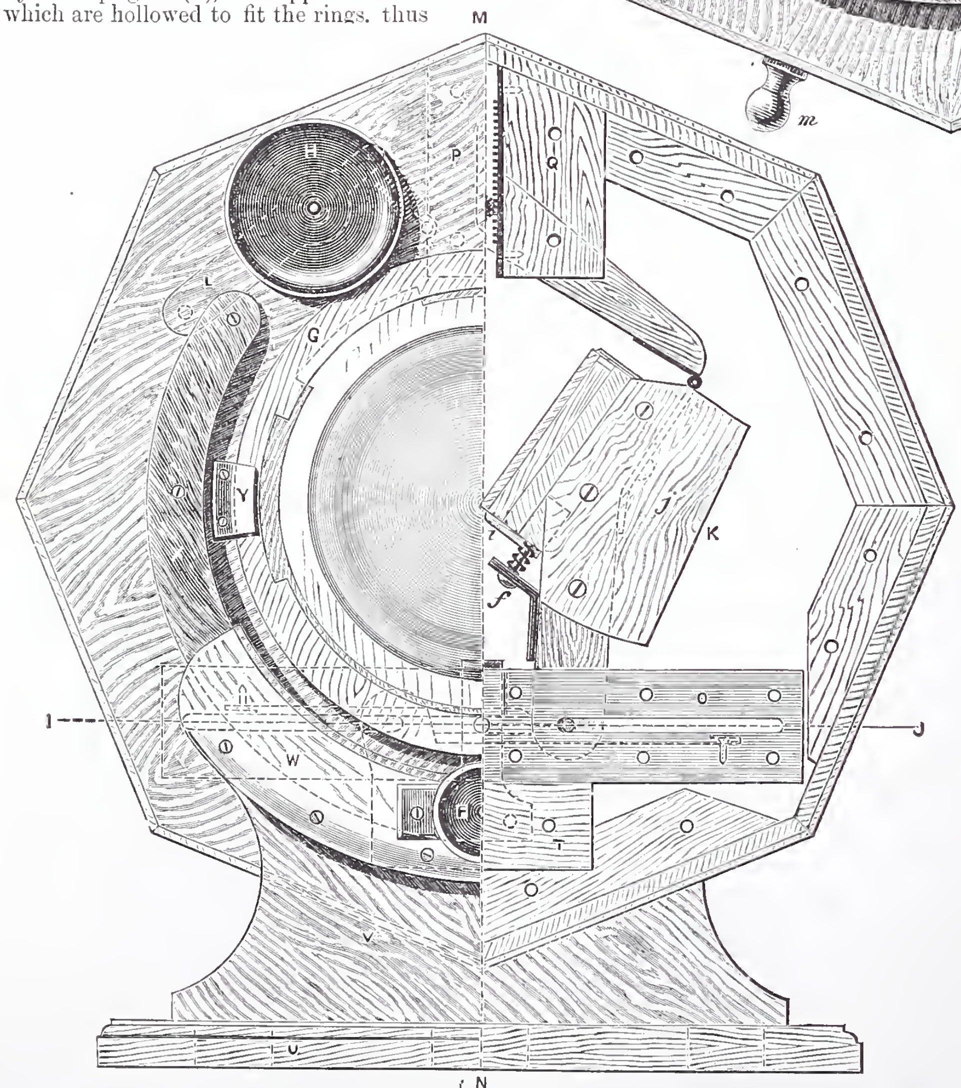


Fig. 2.—Elevation of Object End. One half of the End Plate and the Slotted Vertical Plate P is removed to show Interior. (Scale, half size.)

forming a bearing, and the necessary leverage is provided by the handle seen at *m* (Fig. 1). By means of a milled head at F (Fig. 5), this motion can also be arrested to admit of the picture being copied. The object box is enclosed in a carrier (G), which allows of continuous, clockwise rotation, through the medium of a small rubber-covered disc of wood (H, Figs. 2 and 5), actuated by a milled head, seen at E (Fig. 1), the tension of a coil spring applied to the end of a lever (L, Fig. 2) being sufficient, on turning the disc, to transmit motion to the carrier. In addition to the advantages already enumerated, other accessories, rendering the instrument still more complete, will be described and figured in due course. Meanwhile, sufficient explanation has been given to make the reader conversant with the motions of the several parts before us, and we may now turn our attention to the various details involved in its construction.

It may be argued that were the instrument constructed entirely of metal, the mechanism necessary to produce the several motions recorded above might have been enclosed in a circular tube of very much smaller dimensions than the one here presented; but to have carried out the idea in a confined space would have required an amount of precision in the use of tools seldom attained by any but professional hands. Sacrificing space in order to avert the exclusion of the amateur mechanic, I have endeavoured o so combine wood and metal in its construction as to avoid having recourse o any particularly delicate mechanical operations, the pieces composing it being on that account relatively larger than would be the case if of smaller compass, as it is much easier to file up a level surface an inch wide than one of half or quarter that width; and the same remark applies with equal force to woodwork; therefore, wherever possible, pieces of wood having a small sectional area should be prepared in lengths of 12 or 15 inches.

To those who contemplate engaging in the project, I would suggest at the outset the production, on cardboard, of a full-size drawing, with the aid of the description, where necessary, so that the dimensions of the several parts can be obtained without the trouble of further calculation. Further, as being principally of wood, every care should be exercised in its selection, nothing being allowed to pass muster, especially where lathe work is concerned, except well-seasoned, close-grained mahogany. In the pieces composing the support and sides of the case a more open grain is admissible, although if it is intended to be French polished, it would be well to have the outside of uniform grain throughout for appearance' sake.

Before attacking the woodwork generally, there are a few trifling patterns of the brasswork which it will be well to prepare, so that the castings (which should be thoroughly sound) may be ready to hand when wanted. They comprise patterns for the milled heads shown in Figs. 1 and 5. First turn a pattern for C (Fig. 5); as this will be moulded shank downwards, the latter must be tapered slightly from the point upwards, omitting the hollow shown in the diagram, as also the groove on the edge, which must be tapered in the same direction as the shank. The same pattern will serve for the heads A and E; $\frac{1}{16}$ in. all over the surface must be allowed for turning. One pattern each is also required for the heads B, D, and F, and a plate into which the latter is screwed ($1\frac{3}{4}$ in. long, $\frac{5}{8}$ in. wide, and $\frac{1}{8}$ in. thick), with a circular boss cast on one side as shown. Other materials in metal required are some pieces of brass tube: one piece for sliding pinion, $7\frac{1}{2}$ in. long, and $\frac{1}{4}$ in. outside diameter; with a piece to slide over this $5\frac{1}{4}$ in. long; a piece for the stationary pinion, $7\frac{1}{2}$ in. long, and $\frac{1}{4}$ in. outside diameter. To support the arms which carry the reflectors we require two pieces $7\frac{1}{2}$ in. long, and $\frac{1}{4}$ in. outside diameter; two pieces $5\frac{1}{4}$ in. long, to fit the exterior; and two pieces of steel rod ($8\frac{1}{4}$ in. long) to fit the interior. The best material for the latter would be silver steel wire, such as is used for drills and taps, and sold in 12-in. lengths by dealers in watch and clock materials.

The rackwork figured has thirty-seven teeth in 2 inches, and the pinion wire has twelve leaves. One length of pinion wire and three pieces of rackwork 7 in. long are required. They may be procured from Messrs. James Lancaster and Son, opticians, of Birmingham. A letter enclosing P.O. for 3s. 6d. would, I am persuaded, meet with prompt attention, if addressed to the above most obliging firm.

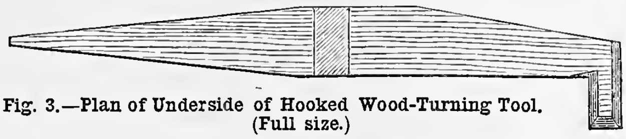


Fig. 3.—Plan of Underside of Hooked Wood-Turning Tool. (Full size.)

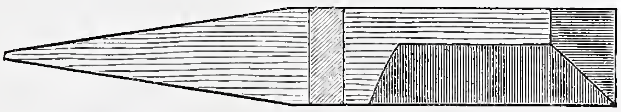


Fig. 4.—Plan of Underside of Side-Cutting Wood-Turning Tool. (Full size.)

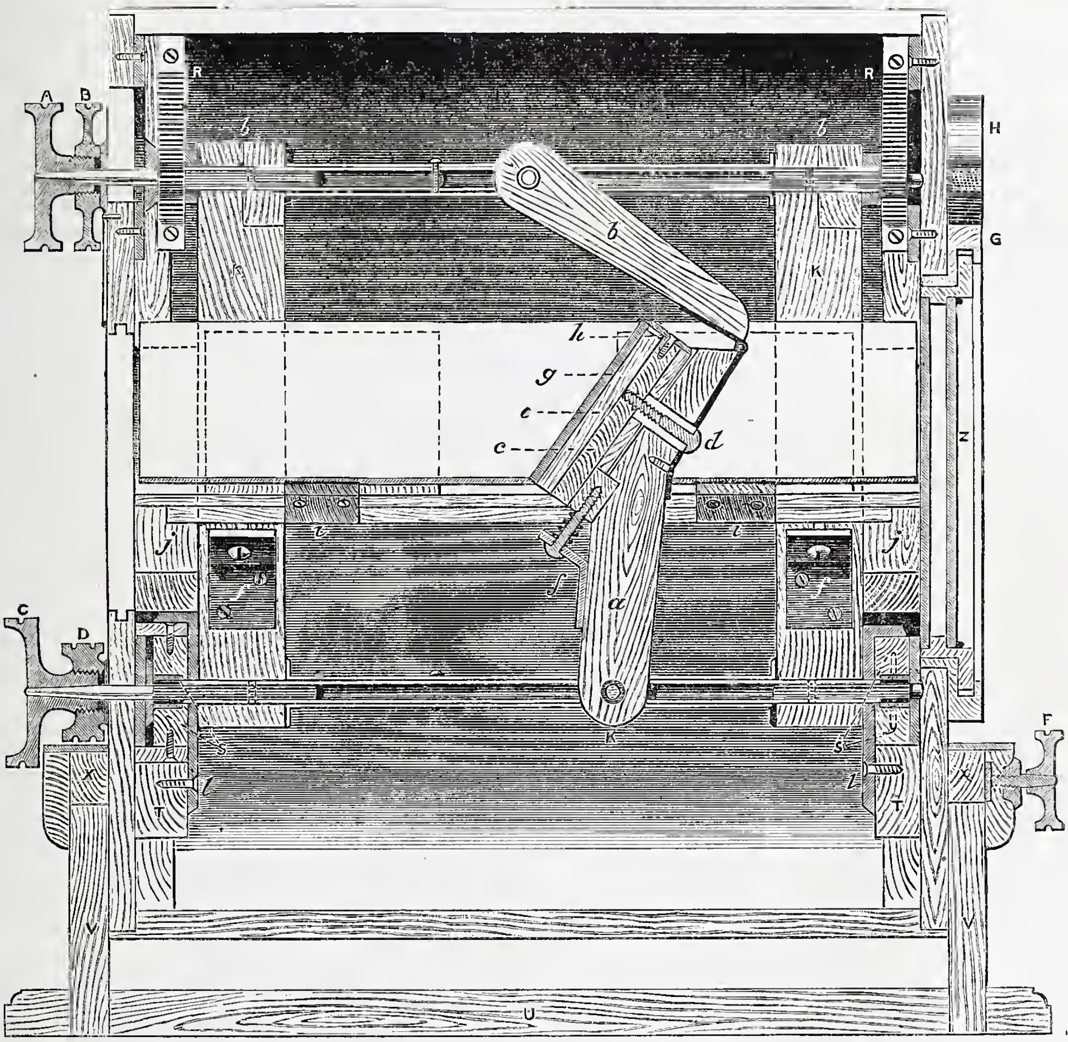


Fig. 5.—Sectional Elevation on Line M N in Fig. 2, showing also Portions of Interior (Mirrors Inclined) and Section through Centre of Arm. (Scale, half size.)

We will commence operations by turning the carrier for the object box G (Fig. 5). For this we require a piece of specially sound, close-grained mahogany, $5\frac{1}{2}$ in. square and $\frac{3}{4}$ in. thick. At $\frac{5}{8}$ in. from the edge, set off four holes, one at each corner; bore these to pass a $\frac{1}{4}$-in. screw, and countersink them, so that the heads shall not be less than $\frac{3}{8}$ in. below the surface; if necessary, level the other side, and fix to the true face of a hard wood chuck. Having trued up the face, find the centre as it spins, and scribe a circle with the compasses, $4\frac{1}{4}$ in. diameter, which is the size of the opening in the object end of the case; outside this circle turn down to a shoulder, barely $\frac{5}{16}$ in. deep, so that when in position it may not project beyond the edge of the opening into the interior. Scribe a line $\frac{1}{2}$ in. beyond the shoulder, and remove it from the chuck, replacing it with a piece of $\frac{3}{4}$-in. deal, 7 in. square; true up the face, and bore to fit the part already turned on the carrier. Cut off the superfluous corners of the latter, and if not sufficiently tight to drive by friction, fix with a couple of screws an inch or so from the centre. Thus secured, true up the face and the edge square with the same to $5\frac{1}{8}$ in. diameter. Now scribe a centre line across the face, and sink a recess $\frac{1}{4}$ in. deep and $4\frac{3}{8}$ in. diameter, with a groove flush with the bottom, bored with a special hooked tool shown as viewed from the underside in Fig. 3. Another tool, which may be made by grinding a firmer chisel at the side, as in Fig. 4, will be found most suitable for finishing the interior portion, which may next be bored to $3\frac{7}{8}$ in. diameter. Using the centre line as a guide, set off an opening at each side, as shown in Fig. 2, and carefully remove a portion of the outer edge of the groove with a dovetail saw and gouge, so as to admit a similar pair of projections on the object boxes, forming what is known as a bayonet joint. Each end of the case is formed of a piece of mahogany, which, for convenience' sake, we will distinguish by the term "plate." These plates measure $9\frac{1}{2}$ in. across the corners, and $8\frac{13}{16}$ in. across the flats. The back plate at the eye end is $9\frac{3}{4}$ in. square, and $\frac{7}{16}$ in. thick to commence with; one face is dressed with a trying plane until it will lie without flexure close to the true face of a wood chuck, on which it is to be mounted by a screw at each corner. To ensure the plate being left of the same thickness throughout, a straightedge must be diligently used to test the surface until it is quite level; then reverse it on the chuck, and reduce it with equal care on this side also to a thickness of $\frac{5}{16}$ in.

Here I must pause to mention the necessity to provide a steel scriber, having one end sharpened to a needle point, and the opposite end like a turning chisel. Mark the centre lightly and exactly at this point with the cutting edge; mark the centre line, M N, right across the grain, and $2\frac{3}{16}$ in. below the centre; scribe the line, I J, perpendicular to M N. We also require three circles on this face of $9\frac{1}{2}$ in., $4\frac{1}{4}$ in., and $2\frac{3}{4}$ in. diameter, respectively, the last-named being the size of the opening for the eye-piece. It may now be bored out, and a groove produced on its edge of the same character, and to serve a similar purpose as in the carrier, the whole being made as smooth as possible with the finest glasspaper.

Following the same directions with the front plate, set off the centre lines and a circle $4\frac{1}{4}$ in. diameter; after removing the central portion, work carefully up to the line, so as to fit the carrier neatly; the surface which comes in contact with the latter to be finished by rubbing with a piece of Nixey's blacklead, in order that the carrier may slide smoothly within it.

WHY FURNITURE IS VENEERED.

WITH REMARKS ON SOLID WORK, ETC.

BY DAVID ADAMSON.

I MUST altogether dissent from the remark about it never being "worth while to buy furniture veneered with mahogany, for a little extra cost may procure the same articles in solid wood," as it is quite inaccurate, if it may be assumed, as I presume it may be, that the furniture, whether solid or veneered, is to be good, that is properly made and finished. If it is to be only common Curtain Road stuff, then certainly the case is rather different, for rubbish can be had at almost any price.

The fact is that the cost is not altogether regulated by the wood being veneered or not, *i.e.*, so far as labour is concerned. It depends far more on the value of the veneer. Now, if we are to understand that any article veneered with finely figured mahogany is to be had made solid of equally finely figured wood, I am afraid the difference in cost would rather startle any one. On the other hand, presuming that the fine veneer is laid on a mahogany base, as it generally is in good work, and that this or a comparatively plain mahogany is worked up solid without veneer, then the solid form would be very much less than the other. Hence there is no cause to wonder at a solid oak table having been obtainable at a smaller price than a veneered one. Given equally good wood to serve as a foundation for veneering on, or to be finished without veneer, it stands to reason that a veneered piece of furniture will cost more than a similar article unveneered. It cannot, however, be expected that a really choice wood—I refer, of course, only to the more valuable kinds—is to be used solid. To do so, apart from other considerations, would be simply a waste of material, or if this is too sweeping an assertion, let it be said that few would be willing to pay the enormous difference in cost for any ordinary article to be made of solid wood fit for high-class veneers.

If, as sometimes happens, pine is the wood on which the veneer is laid, and the veneer not of the most costly, then it would not be incorrect to suppose that a plain solid mahogany article would cost a little more. In the one case we have a fine, handsomely marked surface with a pine backing, in the other a plainish piece of wood, but solid. Of course, the notion of pine may not be agreeable to some, but there is no doubt that for many positions it is quite suitable; and that apart from its softness, it is, when selected with care and proper knowledge, by no means to be despised. I do not advocate its use as a foundation for really fine veneers, but I must confess that for comparatively cheap work, it seems to me that there can be no more objection to veneering pine than to staining pine, say, walnut or mahogany colour, and polishing it. The greatest purist hardly objects to the latter; indeed, some of them rather suggest that it is a very appropriate way of finishing pine furniture, but why veneered pine should not be equally so, I am at a loss to understand. The only reason can be that those who object to it have had the misfortune to meet with some uncommonly bad specimens of furniture of this kind, and that on them they have too hastily formed opinions. The critic of woodwork frequently does so, or those acquainted with the trade of the cabinet maker would not be so much amazed as they are sometimes with the extraordinary statements made with all the confidence of an intimate knowledge of the subject. That good and bad furniture is made cannot be disputed, but the former is always to be had by going to respectable cabinet makers and paying a fair price for it. The individuals who, without any practical knowledge of the subject, but with an overweening confidence in their own ability to distinguish between the false and the true in quality of wood or workmanship, and it may be added, actuated by an unhealthy desire to pick up bargains, rely on their own judgment, are principally to be credited with the immense quantity of slop furniture which is made and sold. It is not made for sensible people, but for the other sort; and as according to the sage of Chelsea, the majority belong to this other sort, it would be very remarkable if a certain proportion of furniture as well as other things were not prepared for their special delectation.

It is sometimes erroneously supposed that articles of furniture are veneered solely that the profit of the maker may be unduly increased, and it is not uncommon to hear a would-be purchaser inquiring if such and such is solid, apparently under the notion that it will be worth more, or be better value if it is. I don't think any honest tradesman would hesitate to say which parts are solid and which are veneered; but sometimes the discovery that a particular thing is veneered comes too late to the user, and disturbs his peace of mind. To do what I can to restore it to any who may happen to read these pages, let me say that, if the things were sold by a good, reliable cabinet maker, or, rather, made by one, that whatever the construction is, they may be depended on. With regard to solid work, there is a point which is liable to a slight misconception, viz., when wood of the same kind as the veneer is used for the foundation; let us say, for example, a mahogany sideboard top. This, for the sake of the extra beauty of surface, might be veneered, but to distinguish it from pine, similarly veneered, it would be called a solid mahogany top, if referred to, by many tradesmen. The fact of the surface being veneered by no means prevents its being a solid mahogany top, as it really is; the error, if any, in description being merely that it is not stated to be composed of two thicknesses. I merely mention this, as I have heard of people supposing themselves to have been deceived by statements about solid wood, but almost invariably it will be found that their questions leading to them have not been sufficiently explicit to elicit a correct answer. I trust, however, I have said enough to show that veneering should not be indiscriminately condemned, and that when properly done, it is not only a judicious, but sometimes a necessary, method of working up a material. I think all the more common forms of objections to it have been discussed in such a way as to dispel from the reader's mind any prejudice he may have insensibly formed against veneering. Though much more might be said to the same purpose, we may take leave of this part of the subject, and concern ourselves with the practical work of veneering. In connection with this, I may say that many different methods are adopted, and that in competent hands they are all capable of producing good results, some better than others, but none of them utterly bad. Do not, therefore, let it be thought that if no allusion is made to some favourite mode of preparing or laying veneers, or I may go a little farther and say, that if some other is stated to be better, that it is done with any intention of inducing practised artisans to abandon their old systems of working. I am quite prepared to admit that any method which has been found in practice convenient and durable, is just as good as any which may be mentioned by me. I am not bigoted, and would let every one practise his own method, *i.e.*, any one who is competent to form an opinion, or is an experienced craftsman; so, good readers among these, don't think I wish to disturb you in your present modes of veneering, but at the same time, please remember that the operations to be described, however they differ from yours, are also quite reliable. I say this with full knowledge that the practice of veneering is subject to many variations in detail, and that men equally competent to form sound opinions differ materially in their views as to what is best; also, I cannot forget that discussions about practical methods are not always carried on with that freedom from acrimony which is desirable. May I therefore suggest, that any one who can add to the lamentably small amount of published matter on veneering, will do better by sending on an account of his methods, than by simply contenting himself with saying that the present writer "is altogether wrong." The following instructions are based on a fairly wide experience of the methods generally practised, but there is no assumption that all the methods in particular shops or istricts are known to me, and I for one hall be grateful to those who are able to uggest improvements. This, however, can nly be done by experts, for veneering is a elicate operation. The present seems to be n opportune time for some addition to the terature of veneering. Many of our younger rtisans are practically ignorant of the pro- ess, which in the immediate future bids air to be more practised in connection with ood work than it, till very recently, has een for some years. Unless it is performed y competent hands, it will soon prove un- eliable, and without saying that the art of eneering is ever likely to be lost completely, ull advantage may not be taken of its apabilities.

To the young workman—I mean the pro- essional—I would therefore especially ad- dress myself, while I hope making my re- marks so plain that they may be easily followed by the amateur who may be in- clined to turn his attention to veneering. As the needs of the latter class of workers must be considered, the following instruc- tions and remarks must necessarily contain much that may seem superfluous to those who have even a modicum of experience acquired in practical workshops, but no doubt, though I may appear prolix, they will forgive me now that I have stated the reason. If such a thing be possible, I want to help those who have hardly seen a veneer till after it is laid, who have not the slightest idea of either caul or hammer-laid veneer, or, indeed, anything about the work to set about it intelligently, with results that will neither be disappointing to themselves, nor yet afford opportunity to their most critical friends to find fault with it.

Of course, it will be readily understood that for any written instructions to be of much use, the learner's co-operation is needed, for unless this can be given the novice need not hope to profit by the plainest directions. In the practice of veneering, the beginner is sure to encounter difficulties; he must make up his mind for that, for success de- pends very largely on judgment as well as care and knowledge of what to do. He should not commence operations with large or costly veneers, nor attempt to lay these until he has had some practice with the commoner kinds.

This, it may be said, applies specially to the amateur working alone and not able to command the assistance usually available where several artisans are working together, in case of anything going wrong unexpec- tedly. The young professional's foreman may safely be trusted to see that he does not make his maiden effort at veneering with any valuable material, and, indeed, he should be guided exclusively by his foreman, notwithstanding that his details may pos- sibly differ from anything written here. Directions in WORK are written to aid be- ginners, not to supersede their employer or foreman's preference for any course of manipulation, and, perhaps, they will pardon my hinting that some of them are just a trifle inclined to air their very superior knowledge of a method which they have seen described "in print." This may in itself be better, but for yourself your em- ployer's is the best in the meantime. Forgive my plain speaking, but if you will take the advice, it may save you now and again a little unpleasantness with your "boss," in which you are sure to get the worst of it. But this is in danger of leaving me to talk of behaviour in the workshop instead of dilating on veneering, and the way in which this kind of work is done.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

86.—JONES'S STENCIL PATTERNS AND CUTTINGS.

MR. G. JONES, East Cowes, Isle of Wight, Decorator to her Majesty, and Designer and Stencil Cutter to the trade, has sent me for inspection and notice a few of his cut stencils and patterns. I have never had the pleasure of seeing patterns that can be surpassed for beauty and excellence of design, nor have I ever had the satisfaction of handling patterns as well cut and as well tied, for my readers will readily understand what an important factor tying is in stencil cutting, inasmuch as the stability and endurance of the perforated sheet, if I may apply such expressions to this work, depend entirely on the skill of the designer in this respect and the care of the cutter in confining himself precisely to the outlines of his designer, and keeping his knife exactly in the tracks thus laid down for him, jealously guarding the passage of the tool a hair's breadth beyond the termination of any two lines, whether straight or curved, that meet at a greater or less angle in any point of the pattern. Mr. Jones's patterns were accompanied by a long roll of stencillings, from plates many of which are much longer than the patterns sent, and which exhibited a boldness of design combined with delicacy of execution and manifest comprehension of the effect to be obtained when the pattern is reproduced on the walls or ceiling of a room, in colours contrasting with the ground or repeating the ground in deeper tints, that it would be difficult to excel or even to equal. It is really a matter of difficulty to single out any patterns for special commendation where all are good, but there are two to which I may call special attention, from the fact that they form part of the decorations in stencil of her Majesty's residence at Osborne, and which, on this account, may be regarded as patterns of more than usual interest. One of these is a floral ornament of great beauty and simplicity which appears on the panels of the ceiling of the Queen's private chapel, and the other an ornament of the same character, exhibiting a pleasing arrangement and adaptation of the national emblems of England, Scotland, and Ireland—the rose, thistle, and shamrock—which forms part of the decoration of her Majesty's council chamber. Mr. Jones's stencil patterns are all distinguished by numbers, and, in accordance with this plan, I may say that the former is distinguished as No. 7, and the latter as No. 10. I venture to suggest to Mr. Jones that he should have a book of his patterns in miniature prepared, in the same manner adopted by Mr. Henry Zilles, Messrs. Harger Bros., and Messrs. J. H. Skinner & Co., and others, so that intending purchasers may be enabled thus to judge of the suitability of the patterns for their purpose before giving their orders. I presume that if Mr. Jones had such a book, he would have sent me a copy of it with his stencils. With each pattern its size, that is to say, its length and greatest breadth, should he stated, and the purpose it is chiefly intended to serve. The price, also, should be named.

Some of Mr. Jones's stencil patterns are intended to render assistance in graining. These are known collectively by the name of the "Arcundian Oak Grainer," and are sold in sets, more or less, I presume, in number. The set supplied at 5s. comprises seven different patterns which are cut to follow on to any length. The directions given for using the "Arcundian Oak Grainer" are as follows:—"Rub in the work very smoothly and clean with graining colour. Comb first with coarse and then fine comb. When the work is properly dry, leather it over with a little whiting and water. Place the grainers where required, and stencil on the veins with Vandyke brown and water, care being taken not to have the brush too wet (an ordinary sash tool answers very well). You will find by rubbing the brush to and fro, instead of dabbing, the veining will come out much cleaner." For oil-graining colour, raw umber should be used, mixed with boiled linseed oil and turps. The following are Mr. Jones's directions for water-graining. Rub the work in very quickly with Vandyke brown and water, and stipple it clean. Comb and proceed as in oil-graining, except the whiting and water. If the graining is required light, place the grainers and sponge out the veins.

Reverting once more to the stencil patterns, there is one of special excellence to which I feel bound to call attention. This is pattern No. 155, in which flowers of the daisy type, conventionally treated with foliage, all symmetrically arranged, rise from a vase of simple design, but producing a remarkable effect by the clever manner in which ornamental bands in the ground colour are contrasted with the dark hue of the oak.

87.—THE NEW WATERPROOF LIQUID GLUE.

I am loath to be in any way behindhand in bringing under the notice of my readers anything that may prove to be a valuable invention, and as pressure of work on my time is so great just at present as to prevent me from making any particular tests of the "New Waterproof Liquid Glue," of which a sample has been sent me by the New Glue Company, Grange Yard, Valley Road, Shipley, near Bradford, Yorkshire, I have elicited from the Company statements which lead me to draw the following inferences with reference to the speciality they are now prepared to supply.

The New Waterproof Liquid Glue, just placed on the market, is a step in the right direction, and marks an area in advancement towards perfection so far as the production of that indispensable article glue is concerned. The trade mark "Water Glue" fairly describes its leading qualities. Being always liquid, it is always ready for use, requiring no boiling. It sets quickly, and when thoroughly dry will bear lengthened exposure to water without visibly decreasing in strength. In every household, how often have articles come asunder, the glued joints having succumbed to the invisible but deadly enemy, damp? To those who use the Water Glue, such a thing cannot happen. The amateur carpenter and joiner will find a true and trusty friend in this glue, always ready, reliable, and strong. Canoe and boat builders will at last obtain a watertight joint without the aid of the troublesome pitch pot. To builders of model yachts, the Water Glue will be highly welcome, as built models, by its aid, can now be planked up with the certainty of being watertight afterwards. For cyclists, this glue, used as a liquid-tyre cement, will supply a long-felt want. Workers in metal will find it invaluable as a means of causing leather to adhere to smooth metallic surfaces, and it can be used as a lacquer for polished metal, giving it a good colour, and being perfectly impervious to water. It is made up in tins containing 2, 4, and 8 fluid ounces, sold respectively at 3d., 6d., and 1s. per tin by all chemists, ironmongers, and oilmen.

I asked the Company to give me some idea of the merits claimed for it over Le Page's Carriage Glue, a preparation which has hitherto been found most useful of its kind. They claim that taking equal quantities of each, and comparing prices, the Water Glue is cheaper, and that Le Page's Glue is not waterproof or even damp-proof. The American Glue, if allowed to stand in a cold place, will solidify so much, that the pot must be heated by standing it in boiling water. Water Glue is always ready, and can be used for all purposes that Le Page's or any other glue can be used for. I intend myself to give this new glue a trial at the first opportunity, and I trust that those of my readers who may procure and make trial of this new article for public favour will give me an account of the results obtained.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

About Work. — GENIUS writes: — "I was pleased when I read T. O. P.'s letter on July 13th in reply to J. P. A. I fully endorse his remarks, and I am really surprised that such wise individuals as J. P. A. should ever think of subscribing to WORK. If he is such a practical man as he professes to be, why on earth, Mr. Editor, do you not put him on your staff? He would be the right man in the right place, just as WORK is right, and in its right place. WORK is a stepping-stone to mechanical ingenuity. By the aid of WORK many will be led to think and undertake work they never dreamt of. Well, Mr. Editor, I am an amateur worker. I have been practising and inventing about fifteen years. I have made several articles all my own ideas, and was thinking of sending some of them for the benefit of the readers of WORK. But, ah! I stand aside; how dare I, when such men as J. P. A. are on the scene? they will be counted as twaddle."—[Send any papers you like on approval. I do not suppose they will in any way be twaddling.—ED.]

About Work.—W. B. (*Ince, Wigan*) writes:—"I beg to add my opinion to others who have written you week after week on the usefulness of WORK, and how they prize it, notwithstanding the few dissentients who think you could do better by treating only on the subjects that are useful to them. It seems very narrow-minded indeed, considering the wide range and different desires of your various readers that you are expected to supply with information on so many different kinds of work, that you should be expected to deal only with the subject adapted to their own particular calling or liking. For myself, I think a ramble through 'Shop' is well worth the price of the whole. A fellow-clerk of mine first called my attention to No. 1 of WORK through the presentation plate that was given with it—both of us do a little fretwork—and I found such useful information in it, and just the sort I had wanted a long time, that I have continued to take it ever since. I wish you every success in your work, and trust you will keep on the same lines as hitherto."

Tube Saws.—S. M. (*Skelwith Bridge*) writes:—"Seeing an article on tube saws in 'Shop,' I may say they have been in use in our trade for nearly forty years (bobbin-making). They are used to cut small circular blocks out of large timber instead of squaring with circular saw. They are made by W. A., Fell Bridge Iron Works, Windermere, and Gilkes & Co., Canal Iron Works, Kendal. They are made in all sizes down to $\frac{5}{32}$ in. to order. The process of making is by forging a piece of steel, boring out inside to diameter required, placing on a mandrel, and turning to size. Of course they revolve when in use, being fixed in a chuck at the end of a vertical spindle. The block of wood being stationary, they would be easily used, as your correspondent F. A. M. says, as the saws are about 10 in. long. I am glad to say that I have received many useful hints from WORK. I wish you success."

Correspondence.—GAUGE POINT (*Paris*) writes:—"I notice many questions remain unanswered. Give and take is the rule of space in correspondence in WORK, I suppose. I should like to see an increase of 'give;' it only costs a little well-spent time in writing and a half-penny wrapper round it marked 'printer's copy.' It does more good to the writer in his first attempts at stating facts than the writer is aware of. It starts his latent powers of thinking with a flow of ink after his thoughts. One illustration will suffice to explain how it did good. A foreman of a large shoptul of machinists and engineers noticed the superior manner adopted by one man in forging, hardening, and tempering steel springs, and said to him, 'You should write about your work.' 'But I cannot write—that is, fit to be read,' he replied. 'You are mistaken,' was the answer. 'Editors seek facts, and pay no attention to fitness of penmanship. You write mighty facts daily with your bellows, hammer, and tongs. You draw well, and chalk up your notes and marks all right that your mate can understand. Let me have those chalkings in pencil; I will see to the rest of the job; leave plenty of room between every line for my writing.' With much persuasion I got a capital succinct account of his mode of procedure that surprised me by its brevity and lucidity, also some good drawings of tools, and suggestions for improving them, and how to do it; for spring-makers make nearly all the tools they use. I wrote an introduction, added preliminary drawings, and let him tell his work tale in his own way. The subject had not been written upon technically before, but when published in a trade journal, his employer brought the work to me, with the workman's name to it, and asked if it were possible for W. T. to write so capitally. I pointed to his superior work around, and asked, 'Why not? He does more than write: he creates. This is an effort to make others as clever as himself.' He was pleased to see himself in print, and soon afterwards to get a cheque for his writings, which was what he least expected."

Incandescent Electric Lamps.—WHEATSTONE BRIDGE (*Enfield*).—Your letter has been forwarded to our contributor, who thanks you for your kind correction of his reply. You are quite right. The process described is one performed some six years ago, when the writer saw some bulbs being exhausted through tubes left in the necks of the bulbs. WHEATSTONE BRIDGE writes to correct a reply given by G. E. B. on page 157, in answer to G. K. on electric lamps for Bunsen battery. W. B. says: —"The lamp is (as regards the bulb, carbon, and connecting wires) complete before it goes to the pumps for exhaustion. The rough sketch will help to explain, as it shows the lamp as it leaves the glass-blower's hands. You will observe that the wires attached to the carbon filament are already fused into the glass. At the opposite end of the bulb there is a short length of glass tube left on, which is contracted at A. The end B is sealed to the pumps, and the lamp exhausted. The workman then plays with a fine blowpipe jet upon the tube at A, and the outside pressure of the atmosphere (as soon as the glass softens) presses it together, thus sealing the lamp. The workman then draws off the lamp, and the glass assumes the form C. On applying the jet to D it melts the glass, and he removes the lamp. He then melts the sharp point so left to a round end, and the lamp is ready for testing." You will observe that we have taken the liberty of making a few slight alterations in your communication, to render it more readable.

Glass for Electric Lamp.

Wanted, Advice.—J. J. (*Bradford*) writes:—"I have been a subscriber to your valuable paper from the first. I read it every week, and am especially delighted with the 'Shop' column; and I am now taking an opportunity of sending to ask if any reader can inform me how to make something profitable with the tools I have—jack plane, smooth plane, fret bow-saw, chisel, and saws? If so, I shall be highly delighted, for I have been at a standstill, waiting for something cheap to turn up."

Folding Screen in Egyptian Trellis Work.—C. H. O. (*Alderney*) writes:—"In my paper, which appears in No. 18, I observe some slight errors, which may be worth correction. 1. The hinges joining the right hand and centre folds are shown on the face of the framework, instead of being on the edges of the two folds, in which position, of course, all excepting the knuckles would be invisible in the sketch. 2. The title of Fig. 1 should read, 'Details of work in centre panel of recess (half-size).' The trellis work in the lower half of body of screen is only slightly larger than that in Fig. 3, and is like Fig. 1 in pattern, excepting that the intervals between the beads are plain."

"Muntin."—R. J. W. (*Derby*) writes:—"On page 277, No. 18 of WORK, Mr. David Adamson mentions the orthography of the shop word 'muntin.' I beg to say this word puzzled me for years, and I, too, looked in many a dictionary without success. One time, however, I dropped across the word 'mullion, an upright division in a window frame, and have since consoled myself with the idea that 'muntin' is a corruption of 'mullion.' I am a railway coachmaker, and should be glad of instruction in private body-making, especially the mysteries of the 'cant board.'"—[Articles on coach building, etc., are in preparation.—ED.]

Trimming Work.—D. T. D. writes:—"Enclosed please find a query to be answered through WORK. I am still pleased with its appearance, and I think it a great credit—as all their works are—to the publishers. One reader desired you to get the leaves of WORK trimmed or cut, as he termed it. My advice is the same as Punch gave—Don't! Trim your correspondent's if you like, but not mine. I have more respect for WORK when bound up than he has. Great success to WORK and your efforts.—Please don't forget promised article on Zinco."

About Work. — FLAX SPINNER (*Longton*) writes:—"I am writing partly on purpose to congratulate you on the success of WORK, and also to ask for a little information. In the first place, I must congratulate you on the fact that you have had the common sense to see the necessity for such a paper, combined with the pluck to venture the launching of it, and I don't think you will have any cause to regret having done so. I have been a first subscriber to more than one or two trade and technical papers, and I have always found them to split on the same rock. They have not been satisfied to treat work from a working or workman's standpoint, but, after their first temporary success, have launched out in a direction in which the average workman was totally unable to follow. Such groupings of letters as

$$T=\frac{c}{Q-g} \text{ or } V=R-\sqrt{R^2-(\frac{1}{2}C)^2}$$

mean nothing or so much Greek to 90 per cent. o those who take in such a paper as WORK; and hope that all articles, however otherwise mer torious, will be tabooed by you, especially as ther are so many subjects of general interest that can b treated without ascending, or rather descending, t the use of intricate algebraic formulæ. I woul also wish to exclude subjects requiring scientifi knowledge to understand and jaw-cracking scie tific terms to express. I must also express my i dividual objection to a lot of space being cribbe for the purpose of advertisements that do not i any way interest the average reader or trad written for—I mean those quack and medical an other notices which are nowadays crowded int almost every paper we can buy. Surely you ca find enough advertisements of trade requiremen for WORK without offending the eye with the othe I have mentioned. I expect a page or two of Jacol Safe Cure or Warner's Oil some week. Please don't d it."—[I thank you for your commendation of WOR and the manner in which the subjects treated in i are handled. With reference to the advertisement that appear in WORK, I have already pointed ou that differences of opinion exist with regard t these as well as on everything else that is said c done under the sun. Some correspondents say with regard to everything that is done with respec to WORK, "Pray continue to do it;" while the er of others is "Pray don't." If attention were paid t all such conflicting opinions, WORK might come ou one day as a blank sheet with nothing more tha the heading. With regard to every publicatio that sees the light, it is as well to put up with tha which you may not like in it for the sake of tha which appears in it in accordance with your ow particular views and proclivities.—ED.]

Engineering.—YOUNG ENGINEER writes:—" have been a subscriber to WORK since it first cam out, and as I see several of your readers hav offered their opinions on each side, I beg to offe one on the grumbling side. Now, when the pro spectus came out, it said for 'all workmen, pro fessional and amateur.' I have before me the las number, and, so far as I can see, two-thirds of th paper is devoted to joiners and cabinet makers Now, I am an engineer, and the only article tha has appeared is 'Wrought Iron and Steel Girde Work,' by Mr. Campin, that has any direct refer ence to the engineering trade. I should be glad t see a few papers on 'Principles of Machinery, 'Strength of Materials,' 'Designing Machinery, 'Mechanical Drawing,' and other articles on engi neering; and I have not the slightest hesitation i saying they would be appreciated by all those o your readers engaged in the engineering trade I wish every success to WORK, and I hope soo to see it enlarged, supposing you have to increas the price."—[Your subjects will not be neglected You have had evidence of that in the paper by Mr Campin. You must bear in mind that carpentr finds most favour among those who adopt practica work as a hobby.—ED.]

About Work.—SPECTATOR writes:—"I have taken your admirable paper from its commencement, and beg to express my unqualified approva of the manner in which it is conducted. I hav noticed the fault-finding and carping spirit of som of your correspondents, and for my own part, I think if these gentlemen were to consider that th title of your paper is WORK, and *not* 'Talk,' ther would be less of this everlasting grumble, grumble grumble, which, to say the least, is only irritating to the overstrung (?) nerves of poor Mr. Editor, and equally annoying to that portion of your subscribers who are not martyrs to dyspepsia, from which disease your critical correspondents are evidently suffering, if one is to judge the state of their health by their letters. I have introduced the paper to a good many of my friends, and every one of them is thoroughly satisfied and pleased with it."

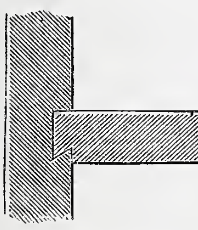
About Work.—G. B. (*Glasgow*) writes:—"DA CAPO thinks there is more talk than work in WORK. It must cause a feeling of sadness to think there is even one reader who can fail to recognise the literary merit of the articles contributed to your journal. They are not only masterpieces in the way of instruction, but bear the stamp of high literary ability, and have afforded me great pleasure in their perusal, quite apart from the instruction they convey. Take, for example, 'Frames' and 'Fretwork,' by J. W. Gleeson-White; 'Binding,' by E. Bonney Steyne; David Adamson's 'Old Bureau;' the 'Folding Chair,' by J. H. Moody; 'Smith Work,' by J. H.; and Fred Miller's 'Wood Carving.' To my thinking, those writers have attained the highest possible perfection, bringing into their subject all that engages the intelligent cultured mind. But I fear we may say to DA CAPO what J. W. Gleeson-White says of Ruskin—the writing in this journal is 'transcendentally' above him; and I trust his remarks will in no way influence past, present, or future writers in WORK."

Building Construction.—T. G. (*Hetton-le-Hole*) writes:—"I have taken in WORK from the first. I like it very well, and I always recommend it to others; but I do think you will make a great mistake if you introduce building construction. There are already many works on building, so I hope you will not take up this subject."—[You are aware, perhaps, that when doctors disagree, those who are not doctors have difficulty at arriving at a decision. Your remarks are inserted to show how hopeless it is for any individual, even an editor, to please every one, and how necessary it is for him to rely on his own opinion.—ED.]

—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Straightening Bird-Cage Wire.—G. C. (*Leith*). As G. C. remarks, this, though a simple question, is a somewhat difficult one in practice. It uld have simplified matters very much, and perps save valuable space, if G. C. had intimated at plans he has tried. Greater difficulty will be perienced in straightening brass wire than iron, being so much harder. Some time since I needed her stout wire in straight lengths, and accomshed the work by fingers and thumbs, making it rve in the opposite direction to the curl. This is effective, but slow, and only practicable for a all quantity. It can also be done by striking it th light blows on hard wood with a wood hamer. This, too, is rather slow. The most successl plan, however, that I can suggest for large antities of wire is to cut it in suitable lengths, d run it through a tinman's set of rollers, which arranged with two soles under and one on the p. Perhaps G. C. is aware that there are two alities of brass wire in the market—a soft wire, d what is known as "hard rolled," used by wellers, etc. I should advise him to get the rmer. Perhaps G. C. will pardon me if I remark at brass wire is not the best for the purpose he quires; it soon gets discoloured, but worse than at, the clear musical ring which it gives when ruck by a bird is said to destroy the purity of a rd's song—it picks up the sound as a false note. I ve known a canary whose song was spoiled by e piping of a chicken which it had heard, and inoduced into its music. Personally, I should not ge a valuable songster with brass wire.—O. B.

Fixing Tops.—E. W. (*East Sheen*).—Yes, the st way of fixing these in similar positions to that ferred to is undoubtedly by dovetailing them into e ends; and you are also correct in supposing at this form of construction is independent of achinery: in fact, it is a very ordinary joint. No ecial tools are required. All you have to do is to ark and cut the dovetails on the ends of the tops. his can easily be done by running the gauge along, f course after you have squared them up, and then rming the dovetail with chisel. Mark off the ovetail on the back edges of the end pieces. With e square scribe lines from back to front of the ner sides of the ends. These lines serve as guides work to, between which the wood to the required epth must be removed. This can be done with a hisel, using if necessary an "old woman's tooth," a ol with which you are doubtless acquainted, to vel the bottom. Should you not know what the old woman's tooth" is, may explain that it a router, and that a hort description of one r home manufacture ill appear ere long. he sloping side of the roove for the dovetail also formed by cutng away with the hisel. Such, in brief, an outline of the proess, which will be more ully treated in some rojected articles on ovetailing. Instead of oing the whole of the utting with a chisel a ne saw may be run along the lines to the depth equired, leaving the waste wood to be removed vith the chisel. Do not cut right through to the ront, unless the front edges are to be faced, and f course, whatever distance you stop from the ront will have to be removed from the front edge f the dovetail on the top or shelf. In cabinet work is only necessary to form a dovetail on one side f the tops, usually on the under side, the other eing left square. The diagram here given will ake this clear. You will see that it is a comparaively easy matter to get the top on the upper side o shoulder well to the end, or, in other words, to ake a good fit, as all you have to do is to cut the roove straight. The appearance of the lower side not of so much consequence, as it is not seen. he parts are to be fastened together with glue, vhich, however, should not come within a few nches of the front.—D. A.

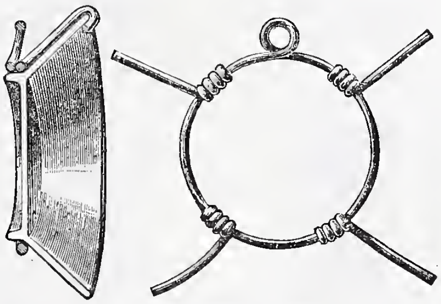


Dovetail for Tops.

Minor Carpentry.—W. H. R. (*London, W.*) vrites:—"Might I ask your kind help in the folowing:—I am desirous of doing various little jobs t home, such as making picture frames, flower oxes, foot-stools, salt boxes, benches, and suchike odd articles; and if you would tell me the tools, vith their length and weight, I should require, I hould be much obliged. I notice that some saws vith a rimmed back, such as butchers use, are also nade use of by wood workers. Would I require uch an article? What is your opinion of the patent crewdriver advertised by Harger Bros.? The tool loes away with the necessity of holding the screw. t is called Kolb's 'Common-Sense Screwdriver.'"—You shall be shown how to make the articles you nention, and a paper shall be written on a handy cit of tools for beginners. The saw with the immed back that you speak of is a tenon saw, and s used chiefly for cutting across the grain and for ard wood. I have one of Kolb's "Common-Sense Screwdrivers" in use. It is a handy tool, but I have een so long accustomed to the ordinary screwdriver that I prefer it to any of the patent screwdrivers.—ED.].

Insurance of Tools.—T. T. (*Kennington*) vrites:—"A question I wish to ask is, Can you tell me if I can insure my tools from fire anywhere, and also, if possible, the cost of a policy? I shall feel greatly obliged if you can answer these questions in their turn."—[I do not think there is any office in which men can insure their tools. I shall be happy to consult with any who are interested in this direction as to the practicability of setting on foot a Company with this object. There are difficulties in the way; but doubtless these may be overcome. If any established industrial office, with a large staff of agents, would take the matter up and create a new branch for the development of this object, it would be the more easily carried.—ED.].

Hanging China.—G. D. M. (*Inverness, N.B.*).—It is true that one often finds the old Delft plates with holes bored through them, and a huge knot of string defacing the plaque itself; but, in addition to the risk of drilling the hole, would it not be wiser to hang it with an ordinary plate wire, sold nowadays at most china-ware shops, or, if needs be, made at home easily enough? As the diagram shows, it is but a circle of wire, large enough to slip over the rim—the foot, so to speak—of the plate, with four other pieces twisted on. These are bent



Wire for Hanging China.

over the edge to the front of the plate, and then nipped close off, say, ½ in. from margin, and may be safely trusted to support the most valuable old china. A round frame, turned to enclose the plate as though it were a mirror, is also used at times; but to me it is too heavy for the decoration of a plate, unless, indeed, it be one of the old majolica ones with a pictorial treatment, where, save for the accident of being on earthenware, instead of on a panel or canvas, the plate is to all intents and purposes a round picture.—T. G. W.

Draught Screen.—W. M. D. (*Govan*).—I am sorry I cannot possibly tell you how to make a screen of the kind you describe for the sum you do not wish to exceed, any more than I can tell you how to make a half-sovereign worth 20s. I take it from your description that you want to use Japanese leather paper, but of course common embossed wall paper will be much cheaper. Your question is, however, couched in such very vague terms that I am by no means sure of what you really do want to make. For example, though you give dimensions, you do not say whether you want a folding screen. I can only suppose you do, and you will easily see that the cost depends greatly on the number of folds wanted. With every disposition to assist all who apply for information in "Shop," it is utterly impossible to do so satisfactorily unless inquirers will state clearly what they want. If you write more fully, I shall be able to answer you more helpfully.—D. D.

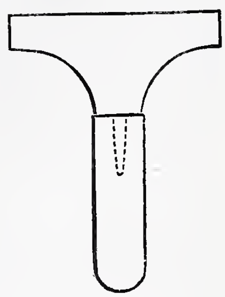
Fire Blower.—R. B. (*Colne*).—Your sketch gives a very fair idea of the thing you want, so that with the following hints no doubt you will be able to make one to suit your purpose, though, if for an ordinary fire, you will find the common bellows do just as well. I do not think the kind you want would be sufficiently useful to justify a lengthy description—at present, at any rate; but if it should seem likely to meet the wishes of any considerable number of readers, an article may be devoted to the subject. Meanwhile, you or any other reader inquiring on any point you may be in difficulty about, will be answered in these columns. Size, of course, depends on use to be made of blower, which consists essentially of a thin narrow box with a revolving wheel inside. This wheel is something like a steamboat screw or propeller, the number of blades depending on circumstances. The blades for a small one may be made of thin brass or block tin fitted into a hub or axle. One end of this projects through one side of the box and has a pulley wheel fixed to it. Near to it is another revolving wheel with a handle. A cord communicates motion from this handle wheel to the other connected with the fan. If preferred, geared wheels may be used instead. A suitable nozzle and spaces for the admission of air complete the arrangement.—D. A.

Inlaying.—H. L. M. (*Birmingham*).—Gum is not suitable for fastening the pieces of inlay together or to the ground. Good ordinary glue is the best thing you can use. Unless the pieces are very thin they will not be injured in colour, though of course if the inlay is very light you will choose a colourless glue. With Lepage's carriage glue you can lay any inlay without fear of discoloration. Fix the inlay up first on a sheet of paper. When dry clean up with a toothed plane, the veneer and inlay being in one sheet supported by the paper. Lay the whole paper side upwards, with a cant on the panel; after the glue has set clean off in the usual manner. You must remember that though it is of comparatively small consequence what kind of glue you use to fasten the pieces of inlay to the paper, if there is much light wood, colourless glue is necessary to attach the veneer to the ground, as the heat of the cant may cause a dark coloured glue to leave a stain. The pattern for fine work should be pounced, as sufficient accuracy cannot be got by tracing. Use powdered asphalte in a piece of muslin or a roll of flannel well dusted with asphalte. After pouncing the design down, hold the pounced pattern to the fire. This melts the asphalte, and the outline is then indelible. You may use coloured chalks instead of asphalte, but the outlines require careful handling, as they are easily erased. By a little adaptation you may use almost any of the ordinary fretwork designs for inlaying purposes; but if you mean designs for marquetry inlays, such as are seen on so much modern furniture, you will find a considerable difficulty in obtaining them, as none are published in this country. Tiersot, of Paris, publishes designs for inlays, but they are not in the style now fashionable here; so they may not suit you. The only thing you can do, or, at least, that I can suggest, is that you apply to any furniture designer whom you may know. He may be willing to supply you; but, as the designs will have to be specially drawn, you must be prepared to pay fairly for them. Possibly Mr. David Adamson, whose name will be familiar to you in these pages, may be willing to supply you. The whole subject of marquetry inlaying will be treated of in these pages in due course.—D. D.

Linseed Oil.—CUMRO (*Rhyl*).—Raw linseed oil may be made thicker by boiling, but by doing this it is rendered unsuitable for French polishing purposes. It will not injure the polish, but if thickened it clogs the work; and it is just because raw oil is thin that it is preferred. I do not know whether I am right in supposing that you wish to render the oil serviceable both for oiling and filling at one operation; but if so, let me attempt to dissuade you from doing this. Your question is put rather obscurely, so I may be wrong in supposing that such is your intention.—D. A.

Reproduction of Fretwork Designs.—I. C. G. (*Reading*).—Yes, fretwork designs can be multiplied by the blue printing process, the reproduction, of course, showing the dark lines of the original white on a blue ground. The original must be interposed between a sheet of glass and the blue paper either in a frame or otherwise. Both papers must be kept in close contact during the printing, or the print will be indistinct. Patterns printed in blue ink, such as those of some of the Italian designs, cannot be copied by this means. The printing may be much expedited by oiling the original, so as to make it semi-transparent. A colourless oil should be used for the purpose.—L. I. P.

Lettering in Gilt.—F. W. H. (*Sheffield*).—In lettering in gilt on leather proceed thus:—Wash the leather with paste-water, *i.e.*, water with a little flour paste mixed in it. When it has become thoroughly dry, coat it over evenly with glaire (prepared from fresh hen eggs); use the whites only, and beat up until a dry-looking, white froth has been formed of the whole mass. After heating allow it to settle. The froth will disappear and leave a clear amber-coloured liquid as thin as water. When the first coat is dry, give it a second, and allow it to dry also. Rub it over with a little hog's lard or olive oil, and lay on the gold leaf. The letters used are made of brass with wooden handles; they are heated over a gas stove, and, when the proper degree of heat is obtained, they are pressed one by one on the top of the gold leaf; the heat causes the gold to adhere to the leather. When the lettering is completed, the surplus gold is rubbed off with an oily rag kept for the purpose. The procedure for cloth is much the same. Omit the paste washing, and give only one coat of glaire. (See reply to ANXIOUS ONE in No. 14, page 221.) In doing the lettering for your sister, you should get a hand palette made with the name and address engraved in relief upon it. Any engraver could make it for you, but it would be best to apply to Messrs. Royle and Son, Lovell's Court, Paternoster Row, as they will know exactly what you want. However, the sketch given above will show the shape of the palette; the lettering is cut on the face.—G. C.



Hand Palette.

Fretwork Designs.—W. V. T. sends a modification of design for cabinet in fretwork, by Mr. Gleeson-White, in No. 1 of WORK, and writes:—"I should be also much obliged if you could tell me of a firm who would be likely to buy designs, and of the usual means of transacting that sort of business."—Your modification of Mr. White's design is very nicely rendered; but I must ask readers of "ours" to take my word for this, as it is not possible to find space to publish it. J. H. Skinner and Co., East Dercham; Harger Bros., Settle, Yorkshire; Booth Brothers, Dublin, all buy designs; but purchase will depend entirely on suitability of designs for their purpose. The usual mode of transacting business of this kind is to submit designs, and name terms at which you would part with them.

Griffin's Fret Saws.—J. A. J. (*Stratford, E.*)—In reply to your intimation that you "would esteem it a favour if I could give you the address of the makers of Griffin's patent fret saws," I regret to say that I am unable to do so. Possibly Messrs. Churchill & Co., 21, Cross Street, Finsbury, E.C., may give you the information you require, or what would do very nearly as well. If you want to sell them retail they would supply you on the most favourable terms.

Enlarging Camera.—CUPID (*Castlejohn*).—If you have made the enlarging camera as described, you will find the process of making enlargements very simple indeed. The *modus operandi* is as follows:—Put your negative in the carrier with the film side inwards; focus sharply upon the ground glass to the size you desire, in which you are guided by the lines on the glass. Then, in the dark room, put the paper in the slide, fastening it in position with fine drawing tacks, and keeping it to the lines corresponding with those on the glass to which you focussed your picture; put the slide in the camera, draw the shutter, and expose. Return to the dark room and develop the picture. The developer is made up as follows:—No. 1. Neutral oxalate of potash, 8 oz.; boiling water, 16 oz. No. 2. Sulphate of iron, 12 oz.; boiling water, 16 oz. No. 3. Bromide of potassium, 60 grs.; water, 1 oz. For use, mix the developer in the following order:—No. 1, 5 oz.; No. 2, 1 oz.; No. 3, 12 drops. Put the paper in the dish and flow the solution over it; gently rock till the image appears and develops to the required tone. Pour off the developer, and, without washing, flood the print with a clearing solution of sulphuric acid, 1 oz., water, 80 oz. Allow it to remain one minute, pour off and repeat. Then wash well and immerse in fixing bath (hyposulphite of soda, 4 oz., water, 20 oz.) for ten minutes. Wash in running water for two hours; then hang up to dry. Do not dry between blotting paper as in the silver print process. There are various brands of paper in the market, all of which are fairly good and give pleasing results. I should, however, recommend you to use Eastman's C paper; it has a rough surface, and is easy to work, giving pure blacks and whites similar to good pencil drawings. The most difficult thing is to gauge the right exposure—everything depending upon the quality of the light, which in this country is a varying quantity. The best way to find the proper time of exposure is to put a strip of the bromide paper in the slide, giving it different exposures by drawing out the shutter one-fourth of its length, then half, then three-fourths, and then full out, with a pause of, say, half a minute between each pull. Develop the strip and see which part is rightly exposed; then expose your picture accordingly. Keep the camera close to a window, with a northern exposure, if possible, but in no case facing the sun, and raise the carrier end of it as much skywards as you can. Avoid walking about or shaking the floor during the time you are making the exposure, or you will get a blurred image. The foregoing is as concise a description of enlarging as can be given in "Shop:" but if you already know something about photography you will easily grasp the details, and after a few trials succeed in making good pictures; but I must remind you that under-exposed negatives will not do for enlarging from. Use negatives that are rather over-exposed, thin, but full of detail, and the results will be pleasing.—G. LE B.

Brass Finishing.—C. H. C. (*Margate*).—This subject will be touched on in due time; but, as I have said before, it is impossible to handle at once everything that it is desirable to handle.

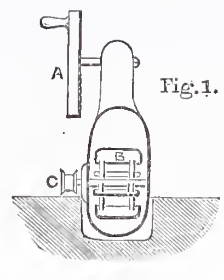
Wooden Beehives.—G. G. (*Hammersmith*).—In reply to your inquiry for papers on the construction of wooden beehives, I will endeavour to give you something to do in this direction in the winter months.

Designs for Wood Carving.—J. P. (*Dundee*).—Mr. George Alfred Rogers, wood carver, 29, Maddox Street, London, W., not only supplies designs for wood carving, but he also lends specimens for learners to copy, carved by himself. It is some time since I have seen or heard from him, but I furnish you with his address, trusting that he is still in the land of the living.

The Tenant's Greenhouse.—G. J. (*Peckham, S.E.*) and J. W. C. J. (*East Dulwich*).—In reply to your letters let me say that Mr. Le Brun's mode of construction referred only to a mode of barring the *landlord's right* to claim a greenhouse erected by the tenant for his own convenience. As to the points mooted in your letters, it would be better for you to place the matter before your respective lawyers, who will advise you according to their conception of the bearing that the Metropolitan Building Act (1855) has upon the subject.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Machine for Current of Air.—CENTREBIT (*Tullow*) writes in reply to BELLOWS (see page 190), who asks in No. 12 of WORK for a machine to give a constant current of air:—"I enclose a few rough drawings of a fan much used in various parts of this country, especially in those districts where the anthracite, or native hard coal, is abundant. It is made entirely of iron, of which Fig. 1 gives the general shape; in height it is about $2\frac{1}{2}$ ft. by 6 in. broad. The large wheel is turned by the hand, and imparts the motion by means of a belt to the small wheel, C (Fig. 2); this is on the fan axle, and the fan, B, inside moves in conjunction with it, drawing in the air at A (Fig. 1), and expelling it through the pipe, B (same figure). It is shown in position in Fig. 3, of which A is the machine, B the hearth, C the fire,



Side View: Section.

A, Wheel, Belt off. B, Fan. C, Small Wheel.

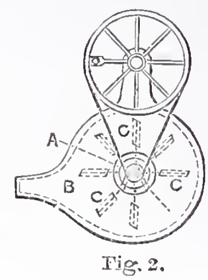
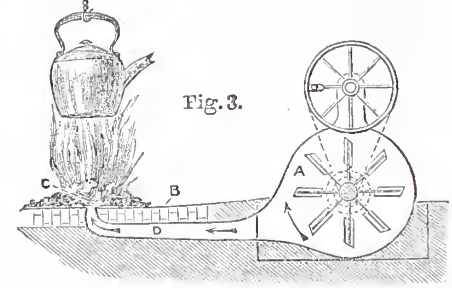


Fig. 2.

Front View.

A, Hole to Supply the Fan with Air. C, C, C, Shows Position of Fan.



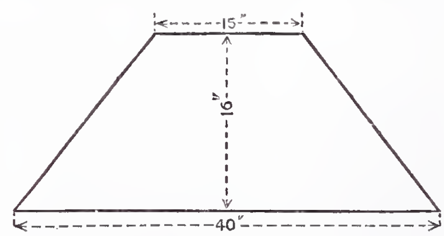
Section in Position.

A, Machine. B, Hearth. C, Fire.

and D the supply pipe. As you see by Fig. 3, it is used with the flat hearth and large open chimney; but I have no doubt that it could be fitted to a fire-place. It is made by Peirce & Co., Wexford, and costs 9s. 6d. I do not black on different parts of it. On the top I drew the flying stork; on the left top corner and right side, the stork standing, and several others on different parts. It made a great difference in the frame, and made it look very pretty."

Drilling Square Holes.—T. M. B. (*Colchester*) writes in reply to A READER (see page 270):—"This appliance was introduced into England many years ago, and Britannia Company advertised it. But not one was sold. It is so much quicker to bore a round hole and drift it out with a square drift with cutting edges. This applies to either metals or wood. The drifts can be driven through with a hammer, or drawn through by a screw and proper appliance."

Dulcimer.—MUSIC (*Govan*) writes:—"In reference to question by T. C. B. in 'Shop,' July 13th, page 268, about sound board of dulcimer, will you allow me to send enclosed sketch with singer marked, as I know it to be the angle to please any one who tries? I am only an amateur, but like T. C. B. have made three dulcimers, and have one at present to dimensions given, which is capable of



Sounding Board of Dulcimer.

playing on platform, or with other instruments if desired, or for that matter anywhere—the corner of the street if you like. Hope you will excuse the amateur sketch, but I like a tip myself, and therefore like to give one when that is possible. Should it be convenient I shall be pleased to let T. C. B., or any others who have a taste that way, examine mine, the shape I mean, not the workmanship, which is only amateur. I trust this may be of some use to those who want to know."

Child's Wooden Toys.—B. A. B. (*Hampstead*) writes in reply to W. A. (*Hanley*) (see page 270):—"He can obtain toys wholesale at several houses in and close to Houndsditch. There is a good little book on making toys, published by Gill, 170, Strand, W.C. It is by J. Lukin, B.A., price 1s."

Trade Note.

"SCRIPP'S League of Newspapers," composed of six newspapers published in the leading cities of the Central States, and circulating largely among working-men, have sent, at their own expense, a deputation of representatives of trades and industries to the Paris Exhibition. These representatives are forty in number, four of whom are women, and include the engineers, foundrymen, sewing-machine makers, blacksmiths, car builders, safe and lock makers, shipbuilders, stove makers, and others, each individual of the forty representing a distinct occupation. Most of the men occupy positions of trust and responsibility in their respective vocations, and the names of several are familiar to us upon this side of the water, as Mr. Robert E. Masters, Joseph Thorpe, Edmund G. Vail, and William J. Keep. It is a pity that our shrewd, practical workmen have not more opportunities for indulging in travel; it would counteract that narrowness of mind which, through no fault of their own, is too generally a feature in their characters. Their observations would certainly be as fruitful as those of their employers.

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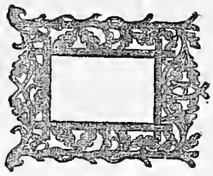

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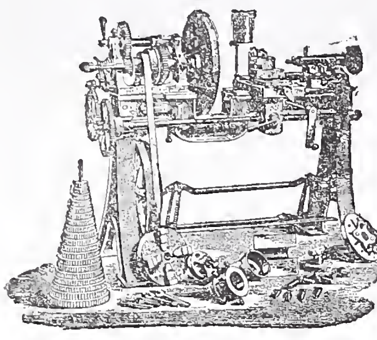

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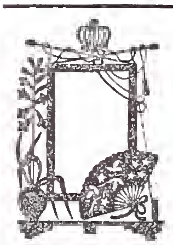

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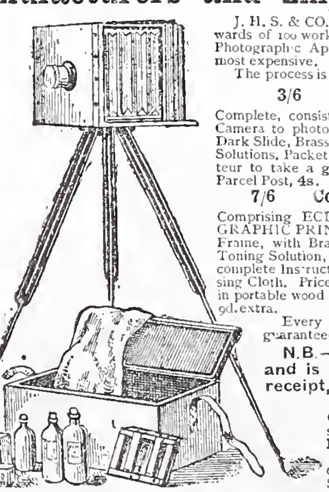

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. HANDY FOLDING BENCH FOR WOOD WORKERS.

BY DAVID DENNING.

'ERHAPS the following account of a small arpenter's bench may be of some assistance o wood workers who are cramped for room, ıs I was when I contrived the one I purpose lescribing. It certainly was not as good as ı properly-made bench, but then this takes ıp a considerable amount of space, and, noreover, requires almost a special work-oom. In the house ıt which I was then iving, no such room vas available, and the lomestic workshop ıad to be dispensed with—only for a time, ıowever; for before very long the contrivance to be described was rigged ıp, and, in default of ı better, answered its purpose well enough. One often hears amateurs complain of having no place which they can use as a workroom; but, after all, there are, I take it, comparatively few houses in which they might not gratify their tastes. In the one referred to, there seemed no likely spot, and the position I ultimately chose—it certainly was "Hobson's choice:" either avail myself of it or go without a bench—may not commend itself to the fastidious worker. I mention the situation and surroundings to encourage others who may be similarly placed. To begin with the "shop" was underground, and, beyond a mere glimmer, no daylight was ever visible in it. It was, in fact, nothing but an underground passage from which coal cellar and larder opened out. A permanent standing bench of the usual size was out of the question, and I resolved to see what could be done with a folding one. It should be said that no heavy work was contemplated, nor yet any of large size. The limited area, apart from other considerations, would prevent that, something that would do for odd jobs and small work being quite sufficient for my purpose. Therefore those in whose minds the above title may have raised visions of a perfectly appointed work bench and all its accompanying outfit will, I fear, be disappointed; still others, no doubt, will welcome a few suggestions which, however primitive they may be, at least have the merit of being based on personal experience. It may further be added that no unnecessary expense was incurred, and that this, as will be seen, was of the most trifling character. Were I to suggest possible improvements, whatever value there might otherwise be in the following description I fear would be reduced. I shall, therefore, content myself with saying that the bench, though of the crudest form, answered very well in the circumstances, and I think it will be more helpful to tell exactly what it was than to tell how it might be improved on.

In order to get to one of the compartments opening out of the passage—the coal cellar, I think—it was necessary that the bench when folded should not project more than a few inches from the wall to which it was attached, and only one part of the wall was available for this purpose. Fortunately, there was a gas bracket just above the place the bench was to occupy, so that no great inconvenience was caused by the light. If that from the fixed bracket did not suit for any particular piece of work, the difficulty was easily got over by having a piece of indiarubber tubing and a very

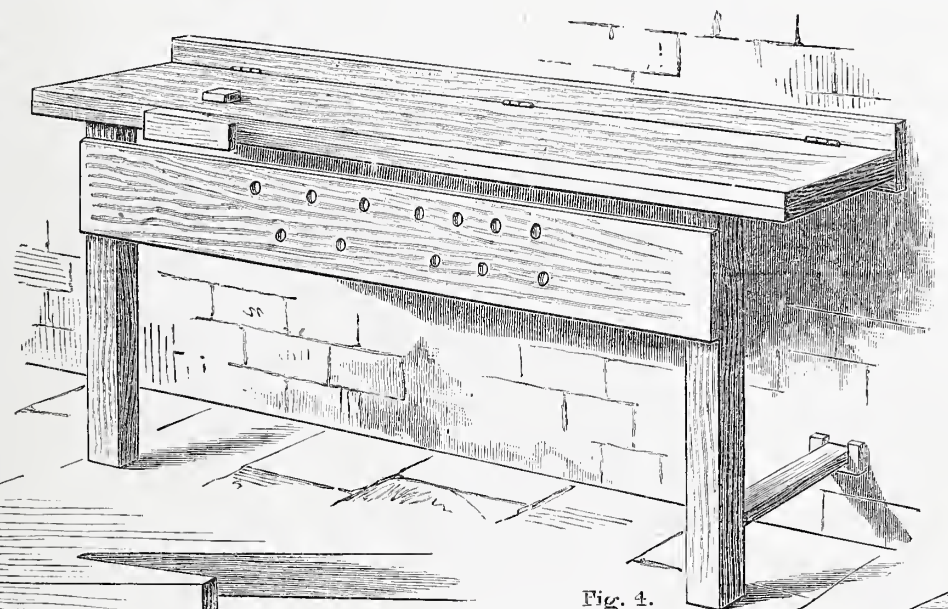


Fig. 4.

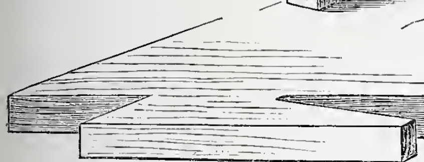


Fig. 1.

Fig. 2.

Fig. 3.

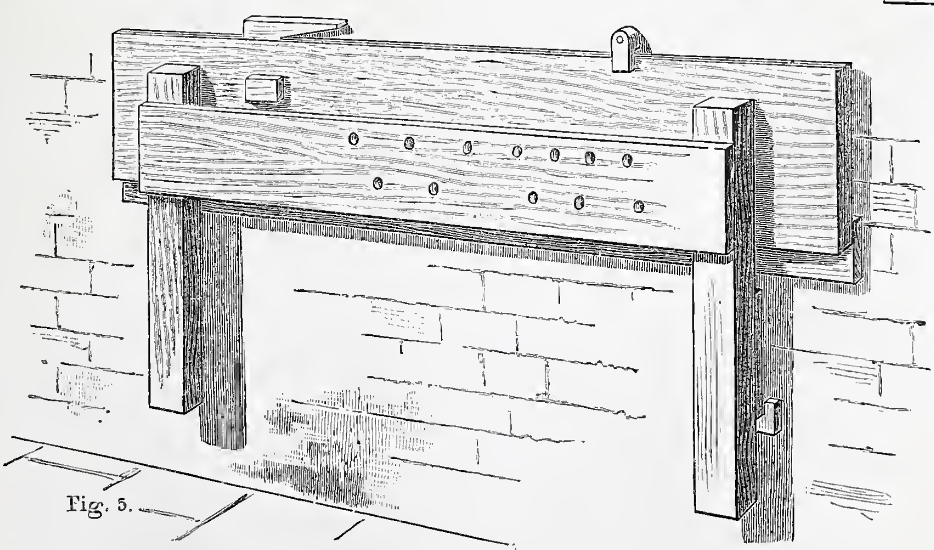


Fig. 5.

Fig. 1.—Stop instead of Bench Screw. Fig. 2.—Catch to hold Bench to Wall. Fig. 3.—Stop for Legs. Fig. 4.—Bench down for Use. Fig. 5.—Bench folded against Wall.

rough but serviceable portable gas stand or bracket. A description of this must, however, stand over, as it can hardly be considered part of the bench.

The top of this was formed of a couple of 1-in. pine boards, screwed together to form one piece. Only the top surface and front edge were planed over, the remainder being left quite rough. Perhaps I should say that when I began it the intention was that the bench should be only of a temporary character, or a little more care might have been taken both in material and finish. Pine, for instance, is not so suitable for the purpose as some harder wood, though this, after all, is only preferable on account of its being more durable and not so likely to be injured. The screws, of course, were driven in through the bottom board, care being taken that their points did not project beyond the upper surface. By using plenty of them—and, if I remember, some glue between the two boards—a plank practically as useful and solid as if it had been formed of one piece was got. The only reason for building the top up in this way was that I happened to have the inch stuff by me, but had none thicker. If I had had any sufficiently thick I should have used it, and avoided the then unnecessary labour of screwing two pieces together. The size of the top was about 4 ft. long + 11 in. wide. To attach this to the wall another piece of wood, say 4 in. wide, was taken, the same length as the top and of 1-in. stuff. Writing from memory, I am unable to give exact sizes, but these are of little consequence, as if the principle of the contrivance be understood there will be no difficulty in any one making a similar bench of such dimensions as may be most convenient to himself. Where sizes are mentioned, it will therefore be understood that they are given more by way of suggestion, though in the main they approximate very closely to those used. I should explain here that the wall to which the bench was fixed was of brick, not of lath and plaster, so that there was no great difficulty in securely fastening it. Lath and plaster are, no doubt, good enough in their way, but I don't advise any one to fit his bench against such a wall; but even then, by tapping on them, he will soon find out where the solid wood into which nails may be driven lies. However, in a brick wall holdfasts were easily driven—too easily, indeed—into the mortar, or stuff so called, and sufficiently resembling it to have passed the authority duly appointed to certify that everything was fit and proper. We who have inhabited houses erected by the speculative builder know how very careful he is only to use the very best of everything; otherwise, in this particular instance, in my ignorance I should have called his mortar sand. Whatever it was, nails would not hold in it, and it is not altogether easy to drive them into bricks. The alternative, therefore, is to plug the walls wherever a nail is to be inserted. This I managed, and I think it is a way commonly adopted, by clearing out some of the mortar here and there between the bricks, making, in fact, a good hole between them, and hammering in pieces of wood to tightly fill them. A small ordinary hammer is no good for this, but the coal hammer will do very well, as it is of the utmost importance that the plugs or wedges be very tightly fitted in. Nails may then be driven in and held securely.

The wall having been prepared at a suitable height for the bench, the piece of wood by which it has been stated it is attached to the wall was nailed up. The extra hold which nails have when driven in slantingly in opposite directions has already been referred to in an early number of WORK by Mr. Adamson, in his articles on "Artistic Furniture," and the novice cannot do better than refer to them.

With regard to the height of such a bench there is no reason why the maker should not suit his own convenience. The practised worker becomes accustomed to work at the ordinary bench height, but it seems absurd, apart from custom, to suppose that one height can be naturally the most convenient for both tall and short people. I venture on this digression to prevent any amateur thinking that the regulation height of benches must necessarily be the best for him whether he be short or tall. Let him choose the height at which he can have the most command over the tools he is using, and that this in practical workshops is to a great extent a matter of custom may be seen by noticing the equal facility with which both the tall and short men work at benches of the same height. The amateur who may be supposed not to be able to work more freely at one height than another should have his bench at such a height that he can do his work conveniently without the necessity of stooping too much. At the same time, he must not have it so high as not to be able to stand well over his work. It will thus be seen that considerable latitude is allowable, although no doubt something near ordinary bench height is about the best. This may be stated as about 2 ft. 6 in. Personally, I find this the best; but an inch or two for general work does not make much difference. In an ordinary bench the height can be easily altered by either cutting the legs shorter or putting something under them; but as this folding bench is hinged to the wall, it will be as well to decide beforehand on whatever height may seem most convenient, to avoid troublesome alterations afterwards.

Three good strong iron butt hinges formed the connection between the top and the piece nailed to the wall. The hinges were fastened to the back edge of the top with knuckles upwards, as the top, when the bench was not in use, was designed to fold in this direction, and not to hang downwards. Those who have read the recent instructions on "Hinges" will not require to be told that back flaps might be used instead of butts, and that they would have to be fastened to the upper surface of the top, or, rather, sunk into it. For further directions about this part of the work the beginner who has no very definite ideas how to go about it may be referred to the above-mentioned articles, in order to save recapitulation of the instructions they contain.

So far as we have gone, it will be seen that the bench, though supported behind, has nothing to sustain it in front. Without some arrangement to do so, the hinges could not bear the strain, nor even if they could would the top be rigid enough to be worked on. I used two legs, which were hinged to the top near the ends and front, so that on this being lifted they hung down and were out of the way. They were, if I may use so grandiloquent a word to such a very simple arrangement, self-adjusting, for on lowering the top they naturally fell into their proper position, and required the smallest possible amount of humouring to get them in their places exactly. The legs themselves require very little description, as they were simply a couple of $2\frac{1}{2}$-in. squares; one of them, I think, was an old kitchen table leg, and the other was an odd bit that came in handy. Beyond cutting them to the right length and squaring off both ends, they required no preparation.

Back-flap hinges were used to attach them to the top, one to each leg, where, of course, it was fastened to the back. Before hingeing them to the top both legs were connected by a piece of board. This was nailed on to the front sides, and being subsequently bored with holes, in which pegs were placed, served to support boards while their edges were being planed up. The width of the board was not great, say, 8 to 10 in., as no large work was done on the bench. It was of 1-in. stuff, and the holes were simply made as wanted till there were enough of them with a centre bit.

I have mentioned this board, as on its thickness depends to some extent the exact distance at which the legs are placed from the front edge of the top.

Perhaps I can make their position clear by saying that the front of this board should be flush with the front edge of the top when the bench is in use. The object of this will be apparent on trial if it is not already so.

At first, instead of a bench screw, I used a small stop, screwed to the front edge of the top, as shown in Fig. 1, the triangular space being prepared to jamb the end of anything being planed up into it. Of course this, though fairly good, is not so satisfactory as proper bench screws, of which I afterwards got one. These, as I daresay is well known, are both single and double, *i.e.*, with either one or two screws; and it is almost needless to say that only a single one was used on this bench. A few words describing the way it was fixed may not be amiss.

With the appliance are included two blocks, one of which is threaded for the screw; the other simply fits quite loosely. The former one must be fastened in some way to the bench top, so that on turning the screw the other is brought up to this as far as may be necessary to hold anything it may be desired to fix. I managed as follows. The screwed block I made fast to the under-side of the top, removing a piece of the board last referred to away for the purpose of affording it space. To keep the movable block with its upper edge level with the top of the bench, I affixed a wooden guide rod to it. This was of some strong, tough wood—probably ash—glued into the movable block, and sliding with a hole bored through the other. This hole should be large enough to let the guide pass quite easily and freely through it.

As a bench stop, a piece of wood was used which fitted quite tightly within a rectangular hole bored through the top. The stop itself should be at least an inch or two longer than the thickness of the top. When not required for use, a tap with the hammer from above levels it with the bench, and to raise it the hammer is applied underneath. Such a bench stop is by no means to be despised, and it may be questioned whether some of the patent arrangements are superior to it in every way. Anyhow, its simplicity is the reason why it is recommended here, and any man who can't use it may depend that it is not so much owing to the inefficiency of the stop as to his own want of skill.

So far as the bench goes this completes its description; but there are—or, rather, were—one or two little matters which, though not actually part of itself, in connection with it may very appropriately be noticed. For one thing, it soon became evident that when folded up against the wall something more than a piece of board resting on the ground was necessary to keep it there. Somehow or other, the end of that unfortunate plank, which seemed quite out of the way, was always coming in contact with somebody's beetle-crushers, or they with it. It was not altogether satisfactory, and nobody ever thought, apparently, that it might be avoided by the simple expedient of walking in the centre of the passage. My own private conviction is that before that bench was put up those who used the passage kept close to the wall on the side opposite to it; ever afterwards, however, rubbing along the bench side, till I put up a catch, which held the bench to the wall. This catch, like everything else about the bench, was of the most simple construction. It is shown in Fig. 2, which explains it so clearly, that remarks about it can hardly be necessary. It was made of wood, and was hung on a screw nail, the neck of which passed loosely through it. The thickness at one end, of course, was merely to keep the catch end away from the wall; but if the screw were put through the middle of a sufficiently long piece of wood it would do just as well. In this case, it would not do to screw the wood close up to the wall, as a sufficient space would have to be left for the thickness of the top.

Another little arrangement, if not an absolute necessity, was at any rate soon found to be a convenience. When working at the bench its front supports were apt to get pushed back, as, of course, there was nothing to stop them at the bottom.

This having resulted once or twice in an upset of everything that was lying on the bench at the time, led to the stop, as shown in Fig. 3, being fixed to the floor. One or two nails being driven in between the flagging prevented it being forced backwards, which was all that was necessary, there being no upward strain. These blocks were rather in the way of people passing to and fro, so these were altered for another arrangement, which got over any difficulty of that kind. To the back of each leg I hinged a piece of wood, to fold upwards when required and at other times to extend backwards as far as the wall, where it rested in a cleat of very similar shape to that which had been previously used on the floor. This arrangement prevented any further mishaps, and served till the bench on removal to another house was finally dismantled.

In connection with this, I may mention a convenient way of keeping one's tools—at least, a good many of them; for, as will be seen, it is not suitable for planes, large saws, and a few other things. For chisels, screwdrivers, and all the smaller articles, it is well adapted, especially if, as in this case, the bench is against a wall. The tools are visible, and each can be reached down as required and put up again when done with without any of them lying about on the bench—an important consideration with a small one. Every one knows the waste of time caused by hunting up a tool, whether it be from among others lying on the bench or from the chest, and all this can be avoided by slinging them in a kind of rack against the wall. I call it a rack, as I do not know very well how to describe it otherwise; but the name does not matter much so long as the contrivance is understood. A piece of wood, say 2 or 3 in. wide and $\frac{1}{2}$ in. or so thick, of any convenient length, forms what may be called the foundation. On this some upholsterer's chair webbing is fastened with tacks, the web being left loose lengthwise between the tacks, so that it forms a series of loops. In these loops the tools are placed, blade downwards. The handles prevent them slipping through. So convenient have I found this arrangement that I regularly keep many of my tools permanently this way in preference to any other. For instance, my lathe—a Britannia, No. 10—stands in a recess of my workroom, for, fortunately, I am not driven to a cellar passage now. Behind it are arranged my turning tools. On another piece of wood, similarly looped with web, are my carving tools. In a workroom tools hung this way are not only ornamental, but, what is more to the purpose, it is very easy to select any one that may be required.

It seems, somehow or other, that this description of my folding bench has run on to a considerable length; but all I can say in extenuation is that when I was a younger and a wiser man (in my own esteem) I should have been glad of similar suggestions to assist me. That these are perfect I do not pretend; but, in the belief that they will be welcome to some among the hundreds of thousands of all sorts and conditions of men who read WORK, they are set down in black and white.

Everything that seems necessary has been described; but if the written explanation is not sufficiently lucid few will experience the slightest difficulty in knowing what is meant if they will refer to the accompanying illustrations (Figs. 4 and 5), the first of which shows the bench open for use, the latter closed or folded against the wall. Should I not have made myself sufficiently intelligible, I will endeavour to rectify any defect in the "Shop" columns, only—may I, without offence, say it?—I would suggest that it will be better for the young worker not to write off immediately he meets with a difficulty, but to try and solve it for himself. It will prove much more useful to him to do so, and he must remember that the object of this article is not so much to tell him how to make a bench exactly like, or, in other words, a copy of, mine, as to suggest plans by which he may profit. Still, should any one meet with a difficulty he feels himself unable to surmount in fitting up a similar bench, I will gladly help him as far as I can in "Shop."

LOCK REPAIRING AND KEY FITTING.

BY THOMAS WILSON.

PATENT LOCKS FOR SAFES.

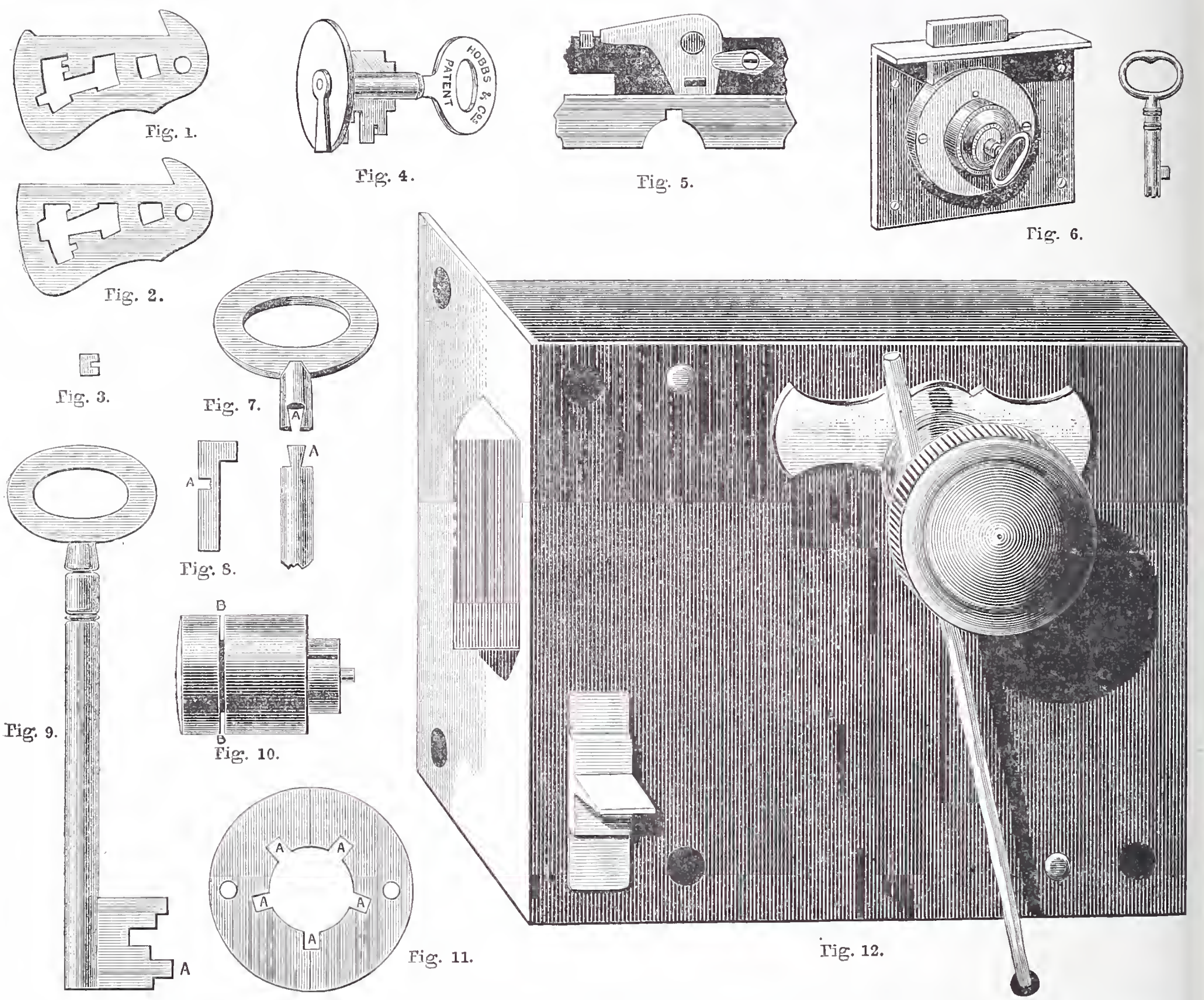
As I remarked at the conclusion of my last article, ordinary lever locks afford ample security for general purposes, but for safes, or where perfect security is required, it is necessary to render them unpickable. There are various means in use for attaining this end, most of them protected by patent. It would be outside the scope of this article to describe all of them, but I will briefly describe those of Hobbs, Chubb, and Bramah, inasmuch as they have been before the public longest.

Messrs. Chubb use levers with notches (or false gatings as they are technically termed) cut in them, as shown in Figs. 1 and 2, so that the bolt stump (Fig. 3) can enter a short distance, and where these are numerous it is almost impossible to tell if the bolt has entered the true or false gating. The makers, however, do not rely entirely on these, for they use a detector, which, briefly described, consists of a trigger so arranged that if any lever is raised too high the bolt is blocked, and it cannot be withdrawn even by its own key. It can, however, be released by turning the key slightly in the other direction. This detector, besides assisting in rendering the lock unpickable, serves to show if the lock has been tampered with. Messrs. Hobbs rely on their patent movable stump, shown in Fig. 5, by means of which any pressure, if applied to the bolt before raising the levers, is transferred to a fixed part of the lock, so that the levers are perfectly free. Both these methods render the locks practically unpickable.

There is one other defect in lever locks which I have not mentioned, and that is the risk of the bolt step, A, shown in the key, Fig. 9, being worn (or, perhaps, wilfully filed or ground down) so that it is not long enough to throw the bolt home, which remaining in the passage of the levers can easily be thrown back by an ordinary pick. To obviate this danger, Messrs. Hobbs introduced their patent protector, in which the bolt step or talon is fixed to a revolving nozzle instead of on the key (see Fig. 4). With these improvements their locks may be said to be perfect. Space will not permit of mention being made of the inventions of Chatwood, Tucker, Parnell, Tann, Price, Fenby, Hart, Cottrell, and Hodgson, all of which have demonstrated the possibility of producing locks capable of defying picking instruments in the hands of experts.

To cut a key to a lever lock it is necessary to remove all the levers, laying them carefully on one side in the order in which they are taken out. Now cut the first step in the blank so that it will throw the bolt, then replace the first lever and cut the second stop so that it only raises the lever to the necessary height to allow the stump on the bolt to pass the gating; next replace the second lever and proceed in the same manner, continuing until all the levers are replaced and the corresponding steps cut in the key. Fig. 9 shows a lever key for a night latch. The first step in this is a sham, as the bolt is thicker than the lever, and takes up the first two steps, so that it follows that the key belongs to a four lever lock. It will not do, however, in buying a lock, to be guided by the key unless it is by some well-known maker, as I have known a lock with only two levers have a key like the illustration (Fig. 9), the levers being kept in their places by a pin riveted in the covering plate, so that it is as well, in buying a lock, to have the covering plate removed and see that the levers are actually there. Fig. 6 shows a Bramah lock. This well-known lock is in principle the same as a lever lock, but instead of levers small guards of sheet metal (Fig. 8) are used. These work in a cylinder (Fig. 10), carrying a stud which turns the bolt; a flat steel ring (Fig. 11) projects into a groove in this cylinder, and the ring is notched to correspond with the notches in the guards, as shown at A, Fig. 8. In unlocking, the key presses the guards down until the notches are opposite the corresponding notches in the ring. The cylinder can then be turned round and the bolt thrown back, a small spiral spring at the back of the guards replacing them in position when the key is withdrawn. Those made by Messrs. Needs and Co., the successors to Joseph Bramah, the patentee, are very secure, but common Bramah locks are seldom perfect, and can be opened in many different ways.

To cut a key to one of these locks it is necessary to fit the blank to pass the outside cylinder, then to take off the cylinder, when it will appear as shown in Fig. 10, with the ring, Fig. 11 (which is in two pieces), in position in the groove, B B; now file down the end of the blank until the stud on the key nearly enters the cylinder, then blacken the end and press it in the cylinder. It will then show the impression of the guards on the end, and these should be cut down equally in the blank for a short distance, say, an eighth of an inch. The cylinder should now be held in the hand with the key pressing it, so as to see the distance back the handle with a piece of wire. Fig. 12 will illustrate my meaning. For this reason I prefer Chubb's Combination Night Latch, in which the levers themselves form the bolt, and which is opened from the inside by turning a handle, and not by drawing it back. A night latch on this principle can now be bought for as low as 3s. 6d. or 4s., and is about the best that can be used. No direction need be given for cutting keys to this kind of lock, as all lever keys are cut in the same manner as twisted round the joint. Get a pennyworth of borax, powder and moisten a piece of it (do not buy it powdered as it is not pure), and put a little over the brass wire. Now hold it with a pair of tongs in the fiercest fire at your command. An ordinary kitchener will do if all the dampers are opened and a clear fire made; in fact, I have brazed them in this way myself, when a long distance from the shop. An ordinary grate would probably do if the top was covered down to the bars with sheet iron to increase



Figs. 1 and 2.—Chubb's Levers with Notches or False Gatings. Fig. 3.—Bolt Stump. Fig. 4.—Hobbs' Patent Protector. Fig. 5.—Hobbs' Patent Movable Stop. Fig. 6.—Bramah Lock (Till Lock). Fig. 7.—Dovetailing New Bow to Key. Fig. 8.—Notches in Guards. Fig. 9.—Key for Lever Lock, showing Defect at A. Fig. 10.—Cylinder of Bramah Lock (Night Latch). Fig. 11.—Ring. Fig. 12.—Mode of opening Night Latch.

necessary to cut the notches in the key, which may be ascertained by holding the cylinder to the light and looking at the groove, B B. The notches in the key should be cut down one at a time, until the gatings in the guards are opposite the grooves in the cylinder, when if the lock is put together the key will be found to fit.

These locks are now seldom used for safes, but they are frequently used for purposes where a small key is preferred, such as night latches, jewel cases, etc. For night latches, however, they cannot be recommended, as like all drawback locks, however good the works may be, they can easily be opened by boring a hole under the latch, and turning previously described. Before closing this paper, it may be as well to describe the method of repairing a broken key (broken, that is to say, at the bow, for if the bit is broken it cannot be repaired). If the bow is twisted off and not damaged, a slot should be filed in the top of the key and the bow driven on but should the bow be broken, an old key must be found with a sound bow.

In ironmongers shops all old keys are preserved for the sake of the bows, so that one could be bought for a trifle, if there did not happen to be one in the house. Having procured the bow, it and the key should be dovetailed together, as shown at A A, Fig. 7, and a few strands of brass binding wire the draught. When the brass has melted, turn the key round once or twice until it has cooled, so that the brass may be equally distributed, and then put it on one side to cool. Take off the surplus brass, and clean up the key with emery cloth, and it is finished, and will be found equally as strong as a new one.

I think I have enumerated now all the ordinary repairs incidental to locks in general use, and have enabled those of a mechanical turn of mind to keep their own locks in repair at a very small cost. As I stated before, I shall be pleased to give any information that may be required through the medium of "Shop."

METAL SPINNING.

BY F. J. DURRANCE.

To those of my readers possessing a lathe, there can be no more interesting or pleasant way of using it than in the process of metal spinning. Very little is known amongst amateurs of this method of sheet metal working, too little, in fact, considering that hundreds of useful articles in daily use can be easily and simply made by this process—pin trays, egg-cups, candlesticks, etc. And most of the articles produced are specially fitted for embellishment by the two methods known to readers of WORK as repoussé work and chasing. The tools required are very few, and can be easily made by any one having a little mechanical knowledge. And the necessary skill is soon acquired, and the results obtained very satisfactory. Now to work. Presuming you have a little knowledge of wood turning, I will commence by describing the making of the simplest thing I can think of—a cigar-ash tray. Take a piece of hard wood of a close grain (beech or birch for instance), about 4 in. square and an inch thick; by any of the well-known methods, fasten it to a chuck. A good way is by the taper screw, or attach it to the face plate by screws from the back, Fig. 5. Now turn it up to the shape of sketch, Fig. 1 (the drawings are not to size, merely theoretical); make it nice and smooth, but do not polish it. Next get a piece of sheet metal to commence practice—lead, pewter, or better still, sheet zinc used for covering the counters of hotel bars is preferable, as it keeps its colour and takes a good polish. Most plumbers will pick you enough out of the scrap for a few coppers. Now cut a piece of metal a little larger than the pattern mould, and attach it to the face of pattern; this is the most difficult thing in this work, to hold the metal close up and prevent its turning. In this case we turn up a piece of hard wood the shape of Fig. 2, then put a little powdered resin on the flat surface of pattern, also a little on the largest face of the retaining block, insert the metal sheet *between* the two, and bring up the back centre against the small end of block. Run the lathe slowly round, and centre the metal sheet. Now screw up the back centre *firmly* and lock it, put a little oil on centre, and we are now ready to begin

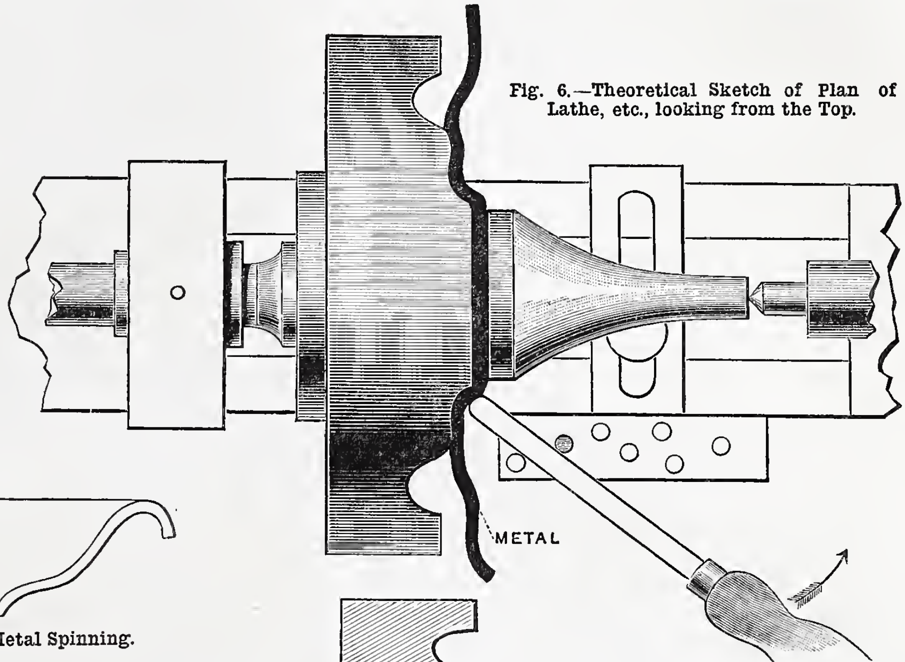


Fig. 6.—Theoretical Sketch of Plan of Lathe, etc., looking from the Top.

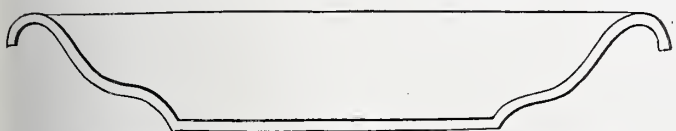


Fig. 1.—Section of Small Tray as Subject for Metal Spinning.

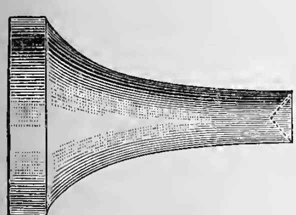


Fig. 2.—Shape of Piece of Turned Wood to hold Metal in place.

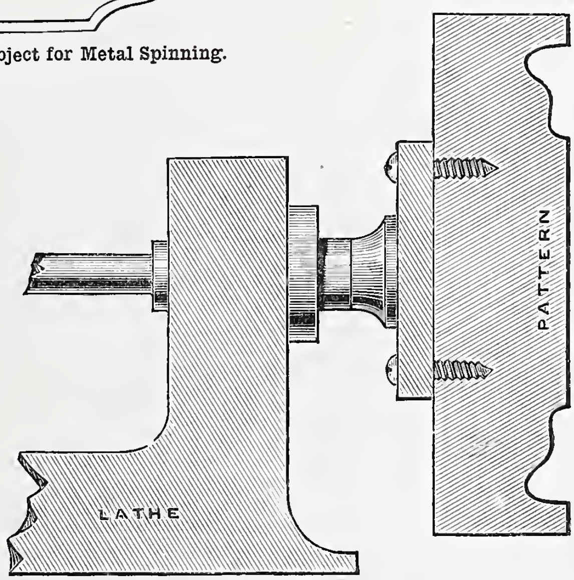


Fig. 5.—Mode of Turning Pattern on Lathe.

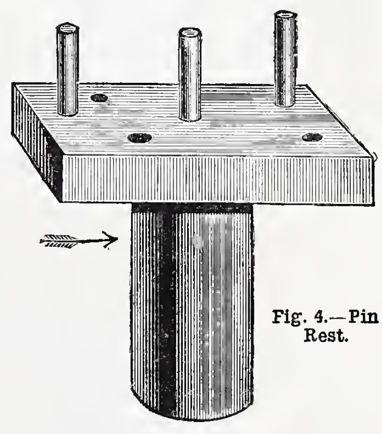


Fig. 4.—Pin Rest.

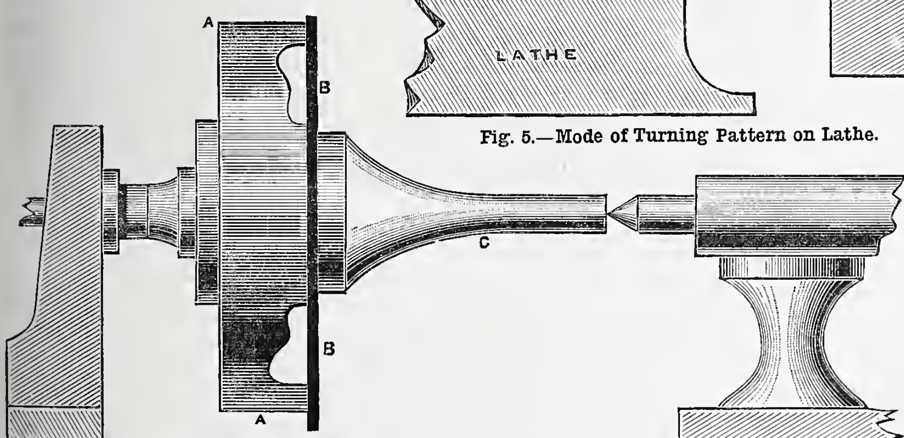


Fig. 3.—Sketch showing Pattern (A), Sheet Metal (B), and Holder (C) in Position on Lathe.

(see Fig. 3 showing all *in situ*). But as we cannot go on without tools these must be our next consideration. These consist of pieces of steel of various forms, and really consist of what are known as burnishers; for the work we have in hand a simple piece of steel rod or wire, about $\frac{3}{16}$ in. thick, rounded off at the end, smoothed and polished, and driven into a good long handle, will do, although it is always preferable to have the steel of *flat* section, square or oblong, as they lay flat on the rest and do not require so much holding. We now come to the *rest* used for this work, which is rather different to that used for wood, but very similar to the one used for metal turning. It is flat on the top, and has a few holes drilled into the upper surface for the purpose of inserting steel pins (see Fig. 4); the lower part fits into the T rest, and is fastened by a screw in the ordinary manner; put on a good quick speed for this work, the quicker the better. Now look carefully at the theoretical sketch, Fig. 6, fix the rest in the position shown, and just a *little under the centre*; next get a piece of suet from the butcher's, and as the lathe revolves hold it against surface of metal sheet so as to well grease it. Suet is preferable to oil, as the oil would fly off and dirty everything about the place; now put a pin into one of the holes in rest, and placing the tool on the rest, and against the *left* side of pin, press firmly against the metal as it revolves. The tool in this case becomes a lever, and the pin the fulcrum, allowing you to exert a great pressure against the metal, which is required in brass or other hard metal. The grease forms a lubricant, reducing the friction to a minimum. Working always from the *centre*, you will see the metal gradually give way and conform itself to the shape of the pattern. When you have got the metal well home to the pattern, cut off the superfluous metal with an ordinary V-tool used for metal, and make the edge round and smooth with emery paper. Clean and polish the surface with fine flour, emery, and oil, finishing off with whiting and water; now remove the retaining block and polish the flat part. The metal tray will not come off yet, as the heat engendered will have made the resin stick inside, and you may have to make metal hot to get it off pattern, which you can do by unscrewing chuck of lathe, and hold the metal tray over a gas flame. You can take off the resin with boiling water. The tray is now finished and can be chased, or a design worked on it by repoussé work, just as the fancy of the workman may lead him to prefer. Of course there is no limit to the number of articles which can be made from the same mould or pattern. In real practice the patterns are made in brass or iron, as the extreme pressure used tends to destroy the shape of a wood mould. In our next we shall try something a little more difficult—an inkstand and a circular box with lid.

SOME NOTES ON SCREW CUTTING.

BY A WHITWORTH SCHOLAR.

Probably one of the greatest difficulties with which the young mechanical engineer has to contend, is that afforded by the subject of screw cutting. Indeed, not only is the pupil or apprentice often perplexed, but the practical mechanic is also frequently at a loss as to what arrangement of wheels is required in order to cut a screw of a given pitch.

This fact is rendered more noticeable inasmuch as the subject is in reality by no means a difficult one to acquire when once the leading principles involved have been thoroughly grasped. Feeling sure that a large number of the mechanical engineering readers of Work will have experienced the want of information on this subject, I will at once proceed to place the matter before them in as simple and concise a manner as due regard for accuracy will allow.

The screw-cutting lathe presents a highly interesting example of the important *copying principle* so often employed in engineering tools. The "guide screw," or, as it is sometimes called, the "leading screw," is an accurately finished screw of about the same length as the lathe bed, and placed exactly parallel to the centre line of the lathe. Upon the exactness of this leading screw depends the accuracy of all screws cut in the lathe; hence the necessity for carefully protecting from injury this most important part of the machine. The pitch of the leading screw—that is the length occupied by a thread and a space—is usually $\frac{1}{2}$ inch or $\frac{1}{4}$ inch; or the screw is said to have two or four threads per inch, as the case may be; the former being generally adopted in large lathes and the latter in the smaller sizes.

A progressive set of change wheels is also supplied, the smallest of which has usually 20 teeth, and the largest 120 teeth, the intermediate sizes varying by 5 teeth. There are generally two wheels of the same size in the set, as two of 90 teeth, and sometimes also two of 25 teeth. Additional wheels of 130, 140, and 150 teeth are occasionally included in the set; but usually the 120 wheel is the largest.

It is scarcely necessary to state that one end of both the guide screw and the lathe spindle or "mandrel" project beyond the end of the lathe bed, and that the extremities are arranged to receive any of the 22 change wheels. To enable us to communicate motion between the mandrel and the guide screw, an adjustable quadrant is provided which contains a stud or pin, upon which another wheel can be placed so as to "gear" with both the wheel on the mandrel and with that on the guide screw.

Now suppose we place one of our two 90 wheels upon the mandrel and the other on the screw, communicating the motion between the two by means of an intermediate wheel of convenient size placed upon the stud in the quadrant. Then for every revolution of the mandrel, it is clear that the guide screw will also make one revolution, and a moment's consideration will show that the pitch of the screw cut by such an arrangement will be exactly similar to that of the guide screw. The whole problem of screw cutting can, in fact, be resolved into the question of the relative velocities of the lathe mandrel and leading screw, and we will now proceed to consider the means whereby desired variations in this relative velocity may be effected.

In the first place it is necessary to remark that the wheel placed upon the mandrel is a *driving* wheel, that upon the guide screw is a *driven* wheel, and the intermediate wheel which connects these two is called a *stud* wheel; the whole system as described being known as a single train of wheels, to distinguish it from the arrangement known as a double or compound train, to which we shall presently have occasion to refer.

The axiomatic principle which underlies all problems in screw cutting may thus be stated:—The number of teeth in the driving wheel must bear to the number of teeth in the driven wheel, the same proportion that the number of threads per inch in the guide screw bears to the number of threads per inch in the screw to be cut. This consideration is the foundation of—

Rule I.—To find the wheels to cut a thread of a finer pitch than the guide screw:—Place the number of threads per inch in the guide screw for a numerator, and the number of threads per inch in the screw to be cut for a denominator. Add a cipher to each, and we have the required wheels. Thus supposing the guide screw has two threads per inch, and that we wish to cut a screw of three threads per inch, then—

$$\frac{\text{Number of threads in guide screw}=2}{\text{Number of threads in screw to be cut}=3} \text{ adding ciphers } \frac{20}{30}$$

that is, the wheels required are of 20 and 30 teeth.

As a beginner might have some confusion in his mind as to which wheel is to be placed on the screw, and which on the mandrel, I may mention that such a doubt may easily be dispelled by remembering that if the screw to be cut is of finer pitch than the guide screw, the smaller wheel is the driver, and must therefore be placed on the mandrel. But if the screw to be cut is of coarser pitch than the guide screw, the positions are reversed, and the small wheel is then placed upon the guide screw.

It is necessary to observe that it is the *relative* and not the *actual* number of teeth which is the important requirement. As a consequence of this, both the numbers of teeth as found by Rule I. may be multiplied by any suitable common multiplier, or divided by any suitable common divisor, without affecting the resulting pitch of the screw. This fact is often of very great service, since wheels which are of inconvenient size may thus be replaced by those of more suitable dimensions.

For our next example we will take a case in which the number of threads to be cut is uneven, as:—Required the wheels to cut $3\frac{3}{4}$ threads per inch; guide screw 2 threads per inch.

Proceeding as directed by Rule I. we have

$$\frac{\text{Number of threads in guide screw}=2}{\text{Number of threads in screw to be cut}=3\frac{3}{4}}$$

and in this form we cannot add the ciphers as directed. In order to proceed we must first reduce the expression to a simple fraction, and for this purpose we multiply both numerator and denominator of the fraction by the denominator of the fraction belonging to the mixed number, in this case, 4. Thus $\frac{2 \times 4}{3\frac{3}{4} \times 4} = \frac{8}{15}$. Adding ciphers we have $\frac{80}{150}$ as the wheels. As, however, the largest wheel in the set has only 120 teeth, we may conveniently divide this result by 2, and we shall then have 40 and 75 as the wheels required.

The size of the intermediate wheel is immaterial in all cases of single train gear, convenience of communicating the motion between the driving and driven wheels being the only consideration.

Let us next endeavour to find the wheels to cut a screw of 14 threads per inch, with a guide screw of 2 threads per inch, and the smallest and largest wheels having 20 and 120 teeth respectively. Proceeding in the usual way we have $\frac{2}{14}$, which, by adding ciphers, becomes $\frac{20}{140}$. Here we see at once that any attempt to divide both numerator and denominator with a view to reduce the size of the large wheel will also have the effect of reducing the small wheel, which is already of the smallest size provided.

This gives rise to the following statement:—The ratio between the largest and smallest change wheels multiplied by the number of threads per inch in the leading screw will give the greatest number of threads per inch that it is possible to cut with a single train. In the case before us the ratio is $\frac{120}{20}=6$ and $6 \times 2=12$ threads as the finest pitch which can be cut with single train.

For finer pitches than this we shall require a "double" or "compound" train consisting of four wheels, of which two are driving and two are driven wheels. One of the driving wheels is placed upon the lathe mandrel, as in the single train, but it now gears directly with one of the driven wheels, which together with the second driver is fixed to a socket, turning on the adjustable pin in the quadrant; the second driver gearing directly with the second driven wheel which is placed upon the guide screw.

Perhaps the most satisfactory method of finding these four wheels is the following:

Rule II.—To find the four wheels necessary to form a double train. Proceed as in

Rule I., and assume, in conjunction with the pair of wheels thus found, two equal wheels of convenient size. Then divide the driver or driven of the one pair and the driven or driver of the other pair by any suitable number.

To make this clear, let us take the foregoing case in which the single train failed. We have here $\frac{20}{140}$, and assuming two equal wheels of 100 teeth in connection with these, we then have $\frac{20}{140}\ \frac{100}{100}$, and dividing both the first driven and the second driver by 2, we obtain $\frac{20}{70}\ \frac{50}{100}$ as the wheels required. Either of the driving wheels—the 20 or the 50 — may be placed upon the lathe mandrel, and either of the driven wheels upon the screw, without affecting the result.

It not unfrequently happens, especially in the case of screws coarser than the guide screw, that the pitch of the screw is given instead of the number of threads per inch. Suppose, for instance, we require to cut a screw of $\frac{7}{8}$ inch pitch—that is, a screw in which a thread and a space together occupy $\frac{7}{8}$ inch in length. This can be done most conveniently by—

Rule III.—To find the wheels to cut screws of a coarser pitch than the guide screw. Multiply the required pitch in inches by the number of threads per inch in the guide screw, and then add ciphers as in Rule I.

Thus $\frac{7}{8} \times 2 = \frac{14}{8}$, or by adding ciphers $\frac{140}{80}$ and dividing by 2 we have $\frac{70}{40}$ as the wheels required.

Again, supposing the pitch of the screw required is $6\frac{3}{4}$ inches, $\frac{27}{4} \times 2 = \frac{54}{4}$, adding ciphers $\frac{540}{40}$, and assuming two additional wheels of 120 teeth, we have $\frac{540}{40}\ \frac{120}{120}$; then dividing the first driver and second driven by 6, we obtain $\frac{90}{40}\ \frac{120}{20}$ as the required wheels.

In all the examples hitherto given we have dealt with right-handed screws, of which the guide serew affords an example. If a left-handed screw has to be cut, it will be necessary to interpose a wheel of convenient size between a driving and driven wheel after determining the required wheels as before. An extra adjustable pin is provided in the quadrant to carry this additional wheel.

Rule IV.—To prove the wheels to be correct:—Multiply the driving wheels together and multiply the driven wheels together. Divide the greater quotient by the less. Then this result is to be multiplied or divided by the number of threads per inch in guide screw, according as the screw to be cut is of finer or coarser pitch than the guide screw. The final answer should give in the first instance the number of threads, and in the second instance the pitch of the screw to be cut.

To render this clear, we will prove the wheels in the examples given to illustrate Rules II. and III. In the first case we have $\frac{20}{70}\ \frac{50}{100}$ as the wheels. Multiplying the drivers together, $20 \times 50 = 1{,}000$; multiplying the driven together, $70 \times 100 = 7{,}000$; dividing the greater by the less $\frac{7000}{1000} = 7$; and multiplying by number of threads in guide screw, since the screw is of finer pitch than the guide screw, we have $7 \times 2 = 14 =$ the number of threads required.

In the second case (Rule III.) we have $\frac{70}{40}$ as the wheels, and we can at once divide the greater by the less, thus:—$\frac{70}{40} = 1{\cdot}75$. But as in this case the screw to be cut is coarser than the guide screw, we must divide by the number of threads in the guide screw, and we then have $\frac{1{\cdot}75}{2} = {\cdot}875 =$ $\frac{7}{8}$ inch as the pitch which would be cut by such arrangement.

In the last case we have $\frac{90}{40}\ \frac{120}{20}$ as the wheels. $\frac{90 \times 120}{40 \times 20} = \frac{10800}{800} = 13{\cdot}5$. Dividing by the number of threads in the guide screw we obtain $\frac{13{\cdot}5}{2} = 6{\cdot}75 = 6\frac{3}{4}$ as the resulting pitch in inches.

I have thus endeavoured to indicate the principles involved in screw cutting rather than confine myself to mere statements of hard and fast rules. For by this means the student or the workman will be enabled to understand whatever theory is involved in the practice of the workshop, and the application of which he will then be in a position to modify or extend.

THE SPEAKING TELEPHONE AND MICROPHONE.

THEIR CONSTRUCTION, AND HOW TO USE THEM.

BY WILLIAM DUFF.

The speaking telephone is without doubt the most wonderful invention of the nineteenth century. Its usefulness for business purposes is beyond question. It has in a great many instances made its big brother, the "electric telegraph," stand aside. And yet it is so simple in construction that any schoolboy, with a few simple tools, and the merest trifle of mechanical knowledge, can easily put it together.

It consists essentially of a wooden or ebonite case, being hollow throughout its entire length, a round steel bar magnet fitting into the case, having a small bobbin of very fine silk-covered copper wire surrounding its north pole, which is placed at the speaking or hearing end of the case. Directly over the bobbin is placed a circular disc or plate of thin sheet iron, fixed round its edge, but free to vibrate at its middle.

The ends of the coil of wire on the bobbin are connected by two wires running the length of the case, ending in terminals or binding screws, for the purpose of connecting the instrument with the line wire.

Formerly, two such instruments were simply joined up to the line and the earth, as shown in Fig. 2, and no battery was employed, for on speaking into the mouthpiece of one, the vibrations of the voice bent the iron plate to and fro in front of the magnetic pole, and thus by magneto-electric induction set up undulatory currents of electricity in the little coil around the pole. These currents were of a strength and form dependent on the vibrations of the voice, and after travelling along the line they passed through the coil of the receiving instrument, where, by a reverse action, they set the iron plate into a vibration sympathetic with the vibration of the plate of the transmitting instrument. The result was that an ear placed at the mouthpiece of that instrument could hear a feeble imitation of the distant speaker's voice. I can well remember the first time I heard a telephone speak. It was then only in the experimental stage. The instruments were the property of Sir Wm. Thomson. When I placed the instrument to my ear, at first, I was so much excited I could hear nothing, but gradually the tones of a well-known voice became recognisable, and when I laid down the instrument, I resolved to set at once to work and make for myself a set of this wonderful apparatus. It was not until long after, however, that I did actually make a beginning, and I have now a pair of as good telephones as any one could desire.

I had a little knowledge of the science of electricity, and knew something of the why and wherefore of certain laws which govern things electrical, so I made my telephones to please myself. I had no figures or diagrams to go by, save an advertisement cut of the Religious Tract Society.

I will set out the details of one of these instruments, hoping to make them plain enough to the ordinary reader, and if any electrical engineer happens to come across this description I hope he will wink at any miscalculations he may find; and should he be inclined to find fault, I will ask him to remember that I am not writing for him. But at the same time, let me assure the amateur that if he follows my directions he will not need to be ashamed of the telephones, for mine *can* speak, and speak well, and the best instrument that ever left the electrician's workshop can do no more.

The outer case then, to begin, is made of mahogany, and is in three pieces, which I will call the body, the mouthpiece, and the cap. The body will be easier to make in two pieces, for if made solid or in one piece it will be very difficult to drill the hole for the magnet. Get two pieces of mahogany, 4 in. by 2 in. by $6\frac{1}{2}$ in., and fasten them together in the usual way for turning—*i.e.*, plane two sides and glue them with a piece of soft paper, such as newspaper, between. They will have the appearance of one piece, measuring 4 in. by 4 in. by $6\frac{1}{2}$ in. Turn them any shape you fancy; but that shown at Fig. 3 will suit the purpose. Make the cavity at the end the sizes indicated in the figure, viz., $2\frac{3}{4}$ in. by $\frac{1}{2}$ in. When you have the body turned and finished, split it (the paper between the halves makes this easy), and make the hole for the magnet with a gouge, taking care to have it in the middle of the entire piece. The hole should be made so that the magnet will fit well and not rattle about; but it must not fit too tight, so as to prevent easy adjustment. Turn the mouthpiece out of a piece of the same stuff as the body, measuring 4 in. by $\frac{3}{4}$ in. Fig. 10 gives the exact sizes to which it must be turned. The cap is shown at Fig. 5; but it can be dispensed with, without in any way lessening the effectual working of the instrument. The bobbin to take the wire for the coil is also of wood, preferably boxwood, and it will require some care in turning, for it is so small and so thin in every part that it will be easily broken. It can be made of paper, with pasteboard ends. I made mine thus: a narrow strip of cream laid paper, glued and rolled round the magnet several times till about $\frac{1}{8}$ in. thick, and two round discs of thin pasteboard, with holes, the width of the magnet, glued at each end of the paper. Fig. 7 shows it in section, and the proper sizes are given, which must be the same whether made of paper or wood.

The wire for the coil is No. 36, silk-covered; about $\frac{1}{4}$ oz. will be sufficient. It should be wound on the bobbin as evenly as possible, and free from kinks; both ends must be left free for connecting up; one end taken through the side of the bobbin, and the other one left where the winding stops. After winding steep the coil in melted paraffin wax. In winding the coils for the pair of instruments one will have to be wound in the contrary direction to the other, and in joining up, the beginning of the one and the end of the other must be connected together.

The ends of the coil are soldered to two stout copper wires, and carried inside through holes to the top of the case, and fastened to binding screws. The diaphragm is a thin ferrotype plate, to be procured at a photographic apparatus shop: cut it 3 in. in diameter, and don't have any wrinkles in it, especially round the edge. After all the pieces have been made and fitted, the best means to put them together will be to begin by gluing the two halves of the body. Previous to this have the two small holes to take the wires from the coil running parallel to the large hole for the magnet, one on each side. When dry and hard put the magnet in place, with its south pole at the top, and insert the adjusting screw, which should have a neck to work in a little collar screwed to the end of the body (see Figs. 4 and 8). Screw and collar should be of brass. Push the wires from the ends of the coil through the small holes in the body, and bring them out at the top; place the hole of the bobbin on the protruding end, the north pole of the magnet; the bobbin should fit tightly; it will be held in position by the wires, which may now be fastened to the binding screws at the top; turn the end of the wire two or three times round the stem of the screws; screw them tightly into the wood. The diaphragm may now be laid in its place; but just before doing this place a piece of paper over the magnet, and with the adjusting screw bring the magnet to touch the paper; place the mouthpiece over all, and fasten with four brass screws; before fastening up tight withdraw the paper; this will leave a space of about a 32nd of an inch, or the thickness of the paper, between the magnet and the diaphragm: the mouthpiece clamps it round the edge, and leaves it free to vibrate at the centre. The magnet, it should be said, will require no further adjustment. It should be strongly magnetised to begin with, and capable of sustaining its own weight.

The instrument just described is what is known as the Bell receiver, and two of these instruments will speak or hear if they are alternatively held to the mouth or ear. The method of connecting them to the line is already described.

There are a great many different telephones in use, and a great many more have been invented that will never be in use. They are all dependent, more or less, on the same principle.

After the invention of the telephone, Professor Hughes, of telegraphic fame, invented an instrument known as the microphone. He had been investigating acoustical phenomena by the aid of the telephone, and discovered that a delicate contact between two conductors could be made to transmit speech. In the course of his experiments he had been using a strained wire, when suddenly the wire broke, causing a great rush of sound to be heard in the telephone which he held at his ear. He sought to imitate the condition of the wire at the moment of rupture by replacing the broken ends and pressing them together. This he did with three common nails; two joined to the ends of the wire lying on the table side by side, and the other lying across them. The effect was improved by building the nails up log-hut fashion. This crude apparatus reproduced sound with remarkable fidelity. Acting on the facts brought out by these experiments, he devised an instrument for magnifying weak sounds, which he called a microphone.

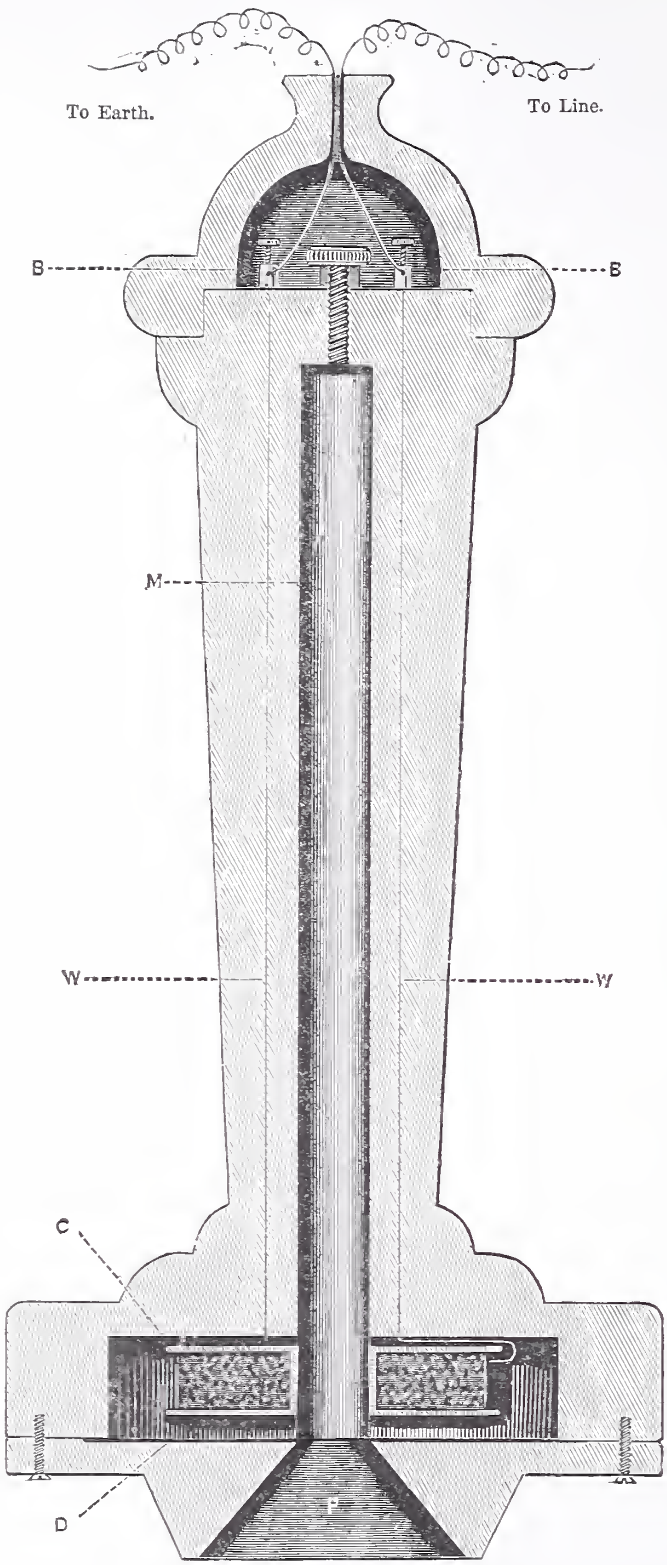


Fig. 1.—Section of Bell Telephone Receiver, of which the Outer Case is of Mahogany or Ebonite.

M, Magnet fitted with Adjusting Screw. C, Coil of Silk-covered Wire. W, Wire from Coil to Binding Screws. D, Diaphragm of Ferrotype Iron. P, Earpiece.

As he made it, it consisted of a lozenge-shaped piece of carbon one inch long, a quarter of an inch wide at its centre, and one-eighth thick. The lower end rested as a pivot upon a small block of similar carbon, the upper end being made round, so as to play free in a hole in a small block of carbon similar to that at the lower end. The lozenge stood vertically upon its lower support.

The form of the carbon is not of importance provided the weight of the upright contact is only just sufficient to make a feeble contact by its own weight. Carbon is used in preference to any other material, as its surface does not oxidise or rust. The general appearance of the microphone will be seen from the drawing, Fig. 6, and the method of connecting it to the line and battery will be understood by reference to the section given at Fig. 11.

This instrument is capable of detecting very weak sounds made in its presence. If a pin, for instance, be laid upon or taken off the table, a distinct sound is emitted; or if a fly be confined in a matchbox, or other suitable prison, it can be heard walking with a peculiar tramp of its own. Thus, the beating of a pulse, the ticking of a watch, the tramp of a fly, can be heard at least a hundred miles distant from the source of sound. The success of the telephone is largely due to the microphone, for the transmitters which are now in use, in conjunction with the telephones, on our exchange systems are, to a great extent, modifications of Professor Hughes' simple contrivance.

When a microphone is used a battery will be required to generate a current. For the fly-walking and watch-ticking experiments a sufficient battery can be constructed for little cost. The following will suit all requirements; it is a modification of the Daniell cell. Three jam pots, three plates of copper, with a gutta-percha-covered wire soldered to each; three plates of zinc, with a copper wire also soldered to each, which may be bare; a few grains of bluestone (sulphate of copper), a little sawdust, and some salt and water. These are all the materials necessary. Put a plate of copper at the bottom of each jam pot. Allow the wire to come up the side; put a little of the sulphate of copper on the top of each plate; pack in the sawdust until a few inches from the top of the pot; place a sheet of zinc on the top of sawdust; allow the wire to come to the opposite side of the pot from that where the wire from the copper plate comes; moisten the sawdust with the water in which the salt has been dissolved; a cork may be fitted to each pot to keep them clean and tidy. Connect the cells together as in Fig. 9.

With this arrangement speech can be carried on, and a great number of wonderful experiments conducted. To have a direct communication between two stations a duplex set of apparatus will be required, including call-bells, etc., mounted upon a switch-board, with all the paraphernalia of practical telephony; but as these do not come within the scope of the present paper, I will leave them to some future time. Perhaps an abler pen than mine may write upon this subject. At all events, I have endeavoured to do my best to put the matters of principle and construction plainly and clearly before the reader, and I hope I shall have succeeded not only in doing this, but in interesting many in a subject which is possessed of considerable importance.

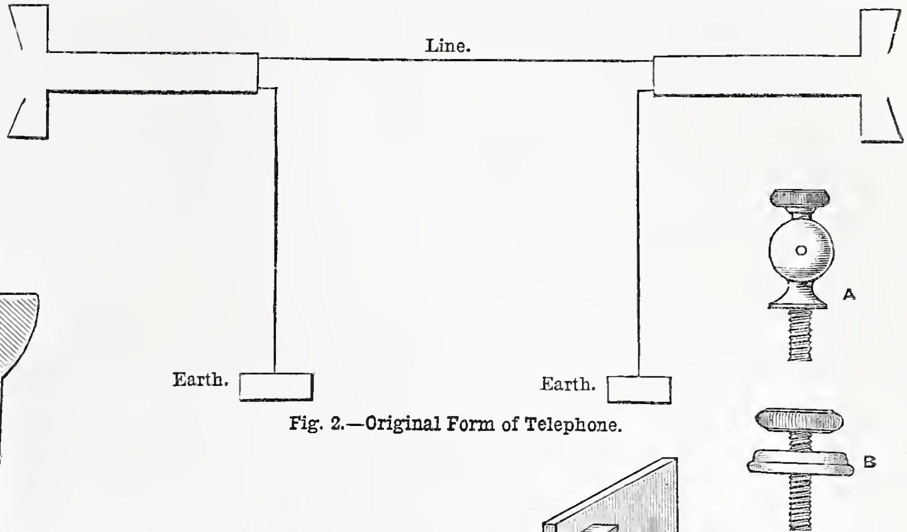


Fig. 2.—Original Form of Telephone.

Fig. 4.—Binding Screw (A) and Adjusting Screw (B).

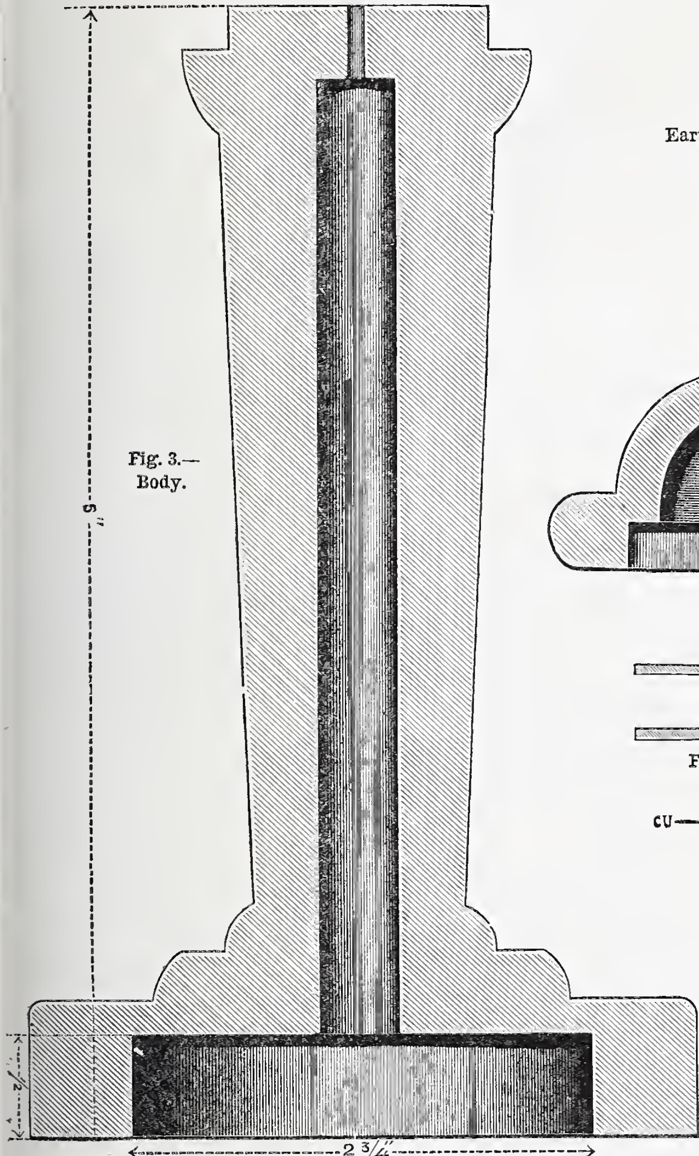


Fig. 3.—Body.

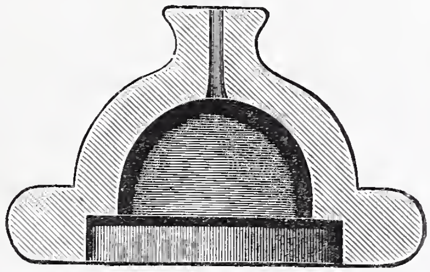


Fig. 5.—Cap.

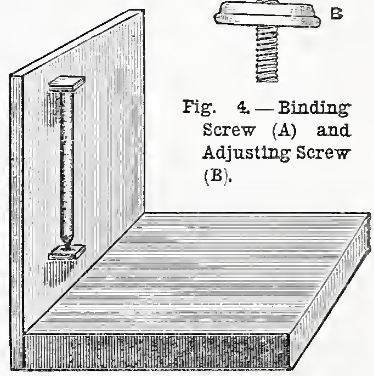


Fig. 6.—Carbon Microphone.

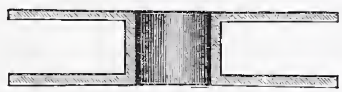


Fig. 7.—Bobbin for Coil.

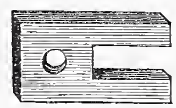


Fig. 8.—Collar.

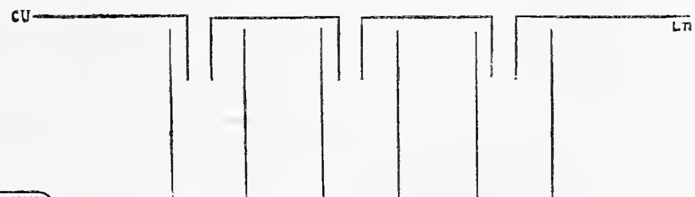


Fig. 9.—Battery.

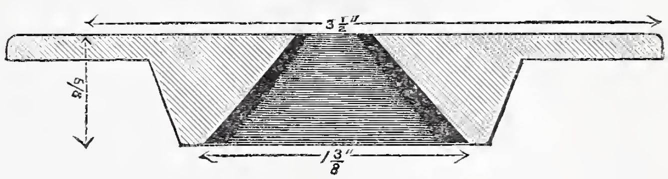


Fig. 10.—Mouthpiece.

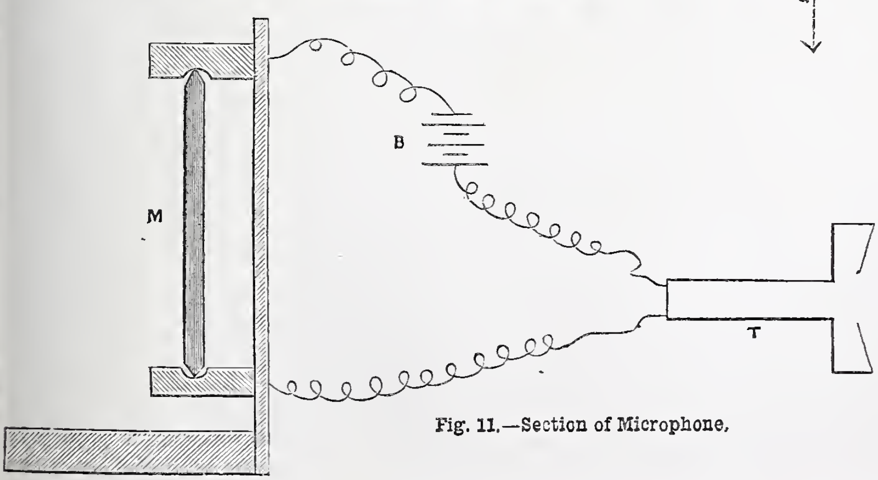


Fig. 11.—Section of Microphone.

CONSTRUCTION OF BOTTLE BICHROMATE BATTERIES.

BY F. W. MASON, F.S.S.

As many amateurs, and likewise professional men, use these in their experiments, it would perhaps not be out of place for some to know how to construct them. These bottle batteries, though generally known by the name of "Bottle Bichromate Batteries," may really be used with any single fluid cell solution; and at the conclusion of this article I will give a few different kinds of solutions which have been practically tested and used for some time past both by myself and many leading electricians.

In the first place take any ordinary wide-mouthed bottle. If it be preferred to use the regular form, bottles can be obtained at any electrician's for about 9d. or 1s. each. They should have the capacity of about one pint. Of course smaller ones can be used if desired, but this size is the one I always recommend. Take a piece of ebonite, or any hard wood, about $\frac{1}{4}$ in. or $\frac{1}{2}$ in. thick, and, by means of cutting and turning it in a lathe, obtain it so that it will just fit loosely inside the neck of the bottle; then take another piece of similar material, about $\frac{3}{16}$ in. thick, and turn this slightly larger than the neck of the bottle, so that it will, when placed on the top of the bottle, rest there without in the least entering the neck. Put these two pieces together by means of glue, so that their centres exactly coincide with each other. Thus we shall have our lid made. When these are dry and firm, drill a hole through the centre about $\frac{1}{4}$ in. diameter; then fit through this, by means of marine glue, a piece of brass tube $\frac{3}{16}$ in. diameter. This should project about 1 in. above the lid, and about $\frac{1}{8}$ in. underneath; it should also have in it, at the upper extremity, a hole drilled and tapped, and a screw fitted to it. This is for the purpose of holding the brass rod (which is attached to the zinc element) in any position.

Having done this, the next step is to take a piece of zinc $\frac{3}{16}$ in. thick and of a suitable size so that it will go through the neck of the bottle into the interior; then drill in this (at the end which is designated to be that which is to be connected to the brass rod) two holes about $\frac{1}{8}$ in. or $\frac{1}{4}$ in. from each end. Then take a strip of ebonite $\frac{1}{2}$ in. thick by (if the zinc is, say, 3 in. broad) 3 in. long and $\frac{3}{4}$ in. width; cut a channel in this about $\frac{1}{4}$ in. or $\frac{3}{8}$ in. deep to receive the zinc (the width to be regulated according to the thickness of the zinc employed); two holes are then to be drilled at each end so as to be level with those holes drilled in the zinc, and by means of two small screws the zinc and the ebonite strip can be attached together. The ebonite strip should also have in its centre another hole drilled and tapped about $\frac{1}{8}$ in. diameter.

Having done all this, next take a piece of brass rod $\frac{1}{8}$ in. diameter, tapped at one end so as to screw into the ebonite strip; pass one end of the rod through the brass tube in the lid, and we have the zinc element complete (except the amalgamation). Then attach to the lid, by means of very small screws, a U-form piece of copper so as to encircle the brass rod without touching it. It should leave a space of $\frac{7}{16}$ in. between the edge of the copper and the brass rod. This copper strip should be about $\frac{1}{16}$ in. thick, and should also be attached to a terminal on the lid. It is to this copper strip that the carbon element is joined (one on each side of the zinc).

When we have got this into its place and properly fixed, we can then choose our carbon plates. These should be made of good hard porous carbon, exhibiting no cracks or coloured marks whatever on its surface. They should, of course, be of such a size as to suit the cell itself; they should reach from the lid to within $\frac{1}{4}$ in. from the bottom, and should be, at least, the same size in width as the zinc plate. Before we can attach our carbon plates to the copper strip we shall have to copper one of the ends of each; and to do this we shall have to make use of the electro-plating process. Take any wide jar holding about a pint, and nearly fill it with the following solution:—Copper sulphate, 1 lb.; dissolve in hot water, and add, when this is cold, 9 oz. of strong sulphuric acid. Be careful in the adding of this, as it will cause the liquid to become hot and spirt; it should be added very slowly. If the reader should not like to make up a quantity of this, he can use the following smaller proportions:—Copper sulphate, 2 oz.; sulphuric acid, 1 oz.; water, one pint.

When we have obtained our solution, and have filled our jar with it, we must obtain a cell of some kind of battery. The Bunsen is very good here; or, if the reader has a Daniell, he can use it in place of the Bunsen. If we have the Bunsen, attach a wire to the zinc, and also one to the carbon plate, and bring them to our jar of copper solution. To the wire coming from the carbon of the battery attach a piece of copper plate, and immerse in the jar of solution; string the carbons to be coppered to the other wire coming from the zinc of the battery. They should be attached to this wire by means of thin copper wire. Immerse the ends of the carbons in the jar of coppering solution to about the depth of 1 inch. Be sure that the carbons and the copper plate do not touch. Leave them in for about one or two hours (according to circumstances), and in about that time we shall find we have a fine firm coating of copper deposited upon them. Then swill these well in cold water, and wipe.

Having done this, the next procedure is to prepare a bath of wax: take an old tin tray about 2 in. deep, and put some good paraffin wax in it, and apply a source of heat (as gas) underneath. Fill this tin up with melted wax, and regulate the heat so that it will just barely keep the wax boiling; then immerse the coppered ends of the carbons in this for about 2 inches. Allow these to remain in for twenty or thirty minutes. Then take out and well wipe with dry cloths. Be careful and well wipe the coppered ends, or else it will be found that we shall never obtain the solder to stick to them; and it must be also understood that the waxing of the carbons must *always* take place *after* the coppering and never *before*, because if the carbons were waxed first we should never obtain a good coating of copper on them, and it is for this simple reason they are waxed afterwards. The waxing is to prevent the salts of the battery solution creeping up and destroying the connection. When we have well wiped and again washed our zincs in water, we can attach them to the copper strip by means of soldering the copper strip to the coppered ends of the carbon. Use ordinary solder and spirits of salts, and well wipe and wash the joint afterwards. Many electricians prefer to use resin for these joints; but I should not advise any of my readers to use it, unless they have the patience of Job, a good temper, and also have had a little experience of using resin with solder. I never use resin in any of my apparatus, and I have never had any fault to find with any of it yet. When we have finished our carbons, we have the battery complete, except the amalgamation of the zinc and the zinc terminal. To make the latter, you can either tap a hole in a brass rod and screw a small terminal in to it; or else, if the battery is for use and not for show, we can drill a small hole down the rod, say for about $\frac{1}{2}$ in., and then drill another hole through the rod, and across this other hole—say about $\frac{1}{4}$ in. from the top of the rod—tap the hole that is drilled down the rod, and insert a small screw. If then we pass a bit of wire through the other hole, and then screw the screw down, we shall have a handy and cheap terminal. It is the method that I always use in similar cases where my object is not show.

Now for the amalgamation of the zinc. This is, in my idea, a very important part. Many seem to think that if there is just a little mercury on the zinc, that is sufficient; but this is *not* sufficient. The zinc plate must have a thorough bright and regular coating of mercury on it. There are two methods of doing this: one is by means of the old troublesome rubbing method with mercury and sulphuric acid, and the other is by the method designed and improved by myself. I will give them both. The one that is the least troublesome to use, and the one I always use, is the latter; nevertheless, as only a very few use this, I will give both. First, the old method:—Take a little mercury in one saucer, and a little sulphuric acid in another; pour a very little sulphuric acid on the mercury. Then, with a piece of rag tied on the end of a stick, dip first in the sulphuric acid, and then well rub the plate; then obtain a few globules of mercury on the plate, and well rub them with the rag till a bright uniform amalgam of zinc and mercury is obtained. Be careful that you do not get the acid on your hands or clothes. If you get the acid on your clothes, a little strong ammonia will remove the red stain, but will not, as may be supposed, turn tailor and mend the burnt hole. If you get any of the acid on your hand, rinse it well in running water; but my advice for these two points is, Do not get acid on your clothes or person unless you possibly can help it.

Second and best method of amalgamation, but slightly dearer; it costs four times more than the old method, and it is this ground that debars many from using it:—Take nitrate of mercury, 1 oz.; chloride of mercury, 1 oz.; dissolve in water to which a little hydrochloric acid and ammonic nitrate have been added; make up with distilled water to one pint. The zincs, before being immersed in this, should be well cleaned with sulphuric acid and water, and should then be swilled with distilled water; or, failing this, with water that has been vigorously boiled and then filtered. I fear I cannot recommend the use of ordinary water as it is. If the zincs have been well cleaned, when they are taken out of the bath they will be found to have a splendid bright coating of mercury. This arrangement, as will be seen, constitutes one of cleanliness and portability. The solution will last for a long time if it is kept well corked in a bottle when not in use.

Now for a few solutions. First of all, the bichromate of potash solution:—Take bichromate of potash, 1 lb.; dissolve in four pints of hot water; allow to cool, and when cold add sulphuric acid, $10\frac{1}{2}$ oz.—This solution is one of the best known, and has been regularly used by me for some years past.

Chromic acid solution: — Chromic acid, 1 lb.; sulphuric acid, 8 oz.; water, four pints.—Very good, and gives an intense current.

Permanganate of potash solutions:—Mason's solution consists of permanganate of potash, 6 oz.; sulphuric acid, 2 oz.; water, 1½ pints.—Gives a most powerful current for same length of time as bichromate.

Bromine cell. — Same solution as permanganate of potash, with a layer of bromine under the solution. It is the most powerful solution known, giving over 2·0 volts E.M.F., and also having an extremely low resistance. The solutions above given have all been tested for a great number of years, and so can be thoroughly recommended to all those that are in want of a good strong solution. They all give at the least an E.M.F. of 2·0 volts.

Any matters pertaining to batteries I shall always be very pleased to answer. I should have before stated that there could, and should, be run round the lid of the bichromate bottle battery a strip of brass, fitting nicely the outside of the bottle. This sets the bottle off, and makes the job look workmanlike, as all work should that is made from instructions given in WORK.

OUR GUIDE TO GOOD THINGS.

**** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

88.—HOME ART WORK.

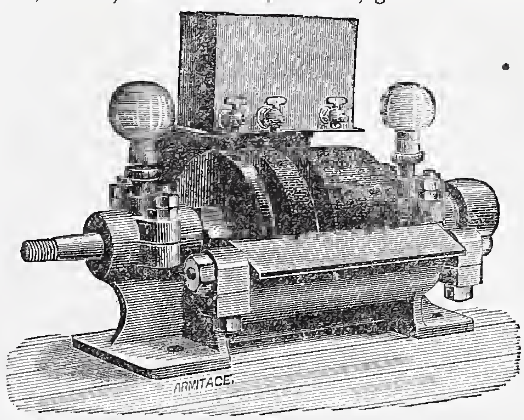
MANY readers of WORK are, without doubt, interested in the employment which is well expressed in the title of the magazine now under consideration, namely "Home Art Work." It is, as the wrapper tells us, the new monthly series of "The Art Designer," and is "A Monthly Portfolio of Full-Sized Designs for Painting and Artistic Work," edited by Mrs. Conyers Morrell, and published at and by Mr. John Heywood, of 1, Paternoster Buildings, London, and Manchester. There is, as a matter of course, much to interest and amuse in the letterpress, but the chief attraction lies in the sheets of designs that are issued with each monthly issue. In the parts before me are two small sheets—one, that is to say, in each part, with some well drawn classical figures from the antique, the most noticeable fault being a somewhat exaggerated gap between the great toe of each foot and the toe next to it, which gives one the impression that the classical figures had originally rejoiced in the abnormal number of six toes in each foot and had lost one of the number by amputation. The larger sheets are very good. One of these has on one side a spirited full-size design by Walter Crane, for the corner of the border of a table-cloth, exhibiting two winged dragons in mortal conflict; and, on the other, designs for glove and handkerchief boxes, adapted for needlework, repoussé work, poker painting, or wood carving, by Mr. G. C. Haite, F.L.S.; a design for a plaque of water lilies, tadpoles, and frogs, by Mrs. Ernest Peel; a border for altar linen by the Rev. Aymer Vallance; a tea cup and saucer, with violas, by E. Hall; and two pincushion needle-boxes, one in the form of a violin and the other resembling a guitar. The other large sheet contains on one side Andromache, reclining on a couch, and on the other the same subject on a small scale, surrounded by a border of flames; various small designs including some Old English patterns for muslin embroidery; two circular designs for needlework or repoussé work for embroidery, the subject being wild boars in some well-conceived scroll work by the Rev. Aymer Vallance, and some seventeenth century designs for gloves useful for painting on needlework. The list of illustrations just enumerated will give intending purchasers a sufficient idea of the nature and contents of this magazine. The large sheets, it may be said, are about four times the size of the small sheets.

89.—HARGER BROTHERS' IVORINE AND VULCANITE.

Messrs. Harger Brothers have sent me specimens of two materials which they have recently added to their large and varied stock of tools, appliances, and materials. They are called ivorine and vulcanite, and, as may be supposed, the former material is of glossy whiteness, and the latter black; the ivorine for fretwork, inlaying, and overlaying in fine work, and is supplied at 2s. 6d. per square foot. The vulcanite is dearer, being 3s. 6d. per square foot, but it is much thicker than the ivorine. Any one who stands in need of them at any time, will find these materials both useful and serviceable for the purposes for which they are supplied.

90.—EXAMPLES OF LATHES, APPARATUS, AND WORK.

This is a very useful pamphlet, by the author of "Lathes and Turning," published by Messrs. E. and F. N. Spon, 125, Strand, W.C. In his preface, the author says: "The following pages are written with a view of describing the construction and capabilities of some of the most recently designed lathes, apparatus, and tools. Those who want further information on the general subject of turning are recommended to read "Lathes and Turning," second edition, published by Longmans, price 18s. The pamphlet is, in fact, an agreeable form of catalogue and price list of the specialities of the London Lathe and Tool Company, many of which were noticed and illustrated in the earlier numbers of this Magazine. Some interesting examples of ornamental turning are engraved, and notably a peculiar specimen of turned work consisting of a cube, having within it a smaller cube, with a horn projecting from each of its sides. This is all turned out of the solid. Ivory or hard wood is the best material of which to make it. Some excellent specimens of geometric turning are also given, which, up to the present time, have been produced only by means of expensive apparatus. The author, however, tells us that he has devised a simple and inexpensive instrument by which this class of work can be executed in a plain lathe, without overhead motion and without division plate. This will manifestly be a great boon to amateurs and others who wish to execute a little ornamental turning of the kind mentioned, but are not possessed of means wherewith to furnish themselves with the costly apparatus that, up till now, has been absolutely necessary. The author of the pamphlet does not tell us what the instrument is, but he refers us to a volume of his "Geometric Turning Simplified," in which all those who want to know how these and other figures can be produced, will find the means of slaking their thirst for knowledge. While writing on this subject, I may call attention to the London Lathe and Tool Company's Grinding Machine, a compact and handy appliance, which has not yet received notice in WORK. "The small cutting tools," says Mr. Northcott, "now used in the best organised workshops, for even tolerably heavy work, are ground far quicker and better by these small tool-grinding machines than by the old-fashioned grindstone, which latter, with its dust, dirt, and disorder, may be relegated to the yard and used only for rough grinding. Unless otherwise ordered, the spindle carries three wheels; the first, a wide and moderately coarse emery wheel for doing most of the work; the second, a fine emery wheel for smooth grinding; and the third, a metal wheel, used with the finest emery or other fine grinding material, for giving the polished edge required by some cutting tools. The spindle end is made to carry a face grinder, buffing wheel, etc. The guide bar or rest in front may be fixed at any angle, and the cutting tool is generally carried by a small adjustable sliding rest, pushed along the guide bar by hand. By these means, all cutting tools may be ground to correct cutting angles, and much better work produced by them than by badly shaped hand ground tools. The grinding machine may be mounted on a bench or upon special stands as preferred." Prices range as follows: — With six-inch wheels, £10; with nine-inch wheels, £15; with twelve-inch, £20. Countershafts complete for each size of wheels are supplied, complete, for £2 10s., £3 5s., and £4 respectively. A representation of this desirable and useful machine is given in the accompanying illustration.



London Lathe and Tool Company's Small Grinding Machine.

This pamphlet, small as it is, for it comprises only forty-eight pages, will, I am inclined to think, give all those who wish to take up ornamental training, and attain proficiency in it, as good an insight into the tools and appliances that are needful and the work that can be executed by them as well as by making reference to, and searching the pages of, many a more pretentious and costly work. At the end of the book are given engravings of many of the simpler varieties of ornamental work produced by many of the lathes and apparatus described in its pages. Although the author speaks of them as "simpler varieties," they present many complex arrangements of curved lines that are almost bewildering in their crossing and recrossing. I believe that all these diagrams are engraved on the wood in the lathe, for they could hardly be produced in all their regularity and intricacy by the artist's pencil and the engraver's graving tool. The pamphlet is appropriately brought to a termination by some specimens of turning in the solid, produced in one of the Company's five-inch geometric lathes by an apprentice who had never before done any ornamental turning. In this page illustration are twenty-five napkin rings of different patterns, most of which were shaped by the Universal Cutting Instrument, aided by the division plate, while some were shaped by one of the Company's Drilling Instruments. I regret that it is not possible to produce here the illustration to which reference is made. I can only hope that a desire to see it, and to judge in some measure of the excellence of the work that is figured, will cause many a reader to send to the Company for a copy of the book itself.

It will be found that some of the appliances described in this pamphlet have been noticed in the earlier numbers of this Magazine, but this need not deter any one who may wish to possess it from sending for it, as the tools and machines which have not been mentioned in these pages considerably outnumber those which have. Added to this there is much information with reference to the uses of the machines that are mentioned which the author of "Lathes and Turning" supplies in an attractive and desirable form.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Broom and Brush Making.—Brushmaker writes:—"I see on page 253 of Work an answer to a query regarding broom and brush making which is very misleading. I understand the material your correspondent has sent you a sample of is called bass. It is of a dark brown colour and very stiff; it is used to make stable brooms with. I will try and explain to the best of my abilities the proper way to tie a knot. Say that the holes in the brush-head are ⅝ in. in diameter. Take up as much stuff as you think will fill a hole; have your pitch melted; dip the one end in it to the depth of full ½ in., so as the pitch will penetrate through it; then take a piece of thin cord about 12 in. long, and roll it tight at the top; then dip it in the pitch a second time and put it in the hole with the right hand with a half circular turn, just as if you were screwing it in. This spreads the knot and puts it to the bottom of the hole."

A Complaint.—W. W. W. (*London, S.E.*) writes:—"After taking in Work regularly since commencement, and waiting for my turn (wheelwright and coach painting), I was astounded to see the article on Battlesden Cart. I supposed your writers were practical men, not clerks. I supposed Work was for the benefit of beginners and improvers of all trades. In your article on cart the writer doesn't mention birch for panels, elm being seldom used, owing to its being liable to cast in drying; walnut is far too costly. He also mentions elm for shafts, but I have never seen an elm shaft in my life, especially one of that description. To an outsider, no doubt your other articles appear reasonable enough, but having asked the opinion of others in the trades, they say the same, being far too amateurish to be of use to improvers like myself. Most of your subscribers being lads like myself, they will admit that 'Shop' is the best portion of the paper (iron trades and sign-writing excepted). However, I shall stick to it, hoping it will improve and become useful."

Metal for Repoussé Work.—F. U. (*Hereford*) writes:—"I have taken in Work from the commencement, and I consider it really the best of its class published. I have obtained much that is useful from it, and should therefore like (with your kind permission) to call the attention of your readers and workers in repoussé (that is, of those who do not already know it) to a very beautiful metal for this work, far superior to either brass or copper in working and in looks when finished. It is known as aluminium bronze or sun metal. The patentee is Mr. John Clark, 80, Great Brook Street, Birmingham, but no doubt it can be got through any ironmonger. I have just finished a piece of work which put it to a very severe test, and it came out victorious in every instance. I see the metal is patented in Belgium, France, Germany, United States, Great Britain, and India, the price of it being very reasonable."

An Opinion of Work.—Stoker writes:—"Allow me to say a few words about Work. Your correspondent W. V. C. (page 268) says that most of the articles in Work are far above his head. Perhaps so, but why don't he try something that won't require so much skill to make as 'A Cabinet in Fretwork for Skilled Workmen?' It only needs a bit of courage and determination to succeed, and then I am sure he will have no cause to grumble when he looks upon his handiwork. Now, here is an instance that should encourage him. Till I had the first number of Work I had never used a carpenter's tool, and I have never been inside a carpenter's shop, or scarcely ever seen a carpenter at work, so surely I was about on a level with W. V. C. in the matter of carpentry. I had very little money to spare, yet I purchased a small plane for 2s. 6d., begged an old file from the scrap heap, and forged myself some chisels out of it, with the kitchen fire for my hearth and a shoemaker's iron last for my anvil, and then I went to work and made a table as described in No. 1 of Work, with turned legs and plain top. I met with many difficulties, but believing that perseverance conquers everything, I worked away with a will, and succeeded in making a good job of it. I then French-polished it, and here again Work came in, for I had never done any French polishing before, but thanks to Work, I succeeded in this also. And now I have sold the table for what I consider a good fair price, and am going to buy a few tools with the money. I might say I made a lathe to turn the table legs, and the ideas for this I got from Work also, and although it is very rough, it does a lot of good work, and the materials in it only cost me about 4s. 6d. I would send a description of it, but I think it unnecessary after what has been said by Self-helper in page 261 of Work, and, as you see, I am not good at writing, and I hope my fellow-readers will excuse my badly-turned sentences. In conclusion I beg to state that in my opinion Work is supplying a long-felt want. I am sure it is just what I've been longing for many years, and I heartily thank you for the good it has done for me."

Simple Measurement of Timber.—Timber Trolly writes, in reply to A. G. H. (see page 269):—"A. G. H. does not understand the reason of timber measurement as given by Hoppus in his calculations, or he would not have intruded his views of which is right: by trade usage and fairness in buying and selling; or by cylinder measure. In measuring timber in the round it is usual to allow from 2 in. to 3 in. less circumference for the bark, if on the tree. A. G. H.'s omission of this fact plainly indicates his ignorance of the usage of the trade. Round timber cannot in fairness be measured as a parallelopipedon, as if it were the outside or inside of a mathematical figure—as for engineering calculations—but for what it will fairly produce to the buyer when the sap is hewed off and the timber squared. Having bought and sold many million cubic feet of timber, 'growing,' 'round,' and 'squared,' and knowing the usage in Europe and America, I may state that the system common to all timber-selling countries for measuring round timber is the quarter-girth squared, or multiplied into itself, and the product multiplied by the length of the piece of timber; this product is then divided by 144; if the calculation is in feet and inches the dividend is the answer, as shown in Hoppus. Now for matter of fact. Has A. G. H. never heard of tare and tret, the long-hundred, heap-measure, the barn gallon, the baker's dozen? Timber measure comes under the same category of reckoning, or it would be called cylinder measurement if that plan were used. From my experience, the difference between timber measure and cylinder measure is as 102 to 120, or 18 ft. of that latter measure or less is charged to timber buyers proportionately, as well as several feet less allowed off for bark, according to local custom or sort of timber; and if the tree has a top, even several feet long, that will not square up 6 in. in quarter-girth, that is given to the buyer, if the timber be ordinary English wood. Limbs, in like manner, that will not measure the 6 in., are also given in, if they happen to be left on the 'but.' Is all this giving-in fair? it may be asked. As a seller more often than a buyer, I can affirm it is only fair. How so? Because timber is not sound and serviceable to its outer circumference. The sap of some trees is useless unless specially converted to other purposes than the 'heart-timber' may be used for—as, oak for spokes for wheels, for instance. The 'but' is useless because of the turn of the grain; the top, because too small; even slight curves out of the straight line have to be cross-cut out and thrown aside for other jobs, and every bit of sap must be got off. This sap may be 2 or 3 in. thick in a large tree, so that the sound part of an ordinary oak tree would not yield much more timber than was charged for, by reason of the sap alone, without reckoning 'but' or crooks in the piece. A variety of chances rise against a tree turning out well when opened. Perhaps it has been stricken by lightning, which even a critically experienced forester cannot always detect, as the five radiating shakes from the heart to outer rings do not show when the bark is on, and sometimes even when the bark is off. The tree may be hollow, or gnarled, or have stones and iron nails in it; even a cannon shot has been found in the sound wood of a tree, and the saw is damaged in finding it. ('The Technics of Forestry,' illustrated in the *Journal of Forestry*, by Rider, St. Bartholomew Close.) It must not be forgotten timber in the round does not represent cost commercially so much as sawing does, which the buyer has that to incur. It might surprise A. G. H. if he had his round log cut down the middle, or 'opened,' as it is called, and the measure showed 80 square feet, to have to pay double for that cut, or for 160 square feet; yet it is the rule of pit sawyers of round and even square logs; and as an arbitrator and referee on sawing matters, I feel sure it is only fair, as it is a payment for the labour of 'hewing,' 'pitting,' 'dogging-down,' 'lining,' and 'hauling' the cut stuff to stack, done by sawyers who make this charge; for on 'opening,' the tree may be 'hollow,' 'doated,' or worthless, and no more cuts put into it, all after cuts being actual square measure reckoning. Did A. G. H. ever buy a plank cut from round timber with a section thus?

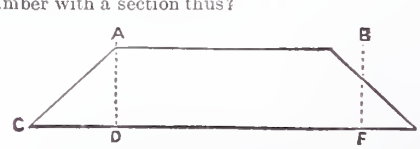


Diagram showing "Wane" of Timber.

The triangle called the 'wane' of the timber, A, C, D, is not measured, but the other 'wane' is, to half its measure, as shown by the dotted lines B, F; thus the buyer of plank has some of the round timber and sawing given to him. If the plank is less than, say, 30½ feet long by ½ in., the bare half foot, or 5½ in., is given to the buyer; this, with the sawing, has been paid for, with all its risks, by the round timber purchaser. If this lesson in timber dealing does not convince A. G. H., let him buy a carpenter's slide rule marked for round timber measure, no matter of what nation, or one of the more elaborate sets of logarithmic scales with gauge points for round timber measure, and test my experience by them, and he will find Hoppus's calculations right. But a visit to a wheelwright in the country, who deals in round timber, with a few questions, will, if intelligently made, teach him the difference between common sense and knowledge: one is the applied science of everyday life, the other may be only the recollection of a dunce or the oracle of a fool—if mere blind book learning which may mislead the inexperienced."

Proportions of Lathe Fly Wheels.—J. W. C. (*London*):—I have received a very silly letter, through the Editor, from an anonymous correspondent, signing himself "J. W. C.," giving his address very precisely as "London;" *re* my reply to J. P. A. on p. 220 of Work. As I much question if the Editor will sully the pages of his journal with my correspondent's sneers, I will mention in brief that J. W. C. speaks of my sketch as "that wonderful design of a tight-laced figure 8," as a "pretty piece of figure skating, but somewhat far fetched, and just a little too much *work* in it," and as an "antiquated idea." After a maundering "tale of the Ark," J. W. C. triumphantly flourishes before my benighted and antiquated mind a "problem" reclaimed from Noah's stomach by a "wily" engineer "in his greed for knowledge." This elegant correspondent informs us how Noah had worked out the problem on the skin of the hard-boiled egg which he was eating: hence the "wily" engineer employed a stomach pump for the reclamation of this famous "problem." The problem is that $1 + 2 = 3$, and $2 + 1 = 3$, whence the obvious inference that, instead of giving the method on p. 220, "with just a little too much *work* in it," I ought simply to have said that the sums of the diameters of each pair of pulleys should be alike. Passing by the sneers in which J. W. C. indulges, I ask him if he thinks that I, who have been among belts and pulleys daily for nearly thirty years, would, in this particular case, commit so stupid an error as that embodied in his arithmetic. J. W. C. imagines that the problem is the same when the centres of pulleys are very near as when they are an infinite or a long distance apart. In stepped pulleys whose centres are not far apart, as in the lathe matter in question, this arithmetic $1 + 2 = 3$ and $2 + 1 = 3$ does *not* hold good, because the angle at which the belt runs on to and leaves the pulleys has to be taken into calculation, and this governs the proportion of circumference of the pulleys embraced by the belt. If it were simply a case of 1 + 2, etc., why the elaborate formulæ for belt lengths given in the books (see Unwin and others) where trigonometrical functions of the angle θ are employed? These formulæ are Greek to most workmen, and I, therefore, gave a graphic method that everybody could understand, and certainly do not think I put "too much *work* in it." Yet it seems that it is not sufficiently clear to the dense intelligence of J. W. C. But will J. W. C. be good enough to set out stepped lathe pulleys as on p. 220 according to the $1 + 2 = 3$ theory, and then set them out according to my directions? Having done so, will he take a pair of dividers, and step round the path of the belt on each pair, and acquaint the readers of Work with the result, omitting the stupid rigmarole about Noah, which would probably be "declined with thanks by our friend Sloper, and is certainly unfit for Work?" For myself, I may say that, though I have been at the pains to correct J. W. C. in this matter, yet in future, when assailed by an ignorant and anonymous and ungentlemanly correspondent, I shall, whether in the right or wrong, treat the communication with the silent contempt which it deserves.—J. H.

II.—Questions Answered by Editor and Staff.

Coach Building—the "Cant Board."—T. T. (*Kennington*) writes:—"If you are not tired of hearing them, allow me to offer you a few words of praise and my testimony as to the usefulness of Work. In my humble estimation it is the one thing that was needful. May I be allowed to ask at the same time if it is a part of your programme to give any practical papers on coach building? It seems in most books to be entirely neglected—why, I know not. I hope Work will be an exception. I happen to be a body maker (improver), and some papers on that subject, especially on the 'cant board,' would be read with great pleasure, and profit, no doubt, by myself."—[I think we must be content to regard Work as one of the things that are needed, and not as the "one thing needful," which is a matter of far higher and greater importance, as you will see if you turn to St. Luke x. 38-42. Your request with regard to coach building generally, and the "cant board" especially, has been forwarded to a skilled coach builder, who will take the matter in hand.—Ed.].

Leclanché Battery for Disposal.—J. C. F. (*Otford*).—Advertise your battery for sale in the "Sale" column of Work. The cost will be one shilling for twenty words. Or advertise it for exchange for something useful to the value in this paper, *The Bazaar, Exchange and Mart*, or *The English Mechanic*.—G. E. B.

Electro-Plating. — J. T. D. (*Sunderland*).—I hope to give full instructions on the art of electro-plating in some future number of Work, in a style easily understood by amateurs and young workmen. Meanwhile you may learn much from my occasional "Notes for Electro-platers." The best book on the subject is "Electro-deposition," by

.. Watt, latest edition, price 12s. 6d. I am glad to now that such a young amateur electrician is aking an interest in electro-plating. I shall be ery pleased to give you instructions in "Shop" if ou meet with any difficulties in your studies.— ;. E. B.

Dry Plates. — Tortoise-shell Tom (*London*). -The preparation of your own dry plates would be , tedious and troublesome job, and unless you are iossessed of a large stock of patience and a cheerful emperament, I would not advise you to attempt heir manufacture; better buy the larger size, a: 'ou are doing, and cut them down. But why not ilter your dark slide, or insert a carrier to take ;-plate size? Then you would be working to a recog-iised standard, and plates, paper, mounts, and leveloping dishes could be used more economically, ind you would have no waste, as at present. To :oat plates requires a rather heavy outlay for apparatus, and the actual process occupies a deal of time, while the result, even when the greatest pains are taken, is often failure, besides which even a brief summary of the process would, to be intelligible, take up about a couple of pages of Work. For further information on the subject, you should procure Burton's "Modern Photography," price 1s., where you will find at page 143 full details of the coating of dry plates and formulæ for emulsion-making. Cassell's also publish an excellent shilling book on "Photography for Amateurs," by T. C. Hepworth.—G. le B.

Electric Bell.—Amateur G. A. S. (*Stepney*).— As your bell stopped ringing when the armature was pressed to the cores, and did not recover itself when the finger was removed, this showed that the cores retained some magnetism after the circuit was broken. This defect was confirmed by the experiment you tried with the iron filings, since they also stuck to the cores after the circuit was broken. The iron of the cores is therefore, hard. Now for the remedy. The surest is, to take out the cores and anneal them as directed on page 180. Sometimes (unless the iron is very hard) the sticking propensities of the armature may be remedied by pasting a bit of paper (gummed paper from postage stamps) on each of the cores. The magnets for a 4-in. bell will take 47 yards of No. 22 B. W. G. silk-covered copper wire. This will weigh nearly six ounces, and cost about 2s.—G. E. B.

Magnet. — Flax Spinner (*Longton*). — The information you give respecting your battery and horse-shoe magnet is insufficient to work upon. I must know exactly the diameter of the magnet cores as well as their length, as I shall have to calculate the cubic contents of the iron in the magnet to arrive at its capability for receiving magnetism. Therefore kindly oblige by giving me the *length* and the *diameter* of the magnet legs, and I will then tell you the size of bobbins to be placed upon them, together with the gauge and length of wire to be wound on the magnet. As the magnetic force developed in the iron of an electro-magnet is proportionate to the strength of the electric current passing around its coils, I must also know the number of cells to be placed at my disposal, as well as the size and nature of the plates. It is not enough to say you "have a lot of Smee cells;" I must know *how many cells*. By-the-bye, your cells are not Smee's, but Walker's, as shown by the carbon plates. The electro-motive *force* of both is low, and not at all suitable to develop the full power of an electro-magnet. I will try to instruct you how to alter your battery, too, if you will write again and give all particulars.—G. E. B.

Corner Bookcase.—E. S. (*Clapham*).—I have a design and description of a corner bookcase, which will appear shortly, and which you may be able to adapt to your own special requirements. It is seldom possible to do more than give a good type of the article required, but this done, advice and suggestions with regard to modifications desired by correspondents can always be given.

Overmantel.—Brushmaker wishes to make an overmantel with mirrors and fretwork panels, and desires a design for one in Work from the pencil of Mr. J. W. Gleeson-White, and adds, "I have made up one of his designs already, which I exhibited at the Glasgow Exhibition last year." I am sure Mr. Gleeson-White will be as pleased as I am to hear of your success. I have many beautiful designs from his pencil awaiting publication, and in course of time you shall have a design for an overmantel in fretwork.

Hot-Air Engine.—C. J. W. (*Beccles*).—Space forbids any further attempt to notice articles of any kind on show at exhibitions. A mere cursory mention of them is of little, if any, practical use, and it is not possible to devote to it the room that the subject demands. For this reason I cannot give a review of the machinery at the Royal Agricultural Society's Show at Windsor. But as soon as it can be managed, descriptions will be given of engines and motions, including a hot-air engine.

House Repairs.—Aitch.—Articles on general house repairs would have to be hypothetical to a certain extent; that is to say, we must first suppose certain damages and the causes thereof, and then describe process of repairing according to the supposition. The term "general house repairs" covers a wide area. If there are any particular repairs that you wish to carry out, put a question to us on the subject, and you shall receive instructions through the medium of "Shop." I am glad you found the first paper on Burglar Alarums "very good, and quite interesting, also instructive."

India-rubber Stamp Making.—Hallamshire. —When I can meet with any one who can and will write on this subject a paper or two descriptive of the appliances and materials used and the process to be followed, it shall be given. I must, however, first catch my writer. Probably this reply to your appeal may bring a volunteer to the front.

Photographic Camera. — H. M. (*Oldham*). — The construction of the camera is already commenced. With regard to the cost of lens, it is not possible for me, being in ignorance of the sort of lens you want, to name a price. The best course you can adopt is to send for the price list of any dealer in photographic appliances, and select for yourself the kind of lens that will meet your requirements in price as well as other points. In the "Photographic Annual for 1889," issued by Mr. Jonathan Fallowfield, 35 and 36, Lower Marsh, Lambeth, S.E., which, in fact, constitutes his price list, twenty-six pages are devoted to description and prices of lenses. You can get lenses at all prices from 4s. 6d. to £50, and even more, but good lenses for ordinary purposes may be bought from £1 to £5. It might be useful for you to watch the photographic journals for advertisements of lenses to be sold cheap by those who wish to part with them.—E. D.

Working Drawings to Scale.—E. J. E. (*Abingdon*).—For the benefit of yourself and others who find a difficulty in reading and understanding working drawings to scale, an explanatory paper shall be written on the subject. You will find "Drawing for Carpenters," published by Messrs. Cassell and Co., Limited, a most useful book. It will not be possible to comply with your suggestion to enlarge Work and raise the price to 3d.

Index to Numbers.—Barrhead writes:—"If the contents of each number were printed in small type over the top of the word Work on the front of each number, I think it would be of great assistance to any one looking for a certain article that he remembered having seen in some back number. It would save his looking all through each number." In reply to your suggestion, which is a good one, the position proposed would not be a convenient one for index to numbers; it would come in better under the date, but as so much room is wanted in the front page of some numbers for cuts, it would be difficult to provide for an index in this page. Still there is so much reason in your suggestion that it shall have careful consideration.

A Wooden Affair.—Progress writes:—"I have taken Work in monthly parts from the beginning, and was induced by your prospectus to do so, there being many subjects mentioned about which I should like information, particularly watch-jobbing, horology, and other kindred arts, but up to the present your Work has only been a wooden affair, and I am glad to see you had complaints from other subscribers. Evidently you put your trust in wood, and I hope it won't fail you, for you will have none but wooden customers unless you give a better all-round pennyworth. Of course, you can't give everything at once, and so I shall continue to take it in till it has had a fair start, and as questions are permitted I will ask one or two."—[The prospectus did not say that every subject was to be commenced and dealt with at once. You will not be long without information on watch-jobbing at all events. "Like cures like," the homœopathists say, and "like seeks like," in accordance with the old saying, "Birds of a feather flock together," so that you may trace if you like the woodiness of Work to the material of which its Editor's head is constructed. Yes, I certainly like wood working myself, although it can hardly be said of me that I put my trust in it altogether. Wood is a material that is far more tractable and easily worked than metal, and hence it is that wood working finds favour among the majority of those who take up manual labour as a hobby. Moreover, the outcome of this is that it is far easier to get writers on carpentry, joinery, and cabinet making than on other subjects, which, although quite as important, are, perhaps, not quite so popular. But you will find plenty to interest you, as successive numbers appear, even in your own particular subjects.—Ed.].

Watch Maker's Mandrel. — Progress. — For my own part, I prefer a largest size "Boley" turns, with universal head and extras, as then you have a good combination tool, but if cost is no object, then a good American lathe, with a mandrel head. To fit a new jewel, if the setting is bad, I should think you could turn out a new sink with a fine lozenge graver, but must confess I have never done so, as when too bad to hold a jewel have usually sent to a jeweller's.—A. B. C.

Spinning Tin Plate —J. C. G. (*Nenagh, Ireland*).—I quite agree with you that spinning in the lathe is a fascinating art, but it requires much practice. Tin plate can, to a limited extent, be spun in the lathe, but to nothing like the depth you name. In trade a great deal of work that used to be spun is now pressed. I cannot give you the amount of pressure to apply; it will depend upon the thickness and quality of plate upon which you are engaged; this and the velocity are best found by trial. You should begin with a light pressure and gradually increase it, but you must be careful not to increase it too suddenly. You cannot anneal the plate without burning the tin off; but why not get the charcoal plate and spin it, and then tin it afterwards? You could then anneal it as often as you liked. Tin plate is not a favourable material, because the iron will not "flow." You would find Britannia metal work better. I believe the best account of spinning metal is to be found in Holtzappfel's "Mechanical Manipulation."—F. C.

Brittle Electrotypes. — A Beginner (*Foley Street, W.*).—In your case, the brittleness of the electro is evidently caused by too much current. In making such small electros as you describe, and in copying coins, you must adapt the surface of the zinc in the battery to the size of surface to be covered, or use fine connecting wires so as to reduce the volume of current. The current may also be reduced by exposing a small surface of anode to the solution (the size of anode should always be adapted to size of mould), and by placing the anode and mould farther apart in the solution. A few practical experiments embracing those varied alterations will soon put you in the way of getting good, tough copper. The solution may have something to do with your failure. The best is made up of:—Saturated solution of copper sulphate, 6 pints; water, 2 pints; sulphuric acid, 16 fluid ounces. You do right in using the large Daniell cell.—G. E. B.

Photo-lithography.—J. P. (*Glasgow*).—When a suitable opportunity offers, this subject shall be touched on.

Model Yacht and Boat-building.—There are so many subjects on hand just at present that some of them must of necessity be cleared out of the way before this and others can be taken in hand.

Catapult.—G. S. W.—You say:—"Could you tell me how to make a catapult in a proper and scientific manner—not a mere child's toy, but one that is capable of throwing a long, straight, dead shot—giving details as to size of shot used, material, whether wood or wire, and how to make it properly?" To this I can only reply, I could, but I would much rather not, as the girl said when her father told her to come off the grass. Catapults are dangerous things; and, as I am obliged to draw a line somewhere, I must draw it at catapults and all things that might be attended with damage to life, limb, and property, if brought into play. However, that you may not be entirely disappointed, I will refer you to Dr. William Smith's Dictionary of Greek and Roman Antiquities for information on the balista and catapult—ancient engines of war that were capable of doing all you want or wish for in the way of throwing "a long, straight, dead shot," and did it well, too.

Work behind Time.—C. H. C. (*Margate*) writes:—"Can you inform me how the delay is caused through my bookseller not receiving Work? I have been a subscriber from the commencement of the valuable work, and I don't think it is quite right that the delay should be so long that I never receive it regularly. I should be pleased if you could assist me at all."—[Your bookseller ought to have Work for each week on sale on Thursday morning at the latest, Wednesday being the date of publication. I cannot *tell how* the delay is caused; but I have a suspicion that it is either through the remissness of the bookseller's London agent, or the inability or disinclination of the bookseller to look properly after his business. If I did not get things up to date myself I should try another bookseller.—Ed.].

Upholstery Work. — G. F. (*Bristol*). — Carpet planning cannot be treated of in these pages yet awhile, as there are many subjects of more general interest awaiting their turn. Bed hangings have been under consideration, and a design may now and then be given, but, like the former subject, this must wait, unless I should find I am mistaken in supposing that there is no large demand for instructions on this kind of work. As you are, no doubt, aware, if I may judge from the heading of your note, with the exception of planning, etc., draperies, the actual making up is done mostly by women, and Work is a magazine for men. The same objection does not apply to stuffing and general chair upholstery, which will take its turn with other subjects. An article on making, stuffing, and covering a chair will shortly appear. I cannot advise you to attempt to make your own buttons as per sample sent. As a matter of business, it would not pay you to do so, and surely you have no wish to make them *en amateur*. You can buy the buttons for far less than it would cost you to make them, and I take for granted you know how to cover them whenever it may be necessary.—D. A.

Electric Light for Photo Dark Room.— Correspondent.—Procure a six-volt 2½ c.p. lamp. Rig up a four-cell battery, double carbons, with single zincs between, each plate being 2 in. by 6 in. by ¼ in. Let the cells in which these dip hold not less than a pint of liquid. Attach the elements to a board as long as the four cells together, and as wide as one. Connect the elements in series. Attach a hook at each end of board, and, by means of a pair of catguts and a weight, counterpoise the whole, so that the entire arrangement can be lowered into, or withdrawn from, cells by a mere touch of the finger. Charge the cells with:— Chromic acid, four ozs.; water, one pint; sulphuric acid (1·840), three ozs. by weight. Mix and allow to get quite cold. Couple up to lamp by means of well-insulated wires. When using, lower the plates only so far as is necessary to give the required light, since at the start, when the solution is fresh, so much current is produced as to endanger the lamp if the whole length of the plates is immersed at once. If your lamp is of higher volt size than six volts, you must use correspondingly more cells, allowing one cell for every two volts over the first four.—S. B.

Dressers. — GIMLET (*Coventry*). — An article describing the construction of one of these useful pieces of kitchen furniture will appear ere long. Meantime the following hints may be of service to you. As I gather from the nature of your inquiry that you are not a practical joiner, fasten the parts together with nails wherever practicable. You will find some valuable suggestions in the description of the overmantel illustrated in our articles on artistic furniture, as well as in other articles treating of cabinet making. Do not attempt sliding doors, but be contented with the ordinary hinged construction. Good, sound pine will do very well for the material, but use the red instead of the white kind, and remember that you will find No. 1 or a good quality cheaper in the end than thirds, though it may not be so low in first cost of timber. Your sketch does not show any plinth, which there certainly ought to be below what you represent as the bottom of the dresser.—D. A.

Bookcase Competition.—CHIPS.—I have given all the information that it is necessary to give in the notice respecting the competition, and all competitors must use their own judgment in preparing designs. You can determine exactly what is asked for from the wording of the notice, and I cannot say any more on the subject. The great object is to elicit the ideas of competitors according to the base of operation set forth in the notice.

Electric Bell Magnet.—J. B. (*Glasgow*).—The magnet of an electric bell should be constructed as described and illustrated on page 180. When two cores are employed, they must be united by a yoke of iron, so as to form a horse-shoe magnet. I have not tried the effect of mounting the two cores on a piece of wood or other insulating substance, so as to form two independent magnets. Small bells are sometimes rung with one core only. Thanks for your expressions of kindly appreciation.—G. E. B.

Mixing Oil of Gold Size. — GILDING (*Walworth*).—Take equal parts oil gold size, linseed oil, and copal varnish, mix well together, and strain through a fine strainer. Young's patent size is equal to parchment size, especially in warm weather, to dry quick. To dry extra quick leave out linseed oil and add terebene.—G. R.

Patent.—MINERVA.—The advice of AJAX was, no doubt, well intentioned, but evidently not very practical. Very few manufacturers or purchasers care to take up an article which is only provisionally protected; they generally ask to know that the complete patent has been applied for. Those who thoroughly understand patents are well aware that this provisional protection is, in reality, a very questionable monopoly, and that no action for infringement would lie against any one for pirating an invention only provisionally protected. All those who have good inventions so protected should lose no time in obtaining their complete patent; and we think that the advice of your agents has been well given.—R. and C.

Silver and Gold Solution.—GALVANUM (*Manchester*).—When you have your nitrate of silver solution ready, add to it a strong solution of cyanide, and when the addition of more cyanide does not cause any further precipitate of silver cyanide, stop adding the cyanide solution, throw silver cyanide on a filter, wash with distilled water, and collect silver cyanide in some vessel. Then add to it one pint of distilled water, with $\frac{1}{2}$ oz. cyanide dissolved in it. Make up to one quart, and then add another $\frac{1}{2}$ oz. of cyanide to it. Do the same with the gold, but, instead of adding $\frac{1}{2}$ oz. free cyanide, add $\frac{3}{4}$ oz. or one oz. If solution should work slow, add a little more, say, at the rate of one drachm at a time. I have a chain which was in the bath for two hours that has been in use for the last fifteen months, and it is not altered much; but it is very hard to state on such matters as these, as it depends upon mode of working, strength of solution, and experience of the depositor. Your deposit ought to have lasted longer than it did. If you make up a solution as in my article, and use these proportions of cyanide, you will, if you are careful in the depositing, be able to obtain a serviceable deposit. I am at present preparing an article on the use of cyanide of potassium, which, no doubt, will be of great interest to you. If you cannot succeed, write again, and send me full particulars of your process and preparations.—F. W. M.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Circular Latch Needle Machines.—CONSTANT READER (*Glasgow*) writes:—"Could any of your correspondents to your valuable paper inform me how the cylinders of knitting machines are made and cut, with the easiest way to make them, the tools required, and where such are to be bought?"

Tool Wanted.—GAUGE POINT (*Paris*) writes:—"Wanted, a rule for prompt and accurate measurements to the $\frac{1}{16}$ of an inch of openings and spaces, as doorways, windows, arches, lengths inside tubes, etc, from 2 to 10 ft. It is done variously by workmen, but all are more or less dissatisfied with the makeshift plans they adopt. Something reliable is wanted suitable for all workers, and yet to be a cheap handy tool, bevel for stair-rail joints, a grip vice for veneer or a door, etc. Those who use such tools might give the best they know in a few words in return for what they take."

Carriage Paint. — W. W. W. (*London, S.E.*) writes:—"Will you kindly submit the following query to your correspondents? To make a dark claret colour for carts as on bus panels. Rose pink is the right colour, but it fades even after varnishing, lake being too costly."

Fretwork and Carving.—W. W. M. (*Glasgow*) writes:—"I would like to know if Mr. Henry Zilles & Company, Wilson Street, London, E.C., could supply me with a few designs, fretwork and carving, for a knife-box, same as engraving in WORK August 10th. If he can supply me with a few, to mention the cost?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Hand Circular Saw Bench.—A.R. (*Scorrier Saw Mills*) writes in reply to G. H. L. (*Hull*) (see page 222):—"I understand by your question that you wish to make a bench of wood, which will do for such work as you state, if properly put together. The kind of wood I should select would be red or pitch-pine, the frame to be nicely mortised and bolted together with $\frac{3}{4}$ in. bolts; the top of bench to be 3 ft. 6 in. long, and 2 ft. wide, and about 1 in. thick of hard wood screwed down on the top of frame, so that it may be taken off should the bearings require looking to. The spindle should be of 1 in. or 1$\frac{1}{4}$ in. iron, with three places turned for the bearings, one near the collar washer, one on the other end of spindle, and another a certain distance from the end to set in a bearing fixed on the frame of bench; the end bearing on the outside of bench should be fixed on a horse, and between these two bearings a small pulley should be keyed about 4 in. diameter. This pulley is to take the driving belt, which should be of leather about 2 in. wide, and driven from a wheel, say 4 or 5 ft. in diameter, keyed on a short countershaft about 12 ft. between centres. The rim of this wheel should be heavy, and a handle fixed well up one of the arms to turn it. The belt should be crossed so as to have more grip, and to drive with less tension. The bearing next to the collar washer should be fixed on a piece mortised in the ends of bench, about 8 in. from the side nearest the saw pulley. Saw to be from 9 to 12 in. diameter, and teeth as in a hand rip saw; the timber should be fed very slow, your power being limited. Even this mode of driving a small circular saw will be far from a pleasant job for the man who has to turn the wheel. In fact, all circular cutters should be driven by motive power, as they should attain a high speed, and are continually cutting. Fuller information could be given by giving sketches of bench, etc.; but as I have not time to give sketches now, and at which I am not a good hand, I hope the above will be of some service to G. H. L."

Paste. — THOMASO writes in reply to J. R. (*Skerries*) (see page 238), who wants a paste that he can keep on his office table to use instead of gum—a paste that will not turn bad:—"Personally, I prefer gum for small office jobs (dextrine, or as it is sometimes called, 'powdered gum,' can be got very cheaply at the oilshop, and makes good mucilage), holding the gluepot in reserve for parcels, etc. But the paste. Put a heaped-up teaspoonful of powdered alum into a breakfast cup of cold water, and stir till dissolved. Use this alum water to mix the paste with, and a flat stick of wood to crush all lumps. If properly mixed, the paste will look like cream—or paint. Boil very slowly with constant stirring, until the stick will stand alone. A quarter pint of paste should take about ten minutes to get in this condition. It is, of course, easy to boil it up in a minute or two; but it must be remembered that paste wants *cooking*. I usually tell when it is done sufficiently by smelling it. If not done enough it smells *raw*. This paste can be kept until it dries up into a solid lump. I have never found it go watery, get mildewed, or smell offensive; and it has this advantage over the bought 'office pastes;' it has no strong smelling or perhaps poisonous preservative in it. Better not cover up too tightly, and do not keep it in a tin, or put a tin mounted brush in it, because of rust. An everlasting brush is made by inserting some bristles, cut from an old broom, into the end of a piece of very small lead gas pipe ($\frac{1}{4}$ in. outside measurement), and then smashing the lead so as to grip the bristles, trimming them up with scissors, and inserting a piece of wood into the other end to make it longer, if necessary."

Drilling Square Holes. — F. H. (*Plumstead*) writes in reply to A READER (see page 270):—"In No. 17 of WORK I see a correspondent asks for a description of the scientific method of drilling square holes patented in Austro-Hungary. I cannot give that, but will gladly try to explain a method I have seen practised in my own shop. This would be more correctly described as boring square holes. A piece of steel was fastened in the bell-chuck of a lathe, and a hole was bored up just a little less in diameter than the width of the square across the flats. The outside was turned down so as to let a nozzle on, which had a square hole drifted through in the centre, so as to act as a guide for the squaring tool. This tool was made in the same manner as an ordinary half-round bit for a lathe, except the cutting end, which was made an equilateral triangle, whose side was the width of the square required, and whose length was rather longer than the length of square hole required and the thickness of the guide plate together. The triangular end was inserted into the guide, and the poppet head centre was run up to the back end of the bit, and fed up by it. The bit was held back against the centre by the mechanic, who had fastened a carrier on the shaft of the bit, and at the same time he let one end of the carrier rest on the slide rest to prevent the bit from turning. The lathe was driven in the ordinary manner. Some of the holes made were very good, but, unfortunately, there were about as many bad ones, so that it had to be given up as a bad job."

Trade Notes and Memoranda.

THE number of applications for patents in 1888 exceeded those of the previous year by nearly six per cent., and were 19,103 in number. Of designs, 25,923 were applied for, 568 of which were refused registration, on account of their similarity to designs already registered. The total number of applications for trade marks was 13,315, as compared with 10,584 in 1887.

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WORK

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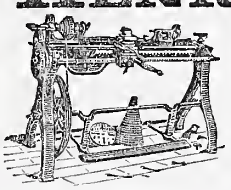

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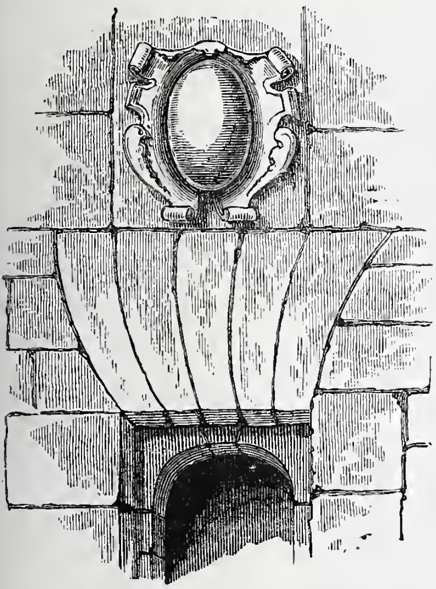

Fig. 1.—Arch in the Calle de la Madre de Dios, Murcia.

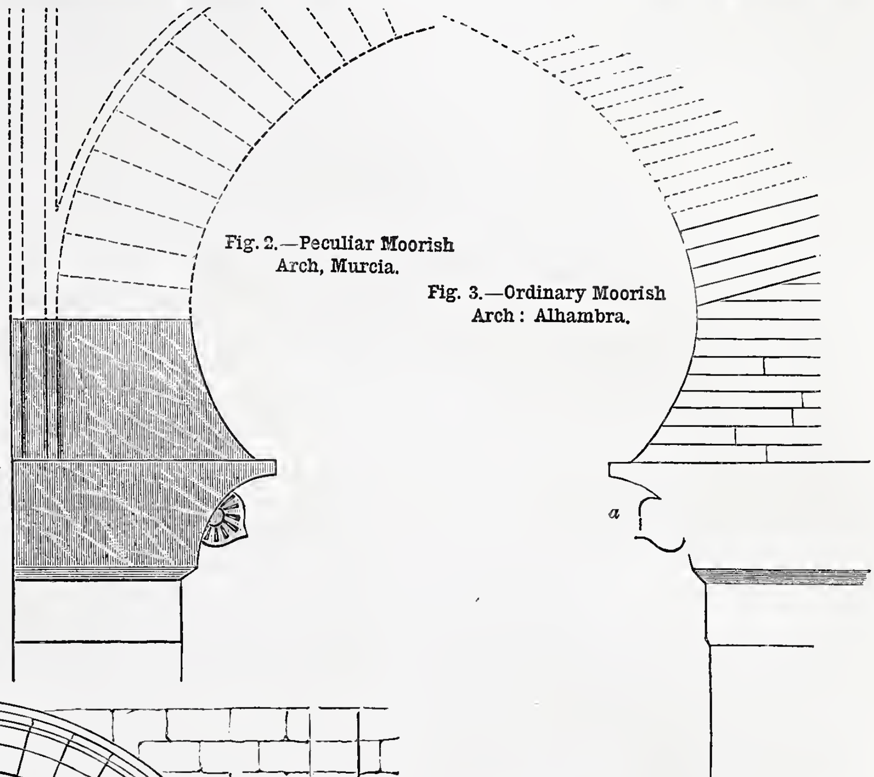

Fig. 2.—Peculiar Moorish Arch, Murcia.

Fig. 3.—Ordinary Moorish Arch: Alhambra.

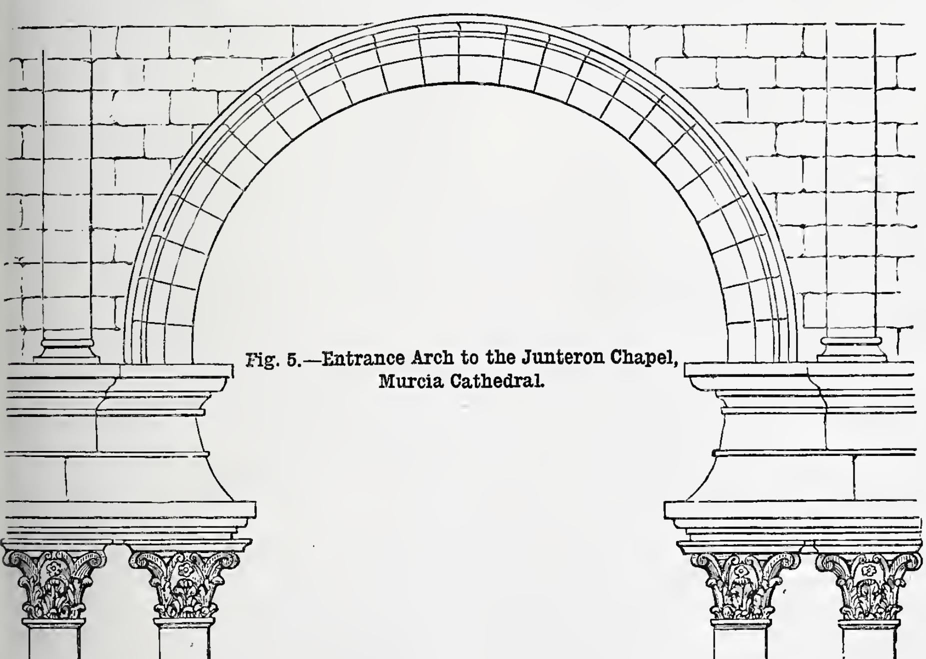

Fig. 5.—Entrance Arch to the Junteron Chapel, Murcia Cathedral.

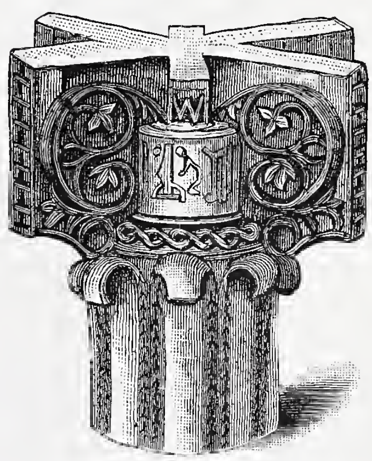

Fig. 4.—Moorish Capital: Murcian Type.

SOME CURIOUS PIECES OF BUILDING CONSTRUCTION.

BY C. C. C.

The very remarkable arch shown in the accompanying illustration, Fig. 1, may be seen over the doorway of an old house in the street of the Madre de Dios, in the Spanish city of Murcia—a city which, from the fact of its having been the capital of a Moorish kingdom through seven successive reigns, proudly styles itself, "The Seven-times Crowned Murcia."

In this city there may still be found some few remains of Moorish architecture, and the arch before us is commonly spoken of by the Murcianos as one of them. This is an error, for it is undoubtedly a work of the seventeenth century, constructed to suit the whim of some eccentric hidalgo. Standing alone as a single arch, it is certainly more curious than beautiful; yet it might, perhaps, if placed in apposition with another similar arch, the stones of which curved in a contrary direction, produce by the combination something more pleasing to the eye, though still impressive from its strangeness. Advantage might also be taken of the curved form of the stones to connect the two arches by a circular dripstone moulding, or an ornamental extension of the keystone might probably be made with good effect. It is laid before those interested in building matters as a text upon which to exercise their ingenuity.

Though this queer arch is certainly not Moorish, the house in front of which it figures, and which towards the public street shows early seventeenth century work only, is undoubtedly Moorish in its origin. On entering and passing on into the *patis*, or small open court, the visitor will come upon some remains of genuine Moorish arches, and these, too, are so far removed from the commonplace as to be worth the attention of those who have an interest in building. Their construction is, as construction, superior to those ordinarily met with; the springstones, which are of dark marble, being of a size sufficient to reach not merely to the nominal but to the actual spring of the arch. Fig. 2, in which a portion of one of these arches is shown, will explain our meaning. The ordinary construction of the Moorish horse-shoe arch is illustrated in Fig. 3 (from a sketch taken by the writer in the Alhambra). In this the springstone, *a*, is of white marble, but above it, to the actual springing of the arch, it will be seen that the work is carried on in horizontal brickwork, the thin bricks rather resembling quarries in their general proportions than what we should call bricks. It must be obvious that such construction will be far inferior in strength to that of the horse-shoe arch in the Murcian house of which we are speaking. The strange mixture, seen in Fig. 3, of costly with common materials, of marble and mere brickwork, is by no means unusual in Moorish building.

Although Murcia is set down in "Murray's Handbook" as a city worthy of only a single day's visit, it has been found by the writer to be singularly rich, as regards its architecture, in examples of workmanship so far removed from ordinary types as to be full of interest and suggestiveness. Fig. 4 illustrates a Mooro-Murcian style of capital different in form (so far as the writer is aware) from anything to be met with elsewhere. Its upper part consists of six arms, four long and two shorter ones, and all richly decorated with carving. Unfortunately it is not in the writer's power to say what form the abacus assumed, as he was unable to meet with any complete capital. The material of the example sketched was white marble, but there is much about the form which suggests its adaptability to wood. Possibly the English wood carver or cabinet maker may be able to derive some useful hints from it.

That he may pick up a wrinkle from Murcian work of a different school, the reader is referred to Fig. 5, which shows the entrance archway to the Junteron Chapel, Murcia Cathedral. This arch is interesting as showing how its architect, building in the pseudo-classical Italian style of his period, contrived so to handle it as to produce an effect approaching that of the Moorish horse-shoe arch of the country.

The story of this chapel is as interesting as its architecture. Its founder, Juan Rodriguez Junteron, was, according to the popular legend of the place, the son of a poor Murcian cobbler, but gifted with a natural aptitude for learning. The contempt with which, in his younger days, he was treated by his fellow-townsmen sank deep into his heart. He made his way to Rome, where his abilities met with more appreciation. He found favour at the Papal Court; became a Cardinal; and eventually returned to Murcia as its Archbishop. In this dignity he had abundant opportunities for paying back with interest the scorn with which the Murcians had treated him in former years, and he neglected none of them. The buildings which he raised, this chapel and his house, the latter a structure consisting of four towers clustered round a central and taller one, are noteworthy as being architectural embodiments of revenge. Cardinal Junteron left them as monuments of his hatred to the Murcian people. It was in words equivalent to "Thou art Junteron!" that he had been taunted when a poor youth, and these words he adopted in his prosperity as his motto. They appear on the front of his house, and wherever they can be introduced among the decorations of his chapel. This chapel he built as his last resting-place, and it is said that all the wrought stones used in it he caused to be carved in Italy, that the Murcian artificers might derive as little benefit from the work as possible. The dome of the chapel is, as regards its carved decorations, as unique as the entrance arch. These decorations consist of dismembered parts of the human body, combined with ornamental details, no complete figure appearing anywhere.

These curiosities of workmanship from a somewhat out-of-the-way corner of Europe are not brought forward as mere curiosities, but as matters which may afford valuable "wrinkles" to those interested in building and decorating, and as showing how, in certain architectural features which we are accustomed to consider as unalterably fixed by custom, the bolder designers of other lands have succeeded in introducing originality and novelty.

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White Lead.—Of all preparations used in oil painting, white lead—white oxide of lead—is at once the most useful and important. It enters into, and forms the "body" of, most light oil paints, and, by the addition of other material colours, tints and hues of every description may be obtained. For covering power, or opacity, it stands pre-eminent amongst all whites. If it is genuine in quality, and has been properly prepared for use, it is a very reliable agent in obtaining a successfully painted surface, viz., a compact and pleasing incrustation, which, under fair conditions, maintains its colour, and is impervious to moisture for a great number of years.

The ordinary process of obtaining white lead is by the slow corrosion of small castings of metallic lead, caused by its exposure over acid in small earthenware vessels. This is known as the Dutch method. Of recent years, however, a successful American invention has been introduced into this country, by the processes of which the dressed ore is volatilised by heat, the resulting fumes are carried forward by air currents, and ultimately solidified, instead of escaping into the atmosphere. The end of which is that, after necessary refining processes are completed, there remains a fine, sublimed white lead, which has been obtained without the escape of any poisonous fumes, and presented fit for practical use without any particular danger to the health of those engaged in its manufacture.

Flake White, Nottingham White, Silver White, etc., are all preparations of metallic lead, differing in process of manufacture and minor resultant qualities, but are not necessary here to be further considered.

The ordinary white lead for painting is obtained, ground to the form of a thick paste, in linseed oil, the heaviest and whitest being the best. It is, as a commercial article, extensively adulterated with sulphate of baryta, whiting, etc., and it follows, therefore, that the surest way of obtaining it genuine is by purchase from a vendor or firm of reliable reputation, and to be willing to pay a fair price according to the fluctuations of the market.

Zinc White.—Oxide of zinc is a very useful pigment, being permanent in both oil and water. To no extent, however, does it rival, for general use, the oxides of lead, since it is vastly inferior in body—covering power—to genuine white lead. Contrary to the latter, however, it does not discolour and blacken by the action of sulphuretted hydrogen—poisonous air; but its principal merit is found in the fact of its being entirely free from the dangerous attributes, both during preparation and use, which attend the handling of white lead. Although there can be only one opinion of the value of the last-mentioned quality of zinc white, the entire advantage of the former particular is open to being questioned. Probably, few persons outside the trade are aware that by use of white lead paint they have in their houses a sensitive detector of poisonous sewer gas—a sanitary quality of which most of the "sanitary enamels," that are now the rage, are, by reason of the entire absence of lead in their composition, almost or entirely destitute.

In practical house painting, zinc white is often used in obtaining the finest white surfaces for enamelling and hand polishing of woodwork, of which more hereafter. Since this class of work is of a very laborious and expensive nature, it naturally follows that a pigment should be used which maintains its colour for a great number of years.

Charlton White.—Of recent years, Mr. J. B. Orr, originally a Scotch chemist on the banks of the Clyde, after much laborious toil of study and experiment, has succeeded in obtaining a preparation of zinc, possessing all the advantages of the ordinary zinc whites, but also, it is contended, equal in body and brilliancy of white to the best leads. Since about the year 1880, when Mr. Orr became connected with a silicate paint company, this pigment has steadily been growing into favour for interior purposes, and is now well known to the trade as "Charlton white," from the vicinity of the works to Charlton, Kent.

Although this article is scarcely likely to supersede white lead for general purposes, it is rapidly getting a wide reputation. Its elementary sources are, I believe, barytes, strontium, and zinc; its market value is about the same as the best white lead. It may here be in place to mention that, mainly by the instrumentality of a notable and successful French house decorator and economist—the late Ed. Jean Leclaire, of "Maison

Leclaire" fame—a preparation of zinc is the principal white pigment used by the painting trade of Paris.

Having thus made familiar to the reader the pigments of white, we will turn our attention to what are generally termed "colours," but more correctly, coloured pigments, or material colours, treating herein only of the most common and useful, and leaving what are termed "fine colours" for consideration in the more advanced portions of our subject.

Yellow, as a colour, having the most affinity to the neutral white, and its pigments being much used for admixture therewith, we will enumerate, firstly, the most serviceable of its pigments:

Yellow Ochres.—For all purposes of house painting, the yellow ochres are the most useful. These pigments are found in a native state in most countries, and plentifully in our own. In colour they vary from a bright golden, but not "lemon," colour of "yellow ochre" to the dull or "sad" brownish-yellow of "spruce ochre." From the earliest days of history, they have been known and used, being of good body, and very reliable, if suitably prepared, for both oil and water painting. The variety of tone and shade in which they are to be found is endless, and to the action of iron is due the colour of them all. As all varieties of ochre, Oxford—a more reddish hue—stone and spruce can be produced artificially and cheaply from iron, and since all native pigments require grinding and washing before being fit for painting, it need scarcely be added that the bulk of such yellow pigments used are of the manufactured kind. For making with white the very serviceable "straw," stone, and buff tints for large, plain surfaces, and the "grounds" for graining, as will be shown in another part of my subject, the ochres are quite indispensable.

Terra di Sienna, or Raw Sienna, is another native yellow, also of an iron nature, and a very useful pigment. Although not so clean and bright in yellow as good ochre, it has more staining power when used with white, with which it forms very soft and agreeable cream tints, and the so-called "ivory whites," so much in demand of late years. It is obtainable ready ground both in oil and water, is equally serviceable in either case, and is reasonable in price. For the imitation of maple, satinwood, pitch pine, etc., it is very popular and useful, prepared in water, whilst its semi-transparent nature renders it valuable where transparent effects are desired in oil painting processes.

Burnt Sienna.—Although coming more under the heading of red pigments, by reason of its bright, if impure, orange red, this is, as its name implies, a burnt preparation of the mother pigment. By the latter process, it gains also in transparency and staining power, and it is equally indispensable when graining some kinds of wood.

Chrome.—This pigment is generally known in three varieties of colour, appropriately enough as "lemon," the palest; "orange," the strongest and reddest; and "middle chrome," the latter a rich golden colour. Notwithstanding so many house painters like to handle chrome, its brightness and purity appearing to have some sort of fascination for them, it is anything but a desirable pigment for house painting. Being chiefly derived from lead, they have a good solid body and appearance, and make with white very bright tints. They do not, however, maintain their purity of colour for very long, and where they have been used a perceptible darkening is soon noticeable, whether in oil or water; neither are they good pigments to use in admixtures or "compositions" of colours. Of this more anon.

Red pigments of a permanent nature are both necessary and forthcoming for our use, and range from the most vivid tones down to the subdued shades of reddish brown.

Vermilion is pre-eminent for its brilliancy and purity of red, and is one of the pigments known and used by the ancients. Although it may be found in a native state, principally in China, requiring grinding, however, before being fit for use, the vermilion of commerce is principally an article manufactured from mercurial sources. It is seldom in much requisition for house painting in its full strength, being too vivid for the light, climate, and social sentiments of this country; and being also very heavy, and ranging from 3s.6d. to 5s. 6d. per pound retail, it is too costly for large surfaces. Vermilion is, however, very useful for obtaining, with white, pure and clean pink, and similar delicate tints, which are permanent; if required in its full brilliancy, vermilion stands best mixed with, and applied in, good oil varnish alone.

The most invaluable, and also the cheapest, red pigments are the class known generally as red ochres, the best for house-painting purposes being Venetian and Indian reds and purple brown.

Venetian Red, or scarlet ochre, is a fairly bright pigment of a "brick-red" colour. It is thoroughly permanent, of good body, makes clean tints with white in both oil and water, and is sufficiently cheap for any purpose.

Indian Red, originally coming from Bengal, is a rich, deep red, of slightly purple tone, with all the good qualities of body and permanence of its preceding pigment. Of late years the supply of that brilliant and rosy-toned pigment which we originally knew as Indian red appears to have been exhausted, its place now being taken, or rather its name usurped, by the comparatively dull and muddy reds of artificial source.

Purple Brown, as its name implies, is the lowest in the scale of brightness, being, in fact, a dense brown. It is most in demand for external painting, when it forms the basis of most so-called "chocolate colours." Although not being useful for admixture with white—muddiness resulting—it presents in mass a comfortable-looking appearance used alone, in oil or water processes.

All these reds having sufficient covering power to hide in one coat, if properly mixed and used, almost any other coloured surface, are, therefore, very useful and economical for preservative and plain painting in such a climate as our own. Although existing in a native condition, these commercial reds are usually manufactured pigments, viz., burnt ochres, and the colour is due to the presence of iron. They are all sold in powder form, but Venetian red and purple brown are generally to be had ready ground in linseed oil. Vermilion and Indian red, from the reason of their more heavy nature, would soon become solidly caked, and, therefore, are only ground in oil or turpentine when so ordered. Of course, I do not here allude to colours in collapsible tubes.

Red Lead is a preparation of burnt massicot, of a bright scarlet colour, and although, if used by itself in oil or varnish, it will retain its brightness for some, it is useless for mixing tints. Being a good dryer—a subject we will shortly touch upon—it is used for hardening white lead, when mixed as a putty or as paint for preservative purposes.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

Introduction—Tension of Piano—Strength of Back—Material Required—How the Back is Made.

There are no doubt many readers of this Magazine who not only desire the possession of a piano, but who would wish to construct one for themselves. It is with this twofold object that I write this series of papers. I shall not aim so much at literary precision as a desire to be explicit, and so simplify everything, with words and sketches, that the amateur will readily understand. To those who do not wish to make a piano, but who possess one already, I hope they will be interested in the perusal of these papers, as they will know how their own piano was made. The reader will see that I have adopted for my *nom de plume* "Never Despair," and I hope the amateur, if he starts making a piano, will adopt it for his motto. I remember about twenty years ago seeing the play of *Richelieu.* When the Cardinal asks his page to deliver an important despatch, the page asks, "What if I fail?" Richelieu exclaims, "Fail, boy, fail! In the bright lexicon of youth which fate has destined to a glorious manhood, there is no such word as fail;" so I hope the reader will omit the word fail from his dictionary.

I can imagine the reader saying, "To make pianos you must have a factory and appliances." To make pianos as a commercial commodity, certainly, but I do not want our reader to rent a factory, or to have special appliances, but that he shall use a spare room, or ordinary workshop, having a bench, a pair of trestles, and ordinary carpenter's tools, such as a saw or two, planes and chisels, brace and bits, and some of the minor tools, such as rule, squares, etc. Of course, in a factory, the facilities are greater, for they are needed, to turn out the quantity of work required, manufacturers making from one to forty pianos a week, according to the size of their premises; but it may interest the reader to know that several of our manufacturers have started in a humble way, not occupying more than one apartment for a workshop. In this series of papers I shall take the reader by short and easy stages, so that he can follow me, and, if he does so, I hope that he will be rewarded by possessing a piano of his own make.

Having said so much by way of introduction, I would impress on my readers that if a thing is worth doing, it is worth doing well; and in making joints, or gluing any part of the work together, see that everything fits, so that when you have put it together you shall be satisfied with it.

The strain, or tension, on a piano is very great, according to the size, or how it is strung. The tension from top to bottom of a cottage piano is about seven to eight tons, while a grand piano has a tension of about sixteen tons. So that the reader will see that the back of the piano, or foundation, must of necessity be strong to bear this great strain. If the back is not strong enough, then the piano would never stand in tune, for the two extremities would be gradually drawing together, so the strings would slacken accordingly.

The parts of the back are named bracings, linings, wrest plank, and bent side. The back of the piano I propose to make will be composed of nine bracings or uprights, the size of the back 4ft. 2in. wide by 3ft. 6in. high. The bracings are made of spruce, as free from knots and as dry as you can get it, 4in. by 3in. It will take about 50 ft. of this. The wrest plank is the upper portion of the back, where the wrest, or tuning-pins, to which the strings are attached, are placed. This is made from beech, 1½in. in thickness, and 8in. wide, and 4ft. 3in. long. Then there is the bent side; this is also made from beech. Pins are also driven into this to attach the other end of the strings. This beech is cut specially for the trade, as it is cut on the quarter, that is, the tree is cut in four parts, and this cut off the faces, so that it is not so liable to split. Wrest planks and bent sides can be purchased from Mr. Burch, timber merchant, Prince of Wales Road, N.W.

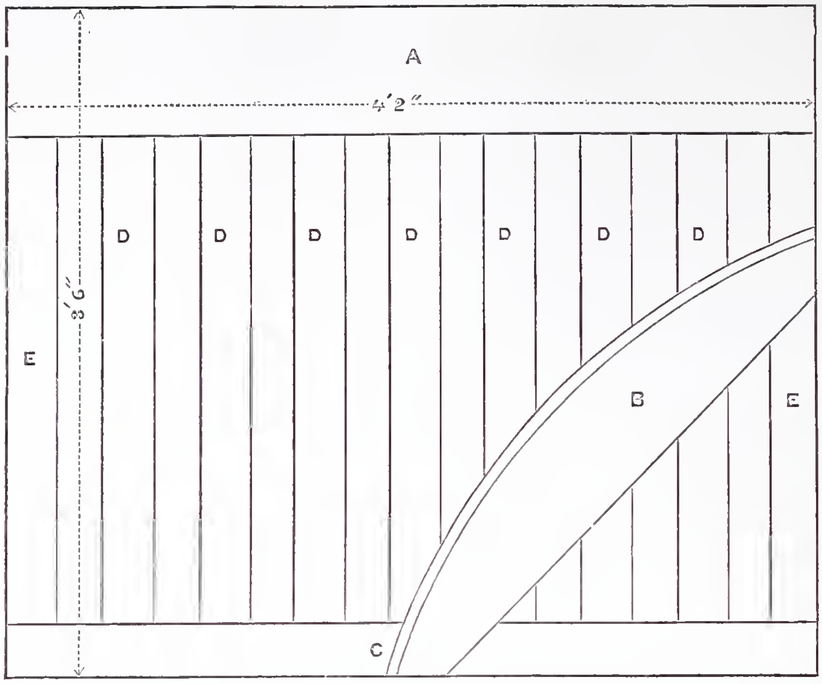


Fig. 1.—Front View of Back—A, Wrest Plank. B, Bent Side. C, Bottom. D, Bracings. E, E, Linings. (Scale, 1 inch to 1 foot.)

I must now speak of the glue, a very important item in piano making. See that you get the best. The best I know of is Cox's Scotch glue. It has the trade mark of "Chanticleer" on each cake. To prepare it, break it in pieces, and cover it with cold water, leaving it to soak all night; then put a portion in your glue-pot with the water, and boil thoroughly, stirring from the bottom occasionally.

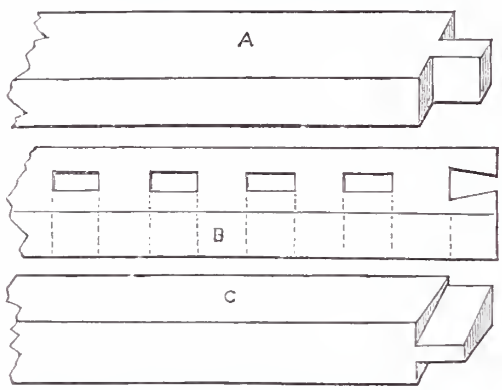


Fig. 4.—A, Bracing with Tenon. B, Plan of Bottom; same for Top. C, Lining with Dovetail.

To use a nautical phrase, having cleared the decks for action, we will commence making the back. Cut nine lengths of bracing 3ft. 6in. long, also two lengths 4ft. 3in. Now start planing one side of each, straight and out of winding; take a straightedge, put it on the work from corner to corner, and if it is hollow, plane off those two corners until you get it straight, that is what is meant by taking it out of winding, or twist; when you have got the 4in. side straight, you square the edge or 3in. side of each, and make a mark, so that you will know them; now take the rough off the other sides, and stand them by to dry, as they dry quicker when planed over. Now prepare the wrest plank and bent side by planing over, so that they will lay level and square across. You now require a couple of sheets of sycamore veneer. You cut it the width of your wrest plank until you have sufficient to cover its entire length, then joint it edge to edge on a board by tacking it temporarily, then glue strips of paper over to keep it together. When this is dry, tooth or scratch it with the edge of a saw. Now you want a board made hot, and glue your wrest plank, also the side of your veneer that is not papered, and place your hot board on, after being rubbed with soap, to prevent sticking, and press with hand-screws. After leaving this an hour or two, take your hand-screws and board off, and plane over with a smoothing plane set fine, and scratch the surface of the veneer. Now take the sheet of veneer the length and width of wrest plank, and glue as before.

Now the reader can make the frame of his back. It is to be 4ft. 2in. by 3ft. 6in. finished. The two lengths of bracing you cut 4ft. 3in.; they are for the top and bottom of your frame, so that their exact length will be 4ft. 2in. I gave you ½in. at each end to work with, for cutting square, etc. Now your outside bracings are called linings; these are dovetailed into the top and bottom, and the bracings tenoned into the top and bottom. You must divide the spaces apart for the bracings about equal; if anything, a little closer together in the centre, as the strain is greatest at this part. If you take the thickness of the bottom and top off the height of the piano, this will give you the measurement between the tenons; for instance, say your bottom and top were 2½in. thick, that would make 5in.; take that from 3ft. 6in., that would give you 3ft. 1in. between the tenons. The mortises you can bore out with a 1in. centrebit, leaving your tenons 1in. to fit. In putting the back together, before gluing see that it all fits together nicely and square; this try by placing a rod from corner to corner; they ought to be the same distance as each other; if not quite, a good push at one corner will make it right. Attend to this also when gluing together. When ready to glue together, get some friend to assist you. Just place the ends of the tenons in their respective places, just so that it holds together, then warm both ends well, and glue with a brush as quickly as possible the parts of the tenons that are visible.

Now knock together with a heavy hammer, and see that it is square,

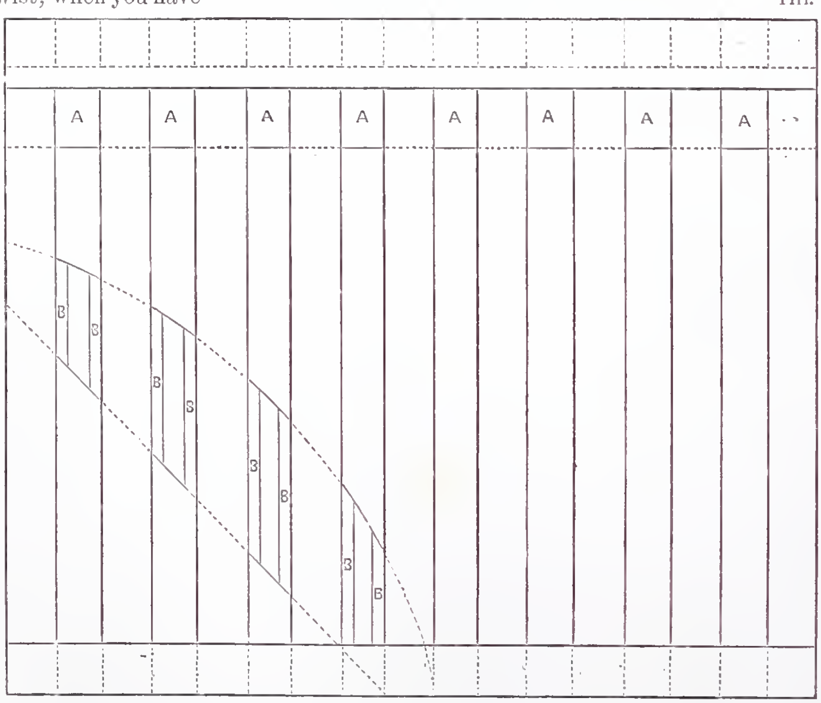


Fig. 2.—Back View of Back—A, Blocks behind Wrest Plank. B, Blocks behind Bent Sides. (Scale, 1 inch to 1 foot.)


Fig. 3.—End Section, Treble, showing how Back is put together.

and lays flat on the floor, and leave it to dry. When the glue is dry, plane over both sides clean. Make a pencil-line 8 inches from the top, and fill up the interstices to this line with blocks 6in. long; this is to make a good bed for your wrest plank to be glued on. When these are dry and levelled, tooth it well, make it warm, also warm the wrest plank. After it has been fitted knock two nails at each end of your line, and glue and put on hand-screws. The reason one veneer crosses the plank, and the front one is put on straight, is to prevent the plank splitting. Now you gauge a line ¾ of an inch from the bottom of your bent side, on the round edge, and ¾in. on the top; then put in your bench screw, and saw with your hand saw down the line on your edge; then chop out with your chisel from the line on the top; this will form a rabbet for the sound-board to lay in. When the back is facing you, with the plank at the top, the treble will be to your right hand. On your treble lining under the wrest plank mark 5½ inches. From your bottom corner at the bass end mark 2ft. Knock two nails in temporarily, and lay your bent side on and mark round with pencil, then fill up the interstices with short pieces of bracing, as you did for the plank. When dry, level and tooth, and glue your bent side up to the nails. After this is dry, get out two pieces of spruce 3in. wide, ¾in. thick, and 4ft. 3in. long. After planing, glue one top and bottom at the back of your back. Your back is now complete. In my next paper I shall deal with the construction of the sound-board.

PRACTICAL VENEERING.

HAMMER-LAID AND CAUL-LAID VENEERS.

BY DAVID ADAMSON.

The first thing that will probably cause the young veneerer to pause will be a doubt on learning that there are two kinds of veneers, or rather, that they are prepared in two different ways, which of them is the best, or as price will probably show him this, whether for practical purposes one is better than the other. He will soon find out that broadly, without referring to kinds of wood specially; veneers are to be obtained either "knife-cut" or sawn. This indicates the way in which they are prepared, the one being sliced or cut with a knife, the other with a saw, as their names imply. So far as I am aware, knife-cut is seldom, if ever, used for good work, partly no doubt owing to its extreme thinness, but, perhaps, principally because the best wood is always sawn. It is rarely that one sees much figure in knife-cut veneer, and I certainly cannot recommend its general adoption. The extra cost of saw-cut veneer is so slight that it is hardly worth while using the inferior kind. Perhaps here I may as well say something about the cost of veneers generally. These are in the ordinary kinds, that is those from logs, usually sold by the foot super. like ordinary timber, but burrs, which by the way are knife-cut, and such like are reckoned at so much each, the price depending not only on size, but marking, probable amount of waste, and various other considerations which need hardly be gone into here. Occasionally, however, whatever their kind, veneers may be quoted for by the foot, which, of course, always means superficial. Prices vary enormously, not only for different kinds of wood, but for different qualities of the same wood, and it may be taken as a fixed rule that the really choicest veneers of any description are more valuable than even ordinary good sorts in the solid, say, of 1 in. thick. Naturally, some sorts do not vary so much as others, and fashion as well as supply has a good deal to do with prices. These matters, however, are for the purchaser to settle with the veneer merchant, and beyond the mere mention of them they hardly come within the scope of this paper.

Fig. 1.—Hammer generally used by Cabinet Makers in Veneering. A Home-made Tool.

The terms "hammer-laid" and "caul-laid" veneers have already been alluded to, and it will be necessary to explain them in order that the learner may have a proper comprehension of the work implied by them.

In the former class of operation, the veneer is laid by pressure with a hammer specially made for the purpose. Perhaps the name hammer may be rather misleading to novices, as according to the ordinarily accepted purpose of this tool it might be inferred that the veneer is laid by knocking. This, however, is not the case, as the veneering hammer is used as a squeegee with constant equable pressure instead of a series of impacts or blows. From this it will readily be understood that a hammer in the ordinary sense of the word is rather a misnomer, and but for the "veneering hammer" being so well known in workshops, it might be more appropriately referred to as an iron squeegee. The face or striking part of an ordinary hammer head is, therefore, of little or no consequence in a veneering hammer, the opposite end of the head or pane being the all important part. This, accordingly, is widened out very considerably in order to cover as wide a surface as is compatible with convenience. It is hardly worth while to buy such a hammer, as it can very easily be made by the worker himself. A strip of iron of, say, from 3 in. to 6 in. long and of any convenient width is firmly fixed between two pieces of wood, or in a groove cut in one piece to form the head. In this a handle is inserted. The precise shape and size of any part are quite immaterial, the principal points to be observed being strength and convenience. The iron edge of course must project beyond the wood, and it must be straight with a smooth

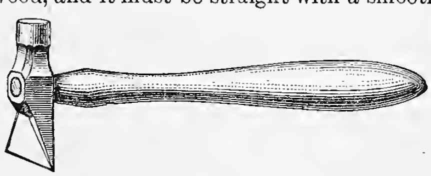


Fig. 2.—A Form of Hammer sometimes used in Veneering.

rounded edge in order to allow it to be passed freely over the veneer. To prevent this being injured, it is also well to slightly round off the lower corners. Fig. 1 is an illustration of a veneering hammer of this kind, and I think it will be sufficient guide to those who wish to make their own. Perhaps I ought to say that the metal should be thick enough not to bend when the hammer is used, and that the smoother the edge is the more easily the tool can be used. Fig. 2 is a form of hammer that may be used, but I have never seen such a tool in the hands of a cabinet maker when veneering.

In the other kind of veneering, viz., that with a caul, the hammer is not used, its place being taken by a uniform equal pressure over the whole surface of the veneer, which is kept in close contact with the foundation on which it is laid till the glue has set. The caul itself is either wood or metal, either of which must be shaped exactly to fit the surface to be veneered. Thus for a flat panel it must be flat, while for a concave surface it must be convex, and so on. The object of the caul is to squeeze out any superfluous glue, for I presume it will be almost unnecessary to remind any one who contemplates doing veneering that too much glue is as bad as too little. Therefore, unless the caul accurately fits to any shaped or moulded surface it is defective. Where large quantities of the same size and shape are required, the necessity of having a caul to fit is not much trouble, but those who have only to veneer a moulded surface now and again will find it scarcely worth while to prepare a specially shaped caul for each, and for such work a substitute will be mentioned later. To do so at present might only confuse the beginner, who should be well acquainted with the way to use a plain flat caul before attempting anything of a more complicated character. As has been said, the caul may be either of wood or metal, but for general purposes a combination of the two may be advocated. Wood

Fig. 3.—Section of Board showing Heart Side uppermost.

alone, unless carefully used, is apt to get burnt while being heated, as will be explained in due course. Iron again is for many reasons unsuitable, and, without going into all the reasons, it will suffice to say that zinc is the metal generally employed for hand-cauls. Other kinds, whether steam or gas, being more of the nature of machines, and only likely to be used where much veneering is done, may very well be left out of consideration in the present directions, which will, however, enable any one who wishes, and has access to a gas or steam caul, to use it intelligently. The actual process of veneering is the same, the difference being in the preparation and management of the caul. For cauls for occasional use wood alone will do very well. I mean by this that the result will be as good as if zinc were used, and the amateur, at any rate, will seldom wish to do so much veneering as to make it worth his while to incur the expense of metal. On the whole, perhaps there is less risk of spoiling work by using wooden cauls alone, provided they are not burnt, than there is with metal, but with a little caution injury should not happen whichever is used. With metal the danger lies in overheating it so that the glue between the veneer and the foundation is not merely softened but gets burnt, and the same thing may happen to the veneer itself. With a wooden caul, of course, such a mishap is much less likely to occur, as the caul itself will probably burn before it is too hot to damage either the glue or the veneer. Of course, I am not wishing to say that a wooden caul cannot be overheated, for it is quite possible to do so, and whether with wood or metal care, to say the least, is highly desirable. To sum up, zinc is desirable because it lasts longer than a plain wooden caul, though otherwise wood is, on the whole, as serviceable for occasional use, though its liability to get out of shape or twist is sometimes objectionable. In thickness the zinc employed may be almost anything over that, say, of a penny. If it is too thin it does not retain sufficient heat, while excessive thickness simply means waste of money. Perhaps as a general thing the zinc is usually preferred of from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in thickness, the former being quite sufficient for ordinary purposes. Less might do, but I cannot state that it would from personal knowledge. One well-known authority recommends $\frac{1}{4}$ in. as the best thickness. I do not pretend to say which is best, as I think more depends on the way the work is gone about than on the thickness of the zinc, but I may state that in one shop with which I am acquainted, where some of the soundest furniture procurable is made, there is no caul (zinc) over $\frac{3}{16}$ in. thick. Even with a zinc caul a backing of wood is necessary to keep it flat down to the work, and to prevent the heat from dispersing too rapidly. This wood may be of about 1 in. thick, which is sufficient generally, though there is no reason why it should not be of any greater dimensions, beyond the fact that any excess, being unnecessary, means waste. A good deal, of course, depends on the way the caul is clamped down and on its size. For the material nothing is more suitable than good sound pine.

Such a piece of wood used alone—without zinc—is a plain wooden caul, so that there is nothing very elaborate in the special preparations required to lay veneers with. Perhaps before leaving this part of the subject, it may be as well to state that wooden cauls are more old-fashioned than zinc, and that in well-appointed workshops they are now generally discarded.

In addition to these things a toothing plane is also desirable to roughen the surface to be glued, but this can hardly be regarded as a tool required only for veneering purposes any more than the hand-screws which are used to hold the cauls down with. Something may now be said about the comparative merits of hammer and caul-laying, though it is quite conceivable that some may altogether object to the word merit in connection with hammer-laid work, and deny that there is any merit in it. On the other hand, some workers will also be found to assert that it is "good enough," and no doubt it is so for some purposes or for very small work. The general concensus of opinion, however, among those who have devoted sufficient attention to the subject is that caul-veneering is out and away the better method, especially when anything but a mere strip of veneer has to be laid. Even then the pressure maintained till the glue has set renders it preferable. When laid with the hammer there are more likely to be blisters than when cauls are used, and besides this there is less shrinking with the latter. For "slop" work the hammer has everything in its favour; the caul for such is not to be compared with it. For ordinary thin knife-cut veneers the hammer does very well, especially if the veneers are of a light-coloured wood. Indeed, some go the length of saying that all light-coloured veneers are best laid with hammer, the reason being that the glue is not so likely to discolour them as when laid in a caul. With care, however, in the selection and use of the glue, there is no reason why the lightest veneer should be stained. With regard to this I suppose it will be understood that the heat of the caul causes the veneer to absorb some of the glue, and this if of dark colour naturally destroys the purity of a light-coloured veneer, though it is not observable in the darker kinds, such as mahogany and walnut. All things considered, it may be said that veneers should be laid with a caul, and that the hammer should only be had recourse to as a substitute, or when experience shows that it can be used without detriment. It must not be forgotten that a practised worker may often violate general principles of construction with good results, while a less skilful man would only court failure by venturing to do so.

Let therefore the *modus operandi* with a caul be considered first, reserving any slight differences when a hammer is used for subsequent mention.

First of all, the wood to be veneered on must be properly prepared by smoothing it down as carefully as if it were to be left uncovered. All saw marks must be removed, and if it is pine, take care to select a piece as free from knots as possible. The surface should be gone over with a toothing plane, though this is not always considered necessary. In addition to planing and cleaning up generally, further preparation is required whenever a panel or anything wider than a mere strip, such as part of a door frame, is being veneered, in order that the board when dry may be flat. The action of the water contained in the glue must be taken into account, and counteracted, otherwise the glue and veneer in drying will pull the wood out of shape. Care must further be taken to veneer on the right side of the wood, for if not, the board or panel will have a tendency to become concave or hollow. This is by no means desirable, and when seen at once shows something wrong. Where absolute flatness cannot be obtained, and it often cannot be, it is better for the panel to be convex or rounded outwards, as the appearance is far better than the reverse way. From this those who are acquainted with wood working will see that when at all practicable the "heart side" of a board should be veneered on, as other circumstances being equal, this is the one which becomes convex. To some novices the fact that there is any difference between the two sides of a board may be a new idea, in which case the term "heart side" will not convey any meaning probably. Well, for them let it be said that though the term is a technical one its meaning must be taken literally.

The "heart side" simply means that it is the side of the wood which was nearest the heart or centre of the log. It can easily be determined by looking at the end grain, and noticing which way the segments of the annular rings turn. These, of course, are more or less regular, but there is seldom any difficulty in discerning them on taking a shaving off one end of a plank with a plane. As it is a matter of considerable importance, not only in veneered work but also in other constructions, that the difference between "heart side" and the other should be known, the diagram, Fig. 3, is given in order that there may be no misapprehension. From what has been said there will be no difficulty in recognising that the upper part of the section there represented is the "heart side." This is the one which should almost invariably be selected for the outer surface not only for veneered but for plain work. Sometimes it may make very little difference which side is veneered on, but no instance occurs to me when it would be wrong to do so on the "heart side," though it would be very easy to state instances to the contrary. It may, therefore, be said that the novice will do well not to veneer except on the "heart-side" till he has sufficient experience to enable him to decide when he may do so on the other without detriment. Even then, unless he has some good reason for veneering on the other side, he will do well to be cautious in disregarding the rule to lay veneer on the "heart side." If he attends to this he will never be vexed by having his panels turn hollow, due attention naturally being given to other details of the work, for it must not be imagined that care on one point will make up for negligence in others. Perhaps for the sake of simplicity it will, instead of generalising, be well to imagine some particular piece of work as being required to be veneered. Let us suppose it to be a drawer front, for this is not only a very usual piece of work, but the wood is generally of a convenient size to be easily handled, so that it offers fewer difficulties than others might do. What the wood, both foundation and the veneer, is does not much matter, but we will assume the former to be pine and the latter mahogany or plain walnut—not burr, which, requiring a somewhat different treatment, will be dealt with later on. Mahogany, however, may be taken as a typical veneer requiring no exceptional preparation, and presenting no great difficulty in laying it. In fact, it may almost be regarded as the easiest to work.

The ground wood or foundation being ready, the next thing is to cut the veneer to the size required. This should be a little greater than that of the wood to be covered—not much, but just enough to let it project over the edges a little to allow of its being trimmed off neatly afterwards. I am presuming that the veneer is saw-cut and of the usual thickness, which may be roughly stated as being from 10 to 14 to the inch. If the veneer is very rough, that is to say, if the marks of the saw used in cutting it, or any other inequalities, are very decided they must be removed. The toothing plane will do this, but it is unlikely that any great amount of smoothing will be necessary, as most modern veneers are so well cut that they require very little preparation in this way, presenting a marked improvement upon those of comparatively few years ago, which were frequently what we should now call very badly cut. However, we may take it for granted that the veneer is smooth either direct from the saw, or has been made so subsequently. The side to be glued down must be gone over with the toothing plane finely set to roughen it slightly, and afford a firm hold for the glue. Doing this with a thin substance like veneer requires delicate and careful manipulation. Unless quite dry the veneer should be made so by laying between hot cauls previous to using it, but this precaution is not so important with mahogany as with some other kinds. With some it is absolutely necessary, and even with mahogany it may often be of advantage, so that as a general rule the novice will do well to adopt it. With practice he will be able to do without it sometimes. Nothing has been said about the way the grain in the veneer should run, as I presume this will be understood. In case it is not, let it be said that in both the foundation and the veneer the grain should be coincident. Sometimes they are used transversely or at right angles to each other, ut not in such a piece of work as we are onsidering. When it does occur, it is so arely that the exception may be said to prove the rule. Now, having said all that needs to be at present about the veneer, let attention be directed to the wood to which the veneer is to be glued. As has been stated, the action of the gluing must be taken into account, but without concerning ourselves with theory it will be enough to lay down the principle that the wood must be damped on the back. I have heard of the wood being soaked for a day or two previously to use, but I believe this plan is now altogether obsolete, as it is unnecessarily cumbersome and open to many objections. Still it shows that much variation in practice may exist, and that it is more a matter of how the work is done than what course is adopted. There is perhaps no detail connected with veneering on which experts differ so much as on the preparation of the groundwork to which the veneer is to be attached, and one is almost forced to the conclusion that when a man has become thoroughly conversant with any particular method and practises it intelligently, good results are obtainable. This does not, however, prevent one method having advantages over another, and without discussing them all in their various bearings it will suffice to mention one course which is applicable to almost all kinds of work, and one which can hardly fail in being satisfactory. It is this.

Damp the back of the wood to be veneered, say, from half an hour to an hour before using, by rubbing it over with a wet sponge or cloth. The wood will then become slightly rounded on this side. On the amount of moisture and consequent swelling a good deal depends, but it is impossible to give any minute directions, as so much depends on surrounding circumstances. The most that can be done here is to say that the surface of the wood should be fairly wet, and that the water must not be allowed to collect in pools on its surface. It is to be damped, not saturated. Sometimes the plan of placing a layer of damp sawdust on the wood to be veneered and leaving it overnight is adopted, but the slight disadvantage attending this is that the wood may get too much damped while waiting, and that the time required may not be always convenient.

When the wood is sufficiently swollen, it is ready for gluing. The glue, it goes without saying, should be of good quality and properly made. It must be of medium consistency, and, of course, be quite hot. Rub it smoothly on the wood, taking care that the whole surface is covered. No glue is to be rubbed on the veneer, which is simply laid on the glued foundation. Then, without delay, get the caul, which should, in the meantime, have been getting warmed, and put it above the veneer. If the caul be zinc, lay the board already mentioned above it, apply the hand-screws till the glue oozes out at the edges, and let it stand till the glue has set. This will be when the caul has become cold, which will be in the course of an hour or two. With a zinc caul, only the metal is heated, the wood backing being applied cold. The heat for the caul cannot be learnt except from experience, though it may assist novices to say that it must not be so great that it cannot be comfortably handled. *Per contra*, neither must it merely have the chill taken off. The object of the caul, it must be remembered, is to partially melt the glue again after the veneer has been laid on it, at least, that is what the heat does. The pressure on the caul forces the liquid glue, to some extent, into both the foundation and the veneer, air bubbles and excess being at the same time got rid of. All this in theory is very simple. In practice, it is not quite the same thing, and the following hints will be of service.

If the caul is too cold, the glue is not sufficiently melted to flow freely between the two contiguous surfaces of the veneer and foundation. Pressure, therefore, is only partially effectual, the excess of glue and confined air will not be expelled. Blisters and imperfect cohesion will be the result. On the other hand, if the caul be too hot, there is the danger of overmelting the glue, and together with excessive pressure of forcing too much of it out at the edges, as well as into the wood. These directions may seem vague and unsatisfactory, but it will be better to caution the novice about risks to be avoided than to tell him exactly what to do, even if it were possible to supplant his judgment by giving definite rules. Not only is the right degree of heat advisable, but it must be evenly diffused over the whole caul, for it will require only a moment's consideration to show that it would never do to have any parts nearly cold, or others overheated. The pressure also must be regulated, but with small hand-screws there is not much danger of this being excessive. Take care that the jaws of the hand-screws press evenly, and do not let them merely grip the edges, while leaving the caul and the veneer only slightly in contact towards the centre. This may occur if the caul is too thin, or if from any cause it is hollow in the middle. As it is quite possible that some of the glue may be forced through the veneer, a sheet of paper should be laid between it and the caul. This should also be slightly greased, though with mahogany veneer it is not so necessary as with one of a more porous nature, such as burr walnut. The paper will stick to the veneer, or perhaps, I should say, may do so, but it will be of no consequence, as it can easily be cleaned off, and is only mentioned as the dirty appearance might cause the novice, at first, to think that the work had been spoiled. One other little matter I must put the worker on his guard against, viz., the necessity of seeing that the veneer does not slip from its place when laying it in the caul. To prevent this happening, veneer pins are sometimes used, but with care they may very well be dispensed with. Any small nail or tack will do for the purpose, and it will not be necessary to do more than say that in many circumstances their use is objectionable. After all these cautions it seems hardly possible for the merest tyro to go very far wrong in laying a plain mahogany veneer on one side of a panel or drawer front, but the subject of veneering is far from exhausted. After the work has been removed from the caul, it should be placed so that the air does not get to the veneer, say, leaning against a wall, and then left till the glue has become thoroughly hard. If everything has been properly done, the board will then be slightly hollow on the back, and rounded on the veneered or face side. From this it will not alter, or, if it does, it will be to such a trifling extent as to be almost imperceptible. After the glue is thoroughly hard, the surface may be cleaned off by first using the smoothing plane, which it is almost needless to say must be very finely set, then the scraper, and finally glass-paper. Of course, it must be left for the worker to say whether the use of a plane is necessary. If not, by all means do without it, as it is by no means a case of cut and come again with a thin veneer. Although the cleaning must not be done before the glue has become quite hard, there is no occasion to do so as soon as it has. The work may suffer by being cleaned off too soon, but it hardly can by delay in cleaning. It may almost be said that the longer it is left the better; the risk being with premature cleaning that ridges through inequalities of glue may subsequently show themselves, and also that the heat caused by scraping and papering may melt or soften the partially dried glue to such an extent that its hold may be considerably lessened. If this occurs to any great extent, blisters, the *bêtes noires* of the veneerer, may make themselves unpleasantly obtrusive. How these, when they occur, may be recognised and reduced will be stated later on.

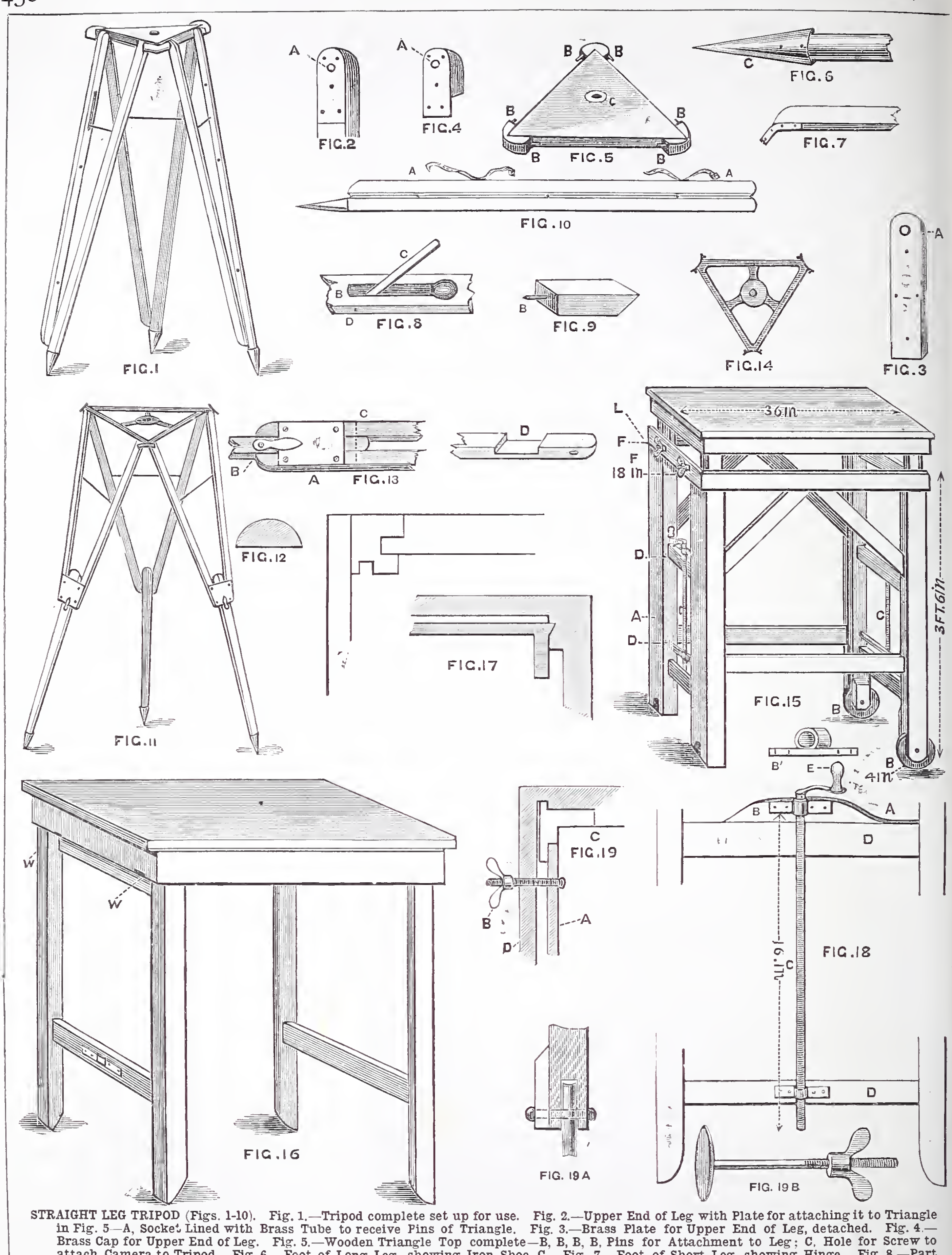
TRIPODS AND STANDS FOR CAMERAS.

BY AN OLD HAND.

THE STRAIGHT LEG TRIPOD—THE FOLDING TRIPOD—THE TABLE STAND—THE STUDIO STAND.

NEXT in order of importance to the camera is the tripod or stand, so designated according to its form, the tripod being almost exclusively used for outdoor work, and the stand for indoor or studio work. The tripod consists essentially of three legs, from which it takes its name, supporting a small platform. These legs may be each in one length or made to fold in several joints. In all cases it is imperative that the apparatus should be perfectly firm when set up and free from vibration. These qualities are the most important of any, for with a rickety or vibrating stand no good work need be expected. Whatever form is chosen it must be one that may be depended on as free from these particular drawbacks. It goes without saying that long, light, and slender legs, especially if jointed, are unreliable. The fashion of making everything so light in weight for outdoor work has unfortunately, in many instances, been at the sacrifice of rigidity; and many stands now in the market are not worth the wood they are made of, if good sharp pictures are looked for as a *sine quâ non*. Many apparently strong stands will vibrate with the lightest touch, and the tremor continue for some seconds; a gust of wind will have the same effect, and when the time of exposure for the plates is calculated in seconds or fractions of them, the result may be anticipated. Blurred, unsatisfactory pictures are generally all that can be made on such stands, except by the merest chance. It will be as well to bear this in mind in their construction, and never let the idea of extra portability trench in the least on this quality of firmness.

For indoor or studio work, the heavier in reason the stand is the better. The framework is always massive in character in those patterns used especially for portraiture. A kind of stand for studio work of a varied kind is called a table stand, as it somewhat resembles this article of furniture, and for real practical usefulness nothing can be better. All ordinary stands may be classed under one or other of these heads, the difference being merely in pattern or unimportant detail. Almost every maker affects some particular design, and the variety is legion. In the present paper I give working designs for each of these leading patterns, choosing as simple ones as I conveniently can, and I would call



STRAIGHT LEG TRIPOD (Figs. 1-10). Fig. 1.—Tripod complete set up for use. Fig. 2.—Upper End of Leg with Plate for attaching it to Triangle in Fig. 5—A, Socket Lined with Brass Tube to receive Pins of Triangle. Fig. 3.—Brass Plate for Upper End of Leg, detached. Fig. 4.—Brass Cap for Upper End of Leg. Fig. 5.—Wooden Triangle Top complete—B, B, B, B, Pins for Attachment to Leg; C, Hole for Screw to attach Camera to Tripod. Fig. 6.—Foot of Long Leg, showing Iron Shoe, C. Fig. 7.—Foot of Short Leg, showing Hinge. Fig. 8.—Part of Leg, showing Strut, C; B, Hollow to receive Strut when Legs are closed for Carriage; D, Pin to act as Pivot and secure Strut to Leg. Fig. 9.—Wooden Block with Pin for Point of Triangle. Fig. 10.—The Leg complete and folded—A, A, Straps. THE FOLDING TRIPOD (Figs. 11-14). Fig. 11.—Folding Tripod set up ready for use. Fig. 12.—Transverse Section of Leg. Fig. 13.—Part of Legs, showing how they are fastened together—A, Brass Plate; B, Button; C, Screw; D, Part of Lower Leg cut away to receive Plate when extended, so that Leg and Plate come flush and allow Button (B) to act. Fig. 14.—Brass Triangle, Top. (*For Continuation of Inscription, see next page.*)

the attention of the constructor to the illustrations given in manufacturers' price lists for any additional modification that may take their fancy, and which by the exercise of a little skill they will be able to add to the designs here given.

The Straight Leg Tripod.—The material of which tripods of this form are made is usually ash, although deal, mahogany, and other woods have been used. Ash combines the qualities of toughness and rigidity, and is heavier than some other woods; but this is overbalanced by its lasting qualities and its power of withstanding a deal of hard usage without becoming disabled. Very useful tripods have been made of bamboo exactly, without any play; the holes may be drilled almost through the thickness of the wood, and lined with a short metal tube. The fitting of the head determines the rigidity of the apparatus when it is set up, so it is as well not to err on the side of lightness in the metal used. If a plate is considered sufficient, it should be made of brass $\frac{3}{16}$ in. thick, as Fig. 3. If a cap, it can be cast in one piece, as Fig. 4, or by bending a piece of brass round the top in addition to the plate, and securing it with screws on each side; but whatever plan is selected the brass-work must be sunk flush with the surface of the wood. The longer laths are then shoed, Fig. 6 being tapered to fit the iron whole may be made into a compact parcel when travelling. A leather strap handle is preferred by some; this can be also screwed to one of the legs centrally, so that a proper balance is secured when carrying it. The head of tripod may be purchased of metal as in Fig. 14, or made of wood as in Fig. 5. It is important that there should be no warping in this part, to prevent which three layers of $\frac{1}{4}$ in. mahogany, placed in different directions of grain, are glued together and dried under pressure. A triangular piece thus built up must be cut 8 in. on each side.

Now make six blocks, as Fig. 9, $1\frac{1}{2}$ in. long, mitred and rounded off afterwards, in which the pins, B, are fixed, and from

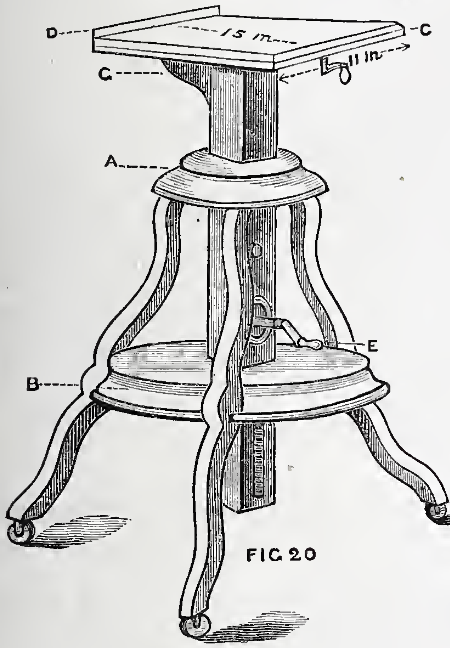


FIG 20

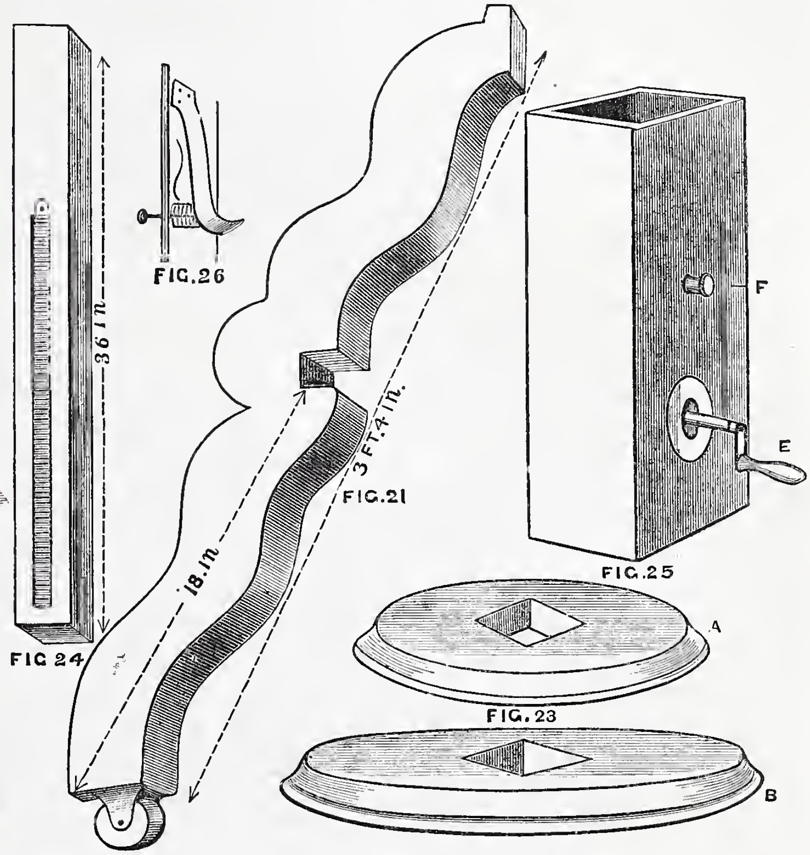


FIG 24

FIG. 26

FIG. 21

FIG. 25

FIG. 23

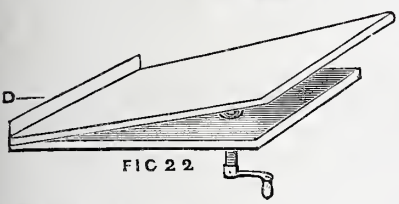


FIG 22

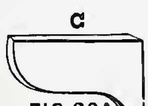


FIG. 20A

THE TABLE STAND (Figs. 15-19). (*For Cuts, see preceding page.*) **Fig. 15.—Table Stand ready for use, complete. Fig. 16.—Table and Sliding Frame with Hinged Top. Fig. 17.—Section of Inner and Outer Frame, showing Groove. Fig. 18.—Bars showing attachment of Screw for raising or lowering Table—A, Fitting to receive Collar B, B′, Collar shown separately; C, Screw; D, D, Bars of Sliding Table; E, Winch. Fig. 19.—Section of Frame, showing how Inner and Outer Frames are Clamped together—A, Clamping Bar; B, Winged Nut; C, Frame of Sliding Table; D, Upper Bar of Outer Frame. Fig. 19 A.—Enlarged View of Wheel of Front Leg (B, Fig. 15). Fig. 19 B.—Enlarged View of Screw and Nut for Clamping Bar (B, Fig. 19). THE STUDIO STAND (Figs. 20-26). Fig. 20.—Studio Stand complete. Fig. 20 A.—Enlarged View of Bracket G, Fig. 20. Fig. 21.—Leg of Stand. Fig. 22.—Double Top, hinged by two Strong Hinges in Front. Fig. 23.—Upper Circular Platform (A) and Lower Circular Platform (B). Fig. 24.—Central Pillar with Iron Rack. Fig. 25.—Outer Casing for Pillar—E, Handle for raising or lowering Stand; F, Spring Top. Fig. 26.—Spring Catch.**

jointed together fishing-rod fashion. Deal is a very rigid wood, but not suitable for hard, rough usage, as it is liable to snap short off if subjected to sudden strain. Fig. 1 shows a complete tripod of the simplest possible form, and for practical usefulness not to be superseded by any other.

To construct a tripod, as in Fig. 1, procure some good seasoned wood, free from knots or shakes, cut out three laths 4 ft. 8 in. long, and three 4 ft. 6 in. long, 1 in. in width, and $\frac{3}{4}$ in. in thickness; round off the edges, and smooth them. One end of each lath is shaped like Fig. 2, and strengthened by a plate (Fig. 3) or cap of brass (Fig. 4); this strengthening is absolutely necessary, as the wood at this point is subjected to severe strain. The holes, A, are drilled to admit the pins, attached to the head (B, B, B, B, B, B, Fig. 5), fitting into them sockets (Fig. 6, C), which consist of sheet iron bent into a conical shape, and brazed or welded, with holes drilled so that they can be securely riveted to the wood. The shorter legs are finished as in Fig. 7, a strong hinge being affixed thereto; the hinge is then screwed to the longer end, so that the upper ends of the legs are perfectly level. At six inches from the top of the shorter leg a groove is hollowed out $4\frac{1}{2}$ in. in length (Fig. 8), in which an iron or brass rod 4 in. long (C) working on a pivot (D) at the lower end can be embedded in B flush with the surface of the wood. This is the strut or stretcher, which, when the tripod is set up, fits into a hole in the opposite leg to which it is attached, in order to keep them in close and firm connection with the top. The legs can now be well oiled and polished, two small leather straps, A A, being screwed on to one of the legs (Fig. 10), so that the which they should project 1 in., and screw and glue one on each side of each point of the triangle (Fig. 5) and round off the points. The exact position of the pins should be such that when attached to the legs the ends of the legs should be level with, or rather below, the surface of the triangle. A quarter inch hole is now drilled through the centre of the triangle, strengthened on one or both sides by a circular brass plate (Fig. 5, C); the under part of the triangle, for about an inch on each side of the screw hole, may be slightly hollowed. This acts as a guide in screwing on the camera. It can now be polished, and it is a good plan to cover the upper surface with a piece of cloth or velvet; it gives a firmer bed for the camera, and prevents scratching, and altogether works more pleasantly than bare wood. This completes the ordinary single tripod.

The Folding Tripod.—Fig. 11 is one of the folding kinds, a thoroughly useful pattern, and for travelling its compactness is a great recommendation.

This kind of tripod varies from the straight leg tripod in the construction of the legs, the attachment to the head and the head itself being the same. Proceed to cut six pieces of ash, ¾ in. square and 31½ in. long; round off two corners; a section of the rod will be as Fig. 12. Round off the ends, and drill and cap as in the other case. Cut out three pieces of ash, 1 in. by ¾ in. in thickness and 27½ in. long; make them slightly taper for three parts of their length and shoe. To fix them together place one long piece on each side of the shorter one, overlapping 5 in., as in Fig. 13, and put a stout screw (C) through all of them an inch from the end of shorter leg; file off the point of the screw level with the wood. This acts as a pivot, and permits the legs to be folded. A plate of brass (A), 2¼ in. in length and 2 in. in width, is attached by screws to the outer legs, the wood in the shorter leg being cut away the depth of the thickness of the plate, as at D, so that when the legs are opened out the plate will be flush with the surface of the wood, in order to permit a button (B) on the shorter leg being turned to keep the whole rigid and firm. The measurements for this stand are suitable for working with a whole-plate camera or lens. A six-inch triangle in brass (Fig. 14) is rather to be preferred to wood, as being more easily carried. If it is elected to make a wooden one, it can be made the same as already described, no alteration being required except that the space between the ends of the pins must be reduced to 4½ in., by shortening the sides of triangle and the pins themselves projecting ⅝ of an inch. The struts may be made of strips of brass 4 in. long and ⅛ in. in thickness, let into the wood edgeways. The cell to contain them is best hollowed out somewhat above the end of the strut, to permit the more easy grasp of the brass by the finger end, as in Fig. 8. The same applies to the larger tripod. The usual polishing and straps complete the arrangements.

The Table Stand.—The table stand, shown complete in Fig. 15, is a much more elaborate piece of apparatus, and is especially useful for all kinds of copying work, and for portraiture, although for portraiture alone a smaller stand, and one that can be moved in all directions with facility, is to be preferred. The outside framework of this table is made of 2 in. stuff, the inner sliding frame (Fig. 16) of ¾ in. stuff. Deal answers every purpose. The outer frame (Fig. 15, A) is first made of the dimensions shown on diagram. The method of joining and grooving the corners is shown in Fig. 17; the two front legs are provided with 4 in. iron grooved wheels, B B, working in slots. The back legs are merely grooved at the bottom, to run on rails, for copying purposes. Two half-round iron rails are screwed to the floor of the studio, on which the table is pushed to and fro, the rails always keeping the stand in the same direction when moved backwards or forwards, an important point in copying; by slightly raising the back legs, the stand, even with a heavy camera on it, is easily moved. If no rails are used, good strong castors may be fixed to each leg; then the table may be moved in any direction with facility. The inner or sliding frame to which the table top is attached by hinges (Fig. 16) is constructed as shown, and is raised or lowered by endless screws working in collars attached to the end bars (Fig. 15 D). The screws, C C, are 16 inches long, which gives sufficient elevation for all practical purposes. The lower ends of the screws work through nuts on the lower bars, raising or lowering the table. A winch handle (E, Fig. 18) on the upper bar effects the movement; two stout pins, with screw threads (Fig. 19), only one shown in diagram (also see Fig. 15, F F), are attached to a bar pinching the inner sliding frame to the outer one at each end of the table, and passing through the outer frame, where by means of winged nuts the table may be steadied at any height. In order that either end of the table top may be raised at will, the top is hinged with two stout book hinges at each end to the framework supporting it (Fig. 16, W W). The upper part of the outer frame is braced together by two cross bars, not shown in drawing, made of ½ in. wood, and let into the lower side of the top frame (Fig. 15). This may now be stained and varnished, and the apparatus is complete. The advantage of having wheels only on the front legs is that the stand cannot be accidentally moved, it being necessary to raise the back legs before altering its position, the flat foot giving considerable grip of the floor. Both ends of the table are made precisely alike, with the exception of wheels. The clamping-bar, which is merely a piece of wood (Fig. 19, A) ¾ in. thick and 2½ in. wide, is retained in its place at the back of the upper bar of the outer frame (Fig. 15, L) by the screw, and when screwed up presses firmly against the legs of the sliding frame, Fig. 19 being a sectional diagram, C, frame of sliding table, B, winged nut pressing clamping bar A and D into close contact.

The Studio Stand.—The ordinary studio stand (Fig. 20) combines in a certain degree the movability, to coin a word for the occasion, of the tripod, with the solidity and firmness of the table stand. It is supported on three stout legs supplied with castors, so that it can be moved readily in any direction on the studio floor. The top, C, is considerably less than the table stand, and double—15 in. by 11 in.; and the wood ¾ in. thick. The double arrangement is in order to tilt the camera; the upper platform is supplied with a ledge, D, to prevent the camera slipping off when tilted. The lower part is supported on a bracket, G, whose shape is shown in an enlarged form in Fig 20 A. The upper circular platform (A) and lower circular platform (B) are shown separately in Fig. 23. E is the handle by which the pillar on which the top rests is raised or lowered. Fig. 22 shows the double top, hinged in front, and raised or lowered by a wooden hand-screw or a winch and screw; a 5-in. screw is sufficiently long, as it very seldom happens that more angle than can be obtained by this length is required. The screw should be a stout metal one, say ½ in. in diameter; each half of the top should be clamped to prevent warping. For legs cut out three pieces of wood, 2½ by 2 in., as in Fig. 21; they might be straight as far as utility is concerned, but the curves make them of more presentable appearance. The length from above the castors to the top is 3 ft. 4 in., and the height of the first circular platform from the ground is 18 in. The upper circular platform, Fig. 23, A, is made of 2 in. wood, and is 8 inches in diameter. The lower one, Fig. 23, B, is 2½ in. wood, and 15 in. in diameter, both nicely shaped at the edges, and with square apertures cut through the centre, just large enough to allow easy passage of a solid pillar of wood (Fig. 24), 2½ in. square and 3 ft. long; this is firmly screwed to the lower part of the top, into which it is let in about ¼ in. One side is provided with a strong iron rack about 20 in. long from the bottom of the pillar, which, when fixed in place, engages with cog wheels attached to winch handle, E, on outer case (Fig. 25) for the purpose of raising or lowering the table. In order to prevent movement after the table has been raised to the required height, by the weight of the apparatus, a strong wooden hand-screw or spring catch (Fig. 26) is fixed on the inside of the thin casing, which, engaging with the rack, prevents any downward movement. By merely pulling the knob F the rack is set at liberty, and may be lowered by the winch. The casing is made of ¾ in. wood, neatly joined, and extending between the upper and lower platforms, increasing the firmness and rigidity of the stand, and of just sufficient internal diameter to permit the pillar moving easily through it, not forgetting to allow sufficient space for the cog wheels and winding arrangements. As this entirely depends on the size of the castings, it cannot be definitely stated; three of the sides can, at any rate, be flush with the apertures in the platforms. A small bracket, Fig. 20, A, attached to the pillar under the table is an advantage, as there is considerable strain on this part when using heavy apparatus. With the exception of the pillar and casing, all sharp edges should be taken off the work. How much roundness shall be given to the legs depends entirely on the taste of the workman. The whole should be well polished, and the castors attached. The stand is then complete.

BLACKLEAD AND BLACKLEADING.

BY GEORGE EDWINSON BONNEY.

Blacklead.—The common and well-known name for *Graphite* or *Plumbago*. The black powder, known by the name of "blacklead," has no relation to lead, but probably received this name because pencils made of it caused a mark on paper resembling that made by lead, only blacker. This similarity, together with its metallic appearance, also gave it the name of plumbago, from the Latin *plumbum*, meaning lead. The name graphite is derived from a Greek source, and bears a reference to its use as a writing material. It is really a crystalline form of carbon found in the oldest sedimentary rocks. It is sometimes found associated with iron in its ores, and in some districts is found in the form of veins in the rocks. Its specific gravity varies from 2·15 to 2·35. This material is of great use to the electrotyper, since it enables him to coat a non-conducting surface of a mould with a conducting substance capable of reproducing the finest lines impressed thereon. For this purpose the very best graphite should be employed.

As there may be several opinions as to what constitutes the best, let me say that the best material for the electrotyper is that which rubs into a very fine powder of a dead-black appearance when undisturbed, but having a metallic lustre when rubbed or brushed on a surface. Coarse graphite is useless, however much it may be lauded by the vendor as being "pure as it comes from the mines." Much of this native graphite is too impure to be used for blackleading moulds.

"Coarse impure graphite may be purified by heating the powder with sulphuric acid and potassium chlorate; a compound is thus obtained which, on being strongly lated, decomposes, leaving pure graphite a bulky, finely divided powder." (Roscoe.) ectrotyper's graphite may have its con-ducting power improved by mixing with it me tin or copper-bronze powder. Mr. att gives the following recipe for improving c conductivity of plumbago. "Dissolve part of chloride of gold in 100 parts of lphuric ether; this is then to be mixed ith 50 parts of plumbago, and the mixture exposed to sunlight, being frequently irred until quite dry."

Blackleading or *Plumbagoing*.—The pro-ss of applying plumbago or graphite to oulds to render their surfaces conductors of ectricity. Small moulds of coins and edallions are blackleaded by brushing in e fine plumbago dust with a sable or mel-hair brush or pencil. Larger moulds quire larger brushes, which should always e soft; whilst those of printing electro-ypes are blackleaded by machinery, the ould being fixed to a travelling carriage nd caused to move to and fro under a ibrating brush. Every part of the mould ust be coated with the conducting aterial, and the coat must be nicely olished to produce good results. Some lectrotypists, it should be said, dispense ith the dry blackleading process and dopt Knight's wet process. By this ethod the mould is coated with a thin ash of plumbago in water squirted on to it rom a rose nozzle.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

91.—One Hundred Photographic Dodges.

This is a brechure which the publishers, Messrs. Piper & Carter, 5, Furnival Street, Holborn, offer te the public for 6d. It contains "One Hundred Photographic Dodges" collected, classified, and arranged by Mr. W. Inglis Rogers, with a number of interesting experiments with the camera, etc. The publishers assert on the wrapper that it is "the book you want," and a glance through it shows that it contains much that is useful and interesting. Here is one of the dodges—a telescope dodge, which runs thus:—"By fixing an ordinary telescope to the flange of the camera, pretty circular views may be taken of objects that would be too distant for the usual process, provided the camera is provided with a bellows that suits the focus of the telescope." Here is another—the sand dodge, a mode of vignetting, which is thus described:—"Make a shallow wooden box with a ground glass bottom (ground side downwards) with a rim below it to fit loosely over a printing frame. Having adjusted it over the frame, pour into it a quantity of fine sand, just enough to render the glass bottom opaque. Then with the finger form an oval of the required size and shape, and give the box one or two taps to equalise the sand. When required to examine the prints, lift the box off bodily. By piling up the sand on the centre of the plate, the margin may be tinted to any desired extent." The production of head on plate is thus described:—"This curious phenomenon is produced by getting the sitter to hold half a plate against his throat above his collar and covering the remainder of his body, including the hands, by hanging a black cloth in front. Then cover the face, get the sitter to hold out his right arm, as if in the act of holding something, and take another plate *without shifting the camera*. In printing, superpose, so as to get the bodiless head with plate beneath exactly over the outstretched hand." I have given in the above a fair sample of the nature of the "dodges," and I must now leave it to my readers who are also photographers to decide whether or not it seems desirable to purchase the book.

92.—Lansdell's Improved T-Squares and Set Squares.

I have received from Mr. Mark J. Lansdell, A.R.I.B.A., Architect and Surveyor, of Bedford Row House, Bedford Row, London, W.C., a specimen in the form of a set-square of his improvement in the manufacture of T-squares, set-squares, and other analogous appliances. These improvements are embodied and described in Mr. Lansdell's Specification of June 28th, 1888, No. 9442, which is now before me; they may be applied not only in the construction of the appliances already named, but to centrolineads, flat rulers, and all similar appliances and apparatus used by draughtsmen and others in setting out and drawing on cloth or paper representations of architectural, mechanical, and other objects of like character. Mr. Lansdell shows that "as at present manufactured, such appliances are made with flat sides, the whole surface of each of which, or of each part of which, as in French curves, lies in the same plane, and, consequently, rests on the paper or other material on which it is used, causing an unnecessary amount of frictional contact therewith at each movement, and soiling the same by rubbing thereover tho detached particles of pencil dust and other matter which adhere to its under surface. Such disadvantages are especially apparent in those of such appliances which are used indiscriminately with either side as the underside, as the moisture from the hands which adheres to the top side for the time being stains the same, and, when the appliance is turned over, causes particles of pencil dust and other matter to be liable to be attracted and to closely adhere thereto, and in the movement of the appliance over the paper such particles are rubbed in contact with the paper or material, and necessarily soil the same and injure any fine work thereon."

I have myself frequently experienced the detrimental effects of the continuous contact of the paper and the appliance placed upon it for the purpose of drawing or setting-out lines, throughout the entire superficial area of the latter, caused mainly by the drawing of particles of lead pencil dust over the surface of the paper when set-square, T-square, ruler, or curve has been moved, and I have also learnt that the removal of such blemishes is a very difficult matter. The great object, therefore, is to prevent contact between the opposing surfaces of paper and appliance. This, at first sight, may seem an insuperable matter, but Mr. Lansdell has been able to show us that the remedy is, after all, but a simple one, but none the less ingenious because marked with simplicity. Briefly described, his plan is to recess the sides of the instrument, be it what it may, so that a narrow strip along its edge or edges is the only part which comes into immediate contact with the material, whether cloth, paper, or cardboard, on which it is placed. Thus the contact is reduced to a minimum, and although the danger of defacement as the instrument passes over and along the surface of the material is not entirely obviated, yet it is reduced to a minimum. In the set-square sent to me as a sample, the piece of thin mahogany is barely $\frac{1}{16}$ inch in thickness, and it is edged on each side with what has the appearance of being a very thin piece of veneer about the thickness of ordinary cardboard and rather more than $\frac{1}{8}$ inch in breadth. The thickness of the mahogany itself and the edgings laid upon it on both sides is less than $\frac{1}{8}$ inch in thickness. To prevent any objection that might be raised to the effect that the substance of the mahogany being so very slight, and the edging itself extremely thin, the central part of the appliance might be brought in contact with the material on which it is placed under pressure of the hand, two small studs of the same height above the surface of the set-square as the edge itself are placed on the mahogany on each side. Of course, there are other modes of effecting the recessing, and notably that of hollowing out the surface of the appliance on both sides, leaving only the extreme edge to rest on the paper, the section of depression from edge to edge being a curved line. I am not aware that rulers and appliances made on Mr. Lansdell's principle are yet on sale; if so, I daresay he will kindly tell us where they may be had, as, doubtless, many readers of Work would wish to become possessed of them. That they are made in vulcanite I learn from Mr. Lansdell's letter to me, in which he says:—"Vulcanite set-squares of the ordinary thickness would be moulded with recessed body part, and I have had several in vulcanite distributed for a long time in different architects' offices, all of which, from letters received, appear to have given the most complete satisfaction." I cordially agree with such expressions of approval of Mr. Lansdell's invention, which I regard as being a most useful one, and this, I think, will be the opinion of all who are induced to make trial of it.

93.—"Laundry Management."

"Laundry Management" is the title of a useful and comprehensive work on the laundry, the work done in it and the appliances that are used in it, written by the editor of the *Laundry Journal*, and published by Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. It purports to be a handbook for use in public and private laundries, and includes descriptive accounts of modern machinery and the apparatus necessary for laundry work. "Laundry Management" is divided into two parts, the first of which deals *seriatim* with the operations and processes generally carried on in the best English laundries. Thus, sorting and marking linen, disinfecting by various means, including chemical agents, fumigation, hot air, and steam, and water and water softening, a subject of the utmost importance, are first treated, and the writer then proceeds to soaking and the removal of stains, washing, rinsing, wringing and drying, blueing, starching, mangling, ironing, completing this branch of his subject with instructions on washing flannels and blankets, curtain and lace cleaning and ironing, and cleaning generally with regard to textile fabrics, leather, and numerous articles that cannot be subjected to the operation of washing. This portion of the work will be found especially useful to those who are about to commence business as laundrymen, and will also show many who are already in the trade, as well as those housewives and housekeepers who desire the highest results, how to set about the business of dressing and washing linen in the best and most economical way.

The second part deals with the planning and installation of laundries, and the machinery to be used therein. Here the writer passes over in review first the laundry buildings with the arrangement of the different departments and the means of securing proper ventilation. After this, machines for washing, hand-power, automatic, and steam power, are brought under the reader's notice; then machines for rinsing and the extraction of moisture, such as wringing machines. Drying machines, box and roller mangles, and ironing machines are next considered, and the book is brought to a close with a chapter on carpet-beating, and with another on some appliances and apparatus connected with the laundry and laundry work that have not found notice in previous chapters. Books likely to prove of service to laundrymen form the subject of the last paragraph: "A Treatise on Steam Boilers," by R. Wilson, C.E.; "A Text-Book on the Steam Engine, with a Supplement on Gas Engines," by T. W. Goodeve, M.A.; "Stationary Engine Driving," by Michael Reynolds; and "The Safe Use of Steam," by an Engineer. To the value of the last brief, but comprehensive, little pamphlet, I can bear ready testimony.

The Editor.

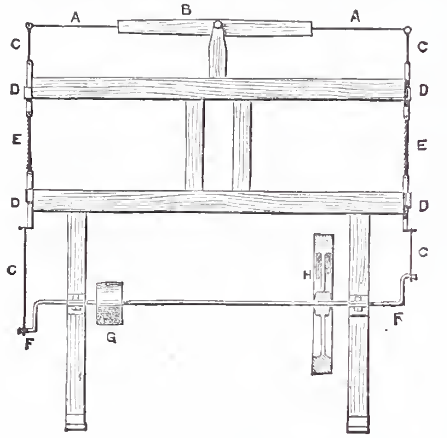
SHOP:

A Corner for Those who Want to Talk It.

, Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Double Scroll Saw.—Artist in Wood writes:—"I forward a sketch of a double scroll saw for coarse and fine work, that I think would run very steady at high speed, one saw to move up when the other is moving down; the springs are to pull



Double Scroll Saw.

A, A, Springs. B, Rocking Beam. C, C, Rods. D, D, Slides. E, E, Saws. F, F, Cranks. G, Driving Pulley. H, Balance Wheel.

the saws tight, and will not bend much when the saw is in use. The plan is a new one, and no machine has been made like it."

Ebonising Door Knobs.—E. P. W. (*Warrington*) writes:—"I notice in 'Means, Modes, and Methods,' instructions showing how to ebonise door knobs, and it has put me in mind of something that would answer the same purpose. We used to stain mouldings for picture frames to imitate rosewood when I was an apprentice. Put a good handful of logwood into a saucepan, cover it well with water, and boil it until it stains a red. Drop in a little pearlash, and dry it on a piece of wood until it gets a rich colour: then put on with a brush while hot. When it is dry put the same stuff on the fire, and add a little bichromate of potash, and you have the black. To make the dark grain get a large feather, and cut it so that it will make three or four streaks at once, and you can grain rosewood like fun. I think the same would answer for door knobs. I am waiting patiently to see articles on violin making."—[Your patience will soon be rewarded.—Ed.]

Subjects in Work.—F. M. (*Glasgow*) writes:—"I am highly pleased with your paper Work, and I anxiously wait on it every Thursday morning. I am much annoyed to see the way you are attacked by some of your readers regarding the subjects which are treated from week to week. Some of the readers appear to me to think that you should give them a paper with an article on every subject under the sun every week. The idea, I think, is preposterous. What I write this letter for is to ask you when I may expect an article on the building of small cottages, etc. I have seen several anxious inquiries about this subject, and I think it would take well. I do not wish to push you too hard, for I see every man wants to see his own trade treated first, and of course some article must stand back. An answer through the columns of your valuable paper will much oblige."—[Pray do not be annoyed at the onslaughts on editorial work and arrangements, as I can assure you they do not trouble me in the least. Once on a time there was a big burly blacksmith, whose wife—an exceedingly small woman—was afflicted with a waspish temper to such a degree, that at times, utterly ignoring her marriage vows, she would assault him with a broomstick. One day a friend asked him how it was that he permitted such a little specimen of the gentler sex to treat him in so ignominious a manner. "Well," said the good-tempered fellow, "you see, it pleases her, and it doesn't hurt me," with which answer the friend was doubtless satisfied. I hope the moral to be gathered from this storiette will be equally satisfactory to you. The papers on building will appear in due course; but I never commit myself to specific promises, lest anything unforeseen should prevent me from coming up to time.—Ed.]

II.—Questions Answered by Editor and Staff.

Photography.—Greenhorn (*Greenock*).—If by "American photos" ferrotypes are meant, it is merely the wet collodion process on ferrotype metal plates instead of on glass. Any treatise on wet collodion will give instructions. A very good shilling hand-book is published by J. Werge, Berners Street, Oxford Street, W., fully treating on positive work, and may be had of him; and there is Hepworth's "Photography for Amateurs" (1s.). In fact, any elementary book on glass positives will afford the information sought.—E. D.

Camera.—M. J. M. (*Aberdeen*).—The plan of folding and making a camera bellows will be found in Work, No. 23, page 359, as simple a form as possible, in the article on "A Whole Plate Camera." Instructions with regard to camera are also therein contained.—E. D.

Electro-gilding.—Aqua Regia (*York*).—I have never seen any gilding that will match the green gold used in some of the French work. I know how to make the gold that colour, but I doubt that gilding can produce it. As to oxidising, I used to use a solution of hydrosulphate of ammonia, but it made such an unpleasant smell, that I now send both oxidising and gilding to my gilder. However, I should use it again if necessary, and for that purpose the work, if of silver, would have to be quite clean, and if of brass, it would have to be electro-plated. The solution should be made with warm water—about one part of hydrosulphate to ten of warm water. Immerse the work until it gets the colour desired, either black, or dark brown, or bluish. Then rinse it in clean water, and dry it in boxwood dust. It will be improved by a final rub with a soft chamois leather.—H. S. G.

Glazing Fretwork Photo Frame.—J. W. L. (*Middlesborough*).—The easiest way by which you can secure glass to your oval fretwork frame is to cut an oval rim, with an opening slightly smaller than that in the frame, and glue it on to this. You will see by this arrangement that the rim forms a rebate, into which the glass will fit, and that it will require no fixing beyond the support afforded by the backing which you will naturally put in behind the photograph. The rim, of course, can be moulded instead of being left with plain edges, but from your inquiry, I judge this will be more than you can accomplish. You will, however, experience very little difficulty in rounding the edges off with any convenient cutting tool, and then smoothing down with glasspaper. The accompanying diagram,

Section of Photo Frame.

showing part of your frame with rim attached, will make everything clear to you: A, the fretwork frame; B, rim; C, glass; D, back cover. Yes, certainly, French polish can be applied to Canadian oak, though oiling or waxing will be easier.—D. A.

Polishing Gunstock, Pear-tree Wood, Gasoline, and Marks on Carpet.—J. McW. Iernus (*Tarbert*).—If your gun is a common one, varnish may have been used, but oil polishing will be preferable if it is a good one. All you have to do is to rub some raw linseed oil into the wood, which, however, must not be saturated. A little oil and much dry friction produce the best results. The more you rub the better the polish will be. Pear-tree wood is suitable for any of the purposes you name, and for furniture generally. It is an admirable material for carving. I am sorry I cannot help you about "gasoline," as, not knowing what it is, I am unable to tell you where it can be got. I may be familiar with it, but under some other name. The "silvery marks" you ask about can only be formed by snails or slugs; at least, none of the carpets I have ever seen have been subject to silvery marks in the morning unless they had been gone over by snails, etc. As you say it could not possibly be these in your case, I am afraid you must endeavour to find some unique cause with which I am not acquainted.—D. A.

Sundial.—Joe Spivens.—A paper or two on the construction of the sundial shall be given as soon as room can be found for them.

Soldering as treated in Work.—D. C. B. (*Reading*).—It is a matter of satisfaction to all who are concerned in the production of Work to find that the papers that appear in it are generally liked and valued by those for whom they are written. With respect to Mr. R. Alexander's paper on "Soldering," which appeared in No. 17, page 257, you write:—"I am glad to say that the first of the articles on tin work has quite come up to, in fact has gone beyond, my expectations. I must say that the article is clearly and explicitly written, so that no one can fail to thoroughly understand how to proceed in this branch of work." I hope, with yourself, that Work will supply the lack of a Technical Institute in many places, or, what is better, pave the way to the establishment of technical institutes. I am obliged to you for your efforts to increase the circulation of Work by introducing it to your friends.

Taxidermy.—E. R. (*Swansea*).—The art of stuffing and mounting birds and animals generally, and the preparation of the skins, will be taken in hand eventually, but it is not possible to commence them yet a while.

Metal Engraving.—R. E. B. (*South Petherton*)—Some excellent papers, well and efficiently illustrated, on this subject are in the hands of the printer and engraver, and will be commenced shortly.

Circular Saw.—Circular Saw (*Clapton*) has a saw 16 in. diameter driven by a 5 ft. 6 in. driving wheel, the proportions of the driving wheel and saw pulley being ten to one; and being turned by hand, it is both hard and slow work. Here double gear must be used to get up speed. A circular saw should properly be speeded to run at about 6,000 feet per minute at the periphery. Your saw being 16 in. in diameter, its circumference is $50\frac{1}{4}$ inches, or, say, approximately 4·16 feet in circumference. Then $\frac{6000}{4 \cdot 16} = 1442$ revolutions of saw per minute. The driving pulley is 5 ft. 6 in. diameter, and the saw pulley, in the proportion of ten to one, is 6·6 in. Say you leave this 5 ft. 6 in. pulley, as at present, on the first motion shaft, and drive thence to a pulley on an intermediate spindle, and on this same spindle drive from another pulley to the saw. Then assume that you turn your 5 ft. 6 in. pulley at 40 revolutions a minute, and speed your intermediate shaft at five times $40 = 200$ revolutions. Then $\frac{66 \text{ in.} \times 40}{200} = 13{\cdot}2$ in.; that is a pulley $13\frac{1}{4}$ in. diameter should go on the intermediate shaft. Then $\frac{1442 \times 6{\cdot}6 \text{ in.}}{200} = 47\frac{1}{2}$ in., the proper diameter of the pulley driving from the intermediate shaft to the saw. So that you will have your first motion pulley turning at 40 revolutions per minute, driving on to a $13\frac{1}{4}$ in. pulley, and on the same shaft as the latter, a $47\frac{1}{4}$ in. pulley driving on to the $6\frac{5}{8}$ in. pulley on the saw spindle, so running at 1,442 revolutions per minute, or 6,000 feet peripheral speed. Though I give 6,000 feet per minute, some saws run at less, others at greater speed, and you can modify your sizes of pulleys if you so desire. If you have the pulleys too close together, the belts will slip with heavy cutting, so put them as far apart as you conveniently can. If your space is contracted, then a good device is to cover the pulleys with leather to increase the bite of the belts. —J.

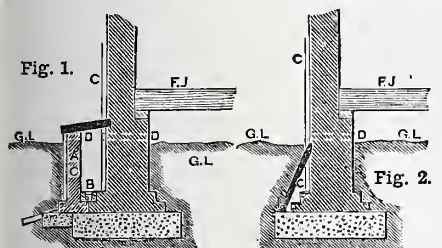
Medical Coil.—Bernhard writes:—"I thank G. E. B. for his reply to my query, battery for medical coil, in Work, June 22nd. I have tried the coil with plates exposed to solution, $3\frac{1}{2} \times 2\frac{1}{2}$, and the carbon full $\frac{3}{8}$ in. from the zinc. Every section works well, giving powerful currents. The contact breaker works well—very brisk; but I wish to know if the positive electrode must be smaller than the negative."—In a small pamphlet I have on the subject, directions are given for the treatment of over fifty diseases, but no mention is made of any required difference in size between the two electrodes, except where necessary for the application of the current to particular parts of the body, as, for instance, to the inside of the mouth. This pamphlet I had with a magneto-electric machine some years since, but it lacks the name of author and publisher. Some of the information is unfit for publication in Work. Perhaps some of our readers can oblige Bernhard with the title and price of a book giving full directions for the treatment of diseases by means of a medical coil.—G. E. B.

Newspaper Rack.—T. A. C. (*Maidstone*).—Unless you are familiar with the work, it is impossible in the limited space of "Shop" to give you sufficient directions to enable you to make newspaper racks. Papers on cane (bamboo) work are in hand, and among the articles will be a newspaper rack which will probably be of use to you. Owing to the pressure of more important subjects, it is, however, impossible for much attention to be devoted to this one at present. Rest assured, though, that in due course full particulars will appear. Meanwhile, if you like to send a rough sketch of the thing you contemplate making, we will see what assistance can be given you in these columns. —D. A.

Pearl for Inlaying.—W. C. M. (*Barrow-in-Furness*).—Messrs. McCallum & Hodson, Summer Row, Birmingham, prepare pearl of the various sorts for inlaying papier-mâché. The same pearl is, we imagine, what W. C. M. requires for his glass work.—S. W.

Bedroom Suite.—J. C. B. (*London*).—For size of 4 ft. 6 in. bedroom suite, those I have given here will be found as convenient and useful as any. I do not say that they are the exact dimensions to which makers in the trade generally work, as they have to economise their wood, in a great many instances, for certain reasons. The extreme outside measurements of the wardrobe would be: height, 6 ft. 6 in.; width on the front of the plinth, 4 ft. 6 in.; width on the side of the plinth, 20 in. The toilet table should be 29 in. from the floor to the top, 4 ft. wide, and 20 in. from back to front, the jewel boxes 13 in. wide along the top, 10 in. at the side, and $5\frac{1}{2}$ in. high. The glass frame ought to be 24 in. by 20 in. without the top moulding. The top of the table should overlap the framing by $\frac{3}{4}$ in. all round. As the legs are turned out of $2\frac{1}{2}$ in. stuff, this will bring the drawer to $20\frac{1}{2}$ in. by 5 in., divided by $\frac{1}{2}$ in. partition. The total depth from the table top to the bottom of the under framing should be 7 in. The jewel drawers will each be 11 in. by 4 in. The sizes of the pedestal pot-cupboard are: height from floor to top, 25 in.; width along the front of plinth, 14 in.; along the sides of the plinth, 12 in. The washstand will be made according to the table measurements. Th ack, if one row of 6 in. tiles is used, should be 47 in. ide and 9 in. high; for every other row of tiles, in-ease 6 in. Chair and towel-rail it is unnecessary give sizes of, as I do not suppose that J. C. B. or ny one else would wish to make them, as they can e bought at very reasonable prices; and, moreover, man may be able to make a firm solid job with oards, but it requires a different kind of skill to make chairs and towel-rails to preserve their en-irety for any length of time without "squeaking." -J. S.

Dry Area.—E. T. (*Blackheath*).—The two sections nnexed give the details of dry areas. You will at nce see that there is a certain amount of work to e done underground. In any case, it is necessary o dig out the ground until you expose the footings nd concrete foundations (it is assumed that they xist). In section in Fig. 1 you will notice a retaining wall, A, of sufficient strength to keep back the ground, built on a concrete foundation, which may e from 6 in. to 14 in. (or more if you have room) rom external wall of house, and covered at the top with stone slabs built into existing wall, one or two of which should be left loose for the purpose of examination from time to time. The floor of area hus formed should be covered with cement con-crete, and a gully, B, let into same at the lowest level, and connected with drain pipes carried through retaining wall, A, into loose earth beyond, to carry off any moisture that might accumulate. Both the walls on the faces marked C should be



Details of Dry Areas—F.J., Floor Joist; G.L., Ground Line.

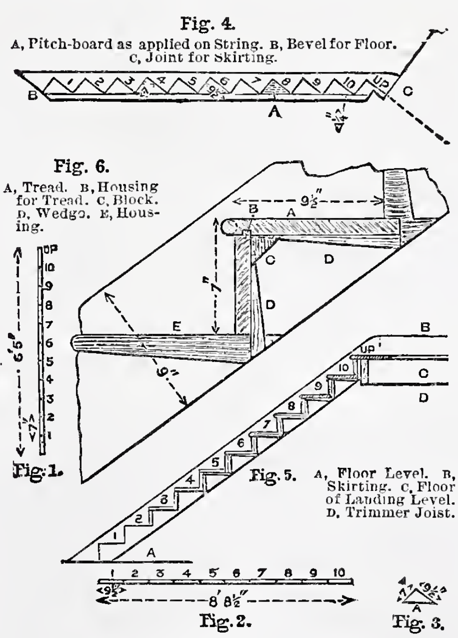
rendered with cement, or, better still, with asphalte. At the point marked D insert air bricks here and there along the length of walls for ventilation. The area could be left open at the top, but that would necessitate more care being given to clearing out same. As to the drainage at B, section in Fig. 2 shows a method sometimes adopted, which is simply slabs of stone leant against the building and the earth filled in, but the former method is recommended, unless you are confined for room. If cheapness is a considera-tion, after digging out the ground, the external face of existing wall may be left with the face, C, ren-dered as described for section in Fig. 1, or covered with slates or damp proof felt nailed to wall and the ground filled in. Whichever plan you adopt, I should at least carry it round the corner of dining-room, for I have frequently noticed that moisture travels by capillary attraction some distance along a wall before showing itself inside. And on no account disturb the slate damp proof course which you notice, for although it is a method open to a great many objections, I have no doubt but that it was originally put there with the best intentions.—E. D.

Paper Replicas and Picture-Frame Compo, etc.—A. E. (*Liverpool*).—For a reply to the first part of your letter I must refer you to the answer given to a similar inquiry by G. M. in No. 13, page 206. With regard to your other questions, I do not quite under-stand whether you require a receipt for making the picture-frame "compo" or not. However, I give the best I know of:—Melt 7 lbs. of best glue in 3 pints of water; melt 3 lbs. of resin in 3 pints of linseed oil. While hot, mix all together and boil for half an hour, being careful to avoid boiling over. Then mix in gradually finest whiting until of the con-sistency of dough; knead well, and press into moulds while hot. If the lump of "compo" be-comes cold and therefore hard, it must be well beated before a hot fire, or in an oven, etc., when it will become workable. The moulds used are gener-ally of boxwood, and the making of them affords scope for any amount of skill in carving, their nega-tive character rendering them rather difficult.—Opifex.

Bell Telephone.—Iernus (*Tarbert*).—Any kind of hard-grained wood will do for the body of a bell telephone; mahogany is commonly used. I made mine with this wood, and I find that after years of use they are still perfect. The magnets should be almost the entire length of the case or body. If you make your case 6 in. long, which is about the usual size, make the magnets 5¾ in. long by ⅜ in. diameter. The diaphragm and coils will depend upon the dimensions of the case for their size also. Assum-ing the case to be the size mentioned above, let the diaphragm be made 2⅜ in. in diameter. Make the space in the case to hold the coil 2⅜ in. by ¼ in.; then the coil bobbin should be 1½ in. by ¾ in. On the bobbins wind ½ oz. of No. 36 silk-covered copper wire; I cannot give you the quantity in yards, as this fine wire is always weighed instead of mea-sured by the yard. There should be no difficulty in getting the materials. I do not know the address of any firm in Ireland where you could get them; but if you write to Messrs. King, Mendham, & Co., manufacturing electricians, Narrow Wine Street, Bristol, I am sure you will be able to get all you want. But I thought you were going to make your telephones. You can do this nicely if you have a turning lathe; all you will require to buy ready made is the wire for the coils. If you want further details, write again.—W. D.

Pattern-Making Book.—Tom Smith.—Has-luck's "Pattern Maker's Handy-book" (2s.), Sta-tioners' Hall Court, London, may answer your purpose. Your other questions will be answered in due course.—F. J. C.

Flight of Stairs.—A Reader of Work (*Ac-crington*).—As you do not mention what kind of stairs you want, or give any particulars as to position, size, etc., I take it that you mean a plain straight flight of stairs, so I have purposely omitted any mention of newels, winders, etc. First, take the distance from floor to floor, and cut off a rod to this length; then divide it into as many equal parts as near 7 in. as possible (Fig. 1); this is called the height rod. You will notice I give the height at 6 ft. 5 in., which gives you eleven steps, or, practi-cally speaking, ten and up. Now determine how far you can allow the stairs to spread out, and divide this into ten equal parts, each part being as near 9½ in. as possible (Fig. 2). I have taken this at 8 ft. 8½ in. Of course I only take the height at 6 ft. 5 in., and the length or going at 8 ft. 8½ in., for the purpose of simplifying the explanation. But the 7 in. rise is about the general height for this class of stair. There are several ways of determining why the going should be about 9½ in. if the rise is 7 in., but it is quite unnecessary to go into this now. Now take a piece of any hard wood about ⅜ in. thick, and shoot one side and one end perfectly square and true, just as if you were going to make a plain set square, and on one side set off the going, which we have determined shall be 9½ in., and on the other 7 in., which is the rise. Connect these two as Fig. 3, and this will give what is called the pitch-board. Great care should be taken in making this, for the pitch-board is the principal, or, I might say, the secret of staircase making; for, unless it is perfectly square and true, the tread of your stairs will not be level when you get them into position, if you get them into position at all. The staircase I am describing is called a housed string stair, so called because the treads and risers are housed or grooved into the strings. I need hardly say that the strings are the pieces which reach from floor to floor, and into which the treads and risers are housed; the one next the wall is called the wall string, and the other the outer string. The next step is to plane up a piece of 1½ ft. 9 in., about 13 ft. long on one side, perfectly straight and out of winding, and gauge it to a width as wide as it will go for the wall string. Then draw a line along the entire length 1½ in. from one edge, place the longest side of the pitch-board (marked A in Fig. 3) on this line, and starting about 9 in. from the left-hand end, mark off as many triangles or steps as you require (Fig. 4). You will notice that you will want ten and one extra (or what is called up), the riser of step 11 or up giving the line of joint between top of wall string and the skirting on floor or landing above, and the line of going or tread giving the bevel of floor below. The same bevels give the notching out of string to fit over



Construction of Flight of Stairs.

trimming joist (Fig. 5), which string is now ready for marking and cutting the housings. If you look at Fig. 5, which shows the string in position, you will see that steps 1 and 2 are simply marked as in Fig. 4; but steps 3 and 4 have the thick-ness of treads and risers marked on. The treads and risers in this case may be out of 1 in. stuff, which will be about ⅞ in. finished. The next two steps (5 and 6) have the wedging shown, Nos. 7 and 8 show the complete housing with nosings bored out, and 9 and 10 show the treads and risers in place and wedged. Fig. 6 is ¼ full size section, showing more plainly how the stairs are put together, and with the size of wedges, etc., marked. After marking the string as in Fig. 4, set off below the line of treads and behind the line of risers ⅞ in. the thickness of same, then slide the pitch-board along the line before mentioned, and draw this thickness parallel to the existing face line of treads and risers. Now allow for wedging, and this will give the exact size or width of housings, which should be ½ in. deep. Cut out the housings for the treads within ½ in. of the face line of risers, as shown at B, Fig. 6, then bore with a ⅞ centre bit a hole the same depth as housing, and this will give a sharp curve for the nosings to fit up to, which would have been destroyed by the saw if done before the rest was cut out. Now follow with the housing for the risers, taking care that the front of the saw does not knock against top edge of tread housing, which would look very unworkmanlike when your stairs were finished. The outer string should be now planed on both sides and treated in the same manner, care being taken that it is marked so that it will pair with the wall string, and they will now be ready for the steps. Now prepare your treads and risers as shown in section Fig. 6, cutting them to the exact length you require the width of stairs to be, allowing for thickness of strings after deducting depth of housings. You will notice that the treads are wider by the thick-ness of risers and projection of nosings than the 9½ in. going, and the risers are less the thickness of treads plus the tongue, which is fitted into treads. One tread and one riser should now be glued together as shown (Fig. 6) and blocked, keeping the blocks 1½ in. away from ends, to allow for going into housings, and for points of wedges in fixing to strings. When the ten steps are glued up and dry, the nosings should be worked. It is better to leave this till now, because there is less likelihood of the round edges getting damaged, and you are sure of not making the mistake of rounding the nosings before you have ploughed for the risers. If you now lay the wall string on the bench or floor, and place the steps in the housings, and lay the outer string on top, taking care that the steps fit, and strut the whole together from the ceiling, or in any other convenient manner, you will at once see if you are all right, and all that remains is to wedge the tread of one step and the riser of the next, working upwards and cutting off the projecting end of wedge of riser or step, as the case may be, and so on to the end. Screw the back edges of treads up to risers, using plenty of glue with the wedging, and you will be all ready for fixing when the whole is dry. The strings might with advantage be 11 in. wide instead of 9 in. if strength is required, and in that case the line on which you set the pitch-board should be about 2 in. from the edge.—E. D.

Sal-Ammoniac.—S. J. (*Birmingham*).—Your query is rather vague. You ask, What is the sal-ammoniac that tinners use to get the bright flush on their work, such as saucepan handles? and so on. Well, there is but one kind of sal-ammoniac that I know of; that is the ordinary sal-ammoniac or chloride of ammonium of commerce, the same as is used for electric bell. The articles to be tinned are pickled in a bath of hot acid till sufficiently clean, then run through killed spirits, in which a lump or so of sal-ammoniac has been dissolved, and then into the tin bath, which is kept well supplied with sal-ammoniac. When thoroughly tinned they are lifted out, and the superfluous tin shook off or wiped with tow, according to the necessities of the case, and cleaned in sawdust. Copper moulds are, of course, not done in a bath. The tin is poured on to them, swilled round and out again till properly tinned, then drained, cleaned, and polished. I should think that in your town you would have no trouble in getting practical illustrations of what you want to know.—R. A.

Bookcase.—Frisby.—Your sketch, though rough, is quite sufficient for the purpose, as it shows better than words alone could do what your idea is. I pre-sume you intend it to stand in a recess, in which case the 1½ in. you have allowed is ample—too much, in fact, if you want to make a close fit. You, how-ever, give the dimensions on the bottom where it is to stand on the cabinet on which you intend to place it; and in setting out the width you must take into account the skirting board, if any, which runs round the walls. I am also not clear whether you intend to put a cornice or moulding on the top, and, of course, if you do you must allow for this. As re-gards thickness of wood, 1¼ in. stuff ought to be sufficient for ends and shelves, while a little less may be used if preferred for the other parts; pine will do very well. Your best plan will be to make the two drawer boxes separate from the upper part or case, which should be complete in itself. Fasten this to the drawer boxes by screws, as may easily be done by removing one of the drawers for the purpose. Fasten all tops and bottoms to ends by means of the ordinary lap dovetail, unless you prefer to adopt the simpler method of nailing the parts together, as suggested in the articles on "Artistic Furniture." A perusal of these will, no doubt, be of assistance to you, not only so far as construction is concerned, but by indicating how you may improve the appearance of your bookcase.

I may also say that an article or two will shortly be devoted to the construction of a bookcase as one of the pieces of easily made artistic furniture; and, unless you are in a hurry, it may be advisable for you to wait till they appear. Unless I am very much mistaken, you will find all the points on which you may now be in doubt thoroughly elucidated. The pieces between the drawers—the bearers—may either be nailed or grooved into the ends. Read the remarks about drawers in the articles on the bureau which have appeared in these pages. No, the back need not be panelled, though, of course, this is the best form of construction. For such a piece of furniture as yours I should, however, advise you to use a munted back, or even match boarding. We shall be happy to help you on any other point you may require advice about.—D. A.

Prospects for Young Workman.—CABINET MAKER.—Yes, I can certainly tell you of one publication of special advantage to young cabinet makers, and I know many experienced hands who take it regularly with benefit to themselves. Its name is WORK, and though, as you are aware, it does not confine itself solely to the cabinet-making craft, I do not think you will find the same amount of useful information, both of a theoretical and practical kind, elsewhere. With regard to other books, much must depend on whether you want to be thoroughly well read on all that pertains to your trade, or are content with having a good general knowledge of the joinery part of it. In connection with the former intention, you will find no book treating of decoration or applied art beneath your notice. Read everything you can get hold of in which woodwork is referred to, and a good many where it is not will be of service, for example, Ruskin's "Stones of Venice," "Seven Lamps of Architecture," etc. Pay special attention to works, both historical and practical, treating of carving, turning, marquetry cutting, polishing, and similar correlated trades. The works of Chippendale, Heppelwhite, Sheraton, and other noted cabinet makers of the last century, will be of use to you. Books on architectural matters sometimes contain hints, though in knowledge of the practical details of cabinet making you will often, if not generally, find architects very deficient. For a general insight into the principles of "art" furniture, I cannot do better than recommend Eastlake's "Hints on Household Taste." There are also the two trade papers—*The Cabinet Maker* and *The Furniture Gazette*. As there is nothing in your inquiry to indicate where you live, I am unable to say whether the information that you will find all the books named, and dozens of others equally useful, in the South Kensington Museum Library. You need never expect to master the whole subject, but you may vastly improve your knowledge by attention to the foregoing hints. I have been studying the literature of furniture for the last twenty-five years, and though I may, in consequence, know a little more than would otherwise have been the case, the subject widens yearly, monthly, daily. There is always something more to learn, so if you want to be a thorough student of furniture you see what you have before you. Your other questions are somewhat difficult to answer definitely, as so much depends on your personal ability, habits, and other circumstances of which I am ignorant, and which you yourself cannot foresee. With exceptional skill and business ability, you may, of course, greatly improve your position, but assuming you are a good average worker, steady, and obliging, I think it may fairly be said that the prospects are as good as in any other trade. If you remain at the bench, you may take it that the wages will be from 27s. to 40s. 6d. per week; at least, that is what they now range from under "Society" rules, and, of course, they may alter. They are, however, not likely to go lower. The rates vary according to the locality. Thus in London 40s. 6d. is now the figure, 27s. being for districts where expenses of living are less, so that, taking all things into consideration, it is a question whether the cabinet maker earning 27s., say, in the Isle of Man is not as well off as the cockney with his 40s. Perhaps the average rate may be given as about 34s. One great advantage a good workman has over others is that he is more likely to be constantly employed. No; on the whole I don't think it can be said that one branch pays better than another. A good deal depends on fashion. For example, when "turned spindles" were all the rage, the turners to the trade had a good time. Later on fret and marquetry cutters had their innings, but things all round soon get equalised. Ability to turn your hand to anything connected with the trade, such as the above arts, carving, polishing, upholstery, would make you more valuable, especially in country towns, but you must distinctly understand that you cannot hope to become so proficient in more than one branch as to compete successfully in large towns with those who have made it their speciality. As "fitter" you might command increased wages, but only experienced and thoroughly reliable men are able to fulfil the duties, so you must wait some years. The same may be said of foremanship. A knowledge of drawing will be of service, if not of actual necessity, to you. You should be able to make and understand a working drawing, and if you can also manage a small sketch so much the better. Of course you stand a chance of getting into a good firm. Why not? It depends principally on yourself. Without having the slightest idea where you are serving your time, what work you have been at, or anything else about you, how can I possibly say what wages you would have at first starting? I have known lads who, as improvers, have been well worth within a very few shillings of men's wages. These, however, are the exceptions. Others, perhaps the majority, are certainly not worth 20s. per week, while many of them would be dear at half that amount in a good general furniture factory. It really is a pity you have not given more particulars, as I might have helped you more. As it is, I have written at length in order to assist you, though I have done so a good deal in the dark, as you give so few of the necessary particulars. These are not wanted from motives of curiosity, as so many inquirers seem to think, if one may judge from the remarkable reticence displayed, but are positively necessary in most instances, if helpful answers are to be given. If the Editor and members of the staff are willing to give their best services, and take time and trouble in helping inquirers, surely these might respond by being a little more explicit than is sometimes the case. Speaking for myself, it is really mortifying not to be able to advise readers who inquire in "Shop" simply because, like you, the questions, though requiring a personal answer, are made in the most general terms.—D. A.

Quick Drying of Photo Negatives.—W. L. D. (*Louisville, U.S.A.*).—Yes, benzine may be used instead of methylated spirit, but I do not like it so much. For one thing, the smell is objectionable. As you say, however, it is inexpensive, and does not injure the negative, so that it may be convenient as an alternative. For the same reason ether may be mentioned as effectual for the purpose. Your other suggestion of placing the negative in the receiver of an air-pump, and then exhausting the air, seems a roundabout way of doing what is wanted, and not nearly so simple as drying with spirit. I have not tried your second plan, so cannot offer any further opinion about it. Glad, nevertheless, to receive your hints, which may be of use, and would have been attended to before but for the fact of your being at one side of the "ferry" and I at the other.—L. I. P.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Machine for Current of Air.—YOUNG ENGINEER (*Newcastle-on-Tyne*) writes in reply to BELLOWS (see page 190):—"I think a small fan would give a powerful and steady current of air. I enclose you a sketch illustrating my idea. BELLOWS

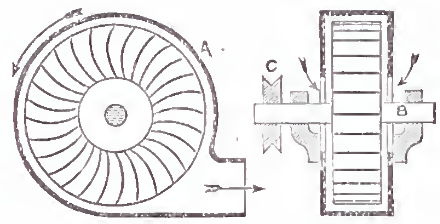


Fig. 1. Fig. 2.

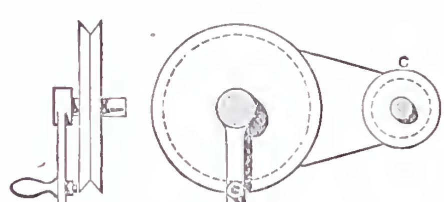


Fig 3.

Fig. 4.

Figs. 1 and 2 show Section of Fan or Blower—A being a Sheet Iron Casing; B, Spindle on which the Wings revolve; C, Small Driving Wheel on Spindle. Fig. 3 shows Speed Arrangement. Fig. 4 shows method of attaching Wings to Plate—E being Wing; D, a small Angle Iron.

could make one if he is a professional, or even a good amateur, or any smith would make him one, at a small cost. Should BELLOWS want more particulars, I should be glad to give him any assistance I can."

Repairing Ivory Stick.—B. A. B. (*Hampstead*) writes in reply to W. A. (*Hanley*) (see page 270):—"You had better try to mend your ivory stick with Marshall's Giant Cement, or Kay's Coaguline. There is also a new fish glue, of which good reports are abroad."

PRIZE COMPETITION.

THE Editor of WORK has the pleasure of informing his readers that the Examiners of the Drawings sent in by One Hundred and Fifty-two Competitors for the Prizes offered by MESSRS. CASSELL & COMPANY, LIMITED, for the Three Best Designs for a small Bookcase to contain 208 volumes of

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Mr. ROBERT BELLAMY, 48, Albert Street, Barnsbury Road, Islington, London, N.;

and the Third Prize of *Half a Guinea* to

Mr. S. J. SPELLER, Bay Cottage, Broadway, Frome, Somerset.

The Drawing sent in by Mr. J. H. WOOLFITT 4, Crooke Road, Lower Road, Deptford, is highly commended.

*** The Designs by the successful Competitors will shortly appear in WORK, and each Design will be accompanied by a brief paper explaining its construction, with hints and suggestions with regard to materials, finish, &c. Many of the drawings submitted gave evidence of originality of conception ability of expression, and considerable skill and proficiency in drawing in those who executed them, and the Editor of WORK sincerely hopes that disappointment in the present instance will tend to stimulate those who have failed to fresh efforts in the future, which, through perseverance and steadiness of purpose, will not fail to produce the ever welcome fruits of success. Indeed, the Editor regrets that there were not more prizes at his disposal, as a great number of drawings, though not so good as the successful designs, were well worthy of pecuniary reward.

WORK

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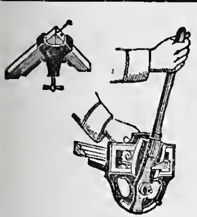

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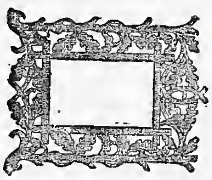

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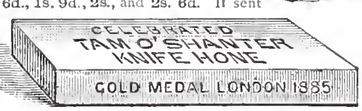

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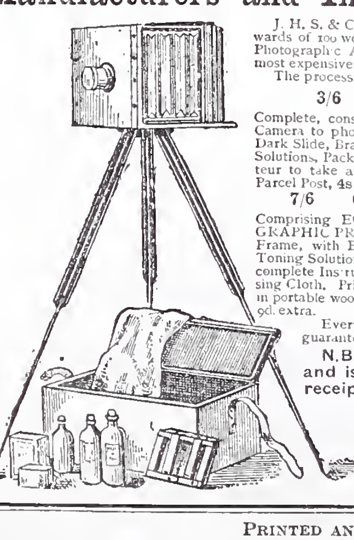

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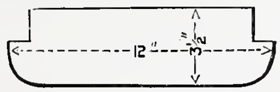

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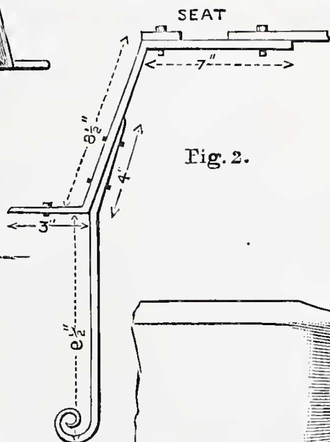

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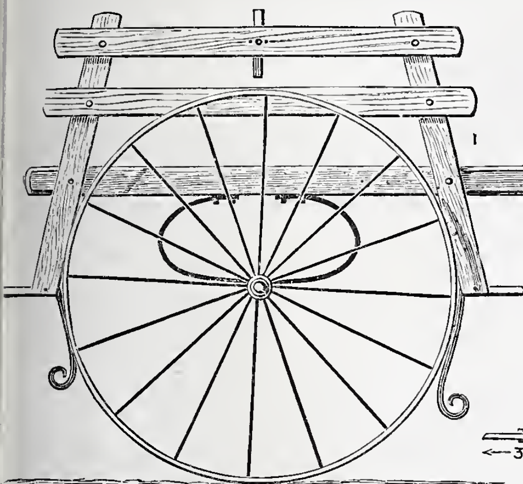

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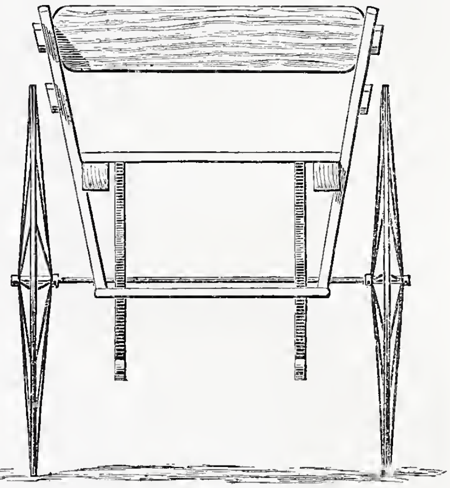

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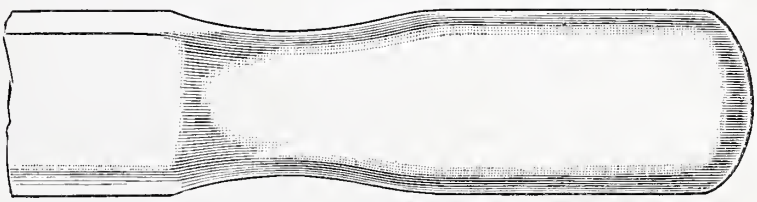

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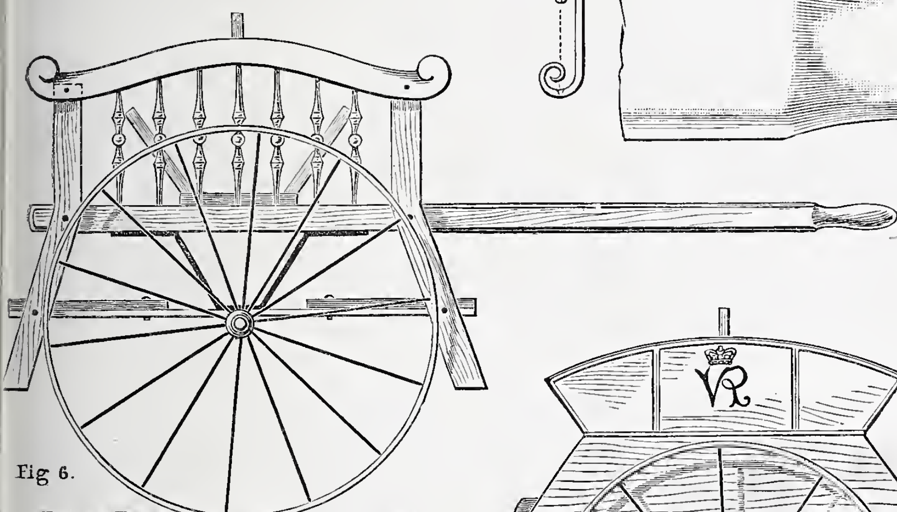

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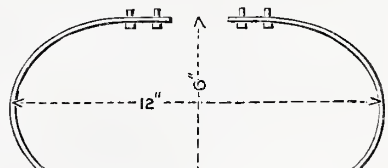

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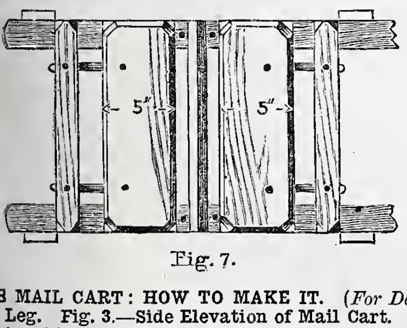

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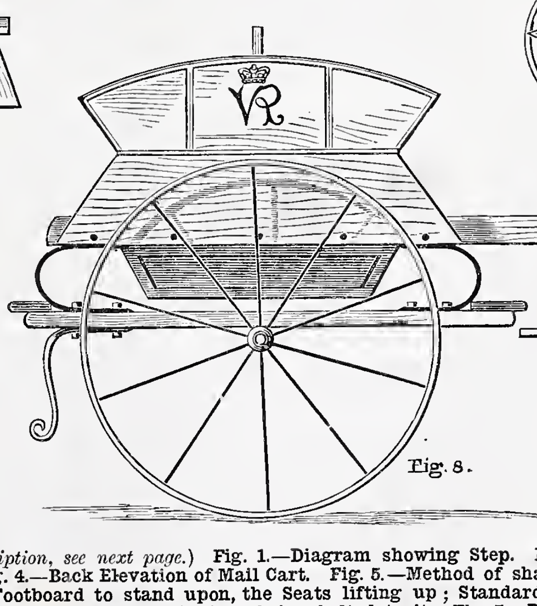

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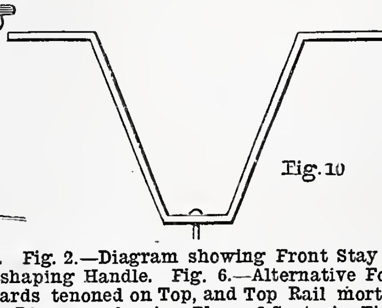


Fig. 10

THE MAIL CART: HOW TO MAKE IT. (*For Description, see next page.*) **Fig. 1.—Diagram showing Step. Fig. 2.—Diagram showing Front Stay and Leg. Fig. 3.—Side Elevation of Mail Cart. Fig. 4.—Back Elevation of Mail Cart. Fig. 5.—Method of shaping Handle. Fig. 6.—Alternative Form, in which Standards and Legs are Combined; Footboard to stand upon, the Seats lifting up; Standards tenoned on Top, and Top Rail mortised on; Piece of Oak 1 inch square fits upon Axle, Footboards and Springs being bolted to it. Fig. 7.—Diagram showing Plan of Seats in Fig. 3. Fig. 8.—Royal Mail with Box: Seat to act as Lid, Side all in one Piece, 12 inches high. Fig. 9.—Oval Spring for Fig. 3. Fig. 10.—Alternative Form of Spring.**

THE MAIL CART.

HOW TO BUILD IT AND FINISH IT.

BY W. P.

THE mail cart (Figs. 3 and 4) which I am about to describe is so simple of construction that any of my readers could make and put one together in an incredible short time. I have been asked which is the better for wear, wood or the rubber tyre wheels? Well, my experience of wheels is that a wood wheel will last fully three times as long as a rubber tyre wheel will. A wooden wheel after it has been in use a couple of years the hoop will become slack, so that the hoop will have to be made smaller by shrinking it up and rehooping the wheel with it again, the wheels afterwards lasting for a dozen years or more. The spider wheels last a long time, and wear very well if used carefully. The rims of these wheels are without the rubber, and are made stronger than the ordinary rubber tyre wheel. The rims are of two different shapes; one is quite round, whilst the other is flat at the outside, or nearly so. The rubber tyre wheel is at present a general favourite, and has superseded all other wheels, both for bassinettes, mail carts, etc. On account of the rubber it runs along easy and noiselessly, and looks light and elegant in appearance. With a continuous pressure upon the rubber it causes it to flatten out, gets cut up with sharp stones, etc., and is a continuous source of trouble after it has once been "started." Some object to wooden wheels because they look heavy and make a grating noise when wheeled on the flags. A list of the wheels and the prices will be found below.

Wood wheels, a pair 22 or 24 inches high, from 4s. to 4s. 6d.
Spider wheels without rubber, springs, and axle, from 7s. to 7s. 6d.
Rubber tyre wheels a pair, with axle only, from 5s. 6d. to 6s. 6d.

In almost every town will be found tradesmen from whom the reader can buy his requirements, but the above-named articles he may purchase at any cyclist's shop, or any place where bassinettes are made or sold, or at any large toy dealer's. The size of the wheel which I am describing is 24 in. high, or the largest size they make for mail carts. The axle is ½ in. square, and measuring across from cap to cap of the wheels will be 22½ in.

We will now consider the kind of wood we are to make our cart of. In the ordinary cheap mail cart it is of stained deal, whilst the better sort are of pitch pine or ash; either of these two will do, but I prefer ash. We can either buy the wood in a piece and saw it into required lengths, or buy it ready for working. Ash is sold at threepence per foot of 1 in. thick, 2 in. thick sixpence, 3 in. thick ninepence per foot, etc., or threepence for every additional inch per foot. Ash can be bought off any English timber dealer, coach builder, or wheelwright. The measurements enumerated below are as they will be when sawn, planed, and finished off, so therefore allow for sawing and planing.

1 Pair of Shafts	52½	in. long,	2	in. wide	1¼	in. thick.
4 Standards	18	,,	1¾	,,	¾	,,
2 Bottom Side Rails	24	,,	1½	,,	¾	,,
2 Top Side Rails	22¼	,,	1½	,,	¾	,,
Board for the Seat	13	,,	14¾	,,	½	,,
2 Steps or Footboards	12	,,	3½	,,	¾	,,
Back Rest	16¾	,,	3½	,,	½	,,

In planing the pieces always get two sides of the piece true to work from. Mark with pencil to show which is the true side, as one must be at the top and the other at the outside. When finished planing, we round the ends of the shafts a little, also the ends of the rails, and at one end of the standards only, which is to be at the top. We now dress the handles off on the shafts, measure 6 in. from the end of the shaft, draw with the pencil, and dress the handle off same as Fig. 5. Do not dress too much out with your spokeshave, but file it a little. The sides of the handles are left square, the average only taken off and slightly rounded.

If possible a large drawing, full size, should be made upon a blackboard, wall, or floor in chalk, or with a crayon if on a white wall; by placing our work upon the drawing it would enable us to work quicker. We lay the shaft upon the bench or floor with the true side towards us. Place the standards in their right position slanting towards each other at the top. The measurement from the top of the shaft to the top of the standard is 10 in.; measuring from across the top of the standards from the ends it will be 21 in., and at the bottom 28½ in.; measuring from underneath the shaft to the end of the standard it will be 8½ in. Get your pencil or steel scriber and mark each side of the standards on the shaft, press the standard down to keep it from shifting, and mark the standards from the sides of the shaft; when marked, number the standards, and the places marked on the shafts to correspond.

Get your shaft and square across the underneath side from the lines we marked where the standard was. Next set your gauge ¼ of an inch, and mark from the true side just across where we have squared it; this marking is only done at the bottom side of the shaft, recollect, as the top end is not touched at all. When all four have been marked we get our tenon saw, and saw within the lines, and down to the gauge mark; pare this out with your paring chisel, beginning at the gauge line, and slanting up to a feather edge at the top.

We now fix a standard into this rebate. Fix all the standards on the shafts; measure from the top of the standard to the top of the shafts to be certain that it is 10 in. before boring a ¼ in. hole through the centre of the standard and shaft. Fasten together with a cup-head bolt 2½ in. by ¼ in. thick, let the bolt head be at the outside of the standard, and be sure to put an iron washer under the nut when screwing up.

When all the standards are fixed, we next fasten our side rails upon the outside of the standards. Get your short rail and place it an inch from the top; let the ends of the rails stand over the end of the standards. Screw this rail to the standards with a couple of stout screws 1¼ in. long, the head countersunk level with the rail; the screws can be either brass or the common sort, the points being dipped in oil before screwing up.

Next get the other rail and place it under the other, leaving a space between of 2¾ in.; screw this rail upon the standards, and when both the sides are finished like this we commence to fix our springs under the shafts. As there is such a variety of springs, I think it best to keep to the simplest in design and make. The oval-shaped one (Fig. 9) as seen on the cart is made of 1 in. spring steel, ¼ in. thick, and measures across the inside 12 in.; from the axle to the shaft 6½ in.; the other spring (Fig. 10), though a different pattern, will be the same in length and height as the above mentioned.

If we are to have our mail cart to run true we must be particular in fixing our axle on right. If you notice on the spring which fits the axle you will see a bolt hole. Now this hole must be in the centre between the standards. When we have got it so, get your lead pencil and mark the holes which are in the springs on to the shaft, bore through the shaft with ¼ in. bit, and put 4 bolts 2½ in. by ¼ in. thick, screwing the nuts up underneath the top of the springs. Now measure from the bolt hole to the end of the shaft to enable you to set the other spring right. When the other spring is fixed, we fix the axle upon the springs, place a leather washer between the spring and axle, and put a cheese-head bolt through 1¼ in. by ¼ in. thick, and rivet the bolt end, holding a heavy hammer on the bolt head whilst you rivet the end to keep the nut tight.

We are now ready for fixing our seat. We saw this piece 13 in. by 14¾ in. into five pieces, two 5 in. wide, and three 1½ in. wide; when planed and finished off get one of the small pieces and screw it down in the centre of the cart just over the axle; put the other two pieces, each to be near the standard, then screw the two larger pieces between the smaller pieces, as in Fig. 7.

In sawing, countersink the heads level with the seat. The seat can be fitted up if desired with one board instead of the pieces.

We now get our steps or footboards (Fig. 1). Measure from across the bottom of the standards; this we suppose to be 12 in. Get a piece this length by 3½ in. wide, hold the piece, letting the sides come flush with the sides of the standards, and mark with the pencil; get your saw and saw this piece out where marked 1¾ of an inch. At the outer ends near the standards we round the step; serve both steps exactly alike, and put a screw through the standards into the footboard.

We are now ready for our back rest (this with the seat can be made of deal). Measure across the inside of the top rail, which we will suppose is 16¾ in. Get a piece this length and 3½ in. wide by ½ in. thick; fit this within the rails; then mark each side of the rail on the edge of the back rest; take out and round the end to the pencil mark; fix this back rest right in the centre and over the axle, and screw from the outside of the top rail. We now get four small blocks 1½ in. long and 1 in. square; the average is planed off one edge and the top; these are glued in the angle of the back rest and the rail; also put a screw in the block from the outside of the rail.

We next procure our ironwork for the feet. These are of the same width and thickness as the springs; these cranked stays and feet are in two parts (Fig. 2). The part which fits under the seat and running in the direction of the shafts is 7 in. long; from the end of the seat down to the step it is 8½ in.; from this underneath the step 3½ in. We now have a leg to fasten on this plate or stay; for the front it will be 9½ in. with the end twisted up, measuring from the footboard altogether 13½ in. long, as 4 in. of the leg are bolted on the other ironwork; the legs at the back are 6 in. from the footboard, also 4 in. bolted to the other ironwork. These plates should be fixed under the seat 1½ in. from the side of the shafts.

We have now finished making our mail cart as shown in Figs. 3 and 4; when we have bolted the ironwork together, the woodwork can be stained and varnished over with oak varnish. To make the ash a pretty colour, get some old dark gold size;

give it a coat when dry; wash it well and give another coat, stopping the screw holes up with putty, and finish off with some old oak varnish.

The mail cart which I have described is the easiest to make, and all the others of whatever shape or design are made upon this principle. The iron legs can be dispensed with by letting the standards be longer, according to the height of the wheel—9 in. longer—and below the footboard, and 6 in. for the back standard, if the wheels are 24 in. high. Fig. 6 has a footboard 8 or 9 in. long at the back and front to allow the riders to stand up when desired, the seats lifting, or as a sort of lid resting upon the shafts, and screwed with brass hinges to a piece fastened under the back rest. Fig. 8 has a box under the seat; the lid of this can be in the centre of the seat, and should have a few holes bored in the side of the box to allow air to enter. Observe the springs; these are half a circle, 1 in. by $\frac{1}{4}$ in. thick, and 5 in. high, fastened under the shaft and on to a cross-bar of ash or oak 1 in. square, and upon which the axle and footboards are fixed.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

The Manufacture and Preparation of Signboards.

The manufacture of signboards is, of course, the work of the carpenter, but as the sign writer has often to give orders for their construction, it is just as well to give the proper and necessary instructions to the carpenter at the outset, in order to ensure a good article being made. A few remarks on this subject can therefore be hardly out of place in these articles, so it is my intention to give some simple directions as to making a signboard, and painting and preparing the surface ready for receiving the sign writer's inscription thereon.

Before I proceed further, however, I may perhaps be allowed to explain that the one object these articles have in view is in lending a helping hand to the novice and apprentice who is taking up this particular branch of decorative art. To all those, therefore, who have already a full knowledge of the art, and are past teaching and even learning, my advice—as far as these articles are concerned—is to pass them over.

These words from me have been called forth by the remarks of correspondents who have complained about the elementary character of these articles. Therefore, I repeat they are meant to be elementary, and that I do not profess to write for the skilled workman. For my own part, I cannot understand a man who knows every trick and wrinkle in his trade wasting his time in reading these pages; but in my past experience I have always found this to be the case, that those people who are so learned, so well up in their work, and, in fact, boast so much about their knowledge, and consider themselves above any further instruction, are generally those very workmen who know next to nothing of their particular trade, especially in its best departments. No sensible person, however clever and skilled a workman he may be, need consider it derogatory on his part to peruse an elementary treatise on the handicraft at which he gets his living; in fact, the oftener he recommences at the beginning, the more proficient he is likely to be, as a workman, in his adopted calling.

The wood used in the manufacture of signboards must be well seasoned and perfectly dry when being worked, and as far as possible free from knots. The wood mostly used is the best pitch pine, free from knots. Oak is sometimes used, but it is harder to work, and more expensive.

A signboard should contain as few joints as possible, so it is advisable to have the boards used in its construction as wide as possible. Neither must they be too thin—at least, $1\frac{1}{2}$ or 2 in. thick—or a very flimsy article will be the result. The boards must first of all be planed up smooth and perfectly true, and tongued and grooved, which, the better to prevent them opening, should be done in dovetail manner. The boards are now laid face to face dowwards, and close together upon some level surface, and are secured at the back with ledges or cross pieces firmly attached with plenty of strong screws. These cross pieces should not be more than two feet six inches apart. Now a good many people will at once say that the boards should be "clamped up" before having the cross pieces affixed, but to do this would be a great mistake, for signboards are exposed to all weathers, hot and cold, wet and dry, consequently they undergo a large amount of expansion and contraction. Consequently, if the boards were "clamped up," which they frequently are, no allowance is made for this expansion, and therefore, on the first appearance of wet or damp weather, the boards, naturally expanding, exert a tremendous force against each other, which causes the whole signboard to warp and twist in all directions; nor is this the worst, for the whole structure having been now pushed apart in this way, the boards, contracting with the first dry weather, will have glaring cracks in place of the previous almost invisible joints. It therefore devolves on the carpenter to use his utmost skill and knowledge to obviate and allow for this swelling and shrinking when making a signboard. There is a much more scientific way of making signboards than the one described herewith, with the special view of doing away with all these defects, but the writer is not sufficiently acquainted with the method to describe it in this place.

A signboard is "finished off" by having an ornamental moulding placed around it. This moulding should be rebated, mitred at the corners, and placed around the signboard, exactly as a picture is framed, and screwed thereto at the edges, and not from the front.

These few remarks may assist the young sign writer in giving his orders to the carpenter; in fact, he should write out a short specification in order to avoid disputes. A carpenter who is in the habit of making signboards a speciality can generally be relied upon to turn out a good article without receiving special instructions; but that there is a lot of bad and scamped work turned out in this direction can easily be seen on noticing the cracked, warped, and twisted signboards which one discovers on all hands, totally destroying all the labour and art which has been bestowed upon them by the aspiring and painstaking sign writer.

The carpenter having delivered the board properly glass-papered and perfectly smooth, we now proceed to prepare the surface ready for lettering. This job is generally handed over to the ordinary house painter, or an apprentice, and they are allowed to do the work in their own way, with the very natural consequence that the sign soon after completion is one mass of blisters, or the colour fades or cracks all over. It may not pay the sign writer—especially if he be a clever man and fully employed—to do this work himself, but whenever and wherever possible, he should always have it done under his immediate supervision, for on the lasting result of the signs he paints rests his reputation; and if at any time a sign does go wrong, he will not only get the whole of the blame, but in nine cases out of ten will lose any future work from the same customer. It behoves him therefore to see that great care is taken in preparing the groundwork of his signboards.

In good firms men are kept who understand the whole process thoroughly, and in such cases I need hardly say the "writer" need give himself no trouble; but when one works for the trade generally, and especially for men in a small way of business, he must see to these things if he wishes to keep up his connection.

There are, again, a good many ways of preparing signboards, all of which have their advocates and detractors alike, so it will perhaps be best to describe more than one process.

But it is no matter what method the workman may adopt, he must, *if there are any*, effectually destroy the damaging power of any knots. These must therefore be carefully coated with patent knotting, glass-papered, and again carefully coated. The panel is now primed with red and white lead, half and half, raw linseed oil, and a little dryers (not liquid dryers); a little turpentine may be added, and the priming should be thoroughly strained. When the first coat is perfectly dry, it may again receive a second coat of the same composition, but both must be laid on very thin and sparingly, especially if the panel is made of oak or mahogany. This priming must be allowed to get quite dry and hard, and then it may be well rubbed down with glass-paper.

The sign now receives a sparing coat of the ground colour mixed in the ordinary way, allowed to get dry and hard and glass-papered. This process is repeated, but this time it is glass-papered with extra care. It next receives a good round coat of "flatting" of the same colour, and if this does not sufficiently cover, it must be lightly rubbed down with some fine glass-paper and again "flatted." It must now be decided whether the panel is to be varnished before or after lettering; if the former, it now receives two good coats of copal or amber varnish; if the latter, it is ready for the writer without any further work.

In Spon's "Workshop Receipts," the following method is described:—

"Brush the board over back and front with equal quantities of linseed oil, japanner's gold size, and turpentine, to which add a little ground white lead, driving or rubbing out the colour well. For the second coat take equal quantities of white lead, common spruce ochre, and whiting, all well dried and ground fine and stiff separately with raw oil; mix the whole together; add sufficient gold size to cause it to dry quickly, firm, and hard; dilute with turpentine to a proper consistency, and apply two or three coats of the above colour.

"When dry and hard rub the surface smooth with either sand-paper or pumice stone and water, then grind equal portions of spruce ochre, whiting, bath brick, and white lead with two parts oil and one part turpentine, adding a little gold size diluted with turpentine, and apply one, two, or three coats if necessary, taking care to rub down and wash off the panel between each coat, repeating rubbing and colouring until the surface is as smooth and level as plate glass. It is then fit to receive the last coat to write, marble, or grain upon."

The finishing application, whether it be a plain ground, landscape, figures, or letters, ought to stand until thoroughly dry and hard; it should be finally varnished twice over with the best body copal or amber varnish, as the delicacy of the painting will admit.

HOME-MADE TOOLS.

BY J. H.

Miscellaneous Planes.

Fig. 19 shows a section through a bull-nose rebate plane. The use of such a plane is similar to that of a bull-nose smoothing plane, only that the one is used for working rebates close up to a shoulder, while the other is for plain surfaces simply. Such planes cannot well be made in wood because of the weakness of the nose in that material, but in iron they are strong as well as serviceable. Fig. 20 shows a plan view of the iron. It is shouldered and extended to the full width of the outside faces of the plane, and the flat face is downwards and the bevelled facet upwards, as in all planes whose irons are set at a low angle.

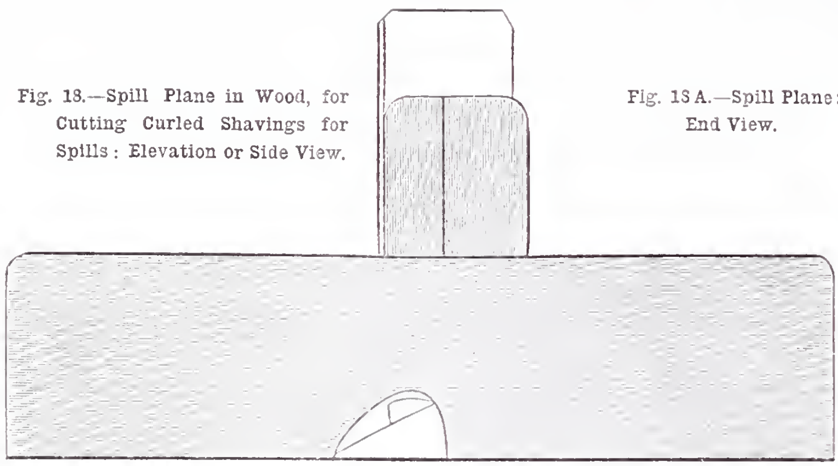


Fig. 18.—Spill Plane in Wood, for Cutting Curled Shavings for Spills: Elevation or Side View.

Fig. 18 A.—Spill Plane: End View.

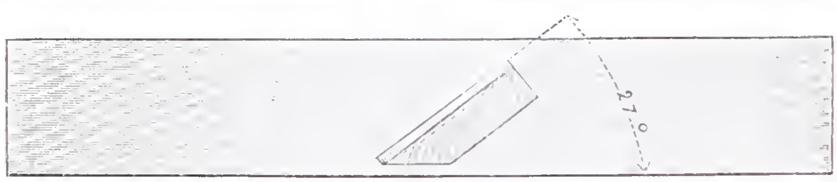


Fig. 18 B.—Spill Plane: Plan.

Figs. 21 and 21A show the patterns of the plane in elevation and plan, Figs. 22 and 22A the core box, also in elevation and plan. The mutual correspondence of these will be evident on comparison. The core outline is dotted in Figs. 21 and 22, and the print, A, is seen to correspond with the width, B, in Fig. 22A. In this example the sides, C, of the plane (Fig. 22) are put in the core box, and the hole, D, for the escape of the shavings is also made in the box, so that nearly the whole of the plane is formed in the core. This is an alternative of the method described in the previous article.

This may be cast either in iron or in gun-metal, it matters not which, and sizes may vary. The bedding of the iron on its face, and the good fitting of the wedge against the under face of the bridge piece, are to be particularly attended to. In this, as in other matters, the instructions already given in reference to previous examples will hold good, and need not, of course, be repeated.

A screw may be tapped into the hinder end of the plane to receive the hammer blows for the loosening of the iron, as noted in a previous example.

Round and hollow planes cost about 2s. 3d. each, and a workman wants a large number. I have seen very many planes made by workmen to supplant the shop-purchased ones, and they answer every whit as well. Figs. 23 and 23A show one of these wooden "rounds" in section and plan.

In making wooden planes there is not much difficulty, but a little care is necessary. In the first place, the stuff for the plane body is squared to width, depth, and length, the silver grain running vertically, or at right angles with the face; and the opening for the escape of the shavings, the seat for the iron, and for the wedge, are carefully marked with a scriber. Then bore holes with a small bit into the mouth. Bore other holes into the opening above, not too deep, but only sufficient to ease the work of the chisel and mallet in cutting out. Do not cut too much out of the mouth at the commencement. This is where a beginner is apt to err and to spoil his work. If the full width of mouth is cut away at once, then when the bedding of the iron, and easing off, and finishing comes to be done, the chances are that the mouth is at once widened as much as it would be if the plane had been in use for a long period.

In cutting out the opening, the chisels used must be as sharp as possible, and, with a flat piece of wood whitened with chalk, check from time to time the truth of the faces which are being cut. A new and coarse flat cut file may be used at the finish to remove the chisel marks and impart a smooth surface.

There is a risk of starting a shake in the angle where the front edges of the wedge fit. Hard driving of the wedge will do this, even if the wood of the plane is perfectly sound at the commencement. For this reason the front edge of the wedge should make perfect contact with its groove, and not be touching on one corner or opposite corners only. Also the chamfer should not start off at too sharp an angle, because that will weaken the wood just where the greatest driving stress occurs.

The surface of the plane should be saturated with boiled oil, which will afford a hard protective coating and gloss to the wood. Over this, when dry, a coat of varnish may be employed with advantage, protecting the wood from the weather and improving its appearance.

Every workman can make for himself small thumb planes—that is, miniature smoothing planes. They are very useful tools. They may range in length from four to seven inches. Single irons for these, from about $\frac{3}{4}$ in. in width, are obtainable in the shops.

It is often the case that pattern makers, carpenters, and joiners, want to work out mouldings, plain, hollow, or ogee around curves. Of course, much of this work can be, and is, done by machine, but not in all shops. In such cases I have seen planes something like that shown in elevation, plan, and section, in Figs. 24, 24A, and 24B, improvised in the space of a few minutes out of a bit of deal worked to the radius of the moulding transversely, and to its curve longitudinally.

They may, for a temporary purpose, be cut from a bit of deal, and they will, for temporary service, answer every whit as well as planes made of hard wood. To lessen the labour still more, I have seen the place for the iron and wedge cut clean out through one of the sides, as in Fig. 24, with a tenon saw. A rough plane like this, cut out for its iron and wedges, and sweeped in two directions, can easily be improvised in half an hour, and will save that small amount of time over and over again, by comparison with the time occupied in working a circular moulding laboriously with an outside gouge.

When its purpose is fulfilled, the plane may be thrown away if its rough appearance is an eyesore, or put away on a top shelf for possible future service.

It is impossible to work long flat sweeps true with a spokeshave, because the base or sole of this tool being so short permits it to rock and roll about, and so to follow, to some extent, the rough contour of the stuff as originally prepared with saw or gouge. To prevent this waviness, and to properly obliterate all lumps, a plane having a sole of considerable length is required. This then rides over the minor projections, and adapts itself to the general or average curvature of the sweep, and so produces true work.

Sometimes workmen make a tool somewhat resembling a spokeshave, but having an iron like a plane iron, and a sole about twice or three times as long as that of the spokeshave. In this way fairly good sweeps can be worked. But still the plane is the best tool for the purpose, and to one of this type the term "compass plane" is applied.

Compass planes, Figs. 25 and 25A, are, therefore, those whose curvature is in the transverse direction to that in Fig. 23, that is in the longitudinal direction of the work. A common smoothing plane is often utilised thus as a compass plane by having a suitable amount of curvature imparted to its sole. But obviously it is not possible to work sweeps accurately with a plane whose

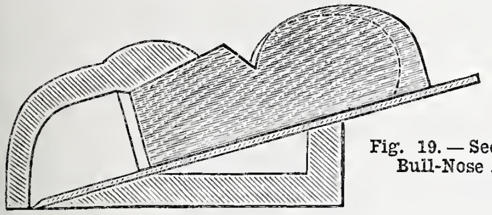


Fig. 19. — Section of Bull-Nose Plane.

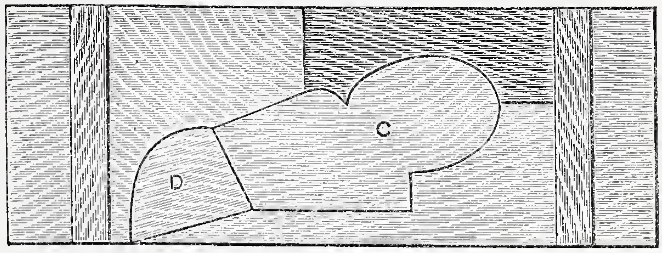


Fig. 22.—Core Box for Bull-Nose Plane: Elevation.

Fig. 20.—Iron for Bull-Nose Plane.

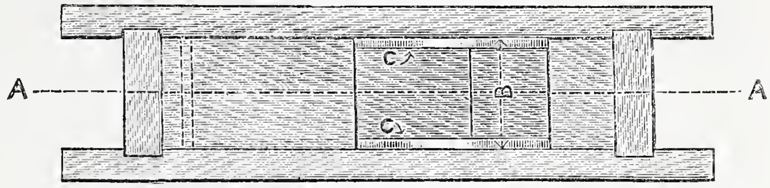


Fig. 22 A.—Core Box for Bull-Nose Plane: Plan.

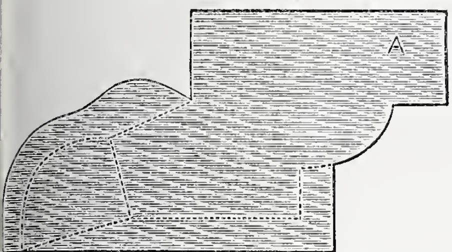


Fig. 21.—Pattern of Bull-Nose Plane: Elevation.

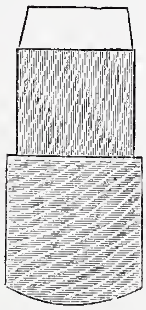


Fig. 23 B.—End View of Round-Soled Plane.

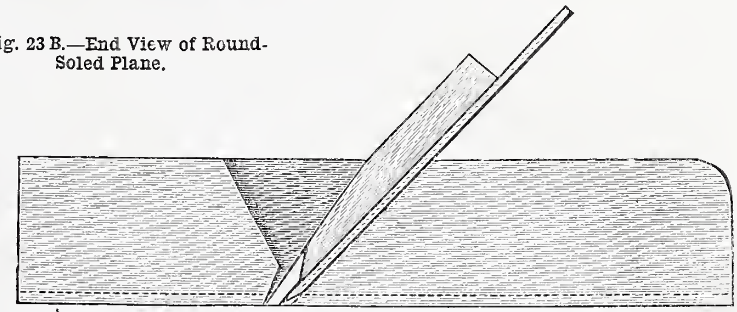


Fig. 23.—Round-Soled Plane: Section.

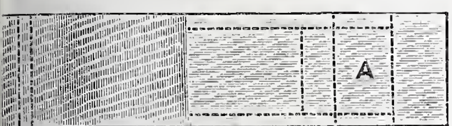


Fig. 21 A.—Pattern of Bull-Nose Plane: Plan.

Fig. 24 B.—Section of Rough Plane.

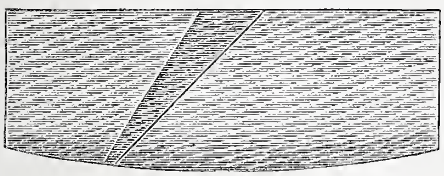


Fig. 24.—Rough Plane for Temporary Use.

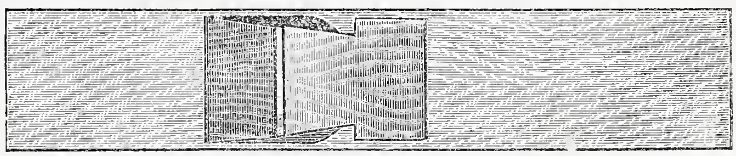


Fig. 23 A.—Round-Soled Plane: Plan.

Fig. 24 A.—Plan of Rough Plane for Temporary Use.

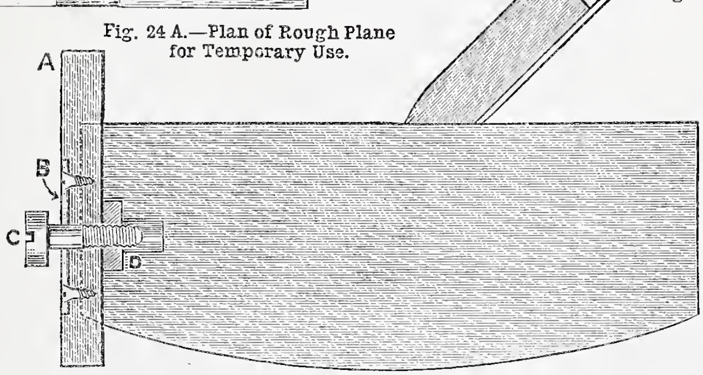


Fig. 25.—Compass Plane: Elevation.

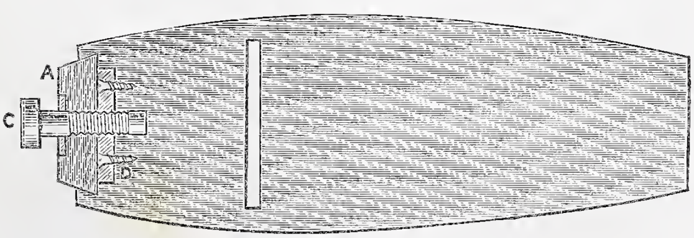


Fig. 25 A.—Compass Plane: Plan.

curvature is very much quicker than that of the sweep which is being worked, while, further, it is impossible to cut a sweep that is at all quicker than the curvature of the plane itself. Hence we want properly a separate plane for nearly every separate sweep, manifestly inconvenient on the score of expense. Hence the great utility of those American sweeped or circular planes having an elastic sole of steel, and a screw, and double lever arrangement with interlocking teeth by which any curvature, either convex or concave, can be imparted to the sole. But these are costly, hardly within the range of amateur work, and are not so well adapted to the rougher kinds of work as a plane of wood. Fig. 25, therefore, shows a device for making a compass plane adaptable to any reasonable range of curvature.

In this a dovetailed adjustable slip, A, is fitted into the front end of the plane with a vertical range of about $\frac{3}{4}$ in. A brass slotted plate, B, is let into and fastened with a couple of screws into the outer face of the slip to take the pressure of the set screw, C. A bit of brass or iron plate, D, tapped to take the set screw, is let into and screwed to the end of the plane, as shown, the set screw being tapped into this, and the loosely dovetailed and slotted piece sliding over the screw body, therefore the turning of the latter with a screwdriver pinches the adjustable slip, A, in any required position, rendering it suitable to a flatter or quicker sweep, according as it is set more or less away from the sole of the plane.

Fig. 18 shows a spill plane made in wood, one of those little articles by which the curling of the shavings used for pipe and cigar lights is effected. These spills look rather pretty on the mantelpiece; the worst of it is that the ashes drop off them as they burn. Gluing thin pine and mahogany together before planing off the spills gives them a pretty variegated appearance.

The important point in these planes is to get the precise angles required; a very slight departure therefrom will prevent that close curling together of the shavings which is essential to good appearance. Both the angle of the iron and of the sole of the plane are of equal importance.

Figs. 18, 18A, and 18B show the plane in side, end, and plan views. A block of wood is planed rectangular to the dimensions shown, and then the hole marked and cut for the wedge and iron, the iron standing vertically. Afterwards the bottom of the plane is rebated through to coincide with the transverse angle to which the iron is ground; the angle of the iron in plan is 65°.

I scarcely think it worth while to occupy valuable space with any detailed description of the mode of construction of the ploughs, filisters, routers, and various bead and moulding and sash planes used by carpenters and joiners. They are very common, and many are made by workmen themselves, many are bought second-hand. In any case, there is no difficulty in their mode of construction. Perhaps the most difficult to many would be the plough, because of the bit of metal work involved. But if the body were described and made, a set of irons would have to be bought, and then it would be cheaper to buy a second-hand plough and irons in good condition. The same remarks apply in the main to the other planes mentioned. The examples which I have selected have been mostly those of planes involving the employment of cast-iron bodies, in whose construction I think most of my readers might be expected to have less acquaintance than with the working of wood. Hence, although I have not by any means exhausted the stock of useful planes, my instructions have embraced all, except some of the most elaborate types which few could undertake with hope of success, and those common planes in wood which are better bought than made. I shall pass on in future papers to the description of some other classes of tools, of which there are many kinds awaiting notice.

The value of these and other home-made tools does not consist altogether in the saving in cost effected over those which are purchased ready made, although that is in some cases very considerable. But they have a much wider value, common to all work undertaken in leisure hours by amateur and professional mechanicians. These are the acquisition of that practical skill which can come only of experiences of failure and success, the intimate knowledge gained thereby of processes and operations, the pride begotten of the successful accomplishment of tasks more or less difficult, the useful and happy employment of hours which might otherwise be given to idleness or to positive vice, the keen interest which grows with devotion to pet hobbies, and the satisfaction of contemplating time past well spent and tasks well done. The stress of life would overwhelm many a man but for his pet hobbies, and it matters little what those hobbies are so that they are innocent. They ever serve the happy purpose of keeping us from brooding over life's worries, and breaking down under its cares, an end which all must desire.

VENEERING PANELS, ETC.

WITH REMARKS ON THE TREATMENT OF LIGHT VENEERS AND BURRS.

BY DAVID ADAMSON.

Let us now suppose that two drawer fronts or panels of the same size have to be veneered. The general work will be exactly as before, but it will be more convenient to place them together with a couple of cauls, the backs of the panels being in contact. This is mentioned as I consider it a better plan than placing the veneered sides together, or, rather, with one caul (metal) between them, though this is done by such very good workers sometimes that I feel loth even to insinuate that it is not altogether desirable, and I certainly would not go the length of saying that it is wrong. If pairs of panels are done, on taking them out of the caul instead of placing them separately against a wall, put the veneered surfaces in contact, and leave the work undisturbed for a few hours in a warm place, when all that has been said applies equally to their after treatment. Perhaps before leaving this part of the subject it should be said that many people before gluing the ground wood size it over with weak glue, just to fill the grain. This may be advisable when the wood is soft, and can never do any harm even with hard woods. A good deal, however, depends on the consistency of the glue, so that whether sizing is necessary or not must to a great extent be left an open question.

It may sometimes happen that both sides of a board must be veneered, and from what has been said about heart side and damping the back the novice may possibly put a few questions to himself which he will find difficult to answer. To save him from any perplexity, he may be told that when both sides of a piece of wood are to be veneered the wood does not require swelling, and that the rest of the work is exactly the same as when only one side is to be veneered. The wood, when ready, is placed between two cauls.

Let us now suppose similar pieces of wood are to be hammer-laid, and the caul dispensed with. The veneer will still be laid on the heart side of the ground wood, which will be glued as before, but not swelled on the back. As the work must proceed without delay in order to prevent the glue setting, everything required should be ready to hand. If the surface is at all large, a warm iron or two should be regarded as among the indispensables. Some warm water, say that from the outer glue kettle—but it must be clean—and a rag or sponge will also be wanted. If necessary, the surface of the wood may be slightly warmed. When all is ready, brush the glue on as usual, and as quickly as possible lay the veneer in position, pressing it down with the hands. Then with the damped rag wet the face of the veneer and squeeze it down with the hammer. To use this with the utmost force which is sometimes required, take hold of the end of the handle with the right hand, pressing with the left on the top of the head, and work the iron edge all over the surface. The moisture on the surface of the veneer should not be excessive, though it must be sufficient to cause the hammer to slip freely over it. Where it can be done without injury to the veneer it is not a bad plan to have a small quantity of glue mixed up with the water to damp the rag. Sufficient will be got by wiping up that which exudes from the edges. The amount of pressure will depend to some extent on the thickness and stubbornness of the veneer, and to prevent this slipping it may be necessary to fasten it down with a pin or two. Blisters should be pressed down as much as possible, and if the glue seems inclined to set too soon, it must be softened either by the application of a warm iron, or, if only locally, by a heated hammer head. Sometimes the inner glue pot laid on any particular spot will do all that is required.

With all veneers the process is very much the same as that which has been described, but some of them want special preparation, and details vary.

Let us suppose, for instance, that a white or light-coloured veneer has to be laid. It would at once be apparent that if put down with a caul, the glue striking through would cause an irreparable blemish. This may be prevented to a certain extent by the use of light-coloured glue, but this is not always obtainable easily, so that it is satisfactory to know that the ordinary kind will do very well when mixed with some white material such as powdered chalk, plaster of Paris, whiting, etc., any of which, it is almost needless to say, must be quite free from lumps or grittiness. One very good plan is to mix some of the white with size or very thin glue, and lightly smear the veneer with it on the side to be glued down. Put the veneer aside till dry, then lay as usual, the only difference, if any, being that the glue should be as thick as it can conveniently be. Another method is not to prepare the veneer by coating it with whitened size, but simply to mix the glue with white before laying. Sometimes it is sufficient to rub the veneer over with ordinary chalk dry; but so much depends on the colour of the veneer that it is almost impossible to lay down hard and fast rules. For example, though oak and satinwood are both light woods, it is evident that the latter is much the more delicately tinted of the two, and consequently more liable to injury. Among the lighter woods commonly met with in veneers requiring care in this respect may be mentioned the following:—Birch, bird's-eye maple, wainscot oak, satinwood, American ash, Hungarian ash.

In connection with these and similar veneers, attention may be called to the fact that the glue is not so apt to strike through when they are laid with the hammer as when the caul is used.

The advisability of thoroughly drying all veneers, and the absolute necessity of doing so with others, has already been alluded to; but, so far, it has inferentially been presumed that they are all of a flat, smooth kind. Burrs, however, are so much wrinkled and crumpled as to require special treatment before they can be successfully flattened out. Among these may be reckoned burr walnut, Amboyna, pollard oak, etc. If they lie flat, well and good; but if not, they must be damped slightly to render them limp and flexible. They should then be placed separately, or in a pile, between hot cauls, and left till they are dry, when they will be flat enough. Be careful, however, that they are thoroughly dry before laying them. All burrs are more or less faulty, and this remark specially applies to walnut, which is frequently full of great flaws and rents. These must be carefully pieced up, and on the way this is done a great deal of the effect depends. Of course, when skilfully patched, the pieces let in should hardly show, and on the finished surface they sometimes require a good deal of looking for before they ca discovered. As I have known amateurs, nply because they could not find any places hich had been thus patched, fancy that ey had got hold of a very superior piece veneer, and cast a doubt on their informer's racity, I may say to those who read this, d have similar notions, that it is almost impossibility to get hold of a very fine ece of burr which has no holes in it. In ct, it may almost be said that the finer the arkings the looser the veneer will be in is respect, so that in veneering with burr is not only necessary to estimate the cost the material, but of the time required to nder it presentable. This is just one of ose points in which the amateur valuer of rniture is apt to go altogether astray, and hich lead him to fancy that he is being imosed on, while in reality he is trying, doubtss unwittingly, to drive a hard bargain. He gues much in this way. A walnut panel the solid is worth so much. He is not to e had, and he knows the value of a burr eneer, large enough to cover it, to be, say, alf-a-crown. Add this to the solid, and -well, yes, not to be unreasonable, a little ore for sticking it to the wood, but that on't take long, as it's only a matter of a ttle glue and sticking the two pieces toether—say 3s. for veneer and laying. The ery important items of time and skill reuired to prepare the burr are altogether eft out of consideration, though it is quite onceivable that they might be worth coniderably more than the cost of the veneer. o show this in its unprepared condition to person of such vast knowledge and expeience would be useless, or worse than useess, for he would think it very poor, comnon stuff, and would much prefer to have a iece as smooth and perfect as a piece of ardboard.

And, without doubt, "so say all of us," only, nfortunately, it is not obtainable. Burrs won't grow according to pattern, and the wood from which they are cut is not machinenade. Uniformity in irregularity is all hat can be expected from natural producions, and where they are not perfect for urposes of manufacture, skill and intelligence are required to make them so. We avail ourselves of the works of nature so far as they can go, and then by art we make them fit for the use we intend for them. This in the case of veneers is that they shall present a smooth, unbroken surface. Every piece of burr, therefore, must be carefully examined before laying, and the larger holes filled with bits cut to fit them. Small cracks and minute holes will be filled up by the glue when laying, so they need no special attention. To fill the others, it should not be deemed sufficient just to fill them up, though this, in any case, could hardly be done generally with pieces cut to fit. It is mostly necessary to trim away the rough edges, and in doing so the hole is enlarged. The aim should be to let in a piece so that it and the join harmonise with the rest of the marking.

In order that this may be achieved it will be seen that it would not do to cut the hole and piece fitted in to a regular outline, such as a square, circle, or oval. This would be too conspicuous, but with a small amount of discretion the joint should be almost imperceptible. The two pieces can easily be made to fit by cutting them both out at the same time. This may easily be managed either with an ordinary fret saw or with the point of a knife, as the veneer, especially if damp, is not difficult to cut. In using the fret saw for this species of inlay it is not necessary to cut on the bevel. The glue will fill up the saw kerf sufficiently. As the pieces are let in, a piece of paper should be glued over them and the surrounding veneer to keep them in place. Any odd scrap of paper will answer the purpose, and I suppose it is unnecessary to do more than state that it must be applied to the face side—*i.e.*, the one which is afterwards to be cleaned off.

In much the same manner burrs which are to be jointed to cover a larger surface must be treated, the edges being cut to fit each other in an irregular line, and then attached by glued strips of paper. As the thickness of different pieces of veneer may vary, they should be reduced as nearly as possible to an equality before laying by going over them with the toothing plane. This is necessary, as it stands to reason that otherwise the caul would not press them down all equally, and surplus glue or confined air would not be driven out to the same extent from under the thinner as from the thick portions. If an unusually large surface has to be veneered, it will be convenient to cut all the different pieces before joining any of them together. This is the general treatment to be adopted with burrs of all kinds, and they should, when at all practicable, be laid with a caul. The hammer does not do for them. Owing to the porosity of most burrs, the sheet of paper between the caul and the veneer must on no account be omitted, and be sure that the caul is either soaped or greased, otherwise the chances are that the glue will not only adhere to the base, but to the caul, and be injured. Nothing more need be said about burrs, of which the walnut variety is that most commonly met with. It must not be confused with plain walnut, though possibly this designation may be confusing to some, as implying that it is without figure. It frequently has plenty of this, but may be distinguished by its presenting much the same markings as a plank instead of a mass of involved figuring such as is seen in burrs.

Rosewood, from its resinous nature, requires somewhat different treatment from any of the veneers which have been considered. Instead of damping it like twisted burrs before pressing flat in the caul, it should be heated at the fire till the oil or gum exudes, and care must be taken that it is equally warmed all over. When the gum has apparently all come out, the veneer is then pressed till cold, after which it is ready for use. It should be said that some of the "bastard" rosewoods which are so often met with now, do not seem to require this special manipulation, but may be treated as if they were mahogany. As a rule they do not emit the peculiar fragrance of rosewood, but in case of doubt they may all be heated. If they contain no oil, of course heat won't bring it out, so that there need be no room for doubt. I believe it is not usual to heat knife-cut rosewood.

Many kinds of veneer have necessarily not been mentioned by name in these directions, but by noticing the leading features of any others which he may come across, the learner will have little difficulty in knowing how to treat them properly and lay them satisfactorily, and we may proceed to consider other matters connected with the art of veneering.

These, however, through want of space, I must defer for another paper, in which I shall consider for the benefit of all workmen, but more especially for the benefit of the improver, such things as blistering and other things connected with the art.

A MAURESQUE COFFEE TABLE.

BY E. BONNEY STEYNE.

How well-to-do folks pass the tempting windows of the warehouses of the Liberty type without buying half their contents is a wonder to poor amateurs. We (not you, my reader, of course) never have those pleasant spare guineas which are required to possess the delightful medley of china, brasses, hangings, and furniture, brought from the spicy East. The very scent of one of these shops is intoxicating, and almost sends prudence to the winds, and leaves one reckless to buy all that is so captivating, with no thought of payment. But although poverty has its pains, it has its pleasures, and the make-shift that does duty in home-made fashion for coveted but unobtainable reality, has a charm of its own in the eyes of its maker, who can trace it back to the first germ, if the idea of it be his own design, or can recall the pleasant sensation of being at last within reach of the long-admired original when some technical journal gives the recipe for cooking a substitute.

The pretty coffee tables sent over from Turkish possessions (it is kinder to be vague, for they may be made in Whitechapel for all I know) are extremely decorative little things, with a squat stability that suggests strength without ugliness. If you examine their detail, it is rarely, save in the very best examples of a high order of art, but they answer their purpose admirably, and know the important point "when to leave off." Yet inlaying with mother-of-pearl would probably be a more costly operation than buying the real thing outright.

To take a suitable design and paint it in set conventional Oriental patterns, with colours in the key those self-taught Eastern folk use so cunningly, would be better than the plan followed in the table hereby set forth. But colour is a hard thing to describe in words. My idea of blue and yours may differ as the sky at midday and Reckitt's advertisements. My notion of purple may be a sort of claret stain, yours the dazzling brilliancy of the aniline so-called violet. Yet I do not say that my notion of each colour is artistic and yours commercial, still less that there are "art colours" any more than art notes in music. Colour and notes are the common material of each artist, and if one makes a beautiful colour harmony, and the other a rare melody, while his rival creates only garish discords and vulgar comic songs, it is purely the merit or fault of the worker who spoils his material, not of the tints or sounds themselves.

Therefore, in lieu of inlay or colour, I have dared to modify the shape, and add some fretwork, of no style in particular, to give a decorative quality.

The necessity of compression (within one page of WORK) of full size working patterns has rendered it important to describe the whole rather fully and with frequent reference to the diagrams.

As this "oddment," to use a dealer's word for the endless variety of small tables and stools, is for the weaker brother to make, its very infantile joinery must be apologised for in advance. In the columns of WORK the correct way is pointed out by many capable leaders, and should any reader wish to make this table, and disdain every word of my suggestions for its fitting, so much the better. But if some unskilled workman would fain try his hand on such a thing, I think the course suggested will keep the structure together until some weighty visitor

A Mauresque Coffee Table.

FULL-SIZE DRAWINGS FOR THE FRETWORK ORNAMENT AND PLAN OF THE CONSTRUCTION.

BY

E. Bonney Steyne.

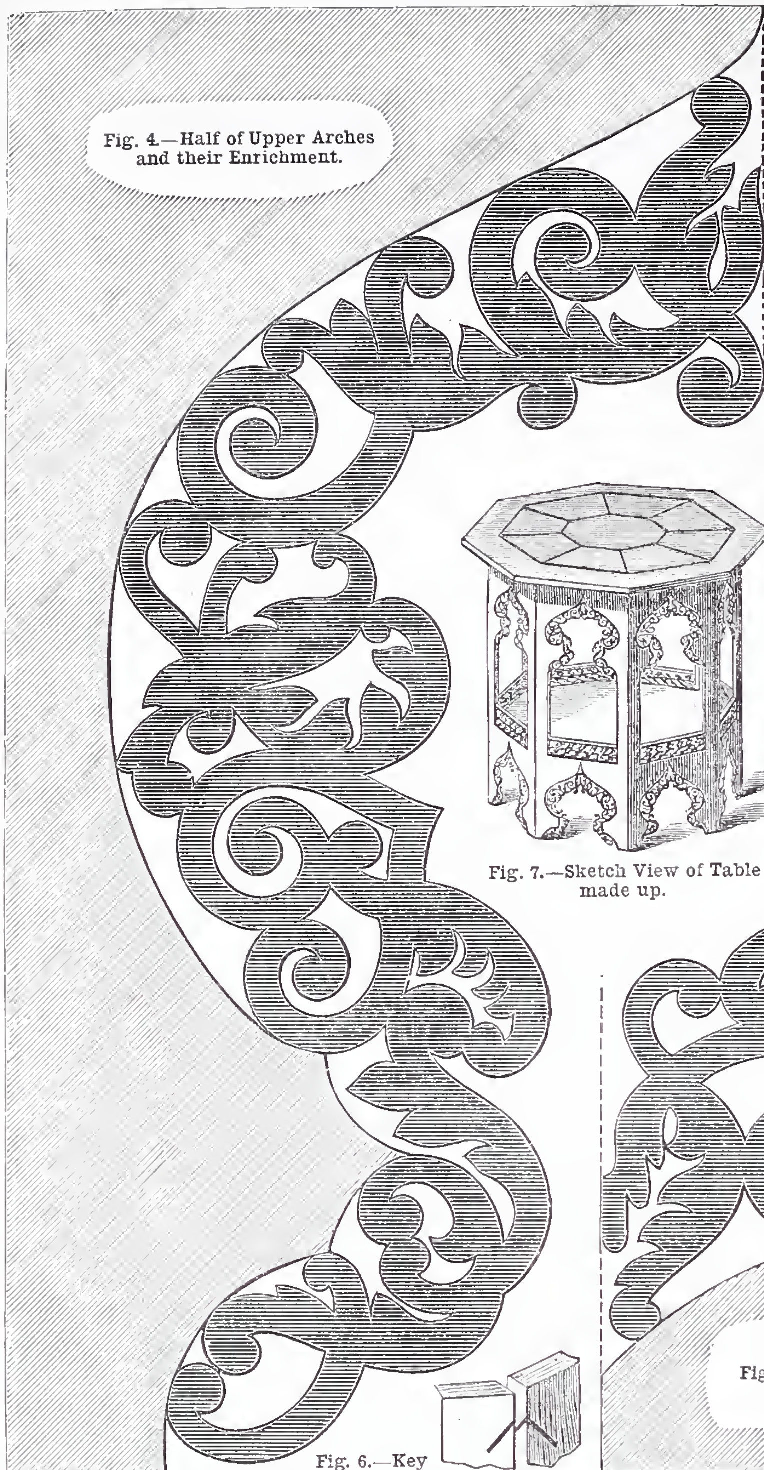


Fig. 4.—Half of Upper Arches and their Enrichment.

Fig. 7.—Sketch View of Table made up.

Fig. 6.—Key Pieces at Angles.

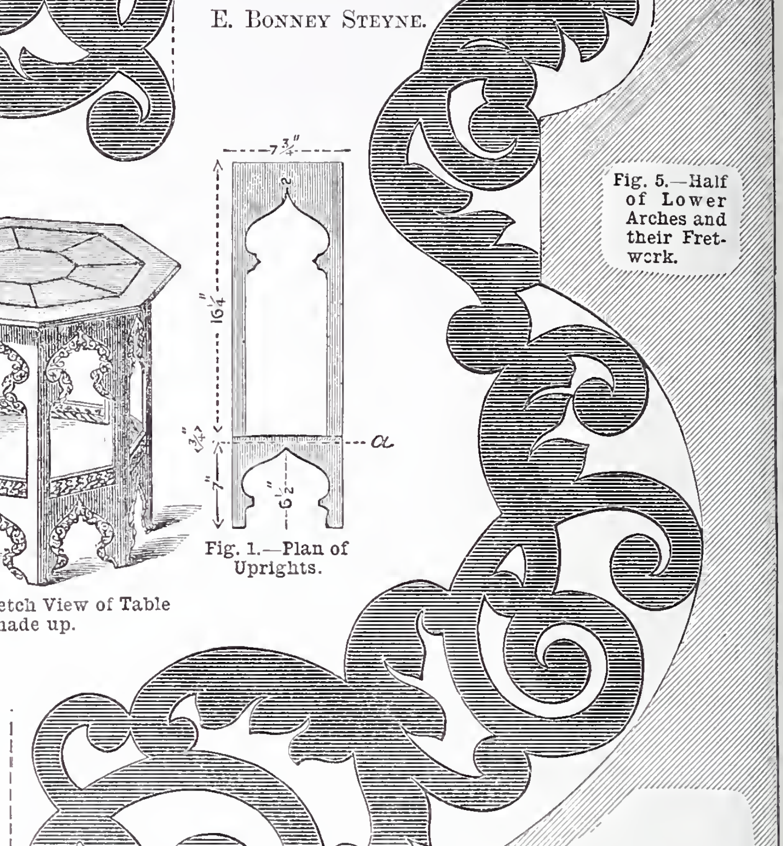


Fig. 5.—Half of Lower Arches and their Fretwork.

Fig. 1.—Plan of Uprights.

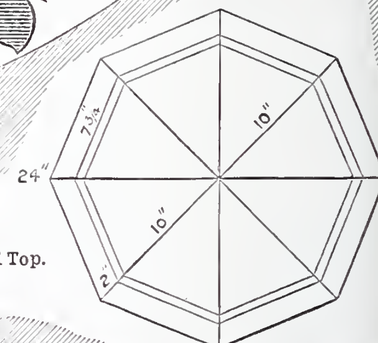


Fig. 2.—Plan of Table and Top.

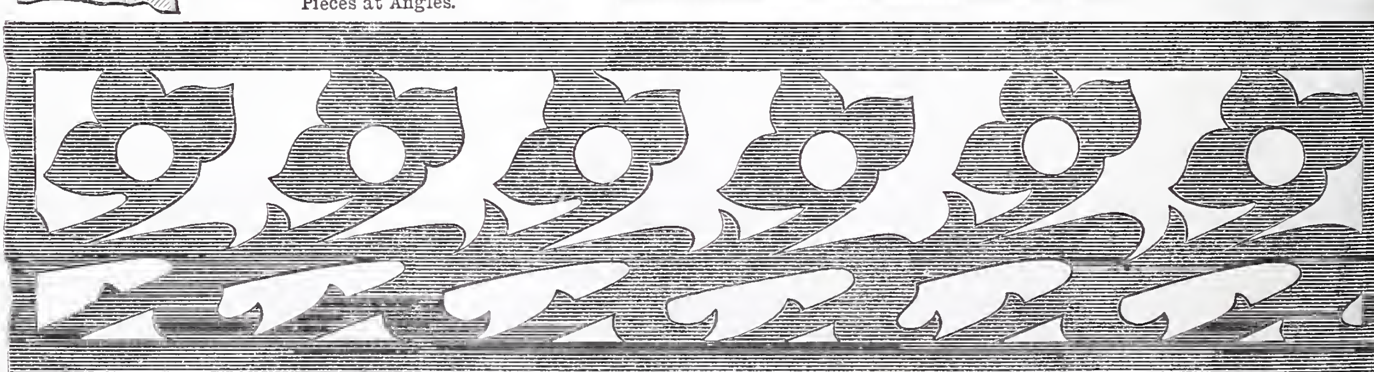


Fig. 3.—The Borders. Cut Eight.

mistakes it for a seat. It is not guaranteed to carry hundredweights or tons, yet if fixed as indicated, will not be more nervous and quaking than I am at venturing to introduce such a bungling piece of joinery into the pages of a paper devoted to serious work.

To begin, take a piece of wood, or pieces, tongued and glued to the requisite width ($19\frac{1}{4}$ inches); on it draw a perfect octagon. For those who have forgotten their Euclid, it will suffice to draw a series of lines in Union Jack fashion—that is, a cross bisected with another at the angle of 45° from the centre; mark each radiating line at 10 inches from the central point; connect these marks with straight lines, and the octagon, from which I propose to evolve the table, is ready to cut. Work two of these in inch stuff, taking care that they are geometrically accurate, and facsimiles of each other; then take eight pieces of deal (or other wood) 2 feet long by 8 inches wide; these may be of half-inch stuff; bevel the edges until they fit exactly round the two octagons, making, as it were, a box, not unlike a concertina (which is usually a hexagon, however), with the bottom placed at the point *a* of Fig. 1. Having fitted them, trace upon them the *outlines* of the two arches within the fretwork, at the distances indicated by diagram. With a keyhole saw cut these as there shown, and smooth the edges to a good finish. If you can rabbet the arches to let in the fretwork from the back, do so by all means, having, say, $\frac{1}{4}$ inch rabbet, and leaving on the fretwork a quarter of an inch to fit therein. The fretwork pieces in Fig. 4 are to be copied in full for the upper arches, and those in Fig. 5 which show pieces for the lower ones. The pieces Fig. 3 may also be provided for in the same way; they form a balustrade to the shelf, and hide the rough edge of the sawn straight line across the grain, which is difficult to finish neatly. Having worked the fretwork either with its $\frac{1}{4}$ inch border for the rabbet, or to the full size as drawn, as the case may be, if the fitting of the structure has been previously completed, the final fixing may be attained by screwing each piece to the octagonal shelf and top, gluing the bevelled edges, and securing them with key-pieces, put in at the angles, as in Fig. 6. Of course, it may be found, in spite of all care, that the table wobbles; if so the fault may be left until the last thing, when all is firm and set; then the feet must be shaved down until the table is both level and firm.

The top (Fig. 2) is an octagon of 24 inches from point to point. Whether this is plain wood with a bead, or with the balustrade Fig. 3 added; whether it is worked with a moulded edge or formed of eight isosceles triangles tongued together, with their grain parallel to the base of each, is just as the workman can or will have it.

The finish of the whole may be ebonised, "Aspinalled," or as you like it. If desired, the top may be painted with a design, the plain spandrels of the arches relieved with patterns, and so on. I think ebonised wood, with neatly painted conventional design in cream colour enamel, to simulate inlaid ivory, would be as little objectionable as any sham can be.

The stability of the structure would be increased by angle pieces or blocks, such as any actual table will show.

So with apology I offer the coffee table, which, may, I hope, give pleasure to some, even if the purist and thorough person look askance at it, and condemn the wilfulness of the writer in venturing to offer such an unorthodox variety of what has hitherto borne an unimpeachable and blameless character.

HOW I MADE A VERTICAL CYLINDER.

BY ELECTRON.

A SHORT time since, I wanted a vertical engine cylinder of a certain size, and not being able to get a casting without making a set of patterns, I set about it in the following manner.

I got a piece of locomotive boiler tube about 3 inches longer than the length of cylinder. The tube was of brass $\frac{3}{16}$ inch thick; the inside was bored in an ordinary wood-turner's lathe, in the following

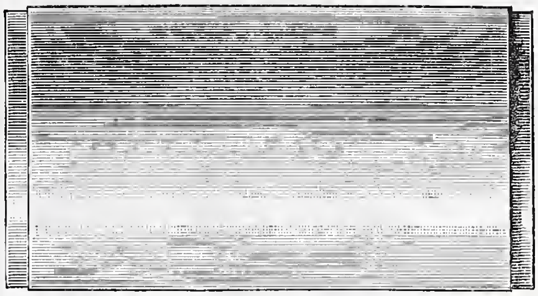


Fig. 2.—Tube for Cylinder.

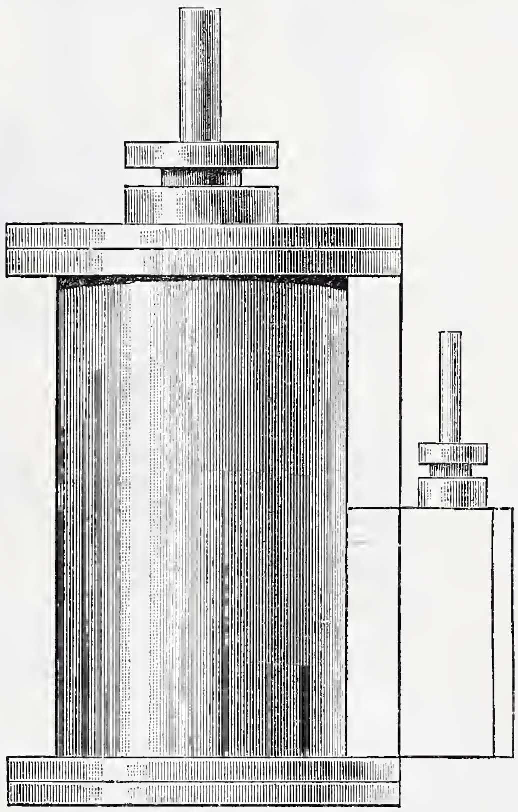


Fig. 3.—Completed Cylinder.

manner:—A boring bar was fixed between the centres of the lathe, and the part at the outer or right-hand end of the cutter was turned true; two discs of wood were turned to fit into the end of tube with a central hole in them to fit the turned part of bar; the tube was then packed up with wood till at the right height, and two strips nailed on the top of packing, to keep the tube parallel to centres; the turned part of bar was then put through the two discs, one being at each end of tube; the tube was pushed forward by hand, the two discs and the packing keeping it parallel. As soon as sufficient length was bored for the cylinder, the tube was cut to the length, fixed on a mandrel, and the ends and outside turned up; each

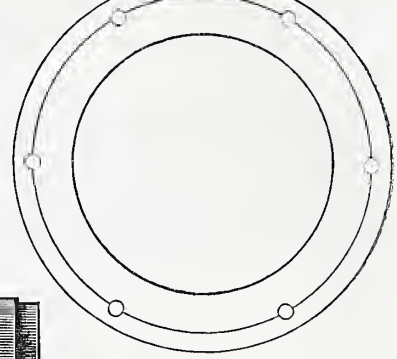


Fig. 1.—Flange for End of Tube.

end was also reduced a little for $\frac{1}{8}$ inch, as shown in Fig. 2.

Two pieces of sheet brass $\frac{1}{8}$ inch thick were fixed on face plate of lathe, and a piece cut out of the centre to fit the end of tube, and the outside cut off $\frac{1}{4}$ inch larger than the outside of tube. Fig. 1 shows one of these. The inside of the holes in these pieces and each end of tube were tinned by a soldering bit, and each piece was then soldered to the ends of tube to form the flanges, and turned up true.

The cylinder bottom was made from brass plate $\frac{1}{8}$ inch thick, and was filed up square; in the centre of this a piece of plate, rather larger than the bore of cylinder, was soldered, then fixed on the face plate and turned to fit the bore of cylinder. Fig. 4 shows cylinder bottom.

The top cover was formed in a similar manner, except that it was circular, and had a piece of brass $\frac{3}{8}$ inch thick soldered on the top side to form the stuffing box. This was turned and bored in the usual way; the gland was also formed in the same manner, a piece of $\frac{1}{8}$ inch brass plate being soldered on a short rod of brass, turned to fit stuffing box, and bored for piston rod. Fig. 3 shows complete cylinder with top cover and gland.

The piston was also formed in the same way, three pieces of brass plate soldered together, and turned to fit cylinder, the centre plate being turned down to receive the packing.

The plates were soldered in the following manner:—Each piece

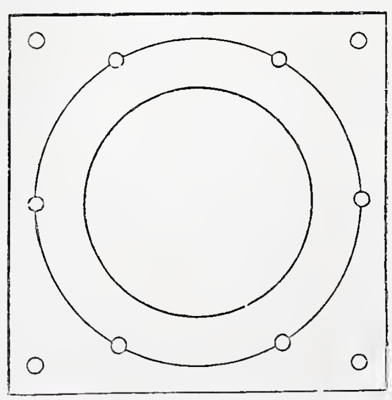


Fig. 4.—Cylinder Bottom.

was tinned all over with the soldering bit; they were then put between two pieces of red-hot iron, and screwed up tight in the vice, and left till cool, when they were quite fast.

A piece of brass the size of steam chest, and ½ inch thick, was filed up and squared, and one side made hollow to fit on the outside of eylinder; the steam and exhaust ports were cut in it, and a hole drilled from one side into the exhaust port, and tapped for the exhaust pipe; a hole was also cut at the lower end of cylinder, corresponding to the steam port: this piece was then tinned on the hollow side, and the outside of cylinder being tinned, the two were sweated together.

A piece of brass about ½ inch square was filed up to form the top steam passage; a groove was cut in the underside of this; a hole was also cut from the top steam port, and into the top of cylinder; the piece of brass was then tinned on the underside and the ends, and the side of the cylinder being tinned, this piece was sweated into its place. The steam chest was cut out of a piece of solid brass ⅝ inch thick, holes were drilled round, and the centre cut out by a small chisel. A stuffing box was formed on the top, and a gland fitted to it; the cover for steam chest was made from a piece of brass plate. The steam chest had a hole drilled and tapped in one side for steam pipe; the cover and steam chest were fixed by four long screws.

The piston rod and valve rod were turned and fitted in the usual manner. The slide valve was made from a solid piece of brass, with a groove in the back, through which the valve rod passed, fixed by a nut at each end. The covers were each fixed by six set screws with canted heads.

The surplus solder at the edges of the joints was all scraped off, and the outside cleaned up with emery cloth.

BINDING SCREWS.

BY GEORGE EDWINSON BONNEY.

Binding Screws.—These are small clamps made of brass, and cast or turned in various forms to suit their requirements. They are used as convenient means of connecting one part of an electric circuit with the rest of the circuit. This has given to them the name of "connectors." When made in the form of a pillar or post and fixed by screwing or soldering to a base, they are named "binding posts." When fixed to the two wires proceeding from a generator of electricity so as to form the two poles of the generator, they are named "terminals." The accompanying illustrations will show at a glance several types of binding screws.

Fig. 1 shows a binding post as used for the terminal poles of dynamo machines. When used for this purpose the post should be massive, the threads on the screws well cut, and the hole for the wire left large. If these posts are nickel-plated, they enhance the appearance of the machine, and require less care to keep them clean. Some makers taper the post from the base upward, whilst others round off the tops. This is merely a matter of taste. The wires from the machine are twined around the tang of the post and secured by a nut beneath the base of the machine. Fig. 2 shows a ball pattern binding post used for a similar purpose. Figs. 3 and 4 show two "telegraph pattern" binding posts. These are used for the terminals of telegraph instruments. When made large, they are useful terminals for ammeters and similar instruments. Fig 6 shows a neat modification of the same terminal; and Fig. 7 shows a similar terminal furnished with a butterfly nut. This form of nut enables the workman to take a good grip on the wire connected to the terminal, and also to unscrew it without the aid of pliers. It is a form of nut that finds favour with French workmen, and is used by them instead of the milled head, so commonly met with in binding screws of English makers. Fig. 5 shows a simple nut and pin terminal, as used to insert in the lead tops of carbons

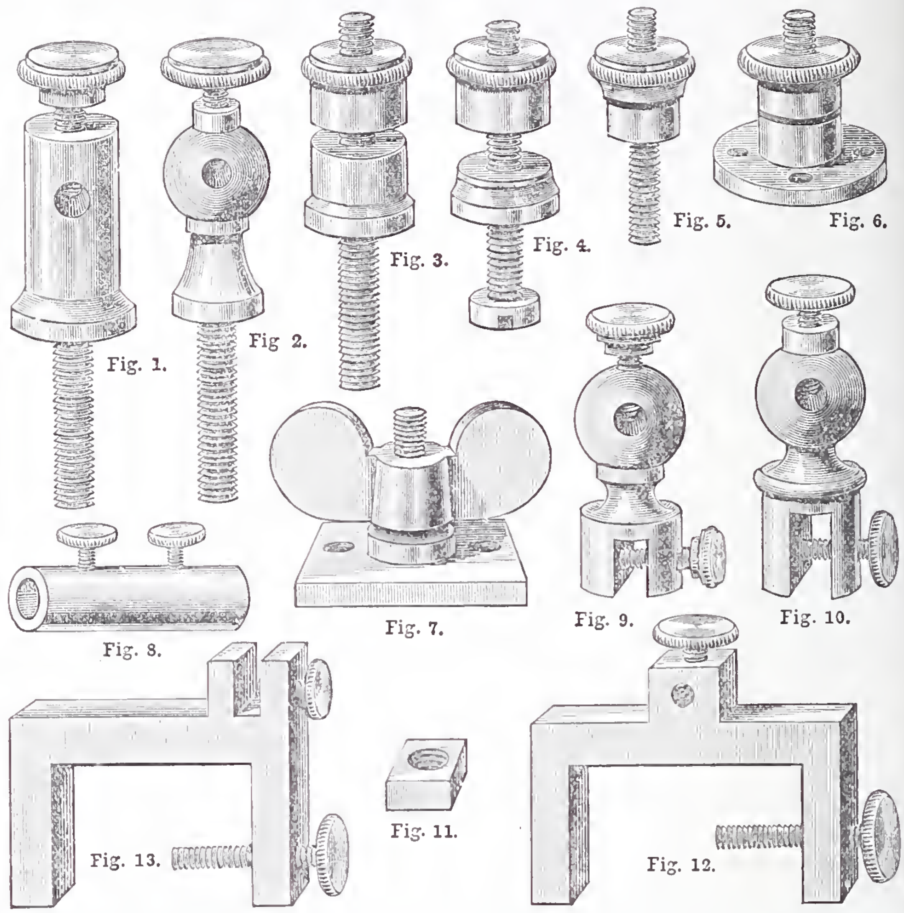


Fig. 1.—Straight Pattern Binding Post. Fig. 2.—Ball Pattern Binding Post. Figs. 3, 4.—Telegraph Pattern Binding Posts. Fig. 5.—Nut and Pin Terminal. Fig. 6.—Flat Base Terminal. Fig. 7.—Butterfly Nut Terminal. Fig. 8.—Wire Connector. Figs. 9, 10.—Binding Screws for Zinc. Fig. 11.—Binding Post Nut. Figs. 12, 13.—Clamps for Carbon Block.

employed in Leclanché batteries. Fig. 8 shows a wire connector made out of a piece of brass tube. Two holes are drilled and tapped in the side of the tube to receive two brass screws as shown in the sketch. These connectors are useful when we wish to connect a broken wire or connect two wires together. Thick brass tube should be used, or else a lug should be soldered to the side to thicken it where the holes have to be made, else the holes will not contain enough screw threads to allow of the screws being tightened on the wires. Figs. 9 and 10 show two forms of binding screws made and sold as clamps for connecting wires to zinc plates and cylinders. These patterns of binding screws are both faulty. The milled heads of the screws hurt the finger and thumb of the workman whilst unscrewing them from the battery. Both forms get weakened at the angle of the jaws by the action of the mercury from the zincs, and then one of the jaws breaks off. The threads on the screws are very fine, and soon wear out. Figs. 12 and 13 show two forms of clamps sold for connecting wires to the carbon blocks of the Bunsen battery. Fig. 12 is a well-formed clamp, but the milled heads of the screws are objectionable. Fig. 13 is only suited to cells connected by strips of copper, or by means of special wires flattened at one end and soldered to a copper strip. They are inconvenient forms of clamps for any purpose.

In No. 1 of WORK, page 4, I show two patterns of clamps made to my order by Messrs. H. Dale and Co. It will be seen that the jaws of the zinc clamp are massive and strong, and the angle of the jaw stands high above the zinc when the clamp is fastened to the plate or cylinder. The top screw passes through a long neck cut with several threads, and this gives it holding power. The threads are also coarser than those in general use, and flat thumb-screws have been substituted for milled heads. The carbon clamps are similarly well made and strong.

The binding screws and clamps of Bunsen cells often get very dirty, and the screw threads become corroded by fumes from the acid. To lessen the labour needed to keep these parts clean and in working condition, have them lacquered whilst new. As the lacquer gets damaged, make the brass warm and dip in melted paraffin; this will cover up bare spots and protect the threads of the screws from being corroded. It is also well to oil the threads of the screws whilst they are dry, before setting the cells up. Clean off all oil and paraffin from the parts to be in actual contact with the battery elements. Should the screws become corroded, soak them first in warm water to loosen the corrosion, then wipe this off with a piece of rag, but be chary of dipping them in acid to clean them, as this will cause the screws to work loose and lose their grip. If binding screws are cleaned and oiled before they are put away, they will always be ready for use and never set fast with corrosion.

Bottles.—Glass bottles stoppered with ground glass stoppers should be the only bottles used by the electro-plater for his acids and solutions. For large quantities of solution the acid-proof stoneware bottles made by Messrs. Doulton, of Lambeth Potteries, will give satisfaction, but common stoneware bottles are untrustworthy, for sooner or later the glazing gives way and the bottles leak. Smaller quantities of acids and solutions are best kept and handled in the tall half-gallon glass bottles known as Winchesters. Bottles holding from 20 to 40 fluid ounces, are handiest for daily use in the laboratory whilst testing and assaying. Strong ammonia, and carbon bisulphide, together with any other highly volatile liquids, should be kept in closely stoppered bottles, with the stoppers tied down. Hydrofluoric acid must be kept in gutta-percha bottles. Should a ground glass stopper become fixed in a bottle, some care and ingenuity must be brought into practice to effect its safe removal. First gently tap the sides of the top of the stopper with a small wooden mallet or the handle of a hammer, then grip the top in the jaws of a stout pair of iron tongs and try to wrench it around. Do not use sufficient force to twist off the neck of the bottle or the top of the stopper, but enough to start the stopper if slightly loosened by tapping. Should this treatment fail to move the stopper, next put a few drops of paraffin oil around it near the rim of the neck and allow this to penetrate the crevice between the stopper and neck. Then try another course of gentle tapping and wrenching. If still stubborn, get an assistant to hold the bottle whilst you twist a towel or piece of flannel around the neck, and work it to and fro rapidly for a few minutes; this will warm the neck by friction and cause the glass to expand. If this fails, the neck should be warmed with flannel soaked in hot water, or with a flame of a spirit lamp, when the glass of the neck will expand and leave the stopper loose. To prevent stoppers from becoming fixed, wipe them with an oily rag before inserting in the neck of the bottle; also wipe the inside of the neck to free it from salts, as these crystallise in the neck and frequently fix the stopper. Do not stopper warm liquids, but allow them to cool before stoppering, as these in cooling create a vacuum and draw the stopper fast. Do not mix sulphuric acid with water in a bottle, as the heat developed is likely to crack the glass. Always label each bottle as filled, and paint them with warm paraffin if intended to be set aside for some time.

Borax.—Sometimes named biborate of soda. This is a compound of boron, sodium, and oxygen, found as a natural salt in India. Its composition is represented by the chemical formula $Na_2 B_4 O_7 + 10H_2 O$. This salt is useful in the workshop and in the laboratory as a flux for brazing operations, a flux for smelting gold, and a vehicle for substances being analysed by the blowpipe. It may also be used as a case-hardening compound, with some success. It also forms an ingredient in mixtures used for colouring gold, and whitening silver. See notes on *Gold Colouring*, and *Silver Whitening*.

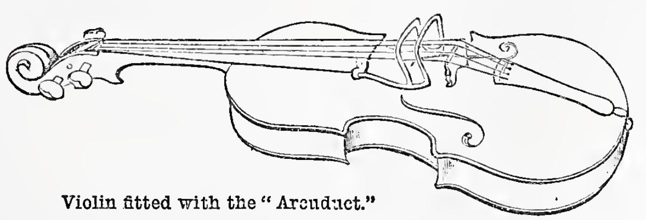
Boxwood.—The seasoned wood of the box tree forms a good substitute for such insulating substances as ebonite and insulite. It is used as insulating rings for the commutators of dynamo electric machines, collars for the insulated pillars of electric bells, and bobbin reels for these and other instruments. The dust from this wood, obtainable from wood engravers and boxwood block-makers, forms the best material for drying electro-plated articles, since it does not stain the pure silver deposit.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

94.—The "Arcuduct."

The "Arcuduct," or, in plainer English, the bow-guide, is a small but useful little instrument, devised and recently patented by Mr. Sydney J. Pope, Purewell, Christchurch, Hants. It is an appliance that is easily attached to the finger-board of violins and violoncellos, and has for its object the guiding of the bow in the proper position. It is claimed by Mr. Pope that it insures perfect bowing, and if it will accomplish this, it must manifestly be a great boon to all those who are learning and practising on the violin and any instrument of its class, whether small or large. The appliance itself is made of wire bent into the necessary form, and filled at the end with a small clamp, actuated by a screw with a milled head. By this clamp it is attached to the upper right-hand corner of the finger-board of the violin as shown in the accompanying illustration. Starting from the clamp, the wire is bent in such a manner as to form two arches about $\frac{5}{8}$ inch apart in the small size, which cross the strings just midway between the top of the finger-board and the bridge. I am told that in playing the violin, the bow should cross the strings in a direction at right angles to the strings themselves, and midway between the bridge and end of the finger-board. I do not play the violin myself—indeed, I do not play any instrument, though a stray correspondent will sometimes try to convict me of playing the fool, if nothing worse—so in this case, I have been obliged to seek information from those who do. Thus, according to what I have been told, the young violinist when compelled to keep the bow between the two arches of wire is obliged to draw it across the strings just in the right place, and thus is led to acquire a habit of bowing which is never forgotten. The "Arcuduct" may be had in brass or electro-plated. For terms, dealers and those who wish to buy them singly must make application to the patentee.



Violin fitted with the "Arcuduct."

95.—A Useful Boring-Bit.

The accompanying illustrations show from three different points of view the form and construction of a very useful boring-bit which has long been in use in the United States of America, and which was first shown me by an amateur who had been travelling in the States, and had there purchased some of them. I then strongly

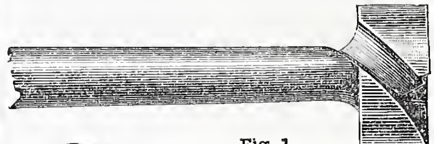


Fig. 1.

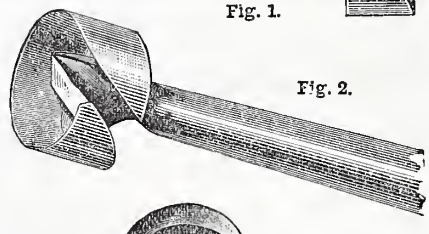


Fig. 2.

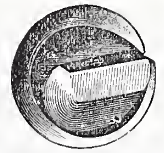


Fig. 3.

Fig. 1.—Boring-Bit, Elevation or Side View. Fig. 2.—View of ditto, showing Form of Interior. Fig. 3.—View of ditto seen as in Plan.

advocated its introduction into this country, but heard no more of until it was brought to me the other day by Mr. Melhuish, of the firm of Richard Melhuish & Sons, 85 and 87, Fetter Lane, London, E.C., and shown to me as a new tool. The nature of the bit will be sufficiently apparent from the illustrations, and it will suffice to say that it does the work of the centre-bit, but does it very much better, for the bottom of any hole that is bored by it is flat and without any mark whatever, while the bottom of a hole made with a centre-bit has in its centre a hole equal in length to the central projecting point of the bit. For this reason, the American boring-bit is especially useful for dowelling, etc. The bits have a long shank, and as they are constructed in a such a manner as to facilitate clearance, holes may be bored to a considerable depth with comparatively little labour. I have a piece of wood before me, in which all that can be done with the bit is shown in a thoroughly practical manner. For example, by boring in two directions at right angles to each other, a square hole may be made which requires but little clearance at the corners with a chisel to make it square at the bottom as well as at the sides. Diagonal holes can be bored with it very readily, and it can be used for boring conical indentations wider at the bottom than at the top by holding the bit in a slanting direction. By means of a series of bits ranging from $\frac{7}{16}$ in. upwards to $1\frac{3}{8}$ in., a set of depressions can be bored, descending by steps, as it were, from the widest to the narrowest diameter named. By moving the bit from point to point round the circumference of a circle, a circular groove of uniform depth may be easily cut. In short, a skilful workman may turn the bit to account in a variety of ways. I do not know the price or the number of bits comprised in a complete set, so readers who wish for information on these points must kindly write to Messrs. Melhuish & Sons, instead of to me. I will, however, when I am myself acquainted with these points, name them in "Shop."

I have no hesitation in recommending this recent introduction from the States as a most useful and desirable addition to the varieties of bits that are used with the brace.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

_ Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Home-made Planes.—E. P. W. (*Warrington*) writes:—"The first thing I look at when I get Work is 'Shop,' and on page 300 I see a moulder approves of my plan. It was a moulder that suggested it to me many years since, and I found it worked well. Some time I will describe a plane that I made myself that will answer for both smoothing plane and rabbet plane, and how to make the pattern, if you think well of it. I know wherever I have worked all hands have used it, and I have had a good price offered for it many a time."—[By all means send me a paper on your plane on approval.—Ed.]

Papers in Work.—D. C. (*Huddersfield*) writes: —"I was very pleased to see my letter appear in a recent number of Work. I was afraid you had thrown it into the waste-paper basket, as it is a few weeks since I wrote to you. I may say I am still looking for the promised article I mentioned in my previous letter, and hope it will not be long before it appears. I may tell you that I have just finished a pattern for an iron smoothing plane, which appeared in Work some few weeks since. I am anxious to have a casting made from it, but do not know how to get it made. I am very much interested in the letters by E. P. W., 'Pattern of Plane for Casting,' and 'Home-made Planes,' by Bert, also the papers by the author of 'Home-made Tools.' I have been thinking it would be a great advantage to many of the readers of Work, who are trying to carry out the instructions of the author of 'Home-made Tools,' if you would try and prevail on Bert to write a few plain instructions telling us how to mould castings for home-made planes. I see, according to his letter, he is a practical man, having made dozens himself. I should also like to repeat the query of G. T. M. (*Liverpool*), with reference to instructions how to make small furnace for melting iron or steel. Also will A. H. (*Wolverhampton*) give us a fuller description of his fan or machine for current of air? I should prefer the fan being of iron or brass, and the sides and top of iron, with detailed instructions how to make the machine complete."—[I daresay Mr. Milnes, lathe and tool maker, of Bradford, would make a casting for you from your pattern if you write to him. I shall be happy to have papers on approval on the subjects named in your letter from the correspondents specified therein, if they will write them and send them to me.—Ed.]

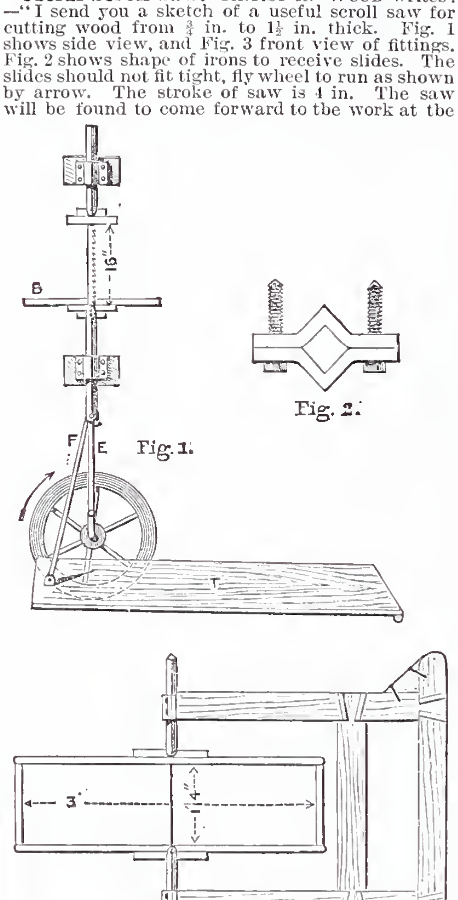
Building Construction.—C. S. (*Newcastle-on-Tyne*) writes:—"Referring to the letters of W. P. and A. E. D. in No. 13 concerning building construction, is it your wish that the various readers of Work who take an interest in the subject should supply plans of various houses to be published in Work, or do you intend, in the course of time, to give a series of articles upon it? If you wish to have plans forwarded by your readers, I would try and do my best to help, as I take an interest in the subject, although I have never before sent to any paper."—[I shall be glad to see any plans you may desire to send.—Ed.]

Overmantel, with Cupboards.—Clerk (*Leytonstone*) writes:—"When I saw and bought the first number of Work, I was not entirely a beginner at woodwork, as I had been through two courses of lessons in carpentry at Toynbee Hall, each course consisting of making various joints, under the instruction of a master, during an hour and a half once a week for three months. In addition to this practice, I had made some Oxford frames out of the top of an old deal table, had knocked up a chicken house with old packing cases, and various other jobs of the same sort, together with a few fretwork frames. But Mr. Adamson's design for an overmantel fired my ambition, and I made up my mind that, at any rate, I would try and make it. Last night I finished it after working for about a couple of hours nearly every evening for the last three months. The wood I used was common ¾ in. floor boarding, together with yellow deal ⅜ in. thick. I took the liberty of altering the design slightly, and instead of making cupboards I put panels covered with Lincrusta Walton at the back, and the open spaces under the side shelves are also filled in in the same way. In the centre, instead of a shelf across the middle, I have inserted an old-fashioned-looking glass, with a wide rosewood frame, which has been in our family for the last century and a half. This is let into rebates, cut in the two middle uprights for the purpose. The woodwork is finished off with two coats of Stephens' satin wood stain, and varnished. The Lincrusta is enamelled sea-green to match the wall paper of the room. Now that it is done, it looks fairly decent, and I don't think any ordinary observer would know that it was done by a nineteen-year-old clerk in his spare time, the total cost (exclusive of the Lincrusta, which was given me) being 6s. 2d. I should like my next job to be an umbrella stand. Could you see your way to giving me a design for one in your valuable columns? The main point with me is that it should be cheap, made of wood, and with as few tools as possible, as I have such a small collection of these. I hope that Work may continue to be as useful to every one as it has been to me; if so, I am sure its circulation will be enormous."—[Yes; you shall have an umbrella stand as soon as I can find room for it.—Ed.]

Swords.—J. C. K. (*Paris*) writes:—"In my article 'Swords' some errors got into print. Page 291, line 25 from bottom of first column, should be 'heating.' Second column, line 32 from bottom, should be 'elliptic.' Page 292, line 34, should be 'play,' not 'plug'; line 63, 'slings,' not 'strings.'"

Swords and Work.—W. E. M. (*Pall Mall*) writes:—"I was pleased with a paper in No. 19, and that was about swords. I showed the article to my master, and he showed it to some more of the workmen, and it has caused three more numbers to be taken in every week. They were so pleased with it; it was the first time they had Work, and they say it is worth recommending to all classes of workmen. For my part, I am satisfied with it, and wish it every success, for I have never before seen such a good specimen of the help-one-another as our little corner 'Shop.'"

Useful Scroll Saw.—Artist in Wood writes: —"I send you a sketch of a useful scroll saw for cutting wood from ⅛ in. to 1½ in. thick. Fig. 1 shows side view, and Fig. 3 front view of fittings. Fig. 2 shows shape of irons to receive slides. The slides should not fit tight, fly wheel to run as shown by arrow. The stroke of saw is 4 in. The saw will be found to come forward to the work at the



Useful Scroll Saw.

B, Table; F, Rod to fit end of Slide and Treadle; E, Rod to fit end of Slide and Crank; T, Treadle Board.

down stroke. It is very easy to work, and will cut wood of the thickness named very quick. Use a saw ⅜ in. wide, ground thin at the back. This saw has been in use fifteen years for trade work."

Moore's Patent Folding Chair.—Mr. J. T. Moore (*Langley, Macclesfield*) writes:—"I note that you have an illustration in No. 23 of Work of a chair, No. 3, that is patented for this country. You are no doubt aware that by the Patent Law of 1883 to make a copy of a patented article, although for personal use, is an infringement, and is actionable at law. Kindly draw attention to the above facts in your next. I am quite sure that your excellent paper will not knowingly encourage injustice in any form."—[Certainly not. Work will never lend itself knowingly to the countenance of anything that is wrong, and therefore I publish your letter with the utmost pleasure. Mr. Lebrun, I am sure, was as ignorant as I was that the form of chair to which you allude was patented in this country, but, you see, none of us can know everything, and hence its appearance. The illustration was derived from an American source. Kindly note that I shall be happy to notice in "Our Guide to Good Things" any speciality you may have or produce, whether patented or otherwise.—Ed.]

Æolian Harp.—G. L. G. writes:—"A detailed description how to make an æolian harp would be an appropriate subject for Work, and welcome to many a subscriber this winter, including myself."—[Will any competent reader oblige?—Ed.]

II.—Questions Answered by Editor and Staff.

Steel Distorting.—G. H. (*St. Helens*).—The reason the steel gets distorted in hardening is, I think, because you make it too hot, and, in dropping it in the oil or water, you let it get horizontal. Just get it a dull red and drop it carefully in perpendicular or endways. I seldom distort anything by going to work this way.—A. B. C.

Wood Pulp.—E. A. (*Liverpool*).—Wood fibre is, we believe, prepared in this country, for the use of paper-makers and others, by crushing withy poles between heavy rollers. Papier-mâché articles made from it in the ordinary way with glue paste would necessarily swell if exposed to wet, but a substance impervious to moisture might be formed by mixing with boiled oil, or some similar medium. As regards procuring pulp, and for further information, E. A. is referred to Messrs. McCallum and Hodson, Summer Row, Birmingham.—S. W.

Silvering Worn Harness Mounts.—B. (*Balsoon, Navan*).—Unless you care to go to the trouble of re-electro-plating your harness mounts, the best thing you can do is to get some silvering solution, and apply to them. I expect you will be able to purchase it at any silversmith's or ironmonger's; if not, here is a recipe:—Nitrate of silver, fifty grains; potassium cyanide, four grains; liquor potash, fifty drops; water, half-ounce (by measure). Mix and bottle. N.B.—This is poison. Apply with a piece of flannel, and use a little plate powder. Polish with chamois leather.—R. A.

Zinc Clock Dial.—Decorator (*London*).—The dials of small circular American times and alarms are printed on paper, and then pasted to the zinc, but the larger American clock dials are, I think, hand-painted. The second query, as to designs on glass doors of clocks, I cannot answer, but I rather think they must be transfers, and then painted over at the back to fix them.—A. B. C.

Photo Camera.—D. M. (*Inverness*).—The size of camera must depend on that of the plate to be exposed. As you will have seen in the article on pin-hole photography to which you refer, the image being always in focus, the length of extension is comparatively unimportant. The further the plate from the hole the larger the image, with indistinctness slightly increasing. Any needle will do. Of course it is only the point that is used, as the hole must be small. Any of the ordinary dry plates, films, etc., may be used. In fact, the only difference in the process consists in having no lens.—L. J. P.

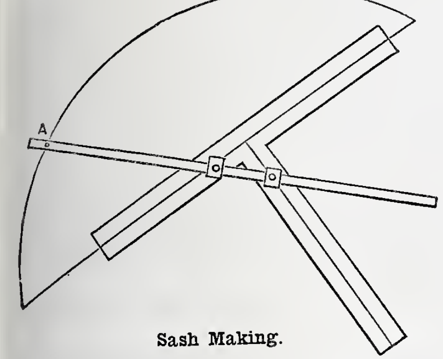
Soldering Aluminium.—G. F. B. (*Dalston*).—(1) On receipt of your letter, I communicated with the secretary of the Aluminium Company, Limited, 115, Cannon Street, E.C. In his reply he says, "The soldering of pure aluminium is a difficulty, and no certain method of doing it is now generally known." The metal has been soldered by Mr. Watts, of 8, Carnaby Street, Regent Street, W., and the soldered articles are exhibited by Messrs. Percy Edwards and Co., 71, Piccadilly, W. Mr. Watts keeps his process of soldering a secret. I *collected* for Rouge Buff all the information obtainable on the subject, and, therefore, gave a guarded reply. I have not soldered the metal myself. (2) The ingredients composing the solder must be melted by fire. I find it best to melt aluminium first, using common salt as a flux, and then add the other metals of the alloy. Granulate and re-melt two or three times. (3) By solid paraffin is meant the pure paraffin wax used by electricians for insulating purposes.—G. E. B.

Electro-gilding in Colours.—Aqua Regia (*York*).—To electro-gild in colours you must have a separate bath for each separate colour, and keep it specially for this purpose. To gild *green*, add silver-plating solution to the gilding solution in very small quantities at a time until the required tint has been obtained; too much silver solution will cause a whitish deposit, known as *white* gold. To gild *red*, add a solution of copper cyanide, or use a copper anode until the desired colour is deposited. To gild *rose pink*, first gild the article and scratch-brush it, then deposit a mere flash of silver on the surface; on this deposit a mere tint of copper from an alkaline copper bath, and then just a blush of gold to tint the copper. The process is a delicate one. To oxidise brass, paint it with a solution of chloride of platinum. To oxidise silver, paint the parts with a fresh solution of ten grains sulphide of potassium dissolved in a wine-glassful of hot water. Apply with a camel-hair brush.—G. E. B.

Electricity from the Earth.—Miller (*Leeds*). —It is quite true that an electric current can be obtained from two plates of dissimilar metals sunk in the earth, such as zinc and copper or zinc and carbon (represented in the case you quote by coke).

I have obtained a current from the gas-pipes and the water-pipes of a house, and a friend of mine has actually done electro-gilding with such a current by way of experiment. At the time you speak of (1844), great things were expected of this discovery (?), but its usefulness is limited by the low pressure of the force thus obtained.—G. E. B.

Sash Making.—JOINER (*Dalston*).—Instructions in sash making would take up more space than could be afforded in a brief reply in "Shop," but a paper dealing with the subject will shortly appear, in which the intricacies of setting out, and the various joints that puzzle the novice, will be clearly shown. The tool you inquire about for drawing ovals is usually called "trammels;" you can buy it



Sash Making.

at a tool shop, but it is usually a home-made thing, and consists of a long piece of wood about ½ in. square, on which are two brass slides with studs on the underside. These studs work in grooves cut in a **T**-square, and the size of the oval is regulated by the distances from the end of the rod and between the studs. The annexed figure will help to show you how the apparatus works. A hole is bored at A for the insertion of a lead pencil.—G. LE B.

Electro-Plating.—MANKTELOW (*Winchett Hill, Kent*).—Plating can be learned by the most inexperienced person, if he will only faithfully follow the directions of his teacher. Amateur plating (such as silvering and gilding alberts, bracelets, brooches, etc., or even spoons and forks) may be easily learnt, and I hope to give some easily understood lessons on this subject in a future number of WORK. If you will take the trouble to read the article on *Anode* in "Notes for Electro-platers," page 123, I think you will fully understand this term; whilst in the first three numbers of WORK you will find illustrated articles on Bunsen cells.—G. E. B.

Accumulator Plates.—D. S. (*Holloway*).—(1) The composition of accumulator plates is lead, coated with red lead, or with lead peroxide. (2) You may make them by the following directions, but you will see that the process is tedious. Procure lead plates of the requisite size, and let the thickness of the lead correspond with the superficial area of the plates, to prevent undue buckling. In cutting each plate, leave a lug 2 in. by 1 in. on the top to form connecting pieces. Perforate each plate with ⅛ in. holes all over. Make a paste of finely-ground red lead with oil of vitriol, and rub this with a lead or pewter spatula all over the plates until each hole has been closely filled and the plates coated with a crust of the paste. Connect the plates in pairs, one on each side of a strip of teak or mahogany (well soaked in hot melted paraffin), by means of short brass screws. See that the screws are not long enough to go through the strips and touch the opposite plate of lead. The plates are now to be placed in their cells (a pair of plates in each cell) to be formed, that is, to be charged and discharged again and again with a strong current of electricity from a dynamo until all the red lead (lead oxide) has been converted into lead peroxide. The cells should be of glass, acid proof stone-ware, or a similar acid proof and insulating substance, and should be charged to near the top of the exposed plates with a solution of one part sulphuric acid to twelve parts of water. Each pair of plates must now be included in an electric circuit, either with a dynamo or a very large battery, if the plates of the accumulator have a large area. If the voltage of the generator (dynamo or battery) is high, several pairs of the plates may be connected in series; but if the current has an E. M. F. of, say, three volts, only one pair of plates may be charged at a time. The E. M. F. of a pair of accumulator plates being two volts when fully charged, we must employ a generator having a higher E. M. F. than the sum total of the plates in series to be charged with it, or the accumulator will discharge itself back through the battery or dynamo, to the injury of either. Charge the plates for half an hour at first, then connect them up to some work, and let them discharge themselves; again charge for a longer period, and again discharge them. Continue this until the plates are formed, that is, until each square foot of positive plate will yield six ampères of current. (3) I should advise you to consult a practical electrician, and abide by his advice respecting the size of accumulators required for your installation, and the other matters connected therewith. (4) If you get the plates from the E. P. S. Co., they will advise you respecting installation, or you may get both plates and advice from Mr. H. Dale, 26, Ludgate Hill, E.C. (5) I must leave this matter to be decided by our Editor. I cannot give professional advice by private letter without a prepaid fee, the amount of which would depend on the work to be done.—G. E. B.

Article for Iron Moulders.—D. J. J. (*Birmingham*).—There is no place in Birmingham, or anywhere else, where you can get your invention registered on credit. The stamp for protection for nine months costs £1. The necessary forms are supplied free at the Chief Post Office, but you must pay for the stamp.—F. C.

Prospectuses of WORK.—E. L. R. (*Oxford*).—These were forwarded to you on receipt of your request for them, and should have reached you long ago. I take the opportunity to thank you for your good opinion of WORK, and your intention "to take it in as long as it continues." That I trust will be beyond my time and yours, too.

Cutting through Paper Tubes.—D. B. (*Glasgow*).—In the papier-mâché trade the approved method of cutting up paper tubing is in the lathe with a keen knife-like chisel, and it is easy to understand how the neatest cuts are to be made in this manner. But paper soon blunts the tool, and thick tubing is frequently merely nicked in the lathe, and then sawn. In default of a lathe, we do not see how D. B. can cut his tubes better than with a fine tenon saw.—S. W.

Covers for WORK.—J. H. (*Wolverhampton*).—The pasteboard covers were suggested as temporary means to keep the numbers clean until binding time comes. Your wish is that the advertisements could be relegated to covers, on the plea that as the numbers are now constituted the advertisement pages must, of necessity, be bound up with them. Well, why not bind up the advertisement pages? In course of time they will prove most useful to the readers of WORK as a record of "What to buy, and where to buy it." Everything, it is said, comes useful once in seven years, but I feel sure that the advertisement pages in WORK, after a time, will prove useful to many, perhaps, once in seven days, if not much oftener.

Book on Paints.—SUBSCRIBER (*Sunderland*) writes:—"Can you inform me of any manuals of technology or any work of chemistry, or colour striking? Also can you tell me where to get 'Trade Secrets,' and the price of the book?"—A work which might suit you is, "Painting and Paint Materials: a book of facts for those who deal in paint materials" (10s. 6d.), Spon & Co., 125, Strand, London.

French Polish.—C. H. W. (*Hastings*).—I am under the impression, from what you now say about not being able to mix the ingredients, that your question was answered in due course for the "Shop" columns. Owing to the length of time which must necessarily elapse between going to press and publication, it is impossible that answers can appear immediately. In case you have not discovered the cause of your want of success, and presuming your inquiry is the one referred to above, I can only advise you not to use so much polish, or to substitute for it methylated spirits. If you had told me exactly how you have mixed the things, I might have been able to discover the cause of your failure; as it is, I cannot do more than I have. The receipt is well known among French polishers, and is always effective.—D. A.

Imitation of Leaded Windows.—SPECTATOR (*Skipton*).—We presume from SPECTATOR'S note that the imitation of leaded lights required is that known as "Patent Glacier." The makers of this are Messrs. M'Caw, Stevenson, & Orr, Belfast. The agents for its sale in Great Britain are Messrs. Perry & Co., Holborn Viaduct, London, who supply a book of designs, with sample, instructions, etc., by post for 1s. It can, doubtless, be procured through any fancy shop.—M. M.

Dressing Skins.—SEALSKIN (*Liverpool*).—To prepare his roughly dressed sealskins for rugs, we do not see that our correspondent can do better than damp them (by rolling in damp cloths), stretch them tightly, and rub down the flesh side, till even and uniform, with pumice stone and powdered chalk. Lumps of flesh or fat will best be removed with a knife. The chalk will clean the hide by combining with and taking up its grease and dirt. Any skin can be made soft and pliant by thoroughly working oil or yolk of egg into its pores. By the last substance the beautiful softness of kid gloves is produced, the skins for making which—like our correspondent's sealskins—have first been roughly cured with alum. After egging, it is usual to draw the skin backwards and forwards across a blunt semi-circular knife fixed upright; this operation is called "staking." In the language of the workmen, "Staking brings the skins to themselves again," *i.e.*, it makes them appear as pliant as when first stripped from the animal.—M. M.

Horsehair Cleaning.—R. J. P. (*Feltham*).—The hair in question is, of course, for use as stuffing in upholstery work. If it is new hair, boiling with a little washing soda will effectually clean it, and remove all smell; and drying afterwards in an oven will tend to make it curl up, which is desirable. If it is old stuffing which has been curled, boiling is not recommended, as it would take out the curl, and so render the hair less elastic. To curl horsehair properly needs appliances which an amateur will not possess. In this latter case, the better plan will be to beat out the dust thoroughly with a pliant stick; to shake the hair in a sieve or riddle, to remove short fragments, foreign matters, etc.; to sprinkle it from a watering-can with dilute Condy's Fluid (this, if done with care, will not destroy the curl); and to dry it, which will best be done in an oven just *not* hot enough to singe it, as this will make sure of destroying any germs of disease or insect life which may have escaped the disinfectant.—M. M.

Tenant's Greenhouse Cost.—A. P. (*Heaton Chapel*).—The cost of material for making the "tenant's greenhouse" will vary according to the locality, as wood is dearer in most inland towns than in places near to a seaport; but I should say that the timber necessary could be bought for, say, £8 to £10. If you want to be economical, use white pine, which is the cheapest, although not so easy or pleasant to work as yellow; and for the sole framing you might procure an old beam at a builder's yard for a few shillings that would suit your purpose quite as well as new wood.—G. LE B.

Carving in Cast Iron.—PIPER (*Manchester*).—I am not quite sure that I understand your meaning. You ask "How to carve in cast iron, etc., such as these sweets we see, fish, raspberry, dolls." Do you mean cast iron moulds or dies? If so, these would not be carved, but cast from a plaster or clay model, and chased up afterwards.—J.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Bicycle Repairs Tools.—ANIMO ET FIDE:—"As a practical repairer of cycles, my experience is that there is almost no end to the tools that may be bought for this work, as a great many are to be had that are more ornamental than useful. As to the tools that seem to me absolutely indispensable for cycle repairing as a pursuit, I will mention them as shortly as possible. The lathe and slide rest are all right to begin with, if the heads are not less than 4 in. About the best chuck is a Cushman two-jaw, fitted to the lathe mandrel. This chuck will take in objects from about 2 in. down to ¼ in., and is splendid for holding the larger-sized drills. N.B.—I never use any other than twist drills, except for boring out spoke stumps; for drills under ¼ in. shank down to No. 14 B.W.G. (Birmingham wire gauge) the 'Essex' drill chuck, price 10s. (Britannia Co.), is A 1. It is held by the 'Cushman' in the lathe, and with these you can drill almost anything. A leg vice of, say, 4½ in. jaws, fixed to a firmly fitted-up vice board, you must have, also a good hand vice of, say, 1½ in. jaws, to hold small articles for filing, etc. A strong pair of cutting pliers; an assortment of files; a taper reamer of square section. A ratchet drill stock is indispensable to drill out old spoke stumps. Then as to screwing tackle. A die stock and set of taps, say, from ⅝ in. down to ¼ in., and a screw plate with taps from ¼ in. down to, say, 18 B.W.G., are necessary. The spoke grip is about the first tool taken in hand, and the last to finish the repair of a wheel with. It costs from 1s. 6d. to 2s. When you get a wheel to repair with butted spokes, a difficulty comes in that does not exist with the direct spoke. A head has got to be worked on the spoke after it has been passed through the rim of the wheel. To head the spoke in these circumstances, a somewhat ponderous spoke-heading machine is used. I make use of a simple substitute which does the work very well. It is shown in the annexed cut (Fig. 1). A A are two plates of steel 4 in. by 2 in. by

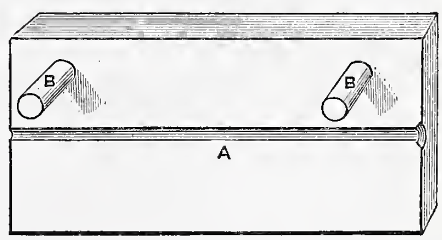


Fig. 2.

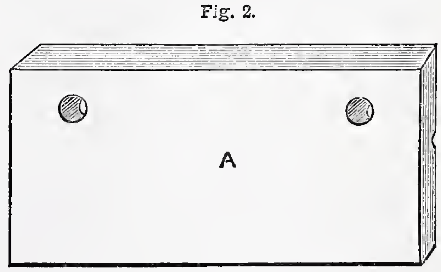
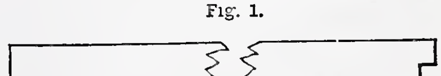


Fig. 1.



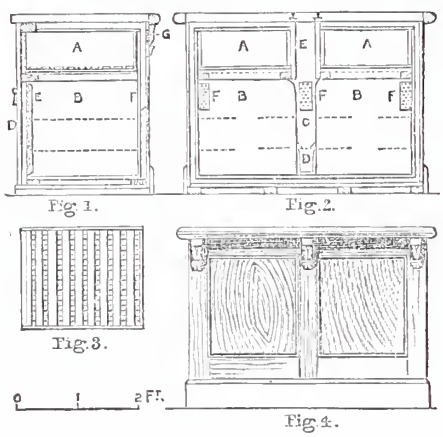
Bicycle Repairs Tools.

½ in. on the upper edges, and $\frac{1}{16}$ in. less on the under edges; in one of the plates are firmly fixed two steel pins, B B, ⅜ in. thick; they fit to slide into two holes in the other plate. Along the centre of both plates is cut a groove, either circular or V-shaped, and somewhat less than the half-section of the spoke. The two plates being placed together, the right-hand end is countersunk to the size of a spoke head. To use this tool the spoke is placed in the groove with the end protruding about $\frac{1}{16}$ in., and the plates fixed firmly in the vice. The head is now staved up cold with a hammer. In the case of butted spokes the wheel is placed in front of bench board, with the rim near the vice, and the spoke having been previously screwed home in the hub and cut to length at the rim, allowing $\frac{1}{16}$ in. to make the head, it is screwed from the hub, pulled through the rim to the vice, when the 'heading block,' just described, being put in vice with the spike, as mentioned, in it, the head is made with ease. The spoke is again screwed into the hub with the grip before mentioned. This heading block I made from two pieces of a heavy file softened to bore in the fire. If your correspondent means to go the length of brazing, he will require a forge with a fan blower or blowpipe. I use a fan blower fitted to a small forge, and it does very well for brazing, the forge being necessary for all kinds of light forgings, tempering drills, heating tyres, cementing rubbers, etc. In fact, it cannot be done without. A grindstone is another necessity. A small one to run in the lathe might serve all purposes, grinding drills and slide rut tools, etc. Now, as to a buckled wheel. If the wheel is badly buckled, the chances are that the rim is cracked at the edges, in which case it had better be put aside altogether, and a new one put on. If the rim is whole, but very much twisted, the best way is to loosen all the spokes with the grip, then see how far the rim has come back to its proper position. If there are still any sharp side bends, place the rim on a block of wood, and hammer the bends straight with a wooden mallet; then proceed to screw up the spokes: some of them may be overhauled—*i.e.*, pulled out of the hub by accident, and the thread spoiled. Where this is the case the hub should be rescrewed with a tap a size larger, in order to work a fresh screw, and a new spoke, a size thicker, screwed to fit. The wheel is now adjusted by screwing in the spokes all round to the depth they were at first. The rubber being removed from the rim, a lath of wood may be used. This lath is as long as to reach from the hub over the rim. A notch is cut on one end of the lath (see Fig. 2); this notch is placed against the hub between the spokes, and a mark is made on the lath at the outer edge of the rim. A truly trained wheel has the outer edge of the rim equidistant from the hub all round, and that on both sides. The lath will at once show which spokes to screw up and which to bring back in order to achieve this result. I have frequently made wheels to run true by simply countersinking the rim every hole the same depth, cutting all the spokes exactly the same length, and screwing them all exactly the same number of threads, and, on putting up the wheel, screwing every spoke exactly the same depth into the hub. Such a wheel will as likely as not run dead true at once, without further adjustment. A buckled wheel is more difficult to put right than building a new one. Sometimes the spokes will not stand the strain necessary to pull the bends out of the rim; hence the necessity of hammering as before mentioned. When your wheel coincides with a mark on the lath at the rim all round, and when applied on both sides, then the hub will be found to project equally from the centre plane of the wheel. Now place the wheel on the axle, and allow it to revolve freely; then holding a piece of chalk steadily, let the parts that may be out of truth touch the chalk for two or three revolutions: do this on both sides. Then at the chalk marks, if the spokes feel tight, loosen them a little, or if the spokes on the opposite side of the chalk feel loose, tighten them up; clean off the chalk, turn the wheel again, and rechalk, repeating the adjustment of the spokes as before; continue this until the last vestige of wobble disappears. The spokes should all now give forth the same sound when twanged like the strings of a harp. There are several firms that send out materials in small parcels: Lloyd & Co., Warman Street, Birmingham; H. Matthews, Snow Hill, Birmingham; Wm. Bown, about the best place to get good things in bearings, etc., 308, Sumner Lane, Birmingham; Thos. Smith & Son, Saltley, Birmingham; Brown Bros., 7, Great Eastern Street, London, E.C. There are several others, but your correspondent would get well served with any of the above, and all of them send out price lists. I shall be happy to give any further information I can on the above subject to ANIMO ET FIDE, or others, by favour of our Editor."—A. S. P.

Broom and Brush Making.—ELECTRICITY (*Camberwell*) writes in reply to T. M. (*Rochdale*) (see page 253):—"I notice the above-named correspondent has a desire to make brushes for his own use. That being the case, I will volunteer (with your kind permission) to add further to the explanation already given respecting this particular handicraft. T. M. must bear in mind that if large quantities of brushes were wanted it would almost be compulsory to have a lathe and brushmaker's bits to bore the holes in the stock (or wooden part of the brush). But for a very limited quantity for household use, and without going to the expense of fitting up a brushmaker's shop, I should say the holes might be made by means of the brace and bit. The holes must be made very clear and placed at a regular distance from each other, but not too wide apart. When advanced so far T. M. must have prepared a hot pan of pitch (but not boiling), which can be kept in a liquid state by means of oil lamp or burning charcoal; then proceed with the stuff (already cut up to a certain length), and knock one end up level in the left hand, and with the right hand pinch off just enough stuff to exactly fill the hole in the stock. Have previously prepared a quantity of hemp (shoemaker's hemp), cut into lengths of about 5 or 6 inches. So when the bunch (or knot) of fibre is dipped into the pitch it must be tied round quickly and tightly with the hemp close to the level end of the stuff, say, within $\frac{1}{2}$ in. When that is so far prepared it must be dipped a second time into the pitch, then into the hole firmly to the bottom, each one in succession, until the broom is completed; trim off the uneven stuff with a pair of shears, then the broom will be finished. Having said so much, it must be understood that the theory of brush making, like everything else, requires practice before any good results can be shown. But still, nothing attempted, nothing done."

Drilling Square Holes.—A. C. O. (*London, E.C.*) writes in reply to A READER (see page 270):—"I notice in No. 17 of WORK, in your questions submitted to correspondents, is the following. A reader states that he noticed in a paper that the scientific method of drilling square holes has been found out and patented in Austro-Hungary. I beg to inform him this method has been discovered in England by Mr. Ainley, and patented (No. 8,688) some months since, in the names of Ainley & Oakes. This machine will shortly be offered to the public."

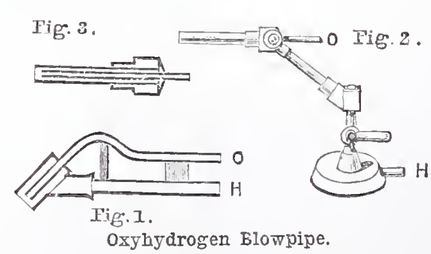
Refrigerator.—C. F. W. (*Hampstead*) writes in reply to URGENT (see page 174):—"I herewith enclose rough plans of refrigerator counter. I think it possesses one feature not met with in any other—viz., the ice drawers. My former communication gives details of manufacture. Description of plans: Fig. 1, cross section—A, ice drawer; B, cupboard; E, inside door, zinc lined; D, outer door that



Refrigerator.

shuts in ice drawer; F, perforated zinc ventilation that opens into shaft, having opening at top under truss, G. Fig. 2, length—A, ice drawers; B, cupboards; C, space between, formed with zinc lining. The ice water trickles down this from ice drawers into receptacle, D, where it may pass through bottom, or be drawn off with tap. E, space for water tank. Fig. 3, bottom of ice drawers formed with laths crossed $\frac{1}{2}$ in. apart. Fig. 4, front elevation with bead and flush panels."

Oxyhydrogen Blowpipe.—H. B. S. (*Liverpool*) writes in reply to T. W. B. (*Barnsley*) (see page 174):—"If you have not yet tried your oxyhydrogen blowpipe, I should advise you not to do so, as, if you use it, you will sooner or later have an explosion. The hydrogen and oxygen should not mix until they reach the nozzle. Besides, you do not require any reservoir like that figured. I give you a sketch of an oxyhydrogen blowpipe that I think will suit you. It is similar to those made by Fletcher, of Warrington. It would be best made in brass, and is intended to hold in the band, for soldering lead sheet, brazing, etc. The blowpipes on stand are similar to the following:—



Oxyhydrogen Blowpipe.

Enlargement of nozzle. O, tube for oxygen; H, tube for hydrogen. In each case you will require a reservoir of each gas, so as to keep up a steady supply.

Trade Notes and Memoranda.

THE *Moniteur Industriel* gives an account of the invention of a glass pen, which is furnished with a helicoid groove to carry the ink.

THE soda engine is gaining in favour in situations where steam is not allowed, or cannot be used. It is employed in the St. Gothard tunnel. The boiler in this engine is filled with a few tons of soda, and when a jet of steam is introduced it produces an intense heat, which gives the motive power. When the soda becomes saturated, the action ceases. A jet of superheated steam from a stationary boiler is then driven through the soda; this drives out the mixture, and the soda is ready for use again.

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3 Twist Gimlets	0	10	1 Pair Pincers	1	3
3 Patent Bradawls	0	8	1 Spokeshave	0	9
1 Screwdriver each, 10d., 1/6	2	4	1 Beechwood Gauge	1	3
1 Cabinet Scraper	0	5	2 Rasps, handled	1	10
6 Assorted Firmer Chisels...	4	2	1 Pencil	0	1
3 Assorted Firmer Gouges...	2	1	And our Patent Combined Tool, Joinery, and Wood-Carving Work Bench Cabinet, with Vertical Bench Stop and Patent Vice, &c., complete £5	10	0
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1 Frame Bow Saw	3	6			
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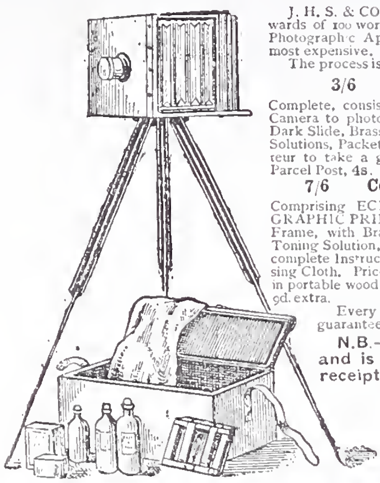

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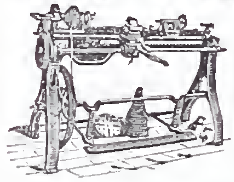

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 31.] SATURDAY, OCTOBER 19, 1889. [PRICE ONE PENNY.

AN AQUARIUM, WITH OPEN FERNERY AND FOUNTAIN COMBINED.

BY C. MAYNARD WALKER.

THERE are very few people, indeed, who do not regard an aquarium with some degree of pleasure, especially if it be tastefully designed, well made, and kept under conditions favourable to the health of its inmates. At any rate, if the latter condition be fulfilled it is a continual source of interest and pleasure, and I have little doubt that if it were more generally known with what ease and how cheaply a practical worker can construct a really good aquarium, and how readily it may be kept in a healthful and vigorous condition, almost every man of a mechanical turn of mind would have one of his own make. I propose in this article helping any such of our readers to this end by giving complete illustrated instructions based upon actual and long experience. And in connection therewith, the reader will permit me, before going further, to refer to a pleasant recollection of my own. It was in consequence of reading, many years ago when a boy, a short description of how to make an oblong aquarium, which appeared in one of the first numbers of THE QUIVER, that I was led to try my hand

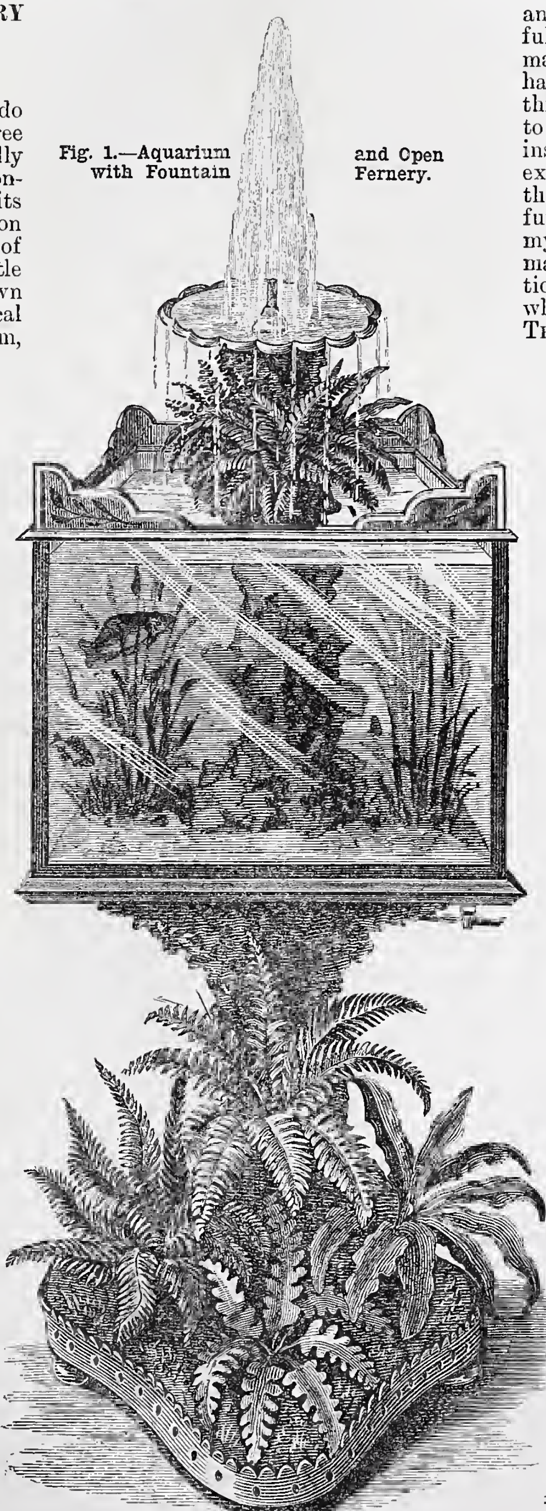

Fig. 1.—Aquarium with Fountain and Open Fernery.

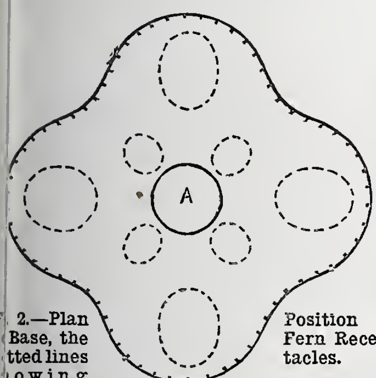

Fig. 2.—Plan of Base, the dotted lines showing Position of Fern Receptacles.

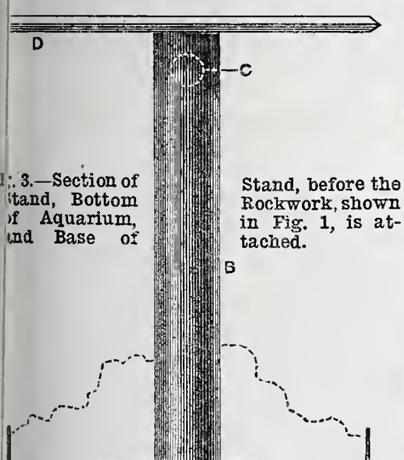

Fig. 3.—Section of Stand, Bottom of Aquarium, and Base of Stand, before the Rockwork, shown in Fig. 1, is attached.

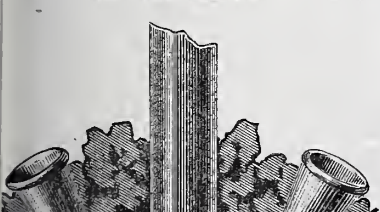

Fig. 4.—Section of Base, showing Method of Building up Rockery for Ferns.

Fig. 5.—Mode of Pocketing Castors before Rockwork is put on. Castors are subsequently bedded in Cement.

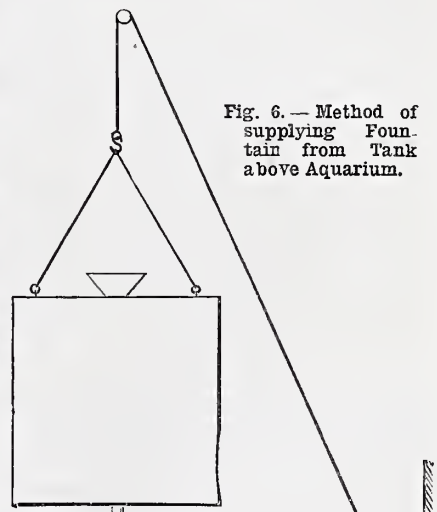

Fig. 6.—Method of supplying Fountain from Tank above Aquarium.

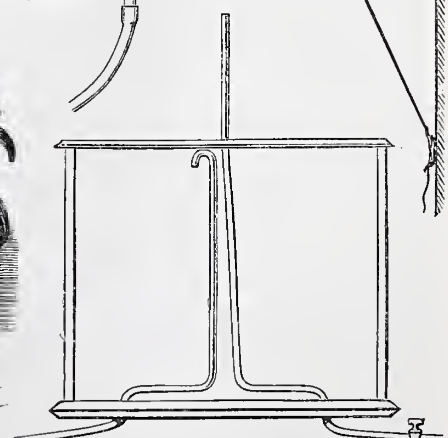

Fig. 7.—Diagram showing Position of Compo Pipes in Central Structure in Aquarium.

at mechanical work in making an aquarium. Since which time I have made a great many of various kinds. And as THE QUIVER and WORK are both published by the same house, it is, perhaps, not unfitting that the writer should return to the subject in the pages of the latter. From the illustration on page 481 it will be seen that the aquarium under consideration is intended to be a bold and somewhat massive article, suitable for standing in a bay window, the centre of a room, or other position where it can be seen to advantage; and although when finished it will be of considerable size, it will be found that the cost for materials will be very low.

The dimensions are as follows:—Height over all, 4 ft. 4 in.; stand (exclusive of castors), 2 ft. 4 in.; bottom of stand from round to round, 2 ft. 2 in. diameter; from hollow to hollow, 1 ft. 6 in. diameter; height of centre rockwork to under side fountain dish, 1 ft. 10½ in.; depth of the aquarium proper, 1 ft. 1 in.; width of aquarium at bottom, 1 ft. 7½ in. These dimensions may be varied, of course, to any extent, enlarged or reduced, but to make it much larger it is somewhat difficult to move if required, and again if much smaller the space is cramped; the writer found these dimensions worked up made a most successful affair in every way. The materials used in the construction are mainly zinc, glass, and cemented rockwork. The angle bar and rebated zinc, for making the aquarium frame, can be bought at any zinc workers, or direct from Messrs. Treggon and Co., Limited, Jewin Street, E.C., and the numbers of the various parts used are the numbers used by them in their catalogue. In making up this design make the bottom of the aquarium first: this consists of four equal lengths of No. 7 sash bar, 1 ft. 7½ in. each, and carefully mitred at each end so as to form when soldered up together a perfect square—an ordinary backed saw will do for this conveniently. The worker will observe that the sash bar has on one side a kind of open seam where the two surfaces of the zinc meet, but are not soldered; it is better that for the bottom these should be soldered perfectly tight, after mitreing, so that they must be so cut that this seam meets the seam on the next one; this being done, you have a square frame with a rebate top and bottom. Now cut a square of No. 10 gauge zinc half an inch smaller than the frame and solder the same strongly to the frame; file up and set aside. Now make the base by taking a square of No. 10 zinc, 2 ft. 2½ in. from corner to corner, centre it, and mark a circle of 3 in. diameter on one side. Now mark and cut out the curves as in Fig. 2, and with a hammer raise a ¼-in. edge all round, which will stiffen up the work and make it ready to receive the ornamental border, which is formed of No. 28 fret (Treggon's), and costs about 3d. per foot run; a smaller size is made at about 1½d., but No. 28 is the best, being bold and strong; this must be soldered so as to be water-tight, or the drainage from the ferns will run on to the floor. The castors should now be fixed. It is most important that castors should be used, as in attempting to move the finished work the strain is very great owing to the weight, especially when filled with water, but with castors it is moved quite easily; nor must they be merely tacked on with solder for similar reasons, but should be pocketed, as in Fig. 5. Make four little tubular pockets and solder in to corresponding holes in the zinc; turn over, fill each with Portland cement of a thick cream, and put the screw or screws of the castors therein, and leave to set hard, taking care that all are on the same level. By this means, when the stand is afterwards made up you will have the castors securely held. You will now require to make the upright centre of stand, which is formed by rolling into the form of a tube a length of No. 10 zinc, 2 ft. 4 in. long, so that when soldered up it makes a tube 2 ft. 4 in. by 3 in. diameter. Having previously marked the 3 in. circles on the under side of aquarium bottom and the upper side of base of stand, solder up, Fig. 3, make a hole about 1½ in. at C, and fill up the tube with small pieces of coke, and then pour in until quite full a batter of Portland cement; this when dry will form a practically unbreakable pillar, and when the other parts are made will be as firm as a rock. Solder in the fountain pipes, Fig. 7, and proceed to build up the rockwork of stand. For this purpose you will require some Roman cement and ordinary gas coke; break up the coke into convenient sized pieces and dip them into a thin batter of cement. Why Roman should be used is that it will take a coating of paint, whereas Portland would require long seasoning; but the latter is much stronger, so that if you propose to paint the work use Roman, if not use Portland cement mixed with sharp sand. Set the work on a level place and see that the pillar is perfectly upright and true to the part you are now working upon; that is, you have got the stand upside down, and from about 3 in. of the edge of D are building up a conical rockwork to the pillar, about one-third of its length, as roughly as possible and yet true; as soon as this is set hard, turn the work right way up, on *a level place*. See that each castor touches the surface of the level place, and see that the whole stands upright, square, and true. This is most important, and the work should be done in a place sufficiently large to get round it and see it from all sides, as when once the work has set firm it cannot be altered to set true. Then build up as Fig. 4, first running in about 1¼ in. of Portland cement and sand, which will make a very strong base; get four flower-pots about 4½ in. in diameter, tilt them on side towards the edge, and fill in all around with cemented coke, taking care that all is well cemented together, and presents a nice rustic appearance. Continue the rockwork a few inches above clear of the mouths of the pots, and then take four pots about 3 in. diameter, and tilt outwards in the same way—between each pair of the larger pots; this will give you two tiers of pots; cover the remaining portion of the upright in the same way, let me again say, taking care to well cement all together, as this part requires to be very strongly made. We now require to complete the aquarium frame. Take four lengths of No. 43 sash bar, 18¼ in. each, and mitre to a square, which should be *exactly the size on the inside with the inside of the bottom;* then for the uprights four lengths of No. 46 bar, 12½ in. long, which solder securely to the frame and to the stand, square and true. Bring to the centre your two pieces of compo (⅜), one for supply and the other for waste; and then glaze the frame with 32 oz. sheet glass, set with putty, made of ordinary putty 1 lb., red lead ½ lb., worked up into a paste with gold size sufficient. Then when well set pour into aquarium to about ½ in. up the glass a layer of *Roman* cement; when set, proceed to build up the centre rockwork, for which purpose the two pipes had better be strengthened by putting in a length of the No. 46 bar tied to them. The waste pipe should extend to about ½ in. of the top, and should be bent down again so that its mouth will be under water when in use, an air hole being made in the top of the bend; this prevents floating objects running down the pipe; both pipes should be soldered in bottom zinc about 3½ in. from edge. The centre rockwork is provided with four pots, set as the upper tier in Fig. 4, at such a height that the bottoms are out of water; and above is fixed a glass dish with a hol in, set quite level and made firm witl cement on top, the supply pipe being fitte with a jet at this end and a tap at th other or bottom of aquarium. The con structive part is now done with the exceptio of the corner ornaments of aquarium show in Fig. 1, formed of the waste pieces o zinc left over cut out with a fret saw.

For finishing, a rich chocolate colour re lieved with lines of gold bronze looks well the rockwork at base looks very effective whe painted a dark bronze, and the ragged edge touched up with gold bronze; the rockwor in centre may be tinted with colour mixe with copal varnish, and the inside corners o the glass should be coated with varnish a well as the floor of the aquarium, and whe thoroughly dry the bottom may have a laye of washed shingle. No live stock excep plants should be put in until the aquariur has become thoroughly seasoned, and it wi save a lot of trouble if the work can be le outside exposed to the weather for a fe weeks, being frequently emptied in th meantime, and the process of painting th outside deferred until the last. Where it convenient a supply of water for the fountai direct from the cistern of course is best; bu where not, a very simple and handy contr vance, Fig. 6, is very useful. A zinc vessel suspended from the ceiling on a pulley-whee and, fitted with india-rubber pipe attache to the supply, is filled and drawn up, and th water when used runs from the waste pi into another vessel or jug, and changed a often as desired.

I trust the foregoing will be sufficient clear in detail to enable any one to make t the design, and would say let no one b deterred from the work, thinking it difficul It is really quite easy, and the more wo there is in it the more value it possesses wh completed.

SOME NOTES ON PLANING.

BY B. A. B.

WHEN the beginner has learnt to sharp his planes according to the instructio recently given in WORK, he will natural want to make some progress in the use these useful tools.

We will try to understand a plane and i mode of action. The cutting edge is arranged that the angle is constant; a chis or gouge can be used in various ways, a held at various inclinations, but the speci feature of a plane is that the cutter is fix by a wedge or a lever and screw. Some our numerous pupils ask why the join uses so many planes; he begins with t jack plane, he then uses the trying pla and after the work is fitted together a glued up, he commonly uses the smoothi plane. Our pupils say, why? Now, t question is reasonable, and ought to answered. The jack plane is used fir because it is a plane long enough to gi some accuracy of surface; it is genera 17 in. long. It is used to take off the ou side surface, and does not need quite su careful sharpening and adjustment as t trying plane, it will do if we take strok of about an arm's length at a time. Now, we may often have very uneven stuff to plane, sometimes slabs axed or adzed into shape, and having an accurately adjusted trying plane; we must take care of it, and economise its use, for the surface of the plane wears uneven on such timber; so our jack plane, which is not called upon for such accuracy, is used first. The trying plane will not then be worn uneven, and it

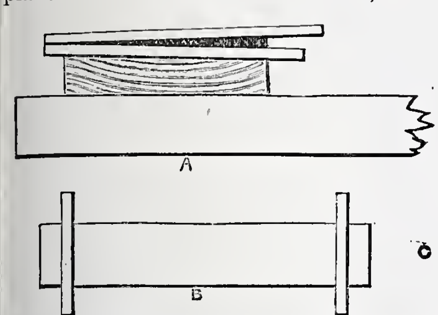

Fig. 1.—Application of Winding Sticks—A, End View. B, Plan. C, Point from which to view.

matters very little if the jack plane is a trifle untrue.

Having reduced the timber to something like accuracy, and also removed the dirt and grit which always deposits upon the surfaces of wood during its exposure for seasoning, and which grit is very destructive to the keenness of the plane iron, with the jack plane, we may take our well-sharpened trying plane and try to obtain a true and finished surface. We shall find it will retain its edge much longer than the jack plane did, because our timber is now clean; and the surface of our trying plane is also likely to retain its accuracy, because our timber is now much less uneven than it was when we began. May I point out the faults a beginner is most likely to reveal as he tries to get his work true? He is extremely likely to take most off the end nearest the bench stop, and he is prone to take most off the corner of the stuff nearest the edge of the bench. This is caused by the fact that the swing of his arms, and, in fact, of his whole body, is in a curved pathway; if he really needs to reduce the front and the near edge, why, certainly; but let him beware of so doing as a mere matter of habit.

Sometimes a piece of wood "lies hollow," as it is often termed, and our beginner may think fit to plane the hollow side first. He begins at the end, and the first stroke sends the wood off the bench, and jerks the plane against the stop, to its probable injury.

We who have seen this will henceforth take care to tuck a thin slip of wood under the end of our stuff, if we *must* plane the hollow side first; if not, we will plane the round side, and if it bends much under our sturdy stroke, we will tuck a piece of thin wood under the middle, taking care that it is not too thick.

We must avoid "winding." What is "winding?" say some of our younger readers. If two of you take a piece of wood in your hands, facing each other, thus:—

Left hand.	Right hand.
Right hand.	Left hand.

Now both raise your left hands and depress your right hands; you thereby compel the piece of wood to be "in winding." Wood often goes "in winding" while drying, and if a door or a shutter is made of winding stuff the consequences are likely to be unpleasant.

Let me explain how to remove this winding. Obtain two pieces of wood about 16 in. long and about 1 in. by $\frac{3}{4}$ in., dimensions are of no importance so that the pieces are straight and parallel. Lay these "winding sticks" across the work and view them; you will at once see which are the highest corners, which are diagonally opposite each other. (See Fig. 1.) Be sure to reduce the thickest of these if there is any difference. If there is much to plane away, most of it may be done with the jack plane.

After the winding is reduced, most likely the stuff is left rounding in the direction of its length. The remedy is to aim at working hollow, constantly watching the effects of the planing, and remembering that the object is not to make shavings, but to make our piece of wood as perfectly flat as possible.

Let us try to understand the reason of this advice to try to plane hollow.

If we imagine a longitudinal section of a plane from end to end we shall find that the section gives us three points (*not in a straight line*), one point at the junction of the front end and the sole, one at the meeting of the sole and the back, and one at the

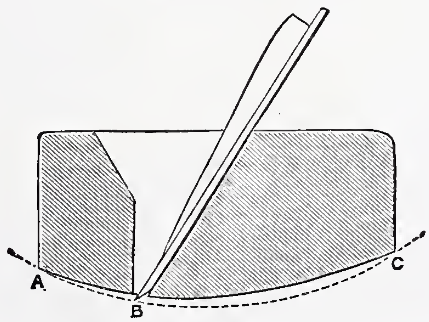

Fig. 2.—Section of Compass Plane, showing three Points, A, B, C, not in a straight line. The dotted curved line is the greatest concavity this Plane will work. Projection of B exaggerated.

point where our section cuts the edge of the cutter, having a projection equal to the shaving we intend to remove. Now, three points not in a straight line must be either the angles of a triangle, or they must lie on the line of a curve. This is what the three points are in the case of a plane; they are in the path of a segment of a circle, whose curvature depends on two conditions: the length of the plane and the projection of the iron. (See Figs. 2 and 3.) Hence a plane can be made about four times as accurate, or rather, one-fourth as defective in accuracy, by halving the projection of the iron. The same increase in accuracy occurs when the length of the plane is sufficiently increased, for we must remember that a plane is an instrument capable of reducing a surface to a small degree of concavity; that is, that although there is scarcely any limit to the convexity that a novice can make with an accurate plane, the most accurate plane ever used on a piece of wood can and often does make a concave surface, and that concavity is limited by the projection of the cutter from a straight line, and the length of the same straight line. In this we must bear in mind that it is longitudinal accuracy we are striving at; the transverse surface of the wood will not be nearly so accurate, however well we may have sharpened our planes, and however carefully set them, inasmuch as the length exceeds the width, so that the truth of our surface will be greater in the direction of the length.

Now, as a truly surfaced plane can make a convex surface (in length), and can make a concave surface, limited as we have seen, we can believe that no tool equally simple and portable can surpass the plane for accuracy of performance.

We are told by opticians that if two flat discs of glass of about equal size are ground together with an abrading substance between, the top one becomes concave and the under one convex; this is just the result of the beginner planing his work—the under surface becomes convex. Now, knowing the amount of hollowing that the plane is capable of is limited, the instructed beginner, however unpractised, sees that to avoid his usual error he must try and plane hollow, limiting the possible error in that direction by having a very slight projection of the cutting edge; the tendency to round off the ends *will* come in, and knowing what to avoid our pupil will be able very speedily to make a fairly flat surface with a good trying plane.

The smoothing plane is small and handy, is easily turned about, and its accommodating shape and size render it fitting for the finishing process, where the trifling use of it is not likely to reduce seriously the accuracy we have attained.

It is most important to so sharpen and set the smoothing plane that the work shall not show plane marks. If the wood has been "tried up" well, probably the mortises and tenons have been truly cut, and the work has been glued up to the workman's satisfaction.

In the final cleaning off, accuracy in sharpening the smoothing plane is most desirable; especially is this the case when the work is to be varnished, for the surface reflecting light as it does, makes every departure from a flat surface most noticeable, and a smoothing plane iron to finish such work (particularly in soft wood where the use of the scraper is out of the question) ought to be very slightly rounded at the corners, enough to avoid the corners projecting from the sole of the plane, and so little as to allow a thin shaving, nearly 2 in. wide, to be taken off with a $2\frac{1}{4}$ in. plane. Such a plane kept well sharpened and the cap iron within $\frac{1}{16}$ in. of cutter, well screwed together, the wedge fitting well, and care

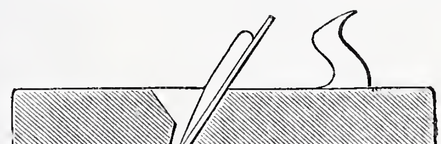

Fig. 3.—Section of Jack Plane, showing three points as in Fig. 1, the depth of curve possible depending upon projection of B. Projection of B exaggerated.

taken to avoid small particles of glue, wood, etc., clinging to the plane, and thereby being forced down on the surface of the work, causing bruises and scratches upon it—such a smoothing plane will leave a surface that will require very little glass-paper to make it fit for the application of paint, polish, or varnish.

My paper may be regarded as affording a simple, but, I trust, clear and intelligible, description of the way to go to work in planing up any piece of wood, and a satisfactory exposition of the reasons for doing so. If beginners in all manual work were thus taught the why and the wherefore of everything that they were told to do, workmen, I think, would be likely to take far more interest in their work than many do at present.

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BY GEORGE EDWINSON BONNEY.

CONTACTS — DALE'S DOOR TRIGGER CONTACT— MAYFIELD'S DOOR TRIGGER CONTACT—DOORPOST CONTACTS—WINDOW CONTACTS.

Contacts.—The little pieces of apparatus employed to connect the alarum bell with the battery when a door or window is opened, are named "contacts." In their construction are employed tubes or brackets made of brass; springs of brass, or German silver, or steel; small set screws of brass; and insulating blocks of ebonite. The names given to the various pieces denote their uses and situation. These will be seen as we proceed.

Dale's Door Trigger Contact.—Fig. 44 illustrates a door trigger contact made and sold by Messrs. H. J. Dale & Co. The base is made of ebonite, $3\frac{1}{4}$ in. by $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. Two holes are drilled and countersunk in two opposite corners to receive screws for attaching the base to the door frame. A strip of spring brass or German silver, 3 in. by $\frac{1}{2}$ in., is fastened by two screws to the upper part of the base. One of these screws is fitted with a brass collar or washer, and to this one of the branch wires is connected. The strip is bent upward to form a curved spring, and a $\frac{1}{4}$ in. speck of platinum foil is soldered to the spot where it will make contact with the trigger, in the centre of the free strip about $\frac{1}{2}$ in. from the free end. A brass trigger (shape and size shown in the illustration) is loosely held by a pin in a small brass bracket, as shown in the figure. This hangs down perpendicularly, with the finger of the trigger free from contact when the base is fixed to the door frame over the door. On opening the door, its upper part engages with the wedge-shaped piece hanging over it, and the trigger acts like a lever with its finger making contact with the spring above. This part of the finger must also be furnished with a strip of platinum foil soldered to it. As the door is pushed open, its upper edge passes the lower part of the trigger, and this falls down again, out of contact with the spring. The other branch wire is connected to the set screw seen on the left side of the bracket. The bell is set ringing as soon as the trigger comes in contact with the spring. It will be understood that this appliance must be fixed to the door frame *over* the door, in such a position as to bring the top of the door in contact with the lower end of the trigger as the door opens. As the door shuts, it passes under the trigger, but does not bring it in contact with the spring.

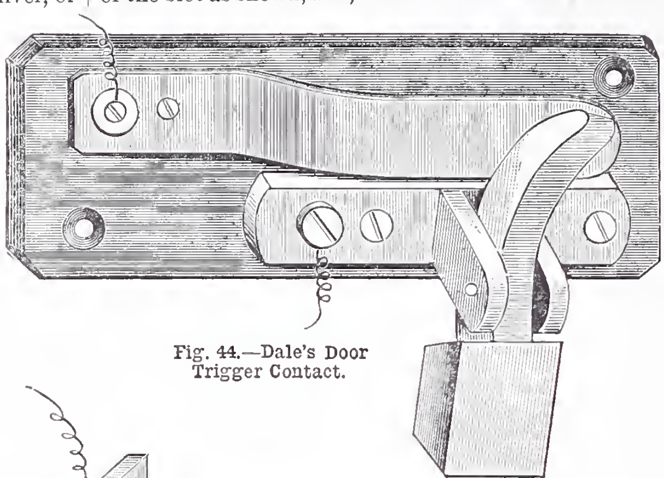


Fig. 44.—Dale's Door Trigger Contact.

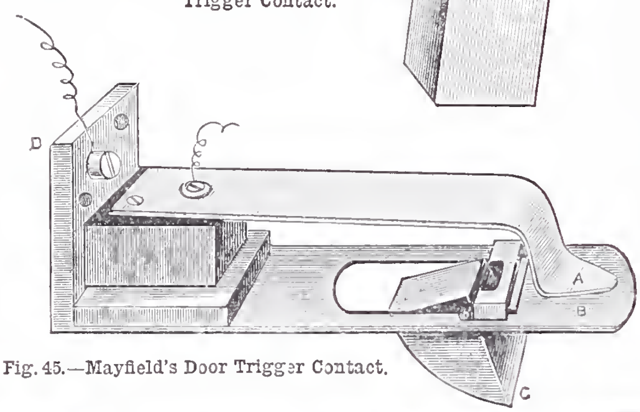


Fig. 45.—Mayfield's Door Trigger Contact.

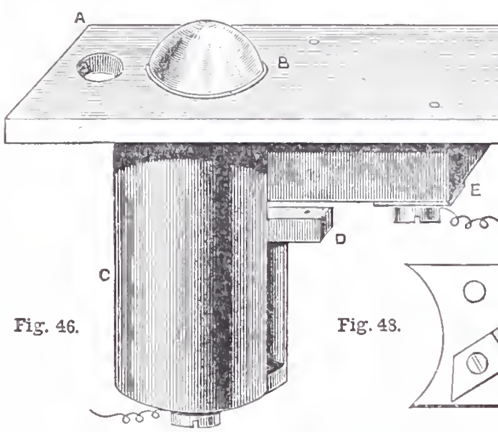


Fig. 46.

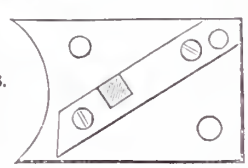


Fig. 48.

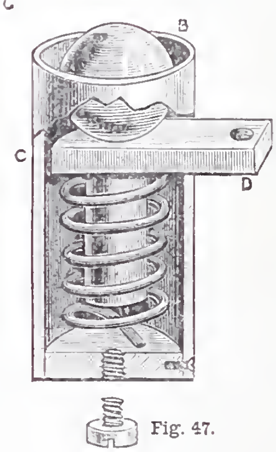


Fig. 47.

Fig. 46.—Doorpost Contact. Fig. 47.—Section of Doorpost Contact. Fig. 48.—Plan of Ebonite Block, E, in Fig. 46.

Mayfield's Door Trigger Contact.—Fig. 45 shows another variety of door trigger contact, made and sold by Messrs. Mayfield, Cobb, & Co., 41, Queen Victoria Street, E.C. It is composed of an angle-shaped brass bracket (D), made out of a piece of brass 2 in. by $\frac{3}{4}$ in. by $\frac{3}{16}$ in., bent at right angles, and drilled with suitable holes for screws, as shown in sketch. To this is attached by screws (the tips of which hold the insulating ebonite block shown) a strip of spring brass or German silver, 3 in. by $\frac{3}{4}$ in. (B), in which is cut a slot $\frac{7}{8}$ in. by $\frac{1}{2}$ in. to receive the wedge-shaped piece of brass, C. This piece of brass is hinged to a small piece of brass soldered to the spring, B, at one end of the slot as shown, and, when thus attached to the spring, the wedge is free to move up through the slot when the top of the door presses against it whilst being shut, but is fixed against the spring when the door is pushed open. The top of the door must, therefore, push the spring upward and bring it in contact with the spring, A, above. This upper spring is made of the same material as the lower spring, but it is fixed to the ebonite block, and is thus insulated from the bracket. The end is also pointed, and bent down so as to nearly touch the end of B; at this point of contact both springs are protected with a speck of platinum on each. One of the branch-line wires is fastened to a screw on the heel of A, and the other wire to the set screw on the bracket, D. This trigger is also fixed *over* the door, as the last-mentioned.

Doorpost Contacts.—Fig. 46 illustrates a form of doorpost contact made and sold by vendors of electric sundries generally. It is made up of (1) a brass plate (A), $2\frac{3}{4}$ in. by 1 in. by $\frac{3}{16}$ in., with a hole drilled and countersunk in each end to receive the screws which fasten it to the doorpost. Half an inch from one end, drill a $\frac{5}{8}$ in. hole, and countersink it on the lower side, or chamfer away the lower edge of the hole until it allows one-third of a $\frac{3}{4}$ in. brass marble to protrude above the surface of the plate. (2) A $1\frac{1}{2}$ in. length of $\frac{3}{4}$ in. brass barrel (C) is soldered to the base plate, A, to form a socket tube for the brass marble, B. This tube has a $\frac{1}{4}$ in. slot cut on the side next the ebonite block, E, to admit the brass cam, D. The inside of the tube is fitted, as shown at Fig. 47, with a strong spiral spring, surrounding a $\frac{1}{2}$ in. brass plunger, to the top of which is soldered the brass cam, D. The tube is stoppered at its bottom end with a disc of brass, kept in place by two or three small screws through the side of the tube. On this bottom rests the end of the spiral spring, and to this is fastened one of the branch wires by the set screw shown in both figures. (3) A block of ebonite $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. by $\frac{1}{2}$ in. (E), cut to the shape shown at Fig. 48, to fit one side of the brass tube, is now to be attached by two screws to the base plate, A. Across this obliquely, as shown in Fig. 48, is fixed a small slip of thin brass, with a speck of platinum foil soldered to the spot where it will come into contact with the corresponding speck of platinum soldered to the upper part of the cam, D, as shown at Fig. 47. To this strip of brass is attached the other branch line. Fig. 49 illustrates another variety of the same appliance, of smaller size, and with a rounded head of brass to the plunger and cam, instead of a brass marble, as at Fig. 46. Let us now see how these contacts are placed in action, and fixed to the door. A hole is drilled in the rebate of the hind doorpost, at any convenient position, to receive the barrel of the instrument. This hole should be sunk deeper than the length of the barrel, to allow for recessing the base plate and give freedom to the set screw at the bottom of the barrel. When this is done, a recess must be cut with a firmer chisel to receive the ebonite block, E, and allow free play to the cam, D. Then the shape and size of the base plate must be marked, and a recess cut to receive it, flush with the surface of the rebate. The branch wires should now be brought into the recess from bottom and side by small holes, and attached in position. See that they are both covered up to the last $\frac{1}{2}$ in. (which must be bared to attach the naked wires to the screws), to avoid accidental contact with the barrel. Then screw on the appliance, and make all good. If we now close the door, its back style will press on the marble and force the cam, D, out of contact with the brass strip on E. Whilst in this position, the circuit of the alarum bell is open, and the bell will not ring; but as soon as the door is open only a little way, the spiral spring will force the cam, D, again into contact and close the circuit. If we left the appliance in the condition it now is in, it would soon get out of order, because the brass marble would wear for itself a recess in the back of the door style. It is usual, therefore, to recess a small brass plate in the style where it comes into contact with the marble, as shown at Fig. 50. A similar appliance, of smaller dimensions, to suit the size of door, may be used for cupboards or French windows.

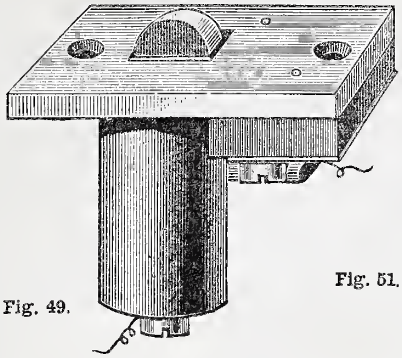


Fig. 49.

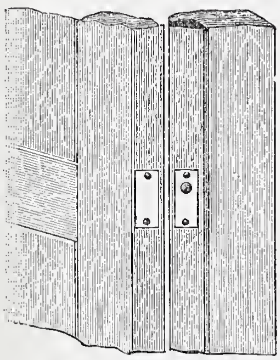


Fig. 50.

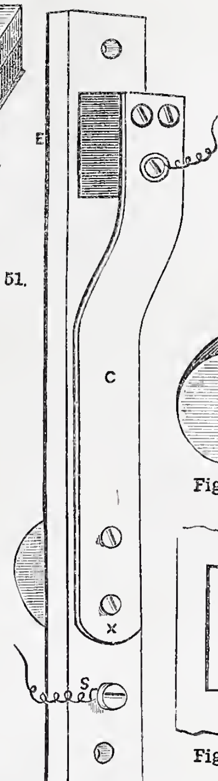


Fig. 51.

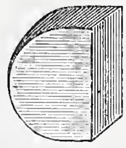


Fig. 51 B.

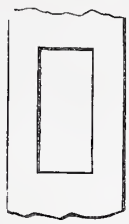


Fig. 51 A.

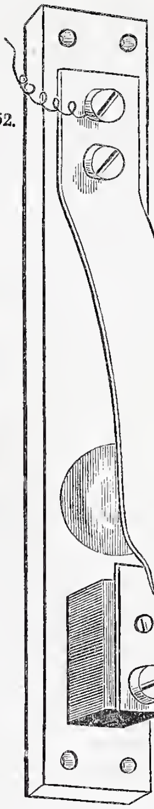


Fig. 52.

Fig. 49.—Small Doorpost Contact. Fig. 50.—Piece of Door Frame and Door, showing how to fix Doorpost Contact and Plate to Rebate of Frame and Back Style of Door. Fig. 51.—Window Contact. Fig. 51 A.—Slot for Ebonite Lug. Fig. 51 B.—Ebonite Lug. Fig. 52.—Window Contact—Ball Pattern.

Window Contacts.— Windows are generally considered to be the most vulnerable part of the house defences. Burglars enter more frequently by windows than doors, because they can be opened with least force and least noise. Window contacts are, therefore, made in great variety to suit every probable contingency, and to guard both bottom or top sash, or both together, as occasion may require. Figs. 51 and 52 illustrate a window contact of easy and simple construction for fixing in the rebate of a window frame to either top or bottom sash, or both. The appliance shown at Fig. 51 is made up of (1) a base plate of brass, 4 in. by $\frac{5}{8}$ in. by $\frac{1}{8}$ in. A small hole (for screws to fix it) is drilled at each end, as shown, and countersunk on the face of the plate. Another small hole is drilled and tapped to receive the set screw, S. At a distance of 1 in. from one end is cut the slot shown at Fig. 51A. This slot will receive the ebonite lug shown at Fig. 51B when this has been fixed to the spring. (2) An ebonite block (E) $\frac{5}{8}$ in. by $\frac{1}{2}$ in. by $\frac{1}{4}$ in., to be fastened to the base plate by short brass screws to form an insulating block for the spring, C. (3) A strip of spring brass or German silver 3 in. by $\frac{1}{2}$ in., to form the spring, C. The form of this and the method of fastening it to the insulating block are clearly shown in the sketch. The point of contact between this spring and the base plate may be at the tip of the spring marked X on the figure or at the inner side of the lug, the exact spot being determined by bending the spring so as to touch this spot alone when the spring closes. This point must be protected with a speck of platinum or a small pin of this metal on both base plate and spring. The insulating lug, 51B, is then to be cut out of

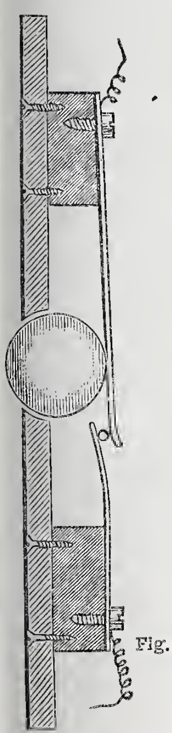


Fig. 53.

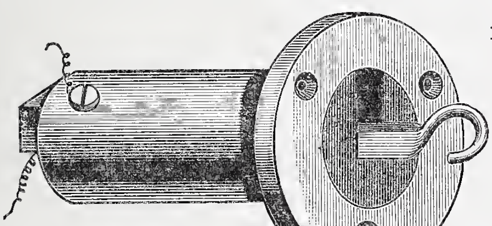


Fig. 54.

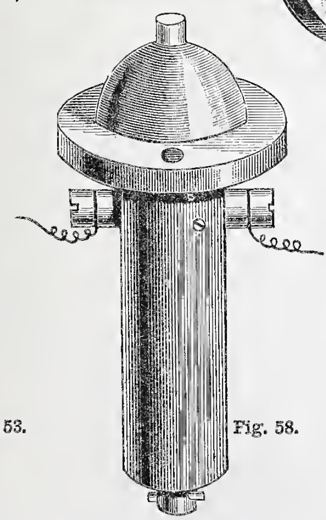


Fig. 58.

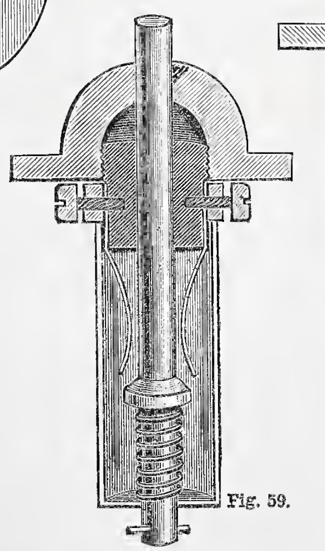


Fig. 59.

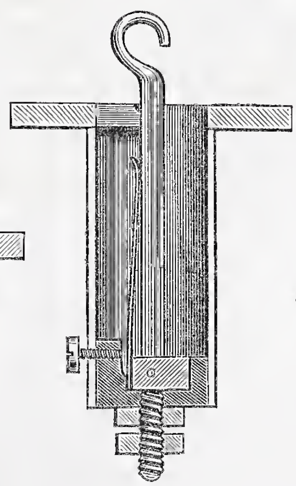


Fig. 55.

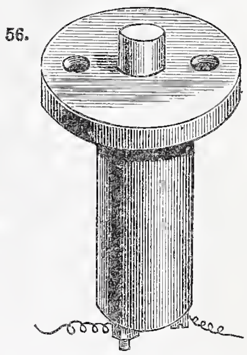


Fig. 56.

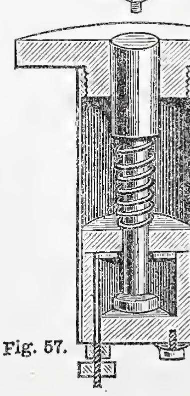


Fig. 57.

Fig. 53.—Improved Window Contact, with Rubbing Action: Section. Fig. 54.—Legge's Window Blind Contact. Fig. 55.—Section of Window Blind Contact. Fig. 56.—Dale's Bottom Sash Contact. Fig. 57.—Section of Bottom Sash Contact. Fig. 58.—Mayfield's Bottom Sash Contact. Fig. 59.—Section of Mayfield's Bottom Sash Contact.

ebonite to the form shown, and of a size to easily slip in and out of the slot in the base plate, whilst the rounded part should be made quite smooth. It is then attached to the spring by small brass screws, as shown.

Fig. 52 shows another variety of this appliance with a marble recessed in the back of the base plate, and kept in the recess by means of the contact spring. This appliance works in a manner similar to that of the doorpost contact (Fig. 46). The point of contact is between the bent tip of the spring and a thin plate of brass on the insulating block. This arrangement gives a certain amount of flexibility to the contact, with a slight rubbing motion, a thing much to be desired in all contacts, to ensure clean bright surfaces at these parts, free from dust. At Fig. 53 is shown in section a modified improvement of Fig. 52, furnished with a rubbing contact. Messrs. H. J. Dale & Co. sell a contact of the form shown at Fig. 51, with all the working parts enclosed in a shoe made of brass and hard wood to protect those parts from dust and damp and other injury. These contacts are neatly recessed in the rebate of the window frame, with the base plate flush with the surface of the rebate, and the recess made deep enough to allow the spring freedom to move. The wires must be brought into the recess through fine holes bored in the frame, where the sash will not come into contact with them.

A very simple, effective, and cheap form of window contact may be constructed by any person familiar with the use of carpenter's tools. A thin plate or strip of copper or brass is recessed in each rebate flush with the surface, 3 in. from the bottom of the lower sash on each side, and also 3 in. from the top of the upper sash on each side, or four plates altogether. The top and bottom plates on each side must be connected to one branch wire, and the top and bottom plates on the other side to the other branch wire. At the top of the top sash at one side, close to the sash cord, fix a curved spring of brass or German silver, and a similar spring to the other side. Connect these together with a piece of cotton-covered No. 18 copper wire, buried in a saw cut along the top of the sash, then puttied and painted. Fix two similar springs to the bottom of the bottom sash, and connect them in a similar manner. When a window is thus guarded, it may be left open some 2 or 3 in. top and bottom (as recommended by Dr. Allinson) without incurring any danger from the entry of unannounced burglars, for, should the thief be tempted by the partly open window to lift it a little higher, or pull down the top sash a little lower, he will bring the springs on the sashes into contact with the plates on each side, and close the circuit of the bell through the wire running along through the top or the bottom of the sash. A similar result is attained by fixing a contact made up of two curved springs, on an insulated base, in the rebate on one side top and bottom, and a connecting bar to the sash. One wire is connected to one spring, and the other wire to the other spring. When the sash is opened wide enough, the connecting transverse bar comes into contact with the springs, and closes the circuit. Contacts for this purpose are sold by Messrs. Mayfield, Cobb, & Co., at 3s. 6d. each.

Should the householder wish to throw open the sashes of his window and draw the Venetian blinds to keep the rooms cool, he can still guard them against intrusion by using Legge's Window Blind Contact, sold by Messrs. T. Gent & Co., Faraday Works, Braunstone Gate, Leicester, at 3s. 6d. each, and illustrated at Figs. 54 and 55. From these sketches it will be seen that the contact must be recessed in the lower part of the window frame with the point of the hook pointing downward. A loop of cord from the blind is passed over this hook when the blind is drawn. Should any person try to raise the blind, the hook will be brought into contact with the metal frame of the appliance and ring the bell.

Fig. 56 illustrates a contact for the bottom sash of a window, made and sold by Messrs. H. J. Dale & Co. Fig. 57 gives a sectional view of the interior, from which it will be seen that the appliance differs in construction from the contacts usually met with. The cap is turned to fit the top of the pin plunger, and is screwed into the top of the barrel to give firmness to this part. Below the head of the pin a spiral spring of brass rests on an ebonite or vulcanite collar, and this spring brings the lower part of the pin in connection with a wire ring below the collar when pressure is withdrawn from the head. This ring is the continuation of a wire which is screwed at the outer end to receive two small connecting nuts. Both ring and wire are held in an insulating chamber of ebonite. A small piece of the bottom of the barrel is bent over the plug of ebonite, and this holds a small set screw to connect one of the wires. It will thus be seen at a glance that all contacts are secure from dust and damp.

Fig. 58 illustrates a contact made for a similar purpose, and sold by Messrs. Mayfield, Cobb, & Co. Fig. 59 gives a sectional view of the interior. This contact presents the novelty of a domed cap, turned to fit the neck of the pin plunger, and screwed inside to fit threads cut on the top part of the barrel. This is made of ebonite, carrying two curved springs of brass or German silver. These springs are insulated from each other by the ebonite top of the barrel. A brass collar is fitted on the pin plunger, and the bevelled edge of this is brought into contact with the springs above when pressed upward by the stout spiral spring beneath, thus closing the bell circuit. The top of the metal barrel is cut away on each side to clear the small binding screws and tops of the springs on each side. The makers claim that this appliance is perfectly damp and dust-proof, and cannot be tampered with by the burglar outside the window. It is fixed (like that shown at Fig. 56) in the bottom frame of the window, so that the lower sash, when closed, shall press on the pin and keep the collar on the plunger from touching the springs. The flanges of the cap are let in flush with the frame, and a hollow is made in the under-part of the sash to fit down closely over the dome. A short brass screw should be inserted in the deepest part of this hollow to press on the head of the pin, and prevent it from wearing a hole in the sash. It will be seen that this appliance meets the requirement of a rubbing contact, and therefore all these parts are kept bright by use.

Readers making their own contacts from the description of them given here, will be able to get the materials from any dealer in electrical instruments. Those I have described are excellent specimens of workmanship, and are made strong, as if to last a lifetime. Nothing less than good material and good fitting should be employed in making these little useful appliances, and all points of contact must be protected with platinum, to prevent the brass from being burnt away by the electric spark which is always caused at these points when contact is broken.

In attaching the wires, see that they are neatly hidden from view, not only to avoid vulgar obtrusiveness, but also to prevent the wires from being broken or being tampered with.

In my next, I hope to show a few traps and dodges to foil the wily burglar, who may know how to damage the ordinary contacts.

BLISTERS IN VENEERING.

BY DAVID ADAMSON.

LET us take blisters, as the swellings resulting from imperfect adhesion of the veneer to its base are called. These naturally are not so likely to occur with caul-laid as with hammer-laid work, still, unless the novice is particularly fortunate he cannot hope to escape them altogether, and they should never be allowed to remain. The sooner they are laid the better, as if the glue has got quite hard and dry, it is a troublesome matter to get them down. The first care after removing veneered work from the caul should be to look out for blisters, and the same may be said before working any surface laid with the hammer. Sometimes the blisters may be so big as to be easily observable with the eye, but it is hardly safe to trust to this, and because anything looks right to pass it as being really so. Blisters may frequently be detected by passing the hand over the surface, but the most reliable and the most common way is to gently tap the veneer with a light hammer head or something of the kind. The hollow sound which is heard when a blister is struck soon shows there is something wrong, and by going over the whole surface carefully all that there may be can easily be discerned. If the novice should fail to discover any difference in the sound wherever the veneer is tapped, he may conclude that it is down everywhere, though of course it may be his want of training which causes him not to notice faulty places. If there are no blisters, for these are by no means necessary though they should always be watched for, he may be very well satisfied. If there are, they will probably show themselves later on, especially when the wood is polished, as very trifling inequalities can then be much more clearly seen.

To give minute directions for laying blisters is, of course, out of the question, and were I writing for experts only, they might very well be left to take care of themselves, and even many novices, who, when they are reminded that blisters are either caused by air between the two surfaces or by an excess of glue, generally the former however, will be able to reduce them without being told how. Still, it must not be assumed that all readers are gifted with such an unusual amount of intelligence—or should I not say conceit?—as to think they can know what to do without being told, and those who attend to the following hints will probably obtain the best results. Perhaps, before going any further, some novices may want to know how big these blisters usually are, as the question has been asked. I am sorry to say I cannot answer it definitely. In the hands of an expert worker they are not likely to be either numerous or large, but with the beginner the case is different, as it is impossible to tell what errors of judgment or manipulation he may not have fallen into. It may even turn out that his veneered work is almost one big blister, and that comparatively little of the work is properly stuck. To give some idea of an ordinary blister, I should say that one the size of a threepenny-bit was small, and that anything over an inch or so across was a tidy size, not quite good enough to take a first-class prize for quality, but quite good enough to take a Liverpool exhibition medal if put in competition and properly arranged. This, of course, does not imply that it is a tip-top blister in point of size, but merely that there are some of less magnitude. It is not, however, the blister but its absence which is desirable. If it is caused by a simple air bubble, it may be laid by pricking a hole in the veneer and pressing this down with an iron warmed sufficiently to melt the glue, the pressure, of course, being retained till the glue has set again. This, of course, is on the assumption that the blister is caused by the air alone, and that there is just the right quantity of glue to do what is necessary. If there is too much glue under the blistered part, it must be squeezed out, the expressive term of "bleeding a blister" being often used to designate this piece of work. The blister must be cut with a sharp edge or point of a knife in order to afford a passage for the glue, which must be first melted and then pressed out with a hot iron. A warmed hammer head, in the absence of anything more suitable, will do very well. Generally the blister will lie flat enough, but in case it does not the cut may be slightly enlarged. Another plan which may be mentioned is to prick a series of holes round near the edge of the blister, and then proceed as before. On a dark veneer it is of very small consequence which way the blister is punctured, but some caution is necessary with the lighter kinds, and I am disposed to favour bleeding by a cut, which, if judiciously made, may almost escape notice or be mistaken for an accidental marking of the figure. The marks caused by pricking round the blister are far more likely to attract unpleasant comment. If the glue has perished, that is, if there is none under a blister, as may happen from a variety of causes, of course some must be inserted, which will be found rather more difficult than taking it out. Even if the glue remains, but has become so dry that heat does not soften it, it will be a job requiring some nicety to moisten it and lay the blister properly. The best way, perhaps, is to prick some moisture in, and then when the glue is sufficiently soft, proceed as before. Blisters, however, should be detected long before the glue has become so hard as to require more moisture, and the last hint will be more useful to indicate to those who have to lay any that may have accidentally been found on old work—to wit, on the aforesaid washstand top. If the blister can be easily reached by a small caul, or, rather, if this can easily be subjected to pressure, it will be found a good plan to lay it in one. The caul, of course, should not be larger than just enough to overlap the blister, as no good and much harm might result from the glue elsewhere being remelted or softened.

A caul for curved work may now be considered, as the nature and work of a caul ought to be pretty well understood from the foregoing. Of course, for plain curves such as a straight cornice-moulding or anything of that kind, there is not much difficulty in forming a suitable caul, but one occasionally meets with some surfaces which, unless they are to be done in considerable quantities, it is practically impossible in the ordinary course of work to make rigid cauls for. The hammer may be, and often is, satisfactorily used in such cases, but when the curves are in all manner of directions a different mode of working must be adopted. The caul, instead of being firm and rigid, must be flexible without being elastic. In other words it must fit itself into every modulation of surface, but should not be compressible by any part of the veneer which may have a tendency to rise. Many substances might be named, but none are more suitable and generally convenient than sand. A bag large enough to cover the work, and of some close material which will not allow the sand to pass through it, must be prepared. This is then filled and heated when required for use. It takes the place of the metal caul, and must be braced up as may be best with pieces of wood which will be fixed down with hand cramps. On the way in which such a caul is clamped down much of its efficacy depends. By the amateur it will seldom be required—nor does the professional worker, with the present fashions in furniture, require it often. Still, there is no knowing how soon styles may not change, and the thorough tradesman ought to be ready for anything that may turn up in his own line of business.

Occasionally, with very sharp curved surfaces, such for instance as a pillar or a column, it may be necessary, to prevent the veneer from splitting, to mount it on thin canvas or something of the sort, but this is so very rarely done that it may almost be regarded as a bit of superfluous instruction to mention it. The sand-caul may be used in all such cases, but where such a thing as a column is being veneered, the wood and hand screws may give way to some binding, such as ordinary chair-webbing, which may be tightly wound round the work. One writer on veneering states that the webbing may be wrapped round the work without a caul, and that by damping and consequently shrinking the binding, pressure will be increased. I don't know that I have seen this plan adopted, but it may be, and as the writer referred to knew what he was writing about, it can only be considered as a practical suggestion not to be despised in case of need.

As marqueterie inlays, *i.e.*, inlaid veneers, are now very much used, it may be said that they should be laid with a caul. Pressure and rubbing with the hammer would be apt to disturb the small inlaid pieces, besides which there are other practical objections.

On panels, square pilasters, or parts of framing where a single line or two of inlaid stringing are required, the veneer may be laid entire and the space for the stringings be scratched out afterwards, in the case of narrow lines the scratch-cutter being just the width of the stringings. Veneered mouldings on the edges of furniture are now so seldom seen that special directions may well be dispensed with; where the worker wants to form any, he will have little difficulty in knowing how to proceed from what has already been said.

It is no doubt well known that the margins of writing-tables, card-tables, etc., are generally finished with veneer. This should be laid before the mouldings are worked, and may be done with hammer or caul. In either case the long pieces, that is those at the back and front of the table, should be laid first, and then the cross-banding or end pieces, which should be within the ends of the others. To prevent shrinkage at the joints, a strip of paper should be glued over these and left till the glue is hard, when it may be removed at any time.

Made-up door frames are done in a similar manner, and I mention this principally to caution beginners against the way in which veneers are sometimes—not so often now as formerly—stuck on the rails, or top and bottom pieces of the frame. The grain of the veneer is occasionally at right angles with that of the solid wood underneath. In other words, it is parallel with that of the door styles, perpendicular instead of horizontal. This, by most authorities, is now considered false construction, and as I think, rightly so. Anyway, without discussing the ethics of veneered door framing, the novice may be told that no one would consider it wrong to lay the veneer with its grain corresponding with that of the pieces on which it is stuck.

It is seldom necessary to lay veneer on end grain of wood, but as it is occasionally so, it will be well to remember that the wood must be thoroughly well sized, I may almost go further and say smeared with glue, in order that the grain may be completely stopped so that it will not absorb more when the veneer is laid.

It is not practicable to mention all the varying circumstances in which veneer may be employed, but enough no doubt has been said to enable the novice to get over any little difficulty he might experience in the general run of work, and if he is in doubt at any time inquiries will no doubt elicit the desired information in the "Shop" columns. Might I, however, as knowing something of the vague character of some of the inquiries frequently put by correspondents, suggest that these should furnish as fully as possible details of the work about which advice is required? Answers frequently require a good deal of thought, and it is impossible that they can be as helpful as the Editor and his staff would wish if inquirers only state half their case. Let them write fully, as by so doing they not only lighten the labour of those who devote their best services to WORK, but they will be helped more than they can possibly be when the questions are so vague that the reply must necessarily be given a good deal in the dark. If the advice and time of capable men are worth anything, they do, at least, deserve to have fair play by knowing exactly what is wanted, either in the way of intended construction or in the avoidance of mistakes in future. I trust that, so far at any rate as veneering is concerned, inquirers will bear these concluding remarks in mind, and it will at all times be a pleasure to the writer "to help a lame dog over the stile."

STENCIL CUTTING.

BY FRED MILLER.

STENCILLING is the readiest way of decorating a surface by means of a perforated plate, and is largely used in house decoration for putting patterns round the frieze, cornice, and upon the ceilings. The design is cut out of some thin material, such as paper or zinc, a pigment is brushed over the plate with short stiff brushes made expressly for this purpose, and the colour passing through the stencil plate on to the surface upon which the stencil is placed, leaves an impression there the shape of that portion of the plate cut away. The simplest kind of stencil we can think of is a circle cut out of a plate, which would leave a round spot upon the wall if we brushed the plate over with colour.

If we cut a few small segments around this circle, not running into it, but each one kept a little distance from the centre, we get a sort of daisy as the flower in Fig. 2. This is an instance of a perfect stencil, for the method and means employed in producing it yield the most perfect result.

Now, suppose we desired to stencil the letter B, and we cut, or attempted to cut, this letter out of a piece of paper, the portions enclosed in the upper and lower loops of the letter would fall out, and we should have an impression, the contour of which resembled the letter B, but detail would be wholly wanting. If we wish to cut a stencil be possible to cut the leaf part of the design out of the plate without reference to "ties," for there is no part of the design that makes a continuous line as in the letter B, and so let a portion of the plate through. But it is important that the stencil should be well held together, for in using it many dozens, possibly hundreds, of times, if the plate were weakened by not having a sufficient number of ties, it would fall to pieces after a little use. There are two ties, A A, in Fig. 2 to strengthen the plate, but such ties form no part of the design; on the contrary, we might say that they rather mar it than otherwise; but in such a pattern as this, itself (thereby avoiding weakening the stencil), but are gradually tapered off, so that when seen at a little distance the leaves appear to *melt* into the stem. This stencil (Fig. 2) was designed by Mr. L. F. Day, and was used as a border, and in order to save time two portions were cut out of the plate so that a double pattern could be stencilled without having to shift the plate. Where a pattern has to be repeated many hundred of times, a great saving of time is effected by having more than one section of the pattern cut. In order to accurately fit the plate on to the portion just stencilled a "key" is cu in the plate, shown at B B (Fig. 2). Thi

Fig. 1.—Example of Stencilled Letter.

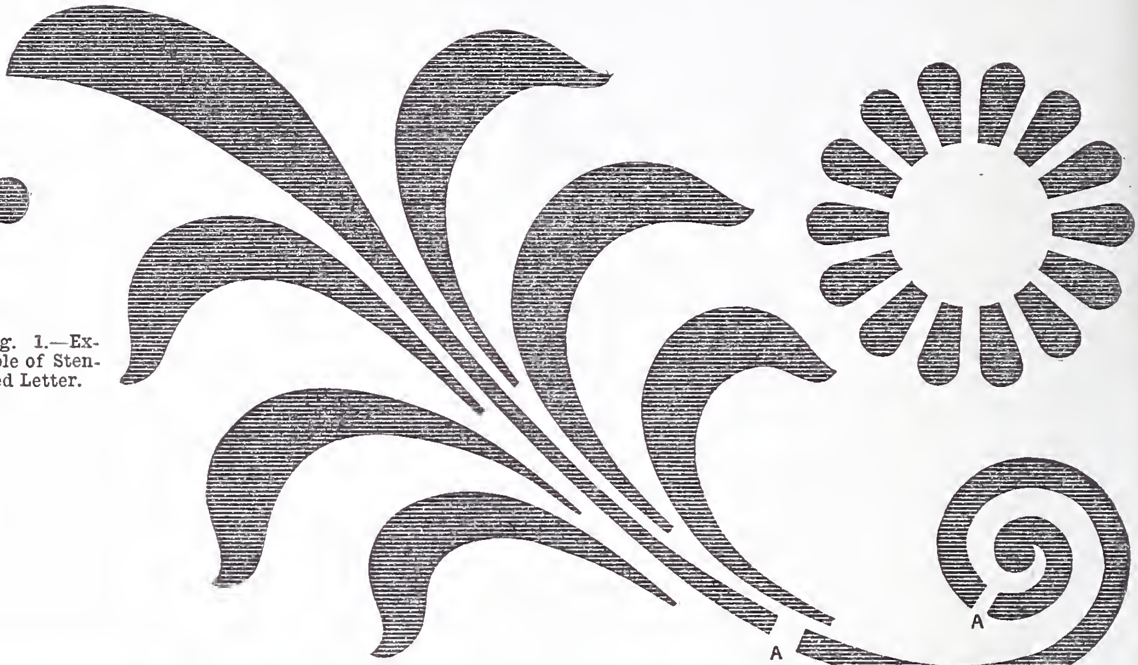


Fig. 2.—Stencil Flower Pattern designed for Border (full size).

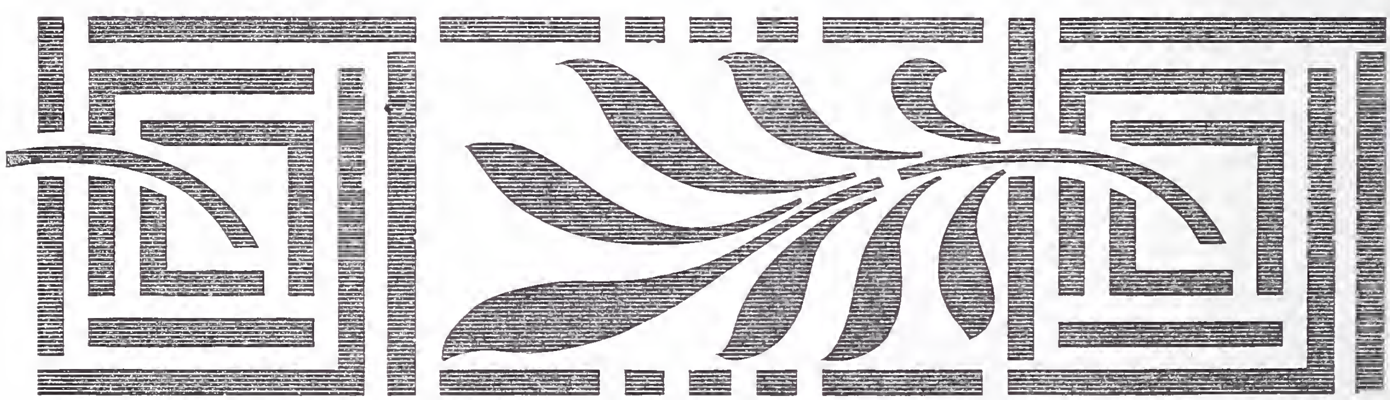
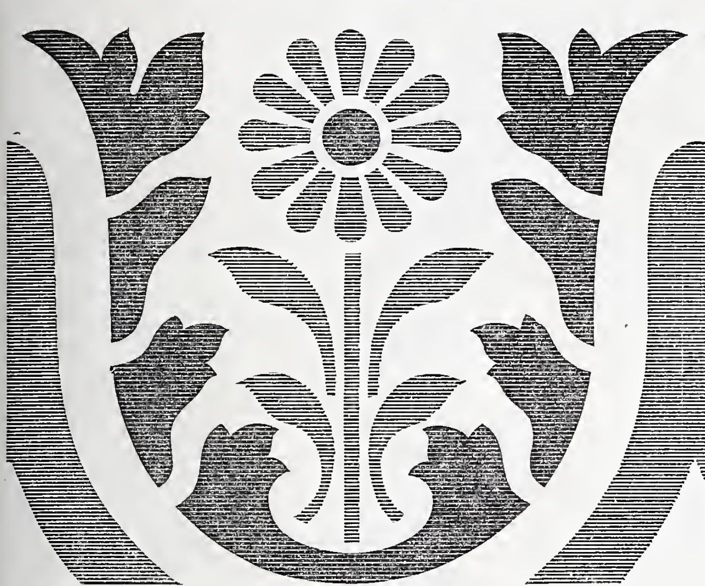


Fig. 3.—Stencil Pattern, showing Combination of Leaf and Old Greek Key Pattern.

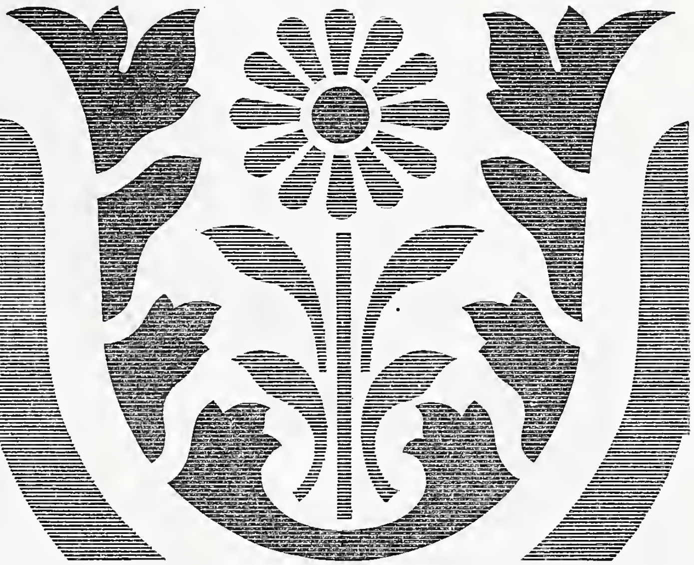
of the letter B, we must "tie" the two pieces that fell out on to the rest of the plate as in Fig. 1, and we can then stencil the letter B, for by not cutting the two loops into the upright, the centre portions are kept in their place. The skill in designing stencils is seen in the way these "ties" are made to actually form an integral portion of the design, so that the pattern actually depends upon the ties for its proper emphasis and expression. But to fully explain myself, let us refer to the illustrations given with this number of Work. We have seen that the flower in Fig. 2 is complete in itself. But the leaf-stalk requires more careful consideration before we cut it, for there are other considerations to be attended to than had to be studied in cutting a flower. It would when placed, for instance, around the frieze of a room, the ties would not be seen. If it is thought desirable to get rid of these ties, a second plate, having the ties *only* cut out of it, is prepared, and when the colour is dry, the stencilling is gone over a second time to fill in the ties. Care must be exercised in getting the plate with the ties on it over the stencilled pattern accurately, and practically I have found it takes little, if any, longer to put the ties in by hand; and it is much more likely to be done by hand without showing than if they are stencilled in. But in patterns placed some distance from the line of sight there is no necessity to trouble about obliterating the ties.

The leaves that spring from the stem, it will be noticed, are not cut into the stem key is stencilled, and when the plate shifted along the right-hand side tl plate is fitted over the key, B B. By th means there are no unequal gaps betwe one impression and another, as would be tl case were the plate shifted along at randoı Remember always to cut "keys" in stenci that are continuous.

In Fig. 3 we have a simple design, which the old Greek key pattern is utilis as a kind of termination to the leaf-stal Such a pattern as this would do for a narro border or on the flat part of a frieze. this design the ties are made to form pa of the design. A good many patterns th have been worn threadbare by long us until the eye tires of them, can be modifi and adapted, and quite a modern feelii given to them. Too many stencil patterns in use are far too trite and hackneyed to be tolerable, and the decorator, instead of using them at all times and places *ad nauseam*, should endeavour to relieve their monotony by importing his own individuality into them. Fig. 4 is another modification of a well-known pattern. This again would be suitable for an "O. G." moulding or a narrow border below the cornice. In this design it is important to stencil the sprig, B, in a lighter colour than the "Acanthus" pattern A. but we must touch on "Using Stencils" on another occasion. The material out of which stencils are cut by decorators is usually cartridge paper, and when the design is cut a couple of coats of knotting varnish are brushed over it (the second one after the first is dry) to make it tough and enable it to wear well and be cleaned. If care be exercised in using paper stencils they will last very well. Draw out your pattern upon thin paper, and transfer it to the material you are about to cut your design out of. carefully, and avoid allowing your knife to go too far and cut more than you want. At the first go off you will find it difficult to keep a mastery over your knife, and cut the curves with freedom and feeling, but a little practice will soon overcome this amateurishness. There is a regular stencil-cutting knife, fixed in a round handle, that can be bought at any good tool maker's for about 9d., and I would advise those who think of cutting many plates to get one. Cut your stencils on a sheet of glass, as the knife travels



No. 1.—Stencil Plate for Fig. 4.



No. 2.—Stencil Plate for Fig. 4.

Fig. 4.—Example of Stencil in Two Colours, requiring Two Plates as above.

Two plates, therefore, are required, A for the acanthus, with the keys, C C, to show where the sprig is to be placed; and B to stencil the sprig and "tongue." Three sections at least should be cut of such a pattern to save time in using the stencil. Here again, though the acanthus is cut up into segments to avoid weakening the plate, these ties are not such as mar the design.

It is possible to stencil in two colours without having two plates by using two stencil brushes, and not having them too large, so that the colour of one part of the plate spreads into that of the other part. In Fig. 2 the flower could easily be stencilled in one tint, and the leaves in another colour; Your knife must be kept very sharp, and have a point so that you can go round your curves with ease, cutting through the paper with one stroke. Be very careful not to cut too far; but should you cut through a tie, you must glue a piece of paper over it. In stencils requiring more than one plate, as in Fig. 4, see that the various sections fit accurately together, and to this end it is well to trace the complete design on tracing paper and transfer the various portions by means of the black transfer paper, marking in the "keys" at the same time. Such forms as the flower in Fig. 2 are the most troublesome ones to cut, and you must not hurry the matter, but cut each petal easily over the smooth surface, and enables one to shape the curved lines with ease. Never attempt to cut on any other material.

Lead foil of the thickness of stout drawing paper I have used; it cuts cleanly and easily, and lies very flat to the wall, and where water colour and distemper are the decorating medium, has certain advantages over paper; but it is much more costly, and, if the ties break, very difficult to repair, so that all things considered I advise my readers to keep to paper. Zinc is often used; but the tyro would not cut this metal, and to get it done by a professional stencil cutter would be a costly proceeding, so we will dismiss it at once.

A stencil looks much fuller on the plate than when it is stencilled, for the thickness of the material has to be taken off all the forms, as the brush, in going over the plate, does not take the colour up to the extreme edge of the design. Therefore keep the design on the side of fulness to counteract this tendency, especially in such forms as stalks and lines, which are apt to look thin and wiry if not cut wide enough.

THE DULCIMER, AND HOW TO BUILD ONE.

BY R. F.

THE Dulcimer, which the Germans call "Hackbrett," the Italians "Cembalo" and "Salterio Tedesca," and the French "Tympanon," is undoubtedly one of the most ancient musical instruments, and the undisputed father of the modern pianoforte.

We have no reliable data as to its introduction into Europe, but it was probably brought to us from the East, perhaps by the Crusaders, for it has been known for ages in Arabia and Persia and also in the Caucasus under the name of "Santir." The old English "Dulsate" and "Dulsacordis" were instruments of which we have no correct information unless they were dulcimers, while the dulcimer of Scripture is still more doubtful.

There is a remarkable resemblance between a seventeenth century dulcimer of Italian make now in the South Kensington Museum, and a modern Georgian santir, as pointed out by Mr. Carl Engel in his "Descriptive Catalogue, 1874."

Dr. Rimbault says, "dulcimer is derived from *dulce melos*" (sweet sounds), probably from the ability of the performer to produce the sweet sounds with the softer side of the hammer or beater with which the instrument is played.

Its use on the Continent seems now to be limited to the gipsy bands of Hungary, but in this country, till within quite recent times, and before it was put in the shade by the introduction of the now ubiquitous cheap piano, it was an instrument in great demand, especially in country places, and many fine performers were to be found whose manipulation was something wonderful. Dulcimer bands, too, were not uncommon, especially in the eastern counties, and generally consisted of a quartette of instruments, composed of first, second, bass, and piccolo or octave. The bass was an instrument nearly six feet long, and strung with heavily bound strings like the bass strings of a pianoforte, whilst the octave was a wee little chap only eighteen inches long. These bands were capable of producing music, especially dance music, of a most go-ahead character, and even performed operatic and other selections with a precision and purity of tone that left little to be desired, the sustained notes being produced by a rapid succession of blows somewhat analogous to that employed by kettle-drummers in the "roll." The unpleasant mixture of sounds caused by the vibration of the undamped strings was, to a great extent, overcome by a judicious application of the soft part of the hand to the strings, but as a rule the music mostly played being of a quick and lively character, did not suffer very much from this "loud pedal" effect.

The recent revival of dulcimer playing is doubtless due in a great measure to the fact that it has been found to make a most charming addition to the piano, and when used to assist at a Cinderella or family dance—when it is not considered really necessary to call in the aid of professional musicians—can render invaluable aid. This, combined with its portability and adaptability for use on board a house boat or yacht, at a picnic or outing, and the undoubted ease with which it may be learnt, justifies the assumption that it is an instrument that has not yet, by any means, seen its last days.

In this and papers to follow I propose to set forth the easiest and best way to build a dulcimer that shall be at once reliable and substantial without being unsightly or heavy, and as portability is a desideratum, we will start on an "F" instrument, that is one that has its lowest steel note tuned to the note  on the piano.

Let us begin then by laying in our stock of wood, and here let me say that it is useless trying to make a good instrument out of inferior stuff; as well attempt the task of "making a silk purse, etc." No; thoroughly good, sound, clean, and well-seasoned wood must be used, or the result will be disappointment and vexation. Tea chests and packing cases will not do, however handy they may be.

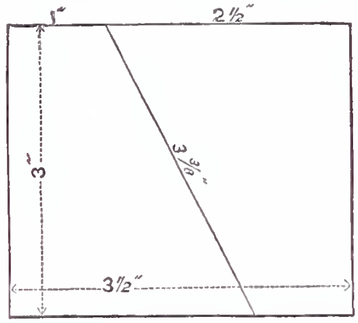


Fig. 1.—Mode of cutting Wood to form "Wrest-pin" and "Hitch-pin" Blocks.

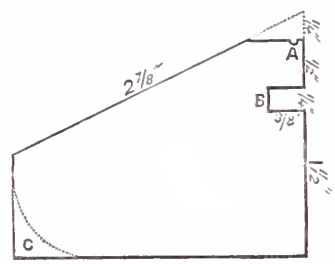


Fig. 2.—Section of Block for "Wrest-pin" or "Hitch-pin" when finished.

The wood we require then is one piece of oak or beech, 18 in. long and 2¾ in. by 3½ in. Beech is the best, as it is "kinder" to work and is not so liable to split. This is for the "wrest-pin" and "hitch-pin" blocks. For the back, about 6 ft. of 9 in. by ½ in.; for the "belly" or soundboard—and this is most important—get 2 ft. 6 in. of ⅜ in. by 15 in. wide best yellow or white pine. It is preferable that this should be in one piece, as a joint in the soundboard should be avoided if possible. Besides this we shall require 6 ft. of 11 in. by ¾ in. for the front and back braces, inside bridges, and front and back facings, and about 2 ft. of 1 in. by 1 in. for inside or lining blocks. All these, with the exception of the belly and pin blocks, should be of the best red or white deal, perfectly free from shakes or knots, as anything of the kind would be fatal to good tone. We have now got all the timber required, except a few feet of moulding and veneer for finishing, which will be mentioned later on.

Now to begin. Cut your piece of oak or beech diagonally from end to end, Fig. 1. This will give you two blocks with sloping faces, which, when planed, should measure 3½ in. across; gauge a mark ¼ in. from the top on the square side of the block, and plane down square to this mark—this will reduce the sloping face to 3 in. In the flat thus formed, shoot a half-round groove, A, ⅛ in. deep and ⅛ in. from the edge, and at a distance of ½ in. from the top edge shoot another groove, B, ¼ in. wide and ⅜ in. deep. The block should now present this appearance, and to give it a finish should be rounded off at the corner, C, as shown by the dotted line, Fig. 2.

Of the two grooves that on the top, A, is intended to take a small brass rod called the pressure-bar, and the one in the side is to take the edge of the belly. Having got out our blocks and seen that the grooves are clean and free from "rags," we will proceed with the back.

Cut off 2 ft. 6 in. of the 9 in. stuff, and another piece of 1 ft. 9 in.; clean them up and shoot one edge of each for joining; the shorter one can be reduced to 7 in. in width or it can remain till the joint is dry. Draw a line across the centre of each, and joint up so that the lines come level, and when thoroughly dry, cut and plane it to measure, 2 ft. 5 in. on the lower edge, 1 ft. 2 in. on the upper, and 1 ft. 2 in. from back to front. If half the distance is measured from each side of the centre line, it will ensure the sides being bevelled at the same angle.

So far our work has been preliminary; in the next paper we will commence the actual work of building.

MEANS, MODES, AND METHODS.

FRENCH POLISH FOR WOUNDS.

RESPECTING the application of ordinary French polish to cuts and wounds as advised in No. 26 of WORK, I have been in the habit of so using that article for years, but it ought to be said that the application at first is extremely painful; it "smarts" so much, that in the case of large wounds the effect would, for a time, be agonising. I find the better plan is, after carefully removing the blood as much as possible, to dust or cover the wound with finely powdered resin, which has a peculiar soothing effect, then to bind or wrap up with rag saturated with the polish. And in regard to the latter, I find it preferable to have it thicker than as used for polishing purposes. This may be very easily obtained by filling a small bottle about three parts full with ordinary methylated polish, and then adding powdered shellac or even resin until nearly full. Shake occasionally until the added gums are dissolved; it will then prove a capital article that ought to be available in every workshop. The resin is a good first dressing. Painters, for cuts, use varnish; copal gum dissolved in oil and spirits for coachmakers; resins for house-painting varnish.—W. G.

RUBBING DOWN OILSTONES.

During fifty years' experience amongst joiners in the metropolis and various parts of the country, I never knew more than one or two men who could keep their oilstones in order without an occasional, and in some cases a frequent, rub down. It is impossible o keep plane irons and wide chisels, etc., rue on a stone, hollow in length or width, nd yet how rare to see a workman's oil-tone but what is so, the old-fashioned plan f rubbing down on a coarse grit slab with and and water being a very tedious and roublesome job. Ah me! how well I emember my apprenticeship days (it was in he forties) when the command was given, 'Bill, rub my oilstone down." Didn't I rumble at that job and no mistake? Rub, ub, and rub, and sweat and rub for an hour t a time. Little more than twenty ears ago, I saw that old-world method ractised at a shop in the neighbourhood of Smithfield where I was working, and it was ot until I came into Lancashire that I earned how such a once tedious job could be lone in a very few minutes by the aid of what s known here as an emery strickle, used by hose who look after carding engines in cotton and woollen mills. For the benefit of those who cannot get an old strickle, I will show how to make an emery board that will quickly level the most irregular oil-stone.

Material required—glycerine glue, coarse-grained emery, and a pine board, say an inch thick, and any size, 12, 18, or 24 in. long, by 4, 5, or 6 in. wide. Take, say, one gill of hot glue, just such as is used for gluing up work, put it in a separate pot or other vessel where it can be kept hot, and add thereto about a dessert spoonful of ordinary glycerine, stirring well. Now take the board, having first of all planed one surface up true, and also bored a $\frac{1}{2}$-in. or $\frac{5}{8}$-in. hole to hang it up by, and lay it face upward upon a large sheet of paper. Cover the surface of the board with the prepared glue, rubbing it in well and evenly with the glue brush. When this is done, without any delay, cover quickly with a thick layer of the coarse emery; bat this down with the flat of your hand all over. Raise the board, shake off the superfluous emery, giving the board a smart rap or two on the bench or table top. Then put aside in a warm, dry place for twelve hours, and repeat the gluing, and covering with emery on the top of the first coat. Rap off all the loose emery, and again put aside to dry. Finally, give the surface a thin coat of boiled oil (with or without the addition of a little black paint), taking care that the interstices between the emery grains are well covered. Let it now rest for two or three days, and when thoroughly dry, it will be found to be a most effective appliance for keeping oilstones nice and level.—W. G.

Cement for Leather Belting.

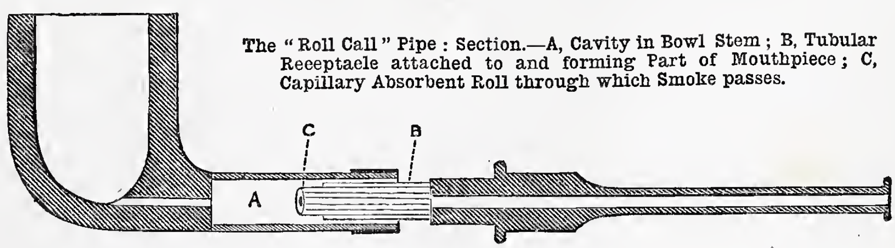
The glycerine glue that is described above makes a capital cement for joining, machine strapping, or leather belting. Power, either of steam or gas, is extending so much in small workshops throughout the country, that many persons, doubtless, will be glad to learn how to piece up broken strapping without having to send a distance and wait for repairs. In my own very modest works, where there is less than a dozen belts running, I find it a very great advantage to be able to repair mishaps to any one of them without any unnecessary delay. Here is my plan. Having first carefully pared down the two ends of the strap to be pieced up, so as to form a lap joint about three inches long, I take a board about three feet in length, and place the two lengths of strap on it so that the joint is midway from end to end on the board. I now temporarily fix the strap to each end of the board by using a hand screw, taking care that the edges of the belt run straight with the edge of the board. Now, first of all, placing a piece of newspaper under the strap at the point of junction, I proceed to glue or cement, as it is termed, the joint with the composition referred to, made quite hot; then driving a couple of $\frac{1}{2}$-in. or $\frac{5}{8}$-in. tacks through the joint into the board, I place another piece of board over the joint, and screw all together tight, either with hand screws, small cramp, or by putting in a vice. Preferably, the whole concern remains thus three or four hours or all night, but, if in a hurry, I unloose the pressure in half an hour or so, take out the tacks, and then stitch with white laces or strong waxed hemp. Joints thus made, when properly dry, are practically unbreakable; the addition of glycerine to the glue preventing the latter from drying hard and cracking, as well as rendering it more adhesive. Where it is exposed to the rain, a teaspoonful of turpentine makes the glue waterproof; that much to a pint of glue.

OUR GUIDE TO GOOD THINGS.

96.—The "Roll Call" Pipe.

Mr. Allen Dewsnap, of 65, Pittes Lane, Glossop, has asked me to notice his "Roll Call" pipe, an invention which is intended to render smoking less injurious and more pleasant than it is when pipes of ordinary construction are used. I have no intention of saying a single word in praise or dispraise of smoking. I do not smoke myself for two very good reasons: firstly, because I do not like smoking; and, secondly, because it does not agree with me. But a great many persons seem to enjoy it thoroughly, and if smoking be really harmful through the nicotine that tobacco contains, it will certainly be useful to make known the existence of a pipe which effectually separates this poisonous and irritating matter from the inhaled smoke, while the fragrant aroma of the tobacco is still retained.

The construction and action of the pipe are shown in the illustration below, which exhibits it in section. It is made in two parts, namely, the bowl and stem, and a mouthpiece which screws into the stem. In a tube, B, at the end of the mouthpiece, a roll, C, of an absorbent substance very much like blotting paper is introduced. This done, the mouthpiece is screwed into the stem, the cavity, A, being nearly filled by the roll, which takes up and absorbs all the nicotine as the smoke passes from the bowl into the mouth of the smoker, the result being, to use the words of the inventor, "a sweet smoke and an absence of nausea, a clean pipe, and one that needs neither scraping nor steaming nor brushing."



The "Roll Call" Pipe: Section.—A, Cavity in Bowl Stem; B, Tubular Receeptacle attached to and forming Part of Mouthpiece; C, Capillary Absorbent Roll through which Smoke passes.

By people who expectorate much while smoking, and to those who suffer from sore tongues, throat, etc., as a consequence of smoking, this pipe will, doubtless, be found a special boon and a perfect cure, and I should imagine its use would be attended with benefit to any smoker, whether he spits or not. The pipe is made of brier, and is fitted with a vulcanite mouthpiece. It is claimed for it that it can be smoked in any position; that it is economical, as all the tobacco is smoked up, and the last whiff is as pleasant as the first; that it is the least offensive of all pipes to other people, as there are no burnt fumes of nicotine to taint the breath or fill a room; and that the roll prevents steam from entering the mouth, and renders the smoke perfectly cool. The price of the rolls is almost *nil*, as twenty-five, or sufficient for more than 100 smokes, may be had for a penny. The pipe and the application of the material of which the rolls are made are both patented. For the price of the pipe, see the "Sale" column that follows "Shop."

97.—Lodge's Patent Self-Locking Cellar Plate.

This cellar plate, the invention of Mr. John Lodge, 24, Shirland Road, Paddington, W., is an important and useful article, inasmuch as it is an advertising medium, by which articles can be

Fig. 1.—Lodge's Patent Self-Locking Cellar Plate.

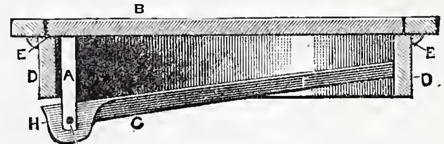


Fig. 2.—Vertical Section of Cellar Plate.

brought under the notice of passers-by, and the names of streets and roads clearly indicated. It seems, however, to be chiefly desirable from the fact that, as the plate is an automatic self-locking plate, pedestrians are in no danger of accidents through stepping on a loose plate not properly put into its place, and the occupants of houses whose cellar approaches are filled with it are insured against entrance in that direction by burglars' boys. The appearance of the plate externally, and the purpose it serves as an advertising medium, is shown in Fig. 1, which speaks for itself; its self-locking principle is shown in Fig. 2. The plate locks itself directly it is placed on the metal ring (D, in Fig. 2) that surrounds the cellar opening, and with the shoulder, E, forms a seating for it. Attached to the under side of the plate, B, is a vertical arm, A, to which a horizontal arm, C, is attached by the pin, G. This arm is just long enough to fall against and grip the side of the ring, D. The end, H, of the arm, C, also butts against the lower surface of the ring, D, and thus affords additional means of preventing it from falling out of the horizontal. The new plate, it is said, has been tested in many places, and has been found to be in every respect simple in action and easily managed, and a safeguard against burglars and accidents to passers-by.

The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

TO ADVERTISERS, MANUFACTURERS, ETC.

*** The Editor of WORK wishes to draw the attention of Advertisers, Manufacturers, Patentees, and Retail Dealers to the following letter from Mr. George H. Bruce, 10, Helena Street, Smethwick, as a proof of the value of WORK as a means for bringing new inventions, machinery, tools, appliances, etc., into notice, and as an Advertising medium. Mr. Bruce writes:—

"I beg to acknowledge the safe return of the gauge and electro lent to you for use in WORK, and to again thank you for the very excellent notice which you so kindly published. As a proof of the extent to which the paper is read, I may say I have received thanks from over forty different towns between Plymouth and Dundee, also from aboard ship, and from Ireland. I shall do all I can to recommend WORK, and should I in the future make anything new to put on the market which would help to make WORK still more valuable to my fellow readers, I will submit it to your approval."

I.—LETTERS FROM CORRESPONDENTS.

Saw Hammering.—J. C. (*London, W.*) writes:—"Your correspondent, in his remarks on saw hammering (see page 333), very rightly states that no two saws, when buckled, can be treated exactly alike; that is the great difficulty, and one which renders it quite impossible for the thing to be placed before the amateur in a readable form. I have had many years' practical experience at the business, and I do not know of anything which is so very puzzling to a beginner, even when in command of the proper appliances. A saw may be what is termed fast or loose, each condition requiring exactly opposite treatment, but the novice could never distinguish between the two. Even when a saw is out of buckle, and what is termed firm, there will occur a variety of bends and twists which are quite distinct from buckles, and require a different-shaped hammer to deal with. Buckles are removed by a heavy hammer with one round face called a 'doghead.' Twists or winds are made to disappear by a hammer with two long narrow faces: one in a line with the shaft, and called a long face; the other at right angles to it, and called a cross face; these and an anvil, and a lot of experience, are the only things that will surmount the difficulty."

Finsbury School of Practical Amateur Mechanics.—MR. THOMAS J. SYER, the Principal of this excellent technical school, which is carried on at Mr. Syer's workshops, 45, Wilson Street, Finsbury Square, E.C., and which is within a few minutes' walk of Broad Street, Liverpool Street, and Moorgate Street Railway Stations, the Tramway Terminus in Finsbury, and the Bank, writes to say that the fresh term has already commenced. Classes are held in cabinet work and carpentry, wood carving and engraving, wood turning, plain and ornamental, metal working, mechanical drawing and coloured plan work, French polishing, upholstery, fret cutting, repoussé work, and tin plate working. Prospectuses with fees, etc., may be obtained of Mr. Syer at the workshops.

An Easily-Made Fret Machine.—ONE IN A FIX writes:—"In No. 21, page 332, W. R. S. gives a method of how to rig up a machine of this kind. Acting on this I started to make one, but cannot see how to work the wheel. I hope W. R. S. will be so kind and obliging as to let me know how it is done, and also how it is fixed."—[W. R. S. is requested to comply with the wish of ONE IN A FIX, and make his meaning perfectly clear.—ED.]

Lock Repairing and Key Fitting.—ERRATUM.—By a misadventure the names of the springs described in the first paper on this subject in No. 21 of WORK, dated August 10th, 1889, became interchanged. The spring shown at G, Fig. 1, is that which is known as the "Scotch Spring," and D is the spring bolt. The "Feather Spring" is the spring illustrated in Fig. 3. This has been pointed out by Mr. Wilson himself, the writer of the article, and several other correspondents, to whom I may say that the passage to which they take exception has been revised by Mr. Wilson. This will be a sufficient reply to IRONMONGER'S ASSISTANT, L. L. (*Salisbury*), and others, whose letters will need no further reply or comment.—ED.

Hinged Bevel for Pocket.—J. G. (*Glasgow*) writes:—"I see a description and drawing of a very handy gauge in WORK No. 23, page 363, for the vest pocket. If a hinged bevel for the vest pocket were made, it would come in handy for many artisans."—[Why not write to the makers of the pocket gauge to which you refer, and ask if they cannot meet your wishes?—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Paper to Imitate Oak Graining.—H. M. (*Crumlin*).—You can buy this of any one who sells paper hangings.

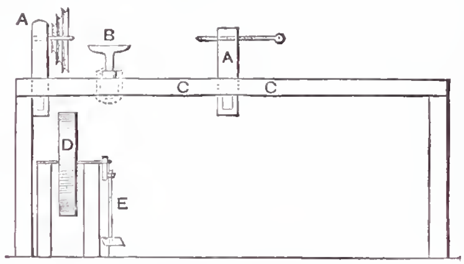
Watch and Clock Repairing.—AMATEUR and NERO.—Before this can meet your eye you will have seen that the papers on this subject are under continuation.

Studio Camera Stand.—DARKIE.—A paper showing how to make this and other camera stands appeared in No. 29 of WORK.

Rubber Stamp Making.—ALBION.—As soon as a competent writer offers his services this subject shall be taken up.

Artificial Leg.—ZOMO.—I cannot undertake to tell you how to make an artificial leg, for I suppose you mean a leg other than that of a mere wooden leg. For anything of this sort the proper person to apply to is Mr. James Gillingham, the celebrated Surgeon Machinist, of Chard, Somersetshire.

Lathes for Everybody.—BEN NEVIS (*Appleby*).—I am glad you like my article on "Lathes for Everybody." I am sure, if you make a lathe of some sort, you will be fully repaid for the labour it will take. It would scarcely be consistent with my object to send working drawings of every part of the complete lathe, as it has to be adapted to existing circumstances, and they are not similar in any two cases. I send herewith a rough sketch, which will explain the position of the various parts, and may be of assistance to you. The bench is an ordinary one on trestles; the top consists of two



Lathes for Everybody.

A, A, Head. B, Rest. C, Bench. D, Grindstone. E, Treadle.

3-inch deals two inches apart; the heads fit into the space thus formed and are secured with wedges, as explained in the article. The grindstone is heavy and driven by a crank and treadle. It occupies the position shown when used as a fly wheel, and can be removed or pushed back out of the way when not in use. A leather band conveys the motion to the pulley. I think you can scarcely fail to comprehend matters, but I will give any other directions you may require with pleasure. The Editor has instructed me to write another article on "Lathes for Everybody." This I will take in hand at once, and describe a simple mandrel lathe. I will remember your suggestion of more detail.—SELF-HELPER.

Alarm Bell Battery.—W. R. (*Bristol*).—The fault you mention is a common one with permanganate of potash in solution. This salt is rapidly decomposed, and a hydrated manganese dioxide is deposited, forming the black mud of which you complain. When used in a single cell, without a porous partition, this mud fouls the zincs, and gives trouble from this cause alone. When about to renew the charge of your cells, use chlorate instead of permanganate of potash, and you will be pleased with the result. Employ half an ounce of chlorate of potash in each cell.—G. E. B.

Galvanic Battery.—GIL PEREZ (*Wakefield*).—(1) The cell described and illustrated by you is similar in every respect to the Bunsen battery described in No. 1 of WORK. You may charge it as there directed for a Bunsen, or with a solution of chromic acid in the porous cell with the carbon, made up as directed in reply to J. R., "Electric Light for Photographic Dark Room." One cell alone, however, will be useless. You must have three such cells, and arrange them in series, to light a very small lamp. (2) If you placed peroxide of manganese in the porous cell together with broken coke, and used a solution of sal-ammoniac in the outer cell, the battery would only be suitable for ringing a small bell, or working a model telegraph instrument, but would be useless for electric lighting. (3) Earth wires are used in electric telegraph systems, but are not to be thought of for your requirements. I would advise you to read closely the three articles on the Bunsen battery in the first three numbers of WORK, and also all the replies to correspondents on this subject in "Shop."—G. E. B.

Plumbing.—SHORTER.—Water is kept back in plumbing by a stopcock—or by what is technically called a stopback—made of clay or new bread. The same thing is arranged in the large cast-iron mains by simply packing the joint.—G. S.

Panorama Tackle.—MACHINIST (*Bath*).—Your only chance of obtaining the necessary drawings for making and erecting the machinery used in working a panorama is by advertising for same in *The Era* and *The Stage* newspapers. A stage machinist, used to working these "shows," would then, no doubt, supply you, if well paid. I certainly know how they are worked, but am not competent enough to write upon the subject. Your first letter did not reach me, or it would have been answered.—H. L. B.

Boot and Shoe Making.—LEATHER.—The introduction of boot and shoe making into WORK has been carefully considered, but if this is touched on, why not include tailoring, hat making, and other kindred subjects? I appreciate your letter, and wish I could see my way to satisfy your wishes, but at present, at all events, it is not possible to do so.

American Organ Building.—GENIUS.—I cannot say with any degree of certainty when these papers will be commenced. I trust you will not have to wait long.

Kaleidoscope.—TOM SMITH.—Indian ink will serve for the back of reflectors, if a thick solution is prepared and smoothly applied with a camel-hair brush. The ground glass circle is to be fixed flush with the inner face of the lid of the object box, in which a recess must be turned or otherwise formed to receive it. The glass is *not half round*, but a *complete* circle, as the dotted line, A B, Fig. 6, refers to the section of box, Fig. 5.—T. R.

Index to Weekly Numbers of WORK.—ELPHYE JANAN.—Your suggestion shall be considered, with the view to its adoption at some future time, if found practicable.

Bicycles Uphill.—A NOVICE (*Southampton*).—I am at a loss to know what your correspondent's difficulty is, as there is nothing indicative in the letter. It simply describes a tricycle of a type now considered out of date, or, rather, out of fashion, the now popular machine being the "Cripper steerer," *à la* handle bar, like the "Safety" bicycle. I may say, however, that a first-class tricycle of the type he mentions will climb hills equal to anything yet on the road, even including the "Safety" bicycle. The side handles give a better purchase for pulling, with the arms in a direct line from the shoulder, than ever can be had with the cross bar in front. When a bicycle comes to a dead stop on a hill, that means a dismount. With a tricycle you may stop and allow your pedals to revolve, say, a quarter of a turn backwards, in order to bring one up for a fresh stroke, when you may again proceed. The principal thing wanted for hill climbing is a good machine, and considerable practice at the work, and a rider who makes a speciality of hill climbing is always immeasurably better at it than one who contents himself with the level and walks the hills. 40-in. wheels, geared level, are not too large for a tricycle, as smaller wheels geared up would be no easier to drive, unless you had gearing to gear them down for hill climbing. I shall be happy to assist A NOVICE in any way I can through the columns of WORK.—A. S. P.

Photography, etc.—F. D. (*Luton*).—I am glad to find that the papers on photography and plating solutions which have appeared in WORK are satisfactory to you. WORK, you must bear in mind, is a magazine of construction and decoration, and that, although the manufacture of photographic appliances will be fully treated, it is not possible to deal seriatim with every branch of the art. When the papers on jeweller's work are commenced, a design for a jeweller's work bench will be given.

Photography, etc.—PALETTE.—Before this reaches your eye, you will have read, and perhaps begun to act on, the instructions given for making a camera. The Instantograph must form the subject of a separate paper. Any question you may wish to ask on the fitting up of lenses will be answered in "Shop." The camera-obscura and its construction must also form the subject of a separate paper.

Gear Cutting.—PENDULE.—Your letter, requesting a paper on this subject, has been sent to a contributor, who will comply with it if possible.

Pen for Ruling Dotted Lines.—H. C. S. (*London, S.E.*).—Your ruling pen seems to be an ingenious contrivance for the purpose in view. I will endeavour to help you in the direction indicated by you. It is a pity that it is not provisionally patented, for the cost of doing so would be only £1.

Printing Frames.—G. P. (*Camberwell*).—An article on this subject will be given as soon as practicable, and special reference will be made to contrivances for printing large cyanotypes. Meanwhile, as you say you do not know what a printing frame is, it may be of assistance to you to know that they are used by all photographers. No doubt any photographer would show you one, and you will then have a very fair idea of what is wanted.—L. J. P.

Hour Glass.—W. E. D. (*King's Lynn*).—I am afraid the subject is hardly a suitable one for an article to be devoted to, and what you ask it is impossible to give in "Shop." I think the best thing you can do is to get a catalogue of carving and fretwork designs from Henry Zilles & Co., whose address you will see in their advertisement. You will, no doubt, be able to pick details from some of the full-sized patterns, which you can combine, to make a stand such as you require. An article on a kitchen dresser is in hand, and will appear in due course.—D. A.

Mediæval Furniture.—T. A. E. (*Newcastle-on-Tyne*).—The subject is referred to in many works, and you can only gain a good knowledge of it from an extensive course of reading. I am not prepared to recommend any one book specially. Your best plan will be to write to Mr. Batsford, bookseller, Holborn, who has a large number of publications on furniture, for his list. You see so much depends on the particular branch you wish to study, that to recommend one book might mislead you. I am sorry to say that your second question, viz., "What period does the style of having straight lines?" is not sufficiently definite to enable me to answer it. If you will supply the words which have evidently been omitted, I may be able to help you.—D. A.

Gold Paper and Mounts.—Anxious One (*Newcastle-on-Tyne*). — It is only by experience that mounts can be properly cut, and the tools are what are known as mount cutter's knife and handle, dividing compasses, iron straightedge, pencil, etc. Gold paper, ready prepared for use, can be bought at City Frame Company, 29, Basinghall Street, E.C. Sixpence per half sheet best gold paper, and postage extra.—G. R.

Cassell's "New Popular Educator."—Ince (*Wigan*).—Cassell's "New Popular Educator" will be complete in forty-eight monthly parts, at 6d. each, or in eight volumes, bound in cloth, 5s. each.

Models for Pasted Papier-Mâché.—W. H. S. (*Southampton*). — Any pattern-maker, joiner, or cabinet-maker would be able to make the moulds for papier-mâché. When many copies are wanted of the same article, it is usual (in the trade) to have a number of casts of the mould made in iron; these are less liable to damage, and, by means of them, the pasting of several copies of the work can be proceeded with at the same time. Tea trays, for instance, being articles wanted by dozens, are pasted on iron moulds.—S. W.

Sign-Writing Book. — Messrs. Brodie & Middleton, artists' colourmen, Long Acre, London, W.C., publish a book on this subject.—H. L. B.

Making Ink. — A Subscriber (*Henley*). — For *black ink*, the following has been recommended:—Bruise 6 oz. of best Aleppo galls, and boil in six pints of water for several hours, adding more water to supply the loss by evaporation. Strain whilst hot through calico into a clean vessel. Add 4 oz. gum arabic, and boil again till the gum is dissolved. Strain again whilst hot into a stone bottle, and add 4 oz. sulphate of iron, previously dissolved in water. Lastly, to preserve from going mouldy, add three drops of creosote for each pint of ink. To appear *thoroughly* black keep for some time before using. A *blue black ink*, but one which appears violet at the time of writing, is made by bruising elderberries, and setting them in a warm place for three days to ferment; straining and adding to each six pints of juice, ½ oz. sulphate of iron, and ½ oz. of acetic acid. A *red ink*, which, it is said, will not lose its brilliancy by use with steel pens, is made as follows: Grind one part carmine with fifteen parts acetate ammonia and fifteen parts water. These are allowed to stand for some time, strained, and then thickened with a few drops of dissolved white sugar. For *blue ink*, the following is said to be good:—To 1,000 parts of boiled water add thirty parts of Prussian blue dissolved in four parts of oxalic acid.—S. W.

Two Speed Geared Cycle.—J. H. B. (*Narbeth*). —In theory, your idea of two gears is desirable, but you are, no doubt, aware that several contrivances for hill climbing power, that is, lower gearing, have been devised and used. They have not, however, been generally adopted, though more than one fully answer the purpose intended. I have used a tricycle with a low gearing in addition to the normal, but, while admitting its occasional advantages for hill climbing, I prefer a light machine without complications. Your specification has, however, been very carefully considered. The plan is, undoubtedly, ingenious, but is open to several objections, though possibly it may contain the germ of something which, if worked by practical cycle manufacturers, might eventuate in success. As it stands at present, I fail to see any advantages over the ordinary run of machines, and I must say that I do not approve of your plan for freeing one wheel when turning corners. I think you will gather from the foregoing that, in my opinion, it would be, to say the least, doubtful whether you would be able to recoup yourself for any expense you might go to. I think your best plan would be to see if you can induce any manufacturer to take up your ideas, but, of course, before doing this, it would be advisable for you to obtain provisional protection. In reply to your second question, I may say that I do not think it at all likely that you would get a patent agent of any standing to give you the guarantee you suggest. He would use every reasonable precaution, and make searches for you, but, of course, he could not take the risk. Unless you are accustomed to patents and specifications, you will find it best to employ an agent, though if you prefer doing without one you are quite at liberty to do so.—D. A.

Ink. — McIntosh (*Highbury*). — Blue black, or purple black inks, become jet black on exposure to light and air, because of the action of the light and air on the iron held in solution with the tannic or gallic acid. If you wish to hasten the blackening process, apply the solution of iron to your paper whilst hot, or heat the sulphate of iron a little before dissolving it. Inks made in this way are not so permanent as those which blacken slowly after being exposed to light and air. You could not possibly separate the ingredients by precipitation, apply them separately, and ensure their combination on paper in the form of jet black ink. Try a strong decoction of nut galls in water thickened with a little gum arabic, as a first solution. As a second, use a solution of sulphate of iron in water thickened with gum arabic and applied hot. If I knew exactly what you aim at doing I might help you further.—G. E. B.

Bookbinders' Tools and Materials.—D. T. D. (*Cardiff*).—You will be able to get binders' cloth, leather, etc., at any respectable bindery in small quantities to suit your purposes. Second-hand binders' tools will not be so easily obtained. Bookbinders' tools are the property of the master, and seldom find their way to the second-hand dealer through the pawnshops, like mechanics' tools. I have seen them, however, for sale in Edinburgh. If you write to Messrs. George Royle & Sons, 5, Lovell's Court, Paternoster Row, London, E.C., they may have some cheap lots to suit you. If you write to the Secretary, Science and Art Department, South Kensington, London, you will get the syllabus for next May examination.—G. C.

Violin Tool. — C. O. N. (*Farrow*). — A purfling tool, like the one I use, is sold for 5s. 6d. by J. Scheerer, Covered Market, Leeds. Another kind is sold by Withers & Co., St. Martin's Lane, London, for 4s. 6d.—B.

Parts of Bicycle.—T. C. (*Chepstow*).—The following makers and dealers will supply all parts and fittings for safeties, and other cycles, either in rough, part finished, or completely finished ready for fitting together:—Brown Bros., 7, Great Eastern Street, London, E.C.; Wilkins & Co., 66, Holborn Viaduct, London, E.C.; Thos. Smith & Son, Ladley Mills, Birmingham; W. A. Lloyd, Waeman Street, Birmingham; Wm. Bown, 308, Sumner Lane, Birmingham. The last is about the best place for all kinds of ball bearings, pedals, and everything connected with the trade.—A. S. P.

Polishing Mahogany.—P. J. S. (*Lambeth*).—The best way to finish mahogany is by French polishing it, if you want a bright glossy surface. The process embraces staining if necessary, to darken the colour, oiling, filling or stopping the grain of the wood, bodying in with polish, and finally spiriting off to get a fine smooth surface without marks. For stain use a solution of either bichromate or permanganate of potash, the strength depending on the colour required. Rub down with fine glass paper after staining to remove roughness caused by the moisture. Oil with raw linseed oil, rubbing it well in with a piece of rag, but not saturating the wood with it. Allow the work to stand by till the oil has become fairly dry, and as long as you like afterwards before beginning to fill in. The best filling you can use is one composed of whitening and turpentine with a little rose pink to colour. Mix these into a stiffish paste, and then rub some of it well into the wood. When you judge this has been sufficiently done to stop up the grain, wipe the surplus away before it gets hard with a clean cloth. The wood is then ready for bodying in at any time, though it is always advisable not to hurry on too fast with any polishing process. To body in use a pad formed of cotton wadding enclosed in a piece of soft rag. Moisten the wadding with French polish and cover it with one fold of the rag. Give this just the least touch of linseed oil, and go over the wood till you have a good body of polish on it. As the rubber dries add more polish, and be careful to cover the wood evenly, rubbing the polish till the spirit evaporates. If necessary, bodying in may be repeated several times at intervals of a day or two. At this stage the surface is smeared and dull-looking, and the final polish is got by spiriting off. This is much the same as bodying in, only spirit (methylated) alone is used instead of polish. Unless you are careful, instead of getting a highly finished surface, you will be apt to remove the previously laid body. Spiriting off is the most difficult part of the process, and requires considerable skill to manage it properly. A series of articles on polishing will appear ere long, meanwhile the foregoing brief directions will, no doubt, be of assistance to you. If, as I conjecture from your second query, you want to polish fretwork, let me advise you to do so before fretting, or if not omit the filling. In the former case you will simply have to touch up the polished surface after the work is completed. If you want very small quantities of thin mahogany, you cannot do better than get it from some local cabinet maker, who will cut a board to any size required, but of course you will have to pay more than if you go to a timber merchant, who, however, will not cut, unless as a matter of favour. The quantity you must take is, however, not excessive, and you will get a great deal more for the same money than you possibly could otherwise by going direct to a timber yard and buying a whole plank. I can recommend D. Witt & Palmer, Drummond Street, Euston Square; Samuel Westlake & Sons, 51, Tabernacle Street, E.C.; or you might try Wm. Bloore, 57, South Lambeth Road; or, W. C. Ware, Lower Kennington Lane, as being nearer to you. I cannot, however, say whether these latter two would supply you. As a guide to you I may say that ⅛-in. plain mahogany may be got from 3d. to 4d. per foot, though of course for fine qualities you must pay considerably more.—D. A.

Engine for Launch.—C. C. (*Hackney*).—Write to Mr. Dugald Clerk, A.M.I.C.E., 13, Temple Street, Birmingham.—J.

Advertisements in Work.—Spes (*Wolverhampton*).—I can only refer you to the reply given to Ad Finem on page 253 of Work.

Violin Varnish.—G. M. L. (*Ashington*).—Amber is only soluble after it has been fused, and is then no good for violin varnish. As varnish making requires both special knowledge and appliances, I should advise you to apply to Mander Brothers, Wolverhampton, who used to make an oil varnish which sets hard and bright in from twenty-four to thirty hours; I think it was made by them on the suggestion of the late Charles Reade.—B.

Tempering Mill-bills. — T. C. (*Chepstow*). — (1) Take two gallons of rain water, 1 oz. corrosive sublimate, 1 oz. sal-ammoniac, 1 oz. saltpetre, one pint and a half of rock salt. The pick should be heated to a cherry-red, and cooled in the above bath. (2) Prepare a bath of lead heated to the boiling point. In it place the end of the bill to a depth of 1½ in., until heated to the temperature of the lead, and then plunge into clear cold water.—J.

Bicycle Wheel. — F. K. (*Lee*).—At that place where the rim comes nearest to touching the fork side, slacken back a few spokes with the spoke grip; then on the opposite side tighten up as many spokes as will pull the part straight. It is, however, quite likely that the spokes at this latter part have got stripped at the screwed ends, or pulled through the rim at the head, in which case all such spokes must be replaced by new ones. F. K.'s best course is to give the machine to a repairer. If he finds, however, that the spokes are all holding good, then he may readily put the wheel right by the means above indicated. To bring it to run dead true, set it revolving, and let the rim touch a piece of chalk. Where the chalk touches, loosen slightly a spoke or two, and tighten one or more on the opposite side.—A. S. P.

Tooth Plane and Paper-Rack.—P. E. (*Ebbw Vale*).—All inquiries are answered as soon as possible, but you must not be surprised at not getting a reply at once. To insert replies immediately is impracticable for more reasons than one, although, if it could be done, it would, no doubt, be a convenience occasionally. A tooth, or toothing, plane is similar in appearance to an ordinary smoothing plane, except that the iron is perpendicular. The face of the iron is ribbed, or rather serrated, for some distance from the lower end. This, on being ground and sharpened in the usual way, gives a sharp saw-like or toothed edge, which is used to roughen the surfaces of wood before they are glued together. You will thus see that though the action is a scratching one, the toothing plane is not the same as the "scratch." One of these, with a special iron, might, of course, be made to answer fairly for occasional use. I do not understand quite what kind of paper-rack you want described. Is it one for keeping stock wall papers in, or for showing them, or what? The thing you ask for may take so many different forms that I must ask you to state more fully what it is intended for, otherwise much space might be occupied in describing several arrangements, none of them suitable. Give particulars as fully as you can, and state space available, quantity of paper kept, and so on. Your other inquiry is altogether too vague for me to answer in a satisfactory manner.—D. A.

Zinc Letters.—T. E. (*Padiham*).—You can purchase the letters and figures that you inquire about at any engravers in copper or zinc, or you could have them cut at any good ironmonger's where they keep workmen on. But why not do it yourself? It is not very difficult work, nor does it require a lot of tools. If you cannot mark out the letters, etc., do as I used to do when a young hand. Get the letters out of auctioneers' bills, etc., the size wanted, paste them on the metal you wish to cut them out of, and chop them out with a small chisel on a flat plate of cast iron, and trim up with a file. Any further information given with pleasure.—R. A.

Parts of Overmantel.—F. M. (*South Hornsey*). —The long turned pieces are spoken of as columns or pillars, the short ones as spindles, and the short ends as knobs. The corner pieces are generally called brackets, but you must understand this word is not exclusively applied to such parts, but is a term of very wide acceptance in cabinet-making districts you refer to. To help you, I name the parts asked about, but as you state the reason for wanting to know them is that the Curtain Road turners would charge you considerably more than the usual price if they thought you a novice, I may as well say that considerably more than a knowledge of the common trade names will be required on your part. Any of the Road people in the furniture line would recognise with "half an eye" that you are not in the trade, unless you have a knowledge of it. Of course, you must expect to pay more for a small quantity, such as you want, than usual (trade) prices. It is absurd to suppose that you could get them at wholesale figures, though, no doubt, several dealers will tell you they only sell wholesale, and have only one price. Take my advice, and order through a local tradesman.—D. A.

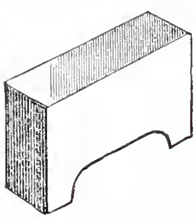
Vulcanite. — E. R. (*Birmingham*). — Vulcanite may be polished when necessary by simply rubbing it with oil and some smooth powder, such as putty powder. The surface will be dull, but uniform, and the easiest way to put a bright gloss will be to go over it with a little French polish or glaze. This I can recommend you as a quick way, though, of course, the work will not stand much rough usage. However, when it becomes dull, you can go over it again with the polish rubber.—D. A.

Pedometer. — W. C. (*Upper Holloway*). — The instrument W. C. requires is a pedometer. It is, I fear, beyond the ability of an amateur to make. It consists of a train of wheels actuated by a mainspring similar to a watch. A lever escapement is so balanced that with each inclination of the body in taking a step the escape wheel is liberated, and the motion is communicated by the train of wheels to the hands on the dial. It thus records the number of steps in a measured mile, and when that has been ascertained it is easy to calculate any distance travelled. W. C. will see from these hints that it requires the skill and knowledge of a watchmaker to construct such an instrument as he requires.—O. B.

Book on Sheet Metal Work.—J. A. (*Grimsby*).—There is a book entitled "The Sheet Metal Worker's Guide," price 1s. 6d., published by Messrs. Crosby Lockwood & Co., E.C. I do not think Warne's publish such a book. If you can get the first volume of Holtzapffel's "Turning and Mechanical Manipulation" you will find a good deal of practical information relative to the working of sheet metals.—J.

Bookbinding.—AN APPRENTICE (*London, S.E.*).—It is intended to carry on bookbinding. A series of practical papers are in the printer's hands, and will appear as early as convenient. Finishing, both plain and extra, will be treated, as the series would be incomplete without it. In the meantime I will be most happy to give AN APPRENTICE any information on gold finishing he may desire, if he states definitely what he wants.—G. C.

Heating Soldering Iron.—E. L. H. (*Begbroke*).—Answering the latter part of your query first, a blowpipe is quite unsuitable for repairing such things as tin cans, kitchen utensils, etc., for this reason: You have, no doubt, seen a tinman soldering with an iron, say, round the spout of a kettle, and noticed that it was done with a kind of rubbing movement. Well, this rubbing seems to do just what the blowpipe cannot do—that is, it brings the metals into more intimate contact, and causes them to adhere; also you cannot guide the metal with the blowpipe so well as with the copper bit, but such jobs as soldering a pin hole, or anything like that, you might manage with a blowpipe, but you will find that you cannot dispense with the soldering iron altogether. With regard to the other part of your query, viz., for a method of heating the iron without lighting a fire or using gas, I am glad to be able to help you. Get a Rippingille's paraffin stove, with not *less* than a 4-in. burner, and a sliding tank. Make, or have made, a sheet iron chimney, like sketch, 3 in. high, to fit over the dome of the burner; rivet four legs on it, or make some arrangement so that it will not topple over. A medium-sized iron will get hot in about five minutes, and the stove is handy for many other things.—R. A.



Heater for Soldering Iron.

Removing Ink Marks from Parchment or Paper.—LANCASHIRE LAD (*Bolton*).—If, as would appear from his letter, our correspondent's error on his plan has been made in *ordinary writing ink*, the stain may be removed by the application of spirits of salts (hydrochloric acid) diluted with five or six times its bulk of water. Solutions of either oxalic, citric, or tartaric acids are said to produce the same results; but in any case the acid must be washed off with clean water a minute or two after application. L. L. is advised to experiment on odd pieces of parchment or paper before touching his plan with acid, as some little neatness is required.—S. W.

Oxygen Gas: "Brin" Process.—C. J. W. (*Beccles*).—Perhaps C. J. W. is not aware that the "Brin" process is protected by patents, and involves special and expensive plant. If desired, I certainly could describe it, but it would take up valuable space, which, I fear, the Editor might object to, as certainly not one in ten thousand of the readers of WORK would be able to carry out the plan. I will, however, direct C. J. W.'s attention to an illustrated article in the *English Mechanic* for July 12, 1889, describing the process. If the information there is not sufficient, I shall be glad to supply any at my command.—O. B.

Electrotyping.—A. W. (*Paisley*).—In answer to your queries *re* moulding, we would suggest that you do away with the frying-pan arrangement at once, and in order to get a practical matrix to cast from (in your small way) make your flong as follows:—Three sheets tissue, one sheet blot, one sheet of brown. After you have beaten in the flong, pack in the whites, and dry off on a copying press heated by gas under bottom platten, bringing the top down hard. After it is dry, cut round and dust with French chalk before putting into casting box.—W. T. R.

Boat Building.—F. G. H.—I have been promised a paper on Canoe-building, but promises, I find, often meet with very tardy fulfilment. I will endeavour to induce some capable writer to take up the subject, but it covers a wide field, and you do not say what kind of boat you wish to try your hand on. Night alarum clocks will also be handled in due course, but it is useless for me, knowing what I have on hand, to make any specific promises. It is satisfactory to know that you and your friends find WORK useful, and that you can say:—"I tried your rational bookcase in No. 15 by Mark Mallett, and have to thank him for his design. I tried it, and made it as good almost, I think, as he could make it himself."

Chairmaking.—CONTENT.—I have an excellent paper, with illustrations, on the method of making a large armchair, usually called an easy chair, by Mr. Adamson, which will soon see the light. I am glad that you also, like F. G. H. and his friends, like WORK, and look forward with pleasure to the appearance of each weekly number.

Polishing Hard Stone.—A. A. M. (*Stockwell*).—Face the stone by working it down to a fairly level surface with the chisel and mallet. If the piece is not sufficiently heavy to remain unmoved under the chisel, fix it to a larger stone with plaster of Paris. Then rub it down with a flat stone, coarse grit, and water. As grit, nothing is better than Yorkshire paving stone smashed up with a hammer. Next rub down with coarsish sand and water, afterwards with fine sand. Finally, polish with putty-powder and a rag. Putty powder—sold under that name at the colourman's—is, we believe, a preparation of calcined tin.—M. M.

Model Locomotive.—W. H. W. (*Scedley*).—One of our contributors, J. H., is describing the construction of such a model locomotive as you require in the pages of the *English Mechanic*.—J.

Grinding Machine.—AMATEUR.—Emery wheels run wet or dry are used for grinding. Write for catalogues to Luke & Spencer, Ardwick, Manchester; L. Sterne & Co., Glasgow; Selig Sonnenthal, Queen Victoria Street, London.—J.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Sketch for Stall.—J. T. (*Middlesborough*) writes:—"Would a kind reader give me a sketch for a stall for to stand in a covered-in market, to show fancy goods, glass, china, and fancy toys, with a racked back, and to lock up at nights, so as not to have to remove the goods, and as little cost as possible?"

Machine for Making Cigarettes.—S. B. R. (*Blackheath*) writes:—"Being a smoker and lover of cigarettes, I should like to have instructions for constructing a machine for making cigarettes. I mean it to be worked like a sewing machine by a treadle, so that you would only have to put in the paper and tobacco, and out rolls a well-made cigarette when the machine is set in motion."

Parchment Mounting and Stains.—MITRE (*Hanwell*) writes:—"Will a reader kindly inform me, through 'Shop,' how I must treat some parchment certificates which I wish to frame and mount? Should they be damped and pasted to a card in the same way as a paper, or do they require any special treatment? I should also be glad to know how to remove some stains."

Pill Making.—J. C. (*Carlisle*) writes:—"May I ask, through the medium of your valuable paper, WORK, if any of your numerous readers can tell me of any firm who deals in, or makes, tools or machines for pill making? or if any one can suggest any simple tool or machine for that purpose, I shall feel very grateful."

Machinery for Breaking up Old Rope.—R. L. R. (*Liverpool*) wishes to know where he can purchase machinery for breaking up old rope and converting it into oakum. He also wishes to know name of makers of the "American Rope and Oakum Picker," which answers the purpose indicated.

Cleaning Engravings.—IVOR (*Bradford*) writes:—"Having some large engravings to clean, I made a wooden tray or 'bath' 40 in. by 40 in. and 3 in. deep. This I lined with thin sheet lead to make watertight. Chloride of lime in solution is used for bleaching or cleaning. I procured the purest lime sold. Yet I find, after a few hours' standing, that the surface of the lead is covered with reddish-brown blotches like rust. If the engraving touches these it is marked like the iron mould stain on linen. Can you inform me how to make the lead impervious to the lime permanently? Would paint or Aspinall's enamel prevent the rust from coming through, or would the paint itself withstand the action of the lime?"

Ink for Posters.—A. J. (*Ilkeston*) writes:—"I should be greatly obliged if any of your readers of WORK would say what kind of ink or paint is used in writing large posters, and also for window tickets."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Distempering Wood.—F. P. writes in reply to BELL (see page 334):—"Mix 1 lb. patent size with three pounds best whiting, or similar proportions; if glue is used instead of size, consider it four times as powerful for your purpose as the size. You want to 'get up' and grain tables and bedroom suites cheaply, say, in imitation of oak. Proceed as follows: Put cold water into a vessel, then whiting into it and dry ochre sufficient to get the desired shade of ground when dry (determine this by trying a little). When all is moistened, pour off water, and add the hot glue or size. Well stir and strain through a sieve or such like. Dust the articles, and coat with mixture. When dry, give another good coat; this should give, when dry, a hard, solid surface. Well rub down with glasspaper to get a smooth surface (don't rub it all off!), and then grain on it, using water ground pigment in a little beer, and wiping out figure and grain with a stiff brush and wet chamois leather. When dry, give a coat of 'half and half,' turps and varnish; then overgrain, if required, and finish with a good coat of varnish. Any other wood and 'mottling' imitation is done in water. Colour upon the size ground in similar manner; but remember, as in all things, 'practice makes perfect!'"

Trade Notes and Memoranda.

THE 111-ton gun was fired recently at Shoeburyness, and a few results may be interesting. Six rounds, each costing £108, were fired, and projectiles weighing 18 cwt. fired by 960 lbs. of pebble powder were sent twelve miles. The approximate initial velocity was 1,850 ft. per second. The gun was fired by electricity. The concussion broke many windows in the barracks and houses in the village, which is more than half a mile from the battery. A large number of well-known artillerists were on the ground.

A PRIVATE company has been formed, and has obtained the necessary capital for the construction of an electric railway from the town of Lanark to Hamilton. The motive power is to be obtained from Stonebyres, one of the Falls of the Clyde.

IT has been resolved to use the Tivoli waterfalls as a motive power for the electric lighting of the city of Rome. Two thousand horse-power will be derived from this means, and led to Rome, a distance of thirty kilomètres, on the systems of Lipernowsky, Déri, and Blattry, and according to the *Pester Lloyd* this is the greatest distance yet compassed by any similar arrangement. A Pesth firm, Ganz & Co., have undertaken to complete the work.

WORK

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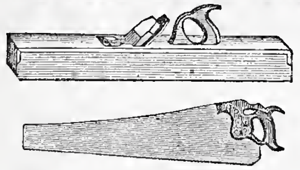

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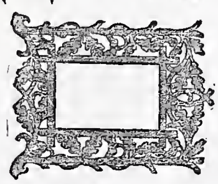

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WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR

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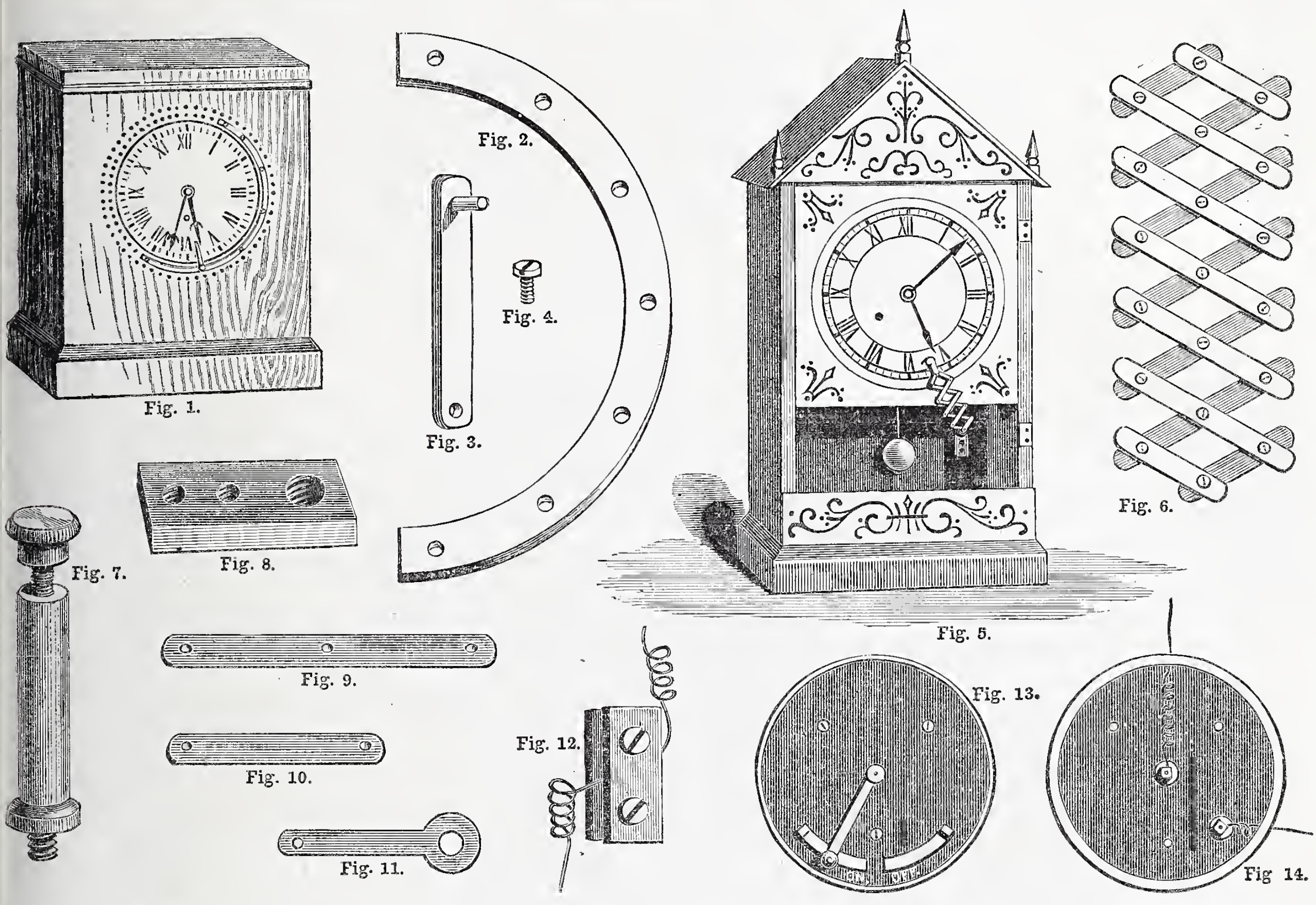


Fig. 1.—Clock in Plain Wood Case, fitted with Electric Time Alarum Hand. Fig. 2.—Semicircle of Frass to hold Alarum Hand. Fig. 3.—Alarum Hand. Fig. 4.—Screw. Fig. 5.—Ornamental American Clock, fitted with Electric Time Alarum. Fig. 6.—Lattice Work Metal Arm for Alarum Hand. Fig. 7.—Brass Pillar for Arm. Fig. 8.—Foot of Brass Pillar. Fig. 9.—Link of Lattice Work shown in Fig. 6. Figs. 10 and 11.—Links for Ends of Lattice Work. Fig. 12.—Electric Connector made with two Thin Brass Plates. Fig. 13.—Plan of Upper Side of Switch. Fig. 14.—Plan of Lower Side of Switch, showing Connections beneath.

HOW TO MAKE AN ELECTRIC TIME ALARUM.

BY GEORGE EDWINSON BONNEY.

ONE of the blessings attending the enjoyment of good health and youthful vigour is the ability to sleep soundly and long. It is not only "the voice of the sluggard" we hear complain: "You have waked me too soon, I must slumber again;" for the industrious but weary sons and daughters of toil find the bed all too sweet to leave when duty calls in the early morning. I often smile grimly as I scan the advertisement columns of a newspaper and read there the frequent requirements for early-rising servants. Poor girls! Up late at nights attending to the wants, the whims, or the fancies of their employers, they must be up again early the next morning to cook, to sweep, and dust, whilst their superiors doze in bed and fetch up arrears of sleep. What wonder is it that, one morning, tired nature in the servant refuses to obey the strident tones of the alarum clock! The alarum runs down and she hears it, but the sound only strikes her *dreamy* senses, and she goes on dreaming. For a moment she dreams she is awake and dressing herself, or perhaps lighting the fire; the next moment her senses are benumbed with sleep, and she sleeps on until she loses her character as early riser. Masters and mistresses should exercise kindly consideration for these lapses, whilst us who are older should deal leniently with the late-rising offences of the young, and help them to avoid lapsing into sluggish habits, by providing for them an alarum that will not run down in a few moments, but will keep pegging away until the person to be called gets out of bed to stop it.

Such an alarum will also be found to be of great use to working men engaged in factories and on works where early punctual attendance is rendered imperative to holding a situation. The essentials for an electric time alarum are: 1. An electric bell and battery. 2. A clock of any kind, providing it is a moderately good timekeeper.

The Electric Bell may be of any size or form of the vibrating or continuous ringing type, such as those usually employed for household use. A small bell with a 2½-in.

gong is preferable to one with a large gong, because the sharp sound given by the smaller gong has a better effect in arousing a sleeper than the duller but more mellow tones of large gongs. Where there exists a system of burglar alarums in the house, a bell giving a sound distinct from that of the burglar alarum bell is advisable, and, as these latter are usually large gongs with loud tones, the selection of a small gong for the time alarum ensures the necessary distinction. In the series of articles on burglar alarums recently published in WORK I have given full instructions on how to make an electric bell, and must respectfully refer my readers to those articles if they wish to know how to make the bell for themselves.

The Battery.—If the time alarum is to be set up in a house already provided with a system of burglar alarums or electric bells, we may use two cells of the battery belonging to this system, and connect them up to the time alarum. In the absence of such a battery, two large Leclanché or Gassner cells should be provided. It should be understood here that a small 2½-in. bell may be rung with current from one small cell of either class of battery, and a working man need go to no further expense than to get one cell; but experience has demonstrated the necessity of providing a surplus of power where electric bells are left to the tender mercies of domestic servants. If the bell is only allowed to ring for a few minutes at a time and then promptly switched off from the battery, a small cell will give enough current and last for a year or two; but if the bell is mufled to stop the ringing, and allowed to remain thus for an hour or two, the battery will soon run down, because current is passing through the bell coils all the time it remains muffled. In the series of articles on burglar alarums, I have given directions for making a Leclanché battery, and have shown how to keep it in order.

The Clock.—Being provided with a bell and battery, we may now concentrate our attention on the clock, and it is at this point where attention is most required. As before stated, the clock may be of any size or kind, provided it keeps moderately good time, but preference should be given by the amateur to clocks in wooden frames, furnished with porcelain or enamelled metal dials, and with a door of some sort to cover the face. This class of clock, such as the common American clocks in wooden cases, may be easily altered, and the work will not present any practical difficulties in the way of getting good insulation for the several parts.

To begin with such a clock, then, on which to try our 'prentice hand: access must be first obtained to the works. These, for the purpose in hand, should be held in a metal frame, or at least, the hour hand spindle should run in a metal bearing to which we can solder a wire. A short piece of No. 20 B. W. G. silk-covered copper wire must have one end laid bare, and this soldered to the metal in which the hour hand spindle runs. It matters little whether the part to which the wire is soldered is in front or at the side, or at the back of the works. If the frame is all of metal, it may be at some remote or easily accessible part of the frame. The wire thus soldered to the works must be brought out through the clock case, where it is likely to be least observed, and there connected by a clean bare end with a metal stud or binding screw, or some other piece of metal easily connected to the line wires of the battery. These outside connections of the clock will call for an exercise of the amateur's ingenuity in planning secret or out-of-sight means of connecting the clock with the battery, as it is undesirable to have a pair of binding screws sticking out of the top of the clock or at the sides, and wires running along in full view on the mantelpiece. If the clock has a pointed roof with an ornamental turned brass pillar on each side, these may be taken off, fitted up as connectors for the wires, and then put on again. Connection may be made between the line wire of the bell and the wire of the clock by tightly clipping them both between two tiny brass plates secured to the back of the clock frame by two short brass screws as shown at Fig. 12.

Having secured a metallic connection between the bell and the hour hand of the clock, we must now make an arrangement on the face of the clock to connect the hour hand with the battery when the hand arrives at the time when we wish the alarum to ring. This arrangement must be a surplus hand insulated from the works of the clock, and connected with the line wire leading to the battery. At Fig. 1 is shown a clock fitted with an alarum arrangement on the dial at the right-hand side. This clock was an ordinary American timepiece enclosed in a plain walnut case, and furnished with an enamelled metal dial. The face was protected by a circular glass door set in a brass frame. This I have removed, to more clearly show the alarum arrangement, but its position is shown by the dotted lines. If the clock selected is similar to this, proceed as follows:—Set a pair of compasses to the circumference of the dial, and strike out on a piece of thin sheet brass or sheet copper a semicircle slightly larger than the dial, and from $\frac{3}{16}$ to ¼ in. wide, as shown at Fig. 2. I cannot give the exact dimensions of this part, as it must be obtained by the actual measurement of the dial of the selected clock. It must not touch the dial (if this is made of metal) in any part, but should be close to it without touching, for if it touches the dial it will probably connect the works of the clock with the alarum hand and render it useless. It must also be wide enough to hold the screws employed in fastening it to the clock case, but not so wide as to interfere with the closing of the glass door. Cut this piece out, smooth the edges with a fine file, then drill the holes for the screws. As these will fulfil the double purpose of fastening this part to the case, and also to hold the alarum hand, the holes must be drilled at regular intervals apart, so as to bring the hand midway between the hours on the dial. The hand can then be fixed to either of the screws, and will command in this position the time between any two hours on that side of the dial. For instance, when placed at half-past five as shown on the dial at Fig. 1, it can be shifted to the right so as to meet the hour hand at five o'clock, or at any time between this and six o'clock. If unscrewed from this position and placed between one and two o'clock, it will command any time between these two hours at which it may be fixed.

The alarum hand is shown full size at Fig. 3. It is made of a strip of thin brass, with a small hole at one end to receive the fixing screw and at the other end a pin of platinum wire. This may be of any gauge from No. 16 to No. 22, but it must only be long enough to engage the hour hand, and must be short enough to allow the minute hand to pass over the hand without touching the pin. The screws employed in fixing this hand should be the small flat-headed variety as shown at Fig. 4, obtainable from all dealers in clock materials. Connection is made between this hand and the battery by means of a piece of silk-covered wire, coming out through a fine hole made in the case close under the figure VII, and attached to the brass semicirclet by passing one end of the bared wire around the screw which holds this end of the brass to the case. The other end of the wire is, of course, made fast to a binding screw at the back of the clock, and a wire goes from this to the battery. When the hour hand of the clock comes around to the spot where the alarum hand is set, the two engage with each other, and contact is made between the battery and the bell through the clock. The bell will then go on ringing until the hour hand has swept the alarum hand along over the space which the latter commands (probably during one hour) unless the sleeper awakes and gets out of bed to switch off the bell. A switch for this purpose, shown at Figs. 13 and 14, is generally placed in circuit at some little distance from the bed of the sleeper, such as on the other side of the room, or outside the room door. When time alarums are fixed for servants, the bell is hung in the servants' bedroom, and the switch is placed on a wall or partition outside the master's bedroom door. The alarum can thus be set on going to bed, and the servant must come out of her room to switch off the bell in the morning. During the day, the alarum hand can be turned back out of sight under the frame of the glass door which protects the dial.

In the form of American clock shown at Fig. 5 a different arrangement is required, as there is not any woodwork to which the semicircle of brass can be fixed, and any insulating substance placed on the dial would disfigure it. The dial might be removed and the semicircle insulated from the back of the dial by strips of ebonite or gutta-percha, attached to it by means of short screws. Holes would then have to be drilled through the dial between each figure, near the outer circle, to receive the screws used in connecting the alarum hand with the semicircle beneath, and these holes must be bushed with ivory, ebonite, or bone, to insulate the screws from the metal dial. Few amateurs care to thus disfigure the clock face, and would prefer some other method of fitting up the alarum.

One such method is shown at Fig. 5, as attached to the clock, which is here shown with the door removed for our convenience. The front arrangement to go over the dial, for the purpose of a connector between the alarum hand and the battery, is made up of a lattice work of thin strips of metal, as shown at Fig. 6. To this, at the upper end, is riveted the alarum hand, shown at Fig. 3, whilst the lower end of the lattice is secured by a screw to the pillar, shown at Fig. 7, and this in turn is screwed into a piece of brass to form a bracket foot, as shown at Fig. 8, the whole being then fastened to the back-board of the clock case, immediately under the dial, as shown at Fig. 5. This arrangement will secure insulation of the alarum hand from the metal dial, and provide an elastic and sufficiently rigid arm capable of being elongated to reach the small hours, turned aside to bring the hand in position under the hours from 5 to 8, and shortened or folded up when not in use to place it out of sight during the daytime, when it would be covered by the opaque part of the door.

The lattice work is composed of several strips of thin sheet metal riveted together as shown; the metal may be thin, hard sheet brass or copper, or tinned sheet iron such as tin utensils are made of. The strips should be only $\frac{3}{16}$ in. in width and $1\frac{1}{2}$ in. in length, cut to the shape shown at Fig. 9, and drilled with three holes in each, as shown. The holes should be only large enough to admit brass toilet pins, and these will thus form excellent rivets, with one head already made. The strips must be firmly riveted together, as shown at Fig. 6, but a little play must be allowed to each joint, just enough to make each work stiffly, for if made too loose the arm will not be sufficiently rigid. The number of strips employed must be determined by the length of arm required, which will vary with the size of clock dial, and with the hours to be covered with the alarum hand. The two strips at top, to hold the alarum hand, and also the strips at the bottom to attach the lattice to its supporting pillar, must be shorter than the others, and should be shaped as shown at Fig. 10. The alarum hand should be riveted between the two top strips at the angle where they meet each other. The lower strips may be made larger or have their lower parts enlarged, as shown at Fig. 11, to receive holes suitable for attaching this part to the pillar by means of the screw, shown at Fig. 7. This pillar should be turned out of a piece of brass rod to size and shape of sketch, but the length must be determined by actual measurement on the clock in which it is to be employed, as it should just stand high enough to enable its arm to clear the face of the dial. The lower part of the pillar may be made in the form of a screwed tang, as shown, to screw into a brass foot, Fig. 8, or it may be soldered to the foot. The top part must have a $\frac{3}{16}$-in. hole drilled and tapped to receive the screw shown in the sketch, which must also be turned out of a bit of brass rod to the shape and size shown.

The various parts may now be put together and fixed in position. If the platinum pin on the alarum hand is found to be too long for the minute hand to clear it, the pin must be shortened. If the lattice arm works too freely the rivets must be tightened. If the enamel on the dial is a conductor of electricity, and the arm or hand touches the dial so as to close the circuit and ring the bell, varnish the under side of the lattice and hand with sealing wax, gutta-percha, india-rubber, shellac, or any good insulating varnish. Connect the various parts up to the line wire as directed in the first part of this paper. The brass ornamental pillars on top may be utilised here, or the wires may be carried to connectors such as those shown at Fig. 12 and already described.

I have given here instructions for adapting an electric time alarum to two different types of clocks, and these will suggest the means to be adopted for other larger or smaller ones of nearly the same type, including the old-fashioned kitchen clock. Almost any type of clock may be used by the exercise of a little ingenuity. If fitted with an ordinary striking alarum worked by means of cords and weights, the descending weight may be made to close the circuit of a relay, and throw an electric bell into action ere the alarum has done striking. For this purpose an action similar to that employed in Dale's Indicator Relay, recently described and illustrated in the articles on Burglar Alarums, will be required. A similar action may be employed with an alarum clock in a metal case. Attach one of the relay wires to the metal case of the clock, and the other wire to an insulated spring fixed to the back of the clock near to the T winding key of the alarum. At night arrange the insulated spring so as to come in contact with the T of the key, as this turns around when the alarum runs down; this will close the relay circuit and set the electric bell ringing. These are a few suggestions employed to stimulate the ingenuity of readers who may wish to make a time alarum. Should any difficulties present themselves to any persons wishing to adapt a clock to this purpose, if they will clearly state these to me, together with a rough sketch of the clock, I will endeavour to help them through the medium of "Shop."

HOME-MADE TOOLS.

BY J. H.

Straightedges and Winding Strips.

I now take another important section of tools—those, namely, which are used for the checking of the accuracy of work, and for lining out. In this article I will consider the straightedges and winding strips made in wood and in metal.

Wooden straightedges are, as a rule, employed by wood workers; metal straightedges by those who work in metal. Straightedges, surface plates, and squares are distinguished from other kinds of tools in this respect, that their accuracy can be best assured by constructing them without reference to any pre-existing standards, originating and completing them by a laborious process of trial and error. The fundamental principle is simple enough in itself, but the labour involved is both tedious and minute. The principle may be stated thus:—If three surfaces are mutually and interchangeably coincident, then each of those surfaces must be a true plane. It is impossible that it should be otherwise, and it is impossible that less than three surfaces will suffice by the test of their interchangeability to assure perfect accuracy. Thus, for example, suppose we have one straightedge with its edges planed parallel, and as true in the linear direction as we can get them when checked by the eye, or even by a more exact method still, by laying the straightedge down upon a plane surface—scribing a line along one edge, and then turning the straightedge over and placing its opposite edge beside the same line, when it may appear to coincide. But now, if we make another straightedge, the precise duplicate of the first, and then try edges to edges, we shall most certainly find that the light is visible between some portions, while others are in contact. There will be some amount of rounding and hollowing of the edges, which, however minute in quantity, is to that extent a departure from truth. And though we may alter and modify until we think we have coincidence between two edges when tested in succession by changing end for end, and although this amount of accuracy would be sufficiently approximate for the ordinary purposes of wood working, and also for much metal work, yet it cannot be absolutely accurate. For if a third straightedge be now made, the counterpart of the first two, then it will be seen on trial that the three will not be mutually interchangeable with one another. But by constructing three the coincidence can be made absolute. Thus it is clear that if the edges of straightedges Nos. 1 and 2 are coincident, it may happen that both are slightly inaccurate in opposite directions—that is, convex and concave. But trying the third against both No. 1 and No. 2, it will indicate whether any inaccuracy exists; because it is impossible that it should coincide with two other edges unless those edges are true. In this manner the least traces of inaccuracy may be detected and gradually reduced to an infinitesimal amount. But the same results may be obtained by making two *parallel* straightedges, and using these edges as a check upon each other. Thus, making two straightedges alike in width, with edges at precise right angles with their faces, calling their edges A and B, C and D, they may (Fig. 26), when A and B are brought edge to edge, have the relationship shown in that figure, the curvature being exaggerated of course for purposes of illustration. The trial of these edges alone, therefore, would tell us nothing, because, to all appearance, they coincide. But, reversing the edges they would have the appearance of Fig. 27; also exaggerated. Obviously now we have to reduce the concavity of one pair of edges, and the convexity of the other, in exactly equal proportions, until either edge when tried against the two edges of the other strip are so nearly coincident therewith that no difference can be detected by ordinary tests of wood workers, such as chalking the edges and laying them together. Practically and theoretically the strips are true.

Carpenters, joiners, pattern makers, and cabinet makers usually make their straightedges in pairs as "winding strips;" and it is clear that if two winding strips are in the first place parallel, and then coincident when the positions of edges and ends are changed, there is obtained really the contact of three edges, and as near an approach to accuracy is obtained as is possible or essential. If they are not made as parallel strips, but simply as single straightedges, then it is absolutely essential that *three* be made.

So much for the principle; now for the details. Take first wooden straightedges. They are usually made either of well-seasoned yellow pine or of straight-grained mahogany. No other woods are so suitable. Pine is used for straightedges many feet in length; mahogany for those under three feet.

First, rough out all the stuff, because strips of timber when newly cut out of the board, even though the board is thoroughly seasoned, are apt to curve and warp to a greater or less extent. This is especially the case with mahogany. Jack it over, and preferably let it stand by for a few days, or even weeks. Then plane to gauged thickness and gauged width, and square the ends. Screw the two pieces together side by side; or if screw holes are deemed unsightly, glue the two strips together with paper joints: that is, slips of paper interposed—say one slip near each end, and one about the middle, and glued between the strips. When the planing is done, the joint can be broken, the paper dividing through the middle of its thickness. Finish now the planing of the edges, using a trying plane sharpened very keenly and set very fine; gauge to width with a fine-toothed gauge; check with calipers also, and test for linear accuracy by means of the best straightedge available. If no such straightedge exists, then a trained eye is a good arbiter. Or, having planed one edge as true as possible, lay the straightedge down upon a board, scribe a fine line by that edge, and turn the strip over, bringing its opposite edge close up to the line, when any inaccuracy will make itself seen (Fig. 28), where it is exaggerated, the amount of inaccuracy being half that of the quantity of divergence. If the strips are of considerable length—say from four or five feet—turn them end for end, when perhaps something of the kind seen in Fig. 29, also exaggerated, will be apparent. Now the projecting portions of the strips, those which come in contact with the scribed lines, will have to be reduced, and at the same time the calipers must be in constant requisition to ensure that parallelism of the edges is secured; and the square must also be used, because the edges must be kept uniformly at right angles with the faces.

Having at last done to the best of our ability in getting the strips parallel and straight, unfasten them, and laying them edge to edge by opposite edges in succession, and then changing ends and trying opposite edges again, correct with the trying plane where necessary, still using calipers and square. Practically, most of the work will have been done during the period when the strips were united, and the less that is left to be done afterwards the better.

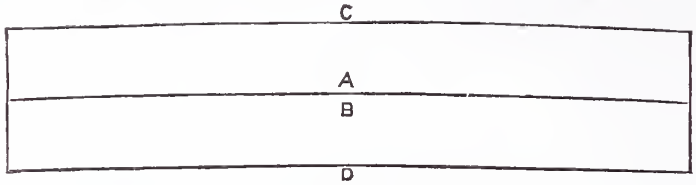


Fig. 26.—Coincidences of Two Parallel Strips whose Edges are not Straight.

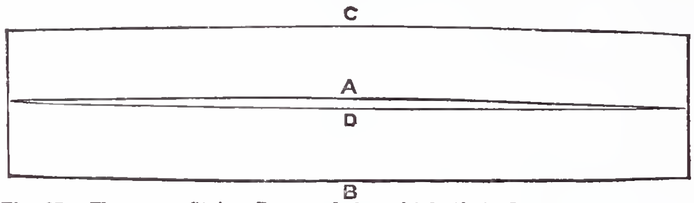


Fig. 27.—The same Strips Reversed, by which their Inaccuracy becomes apparent.

To preserve the wood from subsequent atmospheric influences, it is best to protect the broad faces and ends with an application of shellac varnish. This does not apply to the edges, because they usually have to be chalked. This chalking wears the edges hollow in course of time, and the wood is always apt to warp more or less. It is necessary, therefore, to re-correct winding strips and straightedges every few months.

To prevent wearing of the edges, due to frequent chalking, careful workmen often keep winding strips quite distinct from straightedges, using the former only for testing the amount of winding of stuff, and the latter for checking its transverse truth when planing it over. It is sometimes necessary to make a straightedge so long, or for so temporary a purpose, that it is not desirable to make a couple. Then very fair results may be obtained by laying the two edges in succession against a scribed line, as before described, and also by reversing end for end, and again trying against the line. The errors may be so effectually minimised in this manner as to leave very little to be desired. Another way is to lay the straightedge down upon its flat face, and to strain a chalk line along from end to end, keeping the line away from the edge by about $\frac{3}{4}$ or 1 in., with blocking. Then a gauged thickness strip, carefully tried between the line and edge at intervals, will reveal pretty accurately the condition of the edge. The line must be thin and of equal size, and strained very tightly. Then, for a single long straightedge, it affords a safe method. In the making of long wooden straightedges, very great help is derived from the employment of a true plane. A trying plane recently shot, and with its iron in good order, is a great help to correct results.

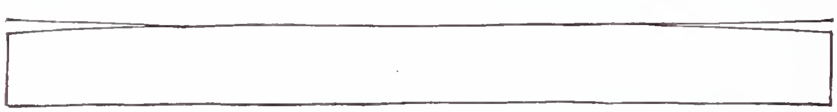


Fig. 28.—Trying a Straightedge against a Line marked from its own Edge.

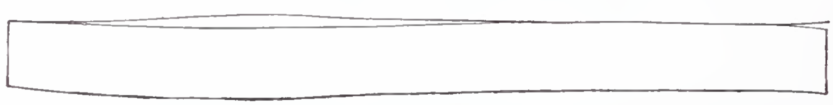


Fig. 29.—Another Example of Trial of Straightedge against Line marked from own Edge.

Taking next the metal straightedges: these are made of steel of moderate hardness, temper, and elasticity. A piece of steel may be thinned down by hammering and so used, but it is better to get a strip of the correct thickness at once. Large shop straightedges and strips are made of wrought iron; very large "master" straightedges are of cast iron, properly stiffened and ribbed. The straightedges to which my present remarks will have reference are those ranging from one to two feet in length, and made of steel plate from $\frac{1}{16}$ in. to $\frac{3}{16}$ in. in thickness. If the plate is not of the correct width, it will be roughly lined out. Centre-pop the outlines of the straightedge upon the steel as a guide for the first stage of cutting out, Fig. 30. Then, if thin, it may be cut round roughly with a cold chisel, or if so much as $\frac{1}{8}$ in. or $\frac{3}{16}$ in. thick, the best plan will be to drill a number of $\frac{1}{8}$-in. or $\frac{3}{16}$-in. holes in close contiguity alongside the lines where the plate has to be divided. If the steel is too hard to stand drilling, it is too hard for a straightedge, and its temper must be lowered, and the metal be annealed to give it equal elasticity throughout.

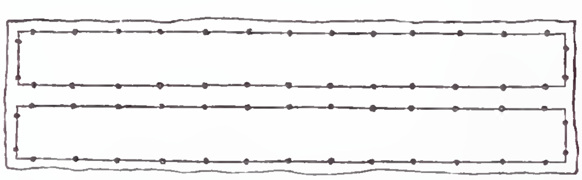


Fig. 30.—Winding Strips Lined out and Centre-popped on piece of Steel Plate.

The edges will now be roughly and approximately filed or ground to width and length. By the time this cutting off and roughing out are done, it is certain that the plate, even if true originally, will no longer be so. Hence, before going into any further details of filing and finishing, the sides must be brought into linear accuracy and perfectly free from winding and unevenness. Probably they may have to be hammered more or less upon a block of iron, or of hard wood set end grain upwards.

The use of a surface plate would be desirable at this stage for the purpose of testing the accuracy of the faces. Failing that, a true lathe bed will answer the purpose. When hammered, draw-filing will have to be resorted to, in order to obliterate the hammer marks; and to ensure reduction to accuracy, bedding on the lathe bed or surface plate will be adopted as a test. During filing, the strip of steel will be laid upon a block of wood, and held steadily between nails driven in around the edges, the wood being clamped in the vice jaws.

The straightedges can be filed now either singly, or both at one time if desired, being united with a particle or two of solder. It will be of much assistance if a light cut can be taken down the edges in a planing machine; but if not, then the next best thing is to use a surface plate or lathe bed as a guide in giving the initial edges to the strips. If the plate or bed is accurate, and the strips are brought into parallelism with calipers, there will be little left to be done afterwards in the way of alteration and correction. But the difficulty of truing up strips is very much increased with every increase in length and in thickness. So that if we have straightedges of metal 2 ft. long and $\frac{3}{16}$ in. thick, they will give us much more trouble than strips 1 ft. long and $\frac{1}{16}$ in. thick. It is difficult to hold the file so that the edge shall be at perfect right angles with the faces, but then allowing the edge to be slightly bevelled in any one section involves a reduction of the edges of each strip to that diminished width. Hence, when we get to the later stages of fitting of the strips, the way to check them together is to lay them side by side and edge to edge on a surface known to be true, and to check the contact of edges in the vertical as well as in the longitudinal direction, and in this way the square will be assisted. During the later stage of fitting, after having used the file until it will no longer afford that localisation of action which is required, we resort to the scrape; and in this way we are able to remove very minute quantities of material. To guide us in localising the action of the file and scrape, a very thin paste of red lead and oil will be smeared along the edge from which we want to transfer contact. At the final stages this must be very thin; in fact, wiping the edge with an oily wiper will suffice. Beyond this, the checking of the various edges until absolute interchangeability is secured will be done precisely as in the case of the wooden straightedge already described.

If any old and experienced hand is inclined to urge that he knows all about the management and manipulation of straightedges, and that it would be difficult for me to tell him anything that he does not know already, let me remind him that it is not for him that I am writing, but for young apprentices whose experience is little more than *nil*, and for workmen who are willing to learn and not above being told.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

THE SOUND-BOARD—ITS CONSTRUCTION AND PREPARATION—HOW THE BRIDGES ARE MADE—FITTING TO THE BACK.

In my first paper I spoke of the back as being the foundation of the piano. From the foundation we take the next step forward, that is, to the sound-board. While the back is firm and rigid, the sound-board is vibrating and sensitive, so that we have the two extremes. If you look at the interior of a piano, you will see that the sound-board lies immediately behind the strings; it covers the back within the wrest plank and bent side. It is technically named the belly. I suppose the person who named the parts of a piano must have had the names of the parts of the human frame in his mind, for in the piano we have the back, belly, cheeks, legs, feet, and toes. The sound-board fills a very important position in the piano, for without it you would only get the tone of the wire, which would be very poor and weak in itself, as can easily be proved by stretching the string over any rigid surface. When the string is struck with the hammer, the sound is transmitted from the bridge on which the string rests to the sound-board, which takes up the sound waves, and increases the power of the vibrations; so that when a person is playing the piano, the sound-board is in one continual vibration. If you strike a tuning fork on the prongs, and the end is placed on a solid block, very little sound is emitted; but if struck when placed on the panel of a door, its tone is intensified. To show how wood is a conductor of sound, let the reader get a friend to strike a tuning fork on one end of a plank, no matter what length, and he will distinctly hear it at the other end.

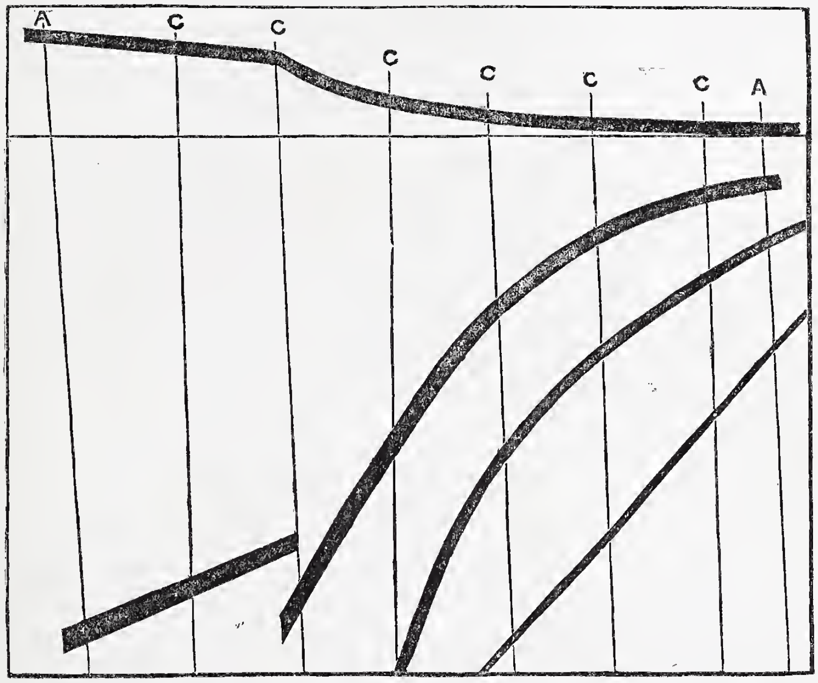


Fig. 1.—Diagram showing Plan of Bridges. (Scale, 1 inch to 1 foot.)

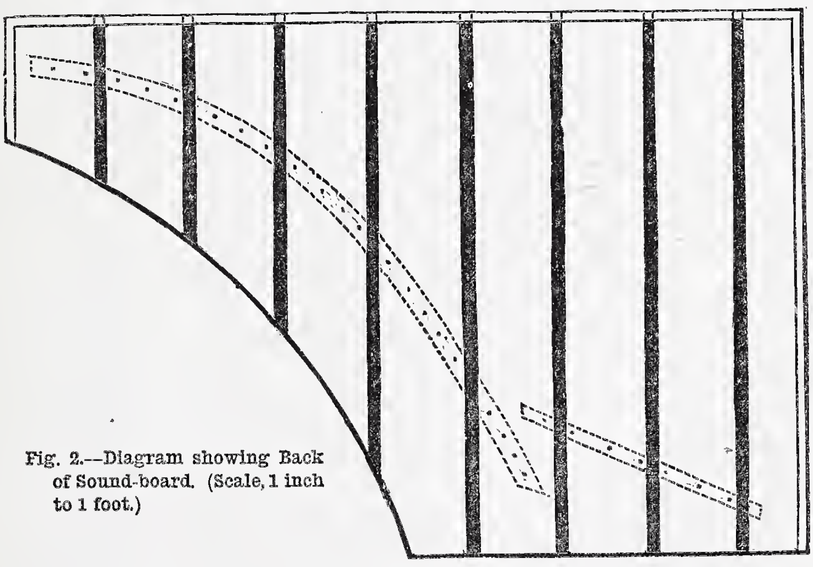


Fig. 2.—Diagram showing Back of Sound-board. (Scale, 1 inch to 1 foot.)

I knew a man who was very deaf—so deaf that you had to write on a slate what you wished him to understand; he had a square piano, and he used to sit playing with the bowl of his pipe resting on the sound-board, and the stem between his teeth, and by that means he was enabled to enjoy his own, or any other person's, playing; the pipe in this case was the conductor. If you take a common fire poker, and tie a piece of string about half a yard long round the head of the poker in the middle of the string's length, then twine the two ends round the forefinger of each hand, place them in the ears, and, bending the head forward, give the poker a swinging motion, and let it strike any object, you will have a splendid imitation of church bells, the string conducting the vibrations to the ear.

I will now endeavour to instruct the reader as simply as possible as to the making of the sound-board. It is usually made from Swiss pine, but can also be made of American pine, or spruce, about $\frac{1}{2}$ inch in thickness, free from knots and shakes, and thoroughly dry. Most timber merchants keep dry material. Having selected the wood, lay the back on the trestles with the plank and bent side uppermost. You will probably find your boards unsound at the extreme ends; if so, cut them off, as it is better to reject them at first than to have trouble with them afterwards. Now lay the boards on your back and cut your first length off; let it run parallel with the wrest plank, and overlap each side of the back $\frac{1}{2}$ an inch, the first board put under the bottom edge of the wrest plank. Now take the remaining boards in rotation, and put together edge to edge; of course, they will decrease in length as you get to the bottom; let them first overlap the rebate of the bent side, so that you have a little to work on. Having done this, make two lines across the whole of the boards in the shape of the letter V, so that you will know their position. Now turn the back over with the wrest plank on the trestles. The reader will probably think there is a lot of turning over; the reason is, that in a factory they have a large board for jointing the belly on, and I want the reader to utilise the back for the same purpose. You will find that your back has two strips of wood across the top and the bottom. Now these will be found useful in jointing your sound-board. Shoot one edge of your first board, and after laying a sheet of paper to keep the back clean, place the board up to the slip of wood mentioned above; put a handscrew on each end to keep it in position; now shoot the edges of the remaining boards, and try to make as good joints as possible. Having jointed them all, get a piece of wood about a $\frac{1}{4}$ inch wider than the intervening space between the bottom edge of the sound-board and the bottom slip, then having made your glue hot and thin for jointing, warm the edges of your wood well, and glue edge to edge on the back, rubbing each joint till you find it bite, then place your slip of wood in, being a quarter of an inch wider than the space; your belly will bulge in the centre. Now by placing a board on the top, and some weight, it will make your joints go up close. While this is drying you may get out your bars; these are made of $\frac{3}{4}$-in. spruce $\frac{1}{2}$ in. wide; these are placed across the sound-board in a vertical direction, one between each bracing, so that you will require eight of them. Plane over the sides after you have cut them out and straighten one edge, and make the other edge a $\frac{1}{4}$ in. round in the centre, graduating to the points; on this edge use the toothing plane, or scratch it with your saw, as this edge has to be glued, and it makes it hold better. When your sound-board is dry you can take it up and remove any superfluous glue that remains with a chisel. Then proceed to plane it over; you can do this while it is on the back, by moving the handscrews to where you are not planing; after planing over one side pretty level, which you can ascertain by rubbing your hand over, then gauge it round from that side about $\frac{1}{4}$ in. in thickness all round, leaving it a trifle thicker at the treble end, also at the bass bottom edge.

Now take a piece of chalk and rub it round the edge of the bent side, and lay your sound-board in its place, which will be a $\frac{1}{4}$ in. below the wrest plank; you can put two pieces of wood on the bottom edge temporarily, about $\frac{1}{2}$ in. long. Now press your sound-board on the chalk line, and that will give you the mark to cut it out, so that it fits in. Having fitted it, you stand the back on its bottom; make a mark with pencil each side of the bracings, and between these marks will be the place for each bar before mentioned. The method of putting these on is by springing a bar a little longer than the distance between the bar and a board or ceiling above, which consequently gives a downward pressure; but it can also be done by gluing one bar in its place at the back, and using another at the front, which must not be glued; for giving pressure, put a handscrew each end of the bars, the round edges to the sound-board.

Before gluing, see that it brings it to a joint; have your glue rather thin and your bars hot. Serve the remainder in the same way. When you have got the bars on, make a line across the top and bottom of them 4 in. from each end; from this point they must be bevelled down to $\frac{3}{8}$ in. from the sound-board, except the bass ones that do not touch the bent side; leave these $\frac{3}{4}$ in. thick at the bottom ends. Now you will have to put fillets on three edges of your belly; these will be of pine 1 in. wide and $\frac{3}{4}$ in. thick for the top and treble one, and 1 in. square for the bass one, graduating it from 1 in. in the centre to $\frac{3}{4}$ in. each end; the top fillet is cut out to fit over the bars at the edge, and these are then glued on; of course, the treble one will just fit the space between the wrest plank and bent side. The sound-board rests on these slips and on the rebate of the bent side.

By reference to diagram you will ascertain the length and shape of the bridges. They are made from beech $1\frac{1}{4}$ in. wide, except the top bridge, which is 1 in. wide and $\frac{1}{2}$ in. thick. When you get your bent side and wrest plank, if you order two wrest planks, one will make your bridges. You cut one edge out to the shape of your long bridge, then gauge it $1\frac{1}{4}$ in. wide from the edge; you will be able to cut out all your bridges from one plank with a little care, cutting up the straight part with a hand saw, and the curves with a frame saw. For the top bridges be careful to keep the flowery side of the wood uppermost; you will see this by observation.

Having planed your bridges, and prepared them for gluing, you can clean any superfluous glue from the back of your sound-board, then take some coarse glasspaper and clean it. Now you will require a pint of white hard varnish; varnish the back twice over, except the fillets and bent side edge, as the glue will not stick to the varnish. Now you must put the sound-board in temporarily, and mark for the long and short bridges, and $\frac{5}{8}$ in. below this line prick through the belly about every two inches with a small bradawl; this is needed when you are putting on your belly bridges. Now get some $\frac{3}{4}$-in. screws ready, and your glue hot and not too thick, so that it will run nicely from the brush; warm your long bridge and glue; put a handscrew on at the treble end, and where you can get others on from the hollow edge; then drive the screws in the holes you have made as quickly as possible from behind; serve the short bridge in the same way.

Now you will want a bottom plate; one made in cast iron for 47 notes will suit you best, and be the easiest fitted. It has three projections on as a rule, with screw holes in, and the bottom of the plate has holes for bolts; the treble end rests on the end of bent side, and the first bass note will be $4\frac{1}{2}$ in. from the outside of the back; this plate must be fitted level. You can bore the holes for the screws through the projections, so that it will go in the same place, as you will want it out to put the belly in. To put the screws in after the belly is in, you must bore centrebit holes through the belly above those previously made. I may mention here that all the ironmongery that is required for the piano may be had from W. Hughes & Co., 37, Drury Lane, W.C.

Now your sound-board is ready to be put in its place. Round the edges bore holes for 1-in. screws for the top and treble and round the hollow edge, and for $1\frac{1}{2}$-in. screws at the bass edge. It would be better to have the assistance of a friend at this stage to help you to glue your sound-board in. Have your glue ready and the screws through the sound-board half way. Warm the edges of the sound-board, and glue all edges except the bottom. Now, as quickly as possible, turn all the screws in their place.

To ascertain the shape of your bridges and their position on the sound-board, you will find by reference to diagram that the bottom edge of the wrest plank is used as a basis for calculating the length of the strings; for this reason it is called the strike line, as the hammers strike the strings at this point. The first note is A, which is $2\frac{1}{2}$ in. from the treble end on the strike line. The first C will be $7\frac{3}{8}$ in.; make a mark at these points. Second C, $13\frac{3}{4}$ in.; third C, $20\frac{1}{8}$ in.; fourth C, $26\frac{1}{2}$ in.; fifth C, 33 in.; sixth C, $39\frac{3}{8}$ in. The last note, which is A, is $47\frac{1}{2}$ in. Take particular care with these measurements, which are all on the strike line, measured from the treble or right-hand side of your back. From the same side at the bottom mark one point 1 in.; second one, $5\frac{1}{2}$ in.; third, $12\frac{1}{4}$ in.; fourth, $18\frac{3}{8}$ in.; fifth, $25\frac{3}{8}$ in.; sixth, $31\frac{7}{8}$ in.; seventh, $38\frac{3}{8}$ in.; and the last, $45\frac{1}{4}$ in.

It would perhaps be easier for the reader if he were to have a sheet of white paper the size of the back, and measure the width of his wrest plank and make a line for strike line. Having made these points, get a straightedge, and make lines from top to bottom intersecting these points.

Now I will give distances above the strike line for the shape of top bridge. The first note, A, runs level with the bottom edge of plank. First C, $\frac{3}{16}$ in.; second C, $\frac{3}{8}$ in.; third C, 1 in.; fourth C, $2\frac{1}{4}$ in.; fifth C, $3\frac{7}{8}$ in.; sixth C, $4\frac{3}{4}$ in.; last note, A, $5\frac{1}{2}$ in. Now for the distances below the strike line for the shape and position of the belly bridge. First note, A, $2\frac{1}{4}$ in. First C, $3\frac{1}{8}$ in.; second C, $5\frac{1}{2}$ in.; third C, $10\frac{1}{2}$ in.; fourth C, $19\frac{1}{4}$ in.; fifth C, $28\frac{1}{2}$ in.—this is the last note on the long bridge. The first note on the short bridge is B, which is $25\frac{1}{2}$ in.; then A, the last, $30\frac{1}{2}$ in.; this bridge is straight and $15\frac{1}{2}$ in. long. On the wrest plank the bridge is placed above the line, while on the sound-board the bridges are placed below the line.

You will see by reference to diagram how these lines are used. Fig. 1 shows the method of obtaining the shape and position of bridges. Fig. 2 shows back of sound-board, the dark lines being the bars and the light double lines slips on the edge.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

TRANSPARENT OBJECTS—PREPARATION—MOUNTING MEDIA—MOUNTING IN CANADA BALSAM—AIR-BUBBLES.

My last article dealt principally with the mounting of opaque objects by the dry method, and we may now, I think, proceed to the second part of our subject, namely, mounting transparent objects for examination by transmitted light.

Objects the most divergent, and, at first sight, quite the reverse of transparent, come under this heading, and by careful preparation can be made sufficiently translucent to enable us to make out the most minute details of their structure. Take, for instance, a piece of coal; who would suppose that anything could be made out of this but the shapeless black mass it appears to be? Yet, by carefully grinding it down to a suitable thickness, it can be made transparent, and its structure can be as clearly defined as the surface of a butterfly's wing.

The different operations involved in the process of preparation of transparent objects are cleaning, hardening, section cutting, staining, and injecting, and it is in these branches of our work that delicacy of manipulation, and, in addition, care in the choice of mounting media, are most essential.

The words "mounting media" in the last sentence at once suggest the primary difference between the operations of mounting opaque and transparent objects. In mounting the former, as we know, the object is simply enclosed in its natural state in a dry air-tight cell, but in the latter case the object requires almost invariably to be mounted in some transparent preservative medium which will permeate its tissues, and, to a certain extent, render the object itself more transparent by increasing its refractive power. The media principally used for this purpose are Canada balsam, gum dammar, and glycerine, with various modifications which will be referred to later.

Since, in order to make a successful mount, it may be necessary to make use of all or any of the processes of preparation referred to above, we will define them briefly before going any further, and leave the more detailed consideration of each particular operation to a future opportunity.

Our dictionary will tell us that the word "cleaning" indicates the action of removing dirt, and a well-known writer has defined dirt as "matter in the wrong place." This definition of dirt suits us exactly, for, from a microscopical point of view, the process of "cleaning" includes the removal of various matters from animal and vegetable tissues, which can hardly be defined as dirt pure and simple—natural oils, fatty and muscular tissues, and colouring matters, for instance.

Some objects are so soft and flaccid in their natural state that they have to be hardened before they can be cut into sections or mounted, and, on the other hand, some objects are already too hard and brittle for our purpose, so that our attention has to be directed to making them soft.

Hardening re-agents are alcohol, turpentine, Canada balsam, oil of cloves, bichromate of potash, and picric acid; and for softening, glycerine, carbolic acid, or a weak solution of caustic potash or soda may be used.

Section cutting involves the art of cutting a section or shaving from a large object sufficiently thin to become practically transparent when soaked in a liquid medium.

Staining consists in colouring the sections, which may at times be *too* transparent, with suitable dyes and re-agents, so as to bring out in strong detail various points in the structure of the object which before were almost invisible.

Finally, injecting indicates the operation of forcing colouring matter into the minute capillary vessels of an object in order to render them distinctly visible.

And now as to the choice of mounting media.

Canada balsam is the microscopist's oldest friend, and when the object will stand the rough usage necessary to adapt it for mounting in this medium, it is the best one to use, because once well mounted in Canada balsam an object may be looked upon as settled for life, for the older it gets the better it looks, and there need be no fear of leakage.

Canada balsam as sold by the druggist is hardly suited for our purpose, as it would take too long to harden. For this reason, a portion should be placed for a short time in an open vessel in a moderately warm oven, care being taken to exclude every particle of dust. By this means the volatile spirit in it will be driven off, and eventually the balsam will become almost brittle. In this state a few pieces should be taken and dissolved in chloroform, and the whole kept in a wide-mouthed stoppered bottle for use. A bottle like Fig. 1 is the best form to use, because the balsam does not run down the outside, and the stopper is not liable to stick as in the case of an ordinary bottle.

The most suitable objects for mounting in Canada balsam are animal sections stained and, or injected, sections of timber and mineral sections, portions of the hard coverings of insects (Coleoptera and Diptera), diatoms, etc.

Gum dammar may be used for the same class of objects, and should be prepared for use by being dissolved in benzine. It is, in some respects, not quite so useful as Canada balsam, being more brittle and liable to crack, though, on the other hand, it is almost entirely free from the objectionable yellow colour of Canada balsam.

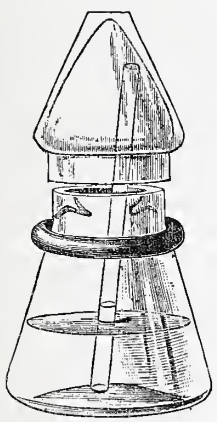


Fig. 1.—Bottle for Canada Balsam.

But I must confess that, for my own part, I much prefer glycerine as a mounting medium with or without modification. My reasons for this preference are—first, because it may be diluted with water to any extent, and, as a rule, will assimilate readily with most animal and vegetable secretions, and thus permit the mounting of an object in as natural a state as possible. This is a great desideratum, and, further, it is absolutely colourless.

The great difficulty with glycerine and its compounds is to prevent it leaking from under the cover glass or out of the cell. It has such an affinity for water and such a strong solvent power, that it is difficult to make a really good permanent mount which can be guaranteed not to leak.

Glycerine jelly is sometimes used for mounting vegetable tissues, and may be made as follows :—Take a small quantity of gelatine, and allow it to soak in cold water for two or three hours, then pour off the superfluous water and heat the gelatine gently until it melts. To each fluid ounce of the gelatine add one drachm of alcohol, and mix well ; then add, in the same way, a fluid drachm of the white of an egg, and boil the whole mass until the albumen coagulates. Now strain through a piece of flannel, and to each fluid ounce of the clarified gelatine add six fluid drachms of pure glycerine and mix ; a few drops of pure carbolic acid should now be added and the whole put into a bottle and allowed to cool. When required for use, the jelly should be melted by immersing the bottle in warm water, and it is as well to warm the slide and cover glass before mounting. I do not recommend glycerine jelly for delicate work, on account of the necessity for the employment of heat in mounting.

Farrant's solution is an exceedingly useful medium for mounting animal and vegetable sections and dissections, but for the latter I always prefer glycerine, either pure or diluted with water and with the addition of a few drops of pure carbolic acid to prevent decay and the appearance of *fungi*. The following is the receipt for Farrant's solution, according to Dr. Carpenter. Dissolve four parts by weight of picked gum arabic in four parts of cold distilled water, and add two parts of glycerine. The solution must be made without the aid of heat, the mixture being occasionally stirred, but not shaken, whilst it is proceeding. When the gum is dissolved, the liquid should be strained (if not perfectly free from impurities) through fine cambric previously well washed out by a current of clean cold water, and it should be kept in a stoppered bottle containing a small piece of camphor.

Some microscopists prefer to filter the solution of gum through fine blotting-paper in a damp chamber and to mix it with the glycerine after straining. This is, perhaps, the best plan, and it certainly gives more satisfactory results. The great advantage of this medium over glycerine jelly is that it can be used cold.

Suppose, now, that we wish to mount a portion of an insect—say the leg of a house-fly or of a beetle—in Canada balsam. Select a glass slip and cover glass, and, placing the object in a drop of water in the centre of the slide, apply the cover glass gently, and examine with the microscope ; we see a densely-black unlovely object, with a number of bristles sticking out of the sides. But now, take the object and soak it for a few hours in a solution of caustic potash or soda, or gently warm it in the same, and a change will come over the scene. Remove all traces of the alkali by washing the object in clean water, and examine again. The black colour will have vanished, and you will see in its stead a delicately-coloured, transparent, brown, horny structure, its surface covered with hairs, and beneath the surface traces of muscular tissue distinguished by minute cross lines.

If there are any particles of dust adhering to the surface remove them by gently brushing the object in water with a camel's hair brush, and then, in order to expel the water, which will not mix with the balsam, immerse the object in alcohol. The alcohol labours under the same disadvantage as the water with regard to the balsam, but it will mix with oil of cloves, which, in its turn, will mix with the balsam. Remove the object from the spirit to the oil of cloves, and leave it to soak there for a few minutes until a slide is prepared.

After thoroughly cleaning a slide, warm it gently over a spirit lamp, and with a pointed glass rod place in the centre a drop of the prepared Canada balsam containing no air-bubbles. With a dissecting needle remove the object from the oil of cloves, and place it gently in the drop of balsam. Take a clean cover glass, and warming it also, place it gently on the top of the whole, as in Fig. 2. Resting one edge of the cover against the points of your tweezers, support the other with your dissecting needle in the manner shown. As the cover glass is

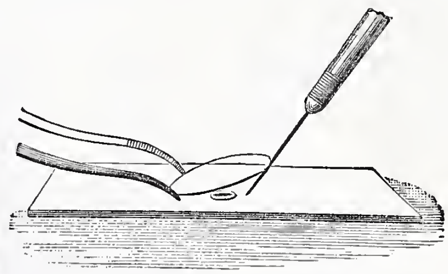


Fig. 2.—Mode of Mounting Object on Slide.

lowered by withdrawing the dissecting needle, the balsam should fill up the space between the centre and the edge of the cover glass, but if it does not do so, apply another drop to the edge and it will at once run in.

If examined now, the object will be seen to be brilliantly clear, and all the points of its structure distinctly visible. The slide should now be put aside in a warm dry place for a day or two, in order to allow the balsam to harden, and if there is any superfluous balsam at the edges of the cover it should then be carefully removed with the help of a rag and a little benzine, left again for a day or two, and then ringed with varnish, when it may be finished off and labelled in the usual manner.

It is necessary to exercise great care in lowering the cover glass on to the balsam in order to avoid the introduction of air-bubbles, but if, in spite of all your care, you find you have accidentally entrapped one of these little nuisances, you can generally manage to induce it to find its way to the edge of the cover glass by pressing the top with a clean dissecting needle. When you have got the bubble outside, the best plan is to bring its existence to an abrupt termination by pricking it with a hot needle, because, if left to themselves, air-bubbles generally die hard, and have a nasty habit of intruding themselves again and again in the places from which they have been expelled.

ON SOLDERING JOINTS IN METAL PIPE.

WITH SOME REMARKS ON BLOWPIPES.

BY R. ALEXANDER.

Importance of the Blowpipe—How to Make Joints—Resin and Grease—Various Forms of Joints — Upright Joint — Horizontal Joint—T-Joint—Soldering with Blowpipe —Benzoline Blowpipe — Gas Blowpipe — Self-acting Blowpipes or Blowlamps — French Patent Blowing Lamp—Regulating Flame Torch Blowing Lamp — Paquelin Lamp.

The jointing and soldering of metal pipes, tin, composition (termed compo for shortness), and lead pipes, will next occupy our attention. Joints in pipes may be soldered with either the iron or the blowpipe ; many people imagine that it is very difficult to solder with a blowpipe, but it is not so, when one has got over the awkwardness that is natural to a beginner in anything. One finds that to work with the blowpipe is as easy as with the copper bit, and it is very essential to a workman to be able to use the blowpipe, for it often happens, in doing a job of gas-fitting, that a fire cannot be had, and, even if it could, joints sometimes have to be made in very awkward places, near the ceiling, between joists, and many other places, where to use the soldering iron is very awkward, and sometimes even impossible. Then the blowpipe comes into requisition, and gets over the difficulty, as the worker will find, easily enough.

It is often a subject of discussion amongst workmen as to which makes the strongest joint, the blowpipe or the iron. My own opinion on the matter is this: That where circumstances are favourable, one is as good as the other, but in awkward places the blowpipe has two to one in its favour, and is far more likely to make a sound joint.

To describe the method of making joints, Fig. 1 is a tampion or pipe opener. This is inserted in the end of one of the pipes to be joined, and the pipe and that held loosely in the left hand and rapped with a hammer or mallet till the end is large enough to admit the other pipe. The inside of the part that has been swelled out (Fig. 2) must be scraped clean and bright; also the outside of the piece that is to be inserted in it. Rub a little tallow round the two cleaned surfaces, and place the joint in position. Sprinkle a little powdered resin on it, and it is ready for soldering.

The handiest and best way of applying the resin is by means of a resin box, Fig. 9. It is a little tin or zinc canister, about $2\frac{1}{2}$ in. high by 2 in. diameter, with a conical top that is removable, and a nozzle that is about 2 in. long and a little less than $\frac{1}{8}$ of an inch aperture at the end. This box is filled with powdered resin, and is the best and cleanest way to carry resin about; a lump of resin thrown loose in the basket, as is often the case, soon crumbles up, and makes all the tools sticky, and wastes the resin as well.

Joints can be soldered with resin alone, or with tallow alone, or even with weak spirits, but I think the resin and grease the best; still, it is as well to know that either can be dispensed with on a pinch. Before proceeding with the soldering part, I will just briefly describe the other joints illustrated. Fig. 2 shows the joint I have been describing prepared. Fig. 3 shows it soldered. Fig. 4 shows a section of it cut longitudinally, showing how the solder has run round it. Fig. 5 shows a method of making a horizontal joint, a kind that often occurs in gas-fitting between joists and along walls. You will notice that one piece is cut slanting; this gives the solder a better chance to flow underneath the other piece than if both were cut square across, the same as Fig. 2. A horizontal joint prepared like this is no longer a difficulty. (For a handy appliance to hold joints, see "Our Guide to Good Things" in this number.) Figs. 7 and 8 show a T joint. The horizontally placed piece has a hole cut in it slightly smaller than the outside diameter of the pipe that forms the T. This upright piece is drawn in a little, and also hollowed out a little on two sides, so as not to obstruct the passage of whatever may have to pass through. It is then pressed into the hole cut to receive it: if it goes in too far a little must be cut off the end.

Now for the soldering part of the process. There are numerous blowpipes and ways of using them. A simple plan, and one much used by gas-fitters, is the ordinary blowpipe, Fig. 10, and a large-sized tallow candle or a bundle of rushes, such as are used for the wicks of rushlight candles. These are procured at the tallow chandler's; they are the rushes that have had one dip in the tallow vat. The best way to use them is not to wrap them up in a piece of brown paper as I have seen men do, but get a piece of $\frac{7}{8}$-in. brass tube a foot long, turn a cap to fit on the bottom tightly, and one for the top not so tight, about 3 in. long. Take enough rushes to comfortably fill the tube and slide, easily push them into the tube, allow about half an inch to project out of the superfluous ends, and slip on the bottom cap.

Now take a strip of blowpipe solder in one hand, the lighted rushes or candle in the other (you must get accustomed to use either hand for either purpose), fix the blowpipe between the teeth, and, bringing the flame close to it, try to blow a pointed flame out of the side of it; you will probably find it rather difficult to keep the flame and blowpipe in correct "juxtaposition," as I may be

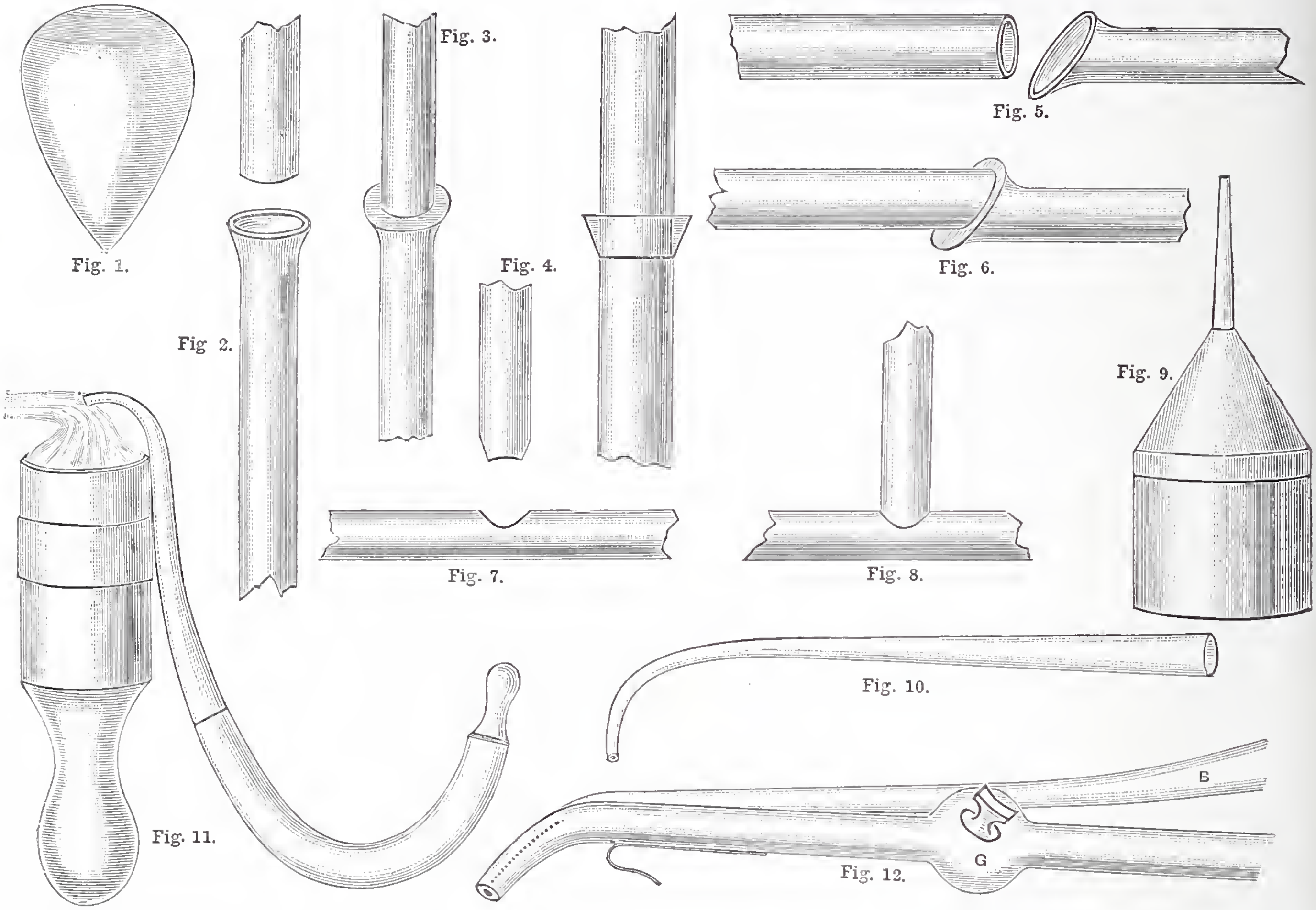


Fig. 1.—Tampion or Pipe Opener. Fig. 2.—Upright Joint Prepared. Fig. 3.—Ditto Soldered. Fig. 4.—Ditto in Section. Fig. 5.—Horizontal Joint Prepared. Fig. 6.—Ditto Soldered. Fig. 7.—T-Joint Prepared. Fig. 8.—Ditto Soldered. Fig. 9.—Resin Box. Fig. 10.—Blowpipe. Fig. 11.—Benzoline Blowpipe. Fig. 12.—Gas Blowpipe.

allowed to say, but you will soon get used to it. Warm round the joint a little, also warm the end of your strip of solder, and just dip the tip of it in a little resin. Then hold the solder to the joint, blow on it, and gently rub it round as it flows under the heat from the blowpipe. Do not blow too long in one place, or the pipe itself may melt, and when the solder has flowed round nicely, cease blowing. Care must be taken not to stop up the pipe, especially very small tubes, such as used for pneumatic bells, for instance.

As the blowpipe just used, or supposed to have been used, is only about 9 in. long, it will be seen that the head and eyes have to be very close to the work, which is sometimes rather awkward. Fig. 11 is another kind of blowpipe which is also much used, and has some good features about it. It has some advantages over the one previously mentioned. The head can be moved about without disturbing the blowing; also, the blowpipe, being fixed to the lamp, is always in the right position for the flame.

It consists of a piece of brass tube, any size, bore from ⅜ in. up to 1 in. will do, about 5 in. long. A bottom is soldered on about an inch up the tube, and a piece of wood put on for a handle to hold it by. The blowpipe is the same as just mentioned, fixed on the side in any way you like; some solder it to the tube, others fit it up with a joint, so that it can be moved in or out of the flame as required. But I think an improvement on either plan is to make a short tube to slip fairly tight on the 5-in. tube, and solder the blowpipe to this. Bend the blowpipe till it is in the right position for the flame, then it is always right, and can be slipped off if wanted. The lamp tube is packed with cotton-waste, and when wanted for use pour benzoline on to saturate it, and then pour off again. It is as well to have a cap of some sort on the top when not in use.

Fig. 12 is a gas blowpipe. This, it is obvious, can only be used in the workshop, or where there is gas to be had. The sketch explains itself. G is the tube that the gas passes along; B is the blowpipe inserted through a hole in the gas tube and soldered along it; it is connected to any ordinary bracket or burner by means of indiarubber tube and a short piece of ditto on the blowpipe, with a bone or tin pipe mouthpiece. This is a very useful tool indeed, and should find a place in any workshop where gas is available.

There are also several self-acting blowpipes, or rather blowlamps. In these there is no blowing to be done with the mouth at all. One of these is the French patent blowing lamp, Fig. 16. This is in shape something like a policeman's lantern with the bull's-eye removed. There is a spherical reservoir on the top, with a filling screw and valve. A small tube leads from this reservoir down to the lamp; the lamp is charged with methylated spirit, and the reservoir on top half filled with the same; the lamp is then lit under it, and in a minute it commences to blow a strong flame—a very useful article. Figs. 13 and 14 show an improvement on this lamp, called the patent regulating flame torch blowing lamp. It is sold by Messrs Rhodes, and is highly recommended by them. By moving the wheel marked A with the thumb (whilst holding the lamp with one hand), the regulator of the wicks can be effectively controlled by the slide, C, and any extent of flame produced. This is a great improvement, as it is often desirable to be able to make a smaller and less fierce flame. There is also a new blowlamp that I must mention. It has not long been out; in fact, I think I am the first to mention it in any journal; at any rate, I have seen no account of it myself. It is the invention of a Frenchman, Dr. Paquelin, and called after him the "Paquelin lamp" (Fig. 15). Benzoline is used with it, and it gives out a very fierce flame. It is sold as a paint-removing lamp, but, thinking it would be useful for many other things, I made some experiments with it. I found that for large lead joints it is first-rate, but it is too strong for anything smaller than 1-in. lead pipe. I recommend our plumbing friends to try it for wiping joints, or for such jobs as cracks in lead roofs, instead of using an iron and metal pot. I am sure they will find it a valuable accessory. But perhaps the most wonderful performance of the lamp is the following: I had a pair of buckles off an officer's belt to alter; the strap loops were too wide for the belt, and I had to make new loops and braze them on to the ornamental buckles. Well, this was rather a ticklish job, with no other means of doing it than the ordinary smith's forge. However, the thought struck me, try the Paquelin lamp. I did so, and the result was better than I expected, and I made a capital job of them, the spelter running like butter. Since then I have brazed a new bow to a key, soldered a silver ring, and sundry other jobs, so can say from experience that it is a capital lamp. So much for its performances; now for a word or two of description.

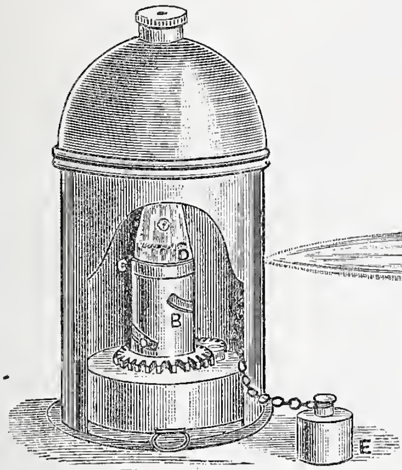


Fig. 13.

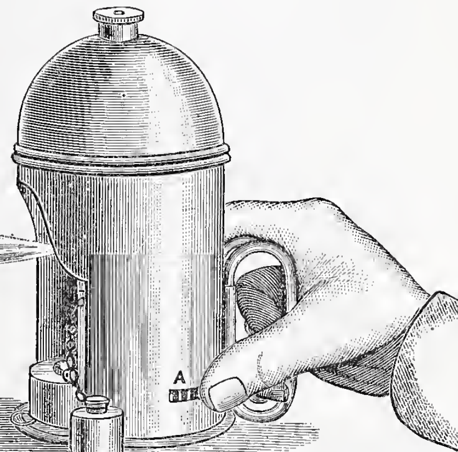


Fig. 14.

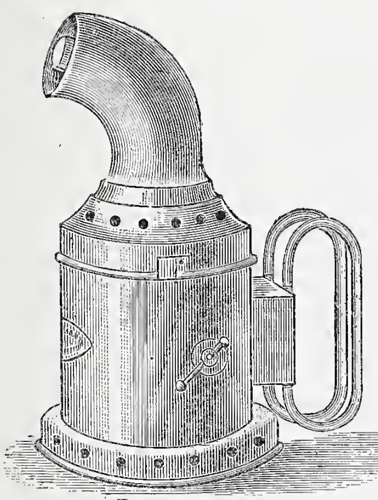


Fig. 15.

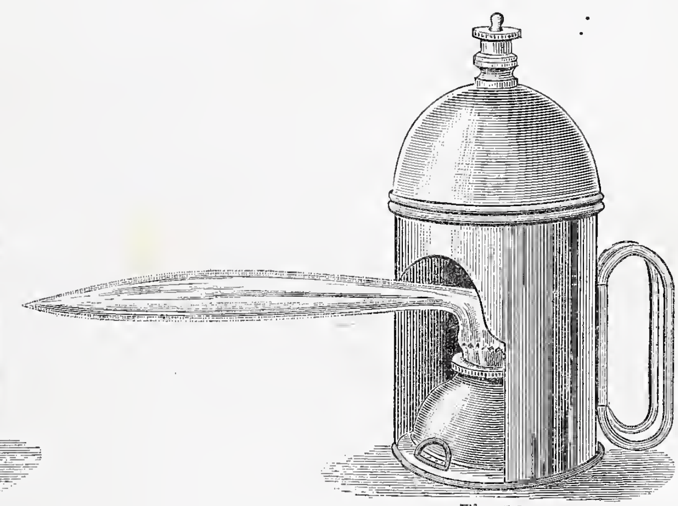


Fig. 16.

Figs. 13 and 14.—Improved French Blowpipe. Fig. 15.—The Paquelin Lamp. Fig. 16.—French Blowpipe.

It consists mainly of three parts—first, a brass body with a wick and some absorbent material inside, and with a capital filling screw with a little vice handle, so that it can be easily unscrewed: a tube runs up the centre of this body for supplying air; second, an inner bent tube of brass, which is slotted to slip over a crossbar, which has a very fine needle-point hole through which the benzoline vapour rushes and ignites at the mouth of the tube; third, an outer tube of sheet iron, which is fixed to a sort of dome which has holes all round it for air; this slips over the inner tube on to the body of the lamp, and is kept in place by a kind of bayonet fastening or stud slot. To set in action remove the filling screw, and fill with benzoline; then stand it upright in some vessel and let as much run out as will; screw up the filling screw, pour a dessert-spoonful of benzoline in the circular trough in the top of the lamp (having previously removed the outer tube), replace outer tube, and light through the air holes; in a minute or two the flame will begin to puff out, and by the time that the spirit in the trough has burnt out the lamp will be in full go. It can be used in any position, sideways, upside down, or anyhow; laid on its handles, with something put through them to keep them from slipping, it will boil a kettle suspended over it very quickly, so that if hard up for a fire you can make your tea or coffee by it.

Having thus described its advantages, I must, to be fair, state that it has a defect. What is that? you say. Will it explode? No; it is quite safe. Will it blow out easily? No; it can be used out of doors as well as in. But its defect is that it makes a great noise whilst working. If you can put up with this it is all right. The English agents for its sale are Messrs. Crowden and Garrod, Falcon House, Southwark Street, S.E., who inform me that they are having a great demand for these lamps, and that they cannot get them fast enough, a proof that I am not alone in my estimation of them.

PRELIMINARY GOSSIP ABOUT POLISHING WOOD.

BY DAVID DENNING.

Probably there are no operations about which there is more popular misconception in connection with the finishing of furniture than the distinction between varnishing and polishing. I do not of course refer to those who are practically acquainted with the furniture trade, or even to those amateurs who have devoted some attention to the subject, but to the large number of people who, when they see a glossy surface on wood, describe the finish indifferently as varnish or polish. The words are, in fact, synonymous in their estimation, and to a certain extent rightly so, for there can be no doubt that French polish is a varnish, though no one who knows anything about it would think of regarding varnish as French polish. Though there is no difficulty to any one who is acquainted with the work in recognising the mode of finishing which has been adopted with any piece of furniture, it is not altogether an easy matter to explain the distinction so that there may be no fear of being misunderstood, for, as has been said, French polish, strictly speaking, is a varnish. No practical man, that is, no man conversant with furniture, would think of confounding the two terms, polish and varnish; but if asked to explain the difference he would probably not be able to do so. The inquirer would most likely be told in effect that varnish is laid on with a brush, while French polish is applied by means of a rubber. This explanation is correct as far as it goes; but it does not go far enough, and even practical French polishers will be none the less capable as executants for knowing at least a little about the theory of the work. By this I do not wish to imply that acquaintance with the theory, with the reasons why certain operations are performed, is essential before a man can be a competent worker, or that a knowledge of theory alone will make him so, but I do say distinctly that the old rule of thumb style of work is not the best possible for the aspirant to skill to be contented with. The man who is satisfied to work solely and wholly in the old grooves is not the one to devise improvements. Now and again he may hit upon some modification of old methods, which may result in improvement, but, taken as a whole, advances in any branch of workmanship emanate from the man who thinks. He takes advantage of every deviation from anticipated results; every accident, every partial failure sets him thinking of the reasons for them. He is not satisfied with knowing that they are, he must go further down and find the cause. He is then able to act intelligently, as a man endowed with brains as well as with eyes and muscles should do. Instead of being a digital machine capable of more or less endurance, he is a reasonable being not deficient in ability to act on his own responsibility when need arises. Traditional methods may be very well in their way, but I would ask any one who is conversant with workshop life, What is the difference between the foreman, or if you prefer it "the boss"—a young man perhaps—and yonder grey-haired, steady-going man, who, though a walking cyclopædia of wrinkles in his trade, has never advanced beyond the journeyman state of existence? The latter knows as much, nay, possibly very much more, so far as manual experience is concerned, than the former, who, however, has the advantage of being able to use his head as well as his hands. In other words he knows something of the theory of his business, and consequently is able to take the lead, to direct others who, either through incapacity or the fallacious idea that head work is only required in the counting-house, or by professional men, have allowed their natural talents to lie fallow.

Although these remarks are made here they are of general application, more especially in a handicraft which, like polishing, partakes a good deal of the nature of an art; or to put the meaning in the plain words of the workshop—knack is the great thing. Without knack, or art, no one can hope to be a good polisher, however much he may know about the materials and their manipulation, and of course the knack of the polisher's craft is not to be acquired without practice. A collection of receipts and instructions is all very well in its way, but I must freely confess that beyond indicating to the novice how to proceed in certain well-defined cases, and telling him the general features of the work, very little, indeed nothing, can be done by any verbal description which will make him proficient. Not long ago a friend was asking me some particulars about French polishing, which he regarded as a mystery rather than an art to be acquired. The mystery certainly exists, though it may not be apparent to the beholder till he actually tries to do the work himself. It then dawns upon him that the way the polish or gloss refuses to come up under his hands is indeed mysterious. It looks such easy, almost lazy, work, albeit somewhat tending to dirty the hands, that the novice may be pardoned for thinking he has not got hold of the right stuff, or that he has been misdirected. Of course, either of these circumstances may be the cause of failure, but it is much more likely to be owing to want of skill. That there is a good deal to be learned in connection with polishing is undoubted, and though much may be explained in black and white, mere written instructions cannot do much more than indicate the course to be pursued when polishing woodwork.

Possibly all this may have a discouraging effect on the novice, as without intending to do so, I may have led him to believe that polishing furniture or woodwork is not to be accomplished satisfactorily without a thorough training in the art. In case any one supposes this, it may be said that everything will be done in these pages to remove difficulties and to indicate right methods of working. The beginner, whether he be amateur or professional, will thus be fairly started, and perhaps it may not be out of place to remind him of the old adage, that "Well begun is half done." Please note only half done, and the other half will rest with himself.

It cannot be expected that the tyro, however clever he may be, will be able to finish his work as well as those who have had the benefit of years of experience. That would be unreasonable, but I may be pardoned for just hinting that some novices are slightly so. They appear, if one may judge from some of their attempts, which have naturally ended in failure, or at least met with very qualified success, to imagine that they ought at once to do as well as the cunning workman with whom the ins and outs of his trade have become almost a second nature. In saying this there is of course no wish to dissuade any ambitious aspirant to skill in French polishing from trying to succeed. The warning is given merely that he may not be discouraged if his first attempts do not reach his expectations. Very likely to an expert they might be satisfactory, that is, when the learner's limited experience is taken into account, although the worker may not be contented. It is somewhat of a platitude to say that excellence can only be obtained with practice, but this fact seems so often forgotten that I venture to do so. What with other articles to which this is preliminary, and answers in the "Shop" columns, it is hoped that no readers of Work will be left in the dark as to what they ought to do and how to do it, on any matter connected with finishing furniture by polishing, whether by French or other process. The wish of all concerned is to make the directions helpful to those who have no other source of information, so that if the advanced polisher should be inclined to think that some of them are superfluous, as they doubtless will be to him, he will kindly remember that I am writing for those who are as unfamiliar with his trade as he is with theirs. Let him imagine he wants to know something about one of these to him unknown trades or handicrafts. He will want to be told as a beginner, not as a journeyman, or even as an improver; no detail will be too trivial for him, and even then he will require to use his brains. Well, the kind of information the skilled polisher would require in other branches of work before he could make a fair start in them is exactly what I aspire to do for those who, however clever they may be in other directions, know nothing whatever about polishing. That polishing is a subject which many readers of Work desire information about is apparent from the many references to it which have appeared in the "Shop" pages. Unfortunately, owing to insufficient details being given in the inquiries, it has not always been possible to answer them so fully as might have been wished, and it is hoped that all difficulties likely to occur to the novices will be anticipated. If not, may I ask inquirers in future to state definitely what they want to know, or at what point difficulty arises; or, in case of failure, if they will describe their *modus operandi* as clearly as they can, saying what the blemish or defect is? I ask this not as a personal matter for the Editor or his staff, but in the interests of inquirers themselves, if they are to be helped as much as the specialists whose duty and privilege it is to answer correspondents would wish to. In making these remarks, reference is naturally made principally to inquiries about polishing. For example, one man says he wants to polish something, and asks how he is to do it. Within the limits of the "Shop" columns it is impossible to tell him what he wishes to know, however much one would like to, for the all-sufficient reason that to do so would be to describe every kind of polishing. No doubt he only required to know of one of them, and that for one sort of timber. Such a question as that supposed admits of only a general answer, but had it been stated whether the inquirer wanted to finish his work with wax, oil, or French polish, bright or dull, together with the kind of wood used, a definite answer could be given. We, that is all concerned in WORK, publishers, editor, and staff, want to help correspondents in any matter which comes within the scope of the Magazine; but how can this be done if some inquirers will not, or do not, no doubt through inadvertence, give sufficient data to go upon? In connection with these remarks, I may say that many of the hints which will be given are based on inquiries from novices who have sought assistance from this and other technical journals. In fact, if I may venture on a personal allusion, there is hardly a detail which will be touched on about which a question has not, at some time or other, been put by a beginner. Thus, however incredible it may seem to the experienced polisher who may not have had the same opportunities of ascertaining on what details beginners want information, I think it may safely be said that all the hints to be given will be found useful, if not in their entirety, at least in great part to the majority of readers.

The question may arise, to whom are the directions likely to be of practical utility? To this, I would say firstly, to those amateurs who want to make and complete any piece of furniture personally; and, secondly, to those artisans and others in kindred trades, such as cabinet making, upholstering, etc., who would find the ability to polish in a fair and reasonable manner an additional source of income.

As is very well known in trade (I allude, of course, to the furniture trade) circles, the polisher's branch of the business is a distinct one by itself. The cabinet maker, the upholsterer, and the polisher are distinct personages, often, unfortunately, totally ignorant of any branch of the business beyond his own special one. Now, I would ask, is there any sound reason for this being the case? Would it not be well for, say, the cabinet maker to be able to do a little polishing when occasion required? Possibly, some of my practical readers may demur to this notion of any man having a right to encroach on the special calling of another. I have no wish to discuss such a question at present, but I do most emphatically say that, at the present time, the tendency is too much towards restriction in the sphere of labour. The artisan, the man, is in danger of becoming a mechanic, a mere labourer in some of our highest crafts. He is clever, or let me say rather an adept, in certain branches of his trade, but he is for all that only a wheel in the great machine, not as he ought to be, a complete piece of mechanism actuated by his head. In country places, and small establishments especially, the "handy" man, the man who, at a pinch, can turn his hand to anything almost with which his trade is even remotely connected, is the most valuable. Therefore I say, without hesitation, that the artisan connected with furniture, who is able to do polishing and all that appertains to it, will command a better market for his labour than the one who ignores everything outside his own groove. As already stated, this applies specially to those in country districts, but, even in the larger centres of population, facility in more than one branch of a trade cannot fail to be of advantage. With these remarks, this preliminary gossip on polishing must end for the present, but in future papers it is intended to treat of the whole "art and mystery" of polishing and its allied operations. All of these, however, cannot be treated "first," but the "Shop" is open to all inquirers who may choose to apply in it.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

98.—Patent Pipe Soldering Cramp.

The Patent Pipe Soldering Cramp, of which various forms are shown in the accompanying illustrations, is a speciality of Messrs. Rhodes and Sons, Wakefield, and an appliance which all gas-fitters, plumbers, pewterers, etc., will find of the utmost use to them in the daily work that falls to their share to carry out. It is, indeed, intended to satisfy a want long felt by the trade, and to obviate the difficulties and prevent the loss of time occasioned by the want of an appliance by which ends of pipes to be soldered together might be brought into close contact, and held firm and steady during the process of soldering. The nature of the cramp will be easily understood from the illustrations, from which it clearly appears that it consists of a couple of jaws springing from a common origin, and brought into a relative position in which they are parallel to one another and of the same height. These jaws are regulated by a screw with a butterfly head, so that they are able to be separated to a greater or less degree, and, therefore, able to receive and hold pipes of different diameter. It will also be noted that by their means the ends of pipes can be brought into close proximity, and held in that position until the process of soldering is completed. To use the words of the inventors and patentees, "the Pipe Soldering Cramp is adapted either for gas or water pipes. It is easily applied to tubes of any diameter, as by merely screwing down one end of a tube in the cramp, the other can be brought into contact at once, and rigidly retained by the other screw, when the joint can be rapidly and effectually made. It also accommodates itself to tubes of different diameters, as, for example, $\frac{3}{4}$ and $\frac{5}{8}$ can be as easily held and soundly soldered by means of the cramp as pipes of equal diameter. It is very portable, being never larger than an ordinary hand vice, easily carried in the tool basket, simple in construction, and not liable to breakage." The two smaller sorts, shown in Figs. 1 and 2, are adapted for soldering tin or composition pipe, and are provided with a joint at the back to accommodate pipes of unequal diameter. The cramp shown in Fig. 2 has a bench screw attached to it, by means of which it may be secured to a bench. The larger cramp shown in Fig. 3 is expressly made for lead water pipes and tubes of larger diameters. The cramps are made of best malleable iron. The tin and composition pipe soldering cramp, shown in Fig. 1, is sold at 2s. 6d. That shown in Fig. 2 with bench screw, forming the gas-fitters' screwing cramp, is supplied at 3s. The third form, shown in Fig. 3, known as the plumbers' cramp, may be bought for 7s.; but the same sort of cramp, made in ordinary cast iron, instead of malleable iron, may be had for 5s. It should be said that this cramp is made and supplied in larger sizes and stronger form, so as to be serviceable in the same manner for holding iron pipes while being connected.

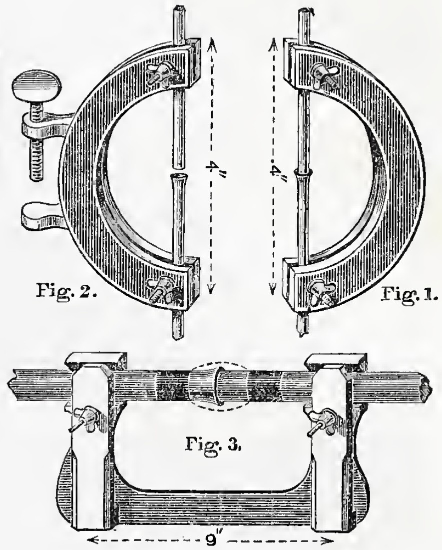


Fig. 1.—Tin and Composition Pipe Soldering Cramp. Fig. 2.—Ditto with Bench Screw, forming Gas-Fitters' Screwing Cramp. Fig. 3.—Ditto, Plumbers' Cramp.

99.—Zilles & Co.'s New Price List.

Mr. Henry Zilles, whom I must heartily congratulate on having developed into Zilles & Co. by a natural process of evolution and expansion, has just issued a monster price list, No. 39, cancelling lists Nos. 32 to 37, which, in their turn, cancelled previous lists. These lists, I may say, contained only selections of fretwork patterns kept in stock by Mr. Zilles, but this giant list of twenty-two folio pages, each measuring 17 in. by 11 in., exhibits every design in miniature that may be made up from the patterns supplied by Messrs. H. Zilles & Co., 24 and 26, Wilson Street, Finsbury, London, E.C., from No. 1 to No. 838 inclusive. These are principally fretwork designs, but a note on the last page enables the reader to discriminate between designs for fretwork, designs for carving, and designs for inlaying and wood painting. List No. 38, I may say, contains a catalogue of cabinet fittings, mouldings, fancy woods, and tools, and is supplied post free at 4d. Mr. Zilles, apparently, has omitted to give the price of list No. 39, or I have failed to find it, so I cannot give it; but this, any reader who will take the trouble to write for the information can ascertain for himself. At all events, when any one has possessed himself of lists Nos. 38 and 39, he will know all about everything that Messrs. Zilles & Co. keep in stock and supply, and will have no difficulty whatever in finding something to suit him in the way of materials, tools, and patterns, unless the multiplicity and variety of designs offered for his selection reduce him to such a pitiable state of indecision that he finds himself utterly unable to make up his mind as to what to choose and have. I must not conclude my notice of Mr. Zilles' specialities without calling attention to "The Amateur," a clever monthly publication of continental origin, issued by him, and which appeals to all fret cutters, wood carvers, inlayers, and decorators of furniture.

The Editor.

SHOP:

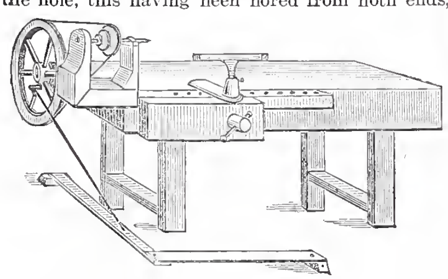
A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

An Easily-Made Fret Machine.—W. W. M. (*Glasgow*) writes in reply to W. R. S. (see page 332):—"I would be very much obliged if he would try and explain how to put on the brass rod to the wheel to work up and down, as I don't understand how it is wrought, and I know this will be a great help to those who are trying to construct one of these machines."

Parts of a Lathe.—S. G. D. (*London, N.*) writes:—"I, like J. K. (*Richmond*) (see 'Shop,' page 348), have made my own carpenter's bench, and in addition have made a lathe attachment such as it appears to me J. K. would find very useful. I enclose a rough drawing of the whole arrangement. The headstock and bed are made of 3 in. by 3 in. quartering, a series of holes being cut in the bed (which, by the way, may be made any length), to allow tool rest to be moved from place to place. The mandrel I made out of an old steel spindle that I picked up for 6d.; this I cut short, and cut a screw thread on the end to fasten on the various chucks. The gut pulley is made out of hard wood, and is held in its place on the mandrel by being very tight in the hole, this having been bored from both ends,



Lathe and Bench.

that is, half way through from each end, and meeting a very little out of truth in the middle; this made it very hard to drive the mandrel in, and consequently it holds very securely. Having fixed the mandrel in the headstock, I proceeded to roughly shape up a part of the wood, and form a groove for the gut to run in; as soon as this was done I was able to turn up the pulley properly. The mandrel rests in a simple plummer block in the front. The fly wheel is about 22 in. in diameter. The lathe is a 9-in. centre. The whole cost was not more than 14s. or 15s. I consider WORK is a very excellent publication; subscribers should read every number through, as they will gain an amount of knowledge upon different subjects that is sure to be useful at some time or other, though many of the matters treated upon may not directly interest them. 'Knowledge is power.'"

An Easily-Made Fret Machine.—BLOCKHEAD (*Penicuick*) writes:—"I see in No. 21 of WORK, p. 332, a fret machine by W. R. S. Would he kindly let me know how he gets the brass pipe to run straight up and down when it is connected to the crank, and what size of table, and how made? Does the wheel go round?"

Flour, Emery, Rouge, and Pitch.—MICRO (*Portsmouth*) writes:—"I want to know a simple way to wash flour, emery, and rouge, in small quantities, say, an ounce or two of each; and the best sort of pitch to use for polishing lenses, and whether it should be worked on cloth over the pitch, or the pitch only."

An Easily-Made Fret Machine.—G. P. (*Islington*) writes in reply to W. R. S. (see page 332):—"Explain more fully the working of crank and its connection with the vertical rod. The sketch in No. 21 of WORK is anything but clear. Is there not some error as to the fitting of C with A? I am anxious to construct the machine, and have by me several parts which could be utilised, but cannot at all see how the upright motion is to be got by the present sketch. I thank most cordially W. R. S. for his little invention."

An Easily-Made Fret Machine.—NEMO (*Manchester*) writes in reply to W. R. S. (see page 332):—"I am a subscriber to WORK, and having seen therein a sketch of an easily-made fret machine, I beg to ask a question relating thereto. I wish to know if the bottom end of the brass gaspipe used in its construction is fastened on the crank of the wheel, or how or where is it fastened, as the drawing does not enlighten me on that point."

An Easily-Made Fret Machine.—A. H. H. (*Leicester*) writes:—"The easily-made fret machine in No. 21 of WORK, page 332, by W. R. S., does not seem so easy after all to an amateur. Should like to ask W. R. S. how the treadle crank is fixed to the wheel, and what part the wheel plays in the vertical motion of the machine. I wish that excellent paper, WORK, every success."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Soldering and Frosting Aluminium.—W. E. T. (*Aston, Birmingham*).—Recipes for solder were given in No. 15 of WORK, June 29th, on page 237, and here is another for you to try your hand at if you care to. Aluminium, 6 parts; copper, 4 parts; zinc, 90 parts. Melt the copper first, and add the aluminium; stir it up with a clean piece of iron, then put in a little tallow, and add the zinc; stir it up again, and pour it as soon as you can after it is properly melted and mixed. You see that this alloy, as well as the others, is very much like pewter solder. It should be used in the same way—namely, by "tinning" the edges of the work first; then bring the parts together, and heat them until your solder runs, which it does not do nicely. A piece of aluminium, used as you would a copper bit, will help, I mean by rubbing it along the seam, when your solder runs. You note the flux mentioned in previous paper. But after all, this metal is generally worked up as you have done—viz., pinned it into a bezel; if it is soldered the seam cannot be left with the solder showing (at least none that I have seen is), it must be covered up; therefore bezels are a necessity, and that being so I make them do all the work. Without doubt this want of a solder prevents the use of this metal, and when one is discovered to match aluminium, and be principally made from it (just as our gold and silver solders are made from these metals), then we shall unquestionably use it to a very great extent. It is nearly time this was found out, for aluminium has been in the market for over fifty years, and in the direction of solders we are not a bit advanced, as far as I know, and as I am now placed, I expect that I shall see the results of any great improvement as soon as anybody, even if I do not at first get hold of the methods. As to frosting—I suppose you polished it with water of Ayr stone (one writer recommends a mixture of rum and oil to dip the stone in) and crocus. Then I anneal it and put it in vitriol pickle; it comes out with a fair surface, but I got my gilder to scratch-brush it as well, for my lathes are not powerful enough. It finally came out a decent sort of frosted surface, but nothing like frosted silver. It will not match the surfaces we get on silver, either by frosting or polishing, and I have had several attempts at it myself, besides getting a steam; polisher to try it. Do any of our readers know of better ways of working this metal? If so, will they help their fellow workmen by sending an account of their tried methods to the Editor?—H. J. G.

Egyptian Trellis Work Screen.—T. E. P. (*Cambridge*).—My acquaintance with Egyptian trellis work was acquired in Cairo, and I know of no firm in England which does this work. Mr. Hatoun, dealer in Oriental goods, Mouski, Cairo, is the leading manufacturer of trellis work in Egypt; and I have always found him honest and obliging. Any handy English turner, however, should be able to make what you require, with a little practice. The idea is simple, and a good workman would originate little alterations in detail, which would give variety of pattern. Perhaps H. C. T. (*Newcastle-on-Tyne*), who recently wrote to me on the subject, would communicate with T. E. P., as he has some experience in this work.—C. H. O.

Polishing Picture Frames.—F. B. (*London*).—The best way to finish picture-frame mouldings, whether black or in the natural colour of the wood, is by French polishing, unless, of course, they are gilt or painted. Possibly you are referring to the cheap continental mouldings, which are faced with compo, and, as you say, are finished partly dull and partly bright. You will find it simply waste of time to make these for yourself, as they are sold at such low prices, and always in a finished state. If, however, you wish to polish ordinary wood mouldings in such a way as to resemble them, you must stain and finish in the usual way. You will not have much difficulty in finishing either all bright or all dull, but you will not find it an easy matter if you want some members bright and others dull, and unless you are a skilled polisher, which I take you are not, I do not advise you to attempt this. You will find it almost impossible to get a clean finish, but, if you are inclined to try, you must first polish all bright and dull down the parts you wish dead by rubbing them with a little very fine emery, or similar sharp cutting powder.—D. A.

Furniture.—SLIP JACK (*Liverpool*).—Your inquiry is an admirable specimen of the kind which shows that some information is wanted, but that the writer has not troubled to give sufficient details to enable any one to assist him satisfactorily. I can only guess at the points you want to know about. Whether you want to renovate the leather or the woodwork is not shown in your inquiry, and each requires different treatment. I shall assume it is the latter, but here again I do not know how the wood has been finished nor its kind. To show the importance of these particulars, it may be said that oak wax polished would require very different treatment from mahogany French polished. I am, therefore, only able to answer you in general terms. The work must be cleaned either by washing with soap and water, or with the cleanser composed of vinegar, oil, and glaze (or methylated spirits), already described in these columns. It must afterwards, if necessary, be repolished, using a suitable polish. Very possibly, after cleaning a little glaze may restore the brightness, but, on the other hand, the work may have to be entirely repolished. The liquid "French polishers rub on with a rag" may be either a reviver, a wash to clean, oil, French polish, methylated spirits, or glaze, according to circumstances. Had you sent your address and name, I might have asked you for more details about the furniture you want to do up, and then been able to reply more definitely.—D. A.

Clock Case.—J. M. (*Pollockshaws*).—The dimensions of a clock case must depend on the size of the works. You say you have these, and I can hardly imagine you will experience any difficulty in working from the design alluded to by you. All you have to do is to reduce or enlarge the various parts proportionately, *i.e.*, if you wish to adhere to the proportions shown. You may, however, alter these considerably if you wish, but, unless you have some experience in designing, I can scarcely advise you to do so. If you like to send on the sizes of the works you have, I will give you my ideas of a suitable sized case, but as my ideas may not coincide with yours, I do not know that you will be much assisted by them.—D. A.

Wood for Turning, etc.—J. H. S. (*Brighouse*).—The kind of wood for table legs depends altogether on the sort of table you want to make. Any of the ordinary furniture woods are suitable, and the one that is best for the purpose must be determined by circumstances. You would, for instance, hardly choose mahogany, rosewood, or walnut for a common kitchen table, nor, though pine or beech would do very well for it, you would not regard them as the best for a handsome drawing-room piece of furniture. In your case, as you say you know nothing about turning, I should certainly not recommend you to use anything more costly than pine till you have acquired some skill in the use of your lathe. Table legs are too big for you to make your first attempts with. Try something smaller at first, working on any odd pieces which will be of little consequence when spoilt. You cannot expect to do anything worth keeping at first, so it would be simply waste to begin with expensive wood. You will soon find your ability growing, especially if you get a fair start, and you will then be able to regulate your efforts by your capacity. We must, you know, all creep before we can walk, but I fancy your idea is to walk without preliminary practice. As you do not know anything about turning, I should strongly advise you to get a friendly turner to put you in the way of using your lathe. Papers on wood turning for beginners will appear in due course, and possibly one which may assist you may be published shortly, but to give all the particulars which a novice would require in "Shop," is, of course, out of the question, much as I would like to assist you. Any light wood can be stained mahogany colour, so that pine, American white wood, beech, and others of similar character, would do for your bookcase.—D. A.

Polishing and Staining.—ROUND O (*Arbroath*).—It is a pleasure to answer such a letter as yours, because it states clearly what you want to know, and by describing the process you have pursued I am able to recognise the cause of your partial failure. In the first place you have used far too much oil with the polish, if, as I understand, you have moistened your rubber with one-fourth oil. You should have used French polish alone on the wadding, and just touched the covering with the least trace of oil to allow the rubber to go smoothly over the wood. I can quite understand your plan taking a very long time, and being tedious. You have also, as you appear to think, used far more polish than necessary by filling the grain with it instead of with a cheaper material. As you have watched a French polisher at work you apparently know the routine, but are unacquainted with the materials, so I do not know that I can assist you in a better way than by telling you what these probably were in the case of the counter top you mention. The polisher may have worked in a slightly different way from that described, but if you follow the instructions you will get good results. The counter top was first darkened by the application of raw linseed oil either in its natural state or mixed with some colour. The next material would be a filling, though from you stating that the first was a "thickish compo," I am inclined to think the order of oiling and filling was reversed from that here given, which is the better of the two methods. Various fillers are employed, but you cannot do better than use one formed of whiting and turpentine mixed to form a paste. Some suitable colouring matter to match the wood, if this is of a dark kind, should be added to it—for example, for mahogany rose pink does well. Excess of filling is wiped off before using the polish rubber as above. After you have got the wood sufficiently bodied up with polish use a fresh rubber with spirits only to get the final gloss or shine, but you must be careful not to spirit off all the body. Great pressure is not requisite, but patience undoubtedly is, though you will find this process superior to yours, both in saving time and results. Oak may be darkened in several ways according to the colour required. One favourite method is by fumigation with ammonia, a process about which a paper is in hand, and will appear as soon as practicable. Oak so treated is, however, seldom French polished, being waxed or oiled instead. Bichromate of potash dissolved in water makes another good stain of an orange brown tone. For a purer brown you will find vandyke brown mixed with a little liquid ammonia to form a paste, after which it can be liquefied with water very good. This stain will also serve for walnut colour on birch. Of course you will understand you can get the various stains lighter or darker according to the quantity of water with which they are diluted. Articles dealing exhaustively with polishing are in hand and in preparation. A preliminary paper appears in this number.—D. A.

Carving Tools for Small Work.—A. W. P. (*Leytonstone*).—In reply to your query respecting carving tools necessary for executing the corners of picture frames, given in WORK No. 10, and for small work generally, six cutting tools would be sufficient—namely, three gouges, a firmer, and two narrow flat chisels. Most good tool shops keep an illustrated price list of Addis's carving tools, and by inquiring there you would at once see the kind of tools you think you are most likely to want.—F. M.

Carvers' Tools.—T. V.—In all probability the wood carver to whom you allude as being possessed of some peculiarly formed tools specially adapted for undercutting had them made for him. If you call on or send to Mr. A. S. Lunt, 297, Hackney Road, London, E., he will readily make any shaped tool for you that you may require.

Smiths' Work.—J. P. A.—The appearance of articles yet to come on "Smiths' Work" has been delayed for the preparation of some engravings of examples required to illustrate them. They will be continued, and clear, practical instructions given on the welding of iron and steel. You write:—"I was speaking about the articles to a friend, and told him that, so far, they had only gone into the history of the trade, and as soon as they came to the practical part they would drop off." Your friend is altogether wrong in his ideas on this point. The numbers of WORK that have already appeared are sufficient testimony to the fact that the writers are practical men fully competent to handle practical work, and the writer of the papers on "Smiths' Work" is no exception to this rule.

Stand for Flat Iron.—NO NAME.—A correspondent has sent me a design for stand for a flat iron, but he omits to give name and address. The design is scarcely fit for publication in WORK, but the sender is thanked for the trouble he has taken.

Model Shipbuilding.—ZERO.—Arrangements are being made for a series of papers.

Bird-Cage Making.—ZERO.—I have no article in my possession on making bird cages, but if any contributor sends me a paper on the subject that is likely to prove useful you may be sure that it will appear.

Crystoleum Painting.—H. J. (*Peckham*).—The article on "Crystoleum Painting," which appeared in No. 3 of WORK, page 42, was continued and completed in No. 4, page 58. I am afraid you are not a very close and attentive reader of the Magazine.

Incubator.—C. H. M. (*Barrow-in-Furness*).—A contributor is at work on a paper on the mode of making an incubator, but I am not aware of the capacity of the appliance to be described.

Rubber Stamps for Music.—G. P. G. (*Wakefield*).—I am afraid your idea of printing music by aid of rubber stamps is one that you can scarcely hope to carry out with success. There is music type which is set up just in the same manner as printer's type, and you can get this at a reasonable rate, and would find it answer your purpose. You would have to use your rubber stamps on ruled music paper, and you would, I think, find difficulty in placing your notes either directly between two lines or on a line as necessary. If you followed up the notion, I fear it would only terminate in disappointment.

Plane for Making Pipe Lights.—J. W. C. (*Lowestoft*).—A plane of this description will soon be described in "Home-Made Tools." In the meantime you may obtain one of Messrs. R. Melhuish and Sons, 85 and 87, Fetter Lane, E.C. You will find a nice clean piece of pine free from knots the best wood for your purpose.

Patent for Brake.—W. D. (*Huddersfield*).—Not having seen either drawing or model of your brake for wagonettes and heavy vans, I cannot tell you whether or not the idea is worth patenting. There will soon be a paper entitled "How to Take Out a Patent," and this, I hope, will be of use to you. I cannot undertake to publish drawings of carriages that you may send me, but I will look at them and tell you what I think of them.

Printers and Printing.—H. E. C. (*Wednesbury*).—By Act of Parliament (39 Geo. III., c. 79) printers are required to be registered by the Clerk of the Peace, the fee for which is 1s. The following is the form of notice required to be given:—

To the Clerk of the Peace for the
or his Deputy.—I,
of
within the , do hereby declare that I have a Printing Press and Types for Printing, which I propose to use for Printing at
within the
and which I require to be entered for that purpose, in pursuance of an Act passed in the Thirty-ninth Year of His Majesty King George the Third, entitled "An Act for the more effectual suppression of Societies established for seditious and treasonable purposes, and for better preventing treasonable and seditious practices."
Witness my hand this day of
in the year (Signed)
Signed in the presence of

You will not be liable to prosecution if you print your name and address on circulars, etc. You cannot use the Royal Arms. If you use your own crest or coat of arms a duty will have to be paid—in fact, the duty for using armorial bearings, namely, £1 per annum. If you use a block or coat of arms as a trade mark, you will have to print the words "Trade Mark" with it.

Condensing Pump.—TYRO (*Liverpool*).—The pump should answer for your purpose, and may be worked by hand, but it will be a slow process. If your plunger is one inch sectional area, and you can put 100 lbs. pressure on the handle, it must multiply twenty times, and your hand must move twenty inches for every inch travelled by the plunger. To get 15 cubic ft. of air at 2,000 lbs. per square inch, you must pump in 134 cubic ft. at atmospheric pressure, which will require a total travel of plunger of about 230,000 inches. Of course you can commence with a short leverage, and increase it as the pressure rises. The valves must be very accurately ground in to hold such high pressure.—F. C.

Wood for Greenhouse.—T. J. H. (*Derby*).—You had better purchase some 3-in. by 9-in. yellow deals at 3½d. or 4d. per foot run, and get them cut to the sizes you require. For instance, you say you intend using 3 in. by 1½ in. for the top of your greenhouse. (Do you mean for the rails of the lights, or for the framework?) Get the deal cut 5 flats, which will make six pieces of 3 in. by 1½ in. The standards and sill could be cut 1 flat—*i.e.*, 4½ in. by 3 in. Where do you propose putting the six doors? You can buy the sash bars ready for use at 1½ in., ⅝d. per foot, or 2 in. 1d. per foot, and the match lining for the panels at ⅝ in. thick, 8s. per square, or ¾ in. 9s. A square will cover about 9 ft. by 9 ft., and can be had from 5 in. to 7 in. wide. If you are near Hull I do not know that you could do better than purchase them.—A. J. H.

Domestic Ventilation.—A. W. (*Liverpool*).—I have examined the models and drawings of the domestic ventilator, and think it well adapted to its purpose; it is ingenious, simple, and complete, and I do not know of any invention that anticipates it. I think it will be preferable to retain the two shutters behind the front plate, and it will then afford a clearer way for the current than if one only is used. The case need not be ¼ in. thick, and in fact might be made of sheet iron. The valve, C, will require a stop, to prevent its being thrown too far back by a sudden draught, so that it may be in a position to close if necessary. A. W. should be careful in drawing his specification not to claim too much; it is only in the details of construction that the novelty exists, as the principle has been applied before, and in the same position as proposed.—F. C.

Battery for Induction Coil.—A READER (*Glasgow*).—A pint Bunsen battery will be quite large enough to work your small coil. The cost of a complete cell will be about 3s. The porous cell, containing the rod of carbon, is charged with strong nitric acid (cost about 3d.), and the outer jar with oil of vitriol in water (a wineglassful of acid to a half pint of water), cost ½d. See article on Bunsen Battery in first three numbers of WORK. The vulcanite ends of the coil are easily made. Procure a sheet of ⅛-in. vulcanite, strike out the size of the ends with a pair of compasses, then the hole for the core, and cut out carefully with a thin, narrow saw such as a keyhole saw. Smooth the edges with a rough file, then glasspaper them, and polish as you would polish hard wood.—G. E. B.

Winding Dynamo Armature.—J. C. W. (*South Lambeth*).—From the sketches in your letter I learn that the armature of your dynamo is of the Siemens H or girder pattern. This is most easy to wind. Hold the armature with the commutator toward you, and commence winding the wire on the left-hand side. Work from left to right, placing each coil neatly side by side around the web of the armature. When the spindle is reached, bend the coils on one side until half the diameter has been passed, then bend the coils on the other side to cover the web. See that the covering of the wire is not chafed as it is being drawn tight over the ends of the web. When the first layer is on wind on another, and so go on forwards and backwards until the wire space is filled. Connect the commencing end of the coil to one segment of the commutator and the finishing end to the other segment of the commutator by small set screws near the inner edges of the segments.—G. E. B.

Battery for Coil.—ELECTRICITY (*Leeds*).—You have so mixed up a "galvanic machine" with "a battery," and this with "a bell," in your letter, as to thoroughly puzzle me. You do not describe your galvanic machine, but I suppose it to be an induction coil. You attempt to describe a battery, but here you fail, for the zincs could not work in "two indiarubber bags," and I cannot at all imagine what you mean by "a stop and brake." I can only guess the nature of your newly-acquired property and your requirements, so if I fail to help you it is your own fault, and you must be kind enough to write again, giving a more clear account of your apparatus. I think it possible you have got hold of a shocking coil, and two cells of an old form of Daniell battery, with pieces of ox-gullet for porous cells. This will be troublesome to you, as you know little or nothing about such apparatus. Nearly fill the copper jars with a mixture of a wineglassful of oil of vitriol in a pint of water, and hang the zincs in this from a rod of wood placed across the tops of the jars, so that the zincs cannot touch the copper. Take one connecting wire from one of the copper jars, to one of the connecting screws of your "galvanic machine." Connect the zinc of this cell by means of a copper wire with the other copper jar (the side of the jar itself), then connect the zinc of this second jar with the other binding screw of your machine. If the acid makes the zincs hiss badly, you must take them out and coat them with mercury by the method described in WORK in the articles on the Bunsen Battery, and also in the note on amalgamation on pp. 86-87. When you wish to stop the action of the battery, merely lift the zincs out of the acid solution, leaving this in the copper jars until again wanted. Discard the ox-gullet (indiarubber?) bags altogether.—G. E. B.

Drop Black.—F. B. (*Guernsey*).—Drop black is a kind of ivory black, but of a better description than that which generally goes by the latter name. It is supposed to be made of burnt ivory, but is really burnt bones. Drop black costs about eightpence a pound, while ivory black can be had at threepence. If you cannot obtain it easily use vegetable black for the receipt you refer to in "Tips for Tyros," as it will do equally well. As you do not say what material your frame is composed of, and I do not know what its surface is like, I cannot here give you explicit directions for gilding it. However, if you refer to WORK, No. 8, page 118, you will find a "Tip" which I think will help you.—OPIFEX.

Walnut Fret Wood.—S. O. P. (*Clapham*).—The following are among the best firms for every kind of hard wood in all thicknesses:—C. B. Snewin, Back Hill, Hatton Garden, and Ray Street, Farringdon Road; W. & J. R. Hunter, New Bethnal Green Road; Oliver & Sons, Bunhill Row. There are plenty of veneer merchants in and around Old Street, E.C.—A. J. H.

Shrunk Forms.—PERPLEXED (*Norwich*).—The difficulty experienced by you arises either from the mahogany boards having expanded or contracted, or the paper having stretched or shrunk. If the fault be with the paper, then the stretching will most probably not be regular. This may be discovered after printing first colour by taking sheets from various parts of the "heap," and holding two sheets together up to the light. If the printing fall exactly in the same place on every sheet then the defect must be in the blocks. If they have expanded dry them thoroughly. If this does not succeed, new "register" will have to be made by cutting the boards or relaying the electrotype plates.—J. F. W.

Automatic Machine.—MINER (*Willington*).—Your arrangement will not answer because, while one valve is closing another is opening and letting in a further supply. To make the thing work the top valve must shut first, then the lower valve open, and at the same time open a vent for air at the top of the measuring vessel. The removal of the glass from its stand may by a counterbalance be made to reverse the action of the taps. The arrangements would be more complicated than your sketch, and I doubt if it would pay you better to patent a new contrivance than to hire one like those in use in London for fresh water—½d. in the slot—at railway stations.—F. C.

Repairing Broken Saw.—MINER (*Willington*).—The only way of joining a broken band saw other than brazing is by electric welding, but that probably cannot yet be done in your district. In my own experience I have found it better in the long run to buy a new band saw than to attempt to mend an old one. In the matter of brazing, if well done it may last a while, but the difficulty is to get it well done, and even then near the braze the temper must be lost, and the endeavour to restore it will generally extend the evil, as the brazing will not stand the heat for rehardening.—F. C.

Barometer.—WEATHERGLASS (*Eastbourne*).—Wash the inside of the empty tube with water acidulated with aquafortis (one part nitric acid to ten parts of water) mixed in a small spouted jug. Pour this into the tube, and pour it out again two or three times, then rinse it with warm distilled water, and warm the tube to hasten the drying. Whilst the tube is still warm refill with mercury, shaking this in as you have done before to get all air bubbles out. The mercury may be cleaned by shaking it up and down in a bottle together with a mixture of nitric acid and water of the same strength as that used for cleaning the tube. When the mercury is bright, throw away the acid mixture, and rinse the bottle two or three times with warm distilled water. Pour the mercury into a basin and dry it with blotting paper, and finally filter through a piece of thin wash leather, or through a piece of linen.—G. E. B.

Tondeur Developer.—E. L. H. (*Begbroke*).—The Tondeur developer is probably compounded from a private formula known only to the vendors. Excellent developers are most easily and inexpensively made. Why not make your own? The following will work with most plates:—No. 1, pyrogallic acid, 6 grains; sulphide of soda, 24 grains;

water, 2 oz. No. 2—pure carbonate of soda, ½ oz.; water, 2½ oz. Mix just before use. If the plates are very sensitive, or the exposure overdone, add a grain or two of potassium bromide, or less of the soda solution.—E. D.

Blocking Book Covers.—A. B. C. (*Liverpool*).—If our friend A. B. C. is a blocker he will find little difficulty in working the self-inking press he speaks of. In fact, it is a great deal easier to work than the ordinary blocking press. The table of the press has a to-and-fro movement which admits of great facility in feeding and setting up. When the press is doing inking work, the rollers pass over and repass the stamp by the movement of the table, and thus printed work is done with the same speed as ordinary blind work. The covers are fed when the table is out, and there is less chance of the gold getting rubbed off as in the old process. One or two sides and the back of cases can be done at one operation, using both gold and colour at once. Thus complete covers can be produced at the rate of 600 per hour. It is not necessary to use any size or prepare the cloth in any way to receive the ink. But in the better class of work it is usual to block the cases blind, and afterwards ink them in. The presses register so nicely this can be easily done. Of course, when putting on the ink the press must be cold. Book-cover ink is the proper thing to use, and may be obtained from any printing ink manufacturer. I expect you will get it readily in Liverpool. If not, send to Messrs. Richardson & Co. for a sample tin; use it as thin as possible, but not too thin, else you will not have the fine gloss that you should have. If you are getting a new press the maker will give you all the necessary instructions for working it; or, if you are going to a new place to work one, a glance at the machine, if you are a blocker, will be all that is necessary. I am very pleased to be able to help you; if you find any difficulty write again.—G. C.

Rabbit Hutch, etc.—A SUBSCRIBER (*Kingsland*).—Yes, a description of a rabbit hutch will, it is to be hoped, appear in due course. Full particulars will be given about it, but I cannot speak for the "allschow," as I do not know what sort of a thing this is, and I do not remember to have heard of one of them before. The preparation of dry plates is hardly suitable work for an unskilled amateur, the process being extremely delicate and tedious. However, for the benefit of those who wish to try their skill it will be described some time. For the present there are many articles of more general interest awaiting publication. You are, however, quite right to name any subject which you would like to know about, even though it should not be possible to give the desired information in "Shop," the space for which is limited.—L. J. P.

Renovating Stained Floors.—J. R. (*Liverpool*).—Although you refer to the floor having been stained only, it may be taken for granted that the surface has been finished in some way, probably by varnishing or waxing. If it has been polished with wax then it will most likely be sufficient to wash this off thoroughly with soap and water before applying fresh stain. A varnished floor is, however, more difficult to deal with, and I could only advise you definitely how to act by seeing its present condition. This, of course, is out of the question, so I must answer you in a general way. If the floor is in very bad condition, and you want to renovate it thoroughly, you must either scrape or plane it over. Papering will be superfluous, unless you want to French polish it instead of varnishing it. You may be able to wash the varnish off with turpentine, of which a good deal will be required. Possibly the varnish may have "perished," or been worn off entirely. Are you quite sure that the floor needs restaining? for it often happens that owing to the varnish having gone the impression is taken that the stain has also, whereas a coat of varnish will do all that is necessary. In any case you will not find it so easy to renovate a floor which has been stained as to stain and varnish an uncoloured one. You may not be able to match the stain exactly, for to do so requires the judgment of experience, and unless you can the result is apt to be patchy. I think if I were you, instead of staining the floor afresh I should paint it, using ordinary oil colour, as the appearance will probably be much better. After the paint has dried give it a coat of varnish. You may, perhaps, also attain your object by mixing a little colour, say, vandyke brown with the varnish, and so dispense with either staining or painting separately. If you still want a walnut stain here is one. Vandyke brown mixed to a paste with ammonia and water added till thin enough for use. The "Badger" is used like an ordinary brush, which will do just as well for your purpose. Of course make the strokes, as you call them, uniformly, and remember that the varnish on a floor is not so closely investigated as to cause brush marks of the ordinary kind to be noticed. Don't apologise. It is recognised as a pleasant duty by those connected with WORK to assist amateurs, and you seem rather "down" on yourself.—D. A.

Reversible Lathe.—J. F. P. (*Darlaston*).—In reply to your question respecting the possibility of reverse action of lathe, allow me to say all real self-acting lathes are capable of backward and forward action and stopping without interfering with engine, or shifting the belt from the pulley on which it runs, action and reaction depending, not on the pulley, but on the overhead riggers, and the train of wheels attached to the mandrel or geared into it.—G. E.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Fretwork Picture Frame. — AMATEUR (*Belfast*) writes:—"Would you permit me a little space in the 'Shop' column of WORK to ask if any brother reader could give me a design for fretwork picture frame? If so, he would very much oblige me."

Varnish for Drawings. — A. M. (*Glasgow*) writes:—"Could you suggest a good, hard drying varnish for coating drawings executed in colours on ordinary drawing paper? The varnish is intended to prevent the drawings being soiled by frequent handling, and it should be, as nearly as possible, colourless."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Drilling Square Holes. — P. P. (*Withington*) writes in answer to A READER (see page 270):—"There are drills in the market that are supposed to drill square holes, but there are none that drill them practically square, the majority leaving the angles round. The one of which I know is composed of four short drills on one shank, all working in the same direction, and close together, the whole enclosed in a square steel casing, sharpened on all sides, with the bevels inward. This drill needs much force to make it penetrate any distance, and unless you have a drilling machine, and a large number of holes to drill, it would not be worth while getting one, as the cost is large, and repairs are often needed. A new drill for square holes has been lately described in the *English Mechanic* as having a 'sun and planet' motion described to cut a clean square hole. Perhaps Melhuish & Sons will bring this to our notice in WORK, if it is found to be all that is claimed for it."—[A tool that will do this kind of work will shortly be noticed and illustrated in "Our Guide to Good Things."—ED.]

Sharpening Carving Tools.—J. W. B. (*Wakefield*) writes in reply to AMATEUR (see page 270):—"I grind my carving gouges almost equally from inside and outside. For the insides I use small emery wheels (such as dentists use), varying the size with the sweep of gouge. In doing this great care is required, so that the temper be not altered. The letter from H. C. (page 268) explains, I think, the reason why carvers do not generally use the handscrew for holding slips, but as I happen to have both bench vice and German screw in my shop, it did not occur to me for the moment that many carvers are without either. As to this method of holding slips being 'amateurish,' I can refer D. D. (page 252) to one of the oldest cabinet carvers who has used this system throughout a working life of over sixty years."

Joiners' Composition.—B. A. B. (*Hampstead*) writes in reply to J. R. (*Oldham*) (see page 270):—"Glue and whiting is frequently used. Glue and sawdust from the wood in use is frequently recommended. Glue and litharge is good for light mahogany. Plaster of Paris mixed with a little glue and venetian red, chrome yellow, and raw or burnt umber is sometimes used, but must be used quickly, and the glue must be thin. I have used a sealing-wax, which is made expressly for the purpose, and can be had in various colours to match different woods, at four sticks for 3d. at several shops near Curtain Road."

Tobacco-Pipe Making.—PIPER (*Manchester*) writes:—"In answer to SMOKE on tobacco-pipe making (see page 222), I must say that there is no book published on the above; but if SMOKE will publish his address, and state what he wants to know, I can, no doubt, help him."

Ivory Walking Stick. — P. P. (*Withington*) writes in reply to W. A. (*Hanley*) (see page 270):—"If you intend to cement it at the broken part, the best thing to use will be the new fish glue (Inventions Exhibition); but it will not stand much rough usage. A better plan would be to drill a hole in each end, and get a piece of round steel to fit; heat it *black* hot, and having filled each hole with resin and knife polish, insert the steel, and hold all in place till cold. This should make a splendid strong joint."

Rickety Table. — W. H. S. (*Willaston*) writes in reply to A. J. T. (*Holborn*) (see page 318):—"Get a piece of wood 8 in. long by 2 in. wide and 1¼ in. thick, which should be planed up. Mark on the piece spaces of two inches; with pencil and square run a line down the centre of the piece; then get a brace and bit, 1½ in. would do, and bore a hole nearly through, according to size of castors; then get a tenon saw, and cut them across into pieces two inches square; take the corners off with a chisel, and place them under the castors on the floor. This is the best remedy that I know of for rickety table."

Spirit Level.—D. J. (*Oldham*) writes:—"Will any reader kindly tell me how to choose a tube for a spirit level, and how to fix it? Level is 9 in. long by 1½ in. by 1 in., with slot 4½ in. by ½ in."

Copying Music.—T. R. (*Gateshead*) writes:—"Seeing such a variety of questions so ably and willingly answered in 'Shop,' I wish to ask if you know of any appliance or quicker method of copying music than by hand with pen and ink? I am in a band, and wishing to have my copy or part always at home, it occurred to me to ask your assistance. I am not a moneyed person, therefore cannot buy a duplicate copy of every piece performed; the time taken up in copying might be more advantageously used upon the instrument, and also to advancement of band."

Trade Notes and Memoranda.

THE oldest steamer in the world, according to the *Steamship*, is lying in Bowling Harbour on the Clyde. The *Industry*, built in 1814, plied for about sixty years on the Clyde, and was finally laid up where she now lies. Last year the engine, a side-lever one with spur wheel gearing, was taken out and placed in the Kelvinside Park at Glasgow. The old boat is fast breaking up, and will doubtless shortly disappear. The engine, however, will show to future engineers what a side-lever engine was like, and how it was connected by gearing to the paddle shaft.

PRIZES to the value of £150, and twenty of the Society of Arts' bronze medals, are offered for objects of art or workmanship to be exhibited in the Arts and Crafts Exhibition in the New Gallery, Regent Street, to December 7th. The work must be the production, not of artists, but of craftsmen, and must have been executed in the United Kingdom, or its dependencies. The objects submitted for competition may be the work of one, or of several workmen in combination, and need not necessarily be the property of the workmen sending them in. Forms of application, and full particulars, may be obtained of Mr. Ernest Radford, Secretary of the Arts and Crafts Society, 44, Great Marlborough Street, W.

As others see us:—"The English shopman (workman) is hardly as reliable as his American contemporary, so far as working steadily is concerned. He takes more days off, his option to do so not being seriously questioned. He is also very tenacious of what he considers his rights, one of which is not to be hurried, and another to do nothing he is not hired to do. If he is a lathesman he could by no means be persuaded to work a week at the bench in an emergency. While the American shopman is usually glad of the opportunity to broaden his field of usefulness, with the idea that knowledge gained in this way will come into play some day, the English shopman will quit his job before he will work out of what he considers his sphere. It is not uncommon in America to see a shopman, with a carpenter perhaps to help him, putting up the counter shafts for and setting some tool which he has to run. In England millwrights must do this. A lathesman does not know how to do it, and he does not want to know how. Insisting upon his doing it would quite likely empty the shop of men. The course of the English workmen does not tend to make mechanics, but perhaps—though we question it—it tends, as is claimed, to make better specialists in the different lines of the machine industry."—*American Machinist.*

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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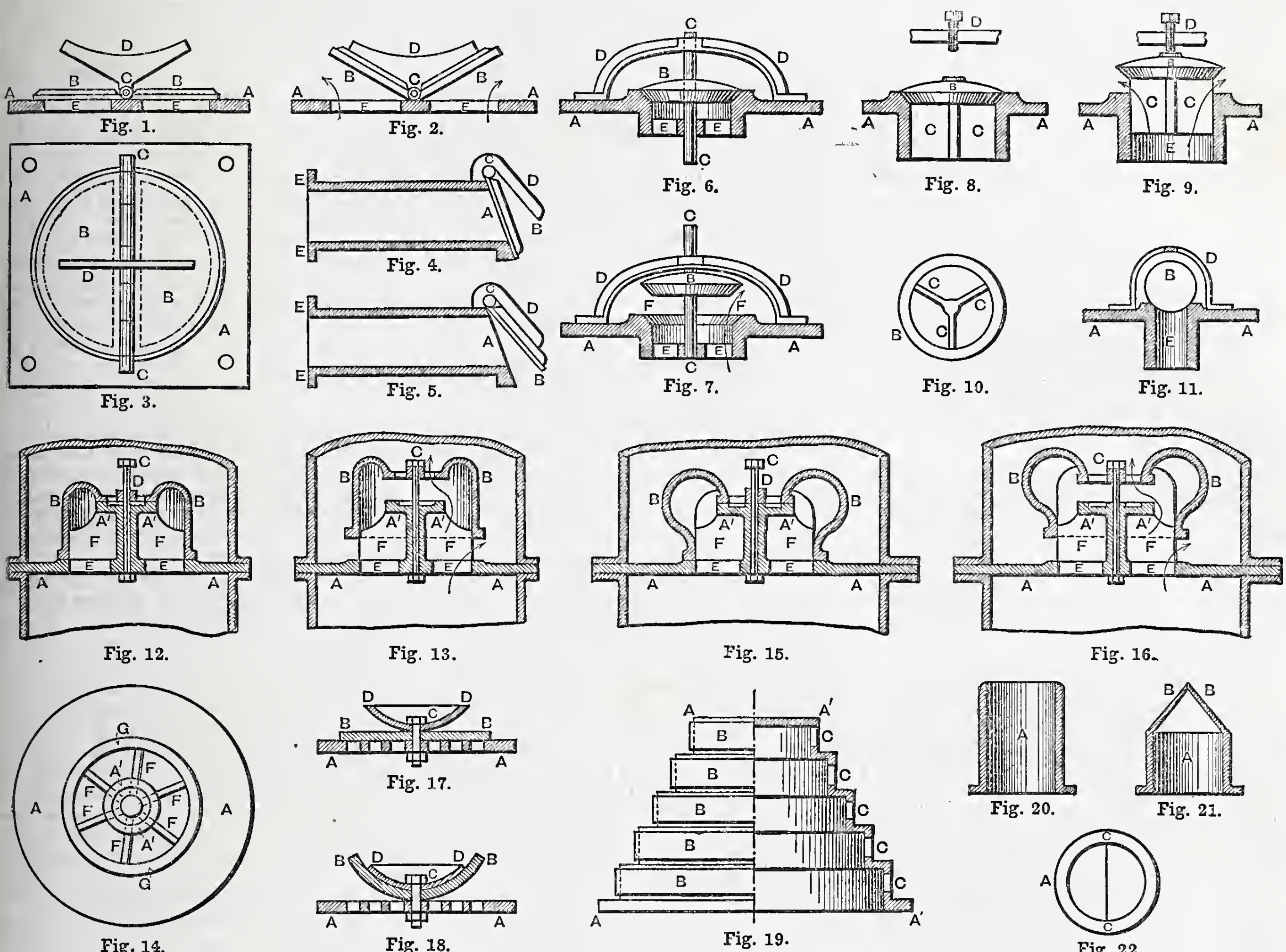


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig. 14. Fig. 15. Fig. 16. Fig. 17. Fig. 18. Fig. 19. Fig. 20. Fig. 21. Fig. 22.

Fig. 1.—Butterfly Valve Shut: Seat in Section. Fig. 2.—Butterfly Valve Open: Seat in Section. Fig. 3.—Butterfly Valve: Plan. Fig. 4.—Flap Valve Shut: Seat in Section. Fig. 5.—Flap Valve Open: Seat in Section. Fig. 6.—Stem Valve Shut: Seat in Section. Fig. 7.—Stem Valve Open: Seat in Section. Fig. 8.—Stalk Valve Shut: Seat in Section. Fig. 9.—Stalk Valve Open: Seat in Section. Fig. 10.—Stalk Valve: Underside. Fig. 11.—Ball Valve: Seat in Section. Fig. 12.—Vertical Section of Double Beat Valve Shut. Fig. 13.—Vertical Section of Double Beat Valve Open. Fig. 14.—Plan of Seats of Double Beat Valve. Fig. 15.—Vertical Section of Crown Valve Shut. Fig. 16.—Vertical Section of Crown Valve Open. Fig. 17.—Flat Indiarubber Valve Shut. Fig. 18.—Flat Indiarubber Valve Open. Fig. 19.—Indiarubber Band Valve, half Elevation and half Vertical Section. Figs. 20 and 21.—Vertical Sections, at Right Angles to each other, of Indiarubber Semi-Lunar Valve. Fig. 22.—Plan of Indiarubber Semi-Lunar Valve.

PUMP VALVES.

BY FRANCIS CAMPIN, C.E.

BUTTERFLY VALVES—FLAP VALVES—STEM VALVES—STALK VALVES—BALL VALVES—DOUBLE BEAT VALVES—CROWN VALVES—FLAT INDIARUBBER VALVES—INDIARUBBER BAND VALVES—INDIARUBBER SEMI-LUNAR VALVES.

ALTHOUGH in machines of all descriptions every part should be carefully designed and accurately made, and therefore all parts may be regarded as of equal importance, yet are we apt to consider certain details as requiring greater care in their execution than some other parts, those details being such as readily show any defects when in action. So long as a machine can get through its work without any obvious irregularity appearing, dissatisfaction will not arise, although hidden imperfections may exist which materially reduce the efficiency of the apparatus. In pump-work, the weak point lies in the valves, and, therefore, some practical remarks on their construction and duties may prove of service to those who are interested in the details of hydraulic and pneumatic machinery.

The duty of a valve being to allow the passage of a fluid or liquid in one direction only, it is evident that the parts in contact when the valve is shut should fit so exactly as to preclude the passage between them of any of the liquid operated upon, and there are several ways by which this end is sought. If one of the faces is made of some elastic pliable material, such as indiarubber, it will, by adapting its form to that of the hard face with which it is brought in contact, form an air or water-tight valve with any reasonably true surface; but if both the valve and its seat are hard and unyielding, the surfaces of contact must be made exact counterparts of each other in order that they may work satisfactorily.

With regard to all surfaces of special forms, these may be fitted by grinding together with fine emery and finishing off with crocus powder, but to flat surfaces a different process should be applied. The mechanical method of preparing a plane surface is as follows:—In the first place, the surface is made as true as the planing machine or lathe will render it. The surface thus prepared is tested by laying it upon a rigid plate having a true surface, on which a little ruddle has been smeared; the plate used for this purpose is called a surface plate, and is one of the most important gauging tools in the shop. Any parts in the surface under manipulation that are higher than the general level will naturally, by their contact with the surface plate, raise the rest of the work from it, so that the highest parts only will be marked with the ruddle; a slight movement of the work upon the surface plate will effect this marking. The work being then turned over on to the bench, the marked parts are carefully scraped down (a very good scraper can be made from an old three-square file, by grinding the cuts out at the end so as to form three curved scraping edges—not cutting edges) and the work is again applied to the surface plate. More parts will now be found to be marked, and these are to be scraped down as before; at every application it will be found that the marking will extend more continuously over the surface under treatment until at last a uniformly even surface is produced, and both the valve and its seat being thus prepared, a perfectly tight contact may be anticipated.

For very large surfaces I should say that it becomes necessary to apply the surface plate to the work, small ones, easily handled, being made for this purpose. As perfect rigidity is absolutely indispensable in surface plates, they are strengthened by being made with deep ribs at the back, running both longitudinally and across, which impart the necessary quality.

One of the oldest forms of pump valve is the double-flap or butterfly valve shown in Figs. 1, 2, and 3. In Figs. 1 and 2, the valve seat is shown in section to exhibit the apertures through which the liquid passes when the valves are open as shown in Fig. 2, the liquid passing in the direction of the arrows; A A is the valve seat, having in it openings, E, E, shown dotted in the plan, Fig. 3; B, B are valves which work upon hinges, C, their movement being limited by the guard, D; the letters apply to the same parts in each figure; the valves are semicircular in plan. Whenever the pressure below these valves exceeds that above them by the amount of weight of the valves, they will open, closing again as the pressure becomes equalised on each side. For small pumps with a light load of water, these valves serve well enough, and are, therefore, suitable to lift pumps worked by hand at slow speed; but, at a high velocity, the rapidity and violence of their closing would soon damage the seatings and render them leaky if made with metal seats and valves; the valves may, however, be lined with leather, provided the pressure of water is not great. In lifting pumps, the pressure will not exceed 15 lbs. per square inch in addition to that of the water above the valve in the pump bucket.

The weight of a cubic foot of water is almost exactly $62\frac{1}{2}$ lbs., therefore the height of a column of water pressing upon a valve being known, the pressure per square foot upon it will be that height multiplied by $62\frac{1}{2}$ lbs., and the pressure per square inch will be equal to the height in feet multiplied by 125 and divided by 288. The area of escape for the liquid around the edges of the valves will be equal to that of the openings, E, E, when the lift of the outer edge of the valve equals two-fifths of the diameter of the openings, E, E. As stated above, the valve will not open until the pressure of the fluid below exceeds that above it by an amount equal to the weight of the valve. In pumps for water and other liquids, this only requires consideration in the case of suction pumps, in which the weight of the column of water, in addition to that of the valve, must not exceed the pressure of the atmosphere; but for exhausting pumps—such, for instance, as the air pump of a steam engine, or the pumps for exhausting the vacuum pans of sugar refiners—more delicate arrangements must be adopted. If a vacuum is to be maintained, the valve must be of the least possible resistance consistent with its closing tightly enough to prevent a reflux of air, gas, or vapour, as the case may be. In Figs. 4 and 5 is shown a valve, the seat and suction passage being in section, in which the resistance to opening is determined by the angle of the valve seat to a vertical line. If the valve, B, depending from the hinge, C, were hung vertically, it would exercise no pressure upon the valve face, A, and as the inclination of A increases, so will the resistance of the valve, B; D is a guard to restrict the opening of the valve as shown in Fig. 5; E, E are flanges for attachment to the vessel to be exhausted.

The next example shown, shut at Fig. 6 and open at Fig. 7, is a spindle valve, having a conical seat; this valve requires to be ground into its seating to make a true fit. The seat, A A, is shown in section, F F being the part upon which the valve closes; B, the valve, carries a rod or spindle, C C, of which the lower end works through a hole in the centre of a wheel-shaped frame at the bottom of the inlet, between the spokes of which are the openings, E, E, to allow of the passage of liquid; the upper end of the spindle passes through a hole in the guide, D D, which also serves as a stop to restrict the rise of the valve, B; the height of rise necessary to afford an outlet equal to the inlet pipe is one quarter the diameter of the latter. These valves are simpler than the foregoing, inasmuch as the hinge is dispensed with; they have also the advantage that they do not require to open so widely in proportion to width as the previous ones, and will therefore close quicker and with less concussion. Rapid closing in valves has some special advantages which will subsequently be referred to in connection with a larger class of valve. A very compact form of valve similar in principle, but more self-contained than the last, is illustrated in Figs. 8, 9, and 10, the seats in the two former figures being shown in section. Fig. 10 is a plan view of the underside of the valve. This valve, which, on account of its compactness, has been much used for feed pumps, and others that are required to be stowed away in small spaces, is made with a stalk consisting of three wings or ribs cast on its underside; A A is the valve seat, which, besides having its conical part ground to fit the edge of the valve, B, is truly bored out to receive the wings, C, C, C, the edges of which are turned to fit it, and thus act as a guide to the valve. The rise of the valve in this case may be restricted by a set-screw, D, passing through the top of the valve box. The liquid escapes, when the valve is open, between the wings, C, as shown by the arrows in Fig. 9.

A simple kind of valve consisting of a ball, B, ground into a spherical seating in A A, at the top of the inlet, E, is shown in Fig. 11; it is kept in place by a guard, D. Where considerable area is required it has been proposed to agglomerate a number of these valves, but I do not know that such an arrangement has found favour. These valves must necessarily be disproportionately heavy in comparison with their areas; the balls also are somewhat costly, as they must be perfectly true to be of any use at all, and taken altogether they do not seem to possess any particular advantages to recommend them.

Passing from the comparatively small purposes for which the valves above described are appropriate to others of greater magnitude, such as the draining of mines and water supply of towns, we come upon essentially different forms of construction.

In order to make clear what is required of the valves under different circumstances, it is necessary to advert to the actions of the different kinds of pumps to which they are fitted, and this I will now briefly do. The simplest form is the common lift pump, with a flap or butterfly valve at the top of the suction pipe, and another in the pump bucket itself. It occurs most frequently in agricultural districts where there is no town supply of water, though the principle has also formerly been used in connection with large draining schemes. Next is the lifting and forcing pump with a third valve at the outlet to prevent the water discharged under pressure from returning; but this is displaced by the plunger force pump, in which, instead of a packed bucket or piston to draw and force the water, a long plunger is used working through a water-tight stuffing-box in the top of the pump barrel.

Double-acting pumps have pistons worked by rods passing through stuffing-boxes in the pump covers, so that work is done simultaneously on both sides of the piston: drawing on one side and forcing on the other. For lifting and forcing large volumes of water the single-acting Cornish engine has been very extensively used, being one of the most economical in its action, and therefore generally adopted before the era of very high pressures commenced. In these machines a plunger pump is used, having on its rod a box loaded with weights, which in its descent forces the water out of the pump barrel; the pump plunger, together with its "preponderating weight," is lifted by steam pressure on one side of the piston, the other being open to the condenser. The exhaust is then shut and communication made between the spaces above and below the piston, thus equalising the pressure and leaving the pump load free to descend. The pump barrel is filled through the suction valve during the steam stroke. These pumps naturally work very smoothly; as there is no sudden change of motion, the plunger comes steadily to rest, allowing the barrel to fill completely before the down or forcing stroke is made, and if the pump valves act perfectly a full barrel of water is discharged at each stroke.

The valves for such pumps will necessarily be very large to allow the free passage of the water, and the old rule of making the suction pipe one half the diameter of the pump barrel soon became obsolete when the construction of large pumps came into the hands of thoughtful engineers, among whom Thomas Wicksteed stood pre-eminent as an improver of the Cornish engine. To give an idea of the mass of water dealt with, we may take a pump with a plunger 50 in. in diameter and working with a stroke of 11 ft., and such a size is by no means the largest in use. The area of a circle is equal to the radius multiplied by half the circumference, and the circumference is the diameter multiplied by $3\frac{1}{7}$; therefore the area of the plunger section will be 25 multiplied by 50 and by $3\frac{1}{7}$, and divided by 2 equals 1,964 square in., or, dividing by 144, equals $13\frac{5}{8}$ square ft.; multiplying this by the stroke of the plunger, 11 ft., we have 150 cubic feet of water expelled at each down stroke of the plunger, which, as 1 cubic foot contains $6\frac{1}{4}$ gallons, amounts to $937\frac{1}{2}$ gallons per stroke.

The friction of water in pipes varies as the square of its velocity, and the velocity of a given quantity of water passing through a pipe in a given time varies inversely as the square of the diameter of the pipe, therefore the friction of the water will vary inversely as the diameter of the pipe multiplied into itself three times—thus, if one pipe is half the diameter of another, the friction in the former will be sixteen times as great as in the latter; this shows the importance of making the valves and passages as large as possible.

Following the experience of smaller things, these large pumps were at first fitted up with butterfly valves, but their unsuitableness to such a purpose soon manifested itself. The great area of the valve met such resistance in shutting that instead of falling through the water it hung until the return stroke, and fell with the column of water. In such a case as that taken above, where the pump acted against a pressure of 100 feet of water, the weight thus falling would amount to $43\frac{1}{2}$ lbs. on every square inch of valve surface, and would cause a concussion at every stroke that would speedily prove destructive to the machinery. The first method tried to obviate this difficulty consisted in providing air-cocks to admit air under the valves so as to allow of their falling more rapidly by their own weight; but this was obviously introducing a gratuitous leak into the apparatus, and in some cases as much as sixteen per cent. of water was lost at each stroke, causing, of course, a corresponding waste in consumption of fuel. The real remedy was to be found in designing a valve that should close quickly from its own form without requiring any extraneous aid.

To get at the principle involved, let us consider the difference of retarding force of a plate falling flat and one falling edgewise. The force tending to buoy it up and retard its passage through the water arises from the friction of the water passing from the under to the upper side of the plate, and when that plate is flat it evidently takes the water a longer time to reach its margin than when it is placed on edge; there is in short a much greater lateral movement of the water necessary in the former than in the latter case. Suppose the plate to be an inch thick and a foot square, laid flat, when it has displaced its own bulk of water once it will have fallen one inch; if on edge when the plate has displaced its own bulk of water once it will have fallen twelve inches. The conclusion arrived at is, that while keeping a sufficient area of opening of the valve to allow of the free passage of the water, the area of the valve acting vertically must be reduced, and this is done by using the double beat valve shown in Figs. 12, 13, and 14. Fig. 12 is a vertical section of the valve closed, and Fig. 13 of the same when open. A A′ A′ A is a casting bearing two seats, of which the smaller is at the top, A′ A′; these are shown in plan at Fig. 14, where G G shows the lower and A′ A′ the upper seat. These are connected by ribs, F, F, etc.; through openings, E, E, between these ribs the water passes from the underside of the valve, B B, in the direction shown by the arrows. Part of the water passes under the lower edge of the valve, B B, and the remainder over the top seat and out through openings round the centre of the crown of the valve. C is a nut which limits the rise of the valve, the hub, D, coming in contact with it when the maximum rise allowed is reached. This valve affords a very large outlet for the passage of the water, for there is the full area of the bottom seat, and the resistance to the escape is also relieved by the outlet at the top; the pressure being thus rapidly reduced within the valve also aids in facilitating its fall directly the flow ceases. The difference of area of the upper and lower seats will be that opposed to the water, and on this the whole weight of the valve is taken; so this form will require a greater pressure to open than a flat valve, but that is of no moment in comparison with the advantages obtained by its use. These valves are made up to weights of 13 cwt., and sometimes more.

Under very heavy lifts the beat of these valves may be felt at some distance, and in some pumps which were used to force water to a height of 270 ft., I have employed valves of the form shown in Figs. 15 and 16; the letters refer to the same parts as in Figs. 12 and 13, the only difference being in the form given to the valve itself; the idea was to give the valve an elastic form, and also to provide better passages for the water to the upper seat, A′A′.

As soon as it appeared that something different from the old-fashioned valves was needed, numerous inventors arose and patented valves of all sorts. One which may be mentioned here consisted of a series of rings placed one upon another, and having a small disc valve on the top of all, the rings gradually diminishing in diameter upwards. The bottom ring formed a seat for the second, which formed a seat for the third, and so on to the top. This valve closed quicker than a plain disc valve of equal diameter would do, because, the water getting away between the rings did not take so long to get clear of them as to get from under a flat plate.

With the increasing use of high pressure, steam, and high speed engines, high speed pumps have also been introduced, the advantage being found in the employment of smaller and less expensive machinery to do a given quantity of work; therefore valves suitable to quick working pumps have become a necessity. In such pumps we have necessarily all kinds of concussions, for their action may be said to comprise a constant succession of sudden and violent reversals of motion; and if the engine is overrun actual blows will result, for there is a limit to the velocity for the suction end of the pump, which is that of the entering water. If this is exceeded the pump barrel does not fill, and on the return stroke the entering water is struck by the piston or plunger. In order to get the full advantage of the atmospheric pressure, it is desirable to place the pump below the level of the supply, for every foot of lift in the suction diminishes the speed at which the pump may be worked, while we can force out the water as quickly as the power at our disposal will allow.

With such machines it is evident that the natural fall of the valve will be too slow to meet the requirements of the case; the valves, therefore, must be shut by the returning current, the very action which in the large pumps proved fatal to the use of flap valves. In this case then we must design valves that will work in the way required without the resulting concussions becoming destructive. The chief points indicated as necessary are light and elastic material for the valves, large area of inlet and outlet for the water, and no working parts to shake or wear loose. The material that most nearly fulfils these conditions is indiarubber, but it has no strength to support the pressure of liquid over a considerable surface, therefore when used it is necessary to make the valve seat in the form of a grating, so that the indiarubber itself may be sustained against the pressure upon it. The less the lift of these valves the better it is, as the force of closing is proportionally less, therefore a large area, afforded by a considerable number of small valves, will be advantageous. The common form of circular indiarubber valve upon a grated seating is shown in vertical section in Figs. 17 and 18, shut in the former and open in the latter. A A is the seat and B B the valve, which is bolted between the seating and a cup-guard, D D, and secured by a nut, C; the guarding, D D, limits the rise of the valve and prevents its being torn or strained by any unusual pressure under it.

A form of valve in which indiarubber bands are used was designed many years since for use with a Cornish engine raising water to a height of 100 feet in one of the London waterworks. This valve, which gave perfect satisfaction, is shown at Fig. 19—the left-hand half is shown in elevation, the right in vertical section. This arrangement consists of a series of diminishing cylindrical seats, A A A′ A′, in the form of vertical gratings having apertures, C, C, etc., around which are wrapped indiarubber bands, B B, etc.; the water pressure within the valve distends these bands and so escapes around their edges, and the bands immediately contract upon their seats on the relaxation of the interior pressure.

Muddy and gritty water will invariably derange metal-faced valves, inasmuch as some deposit is sure to get upon the seating; to obviate the inconvenience thus caused, an indiarubber valve of the form shown in Figs. 20, 21, and 22 has frequently been used with success; it is, however, only applicable upon a small scale. It consists of a tube, A, which is shown at Fig. 20, in vertical section through the line, C C (Fig 22), on plan at which the lips meet. Fig. 21 shows a vertical section at right angles to the line, C C, at which the lips, B B, meet; these lips are forced apart by liquid passing through, and it is obvious that mud and other clogging material will pass freely through, there being no valve seats on which to deposit. These valves are not suitable for high lifts on account of the yielding nature of the material of which they are composed. The idea appears to be taken from the form of certain valves occurring in the circulatory system of animals.

In the preceding remarks I have sought to put before my readers a description of the various kinds of valves in use in pumps, and to show, I trust clearly, their construction and advantages or disadvantages, as the case may be. I shall be happy to give further information through "Shop" on any point which may seem to require further elucidation.

IRON SOIL-PIPES.

BY W. R.

The rage for speculation which has taken possession of the business men of this age has made itself as evident in the building trade as in any other, and to the driving of hard bargains and close-fistedness of property buyers, can often be traced the reason for the fixing of sun-dried bricks, trashy joists, and, worse than all, defective sanitary arrangements.

Especially is this noticeable in the drainage and sanitary plumbing of modern middle-class houses.

In these, lead as a material for soil-pipes is never used. Cast iron, often badly fitted, has been made to take its place.

Now, every intelligent plumber knows the advantages which lead possesses over iron when used for this purpose. Its resistance to corrosion (when well ventilated), the smoothness of the interior (when drawn, not seamed), its adaptability to jointing—all go to proclaim its superiority over iron.

But yet these builders must use iron, for the simple reason that the people for whom they build will not pay the price for lead. Such being the case, it remains only for the plumber to make the best job possible of the materials to hand.

The two worst faults of iron pipe are its liability to corrosion and internal roughness; these may successfully be overcome as follows :—

Get each length of pipe to nearly a red-heat; this may be done by standing it upright on the plumber's fire-devil or grate in the open air, and lighting a blazing wood fire under it. The pipe should be turned end for end once or twice to make it uniformly hot. When nicely hot, coat it inside and out by means of a long handle tar brush, with a mixture of pitch, tar, and resin in the following proportions :—Pitch, 7 lbs.; coal tar, $\frac{1}{2}$ gal.; resin, 2 lbs.

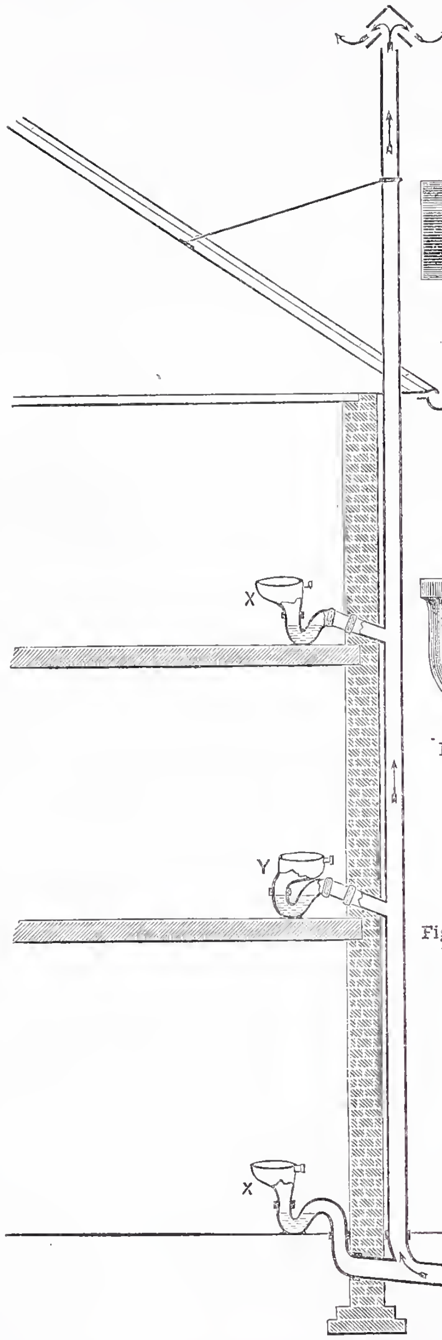
These ingredients should be melted in an iron pot, the pitch and resin first, adding the tar afterwards when the pot is off the fire. When the pipes are quite cold, they will possess a glaze impenetrable alike to water or sewer gas.

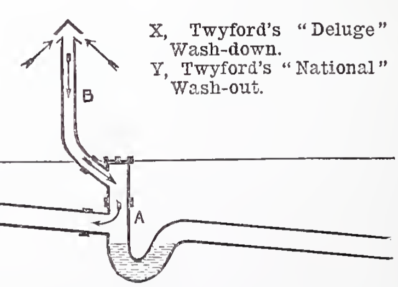
The next thing is the fixing. The pipes should be fastened to the wall as usual by hooks and clout nails through the ears, but every length should have a small wood block placed behind the ears so as to set it off from the wall about an inch (the nails passing through it will hold it in its place), for the purpose of getting the hand round the pipe in jointing. The first length should be placed in the socket of the earthenware bend or junction which has been brought to the surface to receive it. This joint should be made with cement, first, however, placing a ring of tow or flax inside the socket to prevent the cement from running through into the pipe, and thus causing an obstruction.

Before inserting the next length, and, in fact, all above, paint the lower socket with a mixture of red lead and linseed oil.

Paint the end of the pipe to be fixed with the same; now wrap round this end some nice soft tow or flax, and well saturate it with the red lead paint. Put the pipe in it place, and fasten it there. Next caulk i with a thin tool as much tow as you ca occasionally brushing in the paint until th socket is nearly full. Be careful in caulk ing; do not use a hammer, the tool itself wil be quite sufficient, for the ordinary cast-iro pipe will not stand many heavy blows.

Now mix up some red and white lead t the consistency of dough and fill up th socket with it, we squeezing it in to fi up all crevices, an the joint is finishe Joints made in th manner have stoo the smoke test man years after bein fixed, without th slightest leak or crac being found in then





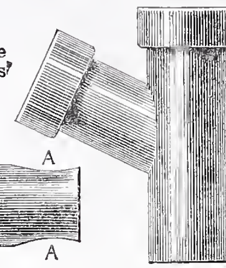


Fig. 1.—Branch Pipe usually known as a "Y-Piece."

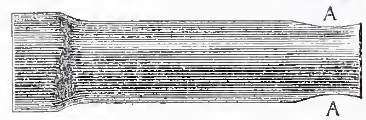


Fig. 2.—Piece of Drawn Lead Soil-Pipe—A A, End compressed to enter Socket.

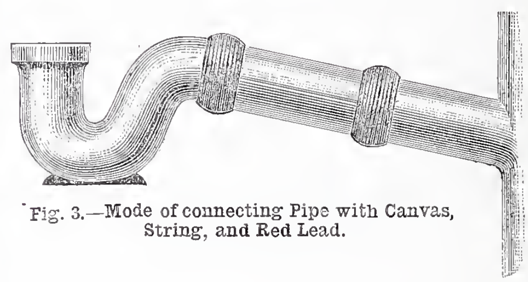


Fig. 3.—Mode of connecting Pipe with Canvas, String, and Red Lead.

Fig. 4.—Connection of Closets with Iron down Pipe and Pipe to Sewer—A, Sewer Intercepting Syphon; B, Inlet for Air.

X, Twyford's "Deluge" Wash-down.
Y, Twyford's "National" Wash-out.

Now as to the co nection for the wate closet, which usuall in these moder middle-class houses is either a "wash-out or "wash-down" pattern. These earther ware closets, by-the-bye, are, generally speak ing, the best sort for use in those position where we often find a large family using on place continually.

Before the soil-pipe is fixed, a hol should be got through the wall on a leve with the floor-line o the water-closet fo a branch to pas through.

The trap shoul then be placed in th exact position it i intended to occupy and temporaril fastened there.

When the stack o iron pipe has nearl reached the hole i the wall, the branc piece should be pu in its position in regard to the closet tra (which, in this case, would be P shape). an the length of the iron pipe taken, which i necessary to connect it with the other pip below.

This branch, or, as some call it, "Y piece," is shown at Fig. 1.

Almost any size can be obtained, but 4-in is generally used for this class of work. O course, this fittin should be coated th same as the rest.

The lengths of pip should then be con tinued to the nex water-closet if ther be one, and then o again above the roo for the purpose o ventilation, as show at Fig. 4.

We shall find ou branch pipe ha barely passed through the wall to the water closet, and is from one to two feet awa from the outlet of the trap.

These must be connected up by means o a piece of drawn lead soil-pipe (not seamed mind) opened at one end to receive the trap and drawn in at the other to enter the iro socket of the branch piece, as shown a Fig. 2.

It will be seen that the smaller end of thi connecting piece is opened out a little. Thi should fit in the iron socket tightly, leaving a space, A A, to hold the packing. Take are that the end of this pipe goes right into he end of the socket, so as not to leave ny space for the accumulation of filth.

This connector should now be fixed, the oints being made with the same materials s the others, but they should not be caulked, s that would cause damage both to the rap and lead pipe. Instead of this, when oth sockets are full, place a thick layer of he mixed red and white lead round each, nd take strips of canvas or calico, and nake a bandage round them.

Saturate the whole with red lead paint, nd then bind on a regular layer of stout string or cord as shown at Fig. 3. This binding will prevent any falling away or racking of the packing, and in a very short ime the whole will set so hard as only o be parted with the greatest difficulty.

In making the drain, a sewer intercepting syphon should have been fixed, as shown at A, Fig. 4, with an inlet for air, B, which should be a pipe about 5 or 6 ft. high, fixed to the nearest wall for support.

There is one thing which cannot be too strongly insisted upon :—*Never carry a soil-pipe up inside a house.*

If these precautions be taken, the cost for workmanship will be but slightly increased, while the causes for complaint against cast-iron pipe will be completely removed.

THE AMERICAN LEVER WATCH.

BY A PRACTICAL HAND.

Waltham, Elgin, or Boston Lever.

The Waltham lever in my opinion is next best in quality and equal in timekeeping to the well-finished English lever. Some will differ from me, I have no doubt, but this was settled a few years ago, after a long discussion in the English press, and was decided in favour of the hand-made English lever on account of its durability.

The Elgin watch, taking its cost and appearance into consideration, is a very strong and useful watch for the working man, far superior to its imitator the common Boston, with its half-finished wheels, the underside of each being left in the rough. Of course the public do not see this, and top plates, etc., are scarcely gilded at all; the few paltry so-called jewels are only on the plate in sight, the under plate is minus. They go fairly well for a time, but the best plan after that is to quit them, or they will be a never-ending source of annoyance and cost. The cases are the lowest mixture of silver, which will scarcely keep bright with wearing; when made in so-called aluminium it is simply brass badly plated. The wearer finds that out in the course of a few weeks. The same price paid for a Swiss silver lever would be money wisely spent. Of course some one must buy them, but my advice is the same as *Punch's* advice on marriage—"Don't."

To clean the above style of watch first take off the hands, hour and minute, with one lift, then carefully raise the seconds hand *evenly* with tweezers so as not to injure the pivot point on which it is fitted; open the inner dome and turn the half-headed screw so as to free the works from the cases; press them out face side. Now hold the movement in your left hand, and draw out the three pins holding the dial in its place; take off the dial and the three dial wheels, as described in page 406; turn over and unscrew the cock or cover to balance and mark the end of hairspring; draw out the pin which holds it in position, and remember which way out, so that in replacing it you do the same; if not you will wonder why it will not go when complete. Lift out the balance and place under glass cover for safety, then let down the spring by turning the winding part a little back, and slip out the click from ratchet notch, gently allowing it to turn down.

Having done this you may now proceed to unscrew the top plate by the three screws

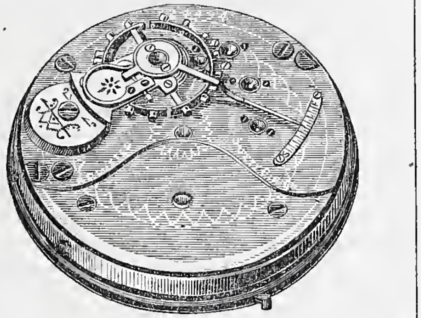


Fig. 1.—American Lever with Top Plate on.

holding it in position, and after examining it well, so that you can remember the position of each part, the top plate ought to be very gently lifted so as not to break or cast any pivot point or other injury; notice the lever, and take out so that you may not drop it and lose it. And so take out each wheel.

One thing in these watches is the ease with which you manipulate the spring barrel; as there is no chain or fusee wheel, in this point they are superior to our watches. There being no chain or fusee work the motion is direct from the spring wheel, for the teeth are around the rim of the barrel. The English makers claim, which of course is true, that by the fusee arrangement the pressure is more equal all the time; the greater leverage when spring is nearly uncoiled. Any one will see that; whereas the American watch must have a longer and exceedingly well-tempered spring to give anything near equal leverage. You will notice, if you listen, that the beat is much weaker when nearly run down.

To proceed, polish the wheels with the brush drawn over the prepared chalk, and also clean plates, using a rotatory motion so as not to show scratches. Many recommend

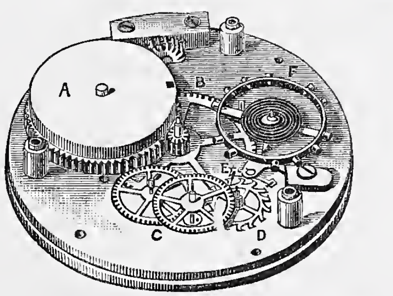


Fig. 2.—American Lever Waltham with Top Plate Removed—A, Barrel; B, Centre Wheel; C, Third and Fourth Wheels; D, Escape Wheel; E, Lever; F, Compensation Balance.

using benzine to dip them in, but unless of the very purest quality the work is unsatisfactory.

Note that it is not advisable to take out the mainspring, for three-fourths of the trade do not, so why recommend it to the amateur; but if you are really of opinion that it must be done to make a thorough job, prise off the lid of spring barrel. Notice the small dots so as to be right when putting it on again; now undo the end of spring in the middle and lift it gradually out, holding the remainder in by your thumb nail, and so gently turning and allowing it to leave; if not, why it will snap off the end at its stud hole. Clean the spring with an oily rag, and brush out the box free from grit; now hook on the spring and gradually work it in as you worked it out. Of course we in the trade do it in a different way, but I am writing for those with few tools, and to describe how would be no use.

When all the spring is in the barrel, put in the centre and hook it on, and try by turning it if it has proper hold, so that when boxed up you may have no further trouble; if it does not grip it, just lift centre out and gently squeeze it inwards. Now replace and try again. Put on cover as previously stated and turn with the key to see if all right; if so, place under cover; having pegged out all the holes clean, touch each one with the oiler, and if you are certain none are worn oval or any jewel broken, cracked, or injured, by such carefulness you may save much time and annoyance.

Having got thus far you may proceed to put together by placing the centre wheel and next the spring-barrel wheel, which works into it and each one; now place on the top plate and guide each pivot into its place; press down, and try if the train runs easy by gentle pressure upon the main-spring wheel; if so, all is right so far; gently raise up the top plate and insert lever pallets with tweezers, using your eye glass. This is not such an easy job to do, but patience will do it, and when all pivots are again in place, also pallet part, then try pressure; and if the pallet moves quickly you may proceed to screw down the top plate; if not, some part is too tight; gently ease the top plate, and try again and screw down. Place on outer plate, holding barrel in position, and screw down with two smaller screws; then as stated before how to clean balance and its spring, replace it, and pin into same mark on the plate; run the pin in *right side*, drop the last coil in betwixt the two studs of regulator, and drop on the cock or cover. Try it to see that pivot is in the jewel hole; if so, screw gently down, trying it all the time by shaking movement, or you may finish the pivot. Try if lever works by using pressure; if not, and balance is locked, or what we call overturned, undo cover, gently raise balance, and just push the extreme outer end of lever towards the other pin and drop balance in again; screw down, and you will find it all right. Now wind up, and the watch will once more be in order; but if the beat is unequal you have not pinned the hairspring to its proper place; partly push out the pin and draw spring a little and try again; if worse, draw the other way until the beat is satisfactory and the pin tight. We have another way to put in beat, but I write so that any may understand; if not, my time and yours is wasted.

Now try the watch for a few hours, and if still working with goodwill replace the dial wheels and dial as previously stated (page 406), and fit into cases; turn the half-headed screw, and replace hands all in correct manner, so that each minute is complete, as the seconds hand denotes. Close cases, and the job is complete and satisfactory no doubt, and in many cases equal to that done by a village watchmaker, so called.

In my next paper I will tell you how to clean the English lever.

BAMBOO WORK AND MATERIAL.

BY DAVID DENNING.

THE trade in bamboo furniture, both useful and ornamental, has of late years made such rapid strides in this country, that no apology need be offered for introducing the subject in these pages with the view of still further popularising it, not merely when made up, but for the workers, either amateur or professional, who may have a taste that way.

For some reason or other, bamboo construction has not received that amount of attention which one would imagine it would have attracted. We are all familiar enough with the appearance of things made partially or wholly of bamboo, but comparatively few are aware of the immense scope this branch of art work affords, and the ease with which the mechanical details can be learned.

Without, at the present time, giving directions for the construction of any specific piece of furniture, a few general remarks will no doubt be of assistance, and perhaps induce many to profit by the designs which will, from time to time, be offered in these pages. In fact, we may consider the subject of bamboo work as virgin ground, which must be surveyed and gone over, ere the practical planting and completion of diagrams can be proceeded with. We may look on the present article as a preliminary canter into an almost unexplored region, of which only some of the salient features can be noted.

We are, perhaps, at first struck by the apparent flimsiness of things made from bamboo; they look so light and fragile that it almost seems as if they could be blown apart.

Further acquaintance, however, shows us that they are by no means so fragile as they appear. The bamboo itself is strong and tough, so that the only source of weakness can be at the joints. That many of the things made of bamboo are not so strong at these parts as they should be, is not to be denied, but with due attention when designing anything for construction in bamboo, *i.e.*, remembering the nature of the raw material and acting accordingly, there is no reason why there should be any inherent weakness in any portion of the work. If any joint or constructive detail is so weak as to render the piece of furniture, be it bracket, table, or whatnot, useless for the purpose which its shape shows it to have been intended for, bad design or workmanship must be blamed, not the material used. It is no use making a pretty thing only, that is to say, unless it is for pure ornament. However pretty to look at, let us say, a chair might be, it is obvious to every well-trained mind that, unless it fulfils the object of chair, the mere prettiness repels rather than attracts. One may admire the design as a design in the abstract, but the futility of the chair causes the beholder to have a feeling akin to pity for those who can admire it. This, of course, is merely an adaptation of the principle that truth is essential to beauty. First truth, then ornament, and if this be remembered, the first great law of art is appreciated. False construction and beauty cannot go together. Now, to the art student, these remarks may seem quite unnecessary, as the principles of them have been inculcated times without number. They are, however, of such extreme importance to the bamboo worker, that insistence on them can hardly be too strong. The worker, to whom they have become almost second nature, is not likely to ignore them, but there are many who seem to think that the highest art is not to hide art, but by artifice to make some material resemble something else. No matter where we look, we find this feeling proclaiming itself in all its hideous vulgarity. "Look at me," says the result of misapplied talent; "you thought I was made of wood—I look like it; but, ha, ha, I have taken you in—I have deceived you. I, through the perverted skill of the artificer who made me, am false from beginning to end; I am in reality made of iron." Well, perhaps exclaims the reader, is not iron as good, as sound, as strong, and useful as wood? Yes, every whit, and, perhaps, better for the purpose of the speech-endowed article above. The material is right, but the wrongfulness consists in trying to make it resemble something else. We may admire, or, let it be said rather, wonder at the dexterity of the artificer, but the feeling is one of pity that he should have gone so out of his way to create a deception. The material and its capabilities must be kept in mind when designing anything.

Now, in bamboo, it is necessary to always remember that it has qualities peculiar to itself. We cannot treat it as if it were so many pieces of wood such as is used in ordinary joinery or cabinet work; it must be manipulated as bamboo not as wood. It cannot be reduced in diameter, but we can select pieces of such a thickness as may seem appropriate. The main portions must be thick comparatively, thick and strong enough to be serviceable, the decorative details being of the smaller and lighter pieces. These can be bent with ease, so that the straight, stiff lines of the main construction are relieved by variety. Then, again, a judicious arrangement of colours afford further scope for the display of taste. However, as the artistic principles involved in bamboo work are not confined to it alone, let us, instead of dilating on them, further descend, or, if the worker who thinks "art all bosh" prefers, ascend to practical work.

"Ah, that's right; he's going ahead now," I almost fancy I hear some one say; or is it the cricket chirping which suggests the words, "and leaving his 'igh hart" notions? Well, my friend, if I have not mistaken the cricket's utterances for your own, let me, in the first place, say that I have no sympathy with "high art" for its own sake; and secondly, without art, no worker can be a master of his craft. I have written a little "art," but I trust not "high art," which, at its worst, is an incomprehensible mystery, even if it is not, as you suggest, "all bosh." If I have unfortunately written anything that is not to be understood, then I plead guilty to having encroached on high art, and freely forgive you for having mistaken what is intended as art, for what is erroneously spoken of sometimes as "'igh hart."

Art and craft must go hand in hand, if our present-day manufactures are to be of any more than merely temporary value, and the more closely the worker can connect the two the better, even in what may possibly be only a passing fashion, such as bamboo furniture.

Well, let us leave the lecture-room, and get right into the workshop. What is the raw material to be? What tools are to be used? These are among the first questions which will occur to the novice's mind. Let them be answered in a general way. You do not want to know about the botanical history of the bamboo, so though a string of scientific, and, perhaps, very interesting, particulars might be given, they must wait. What we have to do is to speak of bamboo as we fin[d] it ready for working up.

Roughly speaking, the kinds may b[e] specified as black, brown, yellow, mottle[d] mahogany, and spotted, according to colou[r] and marking. All the colours are merel[y] approximate, as different sticks, or to spea[k] technically, canes, in a bundle vary co[n]siderably. The artificially coloured cane[s] such as black and mahogany, of course a[re] more uniform than those which are left i[n] their natural state, if we except, perhap[s] the yellow variety. In addition to th[e] plain stained canes, there are some suc[h] as the tortoise-shell with fancy mottling pr[o]duced by artificial means. All the kind[s] are obtainable, either with or without root[s] the rooted canes being the dearer of th[e] two. It must not, however, be forgotte[n] that occasionally dealers run out of sorts, s[o] that the purchaser must not make too su[re] of getting just what he wants at a moment['s] notice. The sizes of the canes vary co[n]siderably, the thickness being from ⅛ i[n.] to 3 in. or more, those most useful f[or] furniture of the fancy kind being from ½ i[n.] or ¾ in. to 2 in. In length, they are fro[m] 3½ ft., the thinner canes up to say ⅜ i[n.] thick not exceeding this, while the thicke[r] ones are cut in 6 ft. and 13 ft. length[s]. Other sizes are also to be met with, but thos[e] named are about the most common. On[e] variety of small canes known as Tonking[s] should not be omitted. Ordinary canes o[r] rattans are also used, and come in hand[y] for a variety of articles.

The prices fluctuate a good deal, and i[t] is impossible, if not out of place, to give the[m] in detail; but the following extracts from [a] recent quotation by one of the principal, i[f] not the chief importer of bamboos, etc., ma[y] be of service :—

Feet					in.		in.	dia.	each
6½	black	bamboos	without	roots	¾	to	1	,,	4½d.
,,	,,	,,	,,	,,	1	,,	1¼	,,	7½d
,,	,,	,,	,,	,,	1¼	,,	1⅞	,,	8d.
,,	,,	,,	,,	,,	1½	,,	1⅝	,,	9d.
,,	,,	,,	,,	,,	1¾	,,	1⅞	,,	10d.
,,	,,	,,	,,	,,	2	,,	2⅛	,,	11d.
,,	,,	,,	,,	,,	2¼	,,	2⅜	,,	12½d.
,,	,,	,,	with	,,	¾	,,	$1\frac{1}{16}$	,,	7½d.

Tonkings from 20s. per 1,000 according t[o] size.

It should be noted that the above ar[e] retail prices at which the dealer referred t[o] is willing to sell small lots, and that i[n] wholesale quantities the figures are corres[-]pondingly less. As some guide to wha[t] constitutes a wholesale order it may be sai[d] that a bale containing 100 canes of a sort i[s] the smallest quantity, and that any fewe[r] or even that number made up of severa[l] sorts, can only be supplied at retail price[s]. In case it may be thought that this i[s] irrelevant, let me say that these particular[s] are inserted as owing to the mention of hi[s] name in a contemporary, the dealer wh[o] quotes the above figures is pestered b[y] numerous letters from persons asking hi[s] *wholesale* prices and favouring (?) him afte[r] a prolonged correspondence with an orde[r] for half a dozen canes.

It will be a great pity if readers of WOR[K] are so indiscreet as to alienate the good-wil[l] of large dealers, not only in bamboos, bu[t] other commodities, by what one can onl[y] stigmatise as "sharp practice." If I ma[y] make a suggestion to the fraternity wh[o] are always seeking to get bargains an[d] buy under value, it is that they shoul[d] remember that time is of some value t[o] men of business and to those who hav[e] something to do, and that by worryin[g] large dealers or manufacturers who ma[y] be willing to oblige the readers of WORK by supplying small quantities, they are likely to do a serious injury to the professional artisan, or even to the amateur, whose proceedings are more business-like and straightforward.

In many of the larger centres of population there are manufacturers of bamboo work who would probably be willing to supply amateurs with such small quantities of the raw material as they are likely to require, but London is the chief market for it. To name any dealers here would be invidious, especially as firms supplying bamboo have already been mentioned in the shop columns.

The tools required for bamboo work are few and simple. A saw of some kind, preferably a small one, is necessary for cutting the canes into lengths. Half-round files of various sizes are also useful, if not indispensable, for shaping the ends to fit against surfaces. This may, however, be managed with a knife alone. Indeed, with patience and a knife almost any piece of bamboo furniture may be constructed, though it goes without saying that the few tools suggested greatly facilitate operations. Several bits for boring are also advisable, though in their absence holes can be made, or rather started, with a gimlet or other suitable tool, and then be enlarged to the required size with the pointed end of a knife. When it is said that unless a thin piece of bamboo is let into a hole bored in another, the usual mode of fastening is by means of wooden pegs or dowels, it will be seen that some contrivance by which these may be cut will be required. The dowels are fitted into the canes, which it may be assumed every one knows are hollow and then let into holes bored partly through the other piece. If this rough outline of the construction is not sufficiently clear to enable novices to start bamboo working, it may be said that in succeeding articles the subject will be more fully gone into, and as illustrations will be given, every necessary detail will be made "as clear as daylight." Glue and nails, it is almost superfluous to add, are required, and having said this, no further remarks are necessary about the appliances used, as those who are familiar with joiners' or cabinet makers' tools will be able to evolve from their inner consciousness the easiest methods of working, while those who are not will soon devise means and become proficient.

One great advantage for the amateur, and perhaps I should say for the professional, worker in bamboo is that there is very little waste of material. The short pieces and odds and ends can be used up till it is hardly too much to say that not a scrap will be left over.

In due course various small articles which can be made up from "waste" will be suggested, so in the meantime the worker who may not have many ideas of his own in this direction may as well keep the bits which at present may seem useless to him.

Bent bamboos have been referred to, and the most casual observer cannot have failed to notice that in many articles made from bamboo the canes are curved. For example, in a table the feet are splayed, not only for the sake of appearance, but to give stability. Now though it might be possible to bend bamboos by hand only, in many positions where the construction is such that the curves are kept from springing out again, the novice will soon find himself in a difficulty in such a case as instanced, viz., in a table leg or foot. The bamboo must not only be bent, but the curve must be retained. The bending may easily be managed by the aid of heat, either dry as from a lamp or by steam. Naturally the former is the easier of the two, and is used by the chief bamboo workers. The bamboo is warmed at the part to be bent by holding it in or over a smokeless flame, in which it is moved about to avoid burning. The cane soon becomes plastic enough to be bent with the utmost facility, and when cold the curve will remain unalterable. A spirit lamp gives an excellent flame for the purpose, but almost any source of heat will do, provided care be taken that the surface of the cane does not get smoked. The heating should be gradual, and on no account must the bamboo be allowed to remain motionless, that is, the flame must not play on any one part sufficiently long to burn the cane. Of course the heat must be applied all over the surface to be bent, and gentle force be used till the desired curve is attained.

Bamboo cannot well be painted, but where nice finish is required it is often gone over with a rubber of polish or glaze.

With these few general remarks by way of introduction to the useful and artistic manipulation of bamboo, the present hints must be brought to a close, and, as it has been said, diagrams and designs accompanied by descriptive explanations will be given in future papers for the benefit of those who, either by way of recreation or from trade considerations, wish to have some acquaintance with the manufacture of bamboo articles.

ENGRAVING ON METAL.

BY NORMAN MACLEAN

INTRODUCTION.

I HOPE I shall not discourage our many readers, male and female, if I mention in the course of this paper a few of the difficulties of this delightful art, followed either as a means of subsistence or as an agreeable occupation for leisure hours.

The practice of engraving is comparatively clean and inexpensive, and its elementary principles are easily learned. By this, I mean that an ordinarily diligent pupil will make such progress as to give him, or her, encouragement to greater efforts. Although I have not come across a workman who of my own knowledge has been self-taught, I have known instances of individuals who have picked up the trade, aided by the assistance of some good-natured workman, and by assiduous practice have so far become good engravers as to have ultimately earned their living by the profession; not perhaps in the highest style of art, but good enough for some mercantile purposes.

The first thing to be considered is the capability for drawing in the learner, who should be able to handle the pencil with ease, as, in the first instance, the subject has to be drawn before it can be cut with the graver. A few terms at the nearest School of Art will be of great use to the young workman, as a knowledge of the principles of drawing will enable the engraver to correct a bad sketch, and also to trace patterns quickly, which in these days of keen competition is an important consideration.

We now come to the requisites for the practice of engraving. A good, strong bench (Fig. 17) sufficiently high to stand at while working at large work—such as a tray, dish cover, or brass name-plate—a good light, and a high stool to be able to sit comfortably when engaged on smaller work, with a box to rest the feet upon when sitting, or when standing on the box, to increase one's height when using the block (Fig. 18) for large hollow ware. This block is fixed, when required, in the hole shown near the edge of the bench, and secured by the wooden nut shown above the block. The block is turned out of beech or elm, and has a slight hollow turned in the top, in which to place a sandbag, and on which the *inside* of the dish cover rests. The engraver, by this means, gets a firm hold of the cover, is enabled to turn it in any direction, and to avoid scratching or bending the side opposite to which he is working.

But for ordinary work which may be done at home the workman may utilise a table, taking care that it stands steadily without rocking, and use an ordinary house chair.

For tools, a very few will suffice at first, but it may be as well to procure all tools likely to be required, as it is a business maxim that "to wait for necessary tools is time doubly lost." Herewith is a list of the tools required by an engraver, with their approximate cost, followed by a list of firms who deal in such tools:—

ENGRAVER'S OUTFIT.

	s.	d.
1 Sandbag or cushion on which to rest the work	2	0
1 Sandbag or cushion, smaller size	1	4
1 ,, ,, ,, smallest size		10
1 best Arkansas oilstone (any price over) ...	6	0
1 dozen Stubbs's square gravers (prices vary), say	2	6
1 dozen graver handles (prices vary), say ...	2	0
1 tracing or etching point (steel, with ebony handle)	1	0
1 Oil can		6
1 Burnisher (steel, with curved end, handled)	1	3
1 Scraper	1	3
½ dozen shading gravers, D threads (handled) Numbers 2, 4, 6, 8, 10, and 12 widths, at 1s. 3d.	7	6
½ dozen plain flat gravers of the above widths, at 3d.	1	6
1 pair Stubbs's spring dividers, say	2	0
Cement block, cement, oil, turpentine, pencil, indiarubber, and pounce bag, say	1	6
Practice plate (German silver, buffed or polished ready for work, about 1 lb.), say ...	2	6
	£1 13	8

BRASS AND ZINC ENGRAVER'S OUTFIT.

	s.	d.
1 Diesinker's chisel for outlining, say		8
1 ,, ,, for sinking the letters, etc.		8
1 ,, ,, wider than above		8
1 pair 12-in. compasses (steel points)	3	0
1 pair large spring dividers	3	0
1 T-square, straightedge, and rule combined, say	2	6
1 Sandbag, 12 in. in diameter when filled, say	4	0
1 Hammer (handled), say	2	6
1 small flagstone, 14 in. by 14 in. by 2 in.		
6 lbs. of cement, at 3d.	1	6
Zinc plate for practice, 3½d. per lb.		
Pumice-stone, water of Ayr stone, crocus, and lampblack for polishing, say	1	0
Archimedean drill and bits	3	6
Files	1	6
Bench vice	7	6
	£1 12	0

MANUFACTURERS AND DEALERS IN TOOLS, ETC., FOR ENGRAVERS.

J. Sellers & Sons, Arundel Street, Sheffield.—All tools. Manufacturers and dealers.

Peter Stubbs & Co., Manufacturers, Lancashire.—Lancashire tools and gravers.

J. Townley & Sons, Bull Street, Birmingham.—Tool dealers.

T. W. Woods, 60, Alderson Road, Highfield, Sheffield.—Threaded shading gravers only.

Starr & Son, Button Lane, Sheffield, Leather Merchants.—Engravers' Sandbags.

Tubbs & Wilkins, Great Hampton Street, Birmingham.—Engravers' cement.

Tucker & Sons, York Street, Sheffield.—German silver, brass, and zinc plates.

Buck & Son, Holborn Viaduct, London, E.C.—All tools.

The above tools are all of the very best quality, and are of the same make as those I use myself, and will cut anything between

Britannia metal and moderately hard steel. If the expense of the above outfit is too great, a smaller quantity may be got at first, the purchaser using his or her judgment as to what may be best dispensed with. The workman now being supplied with tools for a start, I will first deal with the oilstone, as being the most important; as without a good one the engraver cannot whet his gravers in a proper manner. In choosing an Arkansas stone, endeavour to see the whole of the stock of the dealer, and get him to tell you which are the hardest and which the softer stones. Choose a stone 6 in. × 2 in. × 2 in., at per pound weight. The stone should be quite white, without cracks or *yellow veins,* and of the second degree of hardness; such a stone will sharpen any tool in first-rate style, and in moderately quick time. Now take the stone to a cabinet maker, or, if the workman is handy with the chisel, he can mount the stone on a mahogany block (Fig. 5), inlaying it to the depth of ½ in., so that a *gentle tap of the mallet* will fix it. A new stone will not cut very readily, and to make it "bite" scrub it well on the face with a piece of gas-coke and plenty of oil, which will remove a gummy substance often formed on stones when they have been long in stock. The new stone will soak up a large quantity of oil on first being used. Do not forget to clean the stone occasionally, paraffin oil being an excellent cleanser. A useful form of oil can is shown in Fig. 6.

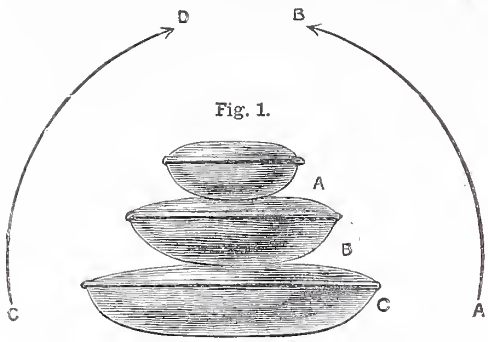


Fig. 1.

Fig. 2.

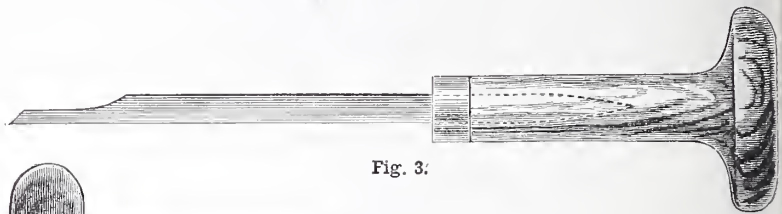


Fig. 3.

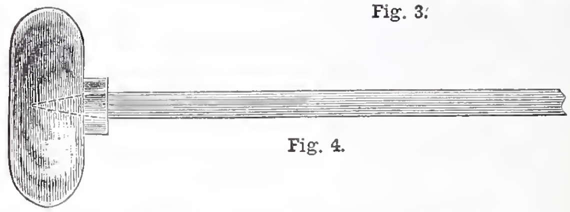


Fig. 4.

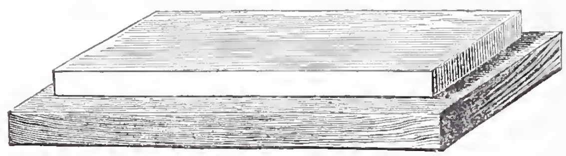


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

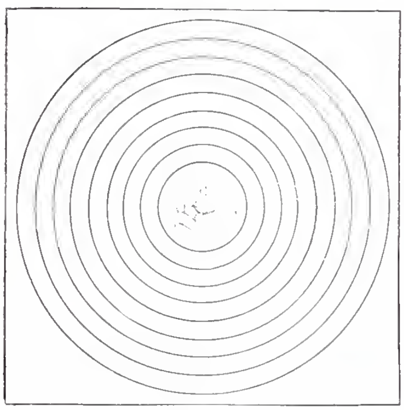


Fig. 9.

Fig. 10.

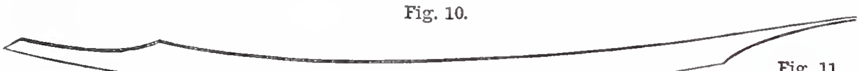


Fig. 11.

Fig. 12.

Fig. 13.

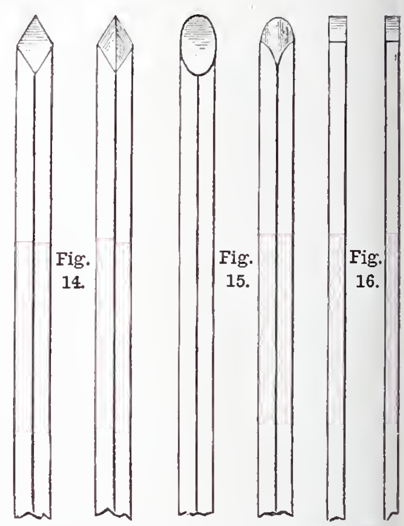


Fig. 14. Fig. 15. Fig. 16.

Fig. 1.—Diagram representing Cutting from Right to Left (A B) and from Left to Right (C D). Fig. 2.—Sandbags. Fig. 3.—Short or Worn Graver with Long Handle. Fig. 4.—Long Graver with Short Handle. Fig. 5.—Arkansas Oilstone on Mahogany Block. Fig. 6.—Oil Can. Figs. 7 and 8.—Set-off Gravers. Fig. 9.—Example of Practice Plate. Fig. 10.—Flat Graver or Scorper, sometimes called a "Wriggling" Tool. Fig. 11.—Back of Shading Graver. Fig. 12.—Belly of ditto: this is Lined and Convex, and requires no Setting Off. Fig. 13.—Burnisher of Oval Section, Curved End. Fig. 14.—Back and Belly of Angle Graver for Outlining, etc. Fig. 15.—Back and Belly of Round-Nosed Graver for Spotting, etc. Fig. 16.—Back and Belly of Flat Graver.

Whetting or Sharpening Gravers.

The method of whetting or sharpening gravers is shown in Fig. 19.

Take a new graver, and break off half an inch of the soft end or tang as it is called; now take a handle—the shortest one you have (Fig. 4)—and gently tap the graver home in the handle, using a bit of brass to stand the point of the graver upon while driving home. A hole is usually left in the handles for this purpose. Put some oil on the stone, and with the finger lay the oil evenly all over the surface. Now take the graver in the right hand and lay it flat on the stone, the bright side or belly of the graver downwards. Place the first and second fingers of the left hand on the end of the graver to keep it in position, and raise the handle of the graver five or ten degrees, still keeping the point on the stone (Fig. 8), then turn the graver slightly inwards and commence rubbing the graver up and down the stone, keeping the tool in the *same position* until the right-hand facet is formed, and then treat the other side of the belly of the graver in like manner. If these facets are formed truly, the line of sight on the belly of the graver and the angle of the newly-formed facets will be in a straight line (Figs. 7 and 14), although of a different level, and will enable the engraver to cut a perfectly straight or circular line at will. If this angle bears to the right hand or to the left hand, it will cause the workman to be unable to follow truly the line which he wishes to cut, therefore he must whet the graver again and again until he can see the

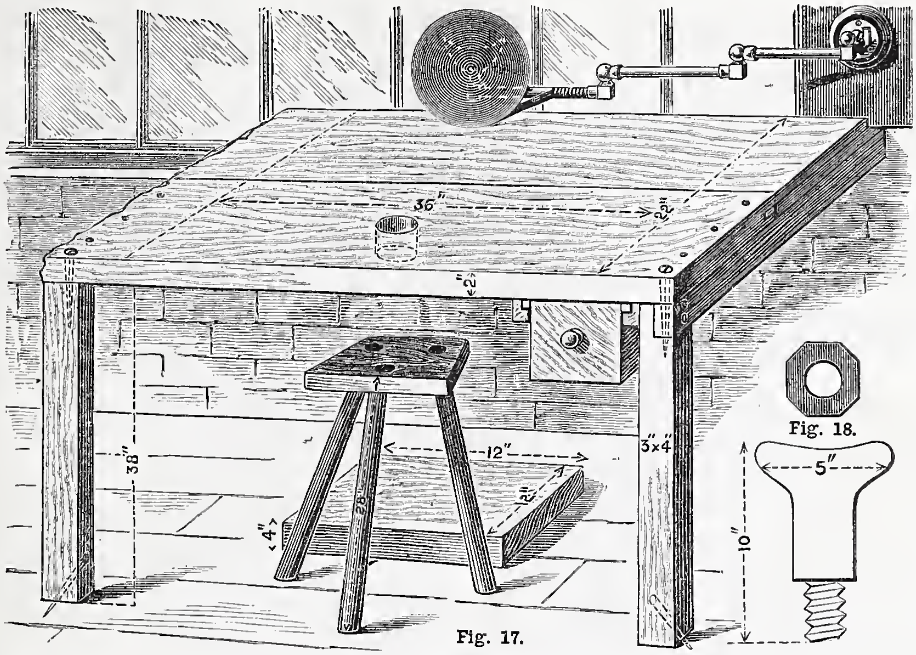


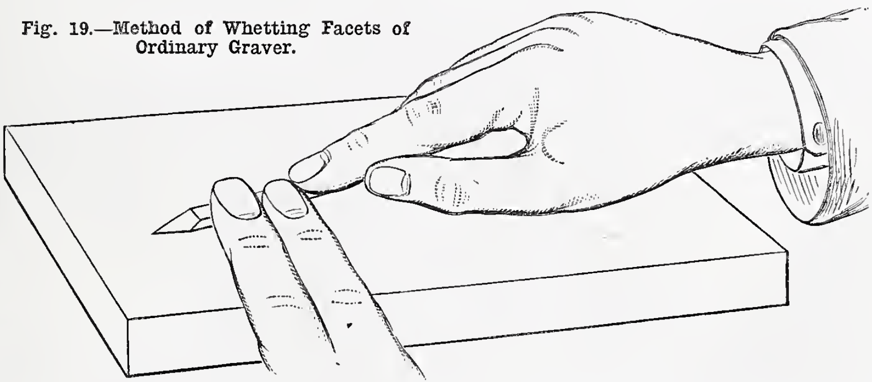
Fig. 17.—Engraving Bench, with Stool, Box for Feet, Gas Bracket, and Shade. Fig. 18.—Block for Large Hollow Ware, as for Dish Covers, etc.

angle of his facets in line with the centre of the belly of the graver. This can be easily seen by holding the graver towards the light and looking along the belly of the graver. This is important, but after a little experience the engraver will be able to whet his tools to suit his own hand, and a little daily practice at whetting will enable him to whet a graver in a few minutes. Now turn over the graver with the newly-formed facets upwards, place the graver on the stone at an angle of 45°, and rub it on the stone until a sharp point is obtained, which may be known by trying the point on the thumb nail. If the point is dull it will slide over the surface of the nail, but if sharp it will cut the nail. Do not rub the stone always in the same place, but use it equally all over the surface, and wear the stone as evenly as possible. The operation of raising the graver handle when forming new facets is termed, "setting off" the graver, and the "set off" of a graver depends upon the kind of work to be done. Thus: the graver we have just whetted is to be used in cutting the plate we are about to mount on the cement block, therefore, being a flat surface and easily accessible, the "set off" of the graver does not require to be very great; on the other hand, if we were about to engrave the bottom of a cake basket (the bottom of which is some three or four inches deeper than the outside edge or mount), we should require a graver "set off" at an angle of 30° to 45°; and in the usual workshop economy of time, these kind of gravers are kept each for its particular purpose, so that it is quite an easy matter to have from fifty to one hundred gravers in use. These and other gravers will be dealt with further on. Meanwhile, should any young workman be unable to get over the difficulty of whetting a graver, if he will send it to me, through the Editor of WORK, I will whet for him a graver as a pattern. It is requested that the postage be paid both ways, as no charge will be made.

To return to the German silver practice plate. These plates may be obtained of a metal dealer at the rate of about 1s. 4d. per pound, according to the state of the metal market. It should be hammered flat by a silversmith, and afterwards buffed or polished, and cut into convenient sizes for mounting on the cement block. This block is a piece of mahogany, 6 in. × 6 in. × 1 in., plain sawn. The cement is called engravers' cement, and may be procured from an oilman. Should any difficulty arise, the cement can easily be made as follows:—Melt in a stone pipkin 1 lb. Swedish pitch—it can be done in an oven; when melted mix 1½ lbs. of plaster of Paris in the pitch while hot, thoroughly incorporating the mixture, and pour while in a liquid state upon the block, spreading evenly all over the surface; now warm the plate, lay it on the cement, and press it down firmly, which, when set, is ready to work upon. When another plate is required to be mounted, the cement can be warmed at the fire, or over the gas, taking care that in the latter case the cement is not smoked or burned. Take also particular care that none of the cement drops while hot upon the fingers, as it inflicts an ugly burn which takes a long time to heal. We have now the plate mounted ready to receive the design or pattern intended to be engraved.

There are many methods of teaching used by professional engravers, which, of course, vary with the individual. Some prefer to start the pupil on the work in hand, such work as tracing from the print, thus making the pupil of use from the first. Others will give the young workman a plate, such as I have described, and having whetted for him a graver, will allow him to quietly get used to the graver in his own way, giving him a few necessary directions from time to time as occasion requires. My own practice is to give to the young workman as great a variety of work as is possible, changing the character of the work frequently, so that it may not become monotonous. Thus, I give a little tracing from the print, cutting, dividing, or "setting out"

Fig. 19.—Method of Whetting Facets of Ordinary Graver.



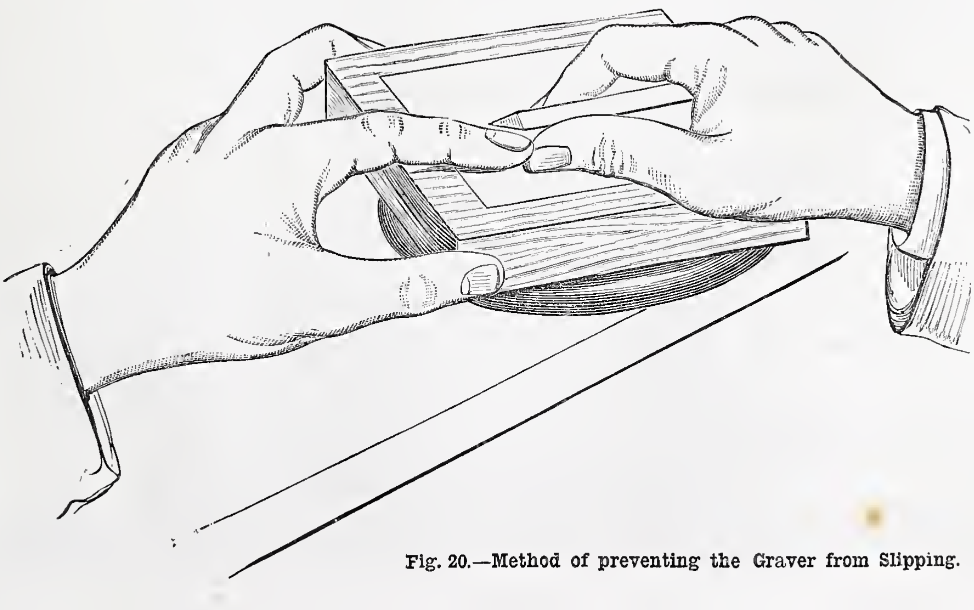


Fig. 20.—Method of preventing the Graver from Slipping.

my own work, with proper intervals for plate practice. However, for a start. take the block and stand it upon the sandbag (second size), B, Fig. 2, and with the spring dividers find the centre in the usual manner, and strike on the plate a number of circles, increasing in size till the outside edge of the plate is reached. Now take the graver in the right hand (Fig. 20), placing the handle in the palm, grasping firmly with the forefinger and thumb. Hold the block with the second, third, and fourth fingers and thumb of the left hand. Thus we have the first finger of the left hand at liberty to place in front of the thumb of the right hand, to guard against the "slipping" of the graver. The workman will now try to cut the smallest circle described on the plate (Fig. 9). He will find this somewhat difficult at first, but with perseverance and practice will soon get into the way of holding the graver. There is nothing difficult about it, except that the holding of the graver in the hand is, perhaps, different to that of any other tool. To resume: now place the point of the graver on the line of the smallest circle, gently raising the graver and pushing it forward till the graver begins to cut. Continue the cut, gradually turning round the plate towards the right hand, cutting towards the left hand, keeping the forefinger of the left hand in contact with the thumb of the right hand. The workman will find that the thumb of the right hand will slide over the work in the rear of the cut; this being the case, a leather thumb stall had better be worn until the end of the thumb becomes hardened. As it is necessary to be able to cut from left to right, as well as from right to left, which I have just described, the second circle must be cut in the reverse direction (Fig. 1, C to D)—viz., from left to right, using the same directions as for the centre circle. By this time the graver, what with slipping about and digging into the metal, will be quite dull, so all that remains to be done to renew the point is to give the graver a few rubs on the stone with the facets upwards, keeping closely to the original angle of 45°. Continue to cut the remaining circles by the above rules, alternately cutting to the right and to the left hands respectively.

The other tools that are illustrated, but to which no special reference has been made above, are a short or worn graver with long handle (Fig. 3); flat graver or scorper, sometimes called a "wriggling" tool (Fig. 10); back and belly of shading graver (Figs. 11 and 12); burnisher of oval section (Fig. 13); back and belly of angle graver for outlining, etc. (Fig. 14); back and belly of round-nosed graver for spotting, etc. (Fig. 15); and back and belly of flat graver (Fig. 16).

Having started the workman in the practice of engraving, I will in my next paper give a few directions to those workmen who have had a little practice, and are familiar with tools, and who wish to know something about lettering on brass and zinc, pewters, etc.

PURCHASING TIMBER.

BY B. A. J. H.

As the purchasing of timber seems to be a difficulty with many amateurs, I will offer a few suggestions, showing how to buy and what to ask for.

Many amateurs are in the habit of getting their timber from builders. This is a great mistake, unless you are willing to pay fifty per cent. more for your wood than if you bought it at a retail timber yard; and as there are now so many of them about London and the provinces, there should be no difficulty in going to one to buy what you require. Of course it must be understood that amateurs cannot buy their timber at the same prices as builders do; but it is possible to get it at a much lower rate than some pay by not knowing what to ask for; and I will endeavour to show how this can be done.

Many make a great mistake by taking a piece of string or tape with knots tied marking the lengths and widths they want. No yard keeper cares for this kind of customer, and frequently has his revenge by altering the knots while the customer is examining his piece of wood. Always take a two-foot rule with you, and should the salesman ask the loan of it, "as he has lost his," be careful that you get it back, as some are not very particular to return them. On the other hand, many customers borrow the rule and forget to return it when they have finished. Avoid unnecessary details in asking for your lengths, such as 3 pieces of 32 in. long, 8 pieces 24½ in. long, etc. Work your quantities out before you go to the yard into as few lengths as possible, such as 1–17 ft. and 1–8 ft., or 2–9 ft. and 1–8 ft. This saves the salesmen a lot of trouble, which they do not care for, and will also ensure your getting the right lengths, as in cross cutting they are not particular to an inch or two, causing much inconvenience if the stuff is cut wrongly. A charge of a ½d. or 1d. is also made in some yards for cross cutting, which they charge on the amount for the timber, and so it is not noticed unless you have asked the price per foot before having the stuff cut. Do not always expect to get just the lengths you want, as few yards have the room to keep every length of all sizes in stock; so it is as well to be prepared with other lengths that will work in for your requirements. For instance, if you wanted some 4 fts. and 3 fts., either 12 ft. or 18 ft. will cut; or ask for any length that will cut. I give a list with prices of the sizes kept in stock at most retail yards, which will be found very useful as a reference. Many writers in giving details of sizes of timber required to make or build greenhouses or such-like often give sizes that are never kept in stock, and upon the amateur asking for them at the yard he is at a loss to know what to take in the place of those sizes not stocked. The technical terms in the trade are often a stumbling block to the amateur, and up goes the price when he asks for a "plank" when he only wants a "batten." These errors mark him as a "green hand" at once. The following are the terms given to yellow, pine, spruce, and white deal, with their relative sizes, that are most likely to be required by the readers of WORK.

A "plank" is a piece of deal from 10 in. in width, and of any thickness, such as ½ in. by 11 in., 3 in. by 10 in., 2 in. by 15 in., and 4 in. by 12 in. A "deal" is 9 in. wide, and from 2½ in. to 4 in. thick, such as 3 in. by 9 in. (this size is generally understood when speaking of deals). A "batten" is the smaller sizes up to 3 in. by 8 in., such as 2½ in. by 7 in., 2 in. by 6 in., 2 in. by 4 in., 1 in. by 7 in., ¾ in. by 6 in., and 3 in. by 1 in; 2 in. by ¾ in. and 2 in. by 1 in. are known as "slate battens," used for slating, etc. Parts of planks cut deep and battens are known as planks and battens, while parts of a deal cut deep are known as boards, such as 1 in. by 9 in., and ½ in. by 9 in. A feather-edge board is thick on one edge and thin on the other, usually ¾ in. and ¼ in. thick, and is used for roofing sheds and garden fencing.

"Quarterings" are such sizes as 4 in. by 6 in., 4 in. by 4 in., 4½ in. by 3 in., 3 in. by 3 in., and 3 in. by 2 in.; and the smaller sizes are called "scantlings," such as 2 in. by 2 in., 2 in. by 1½ in., 1½ in. by 1½ in., and 1 in. by 1 in., etc.; such sizes as 2 in. by ½ in., 2 in. by ⅛ in., 1 in. by ¼ in., are known as "laths." "Floor boards" are generally stocked in the following sizes: 1¼ in. by 6 in. and 7 in., 1 in. by 6 in., 6½ in., and 7 in., ⅞ in. by 6 in., 6½ in. by 7 in., ¾ in. by 6 in. and 7 in. Matching, that is to say, battens which match together lengthways with a groove and tongue, are 1 in., ¾ in., ⅝ in., and ½ in. in thickness, and from 4 in. to 7 in. in width. 1½ in., 1¼ in., 1 in., and ¾ in. by 9 in. planed boards are now stocked at most yards, and the difference in price between the prepared and the unprepared is very little. But in ordering all planed goods an allowance of ½ in. in width must be made on each board for the planing. The following is a list of sizes and prices, which vary according to quality.

PLANKS.

In. × In.	Yellow.	White.	Pine.	Lengths.
3 × 11	4d. to 6d.	3½d. to 4½d.	4d. to 11d.	From 6 ft. to 20 ft. Pine generally 6 ft. to 12 ft.
2 × 11	3d. ,, 4d.	2d. ,, 3½d.	3d. ,, 8d.	
1½ × 11	2¼d. ,, 3¼d.	2d. ,, 2½d.	2¼d. ,, 6d.	
1¼ × 11	2d. ,, 3d.	1¾d. ,, 2¼d.	2d. ,, 5d.	
1 × 11	1½d. ,, 2d.	1¼d. ,, 1¾d.	1½d. ,, 4d.	
¾ × 11	1¼d. ,, 1¾d.	1d. ,, 1½d.	1¼d. ,, 3d.	
⅝ × 11	1d. ,, 1½d.	1d. ,, 1¼d.	1¼d. ,, 2¾d.	
½ × 11	1d. ,, 1¼d.	0¾d. ,, 1¼d.	1d. ,, 2d.	
¼ × 11	—	—	9d. ,, 1/4	per 12 ft.
⅛ × 11	—	—	6d. ,, 10d.	,,

DEALS AND BOARDS.

In. × In.	Yellow.	White.	Pine.	Lengths.
3 × 9	3d. to 6d.	2½d. to 3½d.	3d. to 8d.	6 ft. to 24 ft.
2 × 9	2d. ,, 4d.	2d. ,, 3d.	2d. ,, 6d.	,,
1½ × 9	1½d. ,, 2d.	1½d. ,, 2d.	1½d. ,, 4d.	,,
1¼ × 9	1¼d. ,, 1¾d.	1¼d. ,, 1½d.	1¼d. ,, 3½d.	,,
1 × 9	1d. ,, 1½d.	1d. ,, 1½d.	1d. ,, 3d.	,,
¾ × 9	0¾d. ,, 1¼d.	0¾d. ,, 1¼d.	0⅞d. ,, 2½d.	,,
½ × 9	0⅝d. ,, 1d.	0⅝d. ,, 0⅞d.	0¾d. ,, 1½d.	6 ft. to 18 ft.
Feather edge Boards	0⅝d. ,, 1d.	0⅝d. ,, 0⅞d.	—	,,

BATTENS.

In. × In.	Yellow.	White.	Lengths.
3 × 7	3d.	2½d.	6 ft. to 24 ft.
2½ × 7	2¼d.	1¾d.	,,
2½ × 6½	2d.	1½d.	,,
2 × 6	1½d.	1¼d.	,,
2 × 5	1¼d.	1d.	,,
2 × 4	1d.	0¾d.	,,

QUARTERINGS AND SCANTLINGS.

In. × In.	Yellow.	White.	Lengths.
4½ × 4	2½d. to 4d.	—	6 ft. to 24 ft.
4 × 4	2¼d. ,, 3d.	—	,,
4½ × 3	1½d. ,, 2½d.	1½d. to 2d.	,,
4 × 3	1½d. ,, 2d.	1½d. ,, 2d.	,,
4 × 2	1d.	0¾d.	,,
3½ × 2½	1¼d. ,, 1½d.	1d. ,, 1¼d.	,,
3 × 3	1d. ,, 1½d.	1d. ,, 1¼d.	,,
3 × 2	0¾d. ,, 1d.	0¾d. ,, 1d.	,,
3 × 1½	0⅝d. ,, 0⅞d.	0⅝d. ,, 0¾d.	,,
3 × 1	5d. (Cut in yellow & white.)	per 12 ft.	length
3 × 0¾	4½d.	,,	,,
3 × 0½	4d.	,,	,,
2 × 2	8d.	,,	,,
2 × 1½	6d.	,,	,,
2 × 1	4d.	,,	,,
2 × 0¾	3½d.	,,	,,
2 × 0½	3d.	,,	,,
1½ × 1½	5d.	,,	,,
1¼ × 1¼	4d.	,,	,,
1 × 1	3d.	,,	,,
1 × ¾	2½d.	,,	,,
1 × ¼	Lattice Lath	1s.	144 ft. run.

FLOORINGS AND MATCHINGS.

	Width.	Lengths.	Yellow.	White.
In. 1¼ Flooring per square.	In. In. 5 to 7	Ft. Ft. 6 to 24	12/- to 18/-	10/- to 14/-
1 ,,	,,	,,	9/6 ,, 14/-	9/- ,, 12/-
⅞ ,,	,,	,,	8/6 ,, 11/-	8/0 ,, 10/6
¾ ,,	,,	,,	7/6 ,, 9/-	7/6 ,, 8/6
1 Matchings	,,	,,	10/- ,, 14/-	9/- ,, 12/-
¾ ,,	,,	,,	7/6 ,, 9/6	7/- ,, 8/6
⅝ ,,	,,	,,	7/- ,, 8/9	7/- ,, 8/-
½ ,,	,,	,,	6/9 ,, 8/6	6/6 ,, 8/-

TABLE SHOWING NUMBER OF FEET RUN TO THE SQUARE.

Width.	Feet run.	Width.	Feet run.
In.	Ft.	In.	Ft.
4	300	6¾	185
4½	270	7	180
5	240	7½	170
5¼	230	8	160
5½	220	8½	150
5¾	210	9	140
6¼	200	9½	130
6½	190	12	100

If several lengths of one size are required, it is cheaper to buy the planks or deals cut instead of buying them as boards or scantlings. For instance, say you want three 12 ft. 1 in. by 9 in., ask for 12 ft. 3 in. by 9 in., 2 in. deep., *i.e.*, a 12 ft. of 3 in. by 9 in. with two equal cuts through the 9 in., making three 1 in. boards; or six ½ in. by 9 in. ask for a five-cut deal; four ¾ in. by 11 in. ask for a three-cut plank.

In quartering or scantling the deals are cut "flat," *i.e.*, through the 3 in., thus: one flat cut 3 in. by 9 in. = two 4½ in. by 3 in.; two flat = three 3 in. by 3 in.; or one deep and five flat — twelve 1½ in. and 1½ in., and so on. A lower rate is generally charged if the deal is taken, as it does not leave the yard keeper a lot of odd boards, mostly "outside" ones (*i.e.*, those boards cut from the outside of the deal, the rest being known as "inside;" thus there are two "outside" and one "inside" board in a two-cut deal), to get rid of.

The usual price charged for cutting is 3d. per 12 ft. deep cut 9 in., and 1s. per 100 ft. 3 in. flatting; so in asking for three 12 ft. 1 in. by 9 in. you would be charged 1s. 3d. each, while for a two-cut deal (*i.e.*, the same under another name), the price is 3s. 6d.; being 3d. per foot for the 3 in. by 9 in., and 3d. per cut.

Most yards stock pine, yellow, white, and spruce, and sometimes mahogany; but you will find that you can buy the hard woods, such as mahogany, walnut, oak, beech, etc., better and cheaper at those yards where only hard woods are kept. These are sold at per foot super, the price varying according to the figure in the wood. Timber merchants, as a rule, deliver free any reasonable distance if a fair amount is ordered, say 10s. or 15s. worth, although such orders as 5s. are sent home if near the yard.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

100.—Nurse's Regulator.

That everything comes, sooner or later, to him who is willing to wait for what he wants, is a saying which borders very closely on being an actual and positive truth, and one with which I have often effectually consoled myself when placed in a position of desire and difficulty, and have endeavoured to console many of my readers who labour under the impression that their wants are neglected and their wishes ignored, because they do not get what they ask for immediately after the ceremony of asking has been performed. Now, for years I have been waiting very patiently for a contrivance that would adjust the plane-iron in any wooden plane as perfectly as it is done in some iron planes of American origin, and I have met with it at last in Nurse's Regulator, which satisfies all my wants and wishes in this respect and leaves nothing to be desired.

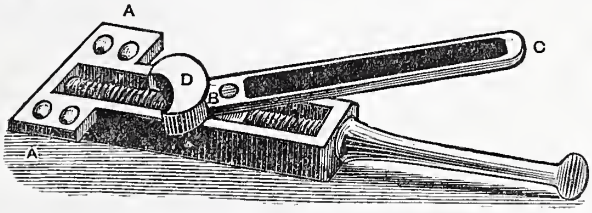


Fig. 1.—Nurse's Regulator for Adjusting Plane Irons.

When I first saw the invention which has been introduced by Messrs. Charles Nurse and Co., Plane Makers and Tool Merchants, 182, Walworth Road, London, S.E., the brass thumbscrew, which shows itself above the top of the plane iron, as may be seen on reference to Fig. 2, put me very much in mind of another plane similarly fitted, to all appearance, which was introduced some years ago, and which, at first sight, I thought likely to answer the end in view, but when I came to remove the wedge and plane iron from the specimen plane sent me by Mr. Nurse and examine the regulator, it soon appeared that the similarity which seemed to exist between the two planes was apparent only, and by no means an actuality. The plane of which I am speaking was an iron plane with a single plane iron, and a piece about ½ in. wide and 2½ in. long was cut in the upper part of the plane iron in the direction of its length to admit of its passage up and down on either side of a piece of iron projecting from the plate on which the plane iron rested, and which carried a screw which worked in a bar with nut in its projecting centre in which the screw worked, and by means of which the plane iron was adjusted. The worst feature of the plane was that the adjusting screw was not made as nicely and truly as it might have been, and the consequence was that the adjustment when effected was soon liable to derangement.

Now I must confess myself to having a strong preference for wooden planes, and a great disinclination to use an iron plane if a wooden one was within reach, but there is a good deal of trying and tapping and looking along the sole of a wooden plane when the iron has to be adjusted, which is simply a matter of course to a professional workman who is handling a plane pretty well every day and all day, but which is decidedly troublesome to an amateur with a minimum of practice, especially if his sight is not so good and keen as it used to be in days gone by. One of the principal reasons for the extensive sale of the American made iron planes in this country has been the ease with which their cutting irons can be adjusted to their work without having recourse to the use of the hammer, and the object of the present invention is to make the ordinary wooden-bodied bench planes, so generally in use throughout this country, equal to the very best American iron planes, as regards the ease with which the cutting irons can be adjusted whilst retaining the distinctive advantages of wooden planes over metal ones.

The general design of the invention is shown very clearly in Figs. 1 and 2, of which Fig. 1 shows the regulator itself and its general appearance, and Fig. 2, by means of a sectional drawing, its mode of application to the plane. Every one who has used a plane and removed the iron for the purpose of sharpening it, will remember that there is a groove in the body of the plane behind the plane iron in which the head of the short screw that holds the two irons together is received. The top of this groove is widened by cutting away a little of the wood on each side to receive the flanges, projecting from the bottom of the brass framework of the regulator as shown at A A in Fig. 1. These flanges are fastened to the body of the plane with brass screws. Lengthways through the frame passes a $\frac{3}{16}$-in. screw, secured both at top and bottom, and terminating at the top in a thumb-piece by which it is worked. Upon this screw works a nut, not very perceptible in the drawing, from which projects a small circular plug, B, by means of which the lever, C, is riveted to the nut, and on which it turns. At the lower end of the lever is a raised semicircular or rather crescent-shaped disc, D, which fits into the round eye-hole always found in planed irons of the English pattern at the upper end of the slot, by which the cutting iron is enabled to be brought down below the edge of the upper iron as it gets ground away, and also to admit of the proper adjustment of the two irons for finer or coarser work. By means of the screw, the plane iron can be easily raised or lowered, as may be required, the lever being used to the parallelism, or otherwise as desired of the edge of the cutting iron with the mouth of the plane. This will be clearly understood by reference to Fig. 2, in which the body of the plane, the wedge, the double-plane iron, and the regulator, properly fitted to the plane, are shown in section. It will be noticed that the planes made by Messrs. Nurse & Co. are fitted with a scroll wedge to allow of its easy removal with a slight tap or two of the hammer. The distinctive feature of the regulator is that it can be easily applied to any bench plane, whether smoothing plane, jack plane, or trying plane, it not being in any way needful that it must be a plane of Messrs. Nurse and Co.'s make to which it is applied. The price of the regulator is only 2s., or 2s. 3d. post free.

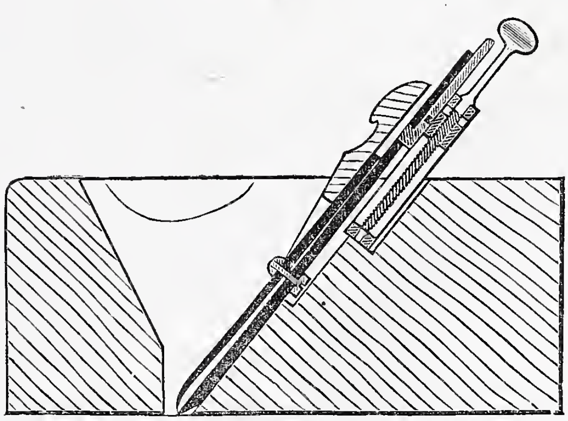


Fig. 2.—Section of Smoothing Plane fitted with Regulator.

I daresay many of my professional readers are well acquainted with Messrs. Nurse & Co.'s name as plane makers, and are quite aware that their name when attached to any tool is an absolute guarantee of its goodness. I heartily wish every tool maker would brand his tools with his own name and not with the names of the retail dealers who merely sell them. Messrs. Nurse & Co. have been plane makers, first at Maidstone and now in London, since 1841. At the International Exhibition of 1862 they obtained honourable mention for the superior workmanship shown in their planes.

The Editor.

SHOP:

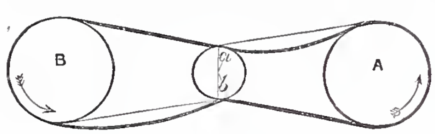
A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Elizabethan Twist.—C. C. E. (*Lincoln*) writes:—"The letter from W. P. W. (page 332) is about a fortnight after date. I have before me, by the courtesy of W. P. W., the piece of pine therein mentioned, which is in no sense an Elizabethan twist. Also I have a spiral cut for me in mahogany, which, though a credit to his ingenuity, is not one either. It seems that we need a definition of an Elizabethan twist. I am informed on the highest authority that it is of Italian origin, and was introduced into England in Elizabeth's reign, and so much adopted for furniture that it received her name. I have specimens of it in chairs made in Italy, and also in others made in her reign. It may be described as a cylinder wound around itself, the whole spiral twisted around an axis contained within itself—the spiral being of such a rate or pitch that one complete revolution extends a length along the said axis, not less than twice its own diameter, and the spiral is such that any section taken at right angles to its own axis or path will be a circle. When I spoke of making a convex curve die into a concave without a break, I was, of course, referring to the twist under discussion, for the operation with a double quarter hollow drill or cutter, for any one definite size, is one of the easiest to any fairly-advanced amateur. The 'pea' in dispute will take a great amount of 'shelling' even by W. P. W. There is, as I intimated in a previous note, no probable difficulty in producing the Elizabethan twist—viz., in a copying lathe, having an iron copy for each rate of twist; but this is not within the compass of an amateur's lathe, and twist from a copying lathe would need, like spokes and gunstocks, to be finished by rasps, files, paper, etc. The work then ceases to be legitimate turning."

Saw Belts Slipping.—J. P. A. (*Walthamstow*) writes *re* belts slipping (page 365, No. 23):—"There is a point not mentioned that is as important as any—that is, the loose side should always be on the top, then the greater the strain the more bite the



Saw Belts Slipping.

belt gets of the pulley, whereas if the loose side is at the bottom there is the more strain, and the less hold the belt gets of the pulley. In the sketch the hold from A is increased by a, and from B decreased by b."

About Work.—A. B. (*Chatham*) writes:—"I quite agree with Kildonan in his protest against enlarging Work and the price. A penny is within the reach of all, and no workman minds paying that for a paper in which he takes an interest; but when it is above that figure, he soon begins to mutter about his not being able to 'run to it,' and 'let them have it that can afford it.' Work is a most valuable paper for the working classes, and, I think, intended for their benefit. I think, therefore, nothing should be done to place it beyond their reach. If not at present, Work will eventually derive its greatest number of subscribers from the poorer classes, and their numbers will more than compensate you for the loss of a few 'imitation gents,' whose hardest work is the bit of carpentering they do for amusement. Those who wish to keep their papers for binding, can easily sew on a cover made of brown paper or newspaper, which would keep their paper quite as clean as a tinted cover from the publisher, and the advertisement page could be pasted over with a picture or drawing. I trust you will not give way to those selfish people who want the paper filled with articles on their own particular trade or hobby; nor do I consider it a good suggestion to give designs and plans of houses, for although a man may make his own boots, clothes, tables, etc., there are very few who have either the time or money to build their own houses. I have now a few suggestions to make in regard to the articles in Work. They are that, while you are giving us lessons in the iron and wood trades, you will not forget those that more nearly affect the home of the humble bread-winner. I refer to the tailoring and shoemaking. When I inform you that I am a journeyman baker, you will not think I am speaking from altogether selfish motives; but how many poor men are there like myself who are always wanting their boots repaired, but can ill afford the three or four shillings charged by the shoemaker? With a piece of leather and a few nails (costing about tenpence), and a few directions in Work, the job is done. Then, again, we could often convert an old suit of clothes of our own into a new one for 'the boy,' if we were only taught how to do it. And lastly, if you would teach us to rivet together our broken earthenware and glass, you will be conferring a great benefit on the hard-working poor."

Combined Bench and Tool Chest.—Mancuniam (*Manchester*) writes:—"I first came across Work by accident, as I was looking for another paper, when I was attracted by the placard of No. 1. So I bought one, and could see it was just the thing I wanted, as I take delight in such things as a hobby. My earlier attempts have been small things, such as a match holder to hang on the wall, or pipe rack, etc., which I have made with a knife; but since reading Work I have got to understand the use of tools, and have bought some secondhand, as I could not afford to buy new ones. The drawing shown in Fig. 1 is what I have made with them;

Fig. 1.

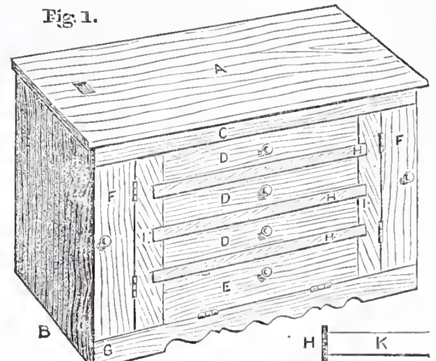


Fig. 2.

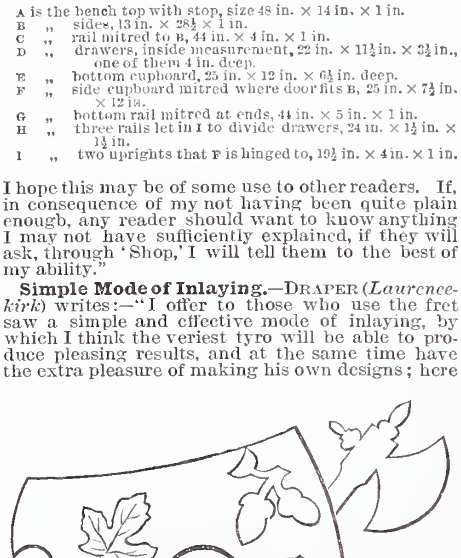
Combined Bench and Tool Chest.

the idea is from Melhuish's Illustration of Tool Cabinet and Work Bench, on advertisement page, which shows that the page is not useless, even to those who can't buy the articles thereon, as some readers complain. It is fastened together by screws, which are sunk below the surface of the wood, then round pieces of wood are glued and forced in, so that the surface is not disfigured; the drawers come over the recess as in Fig. 2, in which H is front of drawer and K the recess. B, C, G are mitred where they meet one another, as is also F, where it meets B, so as to take away the bad look it would have if made to show the cross grain, as I have no bench holder to keep it steady while I plane it. The following is the explanation of Fig. 1:—

A is the bench top with stop, size 48 in. × 14 in. × 1 in.
B " sides, 13 in. × $28\frac{1}{2}$ × 1 in.
C " rail mitred to B, 44 in. × 4 in. × 1 in.
D " drawers, inside measurement, 22 in. × $11\frac{1}{2}$ in. × $3\frac{1}{2}$ in., one of them 4 in. deep.
E " bottom cupboard, 25 in. × 12 in. × $6\frac{1}{2}$ in. deep.
F " side cupboard mitred where door fits B, 25 in. × $7\frac{1}{2}$ in. × 12 in.
G " bottom rail mitred at ends, 44 in. × 5 in. × 1 in.
H " three rails let in I to divide drawers, 24 in. × $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in.
I " two uprights that F is hinged to, $19\frac{1}{2}$ in. × 4 in. × 1 in.

I hope this may be of some use to other readers. If, in consequence of my not having been quite plain enough, any reader should want to know anything I may not have sufficiently explained, if they will ask, through 'Shop,' I will tell them to the best of my ability."

Simple Mode of Inlaying.—Draper (*Laurencekirk*) writes:—"I offer to those who use the fret saw a simple and effective mode of inlaying, by which I think the veriest tyro will be able to produce pleasing results, and at the same time have the extra pleasure of making his own designs; here



Simple Mode of Inlaying.

is one for a photo frame. For this design take a piece of $\frac{3}{16}$ in. oak with rich figure, paste on design with strong starch; pierce small holes at a point in the leaves, and cut out with finest fret saw; put the cut-out patterns in an air-tight tin or box, with a piece of ammonia, and allow them to remain in the box, say, overnight; then glue the edges well (Lépage's liquid glue is the best), and insert the pieces in their respective places. Take a little fret saw dust, and rub well in to fill up the space made by the saw in cutting. See your frame is lying quite level before you leave it to set; after it is quite dry, sandpaper smooth and French polish. Before you glue in the fumigated pieces, allow them to lie exposed for a day, otherwise they will darken the body of the wood. The axe and handle might be fumigated, or a pleasing effect is given by coating the axe with 'diamond' silver powder. If the frame is made of mahogany, darken the leaves by saturating in lime water."

Stencil Cutting.—J. F. (*Elgin, N.B.*) writes:—"I see in No. 23 of Work instructions as to cutting out of stencils (see page 364). I have nothing to say by way of correction as to the method described by R. A., only I find a far simpler and quicker plan which I have done successfully, so I write to explain it should you think it worth your trouble. I should say first it will only be of use when it is zinc that the stencil is to be cut out of. Take a piece of zinc, and instead of painting on the letters, leave them clear, painting all the rest of the zinc, as likewise the ties (it is black japan I use). When it is dry, place it (the zinc) over a basin (earthenware) and pour on a quantity of raw spirits of salt; the letters being clear will fall through as the spirit eats into the zinc; then wash off the acid, and finish off the burr with a sharp knife. I omitted to say, before japanning the zinc, it has to be set up $\frac{1}{4}$ in. all round, and corners soldered. I hope this may be of some use to some of my brother tradesmen. Now, dear sir, what about sheet metal workings? Are we ever to be favoured with anything practical on the above? It is long since it was to appear, but it seems as far away as ever, while things promised but quite recently have appeared, as also things that were never asked for. It is all very well those lessons on soldering for amateurs, but it won't do for those who have learned, or are learning, the art; there is not one apprentice that I have come in contact with but knows all that has been related in those papers before he has been one year at his trade. This with all deference to Work, which I appreciate."

Battlesden Cart.—Homespun (*Tenterden*) writes in reply to Opifex (see page 295):—"In the first place I should recommend the worker to make a full-size working drawing, with chalk, on a plastered wall, or any suitable place, showing both side and back sections; this is of the greatest importance. To draw the wheel, first find the centre, in which drive a bradawl or wire nail, then with a piece of string, and chalk, draw a circle the required size, from which you will be able to see if the cart is likely to balance when finished. While making this drawing, I shall expect the worker to make many alterations until it is to his own satisfaction; when finished he will be able to get all his bevels with the greatest ease. I must now call your attention to Fig. 17 (details Battlesden cart, July 27th): If the seat-rail was 4 in. wide in place of 3 in., it could be screwed on the top of solid sides, which would make the cart deeper if required. If an extra length were left on the bottom of Fig. 13. and turned to the required angle, to screw to the solid side, Fig. 18 would not be required. Before fixing the top sides, or rails, wet them on the in or convex side, holding the outside to the fire; they then can be bent to the required sweep, and fixed without fear of splitting. Over the screws tack a wood valance 2 in. wide and $\frac{3}{8}$ in. thick, plane outside, chamfered to $\frac{1}{8}$ in. at top edge on inside as per section (Fig. 23). Before hanging the tailboard, please read, mark, learn, and inwardly digest the chapters on butts in a previous issue. Previous to fixing the dash, it would be advisable to fix two plates, called bracket plates, made of half round iron $\frac{3}{8}$ in. thick, and about $\frac{7}{8}$ in. wide, to go about 6 in. on front, to hold front corner together, and prevent corner from splitting at A (Fig. 4). The transom, or shaft bar, should be mortised into the shaft $\frac{1}{8}$ in., no more, to prevent it from shifting, as shown (Fig. 10). I should recommend side springs with 3 in. more compass, and a spring block 2 in. deep in the place of 5 in. With his 5 in. block I do not wonder be recommends a solid flap axle, or the spring clips would soon get loose, and the cart would rock about. If any of our readers have succeeded in making a cart from the instructions given by Mr. Opifex, I am certain that they could make their own wheels, and box them, so as to have a vehicle of their own construction. If no abler pen than mine takes the matter up, it would be my greatest pleasure to assist them. I do not wish to commence a hair-splitting controversy, or throw cold water on Mr. Opifex's good intentions; what I write is for the benefit of those who are willing to learn."

An Easily-Made Fret Machine.—E. J. A. (*Reading*) writes:—"In Work for August 10th (No. 21, page 332), W. R. S. has described (?) an easily-made fret machine. I am more than surprised that an Editor of a magazine printed and published by Cassell & Co. should have allowed so much valuable space to have been wasted with a description of such a machine. [Are you? Read on a little further.—Ed.]. How and where is the wheel to be fixed? How, in the name of common sense, can W. R. S. get a vertical stroke if the bar, A, is joined to the arm, C? I can understand its working if the end of the brass bar were made with a straight slot; but in the machine under notice, if the iron guides, B, B, are fixed, I fail to see how W. R. S. can get any stroke. I hope W. R. S. will see the error of his ways."

An Easily-Made Fret Machine.—W. R. S. (*Brixton*) writes :—"HIGHBURY, N., in page 411, says that if the above machine was made according to the illustration it would be impossible to work. He is quite mistaken, considering that the original from which the illustration was drawn has been in use for over twelve months. I shall be quite willing to show it to him at any time he may mention (the Editor has my address). Meanwhile I am anxiously waiting to see the sketch of the machine as corrected by him, asked for by the Editor on page 411."

An Easily-Made Fret Machine.—W. R. S. (*Brixton*) writes in reply to ANXIOUS (*Barnoldswick*) (see page 411):—"You ask how the fly wheel should be suspended. The axle should be fastened firmly to a bench so as to allow the wheel to work easily. In reply to how long the bars of iron should be, mine are eight inches, but they could be made whatever length would be suitable for fixing them. They are both fastened down to a framework, which does not appear in the illustration, and which he must use his own discretion in making. He must remember that the better the pipe, A, works in these bearings the more successful will the machine be. I hope this will fully explain any difficulties which he may have met with, and will be glad to know if he is successful in making the machine."

An Easily-Made Fret Machine.—W. R. S. (*Brixton*) writes in reply to MANCUNIAM (*Manchester*) (see page 412):—"You ask how does C cause A to work vertically? The bottom part of C is fastened to the wheel, and the top part only to the shaft, so that when the wheel revolves the treadle crank pushes up A till it gets to the top, when the crank draws it down, and so on."

Cane Furniture.—J. P. A. writes :—"I made a window stand for flower-pots out of the canes sold for garden sticks. Some were ⅜ in. in diameter and some ⅝ in. Generally there have been six 5-in. pots on each shelf for months, so it bears some weight, and I do not suppose it cost 2s. altogether. I will give my experience on that job, if you think it worth while."—[By all means give your experience in this particular branch of work.—ED.]

Harmonium as Blast for Furnace.—G. H. (*Bradford*) writes :—"No doubt many readers of WORK possess a harmonium or American organ, which they have never dreamt of using for purposes other than charming the savages next door. I am in possession of a small harmonium, and some time ago, wishing to make some brass castings, I conceived the idea of making it act as a blast for my furnace—the kitchen fire. Acting on the spur of the moment I placed the instrument with its back to the fire, bored a hole 1 in. diameter into the reservoir, inserted an iron pipe 6 ft. long, one end of which I put between the bars of the grate, and I had a powerful continuous blast. I have since fitted pipes with suitable bends and couplings, so that my box of music can retain its normal position, and I can at any time attach suitable jets for smelting, smiths' work, brazing, or glass blowing. Further particulars if desired."—[If I possessed a harmonium or American organ I should certainly refrain from treating it as you have treated yours; but, nevertheless, there may be some who might be inclined to follow your example, so I give the latter portion of your letter. The first part I am compelled to omit, partly through want of room, and partly because it would serve no useful purpose to put it into type.—ED.]

Flat or Dead Black.—In reply to F. P. (*Newport, Mon.*) (page 334) OPIFEX writes :—"This correspondent has written a long objection—occupying eighteen lines in 'Shop'—to my 'tip' for quick drying flat black (see page 218), which he characterises as a 'roundabout recipe,' yet it occupies only three and a half lines in the larger type of the other columns of WORK. But although this hundred-galloner grumbles, my poor little tip survives unaltered, as by F. P.'s showing—and he is a professional—drop black, turpentine, and black japan are correct ingredients, for though he substitutes gold size as a binder, and suggests 'any copal oil varnish' as an alternative, which will answer equally well, every one who knows the composition of black japan is aware that it also will answer equally as well as any of the binders mentioned. On the whole, I am obliged to F. P. for his growl, also for having corrected me as to the name of the black. I certainly ought to have written 'drop ivory black,' but thought at the time that every one knew it familiarly as drop black. With regard to the direction that the black should be 'purchased already ground in turpentine,' allow me to point out that amateurs, for whose benefit 'Tips for Tyros' are chiefly intended, do not generally make up their quick black by the 100 gallons, and that it will, therefore, suit them better to grind what they require as they need it. I am sorry to take up so much space in defending my 'tip' from assault, and only hope that all its brethren may prove as much in accordance with 'the results of practical and professional experience and usage' as F. P. has shown this one to be."

Cheap Bell Chuck.—I. L. (*Glasgow*) writes :—"Referring to your article 'A Cheap Bell Chuck,' I would suggest that a diminishing coupling be got from the pipe works without being screwed, or if the tap be sent to the works the smaller end will be screwed by the make, and the larger end left plain; this would give additional strength for screws. Any size can be got on ten minutes' notice; at least it can be got in Glasgow."

Frame for Wardian Case.—J. N. M. (*Salford*) writes with reference to remarks on this subject by W. P. (*Southport*) in No. 19, page 301 :—"I have been hoping to see in WORK something about a wardian case, and having just received my monthly number I have found what I wanted, but not enough of it. I should take it as a favour—and possibly others would—if our friend, W. P. (*Southport*), would explain the *joints* he uses to connect (1) The base of the case. (2) The corner upright astragals to the base. (3) The corner upright astragals to the horizontal astragals. (4) The bevelled astragals to the base and top respectively of the wardian case top. Possibly small diagrams would save much writing and space."

Hand Saw Bench.—J. L. (*Elgin*) writes in reply to B. F. (*Liverpool*) (see page 382) :—"I notice in 'Shop' a description of hand saw bench in which an error has crept in which would overthrow the very first principles of applied mechanics. B. F. says (or is made to say) 'the smaller the pulleys are the greater the speed on saw, but the larger they are the less power.' Surely this is quite the opposite of what he means, for as you lose speed, by using larger pulleys, this will cause a gain of power. I have a bench of same make (my own) by which I do five different processes—viz., ripping, squaring, grooving, beading, and tenon cutting."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Emery Wheel.—J. C. (*Hull*).—You can buy an emery wheel much cheaper and far superior to any that you could make. If you attempt it you will probably have the fragments flying about your head. Churchill, or Buck & Hickman, or Selig Sonnenthal can supply what you require.—J.

Galvanometer.—W. G. G. (*Brighton*). A fully-illustrated description of a galvanometer will be forthcoming in WORK when room can be spared for the article. The construction of coils and galvanic batteries will also receive attention in due time. Space cannot be taken up in "Shop" in showing how to construct galvanometers, coils, and batteries.—G. E. B.

Edison's Chronograph.—R. D. (*Paisley*).—I am told that the needle or stylus in Edison's new phonograph is made of steel, and is fixed to a mica diaphragm by means of a very small nut and screw. Perhaps some reader will kindly oblige R. D. with a detailed account of the diaphragm and stylus of Edison's new phonograph.—G. E. B.

Tire Cement.—BICYCLE (*Rainham*).—A fairly good tire cement at 1s. per lb. from W. A. Lloyd, Waeman Street, Birmingham. Holdtight cement, 1s. 6d. per lb., from Wm. Bown, 308, Summer Lane, Birmingham. Rockbill's cement, 4s. per lb., Wm. Bown as above.—A. S.

Watch Materials.—PORT VICTORIA (*Rochester*).—You can get eyeglasses and watchsprings at Grimshaw's & Co., 35, Goswell Road, Clerkenwell, or at any of the tool shops in Clerkenwell. The best eyeglass I find is the cork frame; they are lighter to hold up, and give to the shape of the eye, and if dropped does not chip like the horn frame. The price is about 1s. each, the horn being about 10d. each. Any material may be had same place.—A. B. C.

Wood.—A. W. (*Hampstead*).—Messrs. R. Melhuish & Sons, Fetter Lane, London, E.C., would probably be able to supply the wood you require. Some years ago S. A. Mitchell, 100, Curtain Road, E.C., used to sell me similar wood, but having no occasion to send him orders lately, I cannot say whether the address would find him now; his prices were reasonable, and the stuff always correct to order, and satisfactory in every respect.—E. B. S.

Mechanics.—NEMESIS (*Manchester*).—The following are two suitable books upon the subjects you refer to :—(1) "Practical Mechanics," by Prof. Perry (3s. 6d.), Cassell. (2) The above, and Rankine's "Civil Engineering," 12s. 6d., Griffin & Co., 12, Exeter Street, Strand, London.—F. J. C.

Painting Iron Bedsteads.—J. R. (*Liverpool*). If, as I presume, you have no facilities for japanning your iron bedsteads, you cannot do better than renovate them with enamel paint. I do not know that any one brand of these has a superiority over all others, so that it would be invidious to name one make to the exclusion of others. If you want to encourage local manufactures, get the "Falcon" brand. Minton's is also another local make. You will find either of these enamels quite equal to Aspinall's, which needs no comment. At Lewis's you will get yet another make, so that you have a choice of at least four, all of which I can recommend from personal use, but I cannot take upon myself to say that one is "the best." There is no particular mode of application that I can tell you of, as I suppose you know enamel, like other paint, is laid on with a brush. Be careful to remove any traces of grease from the work before painting, and if the previous coating is chipped, smooth it down.—D. A.

Hairspring Fixing.—THIRTY-HOUR MOVEMENT (*Liverpool*).—I have always the same difficulty in getting a new hairspring for any of those American movements, and from your query I should say your spring is very much too strong; try and change it for one much weaker at the shop you bought it. If you cannot get one weak enough take the spring from the brass collet in the centre, get a cork larger than the diameter of the spring, and put the spring on a sharp cutting oilstone, and grind the spring down; the cork will keep it flat on the stone. This is a quick and easy plan of weakening a spring, either stock or watch, although it makes the spring narrower, and is inclined to make it wobble in working, unless done carefully. In grinding, press firmly on the cork, and work it in a circular manner, and use plenty of oil with a little paraffin in it, then clean in benzoline, and repeat the dose till going to time; if not successful write again.—A. B. C.

Simple Subjects.—C. E. (*Lydney*).—Your letter is one I should much like to answer with some advantage to yourself, but it is by no means easy to do so, as though you want a description of something simple, you do not say in what craft or trade you want assistance. From what you say I may assume you would find working in wood, *i.e.*, joinery, cabinet making, carving, etc., the most suitable subjects to take up. Of course we want to encourage rising talent, but at your age you really cannot expect to be able to make much. Being, as you say, only thirteen years old, you naturally have still to acquire the very rudiments of tool handling and working, and much as we should like to help you we really cannot devote much space to describing such very trifling things as it may fairly be imagined are within your comprehension and ability. Take my advice if you will, and read WORK carefully. Much that appears in it is doubtless beyond you now, but then, you know, you are not always going to remain "only thirteen," and with increasing years no doubt you will acquire increasing powers. Although you may not yet be able to make many, or even any, of the things described in WORK, you will gain a fund of information which is sure to come in useful when you reach the years of manhood; and I am sure so sensible a lad as you will not be discouraged at being told you must learn the rudiments before you can hope to achieve success. Now supposing you read our articles on jointing up, and put in practice the directions given—in other words, try your hand at joining boards by the methods described. Though you may not by so doing make anything, you are learning a most useful lesson, which will stand you in good stead when you undertake to make a piece of furniture. Certain tools are mentioned in the articles referred to: get and become proficient in them. In "Lessons from an Old Bureau" you will also learn a good deal, though you may not be able to make a bureau yet. In fact, the same may be said about any of the articles which have already appeared or will appear in due course. Try your hand at making a box, and put in practice the remarks about dovetailing, which you will find in connection with the drawers of the bureau. Then, if you do not understand how to use a plane, read the article in No. 20 referring to this tool, and follow the same course with regard to others. By this means you will attain proficiency, and there is no other way, however tedious it may seem. I have answered you at some length, as, though you will see WORK is for workmen, every one must have a beginning, and I am pleased to see one so young as you taking an interest in useful mechanical pursuits. If you will suggest any little thing which might be described for the benefit of yourself and others similarly circumstanced, I will, if a description seems likely to be of general interest, try and arrange for a paper on it.—D. A.

Plough, etc., Plane.—H. S. (*Salisbury*).—Miller's combined plough, fillister, and matching plane is undoubtedly a useful tool, though whether you would find it more serviceable than the separate planes, which it supplies the place of, is more than I should like to say. It is really a point for you to decide for yourself. You are no doubt aware that combination tools, however ingenious, are seldom in every respect equal to all the various things they represent, their greatest advantage perhaps being that less space is occupied by having several things combined in one. As a matter of personal opinion, I prefer the various things combined in Miller's plough, etc., in their separate forms, and in saying this I do so without in the smallest degree reflecting on the efficiency of the combination. Were I constantly travelling about with a quantity of tools, when bulk would be a consideration, I should probably decide in favour of the combination. In case cost may have anything to do with your decision, it may be well to remind you that though the best tools separately would together be more than the combination, this is cosiderably more than you can obtain the lot in lower quality for.—D. A.

Brass Lacquer.—W. J. H. (*Oldham*).—I can hardly understand whether W. J. H. wants a recipe for the making of lacquer or for the application of the same to brass work. If the former, I would suggest that good lacquer can be bought in small quantities cheaper than it can be made by an amateur. But supposing W. J. H. wants it in large quantities, I will, however, try to meet his wants. As there are various colours required for different purposes, it would have been better had he said for what precise purpose he wanted it. 1½ oz. best pale shellac, 1 pint methylated spirit, 10 oz. silver sand, well washed, or powdered glass, put altogether in a bottle, and let stand for a day or two until the shellac is dissolved. It must be occasionally shaken. Let it now stand until quite clear—the fine sand in settling will carry down the other impurities—and pour off. A little spirit may be added to the sediment to dissolve out any remaining gum, and after settlement it may be added to the stock—this we will call No. 1. Take 1 oz. of dragon's blood dissolved in 1 gill of spirits, treating it in the same way as the other—this we will call No. 2. By adding this in small quantities to No. 1 we can get the depth of colour needed. The following recipe is given for philosophical instruments:—Gum gutta 12 drachms; gum sandarach 2 oz.; gum elemi 2 oz.; dragon's blood 1 oz.; seedlac 1 oz.; terra merita 12 drachms; Oriental saffron 2 oz.; powdered glass 3 oz.; alcohol 20 oz. These must be dissolved and treated in the manner before described. The article to be lacquered must be polished until all scratches are removed, and then pickled in pickling acid, then removed and washed in hot water, and dried in boxwood sawdust. Care must be taken that no part is touched by the fingers, as if so every such mark will appear where lacquered. The article must be held in tissue paper of several thicknesses, and heated until it is warm enough to handle comfortably. The exact heat can only be learned by practice; indeed, the art of successful lacquering in all its stages is the result of much practice. The lacquer must be applied by a camel-hair brush in straight lines, and not painted on, and in no place must a second application be made over a previous one, at least until the first is hard.—O. B.

Silvering Glass.—W. J. H. (*Oldham*).—At present there are two principal modes adopted by the trade. First, the old-fashioned mechanical method of mercury and tinfoil; and, secondly, the chemical method. Now W. J. H. simply asks, "How to silver the back of a mirror?" If it is an average size mirror, I do not think he can do so at all, and if he could it would not pay him to do so, as the plant would cost more than the mirror when done. A perfectly level table, say, of marble is required, sufficiently large to take the glass, with a gutter to receive the superfluous quicksilver. But apart from the cost of plant, a great deal of practice is required to evenly distribute the quicksilver over the foil, and then to withdraw a sheet of paper which is placed between the amalgam and the glass. Small pieces of glass can, however, be silvered without much difficulty, as I have found when I have required such pieces, and could not purchase them. On a perfectly level surface—say, a mahogany table—spread a sheet of stout tinfoil; carefully rub out all creases. On this pour pure quicksilver. It is essential that it should be very clean; if there is any doubt about it it should be filtered by being squeezed through chamois leather. With a clean haresfoot distribute it evenly over the foil. Place a sheet of smooth paper on the amalgam, and lay the glass—having been made perfectly clean—on the paper; then, by a firm, steady pull, draw away the paper whilst retaining the glass in its position. By the withdrawing of the paper, what air or impurities may have been in contact with the amalgam will be swept off, and the amalgam and glass will be brought in close contact. It will be understood that no chemical action takes place between the two substances. They simply adhere by contact, and it is clear that if air or any impurity comes between them an unsilvered spot will be the result. The glass must now be placed under pressure for some hours, and then be tilted on its end to drain off the superfluous mercury. I presume this will be all W. J. H. requires. Should he, however, need the process of chemical silvering, I shall be glad to tell him all I know on the subject through "Shop."—O. B.

Book on Heating.—GREENOCK.—The following books may help you: "Warming and Ventilating," by J. W. Baldwin (Spon), 10s. 6d.; "Warming Buildings," a guide to the American practice of warming buildings by steam (Spon), 2s.; "Hot Water Apparatus," engineer's guide for fixing (Spon), 1s.—F. J. C.

Photo.—NO NAME (*Old Kent Road, London*).—There is no publication of the processes for alpha and self-toned paper, they being secret preparations. With respect to the others, "Abney's Instruction in Photography" will supply the necessary information. T. C. Hepworth's "Photography for Amateurs," 1s., Cassell & Co., is also a good book for beginners.—E. D.

Strings to Piano.—NEWSBOY (*Derby*) wishes to tune his piano and also to put on some new strings. The key he names is known in the trade as a tuning hammer. If he writes to W. Hughes, 37, Drury Lane, London, W.C., he can obtain the tuning hammer and the wire he requires. It would be better for him to cut some short pieces off the old strings and send them, then he would obtain the proper thickness. As to the tuning, there would not be space in this column to explain it, but NEWSBOY can order the "Pianoforte Tuner's Guide" through his local music seller. I think it is published at one shilling.—T. E.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Ink Bottles, Where to Purchase.—INK BOTTLE writes:—"I shall be much obliged if any reader of WORK will give me the name and address of any firm of whom I could purchase ink bottles, the same as one buys at shops filled with ink at one penny each."

Small Metal Wheels, Where to Buy.—METAL WHEELS asks:—"Can any reader inform me where I can obtain, either wholesale or retail, small metal wheels, such as are used for wooden horses, engines, and waggons, that we see at our various toy shops?"

Hammered Iron Work, Lessons in.—HIGHBURY wishes to know of any one or any book that would give lessons in the hammered iron or wrought iron work which you see so much about now, or of any school or institute where he could learn it in the evening.

Patterns for Wheel Guards.—CONSTANT READER asks:—"Will any reader tell me the best and quickest method of getting patterns for tin wheel guards for bevel cog wheels for machinery, and shafts both large and small?"

Fluid Cement for Roller Leather.—T. W. R. (*Royston*) writes:—"I shall be glad if any reader of WORK will give directions how to make a fluid cement which will fasten and hold together what is known as 'roller leather,' and harden as quickly as possible."

Attachment of Seams of Waterproof Garments.—A CONSTANT READER asks:—"Will any correspondent oblige me with a receipt for the material with which the seams of waterproof garments are held together?"

Cork Heel, etc.—J. R. writes:—"I shall be much obliged if NITRAM (*Boscombe*) or any other subscriber to WORK would tell me how to make up a cork heel with leather high and small fitting stuff; how many lifts and split lifts; how many to peg down or sew proper place slope in, and draw out at top piece to fit the last to make the heel level with the sole; also flat and medium height; also the draught of shank irons, men's and women's."

Gas Stove, Sketch for.—S. P. (*West Bromwich*) writes:—"I have a lecture room 30 ft. by 14 ft. which I wish to heat with two gas stoves. Can any reader give me a sketch of a good gas stove that I could make myself, with advice as to what kind of burners are required?"

Band Saws.—S. B. (*Nottingham*) writes:—"I have been much pleased with the instructions I have gained from WORK on circular saws. I should be very much obliged if some reader will give a few instructions on band saws, and the cause of their breaking, as I find they often break after one has sawn through the wood. I should also like some instructions on brazing saws."—[Will A. R. (*Scorrier*) oblige, and will he also kindly send me his full name and address?—ED.]

Zither.—J. C. (*Barnsley*) asks for the title of any book that will give instructions how to make a zither?"

Working Drawing of Tram Car.—J. W. F. (*Lancaster*) writes:—"Will any correspondent kindly tell me where I could write for a working drawing of a London tram car with seats on top and spiral staircases? I would pay a good price for a proper plan."

Horse Power of a Windmill.—SCRUTINEER wishes to know how to calculate this.

Packing Case Making.—STUART (*Edinburgh*) will be thankful for any information as to mode of conducting above business on usual trade terms.

Lacquer for Iron and Steel, etc.—STEEL writes:—"There is a blue lacquer, which is used for iron and steel and cheap tin toys, etc., the preparation of which, or where it is to be had, I should like to learn from some reader."

Dies for Taper Tubes.—T. R. (*Gateshead*) writes:—"I should like to know of what material the dies are made of for drawing taper tubes through."

Scotch Glue.—S. J. H. (*Skipton*) writes:—"I should like to know if there is anything to get to make Scotch glue white, so as it will not leave a dark line in the joints of light wood. I shall be pleased if some of our readers could tell me what it is, and where it could be got, and I will do my best to help any one if anything appears that I can solve for any of our readers. Will you kindly put the question in corner of 'Shop?'"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Insurance of Tools.—G. S. (*Aberdeen*) writes:—"In looking over 'Shop,' in that very good paper WORK, I was rather astonished to see a question put regarding insurance of tools. In Aberdeen here it is not only possible to insure tools, but it is a difficulty to avoid doing it. There is the Northern Assurance Co. here whose agents go through the workshops to try to get the workmen to insure their tools in that company. And in fact there is only one way to get rid of their persistent calls, and that is to say that your society insures your tools. Of course that company may not have a branch in the place where your correspondent's domicile is situated, but I think any insurance company would insure tools if asked to do it. The rate for insuring tools here is 3d. per £1, or 2s. 6d. for £10 per annum. That is in a cabinet maker's or joiner's workshop. Do not think, because I say workmen in shops, that amateurs cannot insure their tools. They can, if they like. The agent just comes and inspects the place where the tools are and its surroundings, and puts the usual queries as to how many are to work there, and number of fires to be used, etc., and if satisfied grants policy. Of course that rate is much higher than that for ordinary house property, but then the risk is much greater on account of the shavings and wood that is always about in a workshop."

Trade Notes and Memoranda.

AT the half-yearly meeting of the Forth Bridge Railway Company held at Edinburgh, Lord Colville, who presided, said that the bridge was approaching completion. The great cantilevers were practically finished, and the central girders were being put into position. The directors hoped to be able to walk over the bridge this month, and if the approach lines were sufficiently advanced, Lord Colville thought that they would be able to use the bridge for goods and mineral traffic early in 1890.

OUR readers may remember the gallant deed of John Smith in May last, who, at imminent risk to his own life, rescued a fellow workman from being roasted alive by a great Siemens steel ingot in the casting pit of the Norfolk Works, Sheffield. The rescued man died afterwards in the infirmary, and John Smith is only now recovering sufficiently to give hope of returning to work. But his bravery has been brought under the notice of the Home Secretary by Commander Smith, and the result is that the hero of Norfolk Works has been granted a second-class Albert medal, which was presented to him by the mayor in the presence of his fellow-workmen. A purse of gold (£20 17s. 9d.) collected by the workmen and £25 added by the firm was also given to the gallant John Smith.

AT present the steel pen trade of Birmingham is flourishing. The weekly average production exceeds 160,000 gross, which consumes from 16 to 18 tons of steel. Of this quantity only about 8 tons appear in the manufactured article, the rest being loss or waste.

THE Swedish export trade in woodwork is steadily increasing, the value of the articles exported last year being £95,000, as against £80,000 in 1887. The chief ports of export are Gothenburg, with £70,000, and Stockholm with £20,000. The largest consumer is Great Britain, with £51,000, being followed by Holland with £10,000, Prussia, £8,000, and France and Belgium with £2,000 each. The export to the Cape was £1,000, and to Australia £700.

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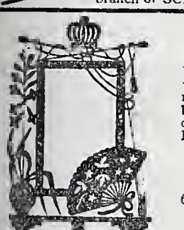

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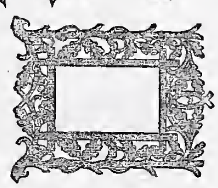

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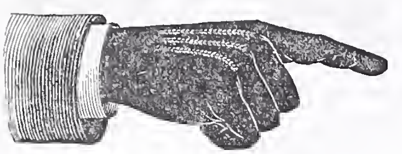

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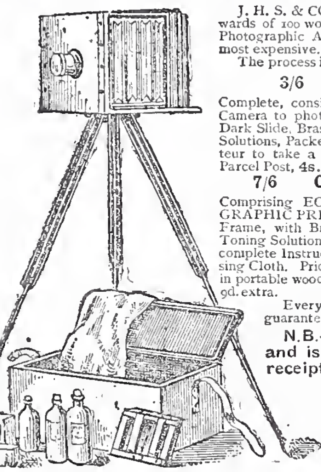

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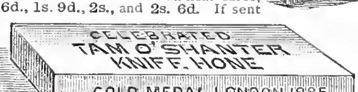

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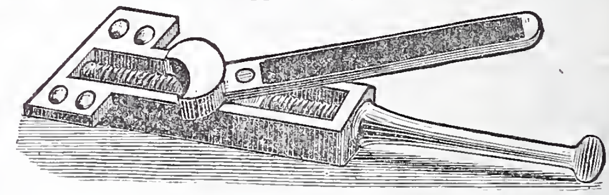

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An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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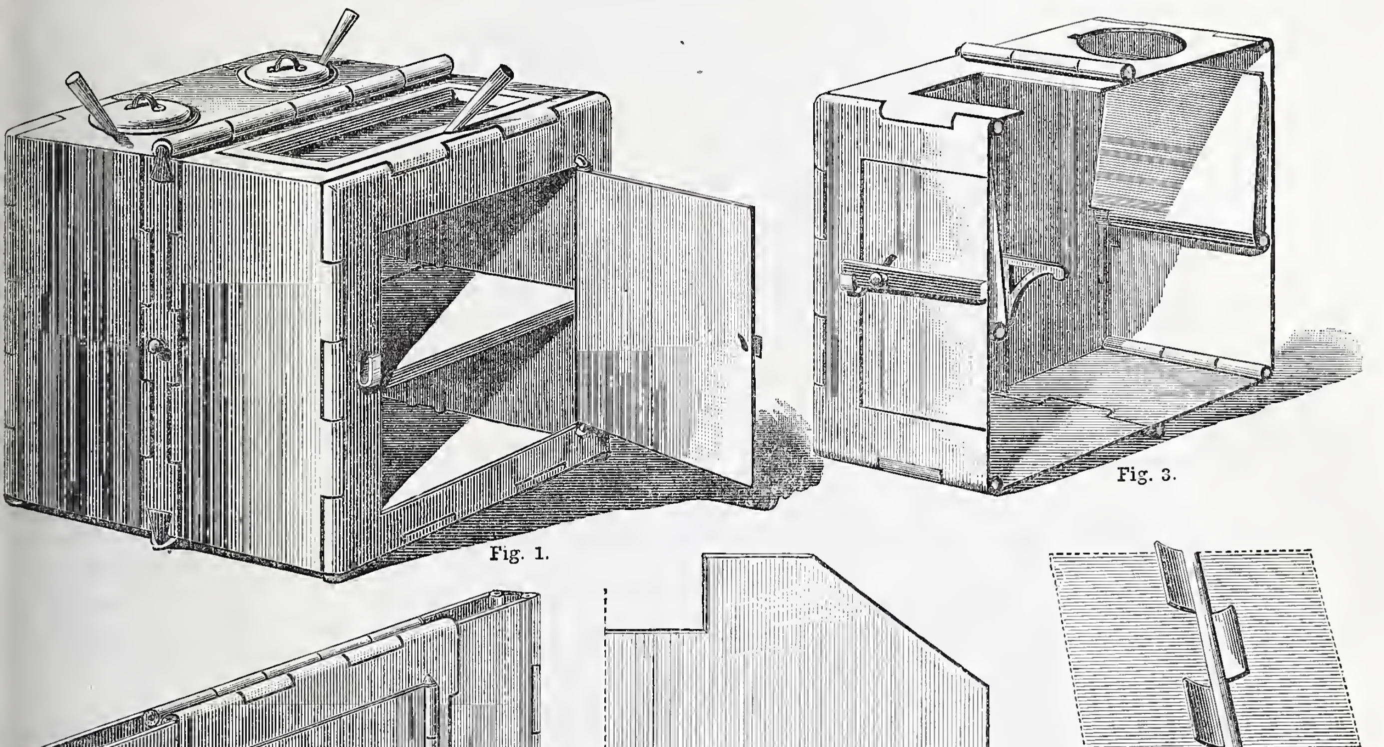


FOLDING COMBINED COOKING STOVE AND OVEN. (*For Description, see next page.*) Fig. 1.—Apparatus shown complete and opened out, ready for use as Oven or Cooking Stove. Fig. 2.—Apparatus shown closed and folded up. Fig. 3.—Apparatus shown cut in half and exhibiting Interior at Back. Fig. 4.—Method of fixing Top and Bottom Centre Rod. Fig. 5.—Diagram showing Corner before being bent and rolled. Fig. 6.—Corner after bending and rolling. Figs. 7 and 8.—Suitable Handles for fitting on Apparatus. Figs. 9 and 10.—Diagrams showing mode of making Saucepan Handles. Fig. 11.—Bracket to support Rod on which Oven Bottom revolves.

A FOLDING COMBINED COOKING STOVE AND OVEN.

BY JAS. SCOTT.

"THE early bird catches the worm." If this is so, it proves that there is not so much good advice contained in the proverb as is generally supposed, for the worm, although an earlier riser than the bird, meets with very great disadvantages from rising so early. But perhaps it may be argued that the "early bird catches the worm" at home, before it—the worm—has started out for its day's business. However, whichever side of the question is right, a great deal may be said both in favour of and against early rising.

My purpose in this article is to lay a few suggestions before the reader, whereby he may profit if he be an early riser. I know several young men who have to start to their work before six o'clock in the morning. One of them is a single lodger, and prepares his own breakfast; the others live with their parents. Now, as it is necessary for them to rise at so early an hour, with the one exception, they have not time to cook their own breakfasts, so that that task devolves upon the mother, who probably retires to rest after she has satisfied her son, and has no need to rise again until two or three hours afterwards. By allowing the mother, or sister, as the case may be, to have her rest comparatively undisturbed, would not encourage idleness, for it may be safely presumed that what is needed to be done will be done.

How nice then for the son when he rises to prepare his own meal without taking up much of his time, and without disturbing the rest of any one else! There are numerous small handy cooking stoves about, and there is no reason whatever to be urged against their use, instead of lighting a coal fire.

I have designed the cooking apparatus here shown so that it can be used as an oven, or for boiling water, and frying any necessaries or luxuries; it can be also compressed, and carried backwards and forwards to work, or stowed away in some corner.

Very little requires to be said about the measurements, the sizes of course being optional. If made 15 in. square, I think that would be a very convenient size. It will be observed that the top and bottom fold together, while the two sides extend outwards. The rods round which the sides are bent should not be very thick, but they must be firm and strong.

Fig. 5 shows how each corner of the back and front should be cut, so that when each piece is bent round the rods they will fit properly, as shown in Fig. 6. Fig. 4 shows the centre rod at the top, the bottom one being similar. They should be a few inches longer than the others, and should be hammered flat at the ends, and bent at right angles; it will then be found that they keep the stove compact. For the benefit of those who do not know, I may as well give a hint for cutting the edges that are to fit round the rods; whatever the diameter of the rods, the pieces which bend round them should be three times the width of the diameter; thus, if the rod is $\frac{1}{4}$ in. thick, the pieces to be cut out at the sides should be $\frac{3}{4}$ in., leaving those pieces projecting (as shown in Figs. 4 and 5) $\frac{3}{4}$ in. wide to bend round them.

I have shown the apparatus as an oven as well for those who may desire it, but I should not like to say I expect it to possess all the merits of the small portable ovens that are now so largely made; but, if well made, I see no reason why it should not answer its purpose satisfactorily. If no oven is required, the stove should not be made quite so high, and the top only should fold in, the two sides and bottom extending outwards.

For the bottom of the oven I have shown two flaps (Fig. 3). Each should be about 9 in. wide, and one should be fixed slightly higher than the other, so as to overlap it. The small iron brackets shown should be soldered on to the inside of the two narrow middle side pieces, while on the outside of these pieces is a small knob, to facilitate opening and folding the entire article.

I should not advise the amateur to try his hand at the saucepans and frying pans. He can buy them already made, and can use his skill by fixing the movable handle I have shown in Figs. 9 and 10. A firm hollow rim should go round the tops of the above named articles, to support them in their positions. Where the handle is to go a piece should be cut out. The handle is an ordinary one, and is fastened into a piece of metal, the end of which has been bent round to the same diameter as the rim. A hole should be made in the rim on either side of the handle, so as to admit a short piece of strong wire to fix the handle in position. Saucepan handles are frequently a source of great inconvenience, and as there is not likely to be much weight brought to bear upon these, I think they will be an advantage.

Fig. 11 shows the shape of the supports to be fixed to the inside of the stove, upon which the flaps composing the oven bottom revolve. Fig. 7 is intended as a handle for carrying the whole affair about; I have not shown it in any of my drawings, but it will be found useful. Pieces are fixed at either side of the stove, one having a slot in it, through which runs the long top piece. A small piece must be cut out of the side of each of the three top openings, to allow the handle admittance; and I believe it will be found that the ventilation through these, when the affair is used as an oven, will be quite sufficient.

I say nothing here about the lamps; that must be left to the reader, as they can be obtained anywhere and everywhere: neither do I speak of the door fastening; the working of it must be apparent to all, and the hinge will be precisely the same in construction as the corners of the stove.

The job should be made in tin, with the oven bottom of iron.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

THE PREPARATION OF SIGNBOARDS AND THEIR GROUND COLOURS.

SOME time since a practical man recommended the use of American cloth or leather as a surface for the sign writer to work upon. I have never given it a trial, but we all know the material, as it is frequently seen on the cottager's table, and also in many kitchens. I have, I should say, used it for temporary purposes many times, such as a bazaar or fancy fair announcement taking place at a public hall, but in such cases the cloth has merely been stretched on to a frame, and the letters have been painted direct on to the black shining surface. This, though, is a simple expedient as a cheap substitute for a proper signboard, and is entirely different from the method employed by my practical friend, which I will now describe.

The face of the signboard should be covered with the best stout American cloth, which is made to adhere, first of all, to the board with bootmaker's paste, viz., glue, flour, and alum. The cloth must be of sufficient dimensions to lap over the edges of the board where it is closely tacked down all round with *tinned* tacks. Do not on any account use iron or blue tacks, as they rust and very soon rot the fabric. The cloth should dry out perfectly taut and free from wrinkles. We next paint the edges of the board where the tacks are with a good round coat of red and white lead mixed as a further preservative, taking care to keep the front of the cloth surface clean. The mouldings, which have already been primed and received one coat of paint, are next tacked on, and the nail holes, joints, etc., well stopped with putty. The back of the board and the beadings, etc., next receive three good coats of paint made up into a slate colour, with black and white and red lead. The cloth itself, being of a shiny and hard non-porous surface, requires but two thin coats of paint, mixed with equal quantities of copal varnish, raw linseed oil, and turpentine. This first coat must be allowed to get perfectly hard, when it is lightly glass-papered with Oakey's No. 0 or No. 1, and it is then ready to receive its second coat. If the sign is to be written on before varnishing, it should be "flatted" in the same colour as used for the first coats, and, after getting thoroughly hard, it is ready for "setting out" the matter thereon. The medium for binding on the flatting should be copal varnish, which must also be used for finishing off the sign.

I do not myself think this method possesses any lasting qualities. It is, nevertheless, a handy dodge for covering up very old and badly cracked name-boards over shop fronts where the tenant does not care to go to the expense of having a new board inserted.

In concluding this subject, I cannot do better than quote the method employed by Mr. William Sutherland of Manchester, one of the best workers, and a recognised authority on all matters relating to sign writing, marbling, and its kindred arts that we have in the provinces. I shal call attention to the literary work of this gentleman at the end of these articles when recommending an advanced textbook on the sign-writer's art.

"A signboard requires to be as smoothly got up as any other description of painted work, and the clearer the polish or lustre and the freer from nits or grit it is, the better the work afterwards put upon it will look. This is especially the case when the letters are gilt. The smoother the surface the brighter and more lustrous will be its burnish. It should, therefore, be pointed out that, although there will be some extra labour required to get up the work properly its appearance when finished will amply repay the trouble bestowed upon it. . . . . The first thing to do will be to kill the knots, but there never should be any in a signboard, it being always a serious defect for no covering in the shape of patent knotting or glue and red lead, etc., will prevent a resinous knot from showing on the surface if exposed to the sun's rays. And the only effectual cure in these cases is to cut out the knot and let in a piece of sound wood in its place. . . . . For priming, use any of the dark reds or browns red oxide, purple brown, etc., mixed with raw oil. The second and third coats should be brown also, but mixed with one-third turps to two-thirds of oil, having a little liquid dryers added to harden it. All the paint used should be carefully strained before being used, and well rubbed down between each coat. If this is not done, we are apt to accumulate on the surface of the board a quantity of coarse particles of colour and skins of paint which are afterwards very difficult to get rid of. . . . . . To finish the board off with a black ground, we first give the sign a bare coat of black oil colour upon the previous three coats of brown. We then grind drop black in turpentine, stiffish, and then add sufficient japanners' gold size or varnish to bind it, and with this carefully coat the sign over. When this is dry and hard, we finish with one or two coats of copal varnish."

In writing a fresh inscription upon an old signboard, it is frequently found to be necessary to clean off all the old material, and otherwise "doctor" it, before it can be made fit for repainting. The old paint must, therefore, be burnt off with the spirit torch, and the board well rubbed down with some sharp new glass-paper until smooth. All holes, cracks, and other imperfections, should next be made good with white lead and putty, and the knots freshly coated with the usual preparation. The board should now be primed with red and white lead, half and half, with the usual quantity of oil and turps. I am always in favour of this priming for all new work, as it has such protecting power and soon dries quite hard, whilst the oxides of iron and the earths have little or any body in them, and are, consequently, unfitted for withstanding and resisting the climatic changes of any country.

A few words of caution here may, perhaps, be the means of preventing a few young hands from making bad work the result of their first efforts :—

1. Always use raw linseed oil for the face of signboards.
2. Always use pure, uncoloured turpentine.
3. Always use the same dryer throughout a job, and do not use one kind in one coat of paint and another in the next or finishing coat: the different chemical actions of the two substances will not agree, and very likely cause the paint to crack, etc.
4. For the same reasons, always use the same quality of varnish and the best procurable : outside copal and outside oak. The best boatbuilders' varnish will be found an excellent preservative when the board is varnished before lettering, as it is made with the special object of resisting water and the sun's action. As it is somewhat dark, I cannot recommend it for varnishing after lettering or on a light-coloured ground.
5. Well strain your paints and pigments.
6. Do not use boiled oil, except for the back of your signboards.
7. Let each coat get thoroughly hard before applying the next—quite hard, and not merely dry.
8. Also, never rub down with glass-paper until quite hard, and be careful not to rub portions of the previous coat "up" or "clean off," or your surface is spoilt.
9. Last and most important : do not have your paint too thick or containing too much oil. Do not let each coat be too round ; it had better be laid on too sparingly than otherwise. Well work each coat about with the brush in every direction, and finish by "laying off" evenly in one direction and with a light hand, leaving no brush marks. This last remark also applies to varnishing. This rule must be attended to in order to prevent the sign from blistering.

Much might here be said as to the general tints and shades of colour which show off the lettering to the best advantage, but as space is limited, a great deal must be left to individual taste and knowledge. For gold lettering, a black groundwork is always the most effective, as the letters show up plainly at whatever angle they may be viewed from ; this is not so with a white or any other light ground. Gold letters also look well on a dark blue or bronze green groundwork. They also show up wonderfully well, when properly shaded, on a ground of Chinese red. This is the colour used on the mail carts, but, as it is particularly liable to fade when exposed to the light and weather, several coats of "flatting" must be applied, and after the gold leaf has been affixed, it must be well protected with two good coats of varnish. A black letter shows up the best on a white ground, but it may not be generally known that a *white letter* on a *black ground* is a great deal more effective than *vice versâ*. At least, this is the opinion of a great many of our best writers, who have frequently pointed it out to the author of these articles. This is more so the case in very small lettering, and on a limited space containing a lot of matter, such as a "Trespassing Notice Board," or auctioneers and land agents' boards, which generally commence with "This valuable plot of freehold land to be sold for building purposes, etc.," and such like examples. Boards of this class, I confidently assert, can be read much easier and at a greater distance—especially by short-sighted people—if the letters are in white on a black ground. Do not, however, use white lead, but oxide of zinc, or, better still, some Charlton white. That is, of course, if the tube colour is not used, which is the rule for common work of this class. If the tube colour is used, resort may be had to flake white, which is the carbonate of white lead oxidised, and which does not consequently discolour so quickly on exposure to the atmosphere.

With reference to other kinds of grounds, there is a species which one frequently sees lettered upon, especially on shop facias, and that is the marbled or grained surface, which exhibits very bad taste indeed when an inscription is written thereon in the ordinary style. It frequently looks as if the grain of the wood or veins in the marble are springing out in all directions from the letters themselves. I have no sympathy whatever with a grained ground, and would strongly urge the employment of a plain colour, which harmonises with the graining colour around it. If a grained ground is used at all, it should imitate a wood totally different to that which is used for the rest of the work, and also contain a small close grain.

In writing on an imitation marble surface, only one class of letter looks really well, and that is the incised letter, or, rather, the imitation thereof. It is a difficult letter, and wants a lot of skilful handling to look effective and real. If the whole of a shop front is marbled, and the name to be inscribed also on a marble surface, the facia or signboard should be worked in a different marble of a somewhat lighter tone, and so as to resemble an inlaid slab which has the appearance of being let into the rest of the structure.

SMITHS' WORK.

BY J. H.

MEDIÆVAL SMITHS' WORK—THE IRON WORK THAT WAS MADE, AND THE MODE AND METHOD OF MAKING IT.

I NOW intend to take a few of those examples of the mediæval smiths' work which remain in existence, and shall endeavour, in a sketchy manner, to discuss the methods of manufacture adopted. Perhaps the term "manufacture" is not well chosen to express the conditions under which the craftsmen of the Middle Ages gave form and permanence to their beautiful creations—their chastened ideals. Let us say, rather, "methods of fabrication, mysteries of craftsmanship, *chefs d'œuvre* of arts and trades."

In this preliminary section on the work of the mediæval smiths, I think it well to divide the subject under several heads, discussing under each head the characteristics of some special kind of work. In this way I shall take hinges, gates, locks and keys, grilles and screens, arms and armour, and, finally, some miscellaneous pieces of workmanship, as lamps, knockers, etc. But before entering on these, I shall best occupy this present article in remarks of a general character on the methods of operation followed by the old smiths in the fabrication of these various articles.

One of the principles of true art is that of adapting the design to the character of the material employed. Thus, massive designs, which are suitable for stone, are not adapted for works in iron ; and designs, on the other hand, which look well in iron, are not suited to the precious metals. Another principle is that of decorating, instead of disguising and concealing, essential portions of construction. We conceal our locks, hinges, nails, and so forth, as far as possible ; the mediæval workmen elaborated and beautified them, and made their work fit for the vision of the gods.

In the elder days of art,
Builders wrought with greatest care
Each minute and unseen part ;
For the gods see everywhere.

And thus the early hinges covered the whole breadth of their doors with beauty. The lock and key were marvels of workmanship intended to be seen and admired, and a smith would sometimes occupy two years in making a lock. The nails and bolts were also often richly ornamented.

The old iron work owes much of its charm to one element of beauty, the reason of which we may yet not be quite conscious of—I mean its extreme lightness. It is this which, as much as graceful curves and delicate tracery, lends so much charm to the screens and the grilles, the hinges and the door-fastenings, the gates and the lamp-brackets. The exceeding lightness both in weight and in appearance of work done in wrought iron is one of its chief recommendations. Nothing in stone, timber, or cast iron can be at once so strong and so light, or be endowed with such graceful outlines.

If we examine samples of iron work from different countries and ages, we shall see much difference in the degree of finish imparted to them. But finish alone is not, however, distinctive of any one period, and some of the earlier works compare favourably in this respect with those of later dates.

As a rule, the bars from which the old work is built up are more or less rough. They show the marks of the hammer, and have a wavy and uneven appearance. It would appear as though the workmen must, in many cases, have themselves hammered their bars to such dimensions as they happened to require for any piece of work on hand. But there are striking exceptions. The best, perhaps, which I have seen is the pair of gates made for Edward IV.'s tomb at Windsor, the reputed work of Quentin Matsys. It is a wonderfully perfect piece of art, and I am at a loss how to account for the smoothness of finish of the surface of the bars. It has been suggested that the heavier portions are of cast iron. It is possible, but very improbable. The art of casting in iron was little understood at the period when these gates were made. I can only think that these are the work of an exceptionally gifted craftsman, and that by the use of a broad flatter, coupled with almost infinite painstaking, the smooth surfaces which are so much admired were imparted to the bars. But certainly the use of flatters by the early smiths appears to have been very much the exception rather than the rule, for few of the main bars upon which the gates are built up, and very little iron work, indeed, of that type, show smooth surfaces.

Another point is that the file seems to have been quite an exceptional tool. Surfaces could have been rendered smooth by a laborious process of filing, but without saying absolutely that this method was not followed, I certainly can detect no traces of its use. There are an immense number of curves whose outlines could have been rendered much more perfect by filing, which were not so rendered. There are many ornamental edges and faces where a file could have been used to much advantage for imparting regularity, symmetry, and finish, where it has certainly never been used; but the work has been, without question, left just as the chisels, punches, or fullering tools left it. Strong evidence that the file was not used is observable in the remarkable freedom from corrosion which these old works manifest, a clear proof, I think, that the work was left untouched after the hammer, the scale of magnetic oxide naturally adherent thereto affording a better protective coating than any paint.

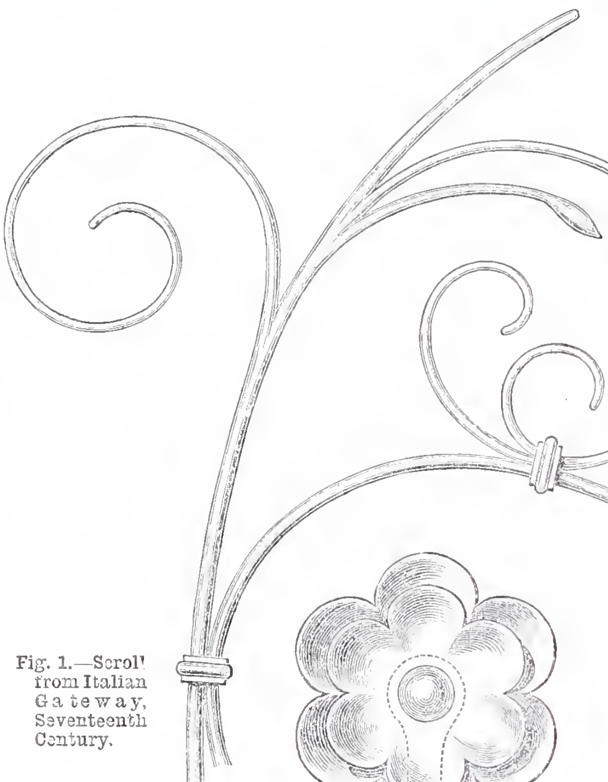


Fig. 1.—Scroll from Italian Gateway, Seventeenth Century.

In the union of parts, riveting and tenoning were the principal devices employed in the craft of the mediæval smiths; the main bars are so united, and so also are the delicate foliage and the flowers. The tenons are mostly used for the heavier bars of the framework, and the rivets for the lighter portions. There is little attempt at concealment of these fastenings. Often where the design lends itself thereto the rivets are made subservient to ornament, their heads being formed into a cupped or semicircular shape.

In large numbers of instances the bars and scroll work are united by means of bands or belts of rectangular, oval, or circular outline. This is a method equally common with riveting, and is used in positions where riveting would not be convenient or possible. Illustrations occur in Fig. 1. The bands are variously secured. In very light works they are often simply bent round without any attempt at welding, or even without their ends quite meeting. In many cases, however, they are so close and fast fitting that they appear to be certainly welded. In the larger work they are riveted in two portions. In numerous instances these are made means of ornamentation, the bands being ribbed as in Fig. 1.

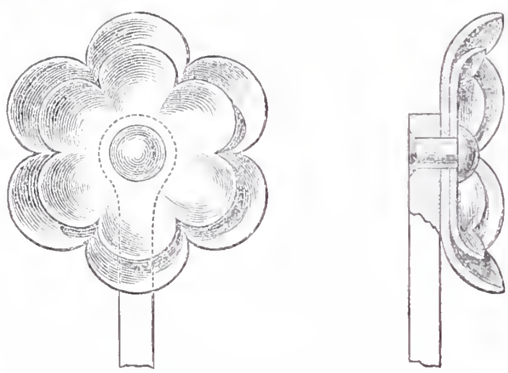


Fig. 2.—Floral Ornament from Italian Gateway, Seventeenth Century.

Another notable feature is that while welding was the exception, swaging down was very common. In large numbers of instances it is quite apparent that a bar of large section has been first taken and bifurcated as many times as there were stems required, and that each of these tongues was then beaten out to required sections, and curved as in Fig. 1, where to all appearance half a dozen separate stems are hammered from a single bar. And expansions made to represent leaves are also often beaten out of the bar. Many stems are of circular section, and it is a difficult task to beat out and curve them also, when, as in many cases, they lie in close contiguity to one another. Even in such work as this, where the inducement to use the file must have been very strong, there is no trace of its employment.

Much of the work of leaves and flowers is convoluted by hammering, the iron being in very many cases not more than $\frac{1}{32}$ in. thick. These leaves are usually riveted on, though also occasionally welded.

The floriated ornament displays much ingenuity, and those who may have ever attempted to hammer, not thin sheet brass, but iron, into floral forms, will appreciate the difficulty of the task. Some specimens of these ornaments are here shown (Figs. 2 and 3). The separate whorls of the corolla, when there are several, are invariably formed of distinct sheets, each cut to outline, and beaten out, and hollowed (see Fig. 2). A torus or base is generally present, and formed by the head of a rivet, which is clenched behind; and this serves to unite the whorls of the corolla to each other, and the whole to the stem as in Fig. 2. Stamens often appear as nails, probably welded in, as they are very firmly set (see Fig. 3). The petals in this illustration appear to have been beaten out of the solid bar. The bar would probably be first divided into five forks, and these beaten into ribbed leaves, which were then bent over.

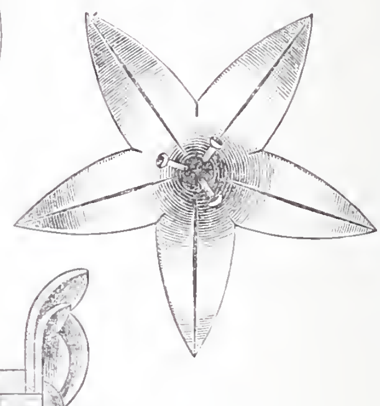


Fig. 3.—Lily, Seventeenth Century.

The beaten foliage is a marked feature of the old work. It conceals many of the unsightly but necessary joints, and much of the plain skeleton of these structures, and the general effect is always pleasing. A candelabrum of hammered iron (Venetian sixteenth century) at South Kensington is thus quite enshrouded with foliage, and this alone catches the casual glance. It is only a close examination that shows the central supporting stem and the scrolls bound thereto, supporting the wealth of foliage. An Italian balustrade (Venetian seventeenth century), also at South Kensington, is entirely formed, save for the top and bottom bars, of cupids and foliage made of hammered iron of about $\frac{1}{32}$ in. thickness, and is made double, the opposed sheets standing out in relief on both sides.

Whatever the method of ornamentation adopted, the secure union of parts is never forgotten. The thin foliage is never without support, usually that of rivets, and the small scrolls and tracery are supported and united at frequent intervals by means of loops or bonds.

The more elaborate scroll work formed from flat bar iron is well worthy of close study. From plain bars of rectangular section the most charming tracery is constructed. Where practicable several convolutions will be formed from one piece of bar, and the smaller the pattern and the closer and more involved the convolutions the greater is the difficulty of bending them enhanced. Little of this could have been done on the anvil—at least, not in the later stages. Much could have been done with tongs and pincers, or with a light hammer, while the work was laid across suitable mandrels held in the vice. And then where much of the tracery is reproduced over and over again, frequent reference to drawings or templets would have been necessary to verify the accuracy of results.

These works are, to all appearance, done by the hammer chiefly. Yet in some of the grilles and gates there is a profusion of panels whose curves are identical in all respects, and in hinges the curved portions which flank the central bar are beautifully symmetrical on each side. Probably, therefore, templets or full-sized drawings would be employed as now, but for the accuracy of the results the workmen must have trusted only to hammer and tongs.

Nor is this all. In the gates and grilles there are mouldings of diverse forms attached to plain bars or frames. We can roll moulded forms between grooved rollers. Not so the old smiths. These mouldings must have been laboriously first chamfered roughly, and then swaged down bit by bit between swages or moulds or dies first carefully prepared. The quantity of material required precludes the likelihood of any other method of formation having been adopted. To these mouldings, and their mode of fabrication, I shall give more detailed notice.

How beautiful were many of these creations! Though the execution of the work is often rude and rough if tested by our modern standard of machine finish and of die-stamping, with their monotonous regularity, yet beauty is interwoven with them all, and the more we study them the greater is the fascination, the more intense the spell of reverence and delight with which we are held in bondage. Though the blacksmith's work is not gaudy, like that of the gold and silver-smith's, or even as that of the brass founder and copper-smith, it still partakes of, and is permeated with, the charm that in some mysterious way is ever associated with the stormy ages when art, science, and learning found an ark of safety within the walls of the cloister, and in the service of the Church.

NEWSPAPER CUTTINGS: HOW TO KEEP THEM.

BY "A COLLECTOR."

Newspapers and magazines contain so many articles of interest to an intelligent workman that it seems a shame that they should in so many cases be consigned to waste and destroyed after being once read. It is true, some of the magazines dealing with subjects of special interest are preserved and bound at the completion of the volume; but I refer more particularly to those odd items of information and practical use which are continually to be found in the daily and weekly newspapers. In as few words as possible I will explain my method of preserving these and arranging them for reference. It is, of course, possible to find other methods which may have advantages in the ease of classifying and finding the cuttings, but, as a rule, they are more cumbrous, and necessitate the use of more drawers or pigeon holes than most of us can command. After an experience of fifteen years, I believe the method I am about to describe will be found to be the most serviceable.

First of all, then, when you read, read with a lead pencil within reach, and mark everything that you want to keep. Don't be afraid of marking, thinking that you can

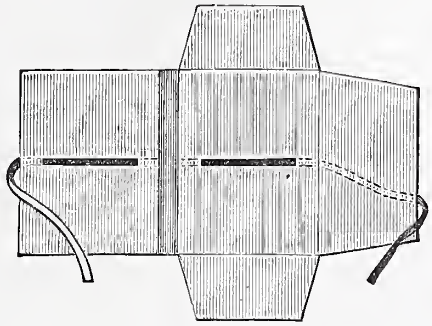


Fig. 1.—Paper Mounted to form Case.

trust to your memory for a certain fact or recipe; when you want it most you will possibly find that your memory is at fault in just some little detail which is of the greatest importance; and remember that it is the man who can lay his hands at once on the information he needs who has the best chance of success nowadays. Mark, then, anything likely to be useful to you. When read put your paper away where it will not be destroyed, and at the week end or first leisure half-hour, take a pair of scissors, light your pipe, and proceed to cut out everything you have marked. Paste these cuttings, either just as they come to hand or,

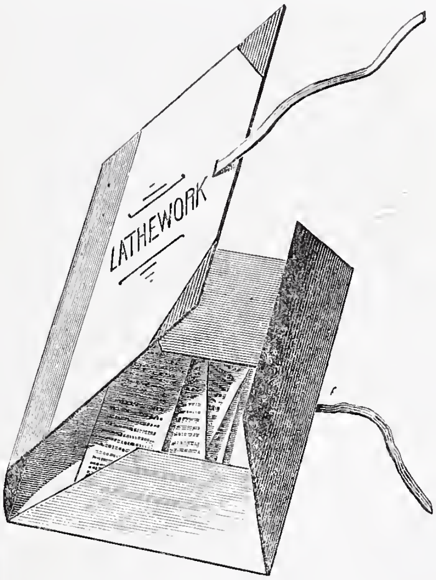


Fig. 2.—Case for Cuttings Complete.

if you have much sense of order, classified as far as you can, into a scrap-book with numbered pages. Those that I use myself are the "Newspaper Cuttings," issued by Messrs. Marcus Ward & Co., and contain two hundred pages each, though smaller ones are to be had. Now then prepare an index in a separate note-book. There is an index in the cutting books named above, but generally it will be found not to have room enough for the requisite entries. Do not skimp your index; make it big enough to last a lifetime, for if you once start it you are not likely to drop it again. Get a good thick note-book, at least an inch thick, and at the top corners of every page place initial letters. It will be found convenient to use the system adopted by accountants in indexing ledgers and other account books; that is, to classify the entries by the first letter and also by the first vowel after the first letter. Thus, "Fretwork" would be indexed on the page devoted to "Fe," "Bridges" under "Bi." Count the pages in your note-book, and then divide them equally amongst the letters of the alphabet, commencing with, say, five pages (or the number found necessary) lettered "Aa;" then following on with Ae, Ai, Ao, and Au. B follows with Ba, Be, etc. This index serves to enter the subjects of all your scraps; and, more than that, any article which you may meet with in your reading should be indexed under its proper heading in such a manner that the book or magazine can be referred to at any future time. The "Newspaper Cutting" books can be referred to as "Sc. I.," or "Sc. II.," signifying Scrap-book I. or II., with the number of the page in smaller figures; while bound books or magazines should have the title and other particulars given more fully. The following examples from my index may make this a little clearer:—

Architecture: Law Court Designs, "Belgravia," Vol. II.; "Builder," end of 1884.
Automata: "Household Words," Vol. IV., 503; "Leisure Hour," 1879.
Foundations: Sc. VIII., 42.
Keyways: Proportions of; Sc. I., 4.

Wherever necessary the item should be indexed under several headings; as, for example, an article on the "Progress of the Manchester Ship Canal," should be referred to under M. S. and C., and *not* under "Progress." I am sorry to say that a valuable weekly journal destroys half the value of its contents by its poverty of indexing, the above item being found only under "Progress," where one would certainly never look for it; while "How to make Glue" is indexed under "How," and never mentioned under "Glue."

The above contains in brief the whole system, and I think I am safe in saying that any one who has tried it for six months will find it of so much use as to be very unwilling to give it up. Sometimes the cuttings relating to one subject will be found to be very long and very numerous. To put these in the scrap-book would be inconvenient for several reasons—they take up too much valuable room, too much time in pasting in, and they get too much separated by other matter coming in between. The plan I use in dealing with these is to make a separate case for each subject, by cutting and folding old mounted drawing paper, as shown in the diagrams. This material I use because it comes most readily to my hands, but if it is not obtainable there will be no difficulty in finding a substitute. The mounted paper is cut to the shape shown in Fig. 1, and folded with the holland side outwards. A piece of red tape, such as is used for bundling papers, is threaded through as shown, and a strip of dark-coloured bookbinder's cloth, glued along the back, serves to keep the tape in position and make the case presentable when put on the bookshelves. With pen and ink print the title on the front cover, as in Fig. 2, and draw the marks across the corners, and the thing is complete. It takes ten minutes to make, does not cost more than twopence at the most, and has quite a respectable appearance.

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

The Case and Interior Mechanism of the Compound Kaleidoscope.

[*For Illustrations to which References are made in this Paper, see pages* 424, 425.]

Having completed the wood turning in connection with the plates forming the ends of the case, the next process is that of cutting out the plates to the correct form: first, square the centre lines across the edges, and continue them on the reverse side; then set out the octagon on the front plate, and having removed some of the surplus wood with a saw, pare off the remainder to the lines, keeping the edge as square as possible. The two plates, with the insides facing each other, must now be attached together by a couple of screws passing through on a line perpendicular to M N (Fig. 2), and $3\frac{1}{4}$ in. from the centre, so as not to disfigure the wood where exposed to view. When fixing, be mindful to notice that the centre lines correspond, and also, that the opening in the front plate is concentric with the circle of the same diameter scribed on the back plate, which may now be pared round the edges to match the front, and a $\frac{1}{4}$-in. hole bored squarely through the two plates corresponding to the centre of the milled head, E (Fig. 1); this hole requires slotting in the front plate, but may be deferred till the spindle has been prepared.

The plates can now be taken asunder, and a start made on the metal work. Turning to O (Fig. 2), a brass plate is shown, having a hole in the centre, in which the pinion turns, to which the milled head, C, is attached, and on each side of the central hole a slot is cut in which slide the ends of two steel rods supporting the arms, K, K (Fig. 5). These slotted plates are cut from sheet brass $\frac{1}{8}$ in. thick, $6\frac{1}{2}$ in. long, and $1\frac{1}{8}$ in. wide; notice if they are winding, or bent; if so, lay them on a level surface, and remove the twist with a few skilful blows of a smooth-faced hammer. Drill and countersink the holes for the screws, which may be $\frac{1}{4}$ or $\frac{3}{8}$ in. long, and attach them side by side to the true face of a piece of hard wood. Holding them thus in the vice, file the surface quite level, heat a soldering iron, and tin the ends of each piece; now lay them face to face, bind them together with a piece of fine iron wire, and using sprits of salts for a flux, sweat them together with a heavy piece of red-hot iron. When cold, level both sides, and one edge as straight and square as possible, then the other parallel to it. Scribe a centre line on one face, and dot the central hole with a fine pointed centre-punch; on each side of this dot set off $\frac{13}{16}$ in. with the compasses; dot these marks for holes denoting the inner ends of the slots, and a second pair of dots 6 in. apart for the outer ends, after which the slots may be spaced out for drilling a series of holes $\frac{3}{16}$ in. apart; the drill used for the purpose should be about $\frac{1}{32}$ in. less in diameter than the width of the finished slot. A twist drill mounted in the lathe will be found the most suitable tool for the work, the plates being fed on the drill by means of a piece of hard wood having a deep hole previously bored in the lathe to fit tightly over the centre of the sliding headstock. The dots will probably require to be deepened to prevent the drill from wandering. A line may now be gauged on each side of the row of holes, the distance between not to exceed the diameter of the steel rods. By a careful use of a fine rat-tail file, the holes may be run into each other; then a stout ward file for roughing, and using a dead smooth for the finishing touches. Drill the central hole $\frac{1}{8}$ in. diameter, and leave it to be finished with a reamer. On applying heat, the two plates will separate, and they may now be secured in their places immediately over the centre line, I J (Fig. 2). It is now necessary to prepare the milled heads, B and D (Fig. 5), which act as lock-nuts on the screws cut on the heads, A and C. Of course, the easiest method would be to hold them by means of a self-centring chuck, but failing this, they may be held for turning by driving them tightly into a recess bored in a piece of hard wood which has been mounted on a face plate. If a good fit is secured, it will be found unnecessary to sink them beyond half their depth. Having trued up one side, bore a $\frac{5}{16}$-in. hole in the centre for screwing with the $\frac{3}{8}$-in. brass gas tap. To make sure that it is truly tapped it will be well to enter the taper tap a little way before removing from the chuck, feeding up the back centre as the tap moves inwards, the screwing to be finished in the vice. Each head having been treated in this way, they must be mounted on a suitable mandrel of brass or iron, and the turning completed, finishing the edges by grooving and milling. The heads, A and C, require much the same treatment as the foregoing. They are mounted first with the shanks projecting; should they exhibit a tendency to become loose in the chuck, they may be further secured with three wood screws, evenly disposed round the edge of the recess, or the back centre may be pressed into the service to assist in steadying the shank while it is being manipulated. A hole $\frac{3}{32}$ in. diameter is next drilled and tapered as shown with a suitable reamer. Should the latter not be to hand, procure a piece of $\frac{1}{4}$-in. cast steel about 4 in. long, anneal it by heating to a dull red, and place it in slaked lime to cool. File about $\frac{3}{4}$ in. at one end, square in section, so that it may be turned with a small wrench or brace, then reduce the point to the necessary taper, making it circular in section to begin with, and afterwards pentagonal, which is not so difficult to accomplish as it seems at first sight. Now make it red-hot and plunge into cold water, polish, and hold it over a thick piece of hot iron until the cutting portion becomes of a deep straw colour; cool this portion and still further lower the head to a blue tint, otherwise it will be apt to snap off in use. It now remains to mount the finished head, B, firm and deep in a piece of hard wood as before, and use it as a support on which to finish the outsides and edges of the heads, A and C, after which, rather than resort to force, it will be well to split up the wood in which the former is embedded.

The next in order is the stationary pinion; first, square up the ends of the brass tube to finish $7\frac{1}{8}$ in. long; it is possible to do this with a file, but a superior way is to turn them, fitting a short piece of iron into the end to support the tube lest it collapse under the screw of the carrier, which latter should be small, and may be easily made out of a piece of brass plate $\frac{1}{4}$ in. thick, having a screw $\frac{1}{8}$ in. diameter. The tube is then trued up at one end, and the opposite end next the carrier separated with a thin parting tool. Should the tube prove too short to admit the carrier as above, use thicker iron, with a shoulder to abut against the end of the tube. Now cut off 5 in. of pinion wire, centre it truly at both ends, and turn about an inch at one end, to fit tightly within the brass tube; set off $\frac{3}{8}$ in. from the shoulder, and beyond this turn a bearing large enough in diameter to allow of the central hole in the slotted plate for which it is intended being broached out to fit it. Leaving fully $\frac{1}{8}$ in. for the bearing beyond this, cut a notch with the edge of a small half round file and break it asunder; centre afresh, and turn the remaining portion to fit the opposite end of the tube for about $1\frac{1}{2}$ in.; then $\frac{3}{8}$ in. set off as before, and from this point it is turned parallel for $\frac{1}{2}$ in., after which the remainder is tapered to fit the milled head, C. If the worker is an adept with the file, the leaves of the pinion wire may be so reduced as to leave very little to be done in the lathe, and thus avoid the jarring of the work as the tool meets each leaf or tooth in succession; in any case, it will be advisable to make a somewhat liberal use of the file, always provided that the process is not carried too far. The pinion to which the head, A, is attached is similar to that just described, and slides in vertical slots cut in two brass plates $2\frac{3}{8}$ in. long and $1\frac{1}{8}$ in. wide; the upper ends are cut to the angle of the case to which they are secured by four screws each. The outline of one half is shown in elevation by the dotted line at P (Fig. 2), and they are also shown in section just behind the racks in Fig. 5. The slots must be polished so that the pinion works freely and smoothly within them, and the plates carefully attached to the woodwork, the centre of the slots coincident with the centre line, M N; of course, the wood must be pierced squarely through to admit the tapering ends of the pinions, and for the parallel necks or journals of these latter, four washers must be prepared; all are circular in section, with the exception of that under the clamping head, B (Fig. 5). The washer in question is an oblong plate curved at the top and square at the bottom end, in order to utilise it as a vernier to indicate the angle of the reflectors; it is kept vertical by a long slot, which slides on a pin formed of a small screw, the head being filed off flush after being screwed home. The plate adjacent to the slide may also be attached at this juncture, the figures being deferred for the present, as their correct position can only be determined by experiment when the instrument is complete.

Having proceeded thus far, we may now turn our attention to the spindle connected to the friction wheel, H (Figs. 2 and 5). There are two methods whereby this may be accomplished: the first which suggests itself is to bore a hole in a hard piece of beech $\frac{5}{8}$ in. thick, so that a No. 18 wood-screw will fit tightly within it; wind the screw, which should be about 4 in. long, to the end of the thread, and cut off the point $\frac{1}{8}$ in. outside the wood; unwind the screw, and weld or braze it to a piece of $\frac{5}{16}$-in. round iron, cut off to $9\frac{1}{2}$ in. from the screw-thread; straighten and centre accurately, then replace the wood disc and finish to $1\frac{3}{4}$ in. diameter by $\frac{1}{2}$ in. thick, a very shallow groove being turned on the edge to support a band of red rubber, as sold by stationers to secure note books. Inserting a small screw in the rim of the disc, we may use it for a carrier to reduce the opposite end of the spindle to fit the milled head, E

(Fig. 1), which has been prepared with a tapering hole for its reception. Perhaps an easier way to mount the spindle would be to reduce the plain part of the wood-screw so as to fit a piece of $\frac{5}{16}$-in. brass tube, 9 in. long, and also reducing the long boss or shank of the milled head to fit the opposite end, securing them in position by sweating together, or drilling a small hole for a pin; though sweating is to be used in preference. By using the brass tube for the spindle, we shall gain an advantage in its being shorter, and thus lessen the distance that the head projects outwards from the case. Selecting a piece of brass $\frac{1}{8}$ in. thick, we may now cut out the lever, L (Fig. 2), as shown in the dotted line; it is attached by a screw at its lower end, which acts as a fulcrum. The central hole is broached out to fit the spindle, which has a groove cut $\frac{1}{8}$ in. wide at this point, the lever acting as a key to prevent end-shake, and at the upper end of the lever is a small stud, round which is hooked one end of a tension spring, the opposite end of which is secured by a screw, and the slotted plate, P, cut away to clear it.

Arrived at this stage, it is now necessary to commence on the rackwork. First attacking the fixed pair, R R (Fig. 5), very little difficulty is likely to be experienced in making them a success. Two pieces of rackwork $2\frac{1}{4}$ in. long are cut off, and at each end the teeth are removed, so as to leave a clear space of $\frac{3}{8}$ in.; in the centre of this space a hole is drilled and countersunk for small screws, by which the racks are secured to pieces of oak or beech, shaped as at O (Fig. 2); these are rabbeted to fit over the slotted plates, and it will be noticed that one is $\frac{1}{8}$ in. thicker than the other, and is also cut away in addition to admit of vertical travel in the washer, which resists the pull of the clamping head, B. Passing on to the sliding racks, S, S (Fig. 5), we require for these two lengths of dry beech, 12 in. long, accurately planed true and parallel to $\frac{3}{8}$ in. square. Previous to being divided into 6 in. lengths, mark one face and one edge, and place some distinguishing mark so that they may be kept in pairs, one pair to each end. As only $4\frac{1}{2}$ in. are useful, I must explain that the extra length is to lessen the danger of the wood splitting on account of having to drive screws in close proximity to the end of the piece. The two remaining lengths of rackwork are equally divided, and a space cleared and drilled at each end as before, after which each rack is screwed to a wood slide in the centre of its length and flush with the face. As in the case of the fixed rack above, provision must be made for the washer, and in order to support the rack, and keep it square with the pinion, a slip of wood about $\frac{1}{8}$ in. thick is screwed to the back of the slide, as shown in section Fig. 5; when these are in position, they should slide just clear of the edge of the slotted plate. Now, it will be seen that the lower slide of the two at each end is supported on a piece of hard wood, T, T, $2\frac{1}{2}$ in. long, 1 in. wide, and the combined thickness of the slide and slotted plate in one instance, with the washer added in the other. The exact position of these supports may be found by placing the end of the case on the bench, inside uppermost, and holding the pinion vertically in its bearing; push the lower rack into position, interposing a slip of writing paper, so that the teeth may not engage too deeply, the support being finally secured with a screw at $\frac{1}{2}$ in. from each end, thus clearing the brass clips, *l l* (Fig. 5), which grasp the backs of the upper slides. These clips are of brass $\frac{1}{3}$ in. thick, filed to the outline seen in the dotted line (Fig. 2), allowing $\frac{1}{2}$ in. beyond for bending. If the brass from which they are to be made betrays a disposition to crack on bending to a sharp angle, it must be annealed by making red hot, and plunging into cold water. The hole is first drilled to clear the pinion, then the latter is placed upright, the paper slips intervening between the racks and pinion teeth, and a line scribed on the inside of the brass clip, which must next be bent at a right angle, over the edge of a piece of smooth $\frac{1}{2}$-in. square iron, bent on itself, in order to grasp the brass on both sides when held in the vice. This done, with a smooth file polish the inside of each clip, rounding off the arris or edge so far as it comes in contact with the wood slides. When all this has been carefully carried out, it will be found that the racks will travel smoothly in either direction on turning the pinion with a small carrier or pin vice. Should this not have the desired effect, one or both the racks is too deeply in gear with the pinion, if they are not pinched at the sides. Taking them asunder for examination, it will perhaps be discovered that the cause lies in their not being of an even thickness from the tips of the teeth to the back, which will be exemplified by a careful use of the calipers; the remedy will be to file a little off the wood, preserving the same square edge, but on no account must the teeth be interfered with. If the calipers reveal no discrepancy in the depth, it may be necessary to remove the brass clip and file the surface adjacent to the slides, only be mindful that a very little clearance will give the necessary freedom to the movement. The rackwork is now complete, with the exception of four brass lugs or hinges $\frac{1}{8}$ in. thick, as seen at *k* (Fig. 1), having holes drilled and broached if necessary to fit the steel rods which pass through the arms of the reflectors. To be certain that this hole is exactly central over the slot in which the rod moves, it will be advisable to bring the racks to the end of the stroke, as in Fig. 2, while the holes for the screws are being marked through the countersunk holes in the hinges. In this way it will be immediately noticed if the pinion is out of wind with the rod on each side of it. The surplus wood at the ends of the slides may now be cut away, the lower slides being bevelled as at S (Fig. 1), to clear the sides of the case, the construction of which will be taken up in the next article.

DESIGN FOR A LARGE BRACKET IN FRETWORK.

BY E. BONNEY STEYNE.

Fret-craft is an art so simple, that the rules for its perfect working might be taught in five minutes and set forth in a few paragraphs. Yet the point where it gains value from careful and precise workmanship is not to be reached by one or two trials only. If, however, the amateur worker intends to become a past master of the craft, the motto of the old Romans—*Festina lente*—which is generally translated "hasten slowly," should be his, for undue dilatoriness or overhaste will alike fail to compass his end. Like to a moth fretting against a garment, he will indeed leave traces behind him, not only of spoilt material, but also of useless toil. If the saw is not tight and taut at each reinsertion—if it be not held in a perfectly vertical position—the best result cannot be achieved. Yet, if the design is only wrought with elaborate mechanical exactitude, there is danger of a stiff cast-iron pattern being produced. In all hand-wrought work, the charm consists in the feeling unwittingly imparted by the worker. A machine will make you ten thousand repeats of the same detail with microscopic correctness, but if an artist has to draw a pattern with frequent repetitions, though he be never so careful, he will, if indeed he be an artist, all unknowingly produce slight variations in each.

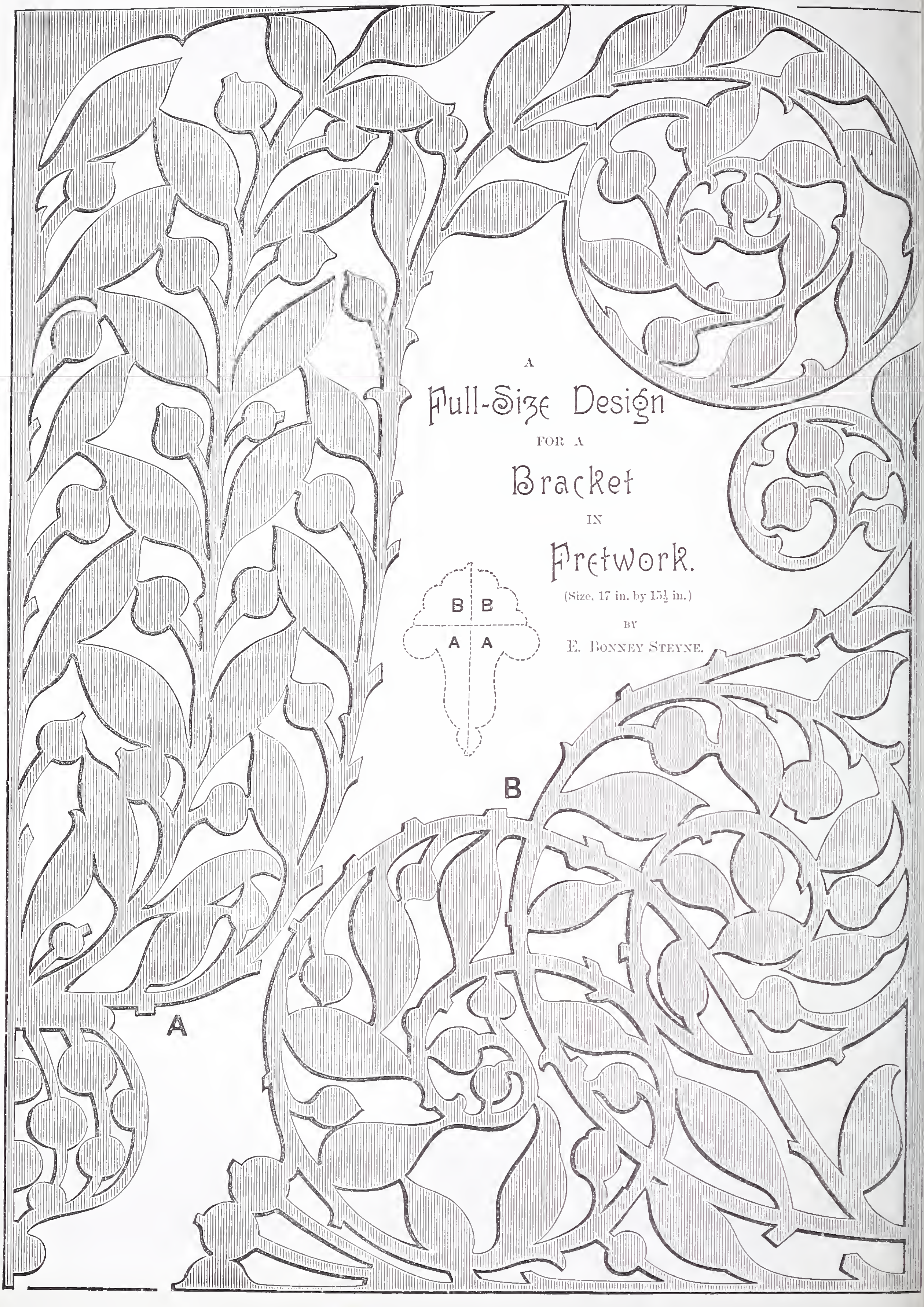
The leaves of a tree, like as they are to each other, are yet not exact replicas of one shape, even in the simplest formed species. But it is waste of words to try to teach what must be instinctive. Though you argue until doomsday, you shall never convince one who has not already felt it of the subtle quality we call "art." Be sure, that if you fail to recognise the difference between things held to be worthy, and the commonplace wares of to-day, that the joy or sorrow of the artist is not yours. If you see nothing in the marvellous drapery of the Fates (in the marble remains of the frieze of the Parthenon in the British Museum) more than in the drapery also of marble that clothes the weeping figures who are fondling urns in the Euston Road stoneyards, then it would be waste of time to try to instil it. To be able to explain wherein and why they differ is quite another thing, that comes only by education and study, but the feeling must be there ere you can in any way cultivate it.

If you take rough carvings by peasant lads, home-made attempts at decoration by artisans, in some you trace the untrained artist, in others merely the mechanic, who assuredly may rival a machine in his finish, but who will never surpass it in the higher qualities.

A sombre sermon this, you say, on a fretwork bracket. Diluted philosophy expended on a trivial piece of ornamental work, lacking merit in design, and exacting little skill in execution. True, I grant you; but the preacher may be aware of the good, although his infirmities forbid him to achieve it. And if the desire to be inspired with the true and sincere love of beauty for its own sake should begin with a thing that has no claim whatever to such a royal description, it will have served a noble end. If in poor work you put your whole heart into making each curve better than your design, letting every leaf or bud mimic the true lines of nature, which, in the desire to keep the whole simple, is impossible in catering for an unknown army of possible workers, then the artist who drew it on paper will be only too delighted to find himself beaten, and be glad to have provoked the energy that caused the initial effort.

The design, for the necessity of the pages of Work, has been planned to give a large pattern in the limit of a page. In tracing leave half an inch of plain wood between the four parts. Trace and reverse for the second tracing of each part. The bracket to support the shelf can be either a simple one or the whole of design A. The shelf may be shaped to any convenient form. It is best kept square with rounded corners. This yields more room for objects to be carried, and is better than a simple half circle.

The size of the bracket when finished and put together is 17 in. by $15\frac{1}{2}$ in. There is no necessity to say anything about material, as when it is possible to do so the material should be suited to the furniture of the room and the surroundings. The design itself will be found in the next page.


A
Full-Size Design
FOR A
Bracket
IN
Fretwork.
(Size, 17 in. by 15½ in.)
BY
E. Bonney Steyne.
B B
A A
B
A

BURGLAR ALARUMS.

BY GEORGE EDWINSON BONNEY.

THE WILY BURGLAR—UNGUARDED POINTS OF THE DEFENCE—BURGLAR TRAPS—LEADBETTER'S BURGLAR ALARM—FLOOR OR DOOR-MAT CONTACT—AMATEUR FLOOR CONTACT ALARM—CLOSED CIRCUIT ALARM SYSTEM—ALARUMS FOR EMPTY HOUSES—CONCLUSION.

The Wily Burglar.—Professional burglars do not always set about their nefarious work in the same way, nor enter the house according to the rules of any concerted system. An open window or open door may generally be relied upon as offering an unresistable temptation to the thief, but he prefers an open cellar grating, a fan-light left unfastened, or scullery window left ajar, to any of these apparent traps. The old bird is not caught with chaff, nor the ticket-of-leave man twice in the same way. As he gets older in his career, he becomes more crafty, and teaches the younger members of his profession the mysteries of his craft. I can quite conceive of such a wily thief studying electricity and making himself well acquainted with electric burglar alarms with a view to turning his acquisitions of knowledge to his own ends. Such a wily thief would examine all windows and doors in search of indications pointing to the presence of alarm contacts, and even invent means for throwing these out of action and so prevent them from giving the alarm.

Unguarded Points of the Defence.—We should therefore endeavour to so plan our system of defence as to leave no points unguarded. Partially opened fanlights may be left in this state if protected with Legge's Window Blind Contact. Scullery windows should always be fitted with a suitable contact, and even the trap-door leading to the roof should not be left unguarded. The cellar-flap or grating may be adequately protected with one of Dale's Burglar Traps fastened to the same with a piece of stout string. Should the thief break the fastenings of the flap noiselessly and attempt to open it, the string of the trap will not fail to ring the bell; and should he discover the string and cut it, he will by so doing release the spring of the trap and cause it to make contact.

Burglar Traps.—These, and the others to be described, are therefore veritable burglar traps, likely to foil the most cunningly devised schemes of the wily burglar, and drive him to despair. Dale's Burglar Trap (shown at Fig. 60) is so named by me because of its cleverly devised double action. This trap is made up (as shown in the figure) of a small brass casting $3\frac{1}{2}$ in. by $\frac{5}{8}$ in. by $\frac{1}{8}$ in., with two pieces bent down in the middle at right angles to form a clasp for the hinged lever below. An ebonite block is attached to each end of the base plate, and to these blocks are fixed brass contact pieces insulated from the base plate. The small brass rocking lever hinged to the base plate is also furnished with platinum points where the ends touch the contact plates. It will be seen that a piece of bent clock spring, D, forms a spring between the base plate and one end of the rocking lever, to keep this from being in contact with the plate at A. This little appliance may be attached by screws to the floor, a post, or any piece of wood at a little distance from the point to be protected. The wire from the binding screw, C, must then be connected to one line wire, and the two wires from A and B to the other line wire of the alarum system. This being done, the bell will ring and continue ringing until the

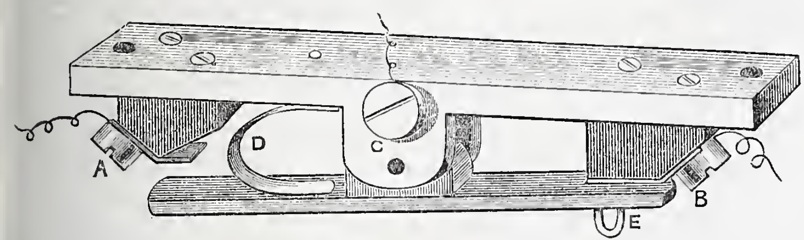


Fig. 60. — Dale's Burglar Trap.

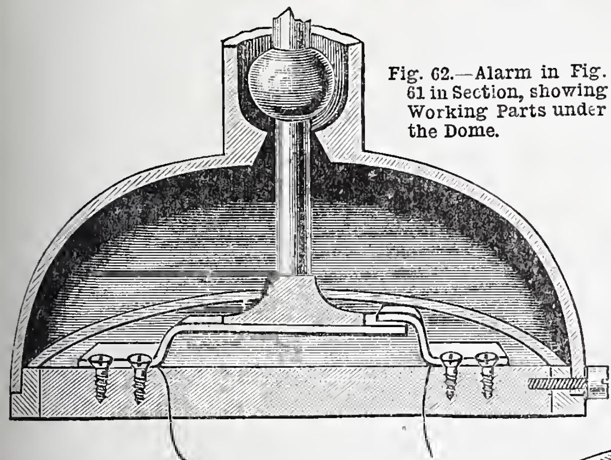


Fig. 62.—Alarm in Fig. 61 in Section, showing Working Parts under the Dome.

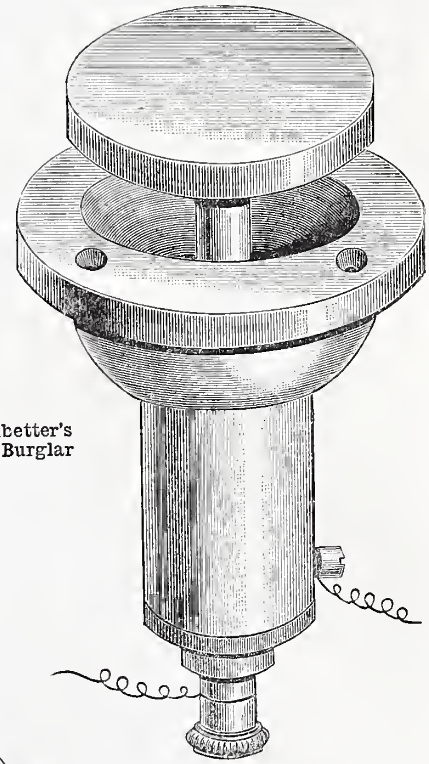


Fig. 63.—Floor or Door-Mat Contact.

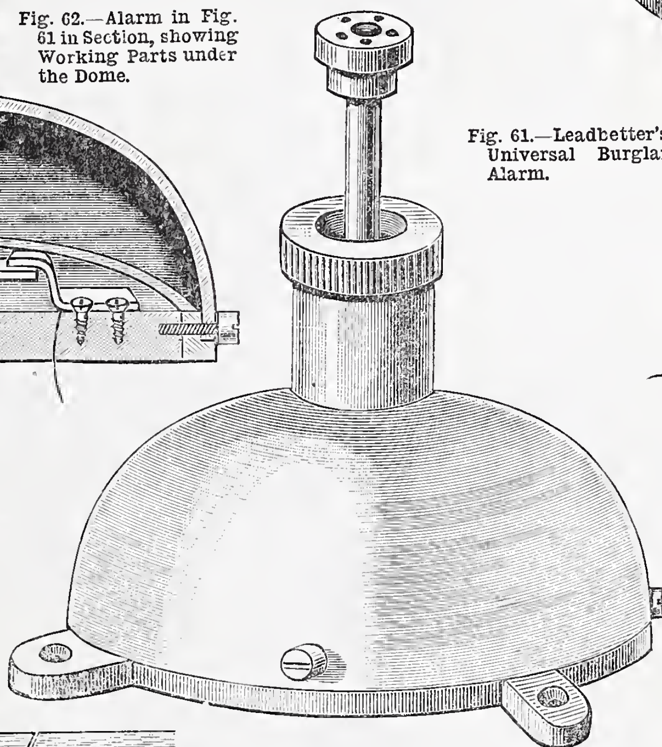


Fig. 61.—Leadbetter's Universal Burglar Alarm.

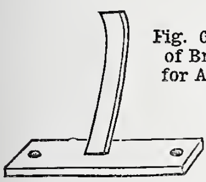


Fig. 65. — Form of Brass Spring for Alarm.

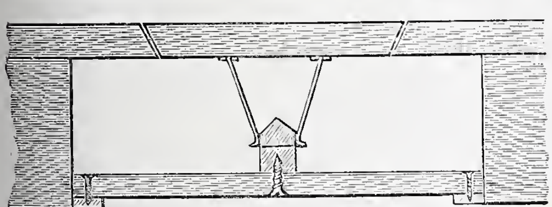


Fig. 66.—Amateur Floor Contact Alarm: Section.

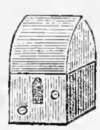


Fig. 67.—Contact Block for Floor Contact Alarm.

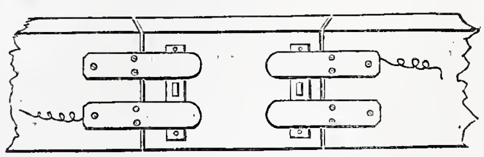


Fig. 64.—Amateur Floor Contact Alarm: Plan of Underside.

rocking lever has been pulled away from B sufficient to keep both ends free from touching either A or B. A piece of stout string is then fastened to the loop, E, and tied to the door-flap, grating, drawer, or whatever we wish to protect. It may be tied to the leg of the table, or of a chair, or to the knob of a drawer, or of a door. Should the article to which it is tied be moved away from the appliance, the lever will be brought into contact with A and start the bell ringing; but should the wily thief discover and cut the string, the lever will be forced by the spring, D, into contact with B, and thus ring the bell. Should he fail to discover the string, he may possibly stumble against it and thus bring both ends alternately in contact. Similar traps are made in cylindrical form for insertion in posts and sills. In these forms a small brass piston working in an ebonite cylinder is kept in contact with the brass casing at one end by means of a spiral spring, until pulled out, when a cross piece makes contact at the other end. These are named "double contacts."

Leadbetter's Burglar Alarm.—This ingenious burglar trap, invented by Major Leadbetter, is shown at Fig. 61, and its internal arrangement at Fig. 62. The external appearance is that of a 3-in. electric bell gong, furnished with a pillar on the top, out of which protrudes a small piston of brass. On taking this instrument in hand we find that the gong is fastened to a brass ring enclosing a disc of ebonite, which forms a base for the gong. The ring is held to the sides of the gong by three small steel set screws, and, on unscrewing these, the dome comes off and reveals the interior arrangement shown in section at Fig. 62. This is most simple. Two small strips of spring brass are fixed to the ebonite base by small screws and bent to form a bridge, coming into contact with each other at the free ends. To the longer and lower strip is soldered (in the middle of the bridge) a small disc of brass raised in the centre to form a cone, the summit of which is hollowed out a little to receive the rounded end of the brass rod or piston. Two short pieces of insulated wire connected to these bits of brass and carried out through holes in the ebonite base, serve to connect them with the alarum system ouside. It will be seen that the pillar on the top of the gong is hollowed out to form a socket, and this fits a ball through which the piston passes. The screwed cap of the pillar is hollowed beneath to form a cup fitting the top of this ball. When, therefore, the end of the rod or piston is inserted in the top of the cone on the contact bridge and the cap of the pillar is screwed down, its hollow cup presses on the ball and causes the rod to press apart the contact pieces below. The alarum is now fixed ready for action. By means of projecting pieces on the ring of the base, it may be fastened by screws to the floor of a room, to a block of wood in a garden, or to a table, or any other wooden support. Pieces of twine or strong worsted are then fastened to the top of the piston (in the holes shown in the cap) and led in any direction from the contact to doors or windows, or to stakes driven in the ground, to which the ends must be attached. If the prowling thief opens a door attached to one of these strings, or if his feet is caught in one of them, the top of the projecting rod is pulled on one side and its foot slips out of the socket on to the contact bridge; these strips at once come into contact, and the bell is set ringing. The contact pieces can be set easily at any time by unscrewing the cap of the pillar and adjusting the rod, and this can be set to almost any degree of stiffness by more or less pressure from the screwed cap on the ball of the piston. These little instruments are sold by Messrs. T. Gent and Co, Faraday Works, Braunstone Gate, Liecester, at 10s. 6d. each. They are said to be most invaluable as detectors of garden thieves, as the strings leading from them can be readily laid among grass and foliage, and so escape observation.

Floor or Door-Mat Contact.—At Fig. 63 is shown the usual form of floor or door-mat contact. The brass barrel of this appliance is furnished with an extra stout spiral spring surrounding the stem of the flat top plunger shown in the sketch. This keeps the plunger in the position shown until pressed down with the foot, when the bottom of the stem comes into contact with an insulated stud fixed in an ebonite disc screwed into the bottom of the barrel. To fix this appliance, a hole to fit the barrel must be drilled with a brace bit in the floor, under the mat; the top part of this is countersunk to receive the lower part of the cap, and then the flanges of the cap let in flush with the surface of the floor. The wires are laid along beneath the floor, and brought up through the hole cut to receive the contact barrel; the ends are connected to the screws shown in the sketch. When placed under a mat in the doorway this appliance serves to announce the arrival of a visitor, and it is also used under the carpet of a dining-room table to enable the host or hostess to summon a servant by pressing the contact with the foot.

The Amateur Floor Contact Alarm.—At Figs. 64, 65, 66, and 67, I give detailed illustrations showing how an amateur may construct for himself an effective floor contact alarm. To do this he must rip up one or two or more floor boards under the doorway, or at any other part of the floor where the alarm is to be fixed. One floor board will be enough, but the area of contact will be enlarged if two or more boards are formed into a kind of trap-door, and then laid down again, for in this case it will be almost impossible for any one to miss treading on the trap. I take, however, one board as being sufficient to work upon for the purpose of elucidating the construction of this alarm. Having taken up the board, mark off an oblong piece on it, just between two joists, at a spot where a person is likely to tread when entering the open door. Cut this piece out of the board, as shown at Fig 66, and thus form a little trap-door with bevelled edges. To the undersides of the remaining pieces of floor board, fasten, by means of short screws, four pieces of thin spring steel or spring brass in the position shown at Fig. 64. When the contact arrangement beneath the floor has been completed, these pieces of board will be nailed down in their places and the springs will support the trap-door as shown in sketch.

Two contact springs will be required for the underside of the trap. The form of these is shown at Fig. 65. Their proportionate dimensions are shown in plan at Fig. 64, and in section at Fig. 66. I purposely omit sizes because these must be obtained by actual measurement on the spot. The springs themselves should be made out of stout spring brass at least $\frac{1}{2}$ in. in width, and the curved ends should have a bit of platinum foil soldered to them where they are likely to come into contact with the contact block beneath the floor. The base plate to which they are riveted must be long enough to span the space between the steel springs supporting the trap, and the springs long enough to reach the contact block as shown in Fig. 66. The contact block is to be made out of a piece of boxwood or of ebonite to the shape shown at Fig. 67, and should measure when finished: height 2 in., width $1\frac{1}{2}$ in., thickness 1 in. The lower part of the block, beneath the tapering part, must be coated with thin sheet brass, with a bit of platinum foil soldered just where the tips of the springs are likely to come into contact with the brass when the trap is pressed down. This block must be fastened to a strip of $\frac{1}{2}$ in. deal secured to the joists and supported as shown at Fig. 66. The floor boards may now be nailed down, and the wires from the alarum system connected to the steel springs as shown at Fig. 64. When the trap is put in its place it should be kept by the tips of these springs at least $\frac{1}{4}$ in. above the level of the floor if intended to be under a mat or carpet. The tips of the contact springs should also be resting on the taper wood part of the contact block. If all has been made aright, the trap will sink when trod upon and the current from the battery will pass by way of the steel springs to the brass springs and the circuit be completed through the metal coat of the contact block.

This form of floor contact possesses the advantage of being easy to construct and keep in order. All the contact points are what are known as "rubbing contacts," and therefore not likely to get rusty or coated with dust. Should any of the parts require attention, the trap can be easily removed and the parts repaired.

The Closed Circuit Alarm System.—To more effectually foil the nefarious schemes of the electrically educated thief, a system of electric alarums has been invented, which depends upon the action of an electro-magnetic relay always connected with a constant battery. This relay keeps the local circuits of the alarum bells open whilst its own circuit remains closed, but should the crafty thief discover the wires and cut them, the circuit of the relay is at once broken, and it then throws into action the local battery connected with the alarum bell. The battery used in this system is a form of the Daniell known as the sulphate gravity battery. In this form, a lead cylinder perforated with small holes at the bottom, and filled with sulphate of copper crystals, forms the negative element in a glass or porcelain cell. In the same cell, suspended near the top from a wooden cover, a massive ring of zinc forms the positive element. The cell is first charged with dilute sulphuric acid, then a saturated solution of copper sulphate is carefully poured into the lead cylinder so as to float the dilute sulphuric acid on its surface. The superior specific gravity of the copper sulphate solution keeps it at the bottom of the cell below the dilute sulphuric acid, unless the cell is shaken or the solutions agitated. This battery keeps in good working order whilst constantly in action, hence its use for this purpose.

If this system is adopted throughout a house all the contacts must have a reversed action; that is to say, they must be made to keep the circuit closed whilst all the doors and windows are closed, but to break the circuit when any of these are opened. No attempt should be made to conceal the ires and connections as it will be an dvantage should they be discovered and ut.

Alarums for Empty Houses.—When well-o-do householders flit to the seaside or to he moor for their summer holidays they annot always leave their houses in the care f servants or care-takers. They therefore ock up the premises and depart in some ear and trepidation lest the house should be roken into during their absence. Messrs. '. Gent & Co. have made arrangements or supplying a specially constructed loud-oned gong to be fixed on the outside of a ouse and connected with the alarum system nside. Notice should be given to the olice that a house is thus protected whilst s owners are away, when they will hold hemselves ready to pounce on the thief s soon as the bell gives notice to them f his intrusion. Of course it will be nderstood that the bell is not placed in a rominent position to be easily seen by the ntending burglar, but it will be best heard f placed high up on the house.

In this series of papers I have not pre-ended to give an account of all the little ontrivances made and sold as burglar larm contacts. Either of the firms men-ioned by me will have much pleasure in upplying any special forms to meet special ircumstances, and to advise on the fixing f the same. I will also endeavour to do vhat I can through the medium of "Shop" to ssist with my advice any reader who may vish to make or repair his burglar alarums. The subject of fire alarms and other auto-natic alarm systems will be dealt with in uture papers.

OUR GUIDE TO GOOD THINGS.

. *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

101.—Moore's Patent Folding Chairs.

A REALLY easy chair is a piece of furniture much o be desired in every house, especially a chair hat is made in such a manner that the inclina-ion of the back to the seat may be varied at leasure from an almost erect position to one hat is very nearly parallel to the floor without ifficulty or much exertion on the part of the perator, and which, when the relative positions f back and seat have been thus altered, is so onstructed as to retain the form which is de-ired and required without shifting either when ouched or sat upon, as is the case with not a ew folding chairs that are said to be secure and table. The best chairs of this kind—best be-ause they satisfy all the conditions that one aturally looks for in an easy chair whose back nay be raised or lowered at pleasure, namely, tability, ease, and comfort—are, as far as my xperience goes, to be found in the Patent Fold-ng Chairs manufactured by Mr. J. T. Moore, of Macclesfield, and sold by any upholsterer in the United Kingdom, or, if not in stock, can be pro-ured from the manufacturer for any customer t short notice. The principle on which these hairs are made varies in some cases, but that vhich governs the construction of most of them vill be understood from an inspection of Fig. 1, rom which it will be seen that the front legs or upports of the chair and the sides of the framing f the back are combined in two large strips f wood that run in one and the same length from the top of the back to the floor, and that the hinder supports are attached to these by bright brass grips, whose hold on the long bars can be released or tightened at pleasure, and which move up and down the back, and thus raise or lower the seat to any inclination desired.

These Patent Folding Chairs are distinguished by different names according to size, form, or fittings. Thus in Fig. 1 an illustration is given

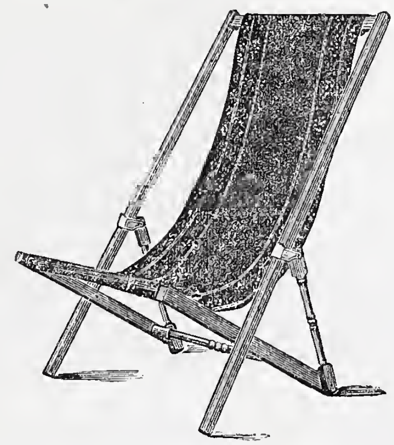


Fig. 1.—The "Waverley" Patent Folding Chair.

of the "Waverley," a luxurious and comfortable hammock chair or lounge chair, nicely upholstered with a strip of carpeting that forms both seat and back, and yields to every movement of the body, to which it affords a strong but most comfortable support. The ends of the framing are firmly planted on the ground, and contain within the straight lines drawn, or that may be drawn, from one to the other, a sufficient area to impart perfect stability to the seat. This chair is said to be one of the best chairs made for use on a lawn or ship's deck, and it can be used when opened out only eighteen inches from front to back, thus rendering it of great utility in cases where room is a consideration. The "Trafalgar" is like the "Waverley" in form and construction, but the frame is more strongly made, and thus perhaps it is more suitable for gentlemen's use as a lounge, hammock, or deck

Fig. 2.—The "Hygienic" Patent Folding Chair.

chair, while the "Waverley" meets the less exacting requirements of the ladies in every particular. The "Pliant," another chair of this class, is placed on rockers, and so are the "Gem" and "Little Gem," most useful chairs, very portable, and suitable in every respect for drawing-rooms, sitting-rooms, and bedrooms, as well as for outdoor purposes. The last-named chairs differ from the "Waverley," "Trafalgar," and "Pliant" in having the inclination of the back regulated by means of a rack on the underside of the seat bars, in connection with the spindle on which the seat bars rest. The "Hygienic," illustrated in Fig. 2, is like the "Pliant," but has a rack at the seat bars and a regulator fastened to the back instead of the grips. When made with arms it is a good nursery chair, and a child may be put to sleep in it. It is specially recommended for invalids, because the peculiar wave-like motion induced by it when in use relieves constipation. "Its action," says the inventor, "is perfect massage without the toilsome labour, and, as prevention is better than cure, the daily use of its gentle, undulatory motion will greatly assist the liver and bowels in securing that vigorous health which is of so much value to every one. A great advantage of this chair is that it combines a perfect rocking chair with a perfect lounge, the restfulness being such that it has many times been used as a bed. THE EDITOR.

MASONRY CLASSES AT SOUTH KENSINGTON.

THE Editor of WORK has much pleasure in saying that he has received the following letter from the Secretary and Members of the Committee for the formation of these classes, dated 17, Shepherd's Place, Upper Kennington Lane, S.E.:—

"DEAR SIR,

"We earnestly request your favourable consideration of the enclosed syllabus of masonry class to be held at South Kensington under the direction of Lawrence Harvey, Esq., F.R.I.B.A., etc., and should you believe the lessons therein are calculated to give a sound knowledge of masonry and construction, and prove a scientific basis of training for masons desirous of rising to the positions of foremen or clerks of works, we respectfully solicit your help to bring these lessons within their reach.

"The Council of the City and Guilds of London Institute either cannot or will not reduce the high fee demanded of $2\frac{1}{2}$ guineas, therefore we the undersigned have formed ourselves into a Committee to receive subscriptions from friends who consider our cause a good one, and tending to raise the general tone and character of a large body of workmen.

"We propose reducing the fee to 25s. each for all bonâ-fide masons, and even this amount, with the addition of railway fare and other expenses, forms a large sum for masons to pay, and it is to their credit that many are now anxiously awaiting the result of this our effort in their behalf."

In giving publicity to it, the Editor has only to add that a letter to the Secretary at the address given above will at once procure for the applicant a syllabus of the classes and a prospectus of the "College of Masons."

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

PRIZE COMPETITION DESIGNS.

IN reply to correspondents who have written pointing out that engravings of these designs did not appear in No. 30 of WORK as announced, the Editor takes the opportunity of explaining that it was considered to be more useful to readers to give working drawings of them instead of small sketches, as was originally contemplated, and that they will shortly appear in turn with descriptive matter explaining mode of construction, etc. etc.

I.—LETTERS FROM CORRESPONDENTS.

"Muntin," and Suggestions to our Writers. —W. B. (*Liverpool*) writes:—"I observe some correspondence in 'Shop,' No. 27 (see page 428), regarding the derivation of the word 'muntin.' I find it given in Ogilvie's Imperial Dictionary as follows:—'Munt (Scotch), to mount. Muntin, or munting, the central vertical piece that divides the panels of a door.' It is evidently a corruption of the word 'mounting.' May I offer a suggestion as to articles in WORK? There is a tendency in some writers to shorten their descriptions, and to offer supplementary instructions through 'Shop,' if required. The effect is to leave the instructions a little vague, and so much is taken for granted that it is sometimes difficult for an unskilled hand to follow them. That is not satisfactory, and though the deficiencies may be made up in 'Shop,' it is only when some one asks for the details. Besides, you will no doubt have correspondents all over the world, to whom the columns of 'Shop' cannot be of much service in that way. The delays are too great. I regard Work as so valuable that I should be sorry to see its usefulness impaired for want of a little extra trouble on the part of the authors. Many of your readers are no doubt, like myself, very amateurish, and require full and complete details of construction from beginning to end, but observe it has only to be done once. Having given such instructions for, say, a bookcase, camera, etc., in all future designs of similar character, readers could be referred to those instructions for details. Do not think I complain of Work—it is the best value for its price that I have seen for a long time. I do not like to mention names, but Mr. Adamson's instructions about the bureau are the kind that I and many others require. I cannot follow the articles on the camera, kaleidoscope, sideboard, etc., so easily."

Tin Ovals, etc.—A. N. (*Airdrie, N.B.*) writes:—"Being a reader of your paper, Work, I may say I am well pleased with it, also the remarks in 'Shop,' which is a first-class feature in it, and which I find very interesting. I may say I am in the metal stamping line, and am pleased with B. M. Ramsden's paper. I also noticed the fanners in 'Shop,' of which I have made a few before seeing same. The only difference in mine is I have spindle running on centres as underneath, which causes less friction, and can be altered in case of blades rubbing on side, having gam nut on the screws. I may say I have made a fern case and aquarium combined, and seeing inquiries for same, I hope to see papers on it. But, Mr. Editor, would you be as kind as to ask some reader for a description of machine or oval rollers for making oval tin bodies with locked seam, such as mustard and tobacco tins, or makers of same, or put me in correspondence with one who knows? I may say I would give something to have a fast method for forming oval bodies. I hope you will be as kind as to put this inquiry before your readers."

Machines for Current of Air.—Fitter (*Walsall*) writes:—"I have noticed a sketch or two of machines for producing a constant current of air, and I should be glad of the dimensions for making same."

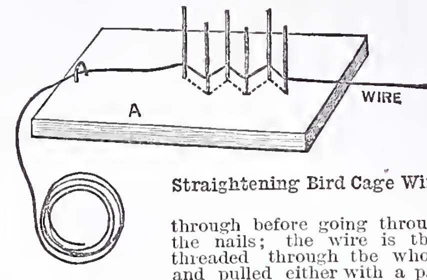
Chamfer Plane.—Apprentice Lad (*Leicester*) writes:—"In No. 20, on page 316, J. W. (*Burton-on-Trent*) writes that he has made a chamfer plane from working drawings published in the *Carpenter and Builder*. I should be very much obliged to him if he would kindly give me the drawing in 'Shop,' so as to make one myself. I think others would like to make such a useful tool too. I am very pleased with Work."

Blacking Gladstone Bags.—R. A. P. (*South Kensington*) writes:—"Seeing in your issue of 24th August (page 365), a paragraph entitled 'Gladstone Bags,' recommending Berlin Black for renovating same, I endeavoured to get some, but found that it is seldom kept in stock by shopkeepers, though it could be got to order, but not less than a gallon. I therefore got some of Harris' Black Leather Varnish, sold by Harris & Son, 33, Beech Street, Barbican, E.C., and found it answer admirably, drying quickly, and it is quite elastic and pliable. Twopennyworth is sufficient for a large bag."

A Hint to Fretsawyers.—C. E. (*Streatham Hill*) writes:—"It may be worth knowing that half a dozen or more exact copies with once tracing can be taken of a design without spoiling the original by placing underneath sufficient sheets of Japanese paper and carbonic paper, and tracing with the end of a needle stuck into a wooden holder. For instance, if six copies should be required, six sheets of the Japanese and three sheets of the carbonic paper would be required, as the latter is prepared on both sides. The paper, being so extremely thin, can easily be removed from the cut work with a damp sponge, provided it has been stuck on with thin paste. Being also transparent, the reverse of a design can be got by simply turning it over. I may mention that Messrs. Isaac Pitman & Sons, of shorthand fame, Amen Corner, supplied me with small quantities of the above."

Wheels, etc., for Mail Cart.—W. P. writes:—"Readers of Work who reside in the North of England and are desirous of building a mail cart can buy their wheels and other requirements of James Henry, 95, Port Street, Piccadilly, Manchester, who supplies wood wheels at 4s. per pair, rubber wheels at 5s. per pair, and other things equally cheap; Alfred Parker, 60 and 62, Great Ancoats Street, Manchester, who supplies rubber tire wheels with axle at 5s. 6d. per pair; and Owen's Toy Bazaar, 84, Ancoats Street, Manchester, where rubber tire wheels may be bought at 5s. 6d. per pair, and spider wheels (without rubber tires), springs, and axle at 7s. the lot. Readers residing at a distance, and unable to get these things in their own locality, should write before making a remittance, giving the height of wheels required and inquiring price."

Straightening Bird Cage Wire.—A. E. D. (*Birmingham*) writes:—"In No. 27 of Work (see page 429) are a few remarks *re* straightening wire, but all have not the use of a set of tinman's rolls, so I take the liberty of sending sketch of a simple method which will straighten any kind of wire, either hard or soft, which I hope will be useful to readers of Work. In the illustration A is a strong piece of wood into which strong nails or pieces of thick wire are driven, not straight but zigzag as shown. A staple is also driven for wire to pass



Straightening Bird Cage Wire.

through before going through the nails; the wire is then threaded through the whole, and pulled either with a pair of pliers or by being bent round a piece of wood or the like; if the wire curls either way the nails are to be hit sideways alternately; the last two or three will suffice. A little practice will soon show how the curl can be broken. And now, in conclusion, allow me to thank you for publishing so useful a periodical as Work. I have taken it from the commencement, and am both instructed and delighted. Long may it flourish is my wish."

Simple Bead Router.—J. M. (*Louth, Linc.*) writes:—"Noticing, as I have in looking through the columns of Work, the many valuable tips and receipts they contain, also about the tools of other trades, which of course I myself am not well acquainted with, it made me think, as I had received some benefit from Work, I could supply

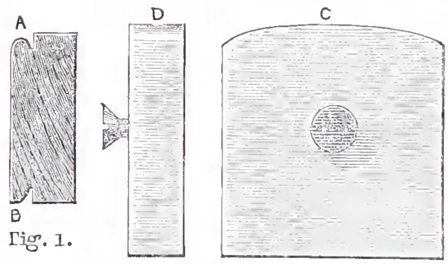
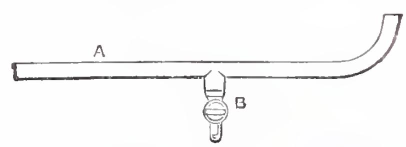


Fig. 1.—Examples of Beading. Fig. 2.—Bead Router in Plan (C) and End View (D).

some of our amateur friends, as well as practical friends, with a design for a very simple and yet very useful and cheap tool, which they all could make themselves. It is a tool (of course I call it a tool, though, perhaps, some would not call it so) for making beads on the edge of doors, or any other article that requires a bead on an edge. I enclose sample of beading, also the tool itself. You will notice one bead is finished with just the edge taken off with a smoothing plane (as at A in Fig. 1), and the other at B, just cut with the screw head, and not finished with smoothing plane. The tool itself is shown in plan (C) and section (D) in Fig. 2."

Noises in Waterpipes.—E. G. B. (*Rochester*) asks:—"Can you tell me the cause of waterpipes humming, and a loud lapping noise occurring when water is drawn? How can I remedy the above defect?"—To this query I may reply:—The noise referred to by E. G. B. is caused by turning the draw-off cock suddenly when there is a high pressure of water. The simplest remedy is to have a screw down cock, or have the pipe lengthened thus:—



Noises in Waterpipes—A, Pipe; B, Draw-off Cock.

Microscope Making, Etc.—G. E. G. (*Bradford*) writes:—"The instructions given by O. B. in No. 22 of Work describe the brasswork part most minutely, but nothing much is said about the most important thing (viz., the optical part), excepting a little about the eye piece, which was of great interest to me. He says there is nothing that an ingenious worker cannot do except the few castings in brass. How would the instructions read if applied to the metal work of a clock, and nothing said about the number of teeth, or the diameter of wheels and their mode of action? I consider it just as vague. The metal work to me now is child's play, but the optical part I don't know much about. I should esteem it a great favour if as good a description of the lenses could be given. I don't mean the making of them, but as to their focal positions, diameters, etc. I, when a boy of fifteen, read an article in *Design and Work* respecting the making of a microscope; the instructions given were mostly about the diameters, positions, and focus of the lenses. I procured the proper lenses mentioned from London, and made the thing according to instructions, but was disheartened on the completion, as the definition of the objects was very bad. I then had the opportunity of examining a professionally made one, and found my lenses to be absurd in diameter and as regard to their positions. Now I wish to point out that such descriptions get young lads and amateurs to spend their time and money, until they come to such a disappointment as I did in my first attempt, when the whole thing is given up in disgust. Perhaps I am too rash in not waiting to see if the subject is to be continued or not. However, here are two or three more things that would put the damper on a boy who commenced to make (1) machine for current of air, No. 19, p. 302. It certainly has a slight look of a fan—perhaps a little resemblance to a Capel Mine fan—but driven in the wrong direction the vanes curved the wrong way, and no inlet for the air shown. (2) An easily-made fret machine, No. 21, p. 332. The most vital part not shown, how i the motion given to the saw frame by a cam—eccentric or what; and bow on earth would the connecting rod pass the axle, fixed in the way it is shown? (3) Soldering in repairs of sheet meta utensils, No. 23, p. 354. Now everybody would no know, in attempting such soldering, that the leas particle of zinc left on his iron or solder would giv no end of trouble in attempting to mend a kettle o especially a soft metal teapot; a good solder fo Britannia metal or pewter contains bismuth t make it more easily fused, so as not to endanger th article. This trouble I had to find out at th expense of spoiling a good teapot. I now kee a piece of solder to itself that I use for zinc only as good solder gets contaminated when soldering galvanised metal. I am also very careful to file o all the old facing from the iron after using it fo zinc. (4) Lock repairing and key fitting, No. 21 first page. Our friend says the chisels for chipping out the keys cost about 6d. Most amateurs i attempting chipping metal with such small chisel would soon send their sixpences flying. I had t find out that using a chipping chisel requires good deal of skill. A boy reading that subject, an seeing how simple it appears to be to cut keys would speculate a shilling or two on the tools, an in the end be disgusted at his chisels breaking. admire such a remark as regards buying a chea vice, as I once bought one; the thread stripped i a very short time. I trust you will see what I an aiming at, not exactly being sarcastic, but simpl pointing out that a little more detail and cautio might be put in the subjects to make them mor easily understood by the younger folk, as really m (1) and (2) would make a practical man stud before he could understand what the drawing were meant to illustrate. I think if such drawing were submitted to more practical men before bein cut less time and money would be wasted. I an not reflecting discredit on the whole of the subject as I consider most of them splendidly described. am now nearly thirty, and have always take a paper of this sort since being thirteen years old *Design and Work*, or *English Mechanic*, an now Work, which I consider by far the best fo amateurs. I am speaking for beginners, as yo will see what difficulties I have met by attemptin these things which appear easy to make or d In my opinion every lad should have a hobby an be encouraged, as a very little thing makes hi give it up if everything does not go right, and the he will perhaps turn for the worse. My fathe encouraged me by buying a small cheap lathe for Christmas-box when very young, and used to hel me out of many a difficulty. I now possess facsimile screw-cutting amateur lathe that too the only medal for lathes at an exhibition held i my town. My hobby now is a good help on m weekly salary."—[Your letter contains just th kind of criticism that is desired and courted, an the recommendations given will no doubt b accepted, remembered, and acted upon by those t whom they refer. You must remember, howeve that many a skilled hand, writing on a subjec with which he is perfectly familiar, will omi reference to some necessary point, because i happens to be so well known to himself that h imagines it is equally well known to all for whor he is writing. I endeavour, however, to impress o every writer the desirability and necessity fo being minute in detail, so that those who ar ignorant of processes, etc., under description o discussion may be helped to as perfect a compre hension of them as possible. Whenever a voluntee writer describes and illustrates in "Shop" any thing that is not actually feasible, it is desired tha either queries should be put to elicit better informa tion on any points which may not be intelligible, o a description supplied which clears up anythin that may not be perfectly plain.—Ed.]

II.—Questions Answered by Editor and Staff

Papers on House Painting, etc.—J. H. Y (*Sunderland*).—Articles on house painting and de corating were commenced in Nos. 27 and 29 of Work and these are furnished by one who is both skilled hand at the work and a competent writer Receipts for making varnishes, greases, cements patent driers, etc., will appear in "Means, Modes and Methods" when sent in by correspondents wh have tried and tested them; but I regret to say tha up to this time I have had but very few contri butions to this portion of the Magazine. I canno comply with your request to facilitate an inter change of receipts between readers of Work. Sen me any that you may have by you, and they shal ppear in due course; and, if you set the ball rolling, ithout doubt others will follow your good example.

Shells.—VULCAN (*Greenwich*).—The firm can aim the application of the punches and dies to the irpose without limiting themselves as to size. If ou use similar punches and dies for the same purpose, you infringe the patent, and an injunction to estrain you from so doing can be obtained, even though your punches and dies are of different zes from those used by the patentees.—F. C.

Revolving Stereoscope, etc.—T. G. (*Hatton-Hole*).—I darcsay some correspondent who underands the construction of this instrument will send paper on it, in which case it shall appear for your enefit. With reference to house painting, see bove reply to J. H. Y. (*Sunderland*). A folding ench for amateur woodworkers will appear very hortly, and will be followed by another on the iode of making a good stout and serviceable work ench with convenient fittings.

Book on Sign Writing.—W. F. M. (*Commercial Road, E.*).—The book on "Sign Writing" referred o has been out of print for years.—H. L. B.

Printer's Roller.—J. P. S. A. (*Penryn*).—Without knowing the size of the roller, or the materials f which it is made, it is impossible to give direcions how to renew it. Printer's rollers are generally omposed of glue and treacle, one pound of the ormer to a gallon of the latter. About one-third of he old material could be mixed with the new. The casting is accomplished by pouring the composition into a mould, the wooden or metal stock occupying the centre. As, however, the casting of a roller is a difficult task to any one who has not done it before, we would recommend your having t renewed by a practical maker.—J. F. W.

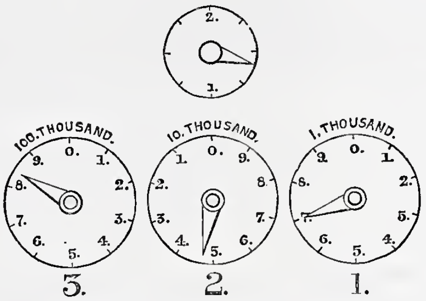
Accumulators.—JAMES (*Peterboro'*).—(1) Start charging the cells with current of a low E.M.F., and raise its tension as the cells get charged. Continue the charging current for thirty hours, or ten hours a day for three days. When, at the end of this time, gas is seen to come off in bubbles from the plates and the liquid appears milky, the charge is complete, and each cell should then have an E.M.F. of from 2·2 to 2·5 volts. Always discharge the cells through a high resistance, and let this be greatest at first if you wish the plates to work well. Always fully charge the cells before commencing a discharge, and do not continue the discharge when the E.M.F. falls below 2 volts. (2) Brown plates are positive plates, and grey plates are negatives. You must have both. (3) Unpasted plates require occasional reversing charges, but this is a delicate task, and should be conducted with great care. The reversing current must be very small at the start, and be gradually increased until the cells are fully charged. A rapid charge or discharge is always liable to scale the plates. See Sir David Solomon's book on the "Management of Accumulators."—G. E. B.

Medical Coil.—H. D. (*Heaton Norris*).—The necessary description and illustrations for a medical coil would take up too much space in "Shop." I may tell you, however, that the primary wire must be wound on by itself, and the secondary wire wound over the primary wire in the same direction. The two should not be connected together. In constructing one with different powers, each power has its own secondary wire. An article or two on coils will be given when space can be spared for them.—G. E. B.

Carriage Varnish.—J. R. (*Glasgow*).—I do not think any one ever makes his own varnish nowadays. For many reasons it would be a very risky experiment, and amateur's varnish would be almost certain to spoil a carriage, etc. As I do not know your requirements I can only advise you to obtain the best carriage varnish from any good oilman at about 16s. per gallon. If, however, I were compelled to make it myself, I should try the following recipe, as the source from which I take it—Spon's Recipes—is most reliable:—"Best pale carriage varnish: 8 lbs of 2nd African copal; 2½ gallons of clarified oil; boil till very stringy; ¼ lb. of dried copperas; ¼ lb. of litharge; 5½ gallons of turpentine, strained; 8 lbs. of 2nd sorted gum anime; 2½ gallons of clarified oil; ¼ lb. dried sugar of lead; ¼ lb. litharge; 5½ gallons of turpentine; mix with the first while hot." This is, of course, for a large quantity, but the various ingredients might be reduced proportionately for small quantities.—OPIFEX.

Solution for Developing Negatives.—AMATEUR (*Oldham*).—To make a concentrated developer dissolve:—No. 1. 4 oz. sulphite of soda; 30 grains of citric acid; 9 oz. hot water; when cold add 1 oz. pyrogallic acid. Call this solution No. 1. No. 2. 2 oz. carbonate of soda pure; 10 oz. water. Call this No. 2. For use take 30 drops of No. 1, add 2 oz. of water, and just before development add 1 oz. of No. 2. This makes a capital developer for most makes of plates. Ordinary clean washing soda will answer in case of difficulty in getting the pure article. You had better try Ilford ordinary plates, and be very careful to use no more light than absolutely necessary for development, especially at the beginning of the process. Both solutions will keep indefinitely before mixing together.—E. D.

How to read the Index of a Gas Meter.—H. N. (*Chelsea*).—The four circles represent the indices of an ordinary dry gas meter. The indicator, or band of circle marked 1, has to travel once right round to register 1,000 feet, once right round circle 2 to register 10,000, and once right round circle 3 to register 100,000 feet. That is to say, that the hand of circle 1 must have travelled once right round before that of circle 2 is on the 1, which will show that 1,000 feet have been used; and the hand of circle 2 must have travelled right round once, and that of circle 1 ten times, before the hand of circle 3 is on the 1, which will show that 10,000 feet have been used, and so on. Now to take the state



Indices of Ordinary Dry Gas Meter.

of meter, commence at circle 1, and whichever number the band is on or nearest to, that will indicate hundreds. You will notice I have put it at 7 or 700. (Bear in mind that it would have to go right round to be 1,000.) In circle 2 you will notice that the hand is between the 4 and 5, but, although it is nearest to the 5, you call it 4, which makes it 4,700. The reason you call it 4, and not 5, is because the hand has not reached 5, but has passed the 4 and about three-quarters, or 700, over. In circle 3, the hand is between the 8 and 9, very nearly half-way, which makes the reading 84,700. The small circle above merely indicates units, and need not be taken any notice of. As the indices of both wet and dry meters sometimes vary with different makers, I will soon put you right if your index does not correspond with the diagram above on receipt of particulars.—E. D.

Plating.—C. E. (*Plainville, Hartford Co. Conn.*).—You are perfectly correct regarding platina plating. It simply means platinum plating. There are no solutions I am sorry to say at present in the market (at least that I could recommend) to plate and oxidise at the same time. You could, however, add a little platinum bichloride to your bath, but it is, as a rule, a little troublesome to work. A good method and solution for oxidising silver is the following:—Take 1 lb. of sulphur and dissolve it in 1 quart of boiling potash solution, prepared by dissolving ½ lb of caustic potash in 1 quart of water (cold). When the reaction following this has stopped and the vessel is cold, pour in sulphur and boil, stirring the solution well, then cool and filter. This gives a fine oxidising solution. If work is too light add little more sulphur and boil, but if too dark dilute with water (with little caustic potash dissolved in it). To use this, well clean the article to be oxidised, then immerse for a minute in this; then dry on a piece of warm iron, and polish with rouge. I do not quite understand what you term the *dull* finish of goods, but if you work with excess of cyanide and small anode the work will darken slightly. The quicksilver method is worked by means of amalgams; either gold or silver is made into an amalgam with mercury, and the work to be plated is covered with this amalgam. The mercury is then volatised off by the aid of heat, which leaves the metal on the article, which then, generally speaking, will bear burnishing. I do not know of the so-called black nickel solution; send me details of its preparation and I will advise. Any further information you or any brother platers may require I shall be very pleased to give. I will also see about another article for the profession.—F. W. M.

Etching Materials.—CUPID (*Castlejohn*).—I have never heard of such a compound as an etching mordaunt. Hydrochloric acid and nitrous acid are the two generally used for etching on copper and steel.—F. M.

Spence's Metal.—J. S. B. (*London, E.*).—Try Billington & Newton, Longport, Staffordshire.—J.

Telescope Tubes.—H. N. B. (*Middleton*).—Let me tell Mr. B firstly that, from actual experience, I can't help him. Though I have dealt with many a "brass telescope tube," I have never needed to blacken the interior of one, for the reason that the blackening is a luxury rather than a necessity. The dull, dead, coppery colour of the drawn brass, in its first unpolished state, I have always found sufficiently unreflective. This for the astronomical telescope; the stops commonly inserted in a terrestrial telescope should render any special darkening of the tubes still less necessary. However, I will give what help my knowledge can. The fumes of burning straw will darken a brass surface, and this is the only homely process that I know. Of satisfactory chemical methods which do not necessitate elaborate manipulation the simplest is this: Dissolve soft copper in nitric acid (scraps of wire covered with the raw acid until they are taken up), and dilute the resultant solution with water. Heat the brass slightly, and apply the solution freely with a soft brush. Then raise the heat of the metal until a sufficiently intense colour is obtained, and finish off with an oiled rag. A considerable degree of heat is necessary to obtain a good finish. Mr. B. may not be aware that a stop that will shut out extraneous light can generally be applied to a telescope without injuring the value of the instrument.—E. A. F.

Size and Glues.—GARRETT (*Dewsbury*).—I am not aware of any work treating specially on the manufacture of these articles, and since I have made special and particular inquiry with those who ought to know, I do not think anything of the kind has been published. Although glue is an article of somewhat ancient usage, size, as now prepared for distemper, painting, etc., is comparatively but a recent development. The gilder prepares the size he uses in "water-gilding" from parchment cuttings, which are put into an iron vessel, covered with water, and then simmered for many hours until all the "virtue" is extracted. The size thus obtained is called "clear size," and is the purest and clearest of any used. The commercial "double" and "extra double," as the ordinary qualities are called, are doubtless prepared from similar gelatinous sources, viz., from the hoofs of different animals, cuttings of hides, and all such refuse of the slaughter-house. In the North of England, I believe, a good clear size is made from tripe-dresser's refuse, trotters, and so on. Although used almost exclusively by painters, in preference to dissolving the glue one's self, the old style in London and other large centres, there must be a good demand to pay for its manufacture on a large scale, since in hot weather size easily putrefies. Young's Patent Size is a much stronger and more transparent make than the two kinds of glue-size before mentioned, and commands a big sale in the metropolis. Various forms also of powdered glue, termed "concentrated size," "size powder," etc., find a ready sale in the trade. A useful account of the method of making glue is, I believe, contained in Spon's "Workshop Recipes," price 5s., published at Charing Cross. The following is a brief description of the process. The hide clippings, hoofs, and such like refuse of the tan-yards are first treated with lime, then dried by exposure to the air, and afterwards simmered in boiling water for a considerable time. The liquid thus obtained is concentrated by evaporation, and when cold and "set" forms a jelly which is cut into blocks. The blocks are then dried by two processes—first by exposure to air in suitable chambers, and afterwards in heated chambers. The process of drying by exposure requires every attention, for change in the weather may spoil the whole batch. The spring and autumn, when the atmosphere is least variable, are the best periods for this drying. Glue in a liquid form is prepared by dissolving the substance in water, and adding alcohol. If GARRETT had given definite particulars I might have assisted him more practically. My advice to him is, get permission to go through a glue factory. If this is not within his reach I may further assist him through our Editor.—F. P.

Tram Car Starter.—AD VALOREM (*Hull*).—Your sketch does not clearly show the action of the foot-brake in regulating the accumulation and distribution of energy, but there is another point which seems fatal to the successful action of your apparatus. Suppose you are running in the direction shown by the arrows in your sketch, and having the friction wheel on the axle in gear with the upper friction wheel of the energy storing arrangement when making a stop, then to make a fresh start in the same direction, the lower friction wheel of the storage gear must be brought into gear with the friction wheel on the axle; unless there is some pawl or detent which is not shown in your sketch, your spring would go down with a rush while you are lifting your friction wheels; in fact, directly the top one leaves the axle wheel. In the arrangement described in the slip you enclose there is evidently a lock of some sort which is released by the pull upon the traces. Your idea of accumulating energy in running down hill and giving it off again is ingenious, but the details do not show how you do it. I should imagine though you would require a long and very heavy spring to make much of this.—F. C.

Exposure Tables.—J. B. R. (*Liverpool*).—There are no tables compiled specially for instantaneous work. Burton's exposure tables are as good as any, but the use of tables of any kind is confined to time exposure.—E. D.

Harmonium.—AMATEUR (*Peckham*).—Papers and plans on this subject will appear as soon as the season for winter work sets in.—ED.

Cricket-bat Handles.—AMATEUR (*Sheffield*).—We are unable to name any shop where cane or whalebone handles are on sale, as they are probably made for "the trade" only; it is likely that they could be procured through any dealer in cricket appliances. But why should not AMATEUR make them for himself? The best cane for the purpose is said to be the male (solid) jungle-cane. This is cheap: in large quantities it may, perhaps, range from £2 to £4 per ton. Whalebone is a more costly thing, and may cost as much as 14s. per pound. The material is merely cut into strips, 3, 4, or 5, as may be desired, and glued together.—A. Y.

Lathe Band.—W. E. H. (*Bognor*).—You ask how to secure the hook and eye of the "gut" band so that it will not come off. The first thing is to get the hook and eye the right size for the gut; have them of such a size that you can screw the gut in, when only very slightly pointed with a penknife or chisel; you should not have to reduce the gut except at the very point. Screw the gut in a vice, slightly grease the end, grasp the hook in a hand-vice, and screw it on without stopping till it comes through; it must screw on rather hard; if you stop it may be difficult to start again; if it won't go on far enough, you can't unscrew it; the only thing is to cut off the end, and bore the bit out of the hook, then slightly reduce the end of the gut, and try again. When you have got the hook on tight, cut away with a penknife whatever bit of gut comes through into the hook; then heat a skewer red-hot, and pass it momentarily through the hook to sear the end; it must be only a quick touch. Now put on the eye the same way. I never have trouble with mine. It is possible you may have bad hooks and eyes with a bad thread; mine come from J. Buck, 56, Holborn Viaduct, as also the gut. You probably know you can tighten your hand by twisting it up a turn before hooking it, and it can be loosened a little by untwisting in the same way, thus you can adjust it to a nicety, according to the weather. The Editor will appreciate your good wishes, and you will soon overcome this slight difficulty.—F. A. M.

Cheval Screen.—W. A. Jr. (*Portglenone*).—Your idea of a cheval screen whereon to display your flower pictures is undoubtedly a happy one. Have you thought of utilising a once popular variety, that is a little difficult to explain without diagram, but is practically the shape of Fig. 2 (page 196), with two panels that draw out, one on either side? Yet I do not know that this is any real gain; it would add to your labour, and need a harder grain than pitch pine possesses, to make the framework strong, and yet slender enough to work in a satisfactory way. I should suggest (as perhaps you intend) ebonising the pine, or enamelling it with white. Either white or black produces a good frame, but the colour of pine, especially in conjunction with gilt moulding, is rarely a success. As a practical hint, I would advise you to use the stout cheap German millboards for mounts, and be quite sure to paste the pictures (or backing paper) on both sides while the paste is wet. If you allow one side to warp in drying, as it most assuredly will on any pasteboard, it is almost impossible to get it to keep quite flat again. So be quite ready to cover each side of the panel, and, as soon as possible, lay the whole under a smooth board, with a few bricks or other heavy weights, to keep it taut in drying. If you could work a moulding of the same wood, and apply it in place of gold (which has always, in these sort of things, a cheap and shoddy effect), I think you would find it in much better taste, or you might rabbet the mount, or tack on a simple beading.—J. G.-W.

Sword Smith.—H. B. (*London, E.*).—You seem to know so well what you want, that it is only the matter of finding a good sword smith (not a mere sword manufacturer). Mr. H. Mole, sword maker, of Birmingham, might give you reliable information; or by a visit to that town, or Sheffield, amongst the sword cutlers, you might try testing blades, and form an opinion of the merit of the tempering. The shape you should supply by a wooden pattern, which prevents any mistake being made by the smith in his work. A single sword of a different pattern would cost more than an ordinary blade. When done you should be sure to try it before the hilt is fixed. The scabbard is unimportant, except for actual service, or to test the best form of suspension to the rider if it be for a horseman. The maker named is sure to use the best steel, as would any sensible sword smith, as it would not cost a shilling more than common steel. £50 is not an out-of-the-way price for a presentation sword, which means forty odd pounds are paid for hilt, scabbard, and fancifying the blade. We are pleased you approve of the way our writers tell readers the how and why of work, and further help learners by telling the how and why of failures. An illustration of logic in work, as well as in words, was given by a sword-smith to a manufacturer. A sword smith, who now is in the United States, was contending with his employer for his claim for better pay. "It is not logical," said his employer, "for you to expect more than any other smith." The smith took up a sword blade made and tempered ready for grinding—*i.e.*, making worse—and fixed it in a vice, and with a sword he had tempered, with one blow cut the other blade in two, with but slight harm to the better blade. "That is my logic," said the workman, scornfully, as he turned away from one whose ignorance was made manifest by his bad sword blade making.—J. C. K.

IV.—Questions Answered by Correspondents.

Tools.—H. C. (*Clapton Park*) writes in reply to G. P. (*Edgeley*) (see page 366):—"The tools he should have to commence with as actual necessities are—a jack plane, a smooth plane, hand saw, 24 in., tenon saw, 8 in.; hammer, turnscrew, oil stove, oil can, three chisels—say, ¼ in., ½ in., ¾ in.; rule, 2 ft.; square, 4½ in.; two bradawls, two gimlets. Your correspondent would find it pay the best to have good tools, and not the cheap ones, and I think he cannot do better than go to Messrs. Syer & Co., of 45, Wilson Street, Finsbury Square, London, who have a good assortment, and where he could also get information practically demonstrated in the use of the tools, if he desires same. I found the firm very obliging in showing the uses of the various tools I have had from them. Of course there are other makers, but I, myself, do not know of one who has a carpenter's shop wherein to try and see the uses of the tools one is buying."

Finishing Brass.—R. L. (*Raheny, near Dublin*) writes in reply to S. H. D. (*Newtown*) (see page 366):—"Gold lacquer, or brass finishers' lacquer, can be got in three shades of colour at most oil shops. To use it on small articles to prevent tarnishing after thoroughly cleaning the brass, warm the metal in a Bunsen burner or spirit lamp, till the back of the hand will just bear it when placed against it; then apply the lacquer quickly and evenly with a soft brush. Do not go over any part twice, or a stain will result. When done pass the article quickly through the flame a few times, and leave to harden. Should the brass be too hot the lacquer will dry or burn at once, and leave marks on the metal, and if too cold the brass will have a foggy or dull appearance."

Removing Ink Stains.—R. L. (*Raheny, near Dublin*) writes in reply to Littleton (*Worcester*) (see page 366):—"To remove ink or iron mould stains from linen, moisten the linen by holding it in the steam from boiling water, then apply weak hydrochloric acid on a piece of stick. When the stain is dissolved out wash the article well to get rid of any acid."

Insurance of Workman's Tools.—Donovan (*Thrapston*) writes in reply to J. K. (*Oxford*) (see page 366):—"You would, I think, do well to join the Hearts of Oak Benefit Society, for by so doing you would (among other things) insure your tools for £15. An application to the Secretary, Hearts of Oak Benefit Society, 17, Charlotte Street, Fitzroy Square, London, W., will procure the necessary forms and information."

Removing Ink Stains.—L. M. (*Putney*) writes in reply to Littleton (see page 366):—"You can easily remove ink stains by moistening them with a weak solution of oxalic acid."

Flour Paste Souring.—A. J. C. (*Finsbury Park*) writes in reply to J. R. (*Skerries*) (see page 238):—"To every half-pint of flour paste (without alum) add 15 grains of powdered corrosive sublimate, and mix well; this, though not attacked by insects, is extremely poisonous.—N. B.—Keep in a covered pot."

Drilling Square Holes.—B. A. B. (*Hampstead*) writes in answer to A Reader (see page 270):—"There is a plan described in one of R. S. Burns' books, which consists of a square steel tube the required size, ground and sharpened inside to a chisel edge. This square tube surrounds an auger, or Jennings' twist bit, which fits the tube as nearly as a round tool can. The bit has an adjustable shoulder, brought into contact with blunt end of tube, so that the bit bores a hole, which the square tube, which is thereby forced into contact with the wood, immediately cuts into a square mortise. A Reader will see that care must be taken to begin the square hole correctly, and that there is a portion of hole left circular."

Regilding Looking-Glass.—F. P. writes in reply to B. N. (*West Ham*) (see page 333):—"As it may probably save disappointment to the worker, allow me to supplement G. R.'s answer to the above by a few lines. Take your frame and clean off dirt, and with it the old clear size; this is a right commencement; but, in nine cases out of ten, a frame requires something else before it can be gold-sized and properly gilded. Nearly all new frames are gilded by water-gilding process (I make no allusion to German lacquered stuff), and, therefore, beneath the exquisitely thin layer of gold we have an absorbent surface. A frame is seldom regilded until some of the gold is worn and rubbed off; and, therefore, to put 'japanners' gold size' upon it without any other preparation, means that the latter will invariably be absorbed into the 'size and whiting' surface underneath, and, consequently, the gold cannot stick. We can touch it up afterwards, of course, but workmanlike methods and amateur makeshifts are two vastly different matters. In any case of regilding, it is always advisable, if not necessary, to give the article, after cleaning, a coat of either French polish or thin 'patent knotting,' applied evenly and expeditiously; or, what is the better job, a thin, bare coat of white paint, made with lead, turps, and a little 'japanners' gold size' in it to dry and harden it. 'Japanners' gold size,' as a medium for gilding upon, is only an 'amateur's touch,' and such as no good job of gilding is done with. Get a little of gilders' oil gold size, spread very barely with a soft hog-hair fitch (working on white paint one can see where one is going), stand it aside, out of dust, until the next day, and then lay on the gold leaf. Wipe off very gently as G. R. directs, and finish with clear size, a bare, even coat, or a weak solution of isinglass, which is more readily dissolved; a pennyworth will do a score of frames."

V.—Correspondence Briefly Acknowledged.

A Reader.—Much obliged to you for your advice, which shall be acted on if found expedient or practicable to do so. J. R. (*Skerries*).—The articles on plans, etc., for building cannot be commenced in the present volume as there are already so many subjects in hand. W. R. (*Old Street*).—I acknowledge the receipt of your letter, which is all that is really necessary for me to do. What you do not care for, others take pleasure in, and *vice versâ*. G. S.—Electric lighting will be treated in Work. Desire (*Peckham*).—Plumbing will be treated in Work in due season.

Trade Notes and Memoranda.

Recently, at Messrs. Beardmore & Company's Parkhead Forge, Glasgow, the casting took place of an unusually large shaft for a dynamo machine. Over seventy tons of metal were run into the mould, which was sunk more than twenty feet into the ground. The casting was of Siemens steel, and will be hollowed to a diameter of twelve inches. When finished the shaft will weigh about thirty-two tons. The dynamo for which the shaft is intended is being constructed to the order of the London Electrical Supply Corporation, and will be the largest in the world. The casting was in every way successful, and would take fully a week for the metal to cool.

A New York correspondent says that besides the clippings resulting from the manufacture of various articles, an immense amount of tinplate scrap is wasted every year in the form of empty tins and other similar objects. Many processes have been devised for utilising the scrap by separating the tin from the sheet iron, but they all failed more or less, either from a technical or a commercial point of view. An American inventor has hit upon the idea of converting the tinplate scrap into nails, and although considerable difficulties had to be overcome at the outset, it is stated that the machinery has now been so greatly improved that it enables a boy to produce nearly ½ cwt. of nails in a day, the cost of the scrap in America being at present about 9d. per cwt.

A Roman correspondent says that the well-known firm of Ansaldo-Bombini in Sampierdarena have recently completed the colossal engine and boilers intended for the Italian ironclad *Sicilia*. The engine is constructed to work up to 19,500 horse power, and it is the most powerful hitherto constructed in Italy. It is constructed on the compound principle, with eight cylinders and four surface condensers. It drives two four-armed screws, which have a diameter of six metres. The weight of the boilers is 500 tons, and the total weight of the engine and boilers is 1,740 tons.

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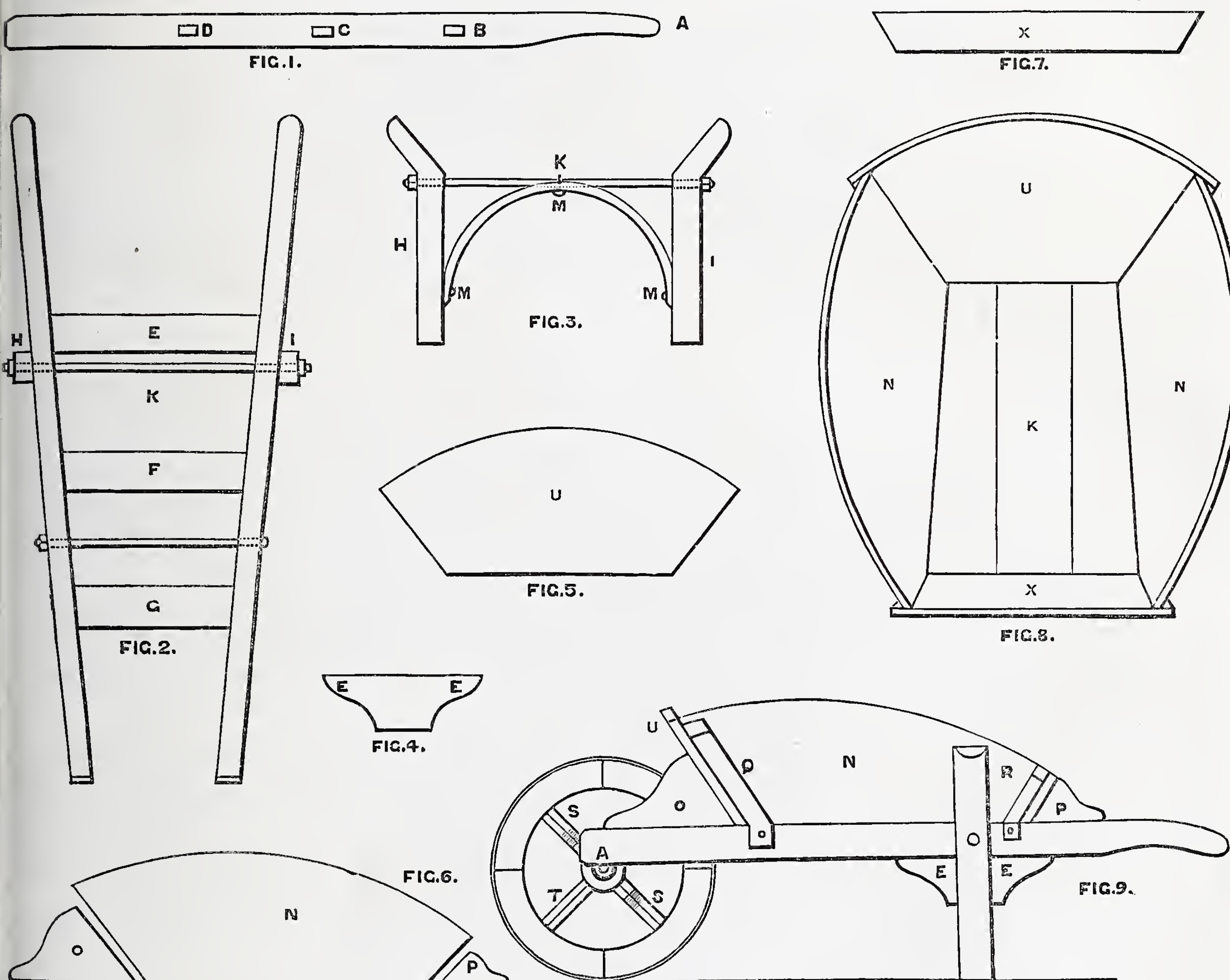

Taking out a Patent: Example of Drawings to Illustrate Specification.

TAKING OUT A PATENT.

BY C. C. C.

Patents and Patent Agents—The Law of Patents, their Origin and Objects—What may be Patented—How to get a Patent at Least Cost—Obtaining Provisional Protection—Necessary Forms, their Cost—Filling up Forms and Making Drawings—Example of a Specification—Rights under Provisional Protection—Completing the Patent—Forms for this, and their Cost—Making Complete Specification—Expense of a Patent.

"How can I get a patent?" "What would a patent cost?" and "What would be the most ready and economical way of setting about getting a patent?" are questions certain to occur at some time or other to those of an inventive turn. The columns of "Shop" show that they exercise the minds of various of the readers of Work. The writer, who has had some years' experience as an unprofessional patent agent, is in a position to answer these questions, and somewhat more at length than it might be found possible to do in the above-mentioned columns. He can also, if desired, say a word or two about the registration of designs and trade marks.

It is well that all those who invent should have this information. Many an idea of practical value is allowed to remain undeveloped, or it is developed and its fruits enjoyed by others than its originator, solely through the apparent difficulty of securing patent rights. Inventors ignorant on these points are scared by the vague fears of expense, or they may not find it easy to consult a patent agent, since these gentlemen are to be found in large towns only. Many inventors, mechanics by calling especially, have a not unreasonable dread of the charges of professional men. And though it is but just to admit that patent agents are as a class very quick in catching the ideas of their clients, there are few among working people who can explain themselves to a strange gentleman as they could whilst chatting with a friend, or sitting quietly jotting down their ideas at leisure on a sheet of paper.

These considerations being borne in mind, it is proposed in the present article to show how any inventor who can express himself intelligibly in pen and ink, and can make a mechanical drawing, or who has a friend who can help him in either or both ways, may get his patent without the intervention of an "acknowledged agent," and secure his rights without running into any unnecessary or unknown expenditure.

In the energetic little manufacturing town in which the writer resides, inventors among working men are numerous, and he has become an "unacknowledged patent agent" involuntarily. His neighbours have fallen into a way of coming to him with their inventions, not only because he was close at hand and they were not afraid of his fees, but also because, knowing him, they could explain matters freely to him. The "unacknowledged" patent agent will, however, soon be a thing of the past, for a clause comes into force in the present year (1889) which subjects any unlicensed person practising as a patent agent to a penalty of £20, though this by no means affects the right of any inventor to act for himself in procuring a patent. Whilst, however, the writer acted in the capacity of agent, none of his work as such has failed, and he believes he has been successful chiefly because in his specifications and drawings he has kept in view the primary and fundamental objects of the patent laws.

What these are we shall see if we just glance at the origin of patents, as we understand that term in common parlance.

Their history begins in the reign of James I. Before that time the inventor had no protection except by keeping his own counsel. Shrewd men protected themselves in this way, and the consequence was that when they died many trade secrets of more or less value were lost to the community.

This was acknowledged to be an evil, and as a remedy it was enacted in the 21st year of James I., c. III., that if any useful secret were fully described and the description placed on record, its inventor should, upon payment of certain somewhat heavy fees, be guaranteed the sole right to use or sell his invention, during a reasonable time, throughout the king's dominions.

Previous to the year 1624, in which the above Act was passed, the practice of granting monopolies had prevailed in this country. Persons with sufficient influence had been accustomed to obtain for themselves an exclusive right to trade with certain countries, to import certain articles of consumption, or to practise certain crafts. This practice was justly regarded as a grievance by the public at large, though, as it was a source of no small profit to the Government, it was defended by the party of prerogative. It was, however, abolished by the Patent Act, and the system of protecting inventions established in its stead.

But this more equitable arrangement was not without its opponents. It was urged that a patent, during the time that it remained in force, deprived other inventors of their inherent right of making the same discovery for themselves—that the new law was opposed to the law of Nature, by which the way of improvement is alike open to all, and more to the same purpose. Nevertheless, the principle held its ground. The system was initiated by England; after a long interval (in 1790) France followed her example; and since that time the plan has been generally adopted among civilised nations.

It will be seen from the above that the prime object for which Patent Laws were instituted was not the protection of the individual, but the preservation of such inventions as might be of practical benefit to the public, and that the condition on which they offer protection is the complete divulgence of the inventor's secret. The one thing, therefore, that is needful in drawing up a satisfactory specification is *that it shall be plain*, nor is there any statutory form to be adhered to beyond that on the paper furnished to the applicant for filling up.

"What may or may not be patented?" is a question to be asked at the outset. It would appear that nothing has a claim to protection under the patent laws which is not the outcome of thought. No mere natural product is a subject for a patent; but evolve the idea of mixing two or more products, so as to form a new and useful compound, and you have a proper subject. A single metal, as such, cannot be patented, but a combination of metals, as *Muntz's Metal*, is entitled to protection. In a general way it may be said that anything is patentable which can be described as a new and useful art, manufacture, machine, apparatus, or article; any improvement in any of these; or any new composition of substances in such a manner as to be useful. By the statute of James I., manufactures brought from over seas, though old in other countries, may claim protection if new to Britain. But nothing may be patented which is dangerous, mischievous, or inconvenient to the public—nothing which is hurtful to trade or to the public morals. Patents for improvements in patented machines or apparatus are allowable; but if the improvements cannot be made use of apart from the patent machine, the expiration of the first patent must be waited for, unless the two patentees can come to a private arrangement. Finally, the invention must not only be new, but it must presumably be useful and beneficial to the public; a novel curiosity, as such, being no subject for a patent.

Let it be supposed that we are in possession of a patentable idea, and that it is desirable for us to protect it on the most economical terms. We have first to decide on the most fitting title for our idea, and whether we are to speak of it as an "invention" or an "improvement." That done, we may quietly sit down with a sheet of paper before us, and as simply, straightforwardly, and clearly as we can, draw up a description of it. If it will admit of such aids to verbal description, we should make rough drawings as we go on, marking them and our manuscript with letters so as to render reference easy.

While thus engaged we should bear in mind the rule already laid down: that the object of our description and descriptive drawings is so to explain our invention, that from them alone any person may, at any future time, be able to make the article or to perform the process which we are describing. If we do this we do all that the Patent Office requires of us. The most experienced agent can do no more.

We are now ready for the proper forms. It is in almost all cases better in the first instance to secure *Provisional Protection;* that is to say, protection for nine months. During that time we can test the value of our invention in the market, we can sell or make arrangements for working it with other parties, or, if we find reason to think that we have overrated its importance, we can abandon it before the expense of an actual patent is incurred, and in a general way it will give us time to look round us and determine on our future measures, we being as safe meanwhile as if the patent had actually been granted.

We, therefore, go to the Post Office and ask for a Provisional Protection Form, and a paper will be handed to us partly printed and partly blank, and it will have a stamp for which we shall be charged one pound. This paper will be marked A (if we require protection for the Colonies as well as for Great Britain it will be marked A[1]). With it will be given us, free of charge, two other papers, which will be duplicates, and these will be marked B. If these forms do not happen to be in stock at the particular office to which we apply, we can, by ordering them, have them procured for us there or at any other Money Order Office in the kingdom.

For filling up the blanks in these forms we shall find directions in their margins. On the stamped form A the application has to be made; whilst form B is for the specification: that is, for that description of our invention which we already have in draft. The blanks to be filled up in Form A are short and simple, and with the directions printed upon it to guide him no one can well err in filling them. The real work is in filling those in Form B properly. It is probable that our specification will require more space than the form affords, and, if so, we shall have to continue it on other paper, good stout wide-ruled foolscap being used of the same size as the form, viz., 13 in. by 8 in. The accompanying illustrations must be on white, smooth, rolled drawing-paper, also of the same size, and they must be drawn in black india-ink only, such shading as is introduced being in lines alone, for no washes are allowed. The reasons for these regulations with regard to drawings being that they will have to be photographed at the Patent Office. It is also required that the drawings should not be creased by folding; they must be rolled up for transmission.

The drawings, like the specifications, have to be in duplicate, and all have to be signed and dated by the inventor. When ready, these papers have (unless delivered by hand) to be forwarded to the Patent Office through the post. By return an acknowledgment will be received through the same channel; and, if they are found satisfactory, in a short space (probably about a fortnight) this will be followed by an intimation that Provisional Protection has been granted.

Perhaps we shall best show how a specification should be drawn up and illustrated by giving an imaginary example in which some well-known invention is described. Will the reader kindly carry his imagination back to a period when the *wheel-barrow* existed only as an idea in the brain of its originator? We will (without any historical authority whatever) suppose that unknown benefactor to his species to have been an ingenious craftsman of Eboracum, who, when the Emperor Severus was busied on that colossal piece of navvy-work, his rampart across this island, conceived a scheme by which to relieve the backs of his fellow-Britons, and, of course, to put money in his own pocket. He would be entitled to protection, his invention being no mean improvement on the Roman *feretrum* or bier previously used for burdens. His specification might run much as follows. The printed matter on the form is given in capitals or italics.

To be issued with Form A or A¹.
Patents, Designs, and Trade Marks Act, 1883 *and* 1885.

FORM B.

PROVISIONAL SPECIFICATION.

(To be furnished in Duplicate.)

(a) Here insert title as in declaration. (a) An improved vehicle by means of which loads may be conveyed from place to place by the labour of one man only.

(b) Here insert name and full address and calling of Applicant or Applicants as in declaration. (b) I, Caius Constantinus Evans, of 6, Forum Street, in the County of York, in the City of York, Wheelwright and Timber Merchant, *do hereby declare the nature of this Invention to be as follows:*

(c) Here insert short description of invention. (c) I construct of wood and iron a vehicle by means of which one man may readily convey loads from place to place for building or other purposes, and I construct it in the following manner:—

I take two pieces of wood, by preference ash, each about 4 ft. 9 in. in length, 2 in. in thickness, and 3 in. in depth. These I dress, and form one end of each in such a manner that it can readily be grasped by the hand, as shown at A, Fig. 1. These pieces I call the "side-pieces."

In each of these, I cut mortise holes as denoted by B, C, D, the hole B being 21 in. from the end A, while D is 15 in. from the opposite end, C being midway between the two.

I shape three pieces of wood, by preference ash, $1\frac{1}{4}$ in. thick and $3\frac{1}{2}$ in. wide, and cut at their ends tenons to fit the mortise holes above-named. These pieces, which I call "slotes," vary in length, as will be seen by referring to Fig. 2, where they are denoted by E, F, G, the length of E being 22 in., while G is 18 in., and F is of an intermediate length. When, therefore, the tenons on E, F, G, are fitted into the mortise holes, B, C, D (Fig. 1), and fixed by pegs or otherwise, the work will appear as in Fig. 2.

I next make the legs of my vehicle from two pieces of oak plank 3 in thick, of the form shown in Fig. 3, where they are marked H, I, and then fasten them to the side-pieces by the iron rod, K, which passes through them, and which is also shown in Fig. 2, where the legs appear in section. I further secure the legs by the pieces which I call the leg-brackets, two in number, of the form shown in Fig. 4, which are nailed to the legs and side-pieces, as appears at E, E, Fig. 9. And I further strengthen the legs by an iron rod, bent to a semicircle, which is nailed to them, and to the back slote, as shown at M, M, M, Fig. 3.

The body of my vehicle, A B, which is to be placed on this frame, is composed of a flat bed and four slanting sides or boards, all of elm. The bed extends from the front to the back slote, and from side-piece to side-piece, and the side-boards are conformable to it. Fig. 5 shows the front-board, U; Fig. 6, one of the side-boards, N; and Fig. 7, the back-board, X; and these I nail together as shown in Fig. 8. I afterwards nail the body to the slotes, side-pieces, and the sloping sides of the legs; and to strengthen it when so fixed, I take two pieces of wood of the form shown at O, Fig. 6, which I call "front-brackets," and which I nail to the side-pieces and front-board, as shown at O, Fig. 9; and two other pieces, shown at P, Fig. 6, which I call "back-brackets," which are nailed in like manner against the back-board, as at P, Fig. 9. And I still further support the sides by pieces of wood nailed to the side-pieces and into the angles formed by the projecting ends of the back and front boards, as shown at Q and R, Fig. 9.

The distinctive feature of my vehicle is that it has one wheel only. For this I prepare an axle of turned wood about 10 in. in length and 4 in. in diameter in its middle parts. My wheel differs from that of an ordinary chariot, inasmuch as the axle itself serves as its nave. Through the centre of the axle I cut a slot lengthwise about 2 in. long and 1 broad, but slightly tapering towards one of its extremities, and into this I drive an ashen spoke cut to fit it, so that one half of the spoke may project on each side. I then cut a second hole, 1 in. square, through the centre of the axle and broad spoke, at right angles to the first, and drive into it a second spoke in like manner, and trim the outer portions of the spokes down to an equal thickness as they appear at S, S, T, Fig. 9. I then complete my wheel with felloes and an iron tire in the manner usual with wheelwrights. Finally, into the ends of my axle I drive two iron pins, upon which it and the wheel revolve in two staples driven into the side-pieces, as shown at A, Fig. 9.

And the improvements and advantages claimed for this, my invention, are these: that by means of it one man may convey a greater burden, and with less labour than could have been borne in the old manner by two; also that, owing to the arrangement of its two legs, the labourer is enabled to rest, and again to resume his labour without loss of time; also, that its sloping sides allow of loading and unloading easily; also, that its single wheel permits of loads being readily conveyed along a narrow plank; and, also, that by means of a strap passed round its handles and over the shoulders, it permits the weight of the load to be distributed over the body of the labourer in a satisfactory manner.

From the foregoing specification, with its accompanying drawings, it will be admitted that any workman, who had never before seen one, might construct a wheelbarrow (possibly some reader of WORK may be tempted with such plain directions before him to make such a useful article—he may safely do so without infringing the inventor's patent); and if they enable this to be done, they fulfil the fundamental requirements of the patent laws.

In this imaginary specification, the writer has described the supposed invention fully. This is not usually done by Patent Agents when applying for Provisional Protection. Their common practice is to give no more than a bare outline of the invention; or, rather, of its principles, and to avoid drawings if possible. Why this should be we can readily understand. The writer, however, prefers to explain as thoroughly in the provisional as if it were a complete specification, and to illustrate it thoroughly; and for this reason—experience shows that inventors having obtained provisional protection, are apt to put off taking any steps towards completing the patent till the time for doing so has all but expired, when the work may be too much hurried to be done properly. Whereas if the description has been thoroughly made out in the first instance, all that has to be done at this time will probably be to make a copy of the provisional specification and refer to the drawings filed with it. A duplicate of this specification is, upon application, returned to the inventor for guidance; it is, however, better that he should have himself kept a careful copy and tracings of his drawings with their letters of reference. Of course, if he has during this time added anything to improve his invention, he will embody this in his complete specification, and if an extra drawing is required, he will make one on paper of the same size as before.

Should there be anything vague in either drawings or specifications, the specifications, if clear, will serve to correct a vague drawing, or exact drawings will serve to correct a vague specification.

Although an inventor may be provisionally "protected," he is not, strictly speaking, entitled to mark his invention as "Patent." Yet this is generally done, and, so far as we know, only one action has arisen in consequence, when the plaintiff got 10s. damages. The proper way to mark the inventions would be "Provisionally Protected;" but the word "Patent" has been so generally substituted for it that no action at law is likely to arise, unless some brother inventor of a similar article gets spiteful, in which case a jury would probably consider the *malus animus* and give nominal damages.

It should be observed that in the case of an abandoned patent—that is, when the inventor has neglected to complete his patent within the period for which provisional protection has been granted—the Patent Office will not return his specification.

Our Provisional Protection claim is for nine months only, and if, during that time, we have reason to be so well satisfied with the prospects of our invention as to be justified in going to the expense of a complete patent, we must, before that time has expired, apply at the Post Office, as before, for complete specification forms. Two will be given us, duplicates, except that one will bear a stamp, for which we shall be charged £3. These forms will be marked C.

On these we have to make out in duplicate our complete specification, and if, as above advised, we made our provisional one carefully, this will generally be little more than a copy of our former work, except that on the margin of Form C is a direction that the specification must end with a distinct statement of the inventor's claim in prescribed form. If distinct novelties are to be insisted on in different parts of the invention, these will have to be mentioned in the claim. Had our imaginary friend, the inventor of the wheelbarrow, introduced any new thing of importance in the legs or sides of his vehicle he would have to mention them, as well as the wheel, in his claim; but as he would consider the importance of his invention to rest on the single wheel alone, his statement of claim would run as follows:—

"Having now fully ascertained the nature of my said invention and how the same is to be performed, I declare that what I claim as my invention is a vehicle having one wheel only, and that the whole is constructed substantially in the manner above described, and for the purposes stated in this my complete specification." This he will date and sign.

As a result of this second application, we shall obtain security for a term of fourteen years, and the *right* to use the word "Patent." For these privileges we shall have to pay the sum of £150, in addition to that already paid for stamps. This we may do either in two instalments, viz., £50 before the end of the fourth, and £100 before the end of the seventh or eighth year from date; or by annual payments as follows:—Before the ends of the fourth, fifth, sixth, and seventh years, £10 each year; before the ends of the eighth and ninth years, £15 each year; before the ends of the tenth, eleventh, twelfth, and thirteenth years, £20 each year.

It may be useful to know that when an inventor has not the means of properly working his invention and has to secure the help of a capitalist to help him in so doing, the name of the person thus joining him may be associated with his own in the patent.

A FEW WORDS ABOUT SCREWS.

BY JOHN CHARLES KING.

When screws are spoken of, the common screw to be turned into wood with a screw-driver is generally understood by those who hear or read about them. It is of such I now write, with remarks as to the best sorts and the most effective way to get them in and out, with the least possible trouble or injury to material they are used in.

Not a hundred years ago, the screws were so badly made that some coach makers preferred to put countersunk clout nails in the hinges of carriage doors, as the screws were apt to break off at the end of the thread part on extra strain, or if the head impinged a little more on one edge of the countersunk than the other, as the sectional sketch will show; the countersunk of the hinge being iron recessed conically and unyielding to the canted head, not at right angles to the countersunk face. The attempt to use a screw in hard wood had the same effect, but not so great. If the cone of the countersunk were fainter in its angle than the cone of the screw head, the chances of a screw breaking would be lessened, as the neck of the cone of the screw head would take the bearing on one side of the hinge, or wood countersink. The screw, as will be seen (Fig. 1), is bent out of straight at its weak part, and at every half turn round it is bent back when the opposite side of the screw is turned to B, which, in effect, is the same as holding the thread part tightly, while the stem part, A, is crooked first one way then the other, the strain being augmented also by the tightening of the thread part producing a torsion strain on the weak part of the screw.

Hinges of carriage and heavy house doors are here selected for illustration, as the result of a broken hinge screw in a door-post or standing pillar of a coach or chariot, which would obviously be a more serious matter than a small light door, the wood generally of heavy doors and carriages being harder, and the door pillar or standing pillar of a carriage smaller than a door jam or post. A broken screw under such conditions was a serious matter in the olden time, and led to a lot of time-wasting contrivances to extract the part bedded in the pillar or post. It had to be done. One plan was to bore a larger hole from the other side of the pillar opposite the point of the screw, and punch the broken part through the hole; then plug up with a wood pin and glue, which needed a few hours to dry hard before it could be bored into for another screw. Another plan was to drive a clout nail in to fill the hole, beside the broken screw. Sometimes the head would be the trouble. If a blunt screwdriver were driven into a narrow saw cut of the head, half the head would fly off; even impinging on the hole countersink, more one side than the other, would cause the head to break half side off. If too tight in to get out, the remedy then was to leave it, and put in putty, to hide the mischief; but if not quite tight in its bedding, it had to be got out somehow, causing an hour's work, perhaps, in trying, and then probably having the other half of the head break off. To get a tight screw out of a hole without a head was not an easy task, and would puzzle workmen of the present day, with all their

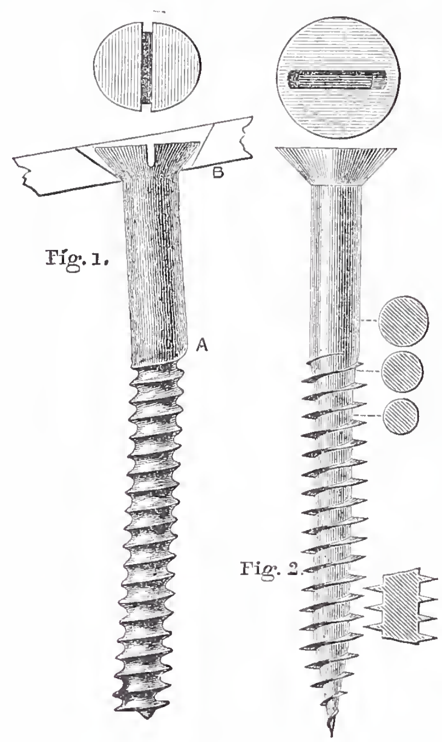

Fig. 1.—Old form of Screw, showing weak points, Fig. 2.—New form of Screw.

handy tools they use for any troublesome jobs. It has to be done, and had to be done a hundred years ago more often than now: that is why countersunk clout nails were used in preference to screws in post-chaise and stage-coach work in many shops, and often in door hinges into oak door posts. As to the headless screw in the hole, we will explain a contrivance to get it out, which was suggested and made by a poor outcast tramp, who was looking for work. This was in the hinge of an iron gate of a nobleman's mansion. The workmen were afraid to try to draw the other screws, as the heads were as brittle as the broken one. The tramp made a fine chisel and cut the stem of the screw to the shape of a triangle, and fitted on a triangular steel pipe stem, like a short length of a padlock key. This he made square on the projecting part for an inch, and with an iron cramp forced this key tightly on the broken screw; while held thus tightly, which prevented it coming off, with a wrench that fitted the square, he turned the screw back at the same time as he turned back the thread of the cramp. It was the keen sense of touch, not eyesight, which determined the degree of pressure of the cramp screw, as the broken part was turned back far enough to enable a small hand vice to grip it, and turn it right out. We may mention that this trifling matter won the poor fellow work, and eventually, by his worth and cleverness, the place of foreman. His name was Crundle, and it may still be remembered by old men in the carriage trade in London.

Screws have been progressively improved since that time, the chief improvement being in the tougher iron used; the next, in the acute chisel edge of the thread; and the next, in the screw tapering to a sharp point, with the thread right up to the tip. The latest improvement is making the stem of the screw smaller than the diameter of the thread part, so that the old evil of having to make a big hole in one piece, to prevent it being "stem-bound" and not drawing, is averted, though a smaller hole is used. The illustration of the screw in Fig. 2 shows this. Finally, the head breaking half off is made almost impossible, as the cut does not extend to the edge of the head, but is as a mortise in it, as the diagram shows, the sharpness of the cutting thread being augmented in keenness at each improvement. It all looks simple enough, and the old remark, "any one could have thought of that," drops short when we refer to the metal of which these are made; it is a mild steel of intense toughness, and they are made by elaborate machinery, so that the "bogy," cost, shall not arise to baulk its introduction, and it is swaged and rolled *cold*. This is one demonstration of the superiority of the metal used; again, the cutting is done laterally, not longitudinally, which makes a feeble thread, so that there is right talent evinced in this improvement shown at the Exposition Universelle by the American Screw Company, of Providence, Rhode Island, U.S.A.

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A NEW MATERIAL FOR ROOFING SUMMER-HOUSE, FOWL-PEN, OR DOG-KENNEL.

BY JOHN W. HARLAND.

I have been much exercised for the last year or two to find some material for covering roofs of temporary structures that should possess the desiderata of inexpensiveness, efficiency, and durability, combined with an ornamental appearance, and which should not be too heavy for the purpose. Not only for my own constructions, but for those of numerous acquaintances, has this question been forced upon me, and I have tried several plans, such as thick brown paper soaked in boiled linseed oil, or laid on the roof with equal parts of resin and Russian tallow applied boiling hot, or with a solution of resin in paraffin. All these methods, however, failed, owing to the sun affecting them; they answer only one condition, *i.e.*, being waterproof, but not heat-proof. Paper treated in any of the above ways is thoroughly waterproof as a lining for cisterns where no heat or frost can attack it, but as a roof-covering is very perishable, though it appears to answer very well at first for a few months. It can be made to look rather ornamental by means of a coat or two of paint, but this soon blisters in the sun and becomes unsightly. It does not keep out the heat to any extent. Slating and tiling are heavy, and necessitate building the roof much stronger, costing in material and time a considerable outlay.

Under these conditions, it struck me that floor-cloth, linoleum, and kamptulicon, might answer the purpose, and, accordingly, the experiment was made; the result was a perfect success. Readers of WORK, therefore, will, no doubt, appreciate some account of the way in which it is utilised. Firstly, floorcloth which has been laid down upon boards wears out at the joints of the boards, and cuts through long before the other parts are worn at all, and very frequently is taken up and replaced by new for appearance' sake, because the pattern gets partially worn off. Even when the greater part is thoroughly worn out, corners and other parts which have been under articles of furniture are better even than new, having had the advantage of long seasoning. There are few houses where, in some lumber room, stowed away, such old cloth cannot be found, and, if not, every furniture broker has pieces of all sorts which may be bought for a shilling or two. The first operation is to cut up the cloth or linoleum into slate-shaped pieces of about 6 in. in width and 13 in. long, rigorously excising every bit of worn-out stuff and every part that has been pierced by tacks. So long, however, as the pattern only is worn off, the cloth is just as good for our purpose as if it were new.

Fig. 1.—Summer-House roofed with Linoleum Tiling.

Having cut a sufficient number of pieces all exactly one size, they may be made more ornamental by cutting off two corners at *one* end, at an angle of 45 deg. or 50 deg. (Fig. 2). My readers have, no doubt, observed that many floor-cloths are of a deep Indian red at the back, others of a terra-cotta hue, others dark, and others lighter stone colour; this should not be lost sight of, for herein lies its capability for ornamentation, for it is the *back* of the cloth we use uppermost.

Suppose, now, the roof is ready to receive the covering: instead of the rafters being slate-lathed, they should be boarded over with thin boards; for this purpose almost anything is good enough—old egg-boxes, "slabs" off logs of timber, or other old stuff, which need neither be planed nor close-jointed: it is merely to support the oil-cloth or linoleum slates.

Now commence by putting on at the eaves with ⅝-in. *tinned* tacks a strip of cloth the whole length, about 9 in. wide, nailing it along the upper edge only, and allowing it to overhang the eaves about 1 in. Then lay the first band or row of your floor-cloth slates with their lower edges flush with that of the strip you have just nailed on, tacking them down only at their lower edges; then lay 4 in. higher up your second band of slates, nailing them only at the lower edges: for these tacks will go through the row underneath as well and thus securely fasten them. Care should be taken that the joints of the second row should come opposite the exact centre of the first row. If care has been taken to make them all one size, you need only measure the first of each row, the rest will fall exactly in their proper places. Proceed next with the third row, the side joints being made to fall in line with the first row and 4 in. higher up, and so on with the next row or band (see illustration, Fig. 2), when you will find that throughout, as in actual slating, you have *three* thicknesses of covering, the lower edge of the fourth band overlapping the upper edge of the first just 1 in., thus ensuring its being absolutely water-tight. If you continue until the ridge is reached, you will thus have to cut the last band of slates but one 4 in. shorter, and those of the last—*i.e.*, the top row—8 in. shorter, so that these all finish at the ridge. Or, if you find that you can utilise other portions of your cloth that will not cut full-sized slates, so much the better, as you avoid waste.

With a little taste and forethought, by laying out your slates on a table, you may add quite an artistic tone to your roof, by arranging, say, two or three different colours of cloth either in bands or patterns and other combinations, the effect at a short distance being quite that of flooring tiles, whilst the peculiar colour harmonises with either the bright greens of spring or the brown and golden tints of autumn foliage.

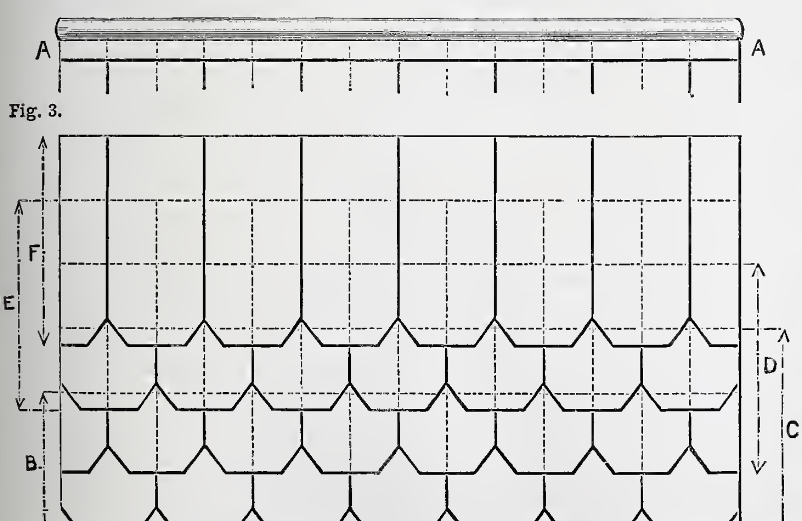


Fig. 3.

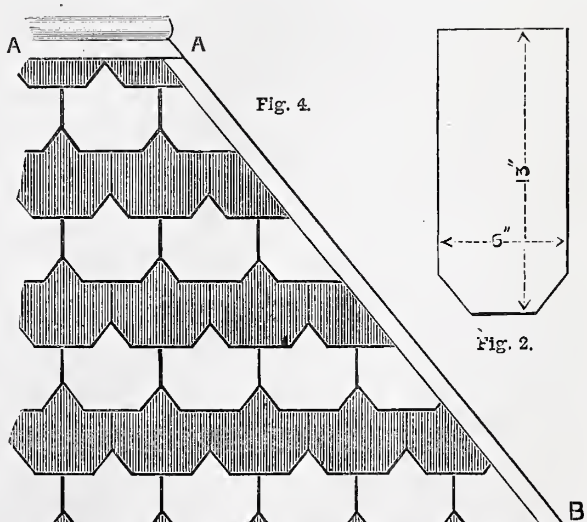


Fig. 4.

Fig. 2.

Fig. 2.—Plan and Dimensions of Single Tile. Fig. 3.—Lean-to, or Side of Span Roof—A A, Ridge Roll of Zinc; B, 9 in. Strip; C, First Row; D, Second Row; E, Third Row; F, Fourth Row. Fig. 4.—Hipped Roof—A A, Ridge Roll of Zinc; A B, Zinc Flashing.

I have hitherto endeavoured to generalise as much as possible for clearness' sake that our remarks might apply to all light, temporary roofs; but it is necessary to point out different modifications entailed by different forms of roofs, viz. (1) a "lean-to" or shed roof, (2) a "hipped" roof, or (3) a "hipped and gabled" one.

In the first (1), the simplest form possible, every alternate row or band commences with a half-slate, *i.e.*, with a piece cut 13 in. by 3 in., instead of 13 in. by 6 in. The ridge slates being cut to finish, as before described, at the wall to which the roof leans, require simply flashing to make them good at their junction with the wall. This is done as follows:—Scrape out the mortar between the two next courses of bricks in the wall just above the roof, and insert the edge of a strip of cloth the full length of the roof, wedging it in with small wooden wedges, say every foot or so apart, and then fill in with Portland or Roman cement, and point the joint over the cloth, or, instead of cloth, thin zinc may be used, tacking down the lower edge here and there to the roof.

In a double shed roof, such as a dog-kennel, the ridge is made by nailing over the top a strip the whole length, overlapping both sides for two or three inches, and over it nailing a ridge roll of wood to keep it well down, which may be grooved at top to receive a cresting if desired.

In "hipped" roofs (2) the oil-cloth tiles have to be cut to the angle at the "hip" rafter, and before the ridge flashing is put on the hip should be made good with a strip of cloth or zinc nailed down over the cut edges of the slates, and the ridge flashing then nailed over its upper end. (See Fig. 3.)

In a "hipped and gabled" roof (3), where the gable roof mitres with the main roof, the "valley" must be laid first with either cloth or zinc about 3 in. on to each roof, and the tiles should be cut to the angle about an inch from the angle itself on both roofs, leaving the valley exposed to view 2 in. wide altogether, thus leaving a clear channel for the water. At the ridge, the strip for making good, whether cloth or zinc, should have a 4-in. piece laid under the mitre joint, or else be twined round one over the other and made good, the ridge roll being also mitred.

Having thus shown how to construct this roof in various ways, let me point out its capability of economic maintenance in good condition. Instead of the trouble and inconvenience of hot tar or asphalte (as in the case of roofing felt), all that this roof requires is periodically to give it a coat of boiled linseed oil, and half its volume of turpentine or terebine laid on as paint. Or, if preferred, it can be painted from time to time either in a self-colour, or in patterns, etc., as desired. In any case, the edges of each tile should be painted over with oil and turps before laying, which leaves them the same colour as before, and preserves them from the weather.

This novel covering excludes heat as well as moisture, is very durable, looks quite artistic, and costs next to nothing. In Fig. 1 is given an illustration of a summer-house roofed with it (from a photograph), which is thoroughly satisfactory and successful.

SOLID LETTERS FOR SHOP-FRONT FASCIAS, ETC.

BY B. A. B.

If it is not going "beyond my last," or, in other words, going from my business into the domain of the author of the excellent papers on "Sign Writing and Lettering," I should like to tell the readers of Work how, owing to Mr. Benwell's articles, I made some solid letters for shop fascia.

First, I ascertained what sized letters would best suit my purpose, and found 7 in. would do well, and that note-paper is just that dimension. Mr. Benwell's outlines of sans-serif served as models, and armed with a pair of scissors, a black-lead pencil, and a straight-edge gauged to the width of the letter I, very little difficulty was experienced in obtaining fairly good, well-formed letters. X gave a little trouble, but note-paper is cheap, and I made another essay. The letters being now cut in paper and satisfactory in shape, were glued to a piece of ¾-in. deal, using judgment to obtain a suitable way of the grain. This was believed to be upright, and all the letters except T, which was formed of two pieces, mortised and tenoned together, were cut out with a bow-saw just outside the paper pattern, so that with sharp chisels and gouges, the wood could be reduced exactly to the size of the paper letter; a shooting-board was found very useful for B's, E's, R's, etc.; a coat of ordinary paint was given to the letters all over, and any fibre which had been left unnoticed before, now that the paint had caused it to show more prominently, was carefully pared off with a sharp chisel, and another coat of paint applied to front and edges of letters. I ought to mention that no stops except full stops were required, and that those were made of square pieces of wood, the sides of the square being the same as the width of the upright member of the letters. The finishing colour was next debated, and some preference was felt for a gilt surface, especially as Opifex had recently given some hints on gilding, but, finally, I decided to have white letters with red edges. For the white, white lead, turps, some crystal varnish, and a little ultramarine were mixed; the edges were painted with white lead, vermilion, and crystal varnish mixed together and finished with a coat of Urquhart's "carmine tint" enamel. These letters fixed on a dark green ground are very satisfactory, and there may be among the readers of Work many who, like myself, would like an effective sign, but are not blessed with very heavy purses, and to whom the alternative is either do it yourself or do without.

Now the letters must be fixed, which reminds me that very small brass plates, such as card-board almanacks and price lists are sometimes furnished with, would be excellent for the purpose, and probably could be purchased of wholesale stationers or ironmongers who stock for fancy leather workers — ordinary ironmongers' plates are too heavy. Being unable to procure suitable plates my letters were fixed with fine wire nails or panel pins well punched in, and holes stopped with white lead, with just a touch of ultramarine blue to match. Such letters can be read with the least possible light, and the coloured edges give a solid appearance as the spectator approaches.

Encouraged by the success attending this attempt, another idea was suggested. Some zinc about No. 10 gauge was in hand, and why not try and cut some letters in that? Still keeping close to Mr. Benwell's outlines, a piece of wood was cut out and carefully squared, every letter was made the height by this one piece of wood, remembering the axiom, "things which are equal to the same thing are equal to one another." Of course, the width of the letters varies from M or W, the widest, to I, the narrowest. S and O were the only difficult letters; U and P, and similar letters, might be cut in part with a centrebit, or marked with compasses; a strong pair of scissors or shears, chisels, gouges, and a half-round file, a hammer to flatten the zinc when required, a mallet, and a flat piece of wood to cut on, are all the tools required.

To make these letters into words, two No. 0 iron rods were taken, and some waste pieces of zinc bent round the rod closely and soldered to the back of the letters, two at least to each letter. Having all the letters now on the rod, they can be carefully spaced and the rod filed, and a bead of solder put upon the spots where zinc and iron meet. The whole can now be painted, and were coloured white as before with a touch of blue in it; but against a bright sky, or when light slates in the full sunlight form the background, white is almost invisible, so red was tried and found a success; the backs of the letters, however, had better remain white. K, R, and other letters, look very odd when seen from the back.

Some people, however, are more attracted by the back and its odd appearance, and so take special trouble to spell out the sign, and, no doubt, remember it the better for their trouble. This is written to encourage the readers of Work to make use of the excellent articles which are placed within their reach; even when, as in this case, the directions are not exactly followed, the spirit or suggestive force of the article is often the most valuable, that is, of course, to those who read with a purpose, and they will find that information they had hardly thought of any value at first becomes almost an inspiration, often becoming a means to an end, a way by which the desired object may be reached.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

Blue and Black Pigments.

In the preceding paper upon this subject of house-painters' pigments, we considered the most useful amongst the Whites, Yellows, and Reds—both for oil and distemper preparations. Therein was enumerated only those which were requisite or advisable for practical and every-day use, taking the mind of my reader from the starting-point of white, at the head of the scale, down through the yellow and red pigments, and leaving the subject at the intermediary or stationary position of the reds—*intermediary*, since it is the turning-point from light and warm aspects towards the cool tones of blue and black; and *stationary* as red appears to the eye neither an advancing or retiring agent.

Although we are not so fortunate with respect to the number and variety of blues for house painting as is the case with warm pigments, there are enough for our purpose.

Warm schemes of colour, depending for effect upon the reds, are by far more suitable aspects for the climate of this country, in which, notwithstanding occasional long and hot summers, we get a preponderance of cold and cheerless weather; and, happily, with these we are well provided, both from natural and artificial sources. Returning, however, to the pigments of blue, the most interesting and important of these are a variety of preparations known under the generic name of *Ultramarine Blue.* Of all pigments in our use and knowledge the real ultramarine blue is by far the most pure and costly, and has been known and used from the time of the first Pharaohs. Its name is derived from the Latin *ultra*, beyond, and *mare*, the sea; and by the ancient Greeks it was known as Armenian blue. Its true natural source is a precious stone called lapis lazuli, of a beautiful azure colour, marked with fine golden veins, and principally obtained from Persia and Siberia. In the recent Inventions' Exhibition at South Kensington I noticed amongst the Persian exhibits some small table-tops formed from this precious stone; they were about eighteen inches in diameter, and were marked at £90 each. In the Geological Museum in Jermyn Street, London—an institution that is, I am afraid, as little known to the average worker as its contents are equally valuable and interesting—there can be seen small specimens of the stone in its natural state, and then the resultant pigment of ultramarine at its side, as well as figures denoting its commercial value. I will here venture to digress from my subject to earnestly advise any student or worker, whose avocation or inclination brings him into contact with pigments and colours, to visit this comparatively little-known museum and to dip into the mine of information upon all kinds and classes of colours and pigments therein contained—for never will his time, I am convinced, be better expended. Returning to my subject, and looking upon it as a pigment in use to some extent at the present time, I find, in George Rowney & Co.'s catalogue, that four qualities of genuine ultramarine blue are therein quoted, ranging from £3 3s. up to £7 17s. 6d. *per ounce.*

Notwithstanding this fabulously priced article has little relationship to house-painters' pigments, I venture to think that the above brief *résumé* of the real and original blue will not be without interest to my brother-workers in paint.

French and *German*, or factitious *Ultramarine*, is, however, a commodity that most painters are familiar with. It is prepared artificially in a great number of qualities, and retailed, consequently, at an equal variety of prices. It is always sold in the form of a fine powder, at prices ranging from 1s. 6d. to 3s. 6d. per lb. for house-painters' use. It is a most useful pigment, possessing much purity and brilliancy, is permanent, and can be mixed with either oil or distemper paints.

Coming next in order of usefulness we have *Lime Blue*, a cheap powder of somewhat similar colour to ultramarine, but far less pure and strong as a stainer. As its name implies, it is useful only for mixing with water preparations of chalk-lime or whiting (carbonate of lime), and is much used by the paper stainer for cheap goods. It is practically useless for oil paint. A fair quality should be retailed at 6d. per lb.

Prussian Blue is one of our most useful pigments, and is a chemical preparation derived from a mixture of iron and potassium salts of the compound cyanides of iron; or, to put it more simply for the ordinary worker—a combination of Prussic acid, iron, and alumina. It is a blue of much beauty and strength, not quite so pure as ultra, but possessing a slight tinge of green, which, however, makes it none the less useful and beautiful for the painter's use. Some authoritative writers on the subject credit Prussian blue with the property of fluctuating—losing and gaining colour—according to the preponderance of oxygen in the air. Although I do not question their conclusions, the experience of many years' use under all ordinary conditions gives me perfect confidence in its general reliability for oil painting. It gives very fine tints of blue in admixture with white lead; added to black, in small quantities, it makes that neutral appear still more black and intense; whilst its brilliancy and transparency make it very useful for glazing over metals—gold and silver leaf—a process so much used at the present time in decorating Lincrusta-Walton, Tynecastle tapestry, Anaglypta, and suchlike modern relief wall-hangings. Some notion of the strength of Prussian blue as a staining pigment may be gathered from the fact that ½ oz. ground in oil would stain, say, 20 lb. of white lead paint to a decided light blue. It is seldom used in water or distemper painting, as it does not show the same qualities of brilliancy and permanence as when used in oil. Its price is about that of good French ultramarine: it is always sold ground in oil or water, being too hard for the worker to grind or mix it himself from its raw state.

Cobalt Blue is a pigment seldom used by house painters, being about three times as costly as the two last mentioned. It is second only to genuine ultramarine for beauty and purity of colour, and is much favoured for using as a sky blue, both in oil and water painting. It is not, however, nearly so strong a stainer as Prussian blue, but is thoroughly permanent and reliable in oil and water.

Antwerp Blue is a very similar preparation, both of source and qualities, to Prussian blue; used as an oil glaze it is somewhat brighter and greener, but it is neither so intense or so permanent as the latter, either in oil or water.

Indigo Blue is an ancient pigment of the nature of a dye, obtained from herbaceous plants which grow in India and other hot countries, and is usually sold dry in the form of little knobs. The finest comes from Bengal, and the annual value of the total quantity imported into this country is given by one authority at £4,000,000. In its colour qualities and appearance it somewhat resembles Prussian blue, but it is very inferior to that pigment for oil painting. It is for water-colour purposes that indigo is invaluable. It is one of the most useful pigments for distemper tints that we have, and is just as permanent in water as it is unreliable in oil—that is, if good and pure indigo is used. The price, however, prevents its use to any great extent in house painting, being about four times as expensive as French ultramarine.

Blue Verditer, a preparation of copper, is a very pure and pretty light blue. As it is serviceable only in water, and is not thoroughly permanent, its use is chiefly confined to the paper-stainers.

This list of blue pigments is, I think, comprehensive enough for all ordinary, and more than ordinary, requirements of the trade; we will, therefore, now turn our attention to those at the bottom of the scale, viz., the neutral blacks.

Ivory Black is at once the purest and blackest of all black pigments. Its name is derived from the supposition that it is, or was at one time, produced from burning ivory. The ordinary ivory black, however, is prepared by charring bones, in closed vessels, by a very strong heat. It is most often termed "drop black," and this by reason of its being usually sold in the form of drops, or knobs, when in its dry state. It is a very strong stainer in either oil or water, but it is most invaluable ground in turpentine, for producing flat or "dead" black paint, for various purposes. Its price retail is about 1s. per lb.

Lamp Black is, as its name implies, carbon given by the soot from resinous or oily flames, and is obtained for commercial purposes from factories where the preparation of turpentine and tar is carried on. It is a good black, but not so intense as "ivory," being more of the colour of Indian ink. It is very useful in either oil or water, and is quite permanent.

Vegetable Black is a similar article obtained, I believe, by burning vegetation. It is wonderfully light, and therefore rather troublesome to mix and handle.

Black Paint, as it is usually termed, is a preparation of these common blacks, but is ground in linseed oil to the form of a thick paste, very useful for common painting.

Blue Black, as its name suggests, is a pigment of a blue hue of black. Its source is charcoal, and its blue tone results from the thorough burning and levigation it goes through, as well as being due to the wood used in the first instance. It is very serviceable as a water-colour pigment, and is indispensable to distemper work generally. Although it is not much used—that is, the finer kinds—as an oil stainer, it is, nevertheless, useful and reliable as such; its price is about 3d. per lb. retail, for the ordinary dry colour, up to 1s. 6d. for the finest qualities, in oil.

Besides these artificial or burnt blacks, there are occasionally to be met with earth blacks, in the West of England and Wales, as well as black chalk, in their native condition. Generally speaking, they are not very pure in colour, nor do they exist in sufficient quantities to warrant my considering them herein as ordinary black pigments. *Black Lead* is a form of native pigment we all are familiar with, but, notwithstanding it possesses certain estimable qualities of permanence and purity, we seldom look upon it in the light of a painter's pigment.

BLOWPIPES AND BOBS.

BY GEORGE EDWINSON BONNEY.

Blowpipe.—A blowpipe of some sort is a necessary tool in an electro-plater's equipment. The mouth blowpipe has a wide range of usefulness as a soldering tool and as an instrument in the laboratory. An ordinary plumber's or tinman's blowpipe made of brass, and costing from 6d. to 8d., will serve every purpose. This is improved by having a few inches of the mouthpiece silver-plated. For the heavier work of hard soldering, brazing, and smelting small quantities of metals in the laboratory, no better tool can be found than the gas blowpipe made by Fletcher, of Warrington, when worked with one of his foot blowers.

Bluestone.—The name given to copper sulphate on account of its likeness to lumps of blue stone. See *Copper Sulphate.*

Bobs.—These are small wheels made up of discs of leather and other materials fastened together. When placed on the spindle of a polishing lathe and caused to revolve, they are used for abrading and polishing goods to be plated. Bobs are made of thick walrus or hippopotamus leather, or of bull-hide, or of other tough leather, and are then used with Trent sand or glasscutter's sand. For finer work they are made of felt, fustian, or other tough soft textile material, and used with fine sand or some other abrading or polishing material. See note on *Polishing.*

A COMBINED PORTFOLIO STAND AND DOUBLE MUSIC STAND.

BY JAMES SCOTT.

I THINK that the article shown in the accompanying drawings would make a useful piece of furniture for the drawing-room.

As will be seen, it answers the purpose of a portfolio stand, where the music can be stowed when not required, and a double or single music stand.

Being used as a double stand, all the portfolios (required or not required) will have to be taken out for the time being ; but he who has a soul inspired for music will hardly be the one to grumble at this.

As it can be adjusted to any height, this will be found of great convenience, for the musician can then either sit or stand ; moreover, supposing his better (or worse ?) half should have a soul similarly inspired to his own, she can sit or stand opposite to him, at the other half of the stand. But whether they both agree or disagree to play the same tune, there is one thing they must both agree upon, and that is either to sit or stand together. If the one half should feel disposed to stand, and the other half feel disposed to sit, I trust they will both forgive me, for although I suppose it would not be an impossibility to satisfy them both at once, still, I have done as well as I can for the present.

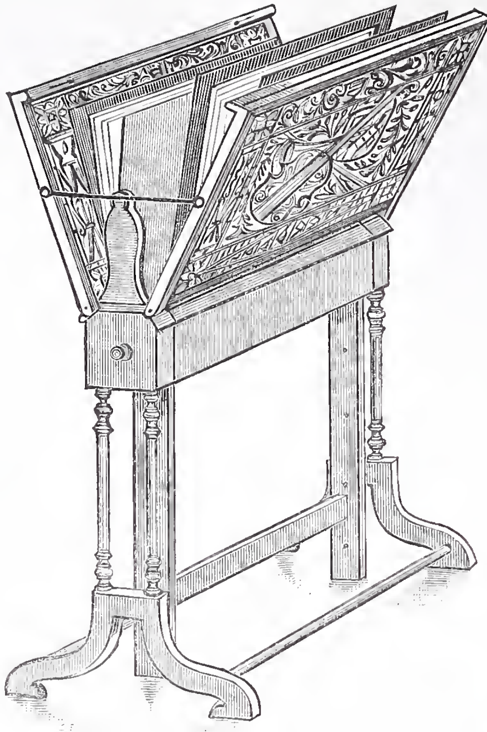


Fig. 1.—Stand with Frames up, adapted to receive Portfolio.

Fig. 2.—Stand lowered with Frames down.

It is customary, when giving a drawing, to describe it in a written article, but although some men—and they are generally professional workmen—say that they do not see the necessity of doing so, it will most always be found that an admirer of any particular design feels an interest in reading about it, although, perhaps, the drawing may sufficiently explain the working of the article.

To furnish a description, then, must be my task.

I will not advise any particular wood for it to be made in, as that must be a matter of choice.

Our blocks at each end must be 4 in. wide, 4 in. high, and 2 in. thick, with a hole bored through the centre of each, to admit the movable peg, which should be about 4 in. long, including the knob.

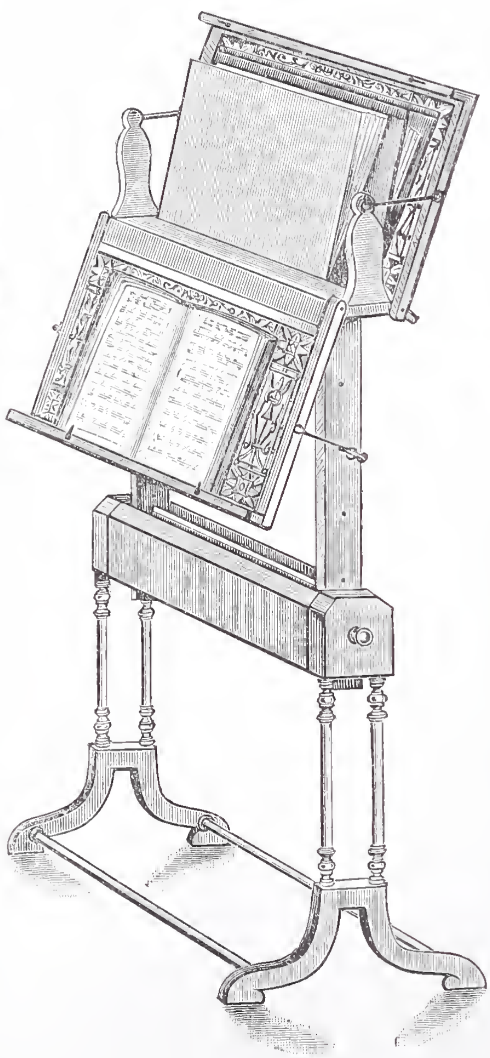


Fig. 4.—Stand with one Frame down as Music Stand, and one Frame up as Music Portfolio.

The turned columns can be obtained at almost any turner's, the four upright ones being 18 in. long, and the two stretchers $12\frac{1}{2}$ in. These must be carefully fitted to the blocks and feet, otherwise, the job will become rickety in a very short time. A word or two as to fixing these columns will not be out of the way, as it is very probable—taking into consideration the numerous letters I have lately read in "Shop"—that there are among my readers several amateurs.

Drill a hole exactly in the centre of the column, place a little sawdust, or other dust, into it, and, after turning the block upside down, place the column in its position, and give the other end a tap; this will cause the dust to be left in precisely the spot where the hole must be drilled. Then have a rounded piece of wood, one half its length, glued into the column, and the other half into the block. Proceed the same with the stretchers and feet, getting them together first. I believe this plan is about the best one to adopt in order to secure strength. Of course, the fixing of the pillars should be left until the top part, with the block at each end, is fastened together.

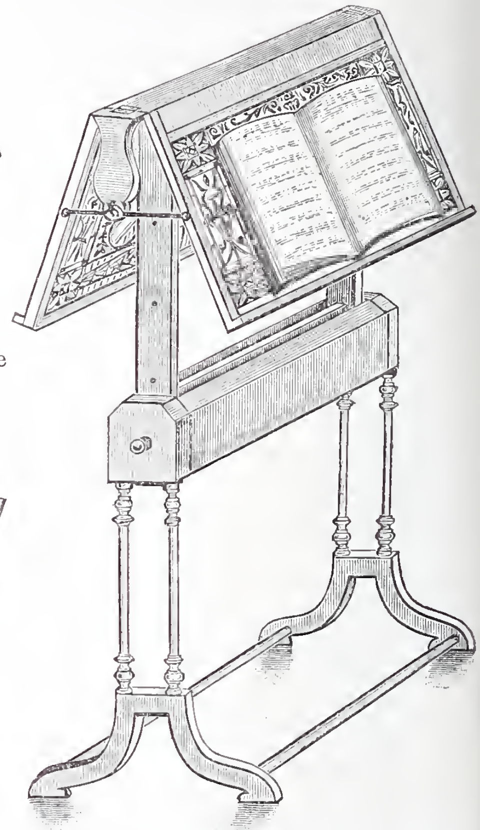


Fig. 3.—Stand raised and in position as Double Music Stand.

Two pieces of wood 12 in. long, 4 in. deep, and $\frac{3}{4}$ in. thick, should be joined to the blocks as shown in Figs. 1, 2, 3, and 4, so as to allow space for the under framework of the movable part to work in. Cut the outside edges off diagonally for $\frac{3}{4}$ in.

Next we have to deal with the bottom part on to which the music frames are fastened. The centre piece of wood should be 16 in. long, $3\frac{1}{2}$ in. wide, and $\frac{1}{2}$ in. thick ; the two outside pieces should be the same length, same thickness, and $1\frac{1}{2}$ in. wide. Round off the outside edges of the two side pieces, and after having canted the two edges of the centre piece, sufficiently fasten the three together.

Our frames must be made of stuff ½ in. thick and 1 in. wide. Each frame will consist of two pieces 18 in. long; and two pieces 14 in. long. The rail which is fastened on the bottom part of the frames is fixed at about 1½ in. from the end of the side rails, to allow for the free movement. Then glue a strip of wood along the edges so as to hold the music. When the frames are ready, fasten them on to the bottom piece at the sides by means of stout pins, so that they will work freely up and down.

The under framework needs little commenting upon; the two side rails must be 30½ in. long, and 2½ in. wide, and ½ in. thick. The cross rail must be a little stouter, the same width, and 12 in. long. These are the lengths before they are joined together.

In shaping out the feet I should advise the amateur to proceed upon the admirable plan suggested by "O. B." in No. 14, page 209. I have drawn my diagrams of the feet and shaped wood to 6-in. scale, so that it is only necessary to enlarge the squares to double their present size.

The squaring method should be practised more than it is, as it is in every respect an excellent plan for reducing or enlarging either pictures or diagrams. Every professional workman should use this mode of procedure in making full-size working drawings from drawings to scale. It saves a great deal of trouble in determining measurements corresponding to those in the original.

I recollect once reducing in this way one of the double-page illustrations in the *Graphic*, of the well-known picture of the elephant demolishing the toll-gate, to about one-eighth the size.

It will be seen that in Fig. 4 I have shown one frame up with the portfolios still resting against it, and the other frame down as a music stand. I think it will be found that the feet are wide enough to prevent the whole affair from toppling over when in this position, provided the portfolios are neither too large or heavy.

With regard to the hooks, if the holes in the upright rails are bored at short distances apart, a long peg can be placed in one at each side to hold them.

When used as a double stand, if it is found that the hooks when linked together do not keep the frames sufficiently firm, and the peg and hole arrangement is not admired, I should advise the shaped piece of wood to be hinged (not glued) to the bottom part; it will then fall down, and can receive the hooks in the same manner as when up, if a peg is fastened on both sides. The fixing of this piece of wood should be left until all the rest is put together. It should be about 8 in. long, by 3 in. at its widest part (see Fig. 6).

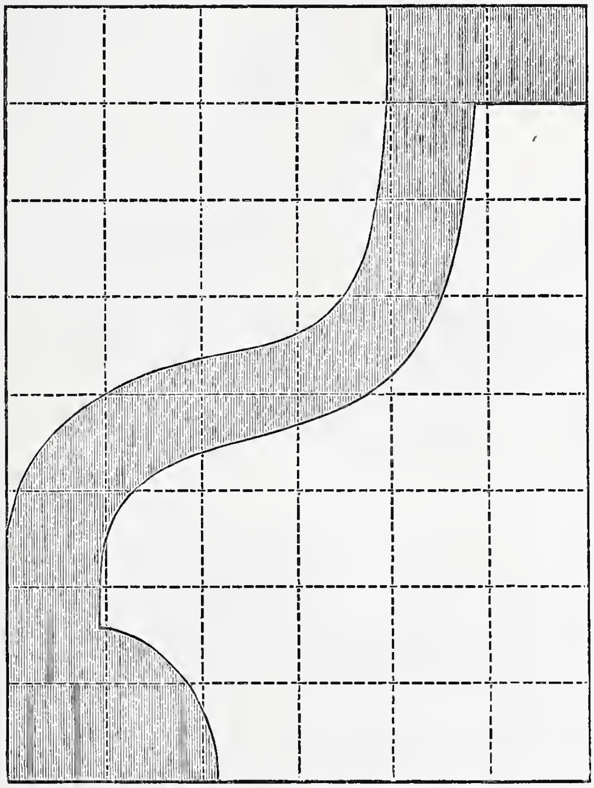


Fig. 5.

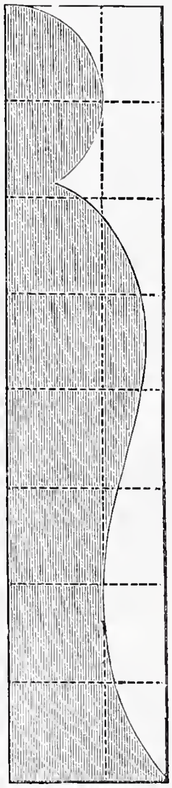


Fig. 6.

Fig. 7.

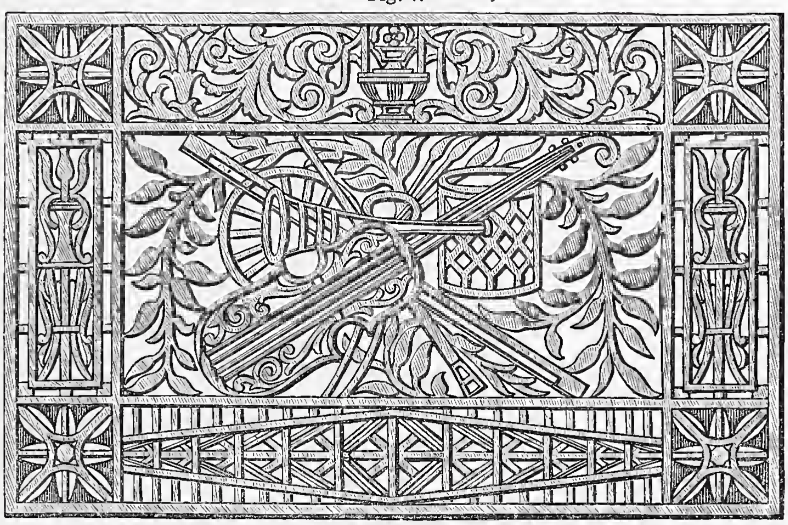


Fig. 5.—Pattern of Feet drawn to Half-inch Scale. Fig. 6.—Pattern of Shaped Upright carrying Hooks, Half-inch Scale. Fig. 7.—Design for Fretwork to drop into External Framing, Quarter-inch Scale.

I must leave the choosing of the lengths of these hooks to the maker, as he can then have the frames to rest at the angle he considers best.

Perhaps it would be best to have the hooks fastened on to the inside of the frame (not on to the outside, as I have shown), cutting away the fretwork to admit them. If this is done, the shaped piece of wood will keep its upright position, supposing it is merely hinged, whereas, otherwise, it would be at a slight angle.

For the hooks to hold the music in its place, read the instructions given by "O. B." lately, or else obtain four pieces of flat iron or brass, 3 in. long, bend the end of each at right angles for an inch, and file it round. They are then ready to fasten in.

I have drawn the fretwork to 3-in. scale; if the cutting of this is above the amateur, any fret cutter would do it for him: or if he did not like the design, and I confess there is nothing particularly new about it, as I have given my attention mainly to the job collectively, he might be able to choose a different pattern from the fret cutter's.

It will perhaps be observed that my drawings represent the article rather wider than it would be if made according to my measurements, but I think that if my description is followed out it will make as conveniently proportioned an article as possible. What I have said with regard to the enlargement of the parts shown in Figs. 5 and 6 applies equally in principle to the enlargement of the design for fretwork to drop into external framing, shown in Fig. 7, which is drawn to a scale of three inches to the foot, called also one-fourth scale, or quarter-inch scale. I have directed the attention of the reader to this pattern, and have said that he may, if he prefer to do so, substitute another pattern for it; this, however, must be in accordance with the size of our design, which, when enlarged into full size, is 16 in. by 10 in. To effect the enlargement, all that the fret-worker has to do is to make a fine tracing of the design, and divide this into squares, half an inch or a quarter of an inch apart, according to his pleasure, the smaller squares being used when the draughtsman has not sufficient confidence in his own skill and powers of reproduction to resort to the use of the larger squares. The reason for this will be apparent when I remind the reader that in the enlargement according to division into half-inch squares, the squares on the full-size drawing would be two-inch squares; but that, if the division of the design be effected by quarter-inch squares, the corresponding divisions on the full-size drawing would be one-inch squares. I have not penned these remarks for the guidance of professional workmen, but for amateurs and any who may find difficulty—and I believe there are many who do so—in working from drawings done to scale and requiring proportional enlargement.

MEANS, MODES, AND METHODS.

KORSHŪNOFF'S PINCE-NEZ SPECTACLES.

OF spectacles, so necessary to many people, the annoyance of their being always more or less wrong in their adjustment is trying and tiring. The Pince-nez is popular from the ready application of the bow-spring holding them on the nose, but in very many cases the plane of the glasses is not truly parallel with the plane of the eye surface; or, in other words, at right angles to the line of vision directed through the glasses. Figs. 1 and 2 show the difference of the planes, which so much depends on the formation of the nose. It is obvious that the plane of the glasses should be adjusted to the orbit of vision independent of the accidental formation of the nasal bones chancing to hold the spring grip of the glass frames rightly. M. Korshūnoff, a Russian engineer resident at Rue Chazelles, Paris, has patented spectacle frames by which their grip on the nose is entirely independent of the plane surfaces of the lens frame, as will be seen by sketches, Figs. 3 and 4.

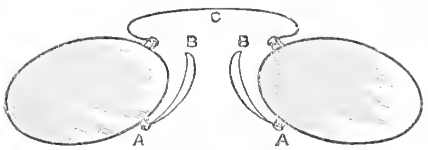


Fig. 3.

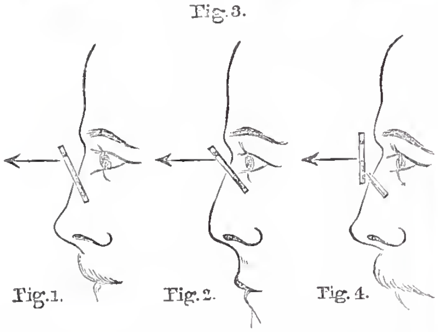


Fig. 1. Fig. 2. Fig. 4.

Figs. 1 and 2.—Difference of Planes of Glasses caused by form of Nose. Fig. 3.—Korshūnoff's Pince-Nez. Fig. 4.—Diagram showing Adjustment of Glasses to the Proper Plane of Vision.

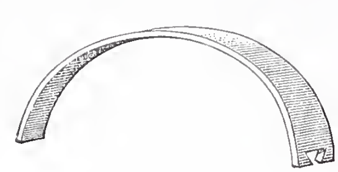
Fig. 3 is a Pince-nez with the usual connecting bow-spring, C, and two spring nose-grips fixed at the lower inside edges of the frame on studs, A, A, which admit of these grips being turned radially on the studs to suit the most fitting position on the nose, and adjust the glasses to the proper plane of vision, as shown by Fig. 4. The mechanical advantages may now be considered; here are three spring grips on the nose, instead of only one, making the "seating" more secure without so much pressure.

This invention was the only new thing I found in this class of goods at the Exposition Universelle, and a busy trade was being done in them, and also fitting to purchasers' own glasses where desired or necessary.—J. C. K.

A HANDY FILE-HOLDER.

The peep into a mate's tool-chest while he is showing his various tools is always interesting to me, and to show mine is often equally interesting to him, and sometimes evokes the remark, "I wish I had had such a tool, what time and trouble it would have saved me!" This was the remark upon showing a "file grip" which was new to him and his shopmates, and not having seen it in any other shop it may be new to some of your readers. Its use will be obvious by the sketch, showing how the whole length of the file may be used with considerable power with such hand-piece, while a handle would be in the way of using the heel of the file.

It is a bit of round iron bent to a hard-cornered curve about 5 in. long and 3 in. high; one end is made larger than the other, and a deep notch filed in it. This grips the "tang" of the file, which at that part is made slightly dovetailed in form, as shown in the illustration at A—a section of a tang. The notch corresponding is slipped on to the tang of the file, and the other end takes a pressure, bearing only on the top side of the file.—J. C. K.



Handy File-Holder. A

OUR GUIDE TO GOOD THINGS.

** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

102.—GRANT'S GAS LIGHT REFLECTOR.

THE handy little article known as "Grant's Gas Light Reflector," made and supplied by Mr. J. T. Grant, Recreation Street, Bolton, is a useful appliance so made that it can be fixed on any gas-burner in a few seconds, and used for the purpose of reflecting and directing the light of the jet of flame issuing from the burner in any direction. Of course it will be understood that it is only intended to be used when there is a glimmer of gas, so to speak, proceeding from the slit or holes in the burner, as the case may be, and not when the gas is turned on to its fullest extent, and the flame, consequently, at its brightest. It is very simple in its construction. A band of metal $\frac{1}{2}$ in. in width is bent into the form of a circle just about 2 in. in diameter, the ends of the band being bent outwards and brought together so as to form a short arm about $\frac{1}{2}$ in. long projecting from the ring of metal already described. Before the band is bent, as described, an indentation is made lengthways along its central line, and this is utilised to receive and hold the edge of a small concave mirror, made apparently of copper and silvered. As soon as the metal ring has been brought round the reflector, two pieces of sheet metal, so cut that the ends, though parallel, are not in the same straight line, but have the connecting piece inclined to each at an angle of about 135°, are attached by means of a brass eye to the projecting part of the band, and on this eye, or hinge, the reflector can be turned upward towards the light, or turned back from it, as may be found necessary. The ends of this portion of the reflector are bent each towards the other in the form of an arc, thus being constituted a kind of clip to grasp the burner. The chief object with regard to its use as a reflector is to afford means of throwing a strong light upon the dial of a watch or clock placed at a distance of 8 or 9 feet, the rest of the room remaining in comparative darkness. This renders the reflector an article that should be prized by householders, artisans, night nurses, and others who may wish to note the progress of time as the hours run by, either through the long night or in dark winter mornings, and for the same reason it will be found useful by invalids or the wakeful. When the reflector is not in use, it may be bent back, as already said, without removing it from the burner. By attaching the reflector to a small stand, it may be made available for a small lamp. Its price is 1s.

103.—THE CLOCK JOBBER'S HANDY BOOK.

This volume forms the seventh of the series known as Lockwood's "Handy Books for Handicrafts," written by Mr. Paul N. Hasluck, as good a guide in all matters pertaining to mechanics and practical work as any man without experience, or with but a little experience, could possibly wish to have. "The Clock Jobber's Handy Book" is a practical manual on cleaning, repairing, and adjusting clocks and watches, and it embraces information on the various tools, materials, appliances, and processes employed in clockwork. It is illustrated with upwards of one hundred engravings, chiefly devoted to the illustration of tools, and the parts and mechanism of clocks and watches. It forms, in fact, a suitable and, it may almost be said, an indispensable companion to Mr. Hasluck's "Handy Book on Watch Jobbing," which also forms one of the series to which the volume now under consideration belongs. "The tools requisite for clock cleaning and simple repairing," says Mr. Hasluck, "are few and inexpensive, and but a small amount of practice will give the necessary manipulative skill. Thus clock jobbing offers an occupation easily acquired by those who have aptitude for mechanical subjects." To this it may be added that, in the eight chapters of which his book is composed, Mr. Hasluck gives sufficient information, clearly written and careful in detail, to pilot the way to successful operations on the part of those who may betake themselves to clock jobbing, either for gain or for amusement, under its guidance.

I have said that the subject matter of the volume is divided into eight chapters, and it may be useful to intending purchasers to show to what part of the subject each of these chapters is devoted. In the first, various forms of clocks are described; in the second, pendulums are considered as the controllers of the velocity of the going trains of clocks, and their regulation, and the various forms of pendulums in use are mentioned; thirdly, the escapements commonly used are noticed; and in the fourth chapter the attention of the reader is drawn to De Wyck's, German, and house clocks; in the fifth, the mode of examining and cleaning an eight-day clock is described; and in the sixth, the minutiæ and manner of repairing are carefully gone through; in the seventh, the treatment of French timepieces is taken up; and in the eighth and last, lathes and turning appliances used by and useful to clock jobbers are reviewed. The price of this useful, well written, and well illustrated volume is 2s.

104.—DYSON'S BEDCLOTHES HOLDER.

It often happens, especially with children, that by their restless movements they will throw off the bedclothes that cover them, especially during the continuance of illness, and that colds in the one case and chills in the other are the inevitable consequences. To prevent this throwing off of the clothes, Mr. Alfred Dyson, 21, Till Street, Bury, has invented a very simple contrivance, which he calls a Bedclothes Holder. This consists of a piece of cord, very much like a piece of thin blind cord, with a wooden button about $1\frac{1}{2}$ in. in diameter at one end, and a piece of wire bent into a fiddle-like form at the other. A loop is made in the middle of the cord, which is used to secure the appliance to the bedpost or rail at the bed-head. The button is then put under the clothes, and the clothes and button are thrust in a little lump through the broad part of the wire loop, and pulled down into the narrow part of the loop, by which clothes and button are securely held. The holder only costs 2d., and is well worth having.

THE EDITOR.

SHOP:

ɩ CORNER FOR THOSE WHO WANT TO TALK IT.

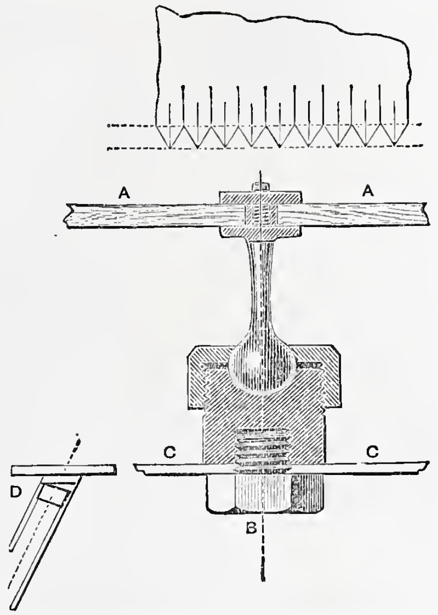
* NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Remedy for Severe Cuts: Treatment of ·ruises.—(WORK No. 26, page 411).—MEDICUS ·rites:—"I have been a subscriber to your valuable [agazine, WORK, since it started, and must thank ou very much for the pleasure it has given me. I ave followed with great interest most of its very seful and practical articles, being extremely fond f mechanical as well as of my professional occuation. I certainly think short paragraphs about ow to treat the various little accidents to which very workman is liable, and from some of which ıost will have at times suffered, cannot fail to be f great use. But I should at least hope that these ·ould be correct, and not likely to do more harm ıan good, or to put impossibilities down as facts. 'o begin with, a saw-cut wound would never heal uickly or without suppuration under the treatment ou advise, and it is simply impossible for a finger ut off by a saw to be again united to the hand by ny means whatever. A stiff-jointed finger is ften more than useless to a workman, as it conantly gets in the way, and is therefore more likely) be injured again. I have amputated several ntirely at the patient's own request alone for this eason. In the treatment of bruises the great thing ; to arrest the extravasation of blood, and to keep hat which is already extravasated from suppurang or turning into an abscess. This is generally one by rest, cold, or the application of some oothing astringent or absorbent lotion, and above ll to keep the skin over the bruise whole, as once roken it is almost sure to suppurate. In your reatment you advise rubbing with a hot irritant r the application of leeches, which would probably ust do the harm which is to be guarded against. hope I have not spoken too strongly, but I write his trusting you will be rather more careful in the uture to obtain accurate information."—[The VRITER of the notes entitled as above in "Means, fodes, and Methods" replies as follows to IEDICUS]:—"As to 'saw cuts,' with forty years' xperience, I know they would heal quickly by the ıeans proposed. Of course there would be suppuation; it is essential to eliminate the disorganised issues. As to turpentine, its application is so eneral in railway and other shops that it is esirable its service in emergencies should be nown to all. A finger cut off and replaced at once vill grow, as I know from having seen only ecently an instance. A foreman at a large sawıill was my informant respecting other instances. Bruises may be variously treated as suggested by he writer. Three ways are named. Turpentine s an absorbent. All are good, but for an emerency and generally, turpentine is the best I know f ready to hand. Many others, as arnica, might e named. In bad cases leeches are so important hat the skin being opened for the blood to escape s far less serious than allowing it to remain and be bsorbed into the system. I speak with confidence rom more than forty years' experience of bruises, nd serious ones, some to myself and family and riends, to whom the application of turpentine was he best remedy, and leeches saved from glandular nflammation and its attendant evils. I seek to erve those who suffer harm that may be alleviated romptly, and am convinced of its efficacy by many ıundred cases having passed under my notice. Let those who have been harmed by it speak; let hose who think differently advance something etter. I, as well as your readers, will be thankful. Guessing as to probable results is not an answer to acts."—[Although it seems unlikely that a severed inger would be reunited to the hand from which it had been cut, I judged it as well to permit the notes o which MEDICUS takes exception to appear. I nyself have known a case where the top of the humb was cut off, bound on again, and reunited, out in this there was no severance of bone. I have reserved MEDICUS'S letter until the reply from the WRITER of the notes in "Means, Modes, and Methods" could appear, and I now give letter and rejoinder together.—ED.]

Stencil Patterns.—MR. G. JONES (*East Cowes, Isle of Wight*), whose excellent stencil patterns were noticed in No. 27 (page 427) of WORK, writes:—"I should like it made known to the readers of WORK that instead of a small book of miniature designs, I send to intending purchasers, post free, a roll of full-sized designs, about 400, and price list per dozen, for selection; and if required I also send samples of cut stencils on approval, unless the selection is left to my judgment, when I do my best to give every purchaser satisfaction, and am quite willing to refund money if stencils are not approved."

Bicycle Camera Stand.—J. A. (*Liverpool*) writes:—"Seeing in your paper, WORK, an article on 'Camera Stands,' etc., I would like to bring to the notice of your numerous readers the stand which I have had made lately for myself. It consists of three legs, each of three pieces of thin brass tube, ⅝ in., ½ in., and ⅜ in. diameter by 15 in. long (connected when together by means of brass diminishers, but when not in use for the stand, they telescope into one another), screwed on to nipples soldered on at the right angle to a circular brass plate. The camera itself is fixed to an apparatus



Bicycle Camera Stand—A, Camera Bottom; B, Hexagon Nut; C, Brass Top Plate; D, Leg on top.

with a ball joint, secured when required by a hexagon nut, which is fastened on to the top by means of a tap bolt, as per sketch above. Thus, when the tripod is once fixed, the ball joint can be adjusted in any direction. I have found the apparatus for the camera very handy when mounted on the head screw of my bicycle by means of a stud screwed into it, and as for the stand, it is by far the stiffest and most substantial I have seen, and in addition is comparatively light."

Signboards, Construction of.—W. S. (*Goole*) writes:—"I think the writer of the article on signboards in No. 30 of WORK must have very little knowledge of the subject, and that his ideas of what a signboard should be are entirely and altogether misleading. I have made many signboards in my time, and have painted and written many more, being a sign painter for fifty years, and during that time have never, in my recollection, seen an oak one nor a pitch-pine one. These, I consider, are, especially the latter, the very worst woods of which to make signs. The best wood is good old yellow pine, or, if that cannot be had, any old, dead, well-seasoned white-wood. Why, if your sign were of pitch-pine, you could not keep the paint on it a single week if it were exposed to the sun. The resin would, especially if the board be painted black, liquefy and push off the paint. The cost of mahogany stands in the way of its general adoption, or else this is far superior to even pine. I have recently made one of Honduras mahogany, 17 ft. 6 in. by 2 ft. 2 in., in one piece. It had not a blemish of any description, and the price of the board at the timber yard was 26s. This board will 'stand' for generations. The thickness recommended by your correspondent is out of all reason. My boards I make of ½ in. and ¾ in. stuff—the thinner the better if properly made—and the way to make is as follows:—Place battens about 3 ft. apart, and do not screw or nail them to the board, but rebate the edges and fix loosely with buttons screwed, not too tightly, to the board. This plan will allow for expansion and contraction of the board. Leave the battens a trifle shorter than the width of board so that the cappings will not push off on contraction. Caps, mouldings, etc., I need not notice, as any skilled maker will know all about them. And now about jointing. Never use glue on a sign—use paint instead. If I have a board to joint, I prefer, instead of groove and tongue, a smooth or, as we Yorkshiremen call it, a slope joint with iron dowels. Let all battens, mouldings, caps, etc., be well painted before they are put together. Glue is a terrible enemy to all outside woodwork; its affinity for moisture keeps the parts always wet, and this is, according to long observation and experience, the sole cause of rot and decay in external woodwork. Who ever saw a door begin to decay in the middle of a panel, or a sash in the middle of a bar or frame—always at the joints? Why, the pins with which sashes are secured at the tenons slide out in damp weather of their own accord. Let me have all external woodwork put together with paint."

Subjects in WORK.—T. B. (*Portadown*) writes:—"I think your very interesting paper, WORK, must provide a long-felt want in many homes. At the same time you will pardon one who has worked with his hands on almost every sort of work from childhood, for suggesting that there are some things which it will save amateurs a vast amount of work and expense not to attempt, and which will cost an amateur even more for the materials than the finished article can be produced for. Now take, for instance, piano making. Is there a single reader of your paper likely to begin one, not to speak of the finished abortion? and will the music likely to be got from such an instrument not depopulate the unlucky neighbourhood where such an amateur may reside? In the name of common sense, give us articles that have a remote chance of application. All that kind of padding so prominent in some amateur papers on how to make a turning lathe without a lathe, how to make reflecting telescopes out of bullseyes and lids of tin cans, should be carefully excluded from WORK. There is a big future for your paper if the articles are written to suit the demand, and your subscriber wishes it well."—[WORK is for professionals as well as amateurs. It is not possible for me to cut down the list of subjects to be treated to those which an ordinary amateur workman may be disposed to undertake. It is quite possible for an amateur to make a piano, and a good one too. Men who make such things look rather to the end to be achieved and the pride of having done so rather than the expense to be incurred. I have known amateurs make good violins, and dispose of them at a remunerative price. It is possible to make a turning lathe without a lathe—namely, by rigging up a temporary substitute for one. I have never yet recommended the manufacture of reflecting telescopes out of bullseyes and lids of tin cans in this or any other publication, and I never shall. Lastly, the greater part of the papers that appear in WORK are written to demand. The difficulty is to satisfy popular craving.—ED.]

A "Multum in Parvo" Querist.—YOUNG APPRENTICE (*London, N.*) asks:—"(1) Can you answer the following questions:—(2) How to case-harden, clean and properly? (3) Should like to have a few more hints on cycle repairs and manufacture. (4) How to make a spoke-cutter? (5) The correct way to braze? (6) How can you calculate gearing? (7) Can you tell me a good book on engineering, or where I can learn it in London? (8) Where to get a good tire cement in a large quantity? (9) How to get a good enamel without baking? (10) What do you think will be the go in machines next season? I have taken in WORK for some time now, and am highly pleased with it."—[Ten questions on one piece of paper, and, metaphorically speaking, all in one breath! Please re-write each question on a separate piece of paper, and then you will put it in my power to send each to the member of my staff who may be best able to answer it. You need not repeat the first and last questions. As to No. 1, I may at once reply, "Yes;" and to No. 10, I do not think anything at all about it, as I am not aware that any season sees a decided run on any particular class of machine.—ED.]

The New Water Glue.—F. C. W. (*Bradford*) writes:—"As you have said you would like to have the experience of subscribers who have used the new water glue, I beg to say I have used it a good deal for all sorts of work, and find it exceedingly valuable; for the smaller joints in cabinet work it cannot be surpassed, as it makes a perfect joint. This is the best liquid glue I have seen, and it has the valuable property of being waterproof in addition."

Combination Bedroom Suite.—T. B. R. (*Hull*) writes:—"Being a great admirer of WORK, and an amateur woodworker myself, I should like to make, with your kind permission, a few criticisms and observations upon the 'Combination Bedroom Suite,' by Mr. Scott, in No. 26 of WORK. I hope Mr. Scott will not be offended by my remarks, as I admire his ingenuity in his contrivance. My first objection to the suite is the unsightly appearance the wardrobe door would present when closed, it having to be binged on the outside, thus showing an ugly angular strip the whole length of the door. The projection at the back of the looking-glass is also unsightly. Now what I would suggest as improvements are that the wash-hand basin should be fitted in a drawer in the compartment where the soap dish, etc., are shown—it would thus be out of the way, and not show when not in use. There would also be room in the angles of the drawer for soap dish and brush tray. This arrangement would do away with the door having to open at the side, and I would suggest that the wardrobe closet be made 10 in. or 12 in. wider, and the door open in the front and have a looking-glass panel. If this were done it would do away with the looking-glass shown by Mr. Scott, the fastening for which is so high up (6 ft.) that many people would have difficulty in opening it. The three cupboards at top might then be formed into two, and would be infinitely more useful than at present arranged. The cupboard and drawer at the base should both open in the front, and be either two drawers or two closets of equal length, and if made a little higher one of them might hold the water jug or other utensils used to contain water, and the other necessary conveniences of a bedroom, provision for which does not appear to have been made. One other observation and I have done, and that is that the thickness of the wood used in the construction (at least of the styles of the panels) should not be less than 1 in. thick, and not ½ in. as recommended."

Band Saw Machines and Band Saws for Sweep Work, etc.—A. R. (*Scorrier Saw Mills*) writes:—"There was a time when the jigger was considered a valuable little machine for sweep work, etc.: but when compared with the band saw machine of to-day it is left in the background. A good band saw machine in a factory where an amount of sweep work is to be done cannot be too highly esteemed. I say a good machine because, as in all other things, there are good and bad. A good machine for such work I consider should be heavy, that is, the main frame should be heavy and strong, and the spindle or shaft on which the bottom wheel is keyed should be at the base of the machine; the boss of both top and bottom wheels should be heavy, and the rim of wheels light; the diameter of wheels from 36 to 42 in. for saws up to 1¼ in. wide. The wheels should run quite true, and be covered with soft leather, or, better still, with a rubber band. The top wheel should rise and fall freely as the tension of saw varies; the speed of such a machine should be from 400 to 500 revolutions per minute. The amount of work that can be turned out with a good saw, if properly worked, on such a machine is really surprising. Yet there are some foolish enough even now to prefer the jigger to the band saw; their reason is that the band saw breaks, but I think if they would take into consideration the small cost of a band saw up to 1¼-in. wide, and the amount of work it will do, the band saw would be preferred: for there was never a jigger yet invented that would do as much work in two days as can be done in one day with the band saw. Of course the band saw will break sooner or later, but with care a good saw will last longer than they often do if the machine is of good construction and properly worked. There are many reasons given why band saws break, and I cannot believe a machine has yet been made on which a band saw will run, and not break. I have heard of a saw being worked from 1 in. wide until it is reduced to less than ¼ in. without breaking; but seeing is believing; it may be so. I said above that saws may be worked much longer than they often are before they break. If I were to give all the reasons stated by makers and others why band saws do break, I think I should be encroaching on valuable space, but the following, in my opinion, are two or three of the chief reasons why they break oftener than they otherwise would, when worked on a good machine.

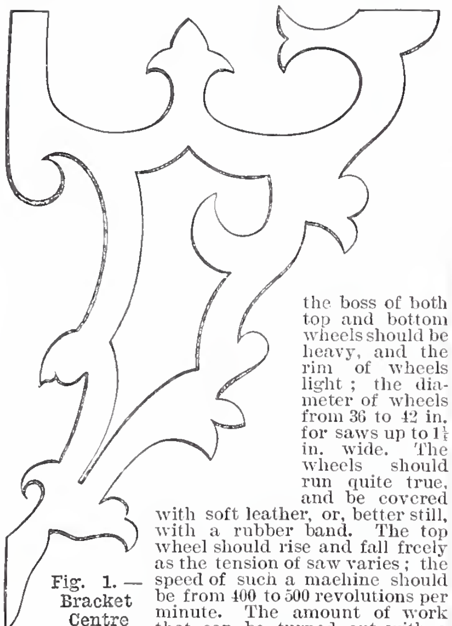


Fig. 1.—Bracket Centre Sawn out.

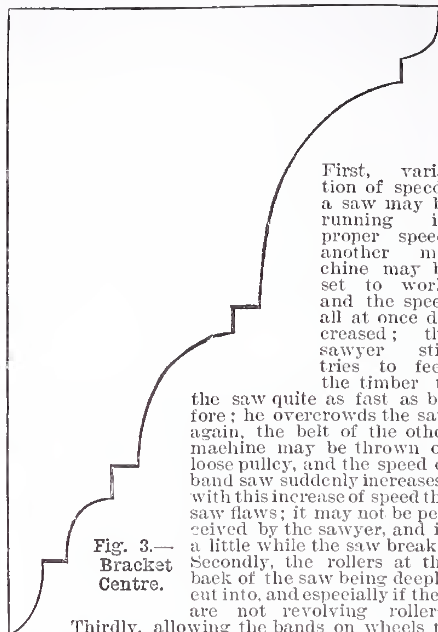


Fig. 3.—Bracket Centre.

First, variation of speed: a saw may be running its proper speed, another machine may be set to work, and the speed all at once decreased; the sawyer still tries to feed the timber to the saw quite as fast as before; he overcrowds the saw again, the belt of the other machine may be thrown on loose pulley, and the speed of band saw suddenly increases; with this increase of speed the saw flaws; it may not be perceived by the sawyer, and in a little while the saw breaks. Secondly, the rollers at the back of the saw being deeply cut into, and especially if they are not revolving rollers. Thirdly, allowing the bands on wheels to become badly worn and hard. Fourthly, overstraining the saw, which, I think, is the greatest cause of band saws breaking. I have more than once ordered half a dozen band saws which have been used chiefly in cutting felloes, shafts, etc., out of ash plank; the saws have been from one maker and ordered to a certain length; one saw has been perhaps ¼ in. longer than the others, so that it could not be strained quite as tight as the other saws; they have been all worked in turn; the five have broken and have been rebrazed and broken again, and the longer saw still has stood good and has not broken. I think this is a good reason why overstraining should be considered the chief reason of the saws breaking on a good machine. With a machine as the above, segments up to 12 in. deep may be sawn, and brackets of any pattern and of any depth up to 12 in. With ⅜ in. and ½ in. saws, we often cut bracket centres, as Figs. 1, 2, and 3, but it will be noticed that the centre of Fig. 1 has to be sawn out, which cannot be done with the band saw; in such a case, a hole or holes should be bored with centrebit, and sawn out with a small hand fret saw. If a band saw is in good working condition, a bracket when taken from the saw will require but little cleaning up: the saw will cut so clean that a little rubbing with glass paper will leave it quite smooth."

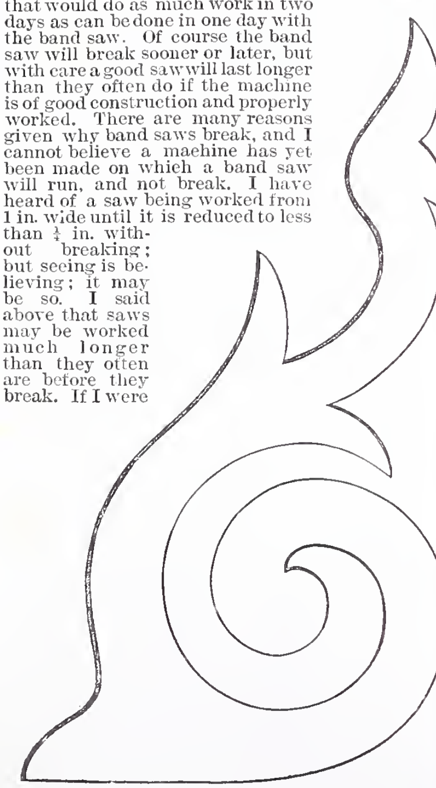
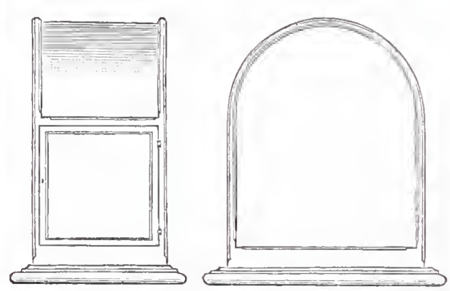


Fig. 2.—Bracket Centre.

Wardian Case. — C. S. (*Newcastle-on-Tyne*) writes in further reply to W. P. (*Southport*), (see page 301):—"Seeing a sketch for above in No. 19 of WORK, and thinking that another sketch



Wardian Case.

might be of use to some of the readers of WORK, I have enclosed one, which is a copy of a case which I fitted up for my own use. It would be best made of oak or teak. The side glass is in one piece, with small doors in each end for working the interior. It would also need a zinc tray two inches deep to form the bottom. If desirable, I would be glad to send details and full particulars for any of our readers."

Cheap Hearth for Smithing.—A. H. (*Wolverhampton*) writes:—"In reply to A. S. (*Liverpool*) (see page 414) in reference to my reply to BELLOWS (*Gloucester*) in page 302, with respect to a machine for a current of air, I beg to submit the following:—(1) In the construction of a cheap hearth for use with the machine. The hearth will be about 3 ft. high. A. S. will want some sheet iron (20 gauge is about the right thickness). Cut a circular piece o iron 2 ft. 7½ in. in diameter, then a strip (for th sides or rim of the hearth) 4 in. wide and 8 ft. long Turn up all the way round the circular piece ¾ i Rivet the long strip together first, then the bottor piece to the strip, as in Fig. 1. Then you will war four lengths of rod iron 1 in. thick. Flatten th top, and drill a hole through for riveting. The turn the flattened piece back, as in Fig 2. Do th to the four pieces (each to be 3 ft. in length). Riv these on the bottom. Connect a piece of rod iro to the four legs, as in Fig. 3. (2) The tue-iron blast pipe. If A. S. wants one for the water circulate it will be more trouble than one wi a plain nozzle. However, as he asks for the mo of constructing a tue-iron for water, I will expla it. The iron, which should be cast, is shaped as Fig. 4. A. S. had better buy one ready-made. will also be provided with the water pipes. Abo 6 in. long will be the best size for the hearth. T pipe at the top must be connected with the botto of a tank or tub, and the one at the bottom mu come up to the top of the tub. The water go down pipe A. The water becomes heated, a then the steam forces it back up pipe B into t tub again. (3) As to the fan. One 10 in. diameter would answer A. S.'s purpose; the b to be 1 ft. in diameter. The mode of working to as follows. The fly-wheel 2 ft. diameter, and t fan pulley 3 in. A the pipe from the fan; B t exhaust water pipe going over to the top of the tu C feeding water pipe; D tue-iron; E treadle: crank; G fan box; H H supports for fan; I er bar from one leg to the other. Four of these v be required."

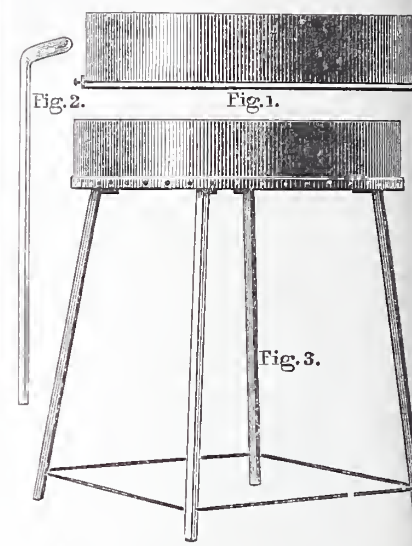


Fig. 2. Fig. 1. Fig. 3.

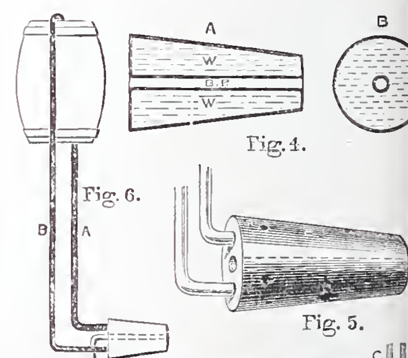


Fig. 4. Fig. 6. Fig. 5.

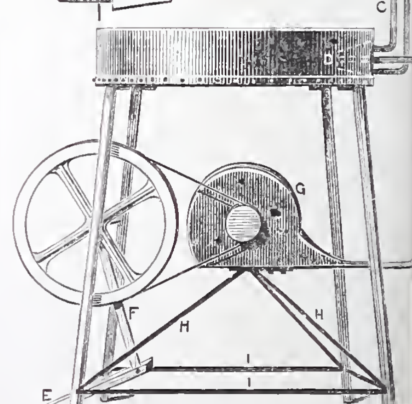


Fig. 7.

Cheap Hearth for Smithing.

Learning a Trade.—Paddy writes in reference)Excelsior's question (see page 413):—"I ean point ut the only way hy which Excelsior ean live nd learn a trade at the same time. He must get n at some good shop as painter's lahourer, and nake up his mind to be *excelsior* in the future, and c is sure to make himself a good tradesman. ;ooks are no use unless you have oeular demonstra- on at the same time, and most painters of to-day ave begun as above, though they may not have ked the discipline. At the same time, like my- elf, he can keep his eyes open on the other trades vith a view to johbing on his own account. This lso is decidedly not approved of, but every right- ninded man wants to be independent."

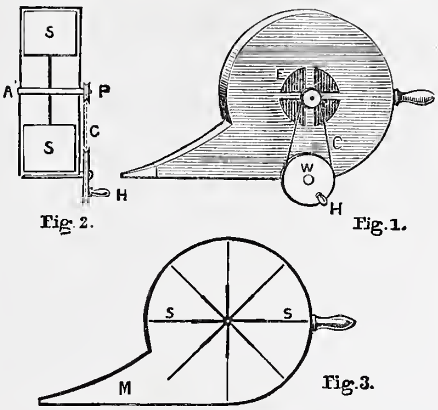
Classes in Carpentry.—B. R. C. (*East Finchley*) vrites:—"I think Amateur (*Bayswater*) (see page 2, No. 19) eould obtain, as I did, 'some elementary nowledge of carpentry' at King's Colicge. I elonged, some eight years ago, for six months, to n evening class (which, doubtless, still exists) vhich met there two evenings a week from half- ast six to nine o'clock, and there learnt to make ome eight or nine different joints, and made myself large hench and tool-box, whieh are now, after onstant use, as strong and sound as ever. The nowledge there obtained, combined with pretty onstant practice in spare moments at home, has nabled me to make in workmanlike manner a ariety of useful, strong, and ornamental articles. he fee, I believe, speaking from memory, is £2 a erm of three months. You receive, sir, so many ommendations upon the manner in whieh you onduct Work, that I will refrain from adding nine, except on one point which I have not seen eferred to yet. It is your light and dexterous touch n letting down the grumblers, as exemplified on age 309 in No. 19, in your reply to R. B. R.'s effusion; t is beautiful."

Classes in Handicraft.—F. S. (*Exeter*) writes:— 'In answer to H. N. (*Kingston-on-Thames*), allow ne to give my little experience with a night elass f drawing for working-men and youths. Having eceived mueh advantage in my trade as brass vorker through a knowledge of drawing obtained t Severn Street Night School, Birmingham, I feel t my duty to encourage others to try that art, nd show in a practieal way I mean to do so hy tarting a penny night elass for drawing, providing verything necessary. First business, to get a room, ree if possihle, with light, and at last the Rev. G. Davis, of Trinity Chureh, in this eity, allowed the ise of a room, and provided gas and firing *free.* Second, I have to obtain drawing boards, **T** squares, ompasses, rubbers, pins, paper, and pencils, with a lack-board and ehalks. These cost me at the rate f £2 15s. per dozen set. On the first night I invited ome of the students to help in the work, and right villingly was it taken up, these to eome half an hour efore time to prepare room, sharpen peneils, ete. And here let me say I only lost three pencils in three nonths. We went on so sueeessfully—increased our umbers to douhle what we started with—that I ould not admit more owing to expense of tools, tc. Only gave up the class owing to lease of remises running out. My generous donor had to ive up. I am thinking of eommencing again in he winter months, and having one night per week or repoussé brass work, if I can get some monetary elp to start. Once start, that is all you require. wish H. W. every sueeess in his work, and am villing to give any advice I can to help him in his ood work."

Model Yacht Building.—Oxygen writes:—"I ee that in the reply to G. H. (see page 269), *re* 'Model ailing vessel,' you say that the writer would natu- rally like to know the taste he has to suit. As I am n ardent model yachtsman, will you allow me to nake some suggestions? I, and probably many ther readers of Work, should like an article on he designing and building of racing model yachts, such as are sailed at Clapham and Kensington; not show models for glass eases and such purposes. Such an artiele I should suggest might be followed up by an artiele on racing model steamers, sueh as one sees in eonneetion with the Manehester Model Yacht Club. I am sure, with the aid of Work, the designing of such would become as popular among amateur meehanics in London as it appears to be n Manchester. No hobby could be more instructive in the mechanieal line, as it would eall into play both the mental and physical eapabilities of the amateur shipbuilder."

The New Waterproof Liquid Glue.—J. B. B. (*Bradford*) writes:—"Your request to your readers to report their experience with the above leads me to write to you. When I first tried it in our pattern shop I formed a poor opinion of its adhesive qualities, but further experiments have caused me to ehange my opinion. If the joint is clamped up hard, and the glue forced from between the joint, the result is failure; if the joint after being coated is simply placed together and left un- disturbed to harden, the result is a good, tight, hard, and thoroughly waterproof joint. I should like it to set a little quicker, but douhtless the makers will improve the glue as time goes on. Meanwhile I have no hesitation in recommending its use in the house or the shop. It is a practical and much wanted improvement in the glue line."

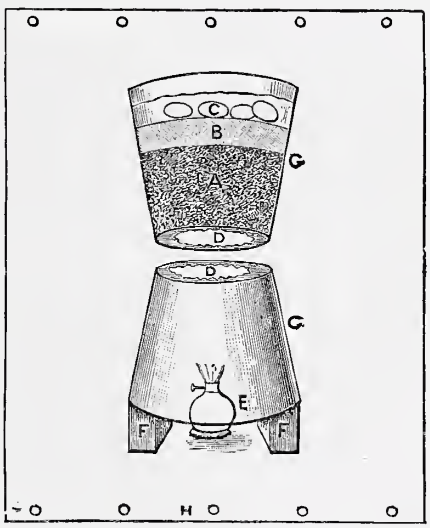
Machine for Current of Air.—A. T. W. writes in reply to Bellows (*Gloucester*) (see page 302):—"In No. 12 of Work, I saw a letter from Bellows (*Gloucester*), asking for a method of making a machine to give a constant current of air. I saw one some time ago, and have represented it here as clearly as I can, to give Bellows and others some idea how it is eonstructed. It is, however, a somewhat clumsy affair to use, and unless well made is apt to get out of working order. Fig. 1 shows it in perspective. Figs. 2 and 3 are two seetional views. H (Figs. 1 and 2) is a small



Machine for Current of Air.

handle which turns the large wheel, W (Fig. 1), round which a eord, C, passes round the small wheel, P (Figs. 1 and 2), which turns the small sheets of metal, S S, whieh are eight in number, and are fastened to the axle, A (Fig. 2), by pieces of wire, the whole of which revolves inside the ease, and blows out a eurrent of air at M (Fig. 3). A space should be left at E (Fig. 1) for the entrance of the air, the axle being supported by two eross pieces. The smaller details may he seen by re- ference to the figures. The one I saw was made of japanned tin, and seemed to work very well, hut I should think one might very easily be made out of wood and eardboard."

Simple Incubator.—W. L. (*Kingsland*) writes: —"In answer to B. F. (*Liverpool*) (see page 302) how to make a simple incuhator, I send a rough sketeh of one easy to make, will work well, and eost next to nothing. All that is wanted is two large-sized garden pots, piece of tin, small lamp, two hricks, fine sand, some flannel, and hox large enough to



Simple Incubator—A, Sand; B, Flannel; C, Eggs; D, Tin; E, Lamp; F, Bricks; G, Pots; H, Venti- lators round Box.

hold same when put together. To make, break out bottom of pots; eut tin to fit in bottom of one at D; then half fill with fine sand (A), top of sand some flannel (B), on the flannel your eggs, on eggs some more flannel. For bottom pot plaee your two bricks in bottom of box, so that your pot rests on them; under pot place your lamp. Then place other pot with sand in on top of this, and your incuhator is complete."

Step Chair.—Ralph E. Scorah (*Urbana, Ohio, U. S. A.*) writes under date of September 2nd:— "In reply to W. W. W. (*Nottingham*) (see page 270), I enclose a eut of a ehair whieh ean be ehanged into a step-ladder. This chair is made and given away to every purchaser of a hutt of plug tobaeco. I do not think it is patented here. Please publish this with full name in 'Shop.'"—[I have mueh pleasure in eomplying with Mr. Scorah's request. I do not engrave the drawings of step-ehair in its two forms of ehair and step-ladder, but I ean assure W. W. W. (*Nottingham*), and any other readers of Work who may be willing to buy a "butt of plug tobacco" in order to get the ehair, that it is a very good-looking piece of furniture. Unfortunately Mr. Scorah leaves us in the dark as to the weight and price of the quantity of tobacco named, and without these particulars it is unlikely that even W. W. W. (*Nottingham*) will respond. I trust Mr. Scorah will forgive my ignorance on this point, hut the United Kingdom is not yet a tobacco- growing eountry, though it is trying to he, and so "tobacco weight" does not yet figure in our "tahles of weights and measures."—Ed.]

Quick Drying of Gelatine Negatives.—E. B. (*Liverpool*) writes:—"In Work No. 29, page 462, I ohserve a reply given to a correspondent on the above suhject which I venture to say is hardly eorrect. Benzine will not do instead of spirit to dry a negative, neither will sulphurie ether. Spirit dries the negative quiekly solely by the powerful attraction which it possesses for water, acting like liquid hlotting paper as it were. Neither henzine nor ether possesses this attraction, and were a gelatine negative soaked in benzine for a week it would at the end of that time contain as mueh moisture as when put into it. Expense ean scarcely apply to articles so cheap as methylated spirit and benzine, the difference in price being only about 2½d. per pint."

Model Locomotive.—W. T. (*Blairgowrie*).—This suhject is receiving eonsideration, and will without douht be taken up and thoroughly treated in Work in due time.

Gasoline.—D. M. I. (*Portsmouth*) writes:—"For the information of your correspondent, J. McW. Iernus (*Tarbert*) (see page 460, No. 29 of Work), I think he eould obtain gasoline from Messrs. Sugg and Co., Vincent Street, Westminster, in small quan- tities. It is one of the lighter paraffins, and is used for making air gas to supply mansions too great a distanee away from gas works to be supplied there- from."

New Water Glue.—J. M. N. (*Bradford*) writes:—"In a recent number of your valuable paper called Work you invited subscribers to give their experience with the 'new waterproof liquid glue.' My experience with this article (which is over twelve months') is that it is a most excellent 'waterproof liquid glue,' and I believe that it will do all that is claimed for it hy the makers."

The New Water Glue.—R. W. (*Shipley*) writes:—"Seeing your article on the new water- proof glue made by the new Glue Company, Shipley, and your request for the experience of those who have tried it, I have much pleasure in stating for the benefit of your readers that I eon- sider the glue invaluable to amateurs; for model yacht building it is a perfect boon, insuring a tight boat, and much facilitating the building process; in fact, by the use of the glue the most unskilled builder is insured a tight eraft. I have also used the waterproof glue with success for domestic purposes, repairing furniture, and even glass and ehina, and eonsider it invaluable for every house- hold, on aeeount of its handiness and other qualities. It requires rather different treatment in use to the ordinary glue, that is, the joint must not be ruhbed, but after being glued simply requires gentle pressure to insure success."

II.—Questions Answered by Editor and Staff.

Tools for Hand Turning.—Bodger.—Yes, you require nothing hut the chisel or gouge and the T-rest for turning such things as egg eups: turners' chisels and gouges are kept at most ironmongers' who sell tools at all, and eost about a shilling eaeh. You should inquire for a turner's shop, and give him a shilling to give you a lesson; that would teach you more about the way to hold a gouge for hollowing out an egg eup than pages of descrip- tion.—F. A. M.

Wood for Cheval Screen Escritoire.—F. J. (*Bristol*).—While fully appreciating your desire to be economieal in the raw material wherewith you pro- pose to construct the cheval screen escritoire that appeared in Work of June 15th, yet I am strongly of opinion that it is false economy to waste good joinery upon inferior stuff, only to find after- wards that all the time and eare lavished is, to a great extent, thrown away. Pitch pine would he, no doubt, eleanly to work, and not unpleasant in its effect. If you deeide to use it, I should advise you to stain it hlack and polish it, and if decoration of the panels hy inlay or earving is impossihle (and with pitch pine it would he practically so), then to try an odd yard of Japanese gold leather paper, or linerusta, and use it on the panels. Pieces the size you require would eost hut a few penee at any good decorator's, for such scraps are sure to be left over in important johs. The form is quite un- suitable for veneer, and I should strongly advise you not to attempt it on a structure so complex as the one quoted. American walnut is eheap, and you ean often buy old mahogany at a second-hand shop, in the shape of some pieee of furniture damaged past repair, that would yet eut up into such a thing as this. If you dislike black a good finish might be made with Aspinall's enamel in a dark peaeoek blue, or even a sealing-wax red. Sequoya wood is as eheap as pitch pine, very pretty, and easy to work, but perhaps too soft to be suitahle for an escritoire. Bearing in mind that accidents in the neighbourhood of an ink bottle usually leave lasting results, I think one may eome back to ehonised wood as the most satisfactory, especially as certain parts, for example, the door frames and the projecting feet, can be cut of harder wood. Your personal thanks I must not overlook, although modesty forbids me to accept them fully. Yet to know that one's efforts are appreciated, and that the pleasure of explaining results in the pleasure of being understood, is an experience that, however often it comes (and the correspondents of WORK are a kindly-disposed set), always comes with a fresh feeling of gratification to yours very faithfully,—J. G.-W.

Books on Plumbing.—SEMPER IDEM (*London, W.*).—You will find the following to be good books on the subject you mention:—"Sewer Gas, and How to Keep it Out of Houses," by O. Reynolds (Macmillan & Co.), 1s. 6d. "Bad Drains, and How to Test Them," by R. H. Reeves (E. and F. N. Spon), 3s. 6d. "Plumbing," by W. P. Buchan (Lockwood), 3s. 6d.

Polishing Cutlery.—C. L. B. (*Tunbridge Wells*).—To repolish cutlery, you will require three wheels about 8 in. diameter, and 2 in. to 2½ in. wide, the edges covered with buff leather. If in possession of a lathe you can use that as a means of revolving the wheels, but it is not advisable to use a good lathe for this purpose, as the grit and dust damage the bearings. If you are going to make a regular thing of polishing, then rig up a proper frame, something like the knife-grinders travel the streets with. The wheels should have a square hole in the centre so as to all fit on one square spindle; they can be keyed on or fixed by means of pins driven through, or holes drilled in the spindle each side of the wheel. Use with the first wheel No. 0 emery and oil, till all scratches and marks are taken out, then use wheel No. 2 with crocus and oil, and polish up on No. 3 with dry crocus or rottenstone, revolving the wheels from you, and working at a good speed.—R. A.

Small Electro-Motor.—J. C. (*Shipton, Yorks*).—I gather from your letter that you wish to revolve a wheel of life, or Praxiniscope, by means of a small electro-motor, worked by a current from a quart Bunsen battery. As you got the battery from Mr. Dale, he will also advise you respecting a motor to be driven from it, if you write clearly, and tell him just what you want. But do not ask for a "Magneto-Morter," as you have in your letter to me. Tell him you want a small electro-motor such as is used in revolving vacuum tubes. It will cost about 15s. As he is a maker of optical instruments, he will also give you the price of a Praxiniscope or wheel of life.—G. E. B.

Electro-Gilding and Electro-Plating.—LEARNER (*Manchester*).—The best book on the subject for a "beginner" or a professional workman is "Electro-deposition," by A. Watt, published by Crosby Lockwood & Co., price 12s. 6d. This you may get for 9s. from a discount bookseller. Be sure you get the latest edition. A cheaper but good book is "Electro-plating," by J. W. Urquhart, published by the same firm, price 5s.—G. E. B.

Electro-Plating.—C. H.—Kindly see reply to LEARNER (*Manchester*), respecting the best book for your purpose. I may say, however, that the subjects you name will be fully treated in WORK in a manner easily understood by everybody able to read. I note with pleasure what you say about boy readers of WORK. It will be always (I hope) my chief concern to so write my articles as to make them quite clear and readable to boys and young men. I write for them specially, and have them always in my mind when writing for WORK. But the boys and young men and apprentices who now read WORK will be, I trust, some day, professional men, and I must write so as to anticipate that time also.—G. E. B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Steel and Florentine Bronze.—J. L. writes:—"Can any reader give me particulars for steel and Florentine bronze for brass work (gasaliers and gas brackets)? I can work green lacquer, but know nothing of these newer colours."

Riveting China and Glass.—F. A. J. (*Canonbury*) writes:—"Can any reader tell me how china and glass riveting is done? How the holes are drilled? Whether the rivets can be purchased or are made at the time, and how they are secured? It seems to me probable that it is a simple process well within the capability of most men, and would often save the destruction of a useful piece of china, and if the information could be given in 'Shop' might be useful to others besides myself."—[I shall be glad to receive a paper on the subject describing the peculiar drill that is used, how to drill the holes, and how to insert the rivets, from any person competent to write on the subject.—ED.]

Barnes' Foot-Power Scroll Saw.—REMINGTON writes:—"If any reader of WORK has tried or seen working one of Barnes' American Foot-power No. 7 scroll saws, I should be thankful if they would give their opinion of same—as to what thickness it will cut easily, etc.—as I am in want of one for practical workshop use. I don't want a toy. Any particulars as to same would be thankfully received."

Harp.—J. K. (*Glasgow*) writes:—"Would any reader inform me how to construct a harp? I should be much obliged."

Small Pump.—W. R. S. (*Brixton*) writes:—"Would anybody be kind enough to give me instructions for making a small pump capable of lifting about a third of a pint of water at each stroke, and where to get castings for same?"

Book on Brushmaking.—BRUSH (*Tipton*) writes:—"Can you recommend a book on common brushmaking? If not, I should be glad of any information on the subject in 'Shop.'"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Cement for Billiard Slates.—W. G. writes in reply to CEMENT (*Cork*) (see page 382):—"Gold size and litharge, worked up into a stiffish putty, will answer the inquirer's purpose. It will set as hard as the slate, and be unaffected by heat."

Illuminating.—H. T. L. (*Tufnell Park, N.*) writes in reply to H. C. (*Lincoln*) (see page 318):—"As I have seen no reply in WORK to the above, I venture to make a few suggestions. Presumably H. C. is about to illuminate a testimonial, or possibly write a missal. You do not specifically state which. Rub your parchment or vellum with pounce, and having stretched it as usual, proceed to work. No more suitable colours than those contained in moist pans can be used. If you mean by their not being brilliant that they have not sufficient gloss, add a little gum water together with a little liquid ox-gall; the latter causing the colour to flow more evenly on the somewhat ivory-like surface of the vellum. The colours I use are, viz.—smalt, French blue, cobalt, and sparingly cerulean, carmine, rose madder, scarlet and purple lakes, and vermilion, emerald and oxide of chromium, deep and pale cadmium, lemon yellow and aureolin, vandyke brown, lamp black, and Chinese white. Surely you can obtain a brilliant colouring with these. Don't mix them much, mixing always destroys brilliancy. Use for gilding gold leaf with a gilder's cushion and short-haired tip. I use both deep and pale gold, the pale on raised parts, such as mouldings, etc., the deep on the flat parts to give some indications of shadow. To answer your question and reply to your remarks properly would take up too much space in this column. Procure Winsor & Newton's 'Manual of Illumination' and 'Companion' (1s. each). The style they indicate is the purest and the instruction among the best."

Insurance of Tools.—F. J. (*Kidderminster*) writes:—"I see in No. 27 of WORK, page 429, that T. T. (*Kennington*) wishes to know if there is any office in which he could insure his tools. I know of no insurance office which undertakes this kind of risk, but if T. T. is not already sufficiently covered in cases of sickness, I would recommend him to join the Hearts of Oak Benefit Society, which, in addition to allowing 18s. per week in cases of sickness, and a correspondingly adequate sum in case of death, also provides its members against the loss of tools by fire to the extent of £15, beside other benefits, on payment of an average subscription of 10s. per quarter."

Insurance of Tools.—A. J. THRESHER (15, *Warwick Road, Stoke Newington*) writes:—"In reference to the query of T. T. (*Kennington*) in No. 27 of WORK, page 429, I do not know whether he or yourselves may be aware that by joining the Hearts of Oak Benefit Society of 17, Charlotte Street, Fitzroy Square, W., he can have his tools insured up to £20. The payment to the Society is 10s. per quarter, but in addition to the insurance of tools this includes benefits as follows:—£20 on death of member, £10 on death of wife, 18s. per week during sickness, 4s. per week superannuation, and other minor advantages. On application to the above address, however, full particulars will be sent."

Paint on Leather.—R. S. W. (*Norwich*) writes in reply to J. B. S. (*Nottingham*) (see page 318):—"You want to know how to prepare bag or portmanteau to receive paint so as not to crumble or fall off. This is the preparation: Thoroughly clean the leather with good spirits of turpentine. Then, when dry, give it three good coats of best japan black, the last one to have a small quantity of vegetable black in it to take the browny hue off it. He will find it will last a long time. I am in the trade."

Child's Wooden Toys.—P. P. (*Withington*) writes in reply to W. A. (*Hanley*) (see page 270):—"If he applies to E. May, Buckledge Avenue, Harlesden, London, N.W., for his catalogue, he will get what he requires."

Tool Wanted.—MEDICAL (*Cambridge*) writes in reply to GAUGE POINT (*Paris*) (see page 446):—"For a reliable rule to measure promptly and accurately (to $\frac{1}{16}$ in.) openings and spaces from 2 ft. to 10 ft., I have one which I made a couple of years back, and which has worked satisfactorily, and which I think may possibly be useful to G. P. The rule consists of a scale 1 ft. long graduated to $\frac{1}{8}$ in. and having a sliding bar working along it, after the manner of a cobbler's measure. This sliding piece corresponds accurately with foot-rule when closed, and has a mark $\frac{3}{16}$ from its end which will, of course, fall half way between first and second mark on fixed scale. Suppose, when rule is extended to fit space, the end of sliding bar fall between 6 in. and $6\frac{1}{8}$ in. marks, then $\frac{3}{16}$ mark on bar will show by its position in regard to $6\frac{1}{8}$ in. mark on rule whether $6\frac{1}{32}$, $6\frac{1}{16}$, or $6\frac{3}{32}$ would be the most accurate reading. To the end of my scale are hinged a number of folding rods, as used in ordinary rules, so that any length from $12\frac{1}{16}$ in. to 6 ft. (the extreme length of my rule) may be accurately read. I think GAUGE POINT will be able to adapt this idea to his requirements, but if it is useless to him let him believe that it has been very far from useless to the amateur who tenders it to him."

Trade Notes and Memoranda.

MESSRS. KRUPP have shipped a cast steel gun weighing 235 tons, from Hamburg for Cronstadt. The calibre of the gun is $13\frac{1}{4}$ in., the barrel is 40 ft. in length, its greatest diameter being $6\frac{1}{2}$ ft. The range of the gun is over eleven miles, and it will fire two shots per minute, each shot costing between £250 and £300. The gun is the largest in existence and the heaviest yet exported by Messrs. Krupp.

THE large weigh beam in the engine house at Le[e] Mill, Bacup, belonging to Mr. Henry Maden, suddenly snapped asunder recently, and in a few seconds the massive beam engine, two galleries and the large window were a complete wreck. The damage is estimated at over £1,000.

SIR EDWARD WATKIN has submitted a proposa[l] for a gigantic railway project to the Secretary o[f] State for India. It is nothing less than a railwa[y] from London direct to India *viâ* Kurrachee. Th[e] Channel Tunnel is a portion of the scheme, thoug[h] not an absolutely essential part of it, since th[e] start could be made from Calais or Boulogne. Th[e] railway would proceed direct to Gibraltar, usin[g] the existing lines as far as possible, and the[n] would be introduced a novel feature in the lin[e]. This would be a vast broad-beamed boat capable o[f] taking on board the entire railway train, as [it] arrives at Gibraltar, and delivering it on the rai[ls] at Tangiers. Here the line would strike eastwar[d] keeping along the north coast of Africa, touchi[ng] at Egypt, and proceeding by the Persian Gulf t[o] Kurrachee, where it would join the Indian railwa[y] system. Sir Edward Watkin's project is said [to] have engaged the attention of several emine[nt] engineers and capitalists.

A DUST-PROOF engine has been designed b[y] Messrs. Hanson, Carter & Co., of Quebec Work[s], Bradford, for use in dusty situations as stokehold[s], foundries, and the like. The engine is entirely e[n]closed, access to the working parts being through [a] door provided with a felt edging to render th[e] closure air tight. They are made in three size[s] with 3 in., $4\frac{1}{2}$ in., and 5 in. cylinders.

THE Worshipful Company of Armourers an[d] Brasiers will hold at their Hall in the City [of] London in May, 1890, an exhibition of specimens [of] modern armour (including helmets, breastplate[s] and blades) and of original art works and designs i[n] brass, bronze, copper, etc., to be the work of Briti[sh] subjects, and manufactured since 1st March, 18[8]. Prizes, certificates, etc., will be awarded for me[ri]torious work, special prominence being given [to] exhibits by craftsmen. Full particulars may b[e] obtained on application in writing to Marsha[ll] Pontifex, clerk, Armourers Hall, 81, Colema[n] Street, London, E.C.

WORK

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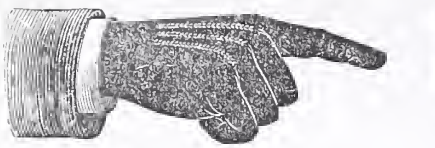

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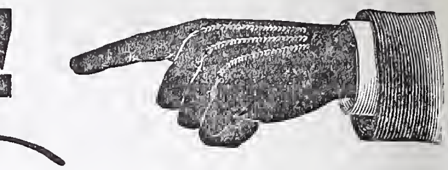

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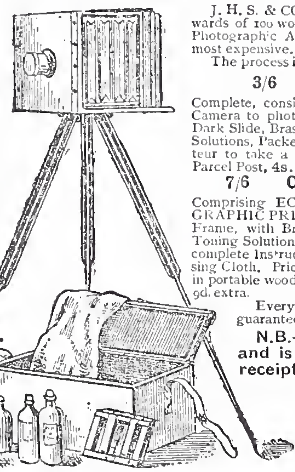

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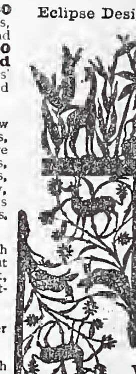

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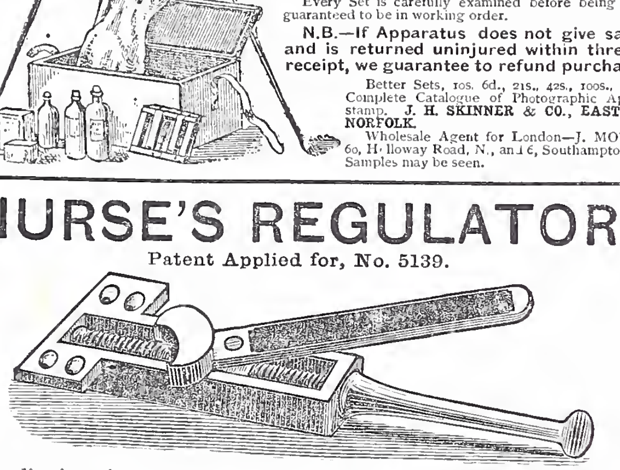

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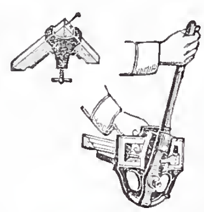

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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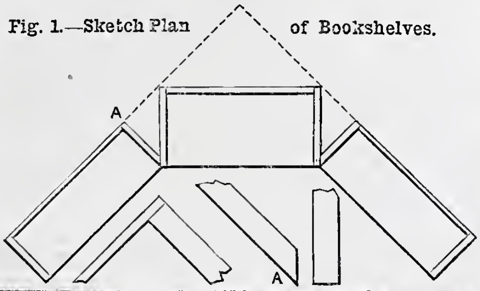
ANGING CORNER BOOKSHELVES IN PAINTED WOOD.

BY PALGRAVE MORRISON.

N arrangement of bookshelves similar to ie one illustrated had long been in my ind; one of its three component parts as made and in use, and the plans of the vo others quite decided, when a room that hoped to secure for my own snuggery iould admit of their being placed in posi-on. The novelty of ie idea was fascina-ng to its inventor, nd offered special dvantages. My un-xpected pleasure on oing into a friend's ooms in one of the 'ambridge colleges, nd seeing the actual et hanging on his all, provoked me to sk, How, when, and hy the shelves in uestion were made? he reply showed that, s usual, circumstances nsightly in them-elves had resulted in ie distinct treatment. or in the room an ld buttress jutted it in the angle of the all, so that no ordi-ary corner cupboard ould fit. This pro-ction being unsightly as hidden in just the ay I had planned for y own shelves.

Apart from any ierit in the appear-nce of shelves so reated—and they are iore picturesque than simple rectangular roup — the vacant pace they leave in the ngle itself would be dmirable for a ven-lating shaft, which, ecessary and health-il though it be, is an nsightly object in a rivate room. It is ften convenient to ave a shaft placed in n angle against an uter wall, but since hen no piece of furni-ire will fit the corner, gives a desolate ap-earance to that part f the room. But a et of shelves in this ishion, whether fitted

Fig. 1.—Sketch Plan of Bookshelves.



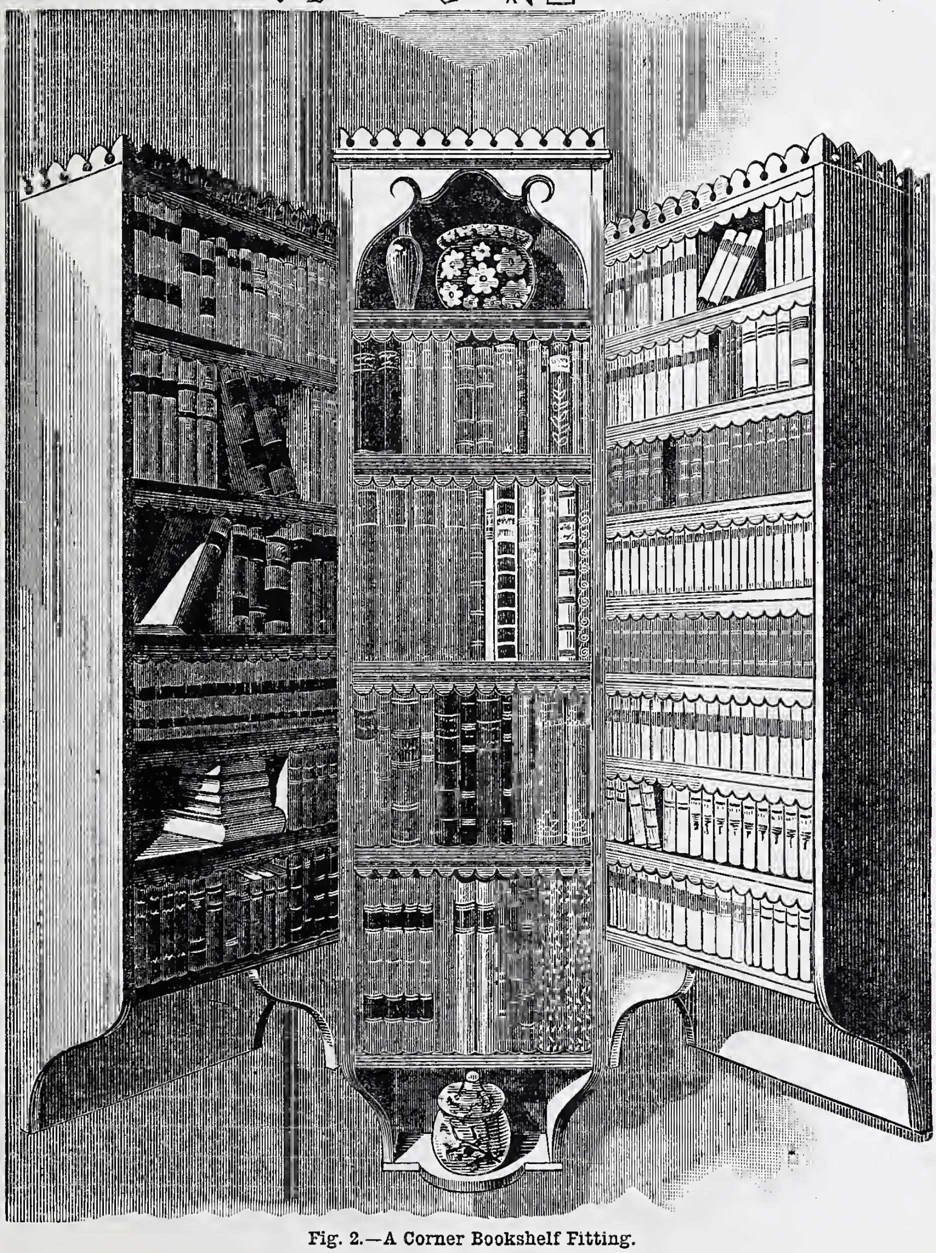


Fig. 2.—A Corner Bookshelf Fitting.

as bookshelves with or without glazed doors, and varied in all respects save the main features to suit the taste of its owner, would solve the difficulty.

It must be clearly indicated that the design offered is purely suggestive; it is not to scale; nor is the arrangement of any of its features a point to be insisted upon. The only structural feature to be followed is that the three separate carcases shall be shaped to form a symmetric group, thus making the whole more portable, saving wood; and more particularly avoid any complicated joinery at acute or obtuse angles.

As a reference to the plan will show, the triple bookcase thus grouped permits the central portion to be deeper, that is, to afford space for wider books, than the wings on either side.

That these wings should be the same height, and harmonise with the central part in their decoration and detail, however plain or elaborate that may be, is perhaps necessary. But that they should be of the same width is hardly needful, for it may easily happen that the obstacle of a door or window will make it more convenient to construct the two wings of different dimensions.

The depth of the side cases is intended to be about (not over) 6 in.; in other words, the uprights and shelves are worked from wood 5½ or 6 in. wide. This scale allows the shelves to be placed at intervals not exceeding 9 in. apart., with a certainty of containing any ordinarily shaped book comfortably.

The central division, being deeper, allows the shelves to be disposed so as to take volumes of larger size. Thus if the wings are 6 in. deep, the central part must be 8½ in. The sketch is in no way to scale; the general effect very fairly indicates the appearance of the complete structure.

The ornamental details to a set of shelves for books are best left out. The books themselves are the fittest decoration. But of course a slightly-pierced caging, as indicated, or a row of small turned spindles, may be used at top. So the top shelf of the central portion may be treated with an arch, leaving space for a bust or vase. The whole is intended to be painted or stained; merely a rough-and-rea ly set for a bachelor's study or professional man's use.

The edge of each wing where it touches the central part is bevelled away as shown in the diagram, so that it appears as if the whole were homogeneous, and not made up of three independent parts.

It is by no means necessary to have such shelves finished in black. I have a similar set finished in bright scarlet enamel, and another in peacock blue, that take their place in the room, and are not a bit staring or out of harmony with the rest; but then in each case the other things accord, so that it is best to recommend every would-be maker to be guided entirely by the future position of the finished thing, and vary size, colour, and decoration as much as he likes; for nothing is so satisfactory as evidence that the design has been subordinated to the needs of its owner, and become, if not an individual creation, at least a pliable adaptation in his hands.

MORE ABOUT POLISHING.

BY DAVID DENNING.

THE novice who has read the "Preliminary Gossip about Polishing Wood," which appeared on page 506, may be inclined to ask whether wood should be polished or varnished, and, following up the answer which will be given in the present article, he will probably want to know something more about the distinction between the two methods of finishing.

Taking up the question which, it may fairly be supposed, would be first put by the tyro who has little more than a vague idea that wood, if not painted, has something put on it to make it shine and improve its appearance, some attempt at a satisfactory reply may be made. Perhaps, however, before doing so it will be as well just to understand what the action of any varnish is, without going into minute particulars. As is well known, varnish when applied is in a liquid state. This liquid is made up of a solvent for the particular kind of gum or resin used in making up the particular kind of varnish required. The surface of the work is coated or painted in some way with the prepared fluid. The moisture evaporates, leaving a film of the resin which has dissolved in it. Wood, or anything else so treated, is said to be varnished. Now, whether this method of finishing is suitable for woodwork depends on circumstances. For coarse work it does very well, but for articles of furniture the process known as French polishing is to be preferred, as finer results are to be got by it. It may, however, be as well to state here that French polishing is not the only method of finishing furniture in addition to varnishing, or even painting. We have, for example, oil and wax polishing processes which, for some kinds of work, are to be preferred to the other, and they will be treated of in due course.

Even choice articles of furniture, from the substantial sideboard to the flimsy fretwork ornament, may be varnished instead of polished; but it must be distinctly understood that a really well-finished surface cannot be got with the former process. This is tantamount to saying that any one who wants to finish a piece of furniture in a suitable and tradesmanlike manner must polish it, and not be contented with the simpler and easier process, which is also more expeditious it may be said, of varnishing it. Where to draw the line between the two classes of furniture, viz., that which will be worth taking some trouble about and polishing properly, and that for which a humble coat of varnish is deemed sufficient, may be safely left to the maker's consideration. Perhaps, as a hint to him, it may be suggested that he will get better results from careful varnishing than from badly executed polishing. There again allusion is only made to French, and not to the simpler wax polishing, of which it may almost be said that it requires no practice, and that it can be done by anybody who has patience.

The only kind of furniture which it may be considered proper to varnish is that made from pine, though even this is frequently French polished. Pine furniture, however, unless it is really well made and finished, is hardly worth polishing—at least, it is not customary to polish it. Like every other wood, it is undoubtedly improved, or, rather, let me say, its appearance is improved, by polishing; but it is obvious that the chief reason for pine furniture being its cheapness, varnishing is in many cases supposed to be good enough for it. The process of japanning, by which much of the cheaper kinds of pine furniture is finished, being akin to painting, does not now concern us, and I, for one, would not be sorry to see it extinct, or, to say the least, very much less employed than it is. The discussion of this is, however, beyond the scope of this series of articles, which will be confined to processes in which the grain or natural figuring of the wood is not hidden, but is simply brought out and improved by a transparent covering. Mahogany, walnut, and all the finer woods used in making furniture should be polished if they are to look as well as it is possible to make them. Enough has now been said to guide the novice in forming an opinion as to when he ought to finish by polishing, and to give him a clear idea of what this is. A little general explanation will be given, after which he will be better able to profit by the more detailed instructions which will follow.

Although the medium used to obtain a French polished surface is in reality nothing but a varnish, it is one of a much finer kind than is generally understood when the word "varnish" is concerned, and probably many of my technical experts may at once be inclined to exclaim that French polish, *i.e.*, the material used, is not a varnish. A moment's consideration, however, will show them that it cannot be described as anything else, and not only so, but that it cannot with accuracy be regarded in any other light. The material known as French polish, were it to be described fully, would be spoken of as a special varnish for French polishing. In colloquial language, however, both the finishing gloss and the material on which, or, perhaps, it will be as well to say by means of which, the gloss is produced, are spoken of as French polish. The material is nothing more nor less than the thin varnish which experience has shown to be the most suitable for producing a fine, smooth, glossy surface by the French mode of polishing. I daresay many of my readers have heard of the celebrated Vernis Martin, which means nothing more than Martin's Varnish, or, as we should perhaps now more elegantly call it, Martin's Polish. This Martin produced a very finely finished surface by means of some material or manipulation which he kept a secret, and which is said to have died with him. This, however, seems hardly probable, or, if his methods were not exactly known and followed, it is only reasonable to suppose that his success induced others in the same line of business to experiment on their own account, and that the result is what is now known to us as French polish. To say that this is exactly the same as the celebrated Vernis Martin is, of course, more than one can do. His materials may have been—indeed, probably were—different from ours. His mode of producing the gloss or polish, perhaps, bore a very slight resemblance to that now adopted; but that he made his reputation by smoothing or polishing a varnish can hardly be gainsaid. Many accounts purporting to describe his process have been given to the world, but it may be doubted whether any of them are absolutely correct, although they may approach very nearly, both as regards materials and manipulation. That the results are good when the somewhat cumbersome processes are followed with skill and ability is an undoubted fact; but the simpler process known to us as French polishing is quite sufficient for all practical purposes, and few, except those who are prompted by curiosity, will care to try any more tedious way of getting similar effects.

The theory that Martin was the inventor of the process which in a modified form is now practised for getting a gloss by mechanical means on a coating of suitable varnish may not meet with general acceptance, but those who urge it have at the least very substantial grounds to build on. This part of our subject is, however, more for the antiquarian than the practical polisher to consider; but even in the humblest of our pursuits it is often interesting to trace the process of development from the first crude idea to the improved processes of the present day. The dirty-fingered French polisher of to-day would likely not be exercising his craft if someone, whether Martin or not is of no consequence, had not observed that a varnished surface might be further improved by polishing. We, perhaps, are rather too apt to consider that when we know all about French polishing practically—that is to say, when we can do the work satisfactorily—everything has been learned. We go as far as the generation which immediately preceded us, possibly even surpass them, or think we do, and then rest satisfied that we have no further progress to make. We have learned all, or acquired all the knowledge which could be communicated, and forthwith sit down in complacent satisfaction, without a thought that improvements may still, at this period of the world's history, be practicable. "Well," says some enterprising polisher, "all this sort of thing, trying to find out improvements, making discoveries, and so on, may be all very well for engineers, electricians, and those engaged in scientific callings, but as for polishing, there is nothing more to be accomplished. That there are certain defects and drawbacks in the way the work is done is, of course, apparent; but then they cannot be avoided, and there is no way of overcoming them." Others again will tell us that they don't see anything the matter with their modes of working, which are quite good enough: they make a living by their work, and what more is requisite? Now, I am quite willing to admit that there may at present be no *known* way of overcoming some of the defects in polishing, but is there any reason why this should always be the case? At one time, and that not so very long ago, the average English polisher, or rather labourer who did the polishing, aspired to no higher gloss than was to be obtained by means of beeswax; and are we now to think that because a better finish can be got that there is nothing superior within the reach of man? True, at the present time we get a very nice surface, or, let me say, it can be got by a competent polisher, and in the foregoing remarks I have no wish to disparage the skill so often shown in finishing furniture; but with all deference to those who have arrived at the highest point of skill, there are defects which show that the craft has not yet attained to that degree of excellence which would warrant one in supposing that further progress cannot be made. Just to give one example of a weakness in the mode of polishing now pursued, let me suggest "sweating," which, as every polisher knows, is a frequent source of trouble and annoyance. It is all very well to say that "sweating"—by which, of course, I do not intend the commercial meaning of the word—is unavoidable, and to give all the reasons why newly French polished wood is liable to it. It may be admitted that with our present knowledge this is so; but is it inconceivable that some improvement might be made which would render "sweating" a thing of the past? I am quite aware that experiments have been made with this intention, and that some of them have been attended with a fair amount of success; but still, the argument remains good that there is still plenty of room for improvement in the details of the work, and it is with a view to stimulating those who are best able to make improvements, viz., those who are professional French polishers, to investigations on their own account that these suggestions are offered. Perhaps it may be thought that after having referred to "sweating" I have some specific against it, or that I have ideas of what ought to be done to prevent it. I am sorry to say I have no remedy to suggest, but it by no means follows that there is none to be discovered. Of course, "sweating" is only named as an example, but other matters in which there is room for improvement will occur to any practical polisher. I know many of these are inclined to regard with suspicion anything claiming to be improvements, but I cannot help thinking that advances might be made by polishers themselves which would be of benefit to the craft, and that those whose experience has shown them how improvements are practicable have a splendid opportunity of disseminating their views in the pages of this magazine. They may be sure that plenty among the readers would try their methods and discuss them; not amateurs merely—for, with all due deference to these enthusiastic workers, they are unable to do so fully—but artisans who have a thorough knowledge of the difficulties to be overcome, and are both willing and competent to adopt any improvement. Perhaps much of the stagnation—which, after all, may be more apparent than real—which exists in minor trades is owing to the fact that, till the appearance of WORK, the means of communication of ideas have been very limited in extent. Trade organs or journals devoting themselves to our particular trade have appealed more to the employer of labour than to the artisan himself. In WORK exists a real workman's magazine, or I would not have ventured to make the digressions I have, and while the amateurs' wants are by no means disregarded, the professional is encouraged to go ahead and let the world benefit by the hints and wrinkles which he has picked up, but which have hitherto seldom got further than his workshop. That there is a vast accumulation of "folk lore" lying almost buried, must be evident to every one who has been much in factories or workshops of any kind, and though in succeeding papers I hope to communicate a general idea of how to wax, oil, or French polish, I can only state what has come under my own observation. As has been stated before, the instructions will at the least explain to amateurs and novices what they ought to do, while those more advanced may find suggestions which will lead to increased skill on their part.

IRON AND STEEL: ITS ANALYSIS.

BY CHEMICUS.

DETERMINATION OF SILICON, SULPHUR, AND PHOSPHORUS.

THIS article is written with the object of enabling those of our readers who possess a knowledge of practical quantitative analyses to make a determination of the silicon, sulphur, phosphorus, manganese, combined and graphitic carbon, copper, etc., in iron and steel. Unquestionably the information afforded by such an analysis is of considerable value, as from it we are enabled, not only to decide as to the suitability or otherwise of the metal for any purpose, but also to account, to a certain extent, for any abnormal behaviour in the same when subjected to mechanical treatment.

For the analysis the sample of iron or steel is brought, preferably, into a state of drillings. This, however, in all instances, is not possible; when such is the case, the sample is reduced to as fine a powder as possible.

SILICON.

When iron or steel is dissolved in nitro-hydrochloric acid, the iron enters into solution as ferric chloride, while the silicon is oxidised into silica (SiO_2), which, by subsequent evaporation of the solution to complete dryness and heating of the residue, is rendered insoluble. Such is the principle upon which the determination of silicon is based.

For the analysis, weigh out four grammes of the sample and dissolve it, with the aid of a gentle heat, in 100 cubic centimetres of nitro-hydrochloric acid* in a porcelain dish of about 500 cubic centimetres' capacity, the mouth of which is covered with a watch glass to prevent loss by spurting. (As regards the actual quantities of the metal taken for the determination of the several constituents, the operator must use his own judgment, being guided by the quantities of the same presumably present.) When completely dissolved, remove the watch glass, after washing any liquid adhering to the same into the dish, cautiously take the solution to complete dryness, and strongly heat, over a Bunsen burner, the resulting residue until it becomes black. Add to the contents of the dish, when cool, 100 cubic centimetres of hydrochloric acid, heat gently to bring into solution, and again take to complete dryness. Make a further addition of hydrochloric acid, and evaporate until a crust commences to form upon the surface of the solution, which dissolve in a few drops of hydrochloric acid. This solution is now diluted with a somewhat large volume of warm water and passed through an English filter paper which retains the silica, or, if an iron be under analysis, a mixture of silica and graphitic carbon, or graphite.* (Invariably small portions of the silica adhere to the sides of the dish, the removal of which is effected by rubbing the same with a "policeman"—a piece of caoutchouc tubing at the end of a glass rod—and rinsing into the filter.) Wash the filter, together with contents, with a hot dilute solution of hydrochloric acid some half dozen times—one acid to three parts water—and afterwards with hot water until the washings give no red coloration with a dilute solution of potassium ferricyanide.

The subsequent treatment of the filter and contents depends upon whether a steel or an iron be under analysis. Should the sample be a steel, the filter and contents are placed in a platinum crucible and ignited, employing at first a low temperature, but gradually increasing to a bright red heat, allowed to cool under the desiccator, and the weight † of the silica, which contains 46·67 per cent. of silicon, determined. If, however, an iron be under analysis, the filter, etc., contained in a platinum crucible is ignited at a heat just sufficient to burn off the paper (the employment of a high temperature must be carefully avoided, as it would result in a loss of graphite), and when this is effected the residual graphite and silica weighed, replaced in the crucible, and again ignited, this time employing a strong red heat, whereby the graphite is burnt off. Finally the weight of the residue (silica) is determined, which weight, as is obvious, deducted from that of the graphite and silica, will equal the graphite contained in the weight of the metal taken for analysis.

The silicon may also be determined by the following method:—Four grammes of the sample, contained in a beaker, are dissolved, with the aid of a gentle heat, in 100 cubic centimetres of dilute sulphuric acid—one part acid to three water—and the resulting solution evaporated until it becomes a white cakey mass (ferrous sulphate), and heavy white fumes are given off. When the beaker and contents are cool, add 250 cubic centimetres of water and heat to boiling, with constant stirring, until the mass of ferrous sulphate has dissolved. The silica and graphite, if the same be present in the metal, are then collected on a filter, washed, etc., as previously described.

The silicas obtained by the above methods should be white, but not unfrequently they are more or less red, due to the presence of iron, which even repeated digestions with hydrochloric acid fails to eliminate. The whiteness of a silica is not, however, a guarantee that it is pure, as, although free from iron, it may nevertheless contain titanium, should the same be present in the iron or steel. To obtain the silica in a state of purity, it is intimately mixed, contained in a platinum crucible, with six times its weight of acid potassium sulphate, and fused, employing

* Prepared by mixing one part nitric acid (sp. gr. 1·42) with three parts hydrochloric acid. It is advisable to prepare a large quantity of this reagent, as it is employed throughout the analysis.

* Steel, practically, contains no graphite.
† The weight of the filter paper ash must always be deducted from that of the precipitates, etc.

at first a low temperature, but gradually increasing to a bright red heat. At the expiration of thirty minutes allow the crucible to cool, remove the lid, and break up the fused mass as completely as possible, then, together with the lid, place in a dish and digest, with constant stirring, with cold water for a considerable time. Withdraw the crucible, etc., after washing, and collect the silica, now pure, on a filter, wash, etc.

SULPHUR.

The methods employed for the determination of this constituent are based upon two principles, viz:—

(*a*) When iron or steel containing sulphur is dissolved in nitro-hydrochloric acid, the sulphur is oxidised into sulphuric acid, which is precipitated as barium sulphate ($Ba\,SO_4$), by barium chloride.

(*b*) Upon passing the sulphuretted hydrogen evolved upon dissolving the metal in sulphuric or hydrochloric acid through a solution of a metallic salt, such as copper sulphate, the sulphur combines with the metal, resulting in the precipitation of a metallic sulphide.

Of the two methods, that founded on principle *a* is the most accurate, but *b* method is the most rapid, and furnishes results which for general purposes are sufficiently accurate.

In determining the sulphur by *a* method, two or four grammes of the sample, according to the amount of sulphur presumably present, contained in a porcelain dish, are dissolved in 100 cubic centimetres of nitro-hydrochloric acid, the resulting solution taken to complete dryness, and the dry mass heated strongly. Allow the dish and contents to cool, and bring the dry residue into solution by the addition of 100 cubic centimetres of hydrochloric acid and the application of a gentle heat. Take the resulting solution to dryness, re-dissolve in hydrochloric acid, evaporate until a crust commences to form upon the surface of the solution, which dissolve by the addition of a few drops of hydrochloric acid. The solution is now diluted with hot water and passed through a filter, which retains the silica, etc., while the filtrate contains the sulphur in solution as sulphuric acid. If the above directions have been carried out the filtrate will be free from nitric acid, and, also, from an excess of hydrochloric acid; two very necessary conditions for the obtainment of accurate results; the former because nitrates are precipitated by barium chloride, and the latter on account of barium sulphate being soluble in acid solutions of ferric chloride. Make up the filtrate, after separation of the silica, with water to a volume measuring 500 cubic centimetres,* add five cubic centimetres of a solution of barium chloride—prepared by dissolving one part of the crystals in ten of water—well mix the liquids, cover the mouth of the containing vessel—preferably a large beaker—and allow to stand at rest in a warm place. After the lapse of at least twenty-four hours, decant off as much as possible of the supernatant liquid, and pass the remainder, together with the precipitated barium sulphate, on to a Swedish filter paper. Wash contents of filter some three or four times with a dilute solution of hydrochloric acid—one acid to six parts water—and thoroughly cleanse with water, then transfer to a platinum crucible, ignite at a strong heat, and when cool determine the weight of the barium sulphate, every hundred parts of which is equivalent to 13·37 of sulphur.

The determination of the sulphur by the method based on principle *b* necessitates the employment of a solution of a metallic salt. A solution of copper sulphate may be employed, which is prepared by dissolving sixty grammes of the crystals in a litre of water.

For the analysis weigh out into the flask, A (Fig. 1), which has a tube, C, bent at right angles welded to the neck, ten grammes of the sample, and insert the caoutchouc cork, through which the safety acid funnel, B, passes, reaching to near the bottom of the flask. Arrange the apparatus over a Bunsen burner, so that the tube, C, dips to a considerable depth beneath the surface of the copper sulphate solution contained in cylinder, D. (D contains 200 cubic centimetres of the copper sulphate solution.) About 200 cubic centimetres of dilute

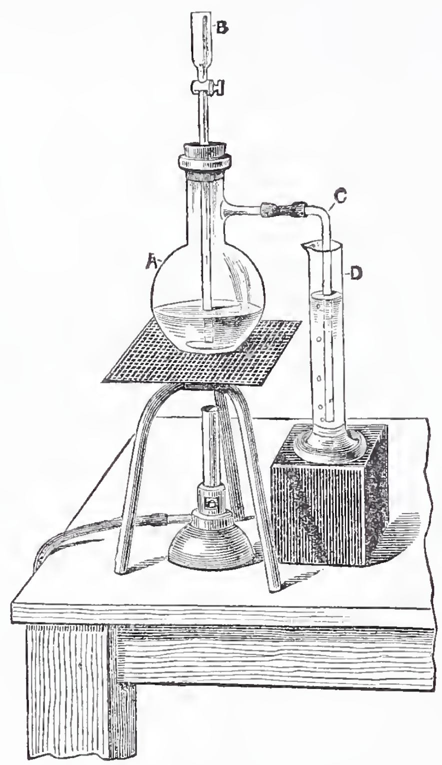


Fig. 1.—Arrangement for Determining Sulphur in Analysis of Iron—A, Flask; B, Safety Acid Funnel; C, Bent Tube; D, Cylinder containing Copper Sulphate Solution.

sulphuric acid—one part acid to three water—are now passed into the flask through the funnel, B; the metal is immediately attacked, sulphuretted hydrogen being evolved, which as it escapes and passes through the copper sulphate solution is decomposed into sulphur and hydrogen, the former combining with the copper, resulting in the precipitation of copper sulphide, while the hydrogen escapes. Towards the end of the operation apply a gentle heat, and when the evolution of gas ceases fill up the flask with warm water, taking care that none be allowed to overflow into D, whereby the whole of the gas is driven over. Then withdraw the flask, washing any of the copper sulphide adhering to C back into the cylinder, and pass the contents of cylinder through a filter. Well wash the copper sulphide on the filter with cold water, then transfer to a porcelain crucible, and convert, by ignition, the sulphide into oxide of copper (CuO), and weigh. Every hundred parts of copper oxide is equivalent to 20·12 of sulphur.

PHOSPHORUS.

The methods of determining this element are far from satisfactory, but that known as the "molybdate" process yields, in our opinion, the best results. The method is based upon the principle that when iron or steel is dissolved in nitro-hydrochloric acid, the phosphorus is oxidised into phosphoric acid, which is precipitated by ammonium molybdate.

For the analysis, take four grammes of the iron or steel, or less should the sample be phosphoric, dissolve in nitro-hydrochloric acid, and separate the silicon as already described. The filtrate will contain the phosphorus as phosphoric acid, but before the precipitation can be proceeded with, the hydrochloric acid must be expelled. With this object the solution, contained in a conical, is mixed with 100 cubic centimetres of nitric acid (sp. gr. 1·42), and evaporated until it acquires a thick syrupy condition. Repeat this evaporation with nitric acid some three or four times. Finally, to the syrupy mass add sufficient nitric acid to cause it to flow freely in the containing vessel, and to the resulting solution, which should occupy a volume measuring not more than 50 cubic centimetres, add 50 cubic centimetres of the ammonium molybdate solution. Thoroughly mix the liquids by agitating briskly the containing vessel, and then allow to stand at rest in a warm place (about 40° C.) for five minutes. After the lapse of this period ascertain, by smell, whether the solution is ammoniacal or acid, and if the former add strong nitric in small quantities at the time agitating well and allowing to stand at rest with each addition, until only slightly acid,* while if acid add ammonia until slightly so Upon the obtainment of the right degree o acidity, allow the solution to stand until th yellow precipitate of ammonium phospho molybdate has settled to the bottom of th containing vessel and the supernatant liqui is clear. Collect precipitate on a tare Swedish filter paper, employing a dilut solution of nitric acid — one acid t five water—to rinse on the last portion and wash filter and contents some hal dozen times with the dilute acid. Finall remove filter paper, etc., to the water oven dry and re-weigh to determine increase du to phospho-molybdate precipitate, whic contains 1·66 per cent. of phosphorus.

The ammonium molybdate solution i prepared by dissolving fifty grammes of th crystals in a litre of water, adding sixt cubic centimetres of ammonia (sp. gr. ·88 and allowing the solution to stand for two c three days and decanting from any precip tate formed.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

MARKING OFF, OR PREPARING BRIDGES TO R CEIVE THE STRINGS—VARNISHING SOUN BOARD, ETC.

In the two previous papers I dealt with tl construction of the back and sound-boar I must now advance another stage and sho how the bridges are prepared to receive tl strings, or what is technically terme marking off (Fig. 1).

In a pianoforte factory the business the marker-off is to take the back, with tl

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* This solution must be distinctly acid, but free from an excess.

* The successful precipitation lies in the obta ment of the right degree of acidity. What this cannot be very well defined. It is such, howev that while there is a sufficient quantity of ac present to prevent the precipitation of ammoniu molybdate, there is not a large excess, which wou prevent complete precipitation of the phosphoru

›und-board in position, and to plane the ridges to their proper height, mark the ale, drill and pin the bridges, clean and ırnish the sound-board, adjust the bottom ıd bent side plates, bore the wrest plank, ıd put in screws and bolts. I will describe ; clearly as I can how this is done. See ıat the bass ırs do not ›uch the bottom of the back; they do so, ıke a chisel and ıt the wood of ıe back away ntil they are ılly free. To ›st whether it free, strike ıe long bridge ı the centre

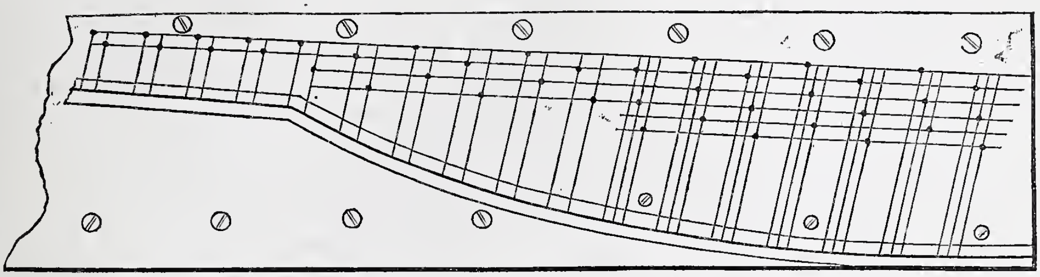

Fig. 1.—Sketch of Wrest Plank and Method adopted for Marking for Wrest Pins.

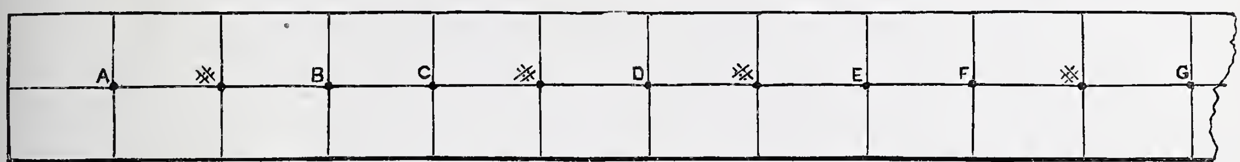

Fig. 2.—Scale for Marking Bridges: actual size.

vith the clenched hand, and it ought to ound like a drum. Now prepare a slip of ›ine $\frac{3}{4}$ in. wide and $\frac{1}{2}$ in. in thickness; this is to e placed round the edge of the bent side on he sound-board, the $\frac{1}{2}$ in. edge to be glued n the sound-board, and close up to the ›ent side. To bend this, you may find it ıecessary to cut some kerfs in with your aw, then put some pins in, to hold it in ›osition until the glue dries. Plane your op or wrest-plank bridges down to $\frac{3}{8}$ in. t the treble, and $\frac{1}{16}$ of an inch lower at he bass end. Now make it straight in its ength, and plane the bent side slip down o $\frac{3}{8}$ in. at the treble, graduating to $\frac{1}{8}$ f an inch at the bottom of the bent side. Now place the bottom plate on temporarily, ecuring it with a hand screw; see that the ›ottom of the sound-board does not touch

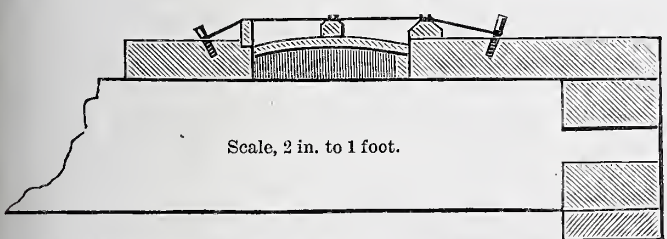

Fig. 4.—End Section of Treble End of Back, showing Sound-Board and Bridges.

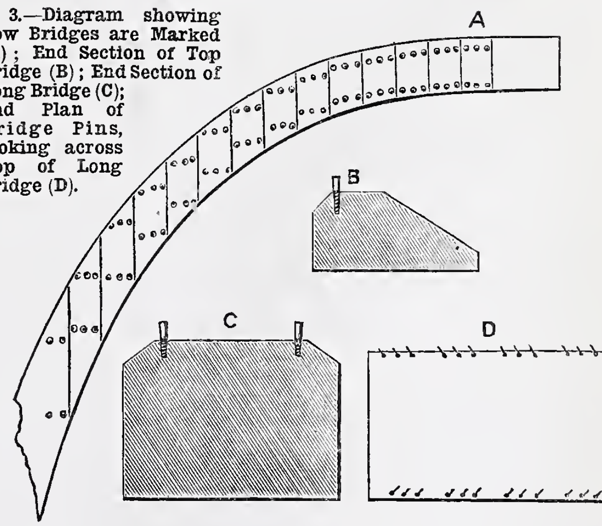

Fig. 3.—Diagram showing how Bridges are Marked (A); End Section of Top Bridge (B); End Section of Long Bridge (C); and Plan of Bridge Pins, looking across Top of Long Bridge (D).

Fig. 5.—Forks for Marking for Bridge Pins: actual size. A, Trichord; B, Bichord.

it. Take a straight-edge and hold it on the plank and long bridges at the treble end, and you will find that your long bridge requires reducing in height; plane it down about 12 in. of its length until your straight-edge is within $\frac{1}{8}$ of an inch from the bent side slip, then move your straight-edge 12 in. nearer the bass, and plane down until it is $\frac{1}{4}$ of an inch; move another 6 in. and make $\frac{3}{8}$ of an inch. Now from this point graduate the slip to the bottom plate. Now place the straight-edge across the bottom end of the long bridge, and make it, and also the beginning of the short bridge, $\frac{3}{8}$ in. above the plate, graduating to $\frac{1}{4}$ in. above the plate at the extreme bass end.

The reason for planing the bridges is that the strings shall have a proper down-bearing, as, no doubt, you have observed the bridge of a violin supporting the strings in the same way.

If the sound-board sinks or the strings lose this bearing, the piano loses its beauty of tone, also making it very thin in power. Now make two slips of wood about $\frac{1}{4}$ in. in thickness, and $\frac{3}{4}$ in. wide, 4 ft. 2 in. long; make them clean on one side; mark one slip top and the other bottom. Gauge a line in the centre of each slip; now take the top slip and mark a line across with a square and marking point $2\frac{1}{2}$ in. from the end, and mark this treble. Now set your compasses to $\frac{9}{16}$ of an inch; start from the mark you have made, and proceed to mark the length of the slip until there are eighty-five marks on it, the space between each being $\frac{9}{16}$ of an inch. Square the marks across, and mark the bottom slip. Make the first mark $1\frac{1}{2}$ in. from the end, and mark it treble. Now serve it the same as the top one, with the exception of the last twenty-seven marks at the bass end; these must be contracted or drawn in, so that they are 1 in. shorter in their space than the twenty-seven in the top scale. This can easily be done by closing the compasses hardly $\frac{1}{16}$ of an inch. Having done this, bore a $\frac{1}{16}$-in. hole with a drill in the gauge line crossing each mark. For convenience it would be as well to mark each note in the following order from the bass end (you can do it with pen and ink): A *, B, C *, D *, E, F *, G (Fig. 2); and continue in the same manner until you get to the treble end of your slips, where you ought to finish with A. Place the top slip under the wrest plank, so that your first note, A, will be $2\frac{1}{2}$ in. from the treble, or right-hand side of your back. Now place the bottom slip at the bottom of back crossing the bent side; fix these temporarily so that they will not move about. The bottom slip will be $1\frac{1}{2}$ in. from the treble end to the first note. Place a piece of wire in the two first holes, and having a stick of black-lead pencil, flattened one side, so that it rests close to the straight-edge, put your straight-edge up to the pins at top and bottom, and mark across the bent side and both bridges; continue this until you pass the bent side, then, of course, take your lines across the bridges. Now set your compasses to $\frac{1}{4}$ of an inch wide, and use them as a gauge; run round both sides of the long bridge, making a mark on the top; also run them round top bridge from bottom side (Fig. 3); now open them $\frac{1}{16}$ of an inch wider, and mark both sides of the short bridge. Now you will have to make a tool as shown in Fig. 5. This can easily be made out of a piece of round steel; flatten one end, and make the prongs with a saw file; the one with the three prongs is for the trichord notes, and the two prongs for the bichord notes. Now take your trichord punch, and place one prong on the first treble line of your top or wrest-plank bridge, the other two prongs being to the left of the line. Punch each one in this way until you have done twenty-two, this will be the number of trichord notes. Now take your bichord punch and punch the remainder with the exception of the last seven at the bass end; these are single notes, so only require one punch mark. You now mark the long bridges. Take the trichord punch and begin with the first note at the treble; place the right prong on the line which crosses the bridge, and the left on the line you made with the compasses, holding the punch in a line parallel with the wrest plank.

You will find that the first twelve notes will run in a line on the bridges, when they will gradually break off. Mark twenty-two with the trichord punch. In the top bridge there is one line of pins, in the long and short bridges there are two lines of pins; now to mark the bottom edge of the bridge, place the right prong on the line you made with the compasses and the left prong parallel with the wrest plank. Of course you mark with the bichord punch to correspond with the top bridge. You may now mark the short bridge with the bichord punch in the line you made with the compasses, except the last seven, which are single notes; serve these the same as the top bridges.

In the trichord you use small bridge pins, bichord middle size, while for the short bridge you use a shade larger. You ought to have your pins before you bore the holes, which is done with a drill stock and bow, or an Archimedean drill will answer your purpose, and are about 2s. each. You can make your drills out of umbrella steel ribs; if they are round, file them so that they have three sides to cut with, which will prevent splitting.

Commence boring the top bridge, using soap on your bit; start at the treble; you can sit on the wrest plank while boring this, and hold your drill in a slanting direction, so that your pins will lean towards the bass. Now bore the long bridge, the top row bore leaning towards the bass, and the bottom row leaning towards the treble; serve the short bridge in the same way.

Having bored all your holes in your bridges, scrape your bridges clean and glass-paper them. Now mix some black lead into a paste with water, and rub with a piece of flannel over the surfaces of the bridges; now rub a piece of round steel over and burnish them. Set your compasses to $\frac{6}{16}$ of an inch; run round the top bridge, using them as a gauge, that will give you a line to work to. Now take a small plane and bevel the bottom edge of the bridge up to the pin holes. Bevel the top side of the bridge up to the line you previously made with the compasses, smooth it well, then varnish with a small brush. Now bevel the bottom edge of the long bridge up to the first hole; also bevel the top treble edge, where the holes run straight; then take a small saw, such as are sold with a brass back and straight handle for 1s. 6d., or a dovetail saw; now sit on the sound-board, looking towards the wrest plank, and begin at the treble end at the thirteenth hole. Hold your saw, and cut in the same direction; your strings will lie across the bridges $\frac{1}{8}$ of an inch the bass side of the hole, down to the hole of the note below, about $\frac{1}{4}$ of an inch deep. You will find these cuts will lengthen as you get down the bridge. After you have cut them all, then take a sharp $\frac{3}{4}$-in. chisel, and hold it half way across the holes and cut the piece out, starting at the treble and going to the end; this is called carving the bridges, and if done carefully looks very nice; see that you clean the side (that you cut with the saw) with the chisel. The short bridge you simply bevel up to the pin holes at the top and bottom edge.

You must now make a bevel in the following manner: take two pieces of $\frac{1}{2}$-in. pine, one piece $1\frac{1}{2}$ in. wide, and the other 1 in. wide, and both 9 in. long. Screw the 1-in. piece across the centre of the other $\frac{1}{8}$th to the inch out of square. Now start at the first treble hole on the top bridge, holding your bevel to the holes in rotation, and marking with a fine pencil across the wrest plank. This is done to mark for the wrest or tuning pins. Where it is trichord, mark a straight line 2 in. from the top of wrest plank, and 5 more below it, with a space of $\frac{5}{8}$ in. between each line. Where it is bichord, you will only require four lines; see that the bottom row of pins are $4\frac{1}{4}$ in. at this point from the top bridge. This is so that the action will have room later on. Take a centre punch, and start at the treble, and punch the first, third, and fifth lines from the bottom; this will be your first note. Now punch the second note; that will be on the second, fourth, and sixth lines. As the grain of the wood in the wrest plank runs straight, this is done to distribute the pins over as large an area as possible. When you come to the bichord, you punch the first and third line for one note, and the second and fourth for the following, repeating it as you proceed. By a little close observation, you will soon see how this is done. Now clean the pencil lines off with a scraper and glass-paper, and give three coats of white hard varnish, allowing each coat to dry before the other is applied. You then clean up the sound-board, and give three coats of varnish.

Next we must turn our attention to the bent side. Run a pencil line round the bent side from the sound-board edge 2 in. From this line, mark towards the treble in short lines parallel with wrest plank across the straight lines previously made, every four until you have marked across thirty-eight lines. Now punch a mark where the lines cross. As you have twenty-two notes trichord in the treble, count this number, and 1 in. behind them make another line, and punch. You can now clean the pencil lines off. Now take a sheet of brown paper, and cut to fit round the inside of slip of bent side, and extend an inch over the holes you have punched. Mark where it crosses each bracing for bolts; get a heel-ball from a shoemaker's, and rub over the brown paper, and this will mark all your holes. This is a pattern for an iron plate to cover the bent side to prevent splitting. You will require to send this to the ironmonger's before mentioned, and order the bridge pins, Nos. 14, 15, and 16, one set and twenty-five over of wrest pins, nine wrest-plank screws and washers, and four 6-in. bolts with nuts, square heads, and sixty hitch pins for bent sides. I have not mentioned screws, as these are generally to be had in most towns, and they are not of a special character.

When you have got your pins, you will know the size to bore the holes; let the bridge pins fit the holes, but not tight enough to split. It is better to bore in a piece of beech till you get your bit the size you require. The wrest pins must fit tight as in tuning; if they were not so, the piano would not stand in tune. Having got your holes bored in your bridges, proceed to pin them (using a small hammer for the purpose); let them stand above the bridges about $\frac{1}{8}$ of an inch, then run over with a file to level them. In boring the wrest plank, use a stock, and probably you will find a $\frac{3}{16}$-in. spoon bit will be the size. You must bore these, standing at top of the wrest plank when the back is on the trestles, and let the bit lean towards you, so that the wrest pin is $\frac{1}{4}$ of an inch out of the upright in its length; this prevents a tendency to fall down, as when the piano is on its bottom, the pins point upward a trifle. Having bored the holes, countersink a little to remove burr off the top. Now mark above the holes the scale you marked on the rods, beginning at bass end, and starting with A and ending with A.

The bent side plate must now be put on so that the holes cover the punch marks; screw on, and put bolts through so that they are level at the back; you can bore in the bracing with a centre-bit for the nut to lie on; now bore your holes for your pins with a small bit, and drive in the bent side. Fix on your bottom plate, put in position by looping a piece of string on the last pin, and see that it comes in a direct line to the bridge. Now hold in position with hand screw, and put 2-in. screws in the projections, and 6-in. bolts in the bottom into the bracings. To find the place for the nut, turn it on the bolt half an inch, then hold it on the bracing opposite to the hole you want it to go in, and strike the nut with a hammer. Now bore a 1-in. centre-bit hole in a little way, and bore through the hole in your plate to meet it, then drop your nut in the hole, and turn your bolt in. Now put some 4-in. screws through the wrest-plank under the top bridge in the bass and over in the treble into the bracings; this will secure your wrest plank at the bottom edge.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

THE THREE SIMPLE DIVISIONS OF COLOUR—SECONDARY AND TERTIARY PIGMENTS.

I WILL now ask particular attention from the young worker on a few points of a theoretical nature, before I bring my selection of house-painters' pigments to a close with a list of the most useful greens and browns.

In the first place, it is absolutely necessary that the student and worker in paints should clearly understand the difference between the two, oftentimes-confounded terms of *pigments* and *colours*. Colour is but a *sensation* conveyed to the brain by the action of light upon the nerve-fibres of the retina. Independent of our eye-sight colour, literally speaking, is not! When a man is colour-blind, for instance, either to red or green colour, the explanation of this phenomena lies in the simple fact that the retina of his eye is lacking in that independent set of nerve-fibres which, in the case of those with perfect vision, answers to the particular sensations of red or green conveyed to them by light. The blue of the sky, the glorious, golden hues of sunset and the beauteous and sight-comforting greens which clothe the forms of vegetation these colour sensations are individually and collectively due to the same source of reflected and transmitted light, acting in concert with the wondrous attributes of our vision.

Pigments, on the other hand, are those *substances* which, when acted upon by light, absorb certain of the rays of colour therein contained, and, by either reflection or transmission, give forth that particular colour by which, as blue, red, green, and so on, they are known. It will, therefore, readily be seen by every reader that this is not in any way a distinction of terms only, but as much a difference as there is between "substance and shadow."

In the more advanced divisions of my subject it will be at once my pleasure and privilege to further practically consider the nature and action of colours and light. No more interesting or important an aspect of the painter's craft is presented to us than the study and knowledge, to a far greater extent than the preceding few lines may cover, of the laws of colour.

For the present purposes of this paper, I will now briefly draw attention to the *classes* of colour into which our pigments are usually divided. It will be observed that, so far, I have confined my list of ordinary coloured pigments to those of the yellow, red, and blue kinds. These are usually termed the *primary* or source colours; since by judicious admixture and compounding of these pigments, and with the further assistance of white and black, any tint, hue, and shade of colour can be obtained, subject only to the purity and perfection of the primaries so compounded.

I will here haste to state, lest someone learned in "light and chemistry" amongst my readers may consider my selection of the primaries as based on an error in optical science long since exploded, that due attention to the latest and more proven theories of prismatic colour will be noticed in their proper time. My adoption here of Sir David Brewster's primaries is but a matter of literary and practical policy, the best means to present ends.

The primary pigments, then, being the first simple division, and consisting of blues, reds, and yellows, by combining chemically suitable blue and red we obtain purple; with red and yellow we get orange; whilst blue and yellow pigments combine to give us green colours or sensations. These resultant admixtures of any two primaries are termed *secondary* colours; and again by a similar process of mixing, in certain proportions, two of the secondary pigments together we obtain the third distinct class into which we divide our colours, which third division is known as the *tertiary* colours.

My purpose in thus generally confining myself to the primaries in the preceding list of house-painters' pigments will now doubtless explain and commend itself to the reader. With all those pigments at hand almost every variety of colour, requisite or desirable for our ordinary use, can be prepared; some portion of *brains* being, I need scarcely add, usually also required.

Since I have already indicated the results of adding any two of the primaries together, I will here advise the young painter to practically work this matter out himself by mixing some of those pigments together, the appearance and nature of which he is now somewhat acquainted with by the careful study of my simple list.

In compounding painters' pigments there is yet a further matter requiring some little consideration by the worker. Not all of our blue pigments are chemically suitable for mixture with yellows or reds, nor all yellows with reds—in fact, a knowledge of the chemical source and affinities of pigments is almost a necessity to the painter and decorator. As the most brief and simple way of aiding the student, I will now define those ordinary pigments which it is usually advisable *not* to mix together.

For mixing in oil colour paints, chrome is an undesirable pigment, and it is particularly to be avoided when compounding *greens* from *Prussian* or *Antwerp* blues, which latter colours it would eventually destroy. In such an instance, for common use, the best substitute for the chrome would be bright *yellow ochre*, or, as it is often labelled, yellow paint. *Raw Sienna* can also be used with the above blue pigments without much detriment to either. In any case where a bright *mixed* green is absolutely necessary, I may say that the lemon chrome can be used in conjunction with good *ultramarine* blue or *indigo*.

In compounding the secondary colour of *purple* from the blues and reds I have given, there is less danger of trouble arising. For oil painting the best and purest are obtained by mixing ultramarine with *madder lake* (which is a beautiful crimson and transparent pigment equally as permanent as lakes derived from cochineal are unstable), or ultramarine and vermilion will answer. Prussian blue and vermilion give very deep purple, which may be lightened up with white. For common purposes the cheap purple brown is most useful, if required full in strength; but if lighter and pure tints are wanted in oil or distemper, ultramarine blue and vermilion, or, for cheapness, Venetian red, is necessary. Prussian blue in water would *not* suit so well, but indigo could be used if cost was not a consideration.

The remaining secondary, *orange*, is not a colour very much called for. In *orange chrome* or *orange red* we have a bright opaque pigment, but otherwise, like all the chromes, not a commendable article. *Burnt Sienna*, previously mentioned in my list, is a very opposite pigment in both nature and source. It is semi-transparent, reliable, and permanent, and, what also the practical student must always bear in mind, it is, when of good quality, a remarkably strong stainer, like Prussian blue in this respect. In compounding orange colour the reds and ochres I have mentioued are usually bright enough; yellow ochre and Venetian red, or raw and burnt sienna together, give us, with white lead, a good and serviceable variety of permanent orange and salmon tints.

The compounding of the third division of material colours, the tertiary, from either of the two secondaries is a subject I need scarcely here dwell long upon. The student who works at this subject practically will soon find from the foregoing and subsequent remarks those secondary pigments of orange and green which produce the tertiary *citrine*, whether bright or sombre, such as occasion requires. Of the remaining tertiaries, *russet* and *olive*, prepared from the secondaries purple and orange, purple and green, respectively, we have a good supply in the form of simple pigments. Notwithstanding, therefore, the necessity and advantage of the worker being able to obtain any colour by the admixture of the three primaries, it is always most economical to use a simple article of the desired colour when such is to hand.

Having now brought before my readers the simple outlines of colour-mixing, I will here append a selection of the most serviceable and everyday pigments of the secondary and tertiary classes which are to be obtained ready for house-painters' use from the manufacturers.

I need scarcely point out how unnecessary, and almost impossible, it would be for me to include here all, or even one half, of the various greens, browns, etc., which are now upon the market. I take up the wholesale colour list of a Newcastle-on-Tyne manufacturing house and find therein a dozen or more kinds to every primary, secondary and tertiary. The bulk of these merely represent differences in nature, hue, or brightness, and three-fourths of which compositions, each rejoicing in some fanciful, and often incongruous, name, could be as easily prepared by the worker himself who understands that little of the nature and qualities of pigments I have herein endeavoured, I trust not without some success, to make plain and intelligible from every point of view.

Green pigments, chiefly derived from the mineral sources of copper, are very plentiful and reasonable in price. Emerald green is the brightest, and is useful to the house painter both in oil and distemper, in which it aids us to get very clean and bright tints. I well remember when it was used in house painting to a great extent, and when some of the aristocratic residents of Westminster and Belgravia were quite satisfied with emerald green tints on their dining-room or morning-room walls. Nowadays, however, what with Sanitary Congresses and Health Exhibitions, the merest suggestion of green is usually interpreted "arsenic," and since the deleterious nature of such copper greens is certainly a definite source of trouble, everybody can be satisfied with seeing less of them.

Brunswick greens, quaker greens, chrome greens, etc., are all useful pigments, owing their colour to, I believe, their preparation from the same mineral sources as Prussian blue and chromes. Generally it may be granted that they are reliable and fairly permanent for their cost, about 3d. to 6d. per lb. retail; but remembering my remarks about the mixtures of the chromes and blue, the painter will do well to avoid their use for tints with white lead in good and permanent interior work. Bronze, olive, and invisible greens are, as their names imply, deep but richly-toned pigments, very useful for external painting and very reasonable in price. They can be almost as easily mixed by compounding black and yellow pigments, or black, blue, and green, according to the particular hue or "cast" that may be desired.

Since we have a surfeit of greens and yellows it follows that there is little need for citrine pigments: they can be mixed best and easiest from those secondaries. Coming under this heading, however, are usually classed the *umbers*. The most common is usually termed raw umber, a natural ochre found almost all over the world. The best is Turkey umber, and this, after burning, which makes it richer and warmer, when it is known as burnt umber, is one of the most useful pigments. For graining it is almost indispensable, and for all general purposes of painters' and paper-stainers' work it is one of the most valuable aids to soft and modest colouring, both in oil and water processes, we possess. Its price varies, according to quality and preparation, from ½d. to 1s. per pound. Of the umbers and Vandyke brown I shall have, necessarily, more to say in the papers in which I shall deal with graining and other imitations, so I may spare the reader any further remarks on them here.

HOW TO PAINT A STAINED GLASS WINDOW BLIND.

BY FRED MILLER.

PAINTED glass for domestic purposes requires a totally different style of work and design to that intended for ecclesiastical windows. It should be simpler in design and less severe in treatment, and the effect largely obtained by "tracing" rather than by elaborate leading. Church windows (I speak of figure windows) owe their effect to the use of coloured glass, and the disposition of the leads that bind each separate piece of glass into a complete design. In the window blind we propose doing as our first effort at glass painting, the glass is simply cut into squares, say 3 in. and $3\frac{1}{2}$ in. or even 4 in. square, and each square is painted or "traced," as it is technically termed, in a solid brown colour, known as tracing brown. The glass is then "stained" at the back with "yellow stain," fired, and the glazier then leads the squares together and completes the blind.

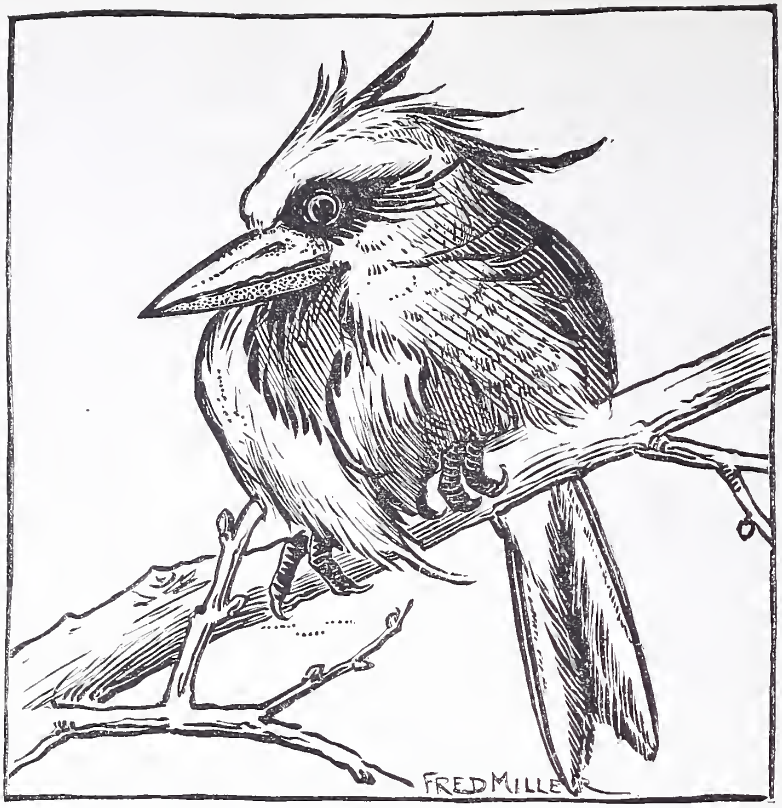

Fig. 1.—Design for Stained Glass: Laughing Jackass of Australia.

This tracing brown and other glass colours can usually be obtained where you get your glass cut, viz., of a firm who produce leaded glass for the trade, such as Pepper & Boyes, in the Euston Road, for I must here assume that my readers do not attempt to do the cutting and leadding for themselves, these both being distinct branches of the work from the painting of the glass, and in the trade are confined to a separate class of craftsmen. You must measure the size of your window, and if you are going to put the glass into a wooden frame, as is usually the case, you must make due allowance for the space occupied by the frame. Get out a piece of paper the size the glass is to be, and bisect its length and width. Assuming that the squares are $3\frac{1}{2}$ in., just see how many you can get in the length, for it does not look well to have to cut down one row of squares; you want to get in a complete number. This can always be effected by slightly altering the size of the square, and sometimes, in order to get a complete number in in the width, it is necessary to reduce or increase the width of each square, as the case may be, in order to work them in.

It is a nice finish to a window blind to have one or two "lines" of glass round the outside, as in Fig. 4, the outside one varied whites, and the inside one ruby. If you tell the glazier to whom you go to get your glass that you want a white and ruby line outside, he will at once know what you mean.

There are many makes of glass, but one I often use myself because of its charming effect is "Anbetti." It has a slightly rough bubble surface (some of it is more "bubbly" than others, and this kind is useful if it is desirable to block out an ugly look-out or prevent people seeing in).

When you get your glass, clean each square very thoroughly with a damp leather, and polish with a dry cloth. Any suspicion of greasiness will prevent the colour taking to it. The tracing brown must be thoroughly ground up, and the most effectual way to do this is to use a glass muller on a piece of ground glass. To every six parts colour put about one part loaf sugar and mix well with the colour. The sugar binds the colour to the glass and enables you to work it easily.

You can tell if you have enough sugar in your colour by putting a little on a piece of glass and drying it. If it dries dead looking and will not rub off by passing a dry finger over it, you know it is then right in consistency. If it rubs off easily put more sugar; if on the other hand it dries shiny and sticky, there is too much sugar, and you must add more dry colour.

Colour improves by being kept, as it then works more smoothly; but keep it out of the dust. When it is hard on the palette you have only to moisten it with water and mull it up again.

Tracing brushes are long black sable writers that come to a fine point, and at the same time hold plenty of colour in their hair. At some brush shops they keep what are known as glass tracing brushes.

Place one of your squares over your design (say one of the designs given in this number of WORK), and filling your brush with liquid colour try and follow the lines of the design accurately, and yet with freedom. Be true to the spirit rather than to the letter of the design, for tracing that looks mechanical is never good. Tracing must be done with feeling, but this only comes of practice, for at first you will feel awkward, and will not be able to get the colour to flow freely from the brush on to the glass.

Fig. 2.—Design for Stained Glass: Toad with Toad-stools.

You want to get a certain body of colour on, for the tracing should be fairly solid so as to be opaque when held up to the light. Remember that glass tracing has to look well when held up to the light. Never work with a dry brush. Always keep the colour fluid, and continually charge your brush with fresh colour, so that it flows freely on to the glass.

Some of the markings on the bird and frog would look better to be less opaque. Such markings are done with colour thinned down with water and put on thinly. An experienced glass painter can produce a charming variety by the use of thinner colour in some portions of the work, for although the tracing must on the whole be opaque, yet it should not

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yellow stain on with camel-
hair brushes, keeping well
within the traced lines so
that when held up to the
light only the particular part of the design destined to be yellow is stained. In the case of the bird and frog "quarries" (as the squares are called), don't stain anything but the bird and frog—*none* of the accessories, such as grass or tree. The squares are now complete, and must be sent to the kiln to be burnt. The heat melts the tracing colour on to the glass, making it permanent, while the silver is driven into the glass and stains it yellow. By the way, I must not omit to say that a thin wash of the silver stain produces a pale yellow, while a heavier wash gives an orange.

Designing.

The treatment of squares with quaint renderings of birds, animals, fish, etc., alternated with ornamental or foliage quarries, is one that gives an entirely satisfactory result. I myself constantly adopt this treatment in my own work, and for large staircase and hall windows the effect is rich without lessening to any great exent the amount of light admitted through the squares. It warms and softens the light and imparts a glow to the walls and furniture, and in cases where it is desirable to shut out the gaze of the curious, painted leaded glass should always be used in preference to the cold, formal, mechanical embossed and ground glass. The variety of tint obtained with the yellow stain is infinitely varied, and has a most beautiful appearance when a large number of squares are leaded together. The squares themselves should be cut out of various tints of white, and the stain takes differently on a greenish-white to what it does on a yellow or grey white, and so on.

In drawing birds and animals for quarries try and accentuate any characteristic of the creature you take a suggestion from. Ornamentalise, as it were, the details of your subject, and get the effect with as few lines as possible. You cannot keep this work too simple in execution. Attempt nothing in the way of light and shade, only so far as it is needful to obtain clearness of form and relief. When you come to stain the quarries you can keep the stain thin in the lights, and darker on the side that would be in shadow. This kind of light and shade produced by varying the stain gives a most excellent result. The more you vary the squares the better, and in window blinds no two ought to be alike. The Japanese books of designs will suggest a good many *motifs* to those who cannot invent for themselves. I have myself drawn a great deal in the Zoological Gardens, and the two designs given here in Figs. 1 and 2 are simply quaint renderings of two Zoo sketches. Fig. 1 represents the Australian bird known as the Laughing Jackass, and Fig. 2 the common Toad with two of the fungus known as toad-stools to form a suitable background. The other two designs in Figs. 3 and 5 represent respectively the blossom of the chrysanthemum and the fruit of the pomegranate conventionally treated.

Alternate the bird quarries with ornamental ones, and do not vary the pattern, as these squares are to be a foil to the animal ones. One window blind might have one pattern, and the other blind the second design. Stain these ornamental quarries very lightly, except the seeds in the pomegranate, and the cusp of the flower. Remember not to carry your tracing up to the edge of the squares, so that a portion is cut off by the lead, but leave a good ⅜ in. all round.

If the entire work has been carefully carried out in the manner indicated above, it may be taken as being a matter of absolute certainty that the glass painter himself will be pleased with it, and his friends also. The liking for the work will grow upon him, and in all probability he will in time proceed from window blinds to windows for staircases and glazed doors, which look very well when treated in this way.

Fig. 3.—Design for Stained Glass: Chrysanthemum conventionally treated.

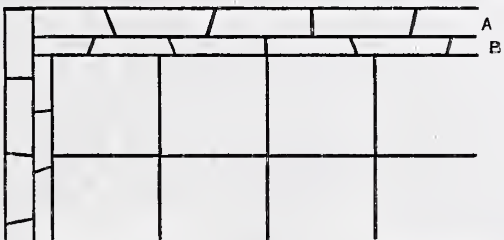


Fig. 4.—Bordering for Blind—A, Varied Whites; B, Ruby.

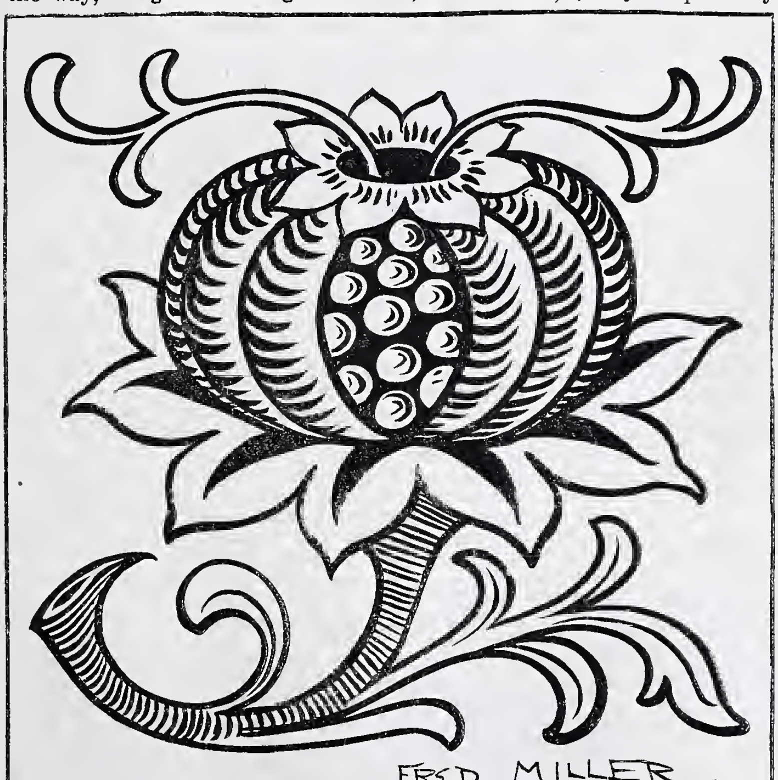


Fig. 5.—Design for Stained Glass: Fruit of Pomegranate conventionally treated.

SOME NOTES ON BRASS.

BY GEORGE EDWINSON BONNEY.

Brass.—Brass is an alloy, composed of copper and zinc in various proportions, as will be seen from the following list. In some varieties of brass a little tin is added. Soft brass, for turning into ornamental articles, contains a small quantity of lead.

TABLE OF VARIETIES OF BRASS.

Name.	*Copper.*	*Zinc.*	*Tin.*
Sheet Brass	84·70 parts	15·30 parts	0
Wire "	70·29 "	29·26 "	0.17
Gilding Metal ...	73·73 "	27·27 "	0
Mosaic Brass... ...	66·00 "	33·00 "	0
Dutch Metal	84·70 "	15·30 "	0
Prince's Metal ...	75·00 "	25·00 "	0
" " ...	50·00 "	50·00 "	0
Muntz Metal ...	60·00 "	40·00 "	0
Bell Metal	80·00 "	20·00 "	0
Pinchbeck	80·00 "	20·00 "	0
Watchmaker's Brass	33·50 "	66·50 "	0
German Brass ...	33·50 "	66·50 "	0
Yellow Brass ...	66·50 "	33·50 "	0

Published formulæ respecting the composition of brass alloys are apt to differ in the proportions of the metals to be employed. Mr. Bloxam gives the proportions of Pinchbeck as 3 parts of copper to 1 part of zinc. Bell metal is given in the above list as composed of copper and zinc, whereas Mr. Bloxam says it is an alloy of copper and tin. It is, therefore, a bronze, not a brass. The colour of brass is dependent upon the proportions of the two metals used in its composition. When there are more than 80 parts of copper in the hundred parts of alloy, a red tint predominates, which is increased as the quantity of copper increases. On the other hand, the colour becomes yellow when less than 80 per cent. of copper is present in the alloy, and the yellow tint gets lighter until 30 per cent. of copper is reached, after which the alloy cannot any longer be regarded as being of a yellow tint, but more nearly approaches that of zinc. The fusibility of the alloy increases as the quantity of copper decreases. This known property is taken advantage of in selecting a suitable solder for hard soldering articles made of brass, the yellow varieties being available as solders for the reddish varieties. Hard solder for brass may be composed of 79 parts of good tough brass added to 21 parts of zinc, using borax as a flux. Further information will be found in article on "Soldering Brass." Brass articles, tarnished or corroded, must have the tarnish or corrosion removed before they can be coated with metal by electro-deposition. It is not enough to scour off the corrosion by mechanical means, since this would still leave minute specks of dirt on and in the surface of the metal, and prevent perfect adherence of the coat of electro-deposited metal. Corrosion and tarnish are, therefore, removed in an acid pickle, made up of a mixture of acids for the purpose in hand. These are sometimes named "acid dips," and also "dipping acids." A good pickle for brass is composed of—

Sulphuric Acid	... ...	$3\frac{1}{4}$ pints.
Nitric Acid	... ...	$1\frac{1}{4}$ "
Common Water	... ...	1 pint.

Mr. Sprague gives the following as the composition of a pickle used for brass, copper, and German silver :—"Water, 100 parts; oil of vitriol, 100 parts; nitric acid, specific gravity 1·3, 50 parts; hydrochloric acid, 2 parts." Mr. Urquhart recommends for "bright dipping" a mixture of exhausted nitric acid, half a pound; water, 1 pint; hydrochloric acid, 3 lbs. The articles must first be cleared of all corrosion by dipping them in strong nitric acid; they are then allowed to soak in the "bright dip" for some minutes, and then well rinsed in clean water to clear off the black slime remaining on them. Mr. Watt gives the following as the composition of a dipping acid to produce a bright and clear surface on "certain classes of work":—

Nitric Acid, Commercial (by measure)	...	1 part.
Sulphuric Acid " "	...	2 parts.
Water	...	2 "

A pickle for "dead dipping" (that is, to give a dead or matted appearance to brass), as recommended by the same author, is composed of "brown or fuming aquafortis, by measure, 2 parts; oil of vitriol, 1 part. To the above mixture a small quantity of common salt is added." This mixture works well on both copper and brass, but it must be used in the open air, where a strong draught can blow the poisonous fumes away from the workman, or else be worked in a "stink cupboard," provided with a flue and a good strong draught of heated air. The fumes are always worse in damp air, as on a damp day or on the near approach of rain. A similar precaution must be observed in the use of the American brass pickle, which is composed of sulphuric acid 2 parts, and nitric acid 1 part only. This is an excellent pickle for brass castings or corroded brass of all kinds, but the articles must be moved quickly in it, and well rinsed in an abundance of clean water the instant they are removed from the pickle. They should then be dried by rubbing or tossing in hot sawdust, when they will assume a nice golden tint. If the pickled articles are to be plated or gilded, they should be well rinsed in at least two waters, dipped for an instant in a bi-tartrate of potash solution, again rinsed, and passed on to the plating-vat without delay. If not wanted at once, they may be left in the bi-tartrate of potash dip, where they will be protected from tarnish.

OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

105.—BEIT'S ENAMELLED ADHESIVE WATERPROOF ADVERTISING PAPER LETTERS AND FIGURES.

AMONG the most useful articles that are supplied as a means by which any dealer may call attention, if he so desire it, to the specialities which he manufactures on the one hand, or sells on the other, there are none perhaps that are more useful than paper letters and figures, for by aid of these show-cards and ticket boards may be speedily prepared in a most effective manner by those who are not possessed of sufficient skill to paint these things for their own purpose, or, to use the proper technical expression, "write" them on card-board or on wood, or even on glass. The best letters and figures of the kind that I have seen for this purpose are "Beit's Enamelled Adhesive Waterproof Advertising Letters and Figures," which are manufactured and supplied wholesale and retail by the Oxford Show-Card Manufacturing Company, 17, Arthur Street, New Oxford Street, London, W.C. These letters and figures are made in all sizes from $\frac{3}{8}$ in. in depth to 6 in., in a great variety of forms, and in gold, silver, and all colours. Rules, corner-pieces, or ornamentations of different kinds, hands, left and right, halfpenny signs, and the sign £, used to denote pounds sterling, may also be had at prices ranging from 1s. per gross upwards according to size, but I may say that sizes, shapes, and prices of letters will be ascertained from the sample price lists which the Company will send to any applicant.

It may interest some readers to know that these letters are cut by aid of steel plates from 2 lbs. to 20 lbs. in weight, according to the size of the alphabet. The paper from which the letters are cut is enamelled and waterproof, so that the letters and figures can be washed, or, if put outside of any window, the rain and weather will not injure them. They are cut by machines to insure uniformity, and the paper can only be purchased in Germany, as nothing resembling it is made at present by English manufacturers. The sheets, in fact, are so large that eight sheets imperial can be cut out of one of them. The letters, when cut, are sorted and bundled up in tens, and many millions are constantly kept in stock ready for use. Being gummed at the back, they have only to be wetted and stuck on any surface, whether of card-board, wood, glass, earthenware, or even iron. The gum used, I am told, is not an ordinary gum, but is a composition which will hold fast to anything, and which, at present, remains a "trade secret." For show-cards and price tickets for shops the letters and figures stand out clear and distinct, and they have the merit of being very durable. They may be used for banners in bazaars, etc., for letter-boxes, for numbering houses, for names on plate-glass windows, sign-boards, bookshelves, and many other purposes. The Company has agents in all parts of the world and the United Kingdom. I mention this because many a general dealer and seller of fancy goods might find it useful to add them to their stock.

106.—WILLCOX BROTHERS' PAPER LETTERS.

As I am writing on paper letters, I may take the opportunity to mention that another very effective kind of paper letters, useful for all indoor purposes and positions where they would not be exposed to the weather, are cut and supplied by Messrs. Willcox Brothers, Paper Letter Cutters, 172, Blackfriars Road, London, S.E. These letters are hand-made, being cut with scissors or knife from plain or coloured paper, six or eight at a time. I have specimens of these letters before me in all colours from $1\frac{1}{2}$ in. to 7 in. in depth, but they are cut in larger sizes than these, even up to 24 in. in depth. Up to 4 in. the price per dozen is 4d. plain and 6d. coloured, but above these the prices range from 5d. per dozen plain and 6d. coloured for letters 5 in. deep to 4s. plain and 6s. coloured for letters 24 in. deep. Fancy cut letters are 1s. 6d. per dozen, and gold and silver letters double the price of shaded letters. Letters shaded in three colours are double the price of shaded letters. Further information as to prices, etc., can be obtained from the makers. The shaded letters are first cut in one colour, and then pasted on to paper of another colour and cut again. Nothing is claimed for them beyond cheapness and effectiveness. Being on thin, common paper they can be utilised anywhere, and can be used on almost any material, and being cheap they can be changed at pleasure when the season may demand it. They may be turned to excellent account for announcements of any kind, and when cut in Church text or Gothic form will be found useful, effective, and cheap as lettering for church decorations. They may be further utilised for announcements of any kind, and especially for concerts and entertainments and meetings of any kind, whether in town or country. The chief points to which to pay attention are the placing of the letters between truly horizontal parallel lines, and equalising the spacing between the letters. Care of this kind bestowed on the work cannot fail to add to its beauty and efficiency when completed. THE EDITOR.

SHOP:

Corner for Those who Want to Talk It.

* Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Portable Sketching Tent.—W. A. M. (*Warrington*) writes:—"The enclosed is a rough sketch of a portable sketching tent. Can you tell me if there is one in use at the present time? The idea, as I have tried to show in the sketch, is to combine

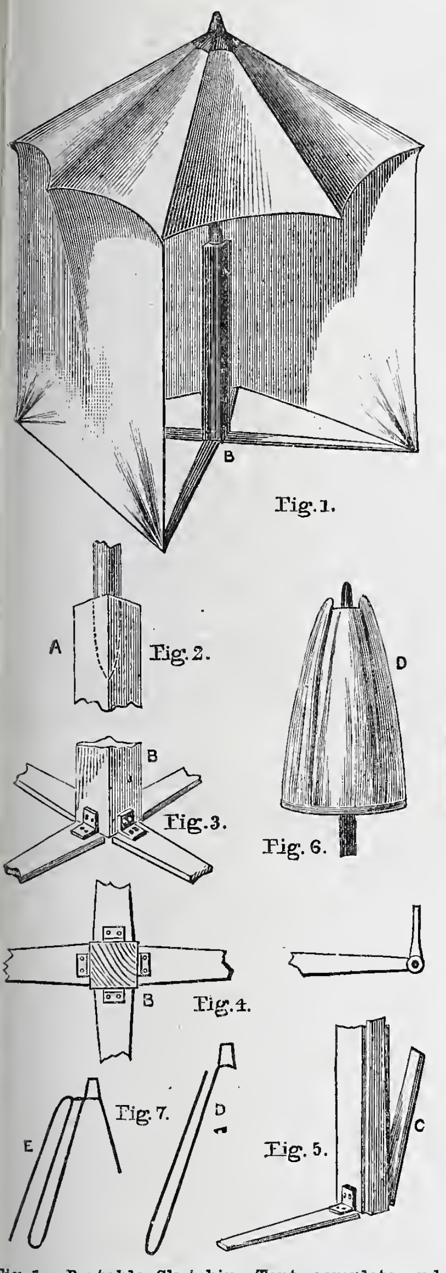
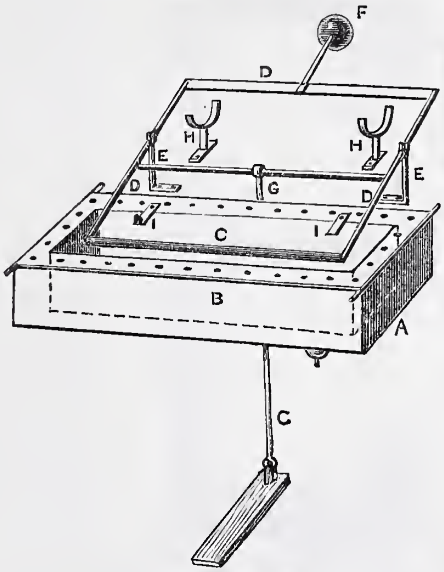


Fig. 1.—Portable Sketching Tent, complete and fixed. Fig. 2.—Top of Socket to receive Umbrella Handle. Fig. 3.—Foot of Upright to receive Umbrella Handle. Fig. 4.—Plan of Fig. 3. Fig. 5.—Bars turned up round Socket. Fig. 6.—Canvas folded up round Umbrella. Fig. 7.—Canvas brought up Umbrella (D) and down (E).

simplicity in working and lightness for carrying purposes, and also the tent to be adapted to be pitched on rock as well as on the soft soil. At A, in the sketch, the umbrella handle fits into the bottom portion. The four horizontal bars are hinged at B, so as to close up. The umbrella covering is brought down, so as to reach the ground, and the corners are fastened to these horizontal bars. Thus these bars serve two purposes: they support the tent on the rock, and also hold the sides of the tent in position. When required to be folded up the canvas forming the sides of the tent could be brought up, as at D, then tied, and the remaining portion brought down, as at E. If there is not one in use now, will you kindly tell me, through your columns in Work, if you think it would be of any benefit to artists or myself to patent it?"—[I do not see exactly what you could claim if you patented your tent. I am sorry to say that I cannot tell you whether or not there is anything of the kind on sale now, except the ordinary umbrella tent about 6 ft. in diameter.—Ed.]

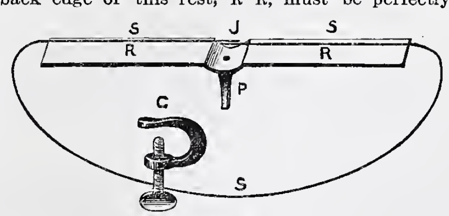
Mounting Calendars.—J. A. G. (*Nottingham*) writes:—"I send a few lines in answer to the inquiry of An Old Gluer for a machine for gluing sticks, being in the same branch at a large firm, and having used this machine for the last three years. Previous to this period, we fanned the sheets out to the width of $\frac{1}{2}$ inch, and laid the sticks on. The contrivance you give is, as you say, very well for sticks that are flat, but, as a rule, they are generally oval, and it would be impossible to lock them up as you would the flat ones. The sketch enclosed, though not a good drawing, may give you an idea what it is; gluing one at



Gluing Machine.

once, you can glue as many as 600 per hour in the machine. The outer pan is iron; the inner or glue pan is copper. The outer pan, of course, is for steam entering at the back with an outlet at the bottom. May be you will see the difference of the parts by letters: A, the outer pan; B, the inner pan; C, the gluing bar; D, frame for carrying bar; E E, loops screwed to bench to carry the frame; F, balance weight; G, treadle; H H stands screwed to bench to hold the sticks; I I, pair of tips to hold the stick while the glue bar or rest comes up from the pan. The bar is only $\frac{1}{4}$ in. thick and 2 in. wide, and the length of pan."

Brazing Band Saws.—A. R. (*Scorrier*) writes:—"Although this is a simple job, there are many that cannot succeed in effecting a good joint. The following is the most simple way that I know of, and I may say I have made hundreds of brazes in band saws. In the first place take a piece of $\frac{1}{4}$-in. or $\frac{3}{8}$-in. iron 4 ft. long, $1\frac{1}{2}$ or 2 in. wide; make it in the form of sketch which I roughly give. The back edge of this rest, R R, must be perfectly



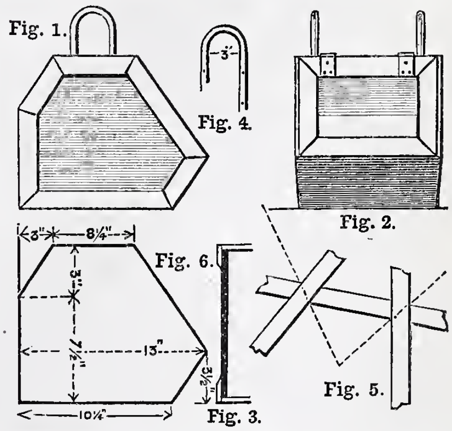
Band Saw Braze.

straight, to which two narrow strips of iron, S S, should be fastened. A piece of iron, P, should be welded, or a hole tapped, and the piece, P, screwed to the centre of the rest so as to hold it in a vice, or insert it into a hole in a small iron horse while the saw is being brazed. Now scarf the ends of saw with a file the length of $2\frac{1}{2}$ teeth. To do this the ends of saw need not to be warmed if the saw is of proper temper. Now place the saw on the rest, keeping the back of saw close against the strips, S S; this will keep the joint straight. Now take four cramps, made as C with thumb screws, and screw on rest, R R, to keep saw in position. Then damp the ends of saw, and take a little powdered borax and mix with a little coarse brass spelter, and place it between the ends of saw, or where they lap at J. All now being ready for brazing, take a pair of heavy tongs and heat them in a fire till bright hot; another lighter tongs must be made black hot. Take the heavy tongs and close it tightly on joint J. As soon as the spelter has properly run this tongs should be slipped off, and the black hot tongs, which has been held in readiness by a boy, slipped on and closed tight for a few moments. Take it away, unscrew the cramps, and lightly hammer the joint on the horse or vice. Then file it a little, and to improve the look of the braze rub it with a piece of emery cloth, and the job is completed. With a little practice a dozen or more brazes may be made in an hour. I may add that no binding wire is required."—[I am obliged for your name and full address, and for your further communications to "Shop."—Ed.]

Combined Bedroom Suite.—J. H. H. (*Oldham*) writes:—"I thank you very much for J. S.'s answer, containing all the information I desired. I enclose a rough tracing from the combination bedroom suite, with the alterations I intend trying to make in it."

Combined Bedroom Suite.

Simple Cheap Coal Vase.—G. W. (*Bournemouth*) writes:—"I send you particulars of a simple cheap coal vase well within the power of an amateur to make, something useful and ornamental. Sizes given are suitable for artisan or small dwelling, and



Cheap Coal Vase. Fig. 1.—Side Elevation. Fig. 2.—Front View. Fig. 3.—Section showing Rebate formed by Moulding. Fig. 4.—Handles, $\frac{1}{16}$ Round Iron. Fig. 5.—Mode of Marking Mitre. Fig. 6.—Size to cut out sides; all measures from back and bottom line as shown, $\frac{3}{8}$ or $\frac{1}{2}$ thick.

may be curtailed or enlarged to taste or requirements; made in pine or mahogany, birch or mahogany mouldings likewise to taste. Those made by myself were pine with birch mouldings, plain iron handles, covered by a saddler with brown leather, for a few pence—may be brass or silver plated—brass hinges, birch moulding 2 in. wide, ⅜ thick, chamfered ⅜, glued on to pine sides (mitred of course), and a few panel pins driven in from back, or bootmaker's rivets ⅜ in. long—nearly same thing. Having prepared sides, mark or gauge a line on back of moulding ⅜ in. from edge. Stick a couple of pins in line for quick guidance. To get the mitre, place two pieces in position, mark from angle to angle, cut and glue on (Fig. 5). When sides are finished, cut any stout piece for bottom 10½ in. long. Nail or screw in rebate formed by moulding (Fig. 3). Lid made same way. With ordinary care a snug, clean job will result. Give a coat of size, *i.e.*, good size thinned with turps. When quite dry clean up (if required) with No. 0 paper and clean turps, and thoroughly varnish or polish if equal to it. Handles are put through the top, and fixed inside with short screws. If of advantage to any one wishing to procure materials, I could supply some sawn in the rough, handles and hinges, pine and birch, 4s. 3d. net."—G. W.

II.—Questions Answered by Editor and Staff.

Bookbinding.—G. F. S. (*Nottingham*).—I hardly know bow to answer your query. You ask for an article or two on Bookbinding. As the space devoted to "Shop" talking is limited, it would be impossible to give lengthy articles. But articles upon bookbinding have been written, and will appear, no doubt, as soon as convenient in the body of the paper. There is no good and cheap book on this subject that I could recommend. Any that I have seen are very much taken up with the history of bookbinding, and describing the bindings of the old masters, who lived centuries ago. This is all very good in its place, but it gives no wrinkle to the amateur to enable him to bind his books. I am quite at one with you regarding the interest likely to be taken in this subject when it appears in our Magazine. You had best make a start to bind your books, and when you come to a difficulty put it down in black and white, and send to "Shop," and I will put you right. Many thanks for your appreciation of Work.—G. C.

Dynamo.—Septimus.—An illustrated series of articles on "How to make a Dynamo" will be forthcoming when space can be found for them in Work.—G. E. B.

Dr. Tibbit's Medical Battery.—J. McG. (*Bootle*).—I am tolerably well acquainted with a dozen or two different forms of batteries, but do not know this. If you will give me some idea of its construction, I will tell you how to recharge it. Perhaps some other reader of Work can oblige you.—G. E. B.

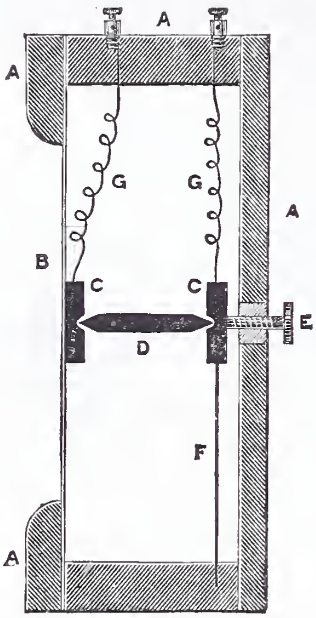
Telegraph Instruments.—H. G. C. (*Liverpool*).—My hands are full of work at present, so I cannot say when the promised articles on telegraph instruments will appear. As you have had several years' practical experience with telegraph instruments, perhaps you can oblige with a descriptive illustrated article on their construction. H. G. C. writes to inform H. D. and others that an excellent book on "The Philosophy and Practice of Morse Telegraphy" may be obtained from Messrs. E. S. Greeley & Co., Day Street, New York, U.S.A.—G. E. B.

Bicycle Materials.—F. W. R. (*Harling*).—1. There are no pliers, properly speaking, for turning spokes. There is a small wrench (Bauer's patent) that turns round objects as well as square: cyclists' size, 1s. 6d., of most tool dealers and cycle shops. 2. Tricycle fittings can be had of many firms. Try Wilkins & Co., 66, Holborn Viaduct, London, E.C.; Brown Bros., 7, Great Eastern Street, London, E.C.; Wm. Bonn, 308, Sunnie Lane, Birmingham, W. A. Lloyd, Waeman Street, Birmingham. Any of the above will supply all requisites. 3. Lines may be drawn of cycle frames and wheels with a large-size drawing pen, provided the colours are not too thick. For straight lines use a straight-edge, or tie a guide to the side of the pen. 4. Boiled linseed oil is used for work exposed to the weather in preference to raw. Raw oil is used for most interior painting and decoration. It is much lighter in colour and thinner than boiled, and therefore does not discolour fine pigments in the same way. 5. In turning slender rods in the lathe the practical turner keeps it running true to the tool with his left hand only. It takes considerable practice to do it, and an amateur could not be expected to do it for a considerable time. For iron work, when the work is of one thickness throughout, there is a guide fixed to the slide rest that travels with it immediately behind the cutter. In wood work for rods all of one thickness, such as broom handles, a hole is bored through a block of hard wood, and a cutter fixed in the hole in such a way that it will take off a shaving. The wood to be turned is first made eight-sided by planes or saw, then a little bit at the end is turned down to the size wanted. The block is now put on to this turned part, the work being now revolved in the lathe. The block is pushed along with both hands, and the rod is thus reduced to the size allowed by the cutter.—A. S.

Flow of Air in Tunnel.—Collier (*Bolton*).—You do not give us the section of the tunnel, so we must assume you refer to a rectangular heading, of which the sectional area would be 6 ft. × 9 ft. = 54 square feet. The cubic feet of air passing per minute will be (assuming it to be equally mixed with smoke in your observation) 90 ft. × 60 seconds × 54 square feet ÷ 23 seconds = 12,678 cubic feet per minute. Your measuring the velocity by the rate of travel of smoke indicates that a charge has been exploded, and therefore the regular current of ventilation disturbed, or otherwise that local smoke has been made that will not quite penetrate the whole current of air, in either of which cases the calculations will not apply. Send full particulars of the method of measuring the velocity, and the section of tunnel (if not rectangular), and you shall have reliable rules to work by.—F. C.

Boat Building.—Paddler.—I should use thin mahogany with a long straight grain, and bend it on to the ribs of the boat, using steam at the bends if required. The slips of mahogany should be about 3 in. to 4 in. wide, or you could use pitch pine. Both look very well. The rivets, etc., can be obtained at any large ironmonger's.—A. J. H.

Microphone Transmitter for Telephone.—W. S. (*Leicester*).—It is somewhat difficult to write and advise upon telephone matters, because of the fact that both receivers and transmitters are so completely covered by patents. But as I see that your receivers are of the "English Mechanic" pattern, and as there is no fear of them coming under the ban of the patentees, I will give you the design of a microphone transmitter, which answers pretty well as a speech transmitter, and is not patented. It was devised by myself, and if it suits your requirements I will be delighted. A wooden case 5 in. by 2½ in., having a round hole in front, closed with a piece of thin wood, to act as a diaphragm; two small blocks of carbon, with a small cavity scraped in the centre of each; a pencil of carbon, pointed at each end to fit into the cavities in the carbon blocks. One of the carbon blocks is fastened with cement to the diaphragm, the other to a piece of springy steel or brass, which is itself fastened in the bottom of the wooden case. The adjustment is made by a brass screw in the back of the box. Wires are fastened to the carbon blocks, and carried to binding screws, which may be placed in the top or back of the box as thought convenient. The sketch is given full size, but the sizes are not very important. There are a great many transmitters, some of them very intricate in the arrangements of the several parts. The one which I have given is just the opposite; it is very simple and easily made, and, providing the batteries and other things are in good order, it will do its work very satisfactorily.—W. D.



Microphone Transmitter for Telephone.—A, Wooden Case; B, Thin Wood Diaphragm; C, C, Small Blocks of Carbon; D, Pencil of do.; E, Adjusting Screw; F, Spring; G, G, Wires to Binding Screws.

American Clock Spring.—Factory Hand (*Brockholes*).—The spring might be made soft at the end by heating to a red heat and allowing to cool, then drill or punch. There is no need to rivet to the arbor, as in winding up; the rivet head, or more properly speaking the arbor hook, will catch in the hole and will hold it quite right. But after you have done it I do not think you will find it stand winding up. The best and simplest way is to get a new spring; it will only cost a few pence—perhaps 9d. at the most—and it will save you trouble. You may get the spring at Grimshaw and Co., 35, Goswell Road, or J. Hunt, 21, Ironmonger Street, St. Luke's, Clerkenwell. Take or send old one for pattern.—A. B. C.

Stains.—A. W. B. (*York*).—Dragon's blood is soluble in methylated spirits, so that you can either make a stain by dissolving a sufficient quantity and diluting afterwards with water, or you can dissolve it in the polish or varnish you may elect to use. With regard to your second question, I should certainly not think it worth while to take the trouble of polishing any piece of pine wood after staining it with dragon's blood. I presume you intend to use this as a mahogany stain, but the colour is far too fiery, and I cannot recommend you to do so. You will get a brilliant red, which is anything but a mahogany colour, though often supposed to be so. If you want a good mahogany stain for your chest, make it up of Bismarck brown, which may either be dissolved separately, or in the varnish or polish. It is a very powerful pigment, so that you must be careful not to use too much of it. As much as will stand on a shilling-piece will probably colour a pint of polish sufficiently for your purpose, though you can add more or less according to the intensity desired. Strain through muslin before using. To get a really nice dark rich mahogany colour on your chest, you cannot do better than stain it with weak walnut stain, and then finish with some of the red polish prepared with the Bismarck brown. Of course you are aware that polishing is more troublesome and difficult than varnishing, but that when properly done the appearance is far superior. I must confess that it seems rather an unnecessary degree of refinement to French polish a tool chest, but for your own purposes naturally you must be the best judge.—D. A.

Gilding Book Edges.—F. J. J. (*Macclesfield*).—There is no special recipe for gilding book edges. I will give a description of the process in common use, and if the querist follows it out I think he will be able to do his work satisfactorily. First then screw the book up as tight as possible in the lying press, between gilding boards, and scrape perfectly smooth with a steel scraper. Then take a wet sponge with a little bole, and blacklead and rub it over the edge, and brush it dry and burnish it with the agate. The bole gives a deeper appearance to the gilding, and if any cracks should be in the edge they will not be so readily observed. The size (which should be one part white of an egg to three parts water) must now be applied evenly with a large flat camel-hair brush, and the gold immediately laid on. After the edge has become perfectly dry it should be rubbed down, and any defects remedied. After this, burnish the edge until it is perfectly clear all over. The best gold leaf is what is known as "deep." The cost of a book is 1s. 3d. It requires a great deal of practice to become a good gilder.—G. C.

Brass Lacquer.—A. H. (*Hull*).—There is no lacquer that will make iron look like brass. Perhaps some kind of bronze would suit your requirements. If the iron articles are gas fittings, for instance, clean them well with sandpaper, and wash in strong soda and hot water. Dissolve 4 oz. shellac and ½ oz. gum benzoin in one pint of methylated spirits, by putting the ingredients in a bottle, and shaking often for two days. Then let it stand for two days, and pour off the clear liquid into another bottle. Now get some bronze green, and mix a small quantity with some of the above lacquer, and paint the iron work, which should be warmed; when dry give another coat. If there are any ornaments, touch them up with a little of the lacquer, and before the latter is quite dry, with a camel's-hair brush dipped in dry gold bronze powder, slightly gild the ornaments; after a few hours the work may be varnished. In reply to M. A. J. J., whose question appears in the same letter, indiarubber may be dissolved in any of the following solvents:—Bisulphide of carbon, benzine, benzoline, chloroform. It is not quite clear from your letter whether you require to cast articles of indiarubber in moulds, or to make indiarubber moulds. If the latter, apply successive thin coats of the indiarubber solution to the article to be reproduced, etc., and thus build up the mould. This, however, is suitable only for very fine and delicate work, and it is impossible to cast articles of pure indiarubber.—Opifex.

Ornamental Work in Lead.—A. K. (*Aberdeen*).—The article you desire to make is, I take it, of the fancy or purely ornamental kind as distinguished from the practical or useful. This being so, your choice of subjects is large, and the selection must depend rather on your own taste and judgment than on external advice, though I must say lead does not seem a very suitable material in itself. You are doubtless aware that it may be used instead of brass for repoussé work, and also for spun metal work. It might also be used instead of iron in imitation of the now fashionable wrought iron fancy articles, such as candlesticks, etc. etc. I cannot, however, advise its use for this purpose as savouring very much of sham production, and imitations are seldom commendable, albeit often ingenious. Perhaps a better way of making something ornamental, and not inconsistent with the material, will be to arrange the lead in form of conventionalised foliage on a wooden foundation. If, however, it is to be artistic work, see that you do not endeavour to get the appearance of some other material. For example, do not try to make your work resemble a piece of carving. Lead has properties of its own; remember these, and let the work show that lead is the material, instead of endeavouring to make it look like something else. I fancy I have heard of lead being used in this way in connection with Jacobean strapwork. If, as I think, you are a plumber, and want to show specimens of your skill at an exhibition, why not prepare something which shall show your proficiency in the recognised lines of plumbing? What you ask seems akin to a painter asking what subject he shall choose, and how it is to be treated, instead of bringing his own artistic perceptions to bear. I know of no book on the subject.—D. A.

Horse-power.—Collier (*Bolton*).—The horse-power of an engine is equal to the area of piston in square inches, multiplied by the effective pressure of steam per square inch in lbs., multiplied by length of stroke in feet, multiplied by number of strokes (that is, twice the number of revolutions per minute), divided by 33,000. The effective pressure is the mean pressure during the stroke, less the back essure. Taking your figures, and assuming the essure you give, 60 lbs., to be mean effective essure, the power will be—

$$\times \underbrace{36 \times 0{\cdot}7854}_{\text{area of piston}} \times \underbrace{60\text{ lbs.}}_{\text{effective pressure}} \times \underbrace{6{\cdot}5\text{ ft.}}_{\text{stroke}} \times \underbrace{2 \times 28}_{\text{No. of strokes}} \div 33{,}000 = \underbrace{673{\cdot}6}_{\text{horse-power}}.$$

ne horse-power is taken as equal to 33,000 foot-lbs. er minute, so we have a short rule. Horse-power quals piston area in square inches, multiplied by iston speed in feet per minute, multiplied by mean ffective steam pressure in lbs. per square inch, ivided by 33,000.—F. C.

Bending Ivory.—W. J. M. (*Liverpool*).—You an bend ivory slightly by immersing it in boiling vater until it gives a little, then clamp it firmly n the position required, and let it get cold. To often it entirely, a solution of phosphoric acid and vater is used; it is immersed until it loses its opacity omewhat; when washed and dried it becomes ard again. But this causes some alterations in it. do not know what, so be careful with it. I know he first is all right, but then I did not have to bend t much.—H. S. G.

IV.—Questions Answered by Correspondents.

Boot and Shoe Making.—Shoemaker (*Somerset*) writes in reply to Boots and Shoes (*Farnworth*) (see page 284):—"I will endeavour to furnish him with the information he requires, and perhaps I shall best accomplish this by describing how I should finish a soleing job. I presume he has a shoemaker's knife, as he 'knows a little of repairing.' I should commence by paring the new sole evenly and in shape with the boot; then rasping it with a rasp, which can be obtained at a leather and grindery seller's for 8d., 8 in. long—this, I think, a convenient size. After this a buffer is used. This can be made from almost any odd piece of steel such as a broken house knife or corset steel. The way to sharpen it is to file it to a semi-circular shape at one or both ends, also file it thin, not thin enough to cut as a knife; then with the back of the shoemaker's knife or awl rub it along the edge with a good pressure; this will have the effect of turning an edge, which does the scraping. Then sandpaper the edge (grasp the sandpaper in such a manner that the thumb will do the work). A burr will now be seen on the bottom. This must be pared off; then with smooth side of the rasp file in an outward direction, taking care to get the edge of sole the desired substance all round. Now take some paste, and spread on the edge, wiping off with a rag and spittle; this makes it smooth. Now ink: ordinary writing ink will do if no other is at hand; this must be allowed to dry, after which is the ironing process. A single iron is used for this work; it is so called because it has only one guide, consequently can be reversed to sole and upper side, and does away with the necessity of a multiplicity of irons. This can be bought at a leather and grindery seller's at a cost of from 4d. to 1s. Black heelball is ironed in to give polish. If the soles are riveted on, the rivets may be filed with the smooth side of the rasp. Now buff (scrape) the bottoms with a buffer made to cut along the sides in the same manner as described for edge buffer; after this freely use No. 1½ sandpaper. If desirable to make what is known as 'a damped down bottom,' an amateur may have some yellow soap (of good quality) dissolved in water till it forms a semi-liquid; use a clean piece of flannel to damp it with. After all the sole is covered, wipe off all that can be wiped off with a dry place in the flannel; allow this to dry. It will now depend on the skill and the quality of the leather whether the bottom is of a good colour or not. Now put some white heelball on the (bottom side) edge, and when the iron is hot melt this so as to make a brown mark on the bottom. Now rub off all heelball with a piece of cloth, and the job is finished. I am afraid I have used too much of your valuable space, but I have tried to act out the 'golden rule.' I wish Work a long and prosperous career. I have taken it in from the first, and have persuaded (successfully) others to take it, and when I met one of them one day, I asked him how he liked it; his reply was 'very well.'"

Lathe Work.—T. R. writes in reply to a Reader of Work (see page 382):—"I am inclined to think it will prove a somewhat difficult job to adjust compound rest on an ordinary lathe to be absolutely certain that a perfect fit will be the result without adjustment in taper work. Where a vernier exists at the base of tool slide, the latter may be approximately set by clamping at the required number of degrees to right or left of zero. Another method consists in using a right and left hand template cut to the angle required, secured with its base resting against the face of the face-plate to a bracket attached to the latter on a radial line with centre of lathe spindle. I always prefer where practicable to do the boring first. Some lathes are fitted with a screw at base of sliding headstock, which is very useful in tapering work between the centres, rendering adjustment easier than by slackening nuts on tool-slide. As the leading screw is ½ pitch, this fraction must be ignored in cutting odd threads as 7 per inch, and the saddle must always travel a certain number of whole inches from the point at which the nut is dropped into gear to the point where the lathe is stopped, and saddle run back to starting point again. You do not state the length of screw to be cut; but say it is 4½ in., then the distance travelled by the saddle must not be less than 5 or 6 in. (no fractions, mind) from starting to stopping. Chalk the lathe bed and the top of wheel on leading screw to indicate the exact position for stopping and starting. In the case of the 4½ threads per inch, this is equal to 21 threads in 5 in., therefore the saddle must run 5, 10, 15, 20 in., or some other multiple of 5 in., as the case may be, before stopping the lathe to run back."

Carriage Paint.—W. P. writes in reply to W. W. W. (*London, S.E.*), No. 28 in "Shop":—"Although you do not state whether the rose pink fades lighter or darker, the following, I think, will meet your requirements. Get some black carriage japan and grind some rose pink in it, then add a very little of Indian or Tuscan red until you get the required tint. To make a better job you might glaze it over with lake at the last coat."

Mounting Calendars.—R. R. & Co. (*Newcastle upon Tyne*) write in reply to An Old Gluer (see page 413, "Shop"):—"Referring to above query, we have a machine in use for gluing sticks for mounting calendars. It is simply an enlarged glue pot made in an oblong shape with water jacket under it, but instead of using a brush having a wooden roller 5 in. diameter resting in the glue with spindle resting in slots at each end with handle at one end to revolve it, the water being heated below with gas, a pipe with holes along being underneath it, the pot should be long enough to admit a roller 2 or 3 in. longer than the longest stick to be glued. The roller (wood) is cut in grooves at distances of 1 in. apart, it not being necessary to glue the sticks all along, saving glue. When the roller resting in glue is turned round the sticks are simply placed one at a time against it, and they take the requisite supply off the roller, which is turned round again as soon as more glue is required. One girl or man can work at each side by placing it in the centre of a bench."

Simple Incubator.—B. A. B. (*Hampstead*) writes in reply to B. F. (*Liverpool*) (see page 302):—"A simple incubator can easily be made, but unless B. F. is prepared to give great attention to the working of it, or can invent or copy a contrivance to prevent the heat fluctuating, he will find it nearly useless. Perhaps he may (if an amateur) copy one of the patented devices; for instance, a small receptacle is made of *thin* metal fitted with a liquid which boils at 103 deg. F., therefore expanding the flexible walls of the receptacle, and

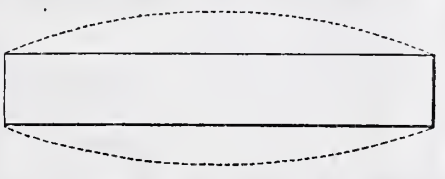
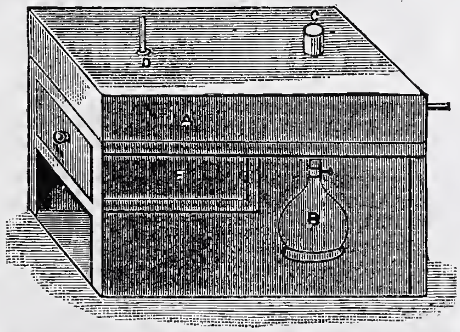


Diagram showing (exaggerated) expansion of receptacle.

by levers diverting the draught from the lamp; or he might get an electric bell and a special thermometer to make contact at 103 deg. F., so ringing a bell to warn him to reduce the heat. Supposing, however, he has mastered the regulation of the temperature, the rest is easy. Let him make a wooden drawer for the eggs with a frame to carry it. Let the eggs rest on a good thick layer of straw, for some ventilation is needed. The drawer need not be very deep, say, 3½ or 4 in. inside, and had better be lined with tin or zinc, as a little water must be given to moisten the straw from



Simple Incubator—A, Tank or Boiler; B, Lamp; C, Chimney; D, Thermometer; E, Drawer for Eggs. The whole, except front of drawer, to be enclosed to keep in the heat.

time to time. The heat must be applied from the top, and the tin box made into a shallow cover to the drawer case. Let this cover project either at back or side, and have a lamp as a source of heat. There had better be a tube through the boiler, with a movable damper to close it. When open the heat will pass away; when shut will play on the bottom of boiler. Have a thermometer on top of boiler, and then enclose the whole with a wood casing to prevent radiation and loss of heat, admitting a view of the thermometer either by having thermometer upright, the stem passing through a hole in the casing, or lying horizontally with a piece of glass let into the top of casing. There had better be a small ventilator in the drawer front, near the bottom, as air is needed especially during the latter part of the process of incubation."

Fretwork and Carving.—B. A. B. (*Hampstead*), in reply to W. M. M. (*Glasgow*) (see page 446), writes:—"I advise you to write direct to Zilles & Co., because that firm certainly know best as to what patterns they keep in stock, and the prices they charge. A fuller answer would be an advertisement."

Removing Ink Stains.—J. C. (*Ryde, I.W.*) writes:—"In reply to Littleton (*Worcester*) (see page 366), ½ oz. of citric acid diluted in 4 ozs. of water will remove all traces of ink, but not printer's ink."

Copying Tracings.—L. M. (*Putney*) writes in reply to Photo (*Chester*) (see page 366):—"I don't know of any process in which tracings can be copied in black and white by means of gallic acid, but I give a formula from the *British Journal Photographic Almanack* for 1889, which may suit Photo (*Chester*). Make a solution of gelatine, 1 part; water, 15 parts; warm it till dissolved, then well mix with it Indian ink or any pigment desired. Pour it while warm and fluid into a dish, and float paper upon it, and let it dry spontaneously without heat, and away from dust. When dry immerse it in the following solution:—Perchloride of iron, 240 grains; tartaric acid, 72 grains; water, 5 oz. Let it remain two or three minutes, and dry it in the dark. Print under the tracing in the usual way. Develop by immersing it in warm water. The light causes the parts not protected by the lines to become soluble in warm water. The lines are thus rendered black or coloured on a white ground."

Fretwork Picture Frame.—H. B. (*Maida Vale*) writes in answer to Amateur (*Belfast*) (see page 510):—I shall be pleased to send him a very effective pattern for above if he will send me his address."

Pill Making.—G. A. B. (*Old Kent Road*) writes in reply to J. C. (*Carlisle*):—"Being a subscriber, and looking over Work (No. 31, p. 494), asking, through your valuable paper, if any of your numerous readers could inform J. C. (*Carlisle*), or suggest any tool or machine for pill making, I beg to say I am employed by Mr. G. W. Niblett, of 26, Rainbow Street, Southampton Street, Camberwell, S.E., who will be most happy to furnish any requirements in same, as he is a manufacturer with every improvement connected with pill-making machinery."

Cleaning Engravings.—H. L. B. writes in reply to Ivor (*Bradford*) (see page 494):—"What a silly thing to do; of course the lime would act on the zinc. Todd's Victory enamels (Todd & Co., Hull) are recognised by practical men as the best things of their class, as they are a little better than ordinary paint mixed with varnish. Some of their bath enamel or the Chez-Lui bath enamel might stand the lime. But the zinc would require three coats, and the enamelled surface would then have to stand at least three weeks to get quite hard. You should not have lined the wooden tray with anything, but coated it with best shellac varnish. We use this in photography for our large trays, and find it waterproof and acid proof."

Pill-Making Machines.—H. L. B. writes in reply to J. C. (*Carlisle*) (see page 494):—"These may be had from Arnold & Sons, 35 and 37, West Smithfield; or, Burgess, Williams, & Francis, 101, High Holborn, W.C., London; or, Maw, Son, and Thompson, 7-12, Aldersgate Street, E.C."

Carriage Paint.—H. L. B. writes in reply to W. W. W. (*London, S.E.*) (see page 446):—"You must use good colours in carriage painting, and pay a good price for them, or your work cannot stand. I should think brown lake would be about the shade you want, it is not very expensive; try Simpson & Co., London Road, Southwark, for this colour, and say I sent you to them for it. For common work a deep purple brown might do, darkened a little with vandyke. For a purple colour mix white lead, Prussian blue, and vermilion. For dark chestnut, mix light red and black, and use red ochre when you require to lighten colour. For chocolate, mix vegetable black and Venetian red."

Ink for Posters.—Smiling Smudger (*Manchester*) writes in reply to A. J. (*Ilkeston*) (see page 494):—"I have tried several methods of poster writing, but have found the best and cheapest, and certainly the cleanliest and handiest, for an amateur who only occasionally does bill writing, to be ordinary oil paint, easily procurable in tins, mixed with about four times the same amount of benzoline. Use a long-handled round fitch to outline with, filling in with small pound brush. Any colours, such as vermilionette and lemon chrome, not always to be obtained in tins, you may obtain in a powder, or ground in oil; when mixing them add about a twentieth part of oil. Tack the whole of your bill, if possible, to a good plaster or boarded wall, and be careful not to splash the lower portion. I have written some very effective calico banners by this method, besides large pictorial posters, 25 ft. by 18 ft. It will serve equally well for colours, only not quite so thin. Heywood, Deansgate, Manchester, supply a splendid paper for this kind of work, called the 'Mammoth,' size 63 in. by 49 in., price 1s. 6d. the quire."

Varnish for Drawings. — A. W. (*Croydon*) writes in reply to A. M. (*Glasgow*) (see page 510):—"First size over drawings with a weak solution of French gelatine to be obtained at any grocer's or chemist's for about 2d. per ounce; then, when dry, proceed to varnish with the following mixture:—Take equal parts of Canada balsam and turpentine; dissolve by gentle heat in a wide-mouthed bottle, and apply with a broad camel-hair brush."

Ink for Posters.—H. L. B. writes in reply to A. J. (*Ilkeston*) (see page 494):—"The ordinary printers' inks, diluted with paraffin or benzine, are all that is used in poster painting. I am engaged by the Editor to write on this novel subject, and shall commence as soon as time permits, which I hope will be shortly."

Parchment Mounting and Stains.—In No. 31, p. 494, MITRE (*Hanwell*) asks for information on the above. Parchment requires no special treatment for mounting. If you wish to mount your certificates on cards for framing, lay them out on a piece of paper (to keep the table clean), and paste them well with good flour paste, not too thick, using rather a large brush, and going over the parchment as quickly as possible. When carefully pasted, lift the parchment, and lay it upon the cardboard, place a sheet of paper over it, and rub it well down with both hands. There is no need for damping, you will find that the paste will make the parchment quite damp enough. About the stains, however, you should have been more explicit. Some stains may mean much or little, and some stains would require a different mode of treatment from others for their removal. However, you might try oxalic acid and water, or rather water to which a little oxalic acid has been added. I intend to go into the subject of mounting by-and-by if the Editor can find room for this subject.—G. C.

Patent.—PATENTEE (*Leeds*) writes in reply to MINERVA (see page 416):—"'Those who thoroughly understand patents are well aware that this provisional protection is in reality a very questionable monopoly, and that no action for infringement would lie against any one for pirating an invention only provisionally protected.' The above remarks, which appeared in your paper on the 28th inst., are altogether misleading. Section 14 of the Patents, Designs, and Trade Marks Act, 1883, states:—'Where an application for a patent in respect of an invention has been accepted, the invention may, during the period between the date of the application and the date of sealing such patent, be used and published without prejudice to the patent to be granted for the same, and such protection from the consequences of use and publication is in this Act referred to as provisional protection.' Section 15 continues:—'After the acceptance of a complete specification, and until the date of sealing, the applicant shall have the like privileges and rights, as if a patent for the invention had been sealed on the date of the acceptance of the complete specification, provided that an applicant shall not be entitled to institute any proceedings for infringement unless and until a patent for the invention has been granted to him.' Therefore it is clearly evident to any one of ordinary comprehension that not only is the invention fully protected by the provisional specification from the date of that document up to the date of sealing of the patent (provided, of course, that a complete specification is lodged and accepted within the prescribed time), but proceedings for infringement can be instituted for any piracy of the invention occurring within the period covered by the dates of the provisional protection and acceptance of complete specification and sealing of the patent. Most patent agents of any repute advise that it is preferable to lodge merely a provisional specification with the application for a patent, because on a complete specification being lodged and accepted it is advertised, and must be open to public inspection for two months to allow any one to oppose the grant of the patent; but a provisional specification is not open to public inspection during the term of provisional protection—*i.e.*, during the nine months or until the complete specification is lodged and accepted. Another very important reason why it is more advisable to lodge a provisional specification at first is that a complete one becomes public as soon as it is accepted, and if the inventor has not before then applied for his foreign patents he must run the risk and danger of being forestalled by some one patenting his invention before him in those foreign countries where the first applicant can usually obtain a patent, whether he be the inventor or not. Another good reason for lodging a provisional protection first is that if the inventor has not sufficiently perfected his invention in all its details, so that a full and complete specification and drawings may be lodged, he will have nine months in which to fully develop and complete it. It would therefore seem desirable for your editorial department to carefully examine any remarks intended for publication, so as to expunge all mischievous and inaccurate statements, if you wish to maintain the reputation of your paper."

Illuminating. — FAL writes in reply to H. C. (*Lincoln*) (see page 318):—"Vellum, not parchment, should be used for illuminating upon, the latter being quite unsuited for the purpose. Vellum is a most beautiful material, and admirably adapted for illuminations, though care is required in working on it, as it is almost, if not quite, impossible to erase any marks when once made. Ordinary moist or cake colours are the best things to use, assuming, of course, that they are obtained from a first-class house. I use Winsor and Newton's or Roberson's generally with shell, and sometimes leaf gold, and have always found these highly satisfactory. I hardly know what you mean by 'brilliant.' Of course they can be made brighter by giving them a coat of gum after the colours are dried, but I do not think the result would be improved by it. You should, by all means, study the illuminated manuscripts in the British Museum, but if this is impossible, if you will state exactly what you want to know I will do my best to tell you. Some years ago I invented a very simple method of stretching vellum, so as to avoid the cockling which wetting it entails. At this moment I am too much engaged to give the particulars of it, but if you would like to have them, and the Editor is agreeable, I would send a sketch and description to our 'Shop' in a day or two. I may just say that the plan answers perfectly."—[By all means send description and sketch of your plan.—ED.]

Plan for Stall for Covered Market.—B. A. B. (*Hampstead*) writes in reply to J. T. (*Middlesbro'*) (see page 494):—"The conditions laid down are that it shall shut and lock up; to secure this, and to utilise the doors for displaying goods upon, it will be advisable to make the front in four sections, two of which are fixed, and help to form the framing, and two hinged to the outer fixed sections; the ends make of two strong frames without panels, having instead a pair of glass cases revolving on centres fixed in middle of inner edges of top and bottom rails, having bolts inside to fix glass cases, either with their solid backs outside

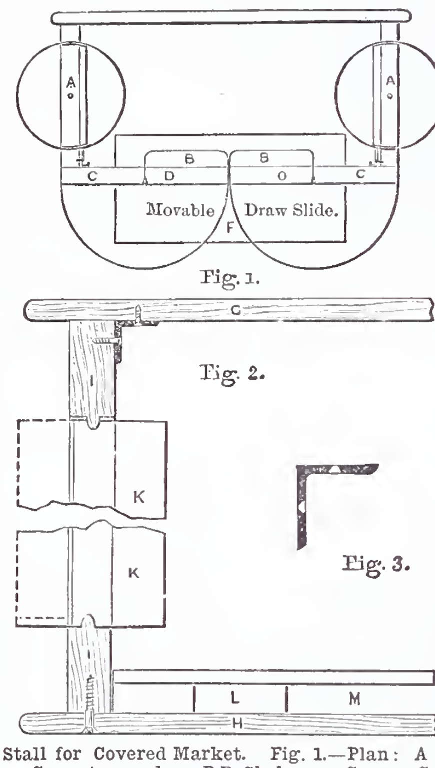


Fig. 1.

Fig. 2.

Fig. 3.

Stall for Covered Market. Fig. 1.—Plan: A A, Cases to revolve; B B, Shelves or Cases; C C, Fixed; D D, Hinged. Fig. 2.—Sections of Stall: G, Roof; H, Bottom; I, End; K, Case; L, Ledge; M, Slide. Fig. 3.—Iron Angle Pieces at intervals, important. Not to scale.

or their glass fronts outside as may be required. The bottom I should make of floor board ledged and screwed, having between the ledges a sliding board to draw out in front like a counter flap; over the ledges a false bottom to enclose flap; the back could cheaply be made of match lining not less than ¾ in. thick; top of same, covered outside with prepared canvas such as coach builders cover carriage roofs with. The whole of inside would be best painted white to obtain more light. I do not know if the stall is to go on wheels; if so, some modification might be necessary for what I have called the front, but which, if made as a vehicle, would of course be one of the sides. The whole of the erection could be done with screws or bolts and nuts, and the only joinery would be the glass cases and the end frames; the bottom screwed to ends; ledges of back fitted and fixed thereto; roof screwed from below through angle plates all round at short distances apart."

Ivory Walking Stick. — J. W. (*Liverpool*) writes *re* P. P.'s (*Withington*) reply to W. A. (*Hanley*) (see page 510):—"I will give simple opinion, as I think it will be an improvement—that is, to drill the ends, as P. P. advises, but tap a thread, and screw a bit of wire, level ends nice and flat, and screw wire in each end; that will pull it up to such a joint that it will not be seen."

Trade Notes and Memoranda.

"TYPOGRAPHIA" EXHIBITION AT STATIONERS' HALL.—The lesson taught by even a casual inspection of these exhibits was, firstly, that English letterpress printing was a long way behind continental and American work, and, secondly, that the older means of printing—that is from raised surfaces like type—is, notwithstanding the rapid improvements made in lithography—still very superior for high art reproduction to its younger rival. The causes of foreign excellence are principally the careful culture of apprentices and workmen under continental governments for a long period under systems of real technical education—not the false mockery of it now palmed off in England—a training as thorough as it can be, commencing with the first drudgery of the workshop, practical and manual, and hand-in-hand theoretical teaching, whereby the workman is taught to think out for himself the reasons for his *modus operandi*. American excellence is traceable chiefly to liberality of payment for excellence, attracting technically educated continental workmen to take with them to the States their abilities and culture to a better market than that of their native land. "The British Typographia," a society formed by typographic printers more especially to cultivate and develop their craft and fellow craftsmen so as to bring up English work to the higher standard of foreign work, has logically started off by proving by this exhibition our inferiority and the necessity for immediate action. "Typographia," by every means in its power—by the preparation and reading of papers, by meetings for the interchange of personal experiences and difficulties and their solution, by true technical teaching of those in the craft, whether apprentices or journeymen, and by gradually breaking down the artificial barriers to social intercourse between employers and employed—intends to place England once more in the van in this important branch of reproductive art-work. All who wish to aid in this crusade should send in their names to the Hon. Sec. of the London Branch, Mr. Robert Hilton, 2A, Gresham Press Buildings, Little Bridge Street, E.C.

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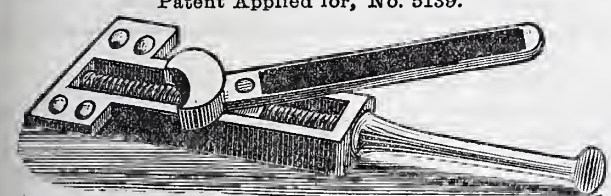

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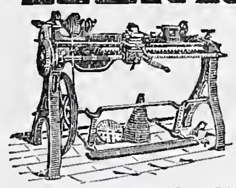

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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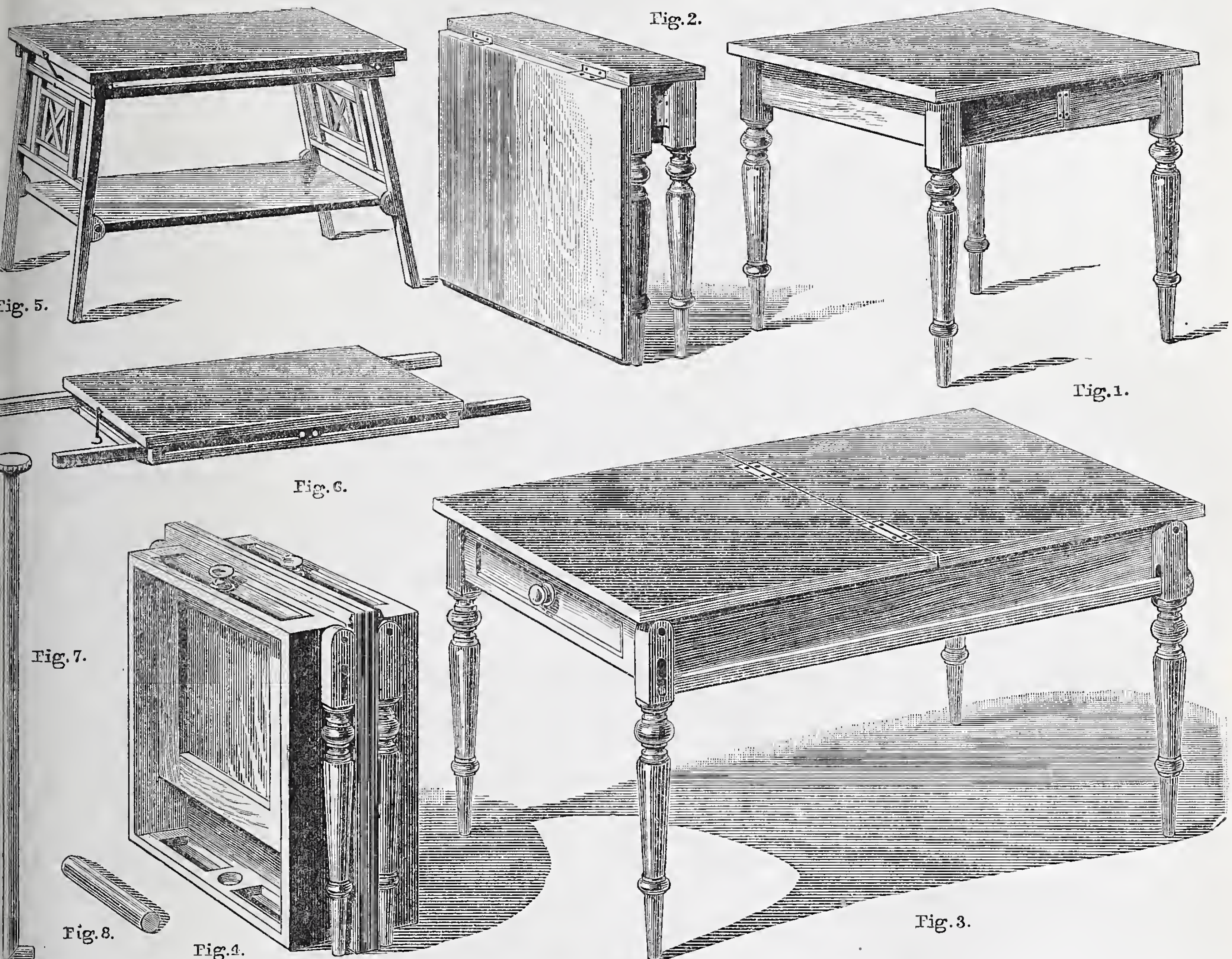


g. 1.—Small Folding Table in ordinary Position. Fig. 2.—Ditto, folded. Fig. 3.—Larger Folding Table with Drawer in ordinary Position. Fig. 4.—Ditto, folded. Fig. 5.—Small Fancy Folding Table. Fig. 6.—Ditto, folded. Figs. 7, 8.—Strips of Wood to keep Table shown in Fig. 2 firm when extended.

CHAPTER ON FOLDING TABLES.

BY JAMES SCOTT.

NECESSITY is the mother of Invention;" ut I have also heard it said that Invention not the only child of Necessity, although take it for granted that it is what may be ermed the eldest child. Among the other hildren of Necessity are to be numbered tarvation and Robbery; but although she the mother of these undesirable children, ill there are other mothers who have hildren of the same names, and among iem must be included Idleness.

But I must tackle my subject, instead of thus metaphorically speaking of a well-worn proverb. It greatly worries me when I visit any female relation on a Saturday to see the avoidable trouble to which she is put when house cleaning. First, she pushes tables, chairs, etc., to one-half of the room, and after sweeping and scrubbing, she transfers them to the other part of the room; and, finally, after having exhausted her patience, she places them in their original position. What a blessing if, for the time being, she could summon to her aid some fairy who would stow them away in his waistcoat pocket!

Necessity, then, to a certain extent is the cause of my designing the tables shown in the present article. It will generally be found that the folding tables already in the market are fancy articles for the drawing-room; or, if an extending table, the—sometimes—cumbersome screw dining-table. I have never seen such tables as I have shown to fold. Figs. 1 and 2 will be found the most useful.

I will do my best, then, to give the reader sufficient details to enable him to make any of these tables himself, if he feels so inclined.

Particulars as to wood, preparing, and finishing, are to be found in articles already published in WORK.

Fig. 1 is 29 in. high, from the bottom of the leg to the top of the table. The top is 36 in. square, and is divided into two parts: one 29 in. by 36 in., the other 7 in. by 36 in. The large flap falls downward, and needs to be very strongly hinged to the smaller one.

The legs are turned from $2\frac{1}{2}$-in. stuff, the blocks of which should be 7 in. long. Those attached to the smaller top piece should be very firmly joined. Those on the opposite side must not be fixed at all to the top.

The two end pieces which form the two immovable sides should be $\frac{1}{2}$ in. thick, 5 in. deep, and 31 in. long. This length allows for joining it into the leg block. For the two movable—that is, folding—sides we require four pieces of the same depth and thickness, and each 15 in. long. Two of these form a side, and care must be taken to firmly screw the hinges on. I have shown some of the hinges on the surface of the wood, but they may be so fitted as not to be seen, as my reason for thus showing them is merely to indicate their position.

The top should be $\frac{3}{4}$ in. thick, and should overlap the outside of the leg blocks by $\frac{1}{2}$ in. The framing, according to the requirements, should be hinged and joined to the *middle* of each block.

To keep the table in its expanded position a strip of wood 1 in. thick needs to be fastened on the large flap, underneath, and $1\frac{3}{4}$ in. from its outside edge.

Of course, it is impossible to provide this table with drawers; hence my reason for giving Fig. 2.

This represents a table 4 ft. 8 in. long, by 3 ft. wide, and 29 in. high. The top is divided and firmly hinged in the middle. The framing, etc., of each half is precisely the same, so that it is only necessary to describe one half. I have intended it to have two drawers.

The framing at each side should be 2 ft. 3 in. long, by $6\frac{1}{2}$ in. deep and $\frac{3}{4}$ in. thick (see Fig. 3). The framing on the end should be $6\frac{1}{2}$ in. deep and 31 in. long. This end piece should be so made as to leave a space for the drawer 5 in. deep and 28 in. wide.

Now we require something to keep our table from collapsing when it is extended. First, we must deal with the two backs which come together in the middle of the table, and which can be seen in Fig. 4. It can be a solid piece or cut out as I have shown, but it must have a hole cut through the centre. Fig. 8 shows a thick piece of rounded wood, which, when put through the two holes, will be sufficient to keep the table firm, if it is made the same thickness as the diameter of the holes.

Next, we must give attention to the legs. Each pair of blocks will have to be cut so as to receive the rod (Fig. 7) which passes through the first block and into the second, where it turns in the same manner as a key does in a lock, and will be a firm support for the legs. The blocks should be rounded off on their tops, and connected with the framing by an iron or wooden peg, upon which they work as a pivot. It must be remembered that the deeper the rods are fitted in the blocks, the more solid support they will afford; and if it is not considered too much trouble I should advise the maker to have legs with a block a good distance down, and have another pair of rods to fit into these.

As this table will occupy nearly 5 ft. space when extended, its folding will be a great advantage, as the space it will then take up will only be about 15 in.; so that, perhaps, it will be worth while to spend a good amount of labour on it.

The fancy table represented in Fig. 5 differs somewhat from the usual run of folding articles. In things of such a character, the aim in the design is to supply a table that will fold flat together, without one of its parts necessarily being disconnected from its fellow pieces. Another advantage to be gained by the use of table, Fig. 5, is that it will bear almost any amount of weight upon it when closed.

The top and the bottom board should each be $\frac{3}{4}$ in. thick, the former being 36 in. long by 18 in. wide, and the latter 36 in. long by $13\frac{1}{2}$ in. wide. The four legs should each be 27 in. long, 1 in. wide, and $\frac{3}{4}$ in. thick. The fretwork should be firmly joined between each pair of legs, thus fastening them together. A hole should be bored through the top of each, to admit a rod in each pair 16 in. long. These rods should be fitted in after all the other part is put together.

The framing should be $\frac{1}{2}$ in. thick, $1\frac{1}{4}$ in. deep, and 34 in. long, on each side of the table top, underneath; but no framing must be fastened on the ends. Each side piece should be cut through to allow of the free movement of the rods above mentioned. At 10 in. from the bottom of each leg should be a projecting piece of wood, through which a hole is bored, corresponding with a hole in the thickness of the bottom board, and through which a wooden or iron peg is driven to act as a pivot.

There are numerous methods to enable the table to be kept firm when being used. That which I have shown is as simple as needs be: it is merely a hook, the upper part of which moves in a kind of staple, and secures the legs from falling together.

This table will look well painted in either light or dark enamel. The two larger ones should be made of deal, with mahogany or oak stained or solid legs.

THE REGISTRATION OF DESIGNS AND TRADE MARKS.

BY C. C. C.

Protection of Designs—Drawings Required—Form of Application and its Cost—Classification of Designs—Trade Marks—Difficulty in Finding Novel Ones—Drawing Required—Rules and Information.

The registration of a design is a much more simple thing than taking out a patent. What we have to do in the first place is to provide three pieces of drawing paper, each measuring 13 in. by 8 in., and to make on each a drawing—the drawings being facsimiles of each other—in Indian ink, of the article or pattern which we desire to have protected. On applying for patents duplicates have to be sent in, but in this case *triplicates*.

Should the design be fairly simple in outline or pattern, we cannot do better than make the Indian ink drawings; but should the reverse be the case, and especially if our design will have to be printed for other purposes, time and labour will be saved by having it engraved or lithographed, and having three copies struck off, *without wording or trade mark*. These we may paste upon our sheets of drawing paper instead of making drawings.

We have now to apply at the Post Office for Form E (Patents, Designs, and Trade Marks Act, 1883 and 1885). It will be stamped with a red stamp, across which the word "Design" will be printed in black; for this we shall be charged 10s. In its margin we shall find directions for filling in the blank spaces between the printed matter. These forms are kept in stock at the more important post-offices, but may be obtained through any money-order office on prepayment of the value of the stamp.

In filling up this form, the one point which will specially require attention will be to determine the class to which the design will properly belong. Designs which have to be carried out in different substances, or which are to be applied to different kinds of articles in the same substance, have to be placed under different classes. Thus designs in or on paper generally come under class 5; but paper-hangings are an exception. There is a class for bone and ivory, a class for jewellery, another for metal goods not included under jewellery, and so on. For full information upon this subject it will be well that every person intending to register a design should obtain a little pamphlet of instructions, issued by, and procurable from, the Designs Branch of the Patent Office, at the end of which he will find a table of the different classes and the subjects contained in them. It should be observed that the applicant will have to state whether his design applies to shape or pattern. This is not always easy to decide. The writer has more than once been obliged to claim *both*, and his claim has been allowed. The remaining matters in the printed Form E are so simple that no one can be in danger of making mistakes in filling up the blanks.

As regards the drawings, the stringent regulations laid upon the applicant for a patent are not insisted upon. The drawing or print must be in a permanent ink, but it is allowable to shade it with washes, if these will serve to render the design more distinct and definite.

In addressing communications to the comptroller upon designs, the words "Patent Office Designs Branch" should be used.

Any person seeking to register a trade mark is advised in the official instructions not to go to any expense in engraving until he has ascertained whether the design for that purpose which he proposes to submit will or will not be accepted. In order to learn this he has to procure a form, which he will obtain from the post-office as in the previous cases, make his formal application, and submit his design. In some classes of goods few things are more difficult than to secure a new trade mark, simple as the matter may seem. The writer's experience has chiefly been gained in connection with trade marks for needles. These come under the same class as Sheffield goods (cutlery); no mark will therefore be accepted by the comptroller, the appearance of which in any way approaches a mark already secured by any maker of saws, files, or such-like matters, and though the goods of the needle manufacturer can in no way be mistaken for or clash with those just mentioned, we have known drawing after drawing rejected by the comptroller, because it trespassed in appearance upon some mark used by a member of the Cutlers' Company or other metal worker. To secure a trade mark may therefore be a tedious and expensive affair. We could instance one manufacturer of high reputation in the needle trade who after compassing heaven and earth to find a new and appropriate trade mark, was obliged at last to content himself with a dragon fly!

The form which the applicant will procure will be that marked F. It will have

"Trade Mark" printed across the stamp, and the charge for it will be 5s. It will have blanks in the printed matter to be filled in according to the directions given, and in the middle will be a blank square. With this two other forms (duplicates) will be given to the applicant, each with a blank square in its centre, and in the blank squares of all three papers, drawings of the proposed trade mark must be affixed.

On the stamped form will have to be stated the class of goods for which the trade mark is wanted (for instance, if for needles it would be class 13), date and signature attached, and all three forwarded to the Comptroller of Patents Trade Marks Branch.

When about to register a trade mark, the applicant will do well to procure the small book of rules issued for his guidance, price 1s. It is sold by ten London houses, of which that of Messrs Waterlow and Sons, Parliament Street, is one; in Manchester by Messrs. Palmer and Howe, Bond Street; in Edinburgh by Messrs. A. and C. Black; and in Dublin by Mr. Alex. Thom, Abbey Street.

HOME-MADE TOOLS.

BY J. H.

Joint Boards and Surface Plates.

Joint boards or surface boards are used by engineers' pattern-makers, for the building up of work which is jointed or parted into two or more portions for convenience of moulding. Thus, in making an engine cylinder by the method of lagging, the first half pattern is built up with its joint face upon the board, and afterwards the second half is built upon the first. The reason why a board is used is twofold. First it is usually truer than the bench; which, although true in the sense of being free from winding, is not usually free from local inequalities and roughnesses; and second, the building up of work often necessitates the use of screws, staples, or other temporary attachments which it is not desirable to insert in the bench; and also glue from the glued joints drops down from the work, and would make the bench in a mess. But the joint boards being true can be kept so by occasional shooting, and any disfigurement due to nails or dogs is of little or no consequence.

These joint boards are used for a variety of other operations by wood workers. They not only afford a true basis for building up work, but also for taking vertical dimensions by means of rule and scribing block, checking or adjusting faces with set square or bevel, for lining off centres and dimensions, and sometimes for drawing out work upon. They are to the pattern-maker what the marking-off table is to the fitter.

A joint board (Fig. 1) is necessarily made of several strips of stuff. A piece of board in one width only would shrink and curve out of truth to some extent, in spite of the coercion of stout battens. Making the board in narrow strips, and uniting these with battens and open joints, shrinkage or swelling due to atmospheric influences is so very much localised that the general level remains true for an indefinite period.

A joint board may be made to almost any dimensions according to requirements. It will generally be more convenient to have it oblong. Perhaps the most generally useful dimension would be from 4 to 5 ft. long, by about 2 ft. wide. Supposing it is 2 ft. wide, make it in four strips of 6 in. wide each, or in three of 8 in. wide. It is not necessary to plane to thickness and width, but it is a neater method. At least, the strips should be planed to a parallel width to make the slightly open joints, say $\frac{1}{32}$ in. open, of about equal width throughout. If they are not planed to thickness, then the best plan is to make one face true and gauge and rebate narrow faces on the opposite side to take the battens.

The battens should be stiff. They may measure from 3 to 4 in. in width by $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. in thickness. They will be screwed to the strips in such a way that a slight amount of expansion and contraction will be allowed to the stuff. To do this, make the screws a slack fit in their holes in the battens. Put two screws from each batten into each strip, arranging them diagonally, and about in the position shown in Fig. 1.

It would be as well to let the board remain at this stage for a few days before planing it over, in order to allow any twist due to the exposure of the new surfaces, and the tension caused by screwing the parts together, to develop itself.

To plane it over true, we require the assistance of a straightedge rather longer than the board, and of a pair of winding strips. In a board of this length there will, unless the stuff is very thick, be an amount of elasticity which will permit it to accommodate itself to some extent to the bench, or trestles, on which it is laid. For this reason the stuff should be thick, not less than $1\frac{1}{2}$ in. in a board of the length we suppose we are making. And always before building up anything upon the board, it should be levelled on the bench or trestles with wedges or blocking pieces, using winding strips and straightedge for the purpose of testing. To plane the board over, in the first place the bench should be true, so that the board may be laid upon it in the most favourable condition. Its surface is then tried with winding strips, the strips being placed transversely near the ends. The straightedge is then tried lengthwise to check condition of surface which lies between the extreme ends just tried with the strips.

The surface may be free from twist as tested with the strips near the ends, but the intermediate portion tested lengthwise may be curved more or less, being either convex or concave. Or the surface longitudinally may be straight, but the ends winding in relation to one another. If the surface is true, not only longitudinally, but also diagonally, when tested over cross corners with the straightedge, then there is no winding. To face the board true, the trying plane must be sharp, and its iron adjusted as straight across as it is possible to work with, and set fine. A board made of well-seasoned stuff, put together in the way described and shot true, should last good in constant use for from six to twelve months without requiring to be reshot.

In making these boards there is no attempt to check one with another as in the straightedges and surface plates, the direct tests of straightedges and winding strips being sufficient for the purposes for which they are required. It is essential, of course, that the winding strips, etc., used in testing be themselves as true as possible.

Surface plates and lining-off tables are made in various forms and sizes. The lining-off table is used by the metal worker for the same general purposes as the joint board of the wood worker. The proper function of the surface plate is of a somewhat different character. Work is marked out on the lining-off table, and small work is built up thereon, or is taken thither for checking the accuracy or otherwise of lines and centres. The true and only legitimate function of the surface plate is the testing of faces and edges to which it is desired to impart the highest possible degree of accuracy. The functions of the two being distinct from one another, they are prepared by different methods. In their general form they are similar, consisting in each instance of a broad plated surface, well stiffened with vertical ribs underneath. But while the lining-off table is simply planed over, and so left, the surface plate is planed, filed, and scraped. The former is approximately true only, the latter absolutely so. The general truth of the broad area alone of the former is of importance; in the latter every minute localised section of area is in the same absolute plane with the rest. The former is easily and quickly prepared, the latter involves the labour of many days, perhaps of weeks.

Unless the aid of a true surface plate already in existence is available, it is absolutely essential to perfect accuracy that three surface plates be made. This, however, is a task in which three skilful amateur metal workers might well engage and take equal shares in the expense and labour.

For all work of large and moderate size, surface plates are made of rectangular and oblong forms; for very small work they are often circular (Fig. 4). In each case patterns are required, and they are to be constructed so that the face shall be cast downwards. It is best for this purpose that the stiffening ribs be only dowelled upon the plate, and they will be thinner upon the top edge than at the bottom. If the plate is large, diagonal stiffening ribs (Fig. 3) will be required in addition to those which run round the edges. If the plate is small, say 15 in. or 18 in. long, hand-holes should be cast in the two end ribs to lift the table by. If large, say two feet or over in length, handles of wrought iron are screwed in (Fig. 2, B). But such tables are only used in large workshops. The design shown in Fig. 3 will answer very well for tables up to about 24 in. long. The drawing is proportional for any dimensions below 24, so that a table of any length, from say about 8 in. × 6 in., which is about the smallest that is worth one's while to make, upwards to 2 feet, can be scaled from the drawing.

The oblong tables are the most useful. The rectangular surface is handier than the circular, and the edges afford a convenient base for the trying of the square across. But many small circular plates are made (Fig. 4). They are then commonly of the form in Fig. 4, the three legs enabling them to stand steadily on an uneven bench.

The making of surface plates is not an essentially different operation from that of straightedges and winding strips.

Having received the castings, grind over the surface and edges to see if they are sound before spending any other labour upon them. Then if they can be planed over in a planer or shaper, so much the better. If not, go to work with coarse file and straightedge until the surface of each is reduced to a fairly level condition.

If the surface plate is of small size, the file may follow immediately after grinding. If it is of moderate or large size, and in any case if its surface is uneven and rough, it must be chipped before the file is employed. The chipping should be commenced with a narrow cross-cut of about $\frac{1}{4}$ in.

in width, cross-hatching the surface with a series of shallow grooves. The truth of the grooves from edge to edge will be tested with a straightedge. Afterwards, the metal between the grooves will be removed with an ordinary broad-faced chipping chisel. When chipping near the edges, do not cut outwards towards the edges lest they become broken out, but strike inwards. Test the general level from time to time with a straightedge, and get it as accurate as possible with the chisel, because it is quicker and easier to chip than to file. It will also be found that by cross-hatching, it is much easier to get below the hard skin, and a truer surface can be obtained in less time than by using the broad chisel in the first place.

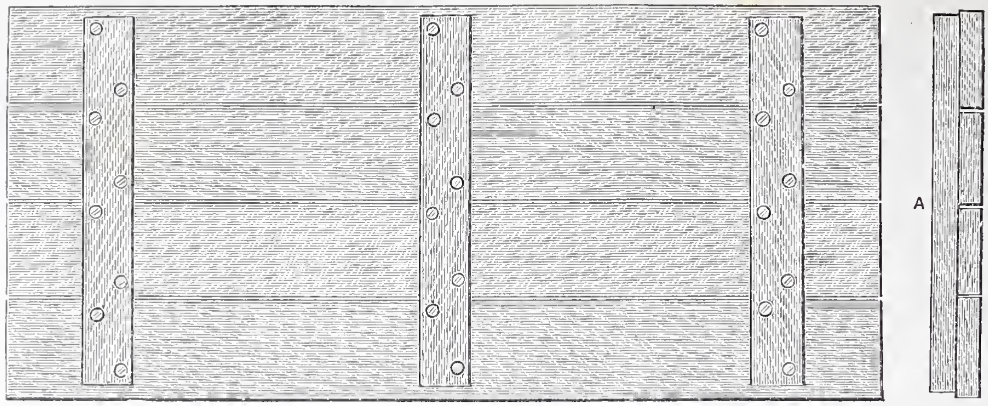


Fig. 1.—Joint Board in Plan seen from the Back—A, End View.

In the first rough stage of filing, when the chisel marks are being obliterated and the surface brought to a general level free from winding and curvature, no special precautions are necessary except the testing with straightedges. When the finer files are brought into requisition, their efforts will have to be more precisely localised, and red lead paste will be smeared over the straightedges, and transferred thence to the surface of the plate.

Not until we have done all that can be done in this manner is there any advantage in testing the plates by mutual contact. This will be done when we are using the superfine file and the scrape.

At these stages we shall get each plate first as true as possible, quite independently of the other, and then test each by the others.

It will be rather surprising when these plates, to all appearance true when tested singly by straightedge, are brought together in succession with red lead on their faces, to note how small a portion of the colour will be transferred from one to the other. Such being the case, we shall have no difficulty whatever in selecting the higher-coloured portions. and removing material with the point of the fine-cut file, and this alone will occupy us some considerable time. By-and-by, when the colour becomes more equally distributed, it will not be easy to localise the action of the file, and it is at this crucial stage, therefore, that the scrape has to be brought into service. By means of this tool the most minute localisation of action is possible, and the only limit to its use is the patience of the operator, as under the action of the scrape the number of minute points of contact made between the several plates increases, the action of the scrape is more and more localised, and the red lead mixture is made thinner and thinner until it is a mere film of coloured oil, and presently even this will be superfluous. It is better in the latest stages to trust simply to the contact of surfaces, the polish produced by the rubbing of the metallic surfaces upon one another being sufficient to indicate the higher points. At the last stage the surface of the plates will be covered with these points, imparting that lustrous appearance common to all scraped work.

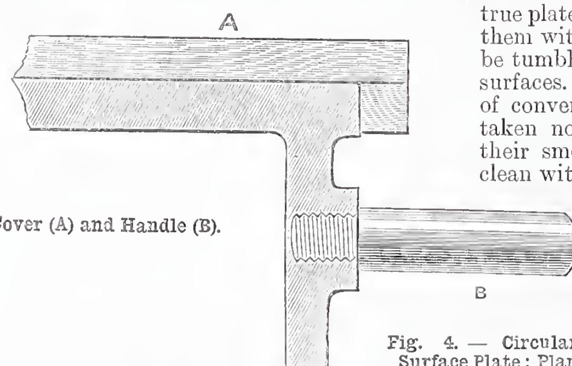


Fig. 2.—Cover (A) and Handle (B).

So intimate is the contact of surfaces in plates which have been prepared with the utmost perfection, that the upper one is capable of lifting the lower. Professor Tyndall attributes this to molecular attraction rather than to atmospheric pressure, because the same effect follows in vacuo as in air. In surface plates not prepared with this high degree of accuracy, there is nevertheless a very sensible force required to pull them asunder. When the plates are put together, the upper one floats for a while on an interposed film of air, and when this is squeezed out, it requires a good pull to separate the plates, unless the top one is slid sideways off the lower one.

After taking so much pains to produce true plates, we cannot do otherwise than treat them with consideration. Work should no be tumbled about or hammered upon thei surfaces. If lining out is done for the sak of convenience upon them, care should b taken not to scratch or otherwise impai their smoothness. They should be wipe clean with waste or with a wiper after us and when not in use should b covered with a wooden cove as shown at A in Fig. 2, in pos tion on the surface plate. Th cover consists of a board car fully jointed if necessary, o account of size, with a ledg screwed on round the edge.

Fig. 4. — Circular Surface Plate: Plan —A, Elevation.

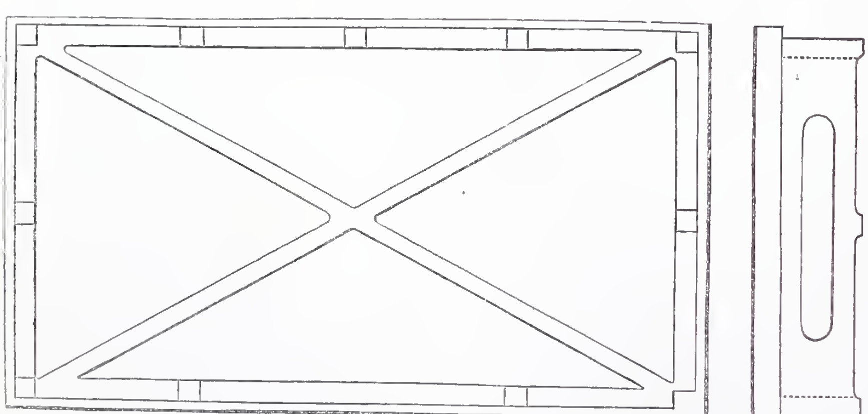
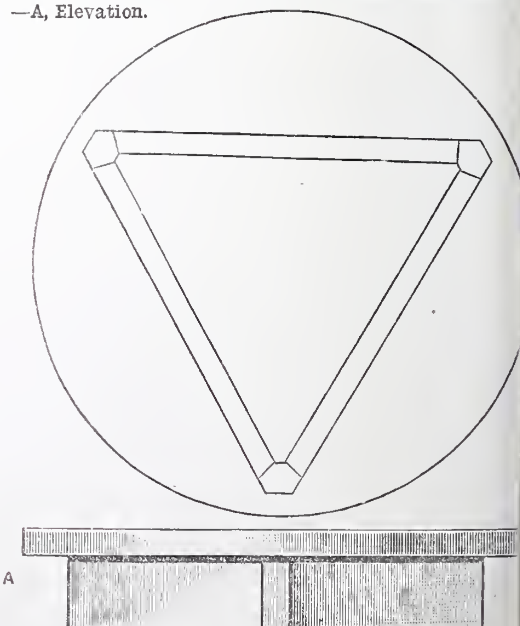


Fig. 3.—Square Surface: Flan from Below—A, Side View; B, End View.



TOOTHED GEARING.

BY FRANCIS CAMPIN, C.E.

HEN one shaft is required to be driven om another, and the relative velocities of e two rigidly maintained, frictional contact not to be relied upon, and, whether for ;ht or heavy machinery, toothed or spur heels must be used, and these so conructed that they move together in exactly e same way as they would were the otion communicated by the mutual conct of their circumferences. To determine ie form of tooth by which the required otion can be transmitted is the question ow before us. In Fig. 1 let E and F present two circular discs of which the of the teeth, will be equal to the corresponding least distance from the points 1, 2, 3, etc. Therefore, to find points in the side of the tooth on F, so that it shall work properly with *dd'*, and remain always *in contact* with it, proceed thus:—Placing the compass-point at C as a centre, open the compasses till the pencil touches the nearest point of the curve *dd'*, and draw the arc *e*9; then take in the compasses the shortest distance from point 1 in circle E to *dd'*, and using point 5 in circle F as a centre, draw the arc 9, 10, meeting *e*9 at 9; in like manner take the shortest distance from 2 to *dd'*, and from the centre 6 draw the arc 10, 11, meeting the arc 9, 10, at 10; then from 3 take the shortest distance to *dd'*, and from 7 as a centre, with it as radius draw —of the accuracy of the solution. It is now to be found what law is established to guide us in determining the suitability of a curve for the sides of teeth. It will be seen that in every position a line drawn from the point of contact of the circumferences of the circles to the point of contact of the teeth will be a radius at that point to the curve *ee'*, and therefore (from the properties of circles) it will be at right angles to the curve *ee'* at that point; and because the curve *dd'* touches *ee'* at the same point, the said line (C*e* for the position shown in the figure) will also be at right angles to *dd'*. We therefore find as the condition to be satisfied in order that the circles, E, F, may be made to revolve by the surfaces *dd'* and *ee'* precisely as they would by the friction

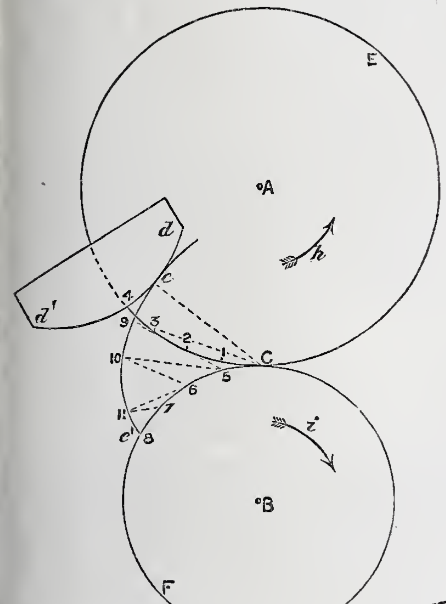


Fig. 1.—Contours of Teeth.

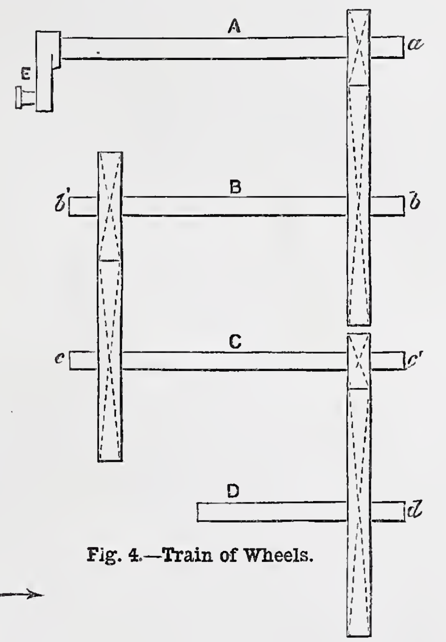


Fig. 4.—Train of Wheels.

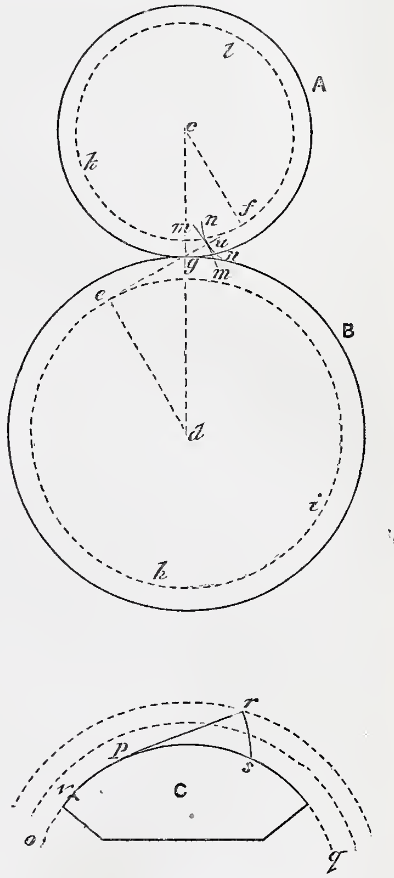


Fig. 3.—Involute Teeth.

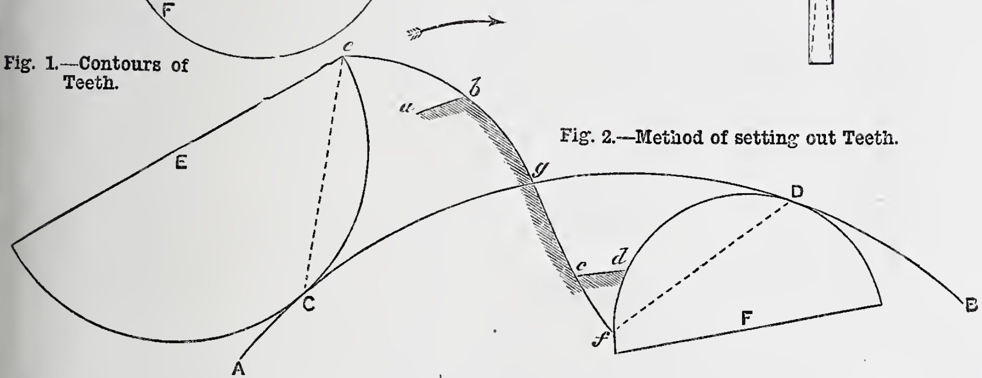


Fig. 2.—Method of setting out Teeth.

:entres are at A and B, and let them be in :ontact at the point C; then, assuming that there is no particular resistance, if one disc be turned, the other will revolve with it by reason of the friction at C. Upon the disc E let there be a tooth, the face of which is shown by the curve *dd'*, which cuts the circle E in the point 4. Divide the arc C4 into any number—in this case four are taken—of equal parts, and mark off the same number of equal parts on the circle F from C, making the arc C8 equal to the arc C4. Now if the disc E be turned in the direction of the arrow *h*, the disc F will revolve in the direction of the arrow *i*, and the points 2 and 6, 3 and 7, and 4 and 8, will successively come together at the point C. Now it is required to make a tooth which, fixed on the disc F, shall, during this movement, remain in contact with the curve *dd'*. It is evident that, at each successive position, the distance from the point of contact, C, to the point of contact the arc 11, 8, meeting 10, 11, at 11; and then the points *e*, 9, 10, 11, 8, will be points in the side of a tooth that will remain in contact with the curve *dd'* during the revolution of the discs through the arc C4. The more of these points that are taken, let me say, the more correctly will the form of tooth be given.

As in this lies the proof that the teeth can be made to work together concurrently with the natural motion due to mutual contact of the circumferences, and therefore can be used to make one disc drive the other in the same manner as, but without, the contact of the circumferences, I strongly advise the student to set this problem out on strong Bristol drawing board, so that it may be made into a working model, this method of investigating such matters impressing their results firmly on the memory, besides convincing the inquirer by the most satisfactory of all proofs—ocular demonstration of their circumferences, is that a straight line drawn from the point of contact *e* of the teeth to the point of contact C of the circles must in every position of the point *e* be at right angles to the surfaces in contact there.

As we may take an infinite number of points between C and 4, it is evident that the radius is continually changing for the side of the tooth, and therefore a curve made up of circular arcs will only approximate to the strictly correct form. There are, however, some curves which may be easily set out which answer exactly to the conditions required, and these, and the methods of applying them, I will now describe, premising, however, that the circles E and F, which would be in contact if there were no teeth, are called the *pitch-circles*, and that the part of the edge of a tooth *outside* the pitch-circle is called its *face*, and that part *within*, its *flank*.

In Fig. 2 let AB represent part of the pitch-circle of a wheel upon which it is required to set out teeth in accordance with the principles laid down above. If upon the arc AB a circular template, E, is caused to roll, and this template is fitted with a tracing-point at *e*, then as the template rolls in the direction of the arrow the point will describe the curve *ebg*, and at each point in the curve its radius will be a straight line from the point of contact of the template E and pitch-circle AB, one of these radii being shown at *ce* in the diagram; this curve therefore fulfils the conditions required for the proper working of the tooth. In similar manner, if a circular template, F, is caused to roll upon the inside of the pitch-circle, and has a tracing-point in its circumference at *f*, it will draw the curve *gcf*, the radius of which also will be at any point a straight line drawn to the point of contact of the circles. Thus we have obtained one side of a tooth, *abgcd*, of which *bg* is the face and *gc* the flank; E and F are termed the *generating circles*, and AB the *base*. In mathematical language, the upper curve *ebg* is known as an epicycloid, and the lower, *gcf*, as a hypocycloid, and teeth thus set out are known as epicycloidal teeth. The same generating circle may be used for both face and flank of the teeth, but this is not necessary; but it is necessary that the faces of the teeth on one wheel shall be described by the same generating circle as the flanks of the teeth on the wheel working with it. If any number of wheels of different diameters are made, and the teeth on all of them are described by the same generating circle—both flanks and faces—these wheels will work promiscuously together, the teeth of any one of the wheels being suited to work with the teeth of any other of them. Before proceeding with the work of practically designing the wheels, I will describe another form of curve which also meets the required conditions, and which has some advantages in certain cases; they are called involute teeth, and their form is described by the unwinding of a thread from the circumference of a circle.

In Fig. 3 let A and B represent the pitch-circles of two wheels, of which the centres are at *c* and *d*, and let the dotted circles *klf* and *ehi*, drawn about the same centres, have their diameters in the same proportion to each other as are the diameters of the circles A and B. Join *cd*; then *g*, the point where the line *cd* cuts the circumferences of the circles A and B, will be their point of contact: *ef*, a line touching both circles *ehi* and *kfl*, will pass through the point of contact, *g*. Let *u* be the end of the flexible line, *ueh*, wound round the circle *ehi*, and also let it indicate the end of another flexible line, *ufl*, wound round the circle *klf*, and at the ends of these lines describe respectively the tooth-edges *mm* and *nn*, touching at *u*. Because *en* is the radius of the curve *mm* at the point *u*, it is at right angles to it at that point; and because that is also the point of contact of the curves *mm* and *nn*, it is also at right angles to the curve *nn*; it also touches the point of contact *g* of the pitch-circles; therefore the involute curves *mm* and *nn* fulfil the conditions required for the edges of the teeth of wheels required for the proper working together of the wheels of which A and B are the pitch-circles. These teeth may be easily set out by means of a template, C, to which is attached by the screw *v* a spring, *vpr*: *opq* is an arc of the circle *ehi*, and the edge of the template C is made to exactly fit it, *t* being the centre. At *r* on the spring is fixed a tracer, by means of which the edge of a tooth, *rs*, is marked.

All the teeth of one wheel will, of course, be of one size and shape, and therefore a template having been made for one it can be used to mark them off all round the wheel.

The object of toothed wheels being usually to transmit work with certain modifications of speed and pressure, it will follow that two teeth in contact will be subjected to the same force, and will therefore require to be of the same strength and thickness; hence in a pair of wheels of different sizes the numbers of teeth on each will be proportional to their circumferences, and therefore to their diameters, and the number of rotations made by the wheels will be to each other in the inverse ratio of their diameters; for it is evident that if two discs are in contact, and the circumference of one is half that of the other, the former must turn round twice to pass over the circumference of the latter; and as the teeth cause the wheels to act in precisely the same way as if they turned by friction of their circumferences, the same will be true of toothed wheels; and, moreover, it is obvious that if one of two wheels has twice as many teeth as the other, the smaller wheel must revolve twice to engage with every tooth of the larger. So the rule for velocities of two wheels working together in gear is—*the numbers of revolutions per minute of the wheels are inversely as the diameters of their pitch-circles*, or *are inversely as the numbers of their teeth.* Thus, if a driving-wheel is 6 ft. in diameter, and the driven wheel is 4 ft., the speed of the driven wheel or *follower* is equal to that of the driver multiplied by its own diameter (or number of teeth), and divided by the diameter (or number of teeth) of the follower.

In a train of wheels the relative speeds of the shafts at each end of the machine—say, that of the last to that of the first or driving-shaft—will be found by multiplying together the numbers of teeth in the successive driving-wheels, then multiplying together the numbers of teeth in the followers, and dividing the former by the latter. For instance, let Fig. 4 represent a train of wheels, A being the driving-shaft, to which power is communicated through a crank, E.

Upon the shaft A is keyed a toothed wheel, *a*, working into a wheel, *b*, which, together with wheel *b'* is keyed on to shaft B; the wheel *b'* gears with wheel *c* on shaft C, on which is also fixed wheel *c'*, gearing with wheel *d*. The drivers in this train are *a*, *b'*, and *c'*, and the driven wheels or followers are *b*, *c*, and *d*. The number of revolutions per minute of the shaft A being given, the number for shaft D will be found by multiplying it successively by the diameters of *a*, *b*, and *c'*, and dividing the product by the diameters of *b*, *c*, and *d*. Let $a = 20$ in., $b = 45$ in., $b' = 25$ in., $c = 50$ in., $c' = 15$ in., and $d = 30$ in., and the number of revolutions of the shaft A = 60 per minute; then 60 multiplied by 20, by 25, and by 15 = 450,000; and this divided by 45, by 50, and by 30, gives $6\frac{2}{3}$ revolutions per minute as the velocity of the shaft D.

The proportioning of the teeth to the work to be done must now be considered, and this will be done on the supposition that the whole pressure transmitted by the wheel falls upon each tooth in succession, and so is entirely supported by one tooth. The tendency of the force will be to break the tooth off at the root like a bracket or beam-end projecting from a wall the same distance as the tooth from the rim of the wheel.

The strength of a tooth to resist fracture in cross-breaking varies as the square of its thickness, and simply as its breadth, and inversely as its length. If, then, all the dimensions are given in inches, its breadth multiplied by the square of its thickness and divided by its length, and the quotient multiplied by a constant according to the material used, will give its working pressure; or, putting it in a more convenient form for use, to find the thickness of tooth required, multiply the pressure in pounds upon it by the length of tooth, divide by the breadth of tooth and by 800, and take the square root of the quotient. This is based upon taking one-tenth of the breaking weight as the safe working load, for a tooth of good cast iron one inch in every direction will break with 8,000 lbs. at its extremity.

There are certain proportions of depth and other dimensions to the distance from centre to centre of the teeth—this distance being called the pitch of the teeth—that are found convenient in practice, and to these for all ordinary work it is best to keep. Calling the pitch 100, the dimensions are relatively as follows:—

Pitch of teeth	100
Depth	75
Working depth ...	70
Clearance at bottom ...	5
Thickness of teeth ...	45
Width of space... ...	55
Play	10
Length beyond pitch-line	35

Working with these proportions, a simple rule can now be found for determining the thickness of the teeth. Divide the pressure upon the tooth by 480 times, the breadth in inches, the quotient will be the thickness in inches. Let a wheel be required to carry a force of 3,000 lbs., the breadth on the face of the wheel being 5 in.; then 3,000 divided by 480 times 5, gives $1\frac{1}{4}$ in. as the required thickness of tooth.

As in the table it appears that the pitch of the teeth should be to the thickness as 100 to 45, the pitch in this case will be $2\frac{7}{9}$ in., and the length or depth of the teeth $2\frac{1}{12}$ in., of which length one inch will be beyond the pitch-line. The pitch having been determined, the circumference of the pitch-circle must be made to fit it. Thus, suppose the smaller wheel of the pair required is desired to be about 3 feet in diameter, that would give a circumference of $3\frac{1}{7}$ multiplied by 3 ($3\frac{1}{7}$ being the ratio of the circumference of a circle to its diameter), equal to $9\frac{3}{7}$ feet or $113\frac{1}{7}$ in. This will not quite fit the pitch, allowing for a little more than 54 teeth; therefore it must be made for either 54 or 55 teeth. If the ratio of numbers of revolutions of the wheels is a whole number, it does not matter which number of teeth is taken; but if it is any fractional number, this must be considered in deciding upon the number of teeth to be adopted. Suppose, for instance, the pair of wheels is required to reduce the speed from 70 to 45 revolutions per minute; then the numbers of teeth in the wheels will be 54 and 84, which give the same ratio inverted. The strain on the teeth of the driven wheel will, of course, be the same as on those of the driver; but it will be greater on the teeth of wheel *b'* than on those of wheel *b*, in proportion as the radius of *b* is greater than that of *b'*. This follows from the law of the lever.

It is a general law that, taking any two points in the machine, the pressures acting upon them will be in inverse proportion to the velocities of those points. To return to our example : if the wheel is to have 54 teeth, its circumference will practically be $112\frac{1}{2}$ in., which is equal to $2\frac{1}{12}$ in. multiplied by 54 ; and multiplying by 7, and dividing the product by 22, the diameter corresponding to this circumference is found to be $35\frac{35}{44}$ in., which is very nearly $35\frac{13}{16}$ in. The circumference is spoken of as being *practically* $112\frac{1}{2}$ in., because, strictly speaking, it is a trifle more; for, the pitch being measured from tooth to tooth in a straight line, it is a chord of the small arc of the pitch-circle between the centre of the teeth. It is practically of no consequence, as in the present case it would not make a difference of one-fortieth of an inch in the diameter.

THE ENGLISH LEVER WATCH.

BY A PRACTICAL HAND.

THE watch that holds its own the world over is made by the firm of Thos. Russell and Sons, Church Street, Liverpool. This watch, that has stood A 1 for such a long period, in fact, since they were first sent out by them—(this escapement was invented by Berthoud)—for accuracy combined with durability has no equal, the cases of 18-ct. or 9-ct. hall-marked gold or sterling silver, centre seconds, quarter seconds, and flyback seconds. The finest work are the £100 repeaters by the above firm—work that can be relied on. Seeing the amateur will have more sense than to meddle with last mentioned style of watches, I need not describe them; many in the trade cannot do this class of work, but place it in the hands of those who make it a speciality. The English lever, with a steel or gold balance, having the fuzee arrangement to equalise the power of the main spring, will, by careful regulation, keep correct time to about one minute a month; and the English-going barrel without fuzee will keep time to a minute or so a week; some may claim more, but I speak fair on the subject.

To clean an English lever, open the front dome, push out the joint pin from the 10 o'clock side of dial, and the movement is then free from the cases; prise off the minute and hour hands both at once, then carefully take off seconds hand; undo the cap and draw out the three pins holding dial; remove dial wheels, as described in Chap. II., unscrew cock of balance, and mark the tip end of hair spring on top plate for a guide in putting together again; draw out the pin and spring, and place under glass cover. Now proceed to let down the spring by placing the key firmly on square of ratchet (dial side), and prise out the click, keeping firm hold of the key; observe a dot on top of barrel arbor and a similar one on the bar: take note of this and the relative positions in resetting the main spring again.

Another way we practise in the trade, but too difficult for the amateur, is to remove the bar across the barrel, keeping firm hold in your left hand; put your thumb on the barrel, take up a small screwdriver, place it in the hole of the cover of the barrel, then press the barrel back until you can unhook the chain, using the thumb before mentioned as a brake to gently let down the barrel (easier said than done); now keep it upright in its place as well as you can, seeing it has only one side to work on: have no fear and you will do it easier. Now lift the spring free from the maintaining power, and all will be right. Withdraw the pins holding the top plate to pillars, raise top plate gently so as not to injure any pinion, more especially the lever; see that it does not drop out unnoticed, as it is liable to do so; lift it out with tweezers. Now notice the parts and the sketch engraved to this chapter, so that you may easily understand the replacing of same. Take out each wheel, and notice the maintaining power near fuzee wheel; do not

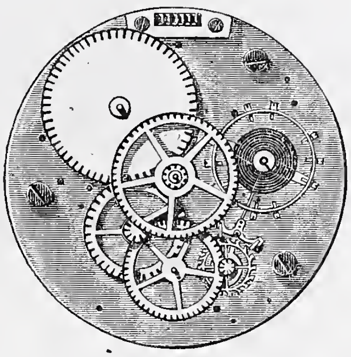


Fig. 1.—English Lever: Going Barrel.

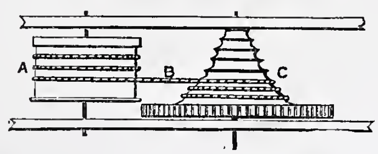


Fig. 2.—English Lever—A, Main Spring; B, Chain; C, Fuzee.

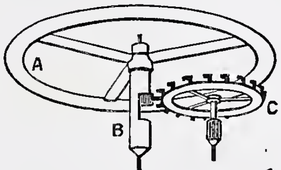


Fig. 3.
A, Balance.
B, Cylinder.
C, Escape Wheel.

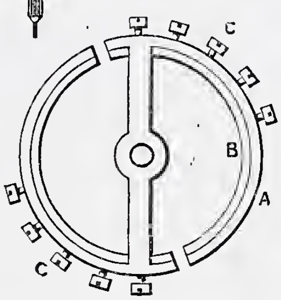


Fig. 4.—Compensation Balance.
A, Brass.
B, Steel.
C, Screws.

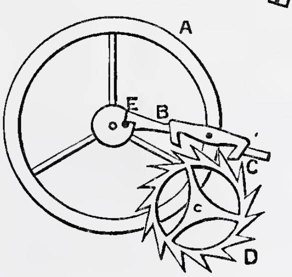


Fig. 5.—The Balance, etc.
A, Balance, etc.
B, Lever.
C, Pallets.
D, Escape Wheel.
E, Ruby Pin and Lever Notch.

lose it, as is too often the case. It is gone in many that come into my hands, and it must be through watchmakers' apprentices or careless men. The ratchet of main spring be careful to put away. Now clean plates, wheels, etc., as described in Chap. II.; hold every part in small squares of paper so as not to soil them in the slightest, the lever being better class work; tap the hair spring with the bristles of the brush, polish the steel or gold balance, peg-wood every pivot hole, and see no jewels are cracked or injured. A piece of clean cork cleans the pivots best, and in polishing plates, etc., keep the brush clean by drawing it over the prepared chalk. I would not recommend the main spring to be taken out and cleaned, but if you choose to do so, see previous chapter. All being clean and in good order, put in the third wheel, then centre wheel, next fuzee wheel and the maintaining power, then replace fourth wheel, and now the 'scape wheel; drop the least possible oil on the top fuzee pivot, place on the top plate, and press gently down, guiding each pivot. Having your eye-glass in position, examine if they all run clear and easy; if so, again gently raise top plate and replace lever pallets with the tweezers, bottom pivot first, and then press down top plate, and try if pallets move quickly by using moderate pressure on the fuzee wheel; now replace the barrel and its bars, of course holding the movement in clean paper; have its position so that the barrel is upwards and towards your right hand; now lift the hook end of the chain with tweezers and pass it under the pillar near the barrel and fuzee; hook it into its hole, which is near the small opening of the barrel cover. So guide the chain with your left thumb and gently wind with the key in your right hand until sufficient is only left under the pillar to hook it into its position on the fuzee part; next replace the small ratchet wheel, and set or turn the main spring up to the before-mentioned dots, which will be about half a turn; then oil the under plate, using very little oil, and slightly tip the pallet ends or two or three of the 'scape teeth; be sure not to use too much: this is the amateur's failing point. Now wind slowly up, guiding the chain into the grooves for the first time; unless you do so, it may miss, and so twist the chain that it will be permanently injured. Do not hurry over this or any part, in fact; some regular workmen will boast how quick they can take down, clean, and replace. Often these men have the work returned, and in the end it takes longer, besides annoying customer and master. Next oil all the top holes and replace balance, fixing hair spring to old position, as stated in former chapter; it should now be in full swing, with what we call a fine healthy beat; if not, some part is too tight or repair is needed. If so, see chapter to come on repairs, which will appear in due course.

If all right, try it under the glass cover four hours or so face downwards, and then if the beat is equal and all right, replace dial wheels, then dial, re-fix the three pins, and now replace the hands. Clean the cases well with rouge and chamois leather, and fit in the movement; push in the joint pin from 2 o'clock side, close up watch, and all is complete. Of course it will require regulating, as its going will be changed by the cleaning; move the regulator a very minute portion, using your eye-glass so as to have the greatest accuracy; it is worth the trouble. Many watchmakers only regulate them for hanging position in windows until called for, but they should be tried in several positions for good results.

AN ORNAMENTAL PLANT STAND.

BY CHAS. E. DODSLEY.

THE purpose of this paper is not to describe a plant stand which may be knocked together in a few minutes, but to show how, with a little care and at small cost, a stand for plants may be constructed—useful, ornamental, and unique—by any amateur in joinery, and, I venture to hope, be a new idea to some who are not amateurs. I take it that one of the primary aims readers of WORK, or, more properly, workers, should bear in mind is, "What is worth doing at all is worth doing well." To any who may be inclined to consider correctness in detail of secondary importance, the following stanza may be helpful :—

"In the elder days of art,
Builders wrought with utmost care
Each minute and inmost part ;
For the gods see everywhere."

The stand as shown in Fig. 1 is similar to one I have had in use now for some twelve months. It has proved very useful, and, as now filled with well-grown ferns, is a graceful decoration to the room.

So much by way of preface. The plan is reduced to one-sixth. As will be seen, it consists of a framework made in two parts: the lower one 3 ft.; the upper 1 ft. 11 in. long; each about 2 ft. high. It is fastened throughout by mortise and tenon, glued. This frame supports three

Fig. 1.—Ornamental Plant Stand, drawn in Perspective on Scale of one-sixth, or 2 in. to 1 ft. Alternative Designs in Fretwork or Splashed Work over Leaves for Panels.

shelves; the lower one, an open board from end to end. This was suggested to me as an improvement, and will prove useful, my own having simply a rail in place of it. The two upper shelves are made of bars, or rails, as being lighter. The panels are of thin wood as used for fretwork, and may be either splashed work over leaves (this I will describe in its turn) or fretworked, as shown in plan. A general idea will be gathered from the foregoing: now to set about the making. In the first place, what wood shall be used? Preferably, either walnut or oak. From a board 4 ft. × 10 in., and when planed 1 in. thick, all the pieces required for the framework may be cut. Care must be taken that the wood is thoroughly dry and seasoned. Mark out, as shown in Fig. 5, the letters corresponding with those parts in the plan. It will be seen that, though the board is 10 in. broad, it is only cut into nine 1-in. pieces. This will allow of the saw-roughened edges being planed so as to measure just 1 in. square. If preferred, the wood may be got ready cut and planed; though I think it more satisfactory to do it oneself. It will be better to make the framework in two portions, making all joints to fit exactly, that the parts may be fixed together and taken apart again as the work proceeds. Take the eight pieces 2 ft. long × 1 in. × 1 in., which will form the uprights or legs, A, A, A, A, and F, F, F, F. These must each be fashioned separately, but may all be placed together and marked out at once. Fig. 4 shows the marking on the bar, each of the eight being alike. At the lower end make a tenon $\frac{1}{2}$ in. deep, 1 in. long, × $\frac{3}{8}$ in. thickness, taking care that each is cut with the grain and not across. Above this a square base 5 in. long, then $10\frac{1}{2}$ in. to be formed into an octagon with equal sides. This will require to be done with a chamfer plane, the top and bottom being finished off with a chisel. Above the octagon, another square like the base, but $6\frac{1}{2}$ in. Each of these squares will have two mortises to receive the side and end bars. The knob at the top gives a finish, and is easily shaped. Above the square mark a $\frac{1}{2}$ in. space, leaving 1 in. to the top for the knob. On either side make two saw cuts across $\frac{1}{4}$ in. deep, and on the lines marking the $\frac{1}{2}$ in. space; with a sharp chisel hollow out, leaving a neck $\frac{1}{2}$ in. each side supporting a knob (as Fig. 3), with a square base, and a square cone with its apex cut off above. When the eight pieces are fashioned as described, take four of hem, and four pieces 7 in. long for bars, , C, and staves, D, D; also two bars 2 ft. 1 in., B, B, for the sides. At each end of hese pieces, with a fine saw, cut a tenon he same size as at the bottom of uprights—e., full breadth of wood $\frac{3}{8}$ in. thick and $\frac{1}{2}$ in. eep. The mortises in uprights to receive hese tenons will require to be 1 in. long, in. across, and $\frac{1}{2}$ in. deep.

t is hardly necessary to ay that the mortises should e cut just within the ieasurements of tenon hey are to receive, so hat when united a firm oint is formed. Much fter-finishing and fitting nay be avoided by taking ains that each measurement is exact; and all cuts, ither with saw, chisel, or lane, cleanly done to neasurements, this being nsisted upon throughout.

The mortises in uprights nust be made in proper rder, or a hole in the vrong side will result. The asiest way is to first fit he staves and end bars. Take the uprights, and 2 n. above the tenon and arallel to it cut a mortise, nd a second one in the op square $\frac{1}{2}$ in. above the ctagon. Unite the staves nd bars with the uprights, nd thus form two ends. Place them opposite each other, and on the inner sides mark the position where the long bars, B, B, will fit in at right angles to the ends. When these mortises are cut, it will be found necessary to cut a square out of one of the tenons at either corner to fit as shown in Fig. 2. The shorter stand forming the upper part is united in the same manner; G, G, and H, H, being jointed into uprights; F, F, F, F, as described above, only in this case there are no staves. Care must be taken that the side bars in this case are fixed in the same line as tenons of the uprights, and the end bars at right angles.

It will be noticed that throughout the sizes of mortise and tenon are the same in each case. If desired, a square tenon might be made with $\frac{1}{2}$-in. side, but the size I have worked to entails less trouble, and if the

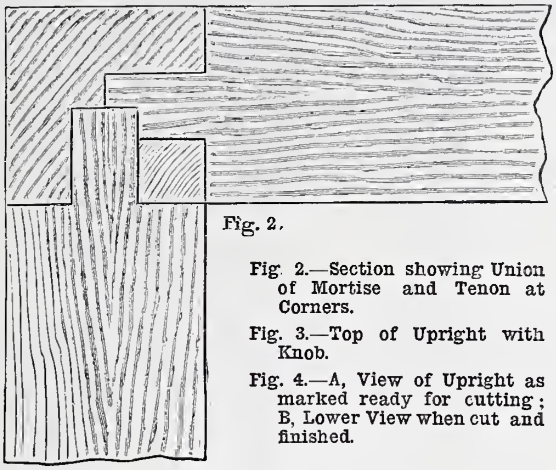


Fig. 2.

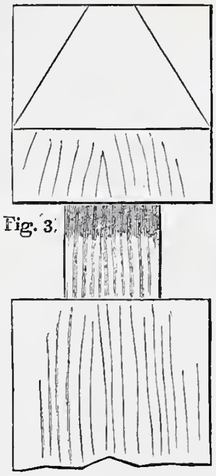


Fig. 3.

Fig. 2.—Section showing Union of Mortise and Tenon at Corners.

Fig. 3.—Top of Upright with Knob.

Fig. 4.—A, View of Upright as marked ready for cutting; B, Lower View when cut and finished.

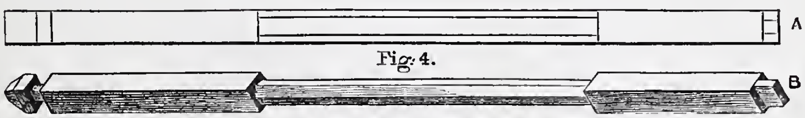


Fig. 4.

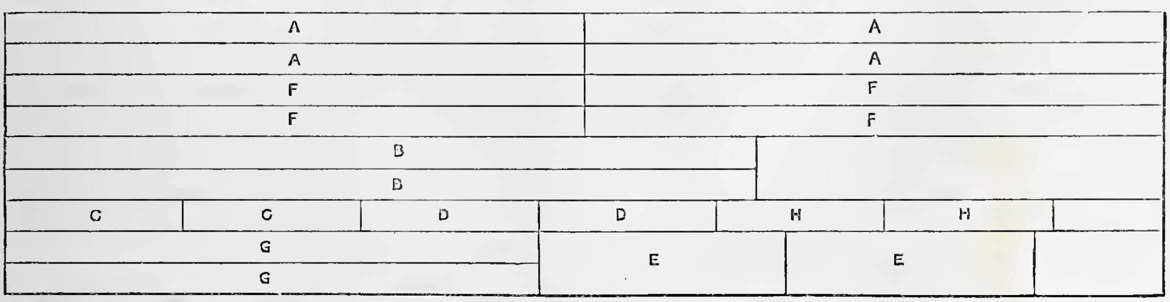


Fig. 5.—Board Marked for cutting all the Pieces for Frame of Plant Stand. Drawn to one-eighth Scale, or $1\frac{1}{2}$ in. to 1 ft. Length of Board, 4ft.; Breadth, 10 in.

mortises are carefully cut, is stronger and quite as neat.

For the feet take two blocks, E, E, and fashion them thus:—In each piece cut two mortises 6 in. apart, 1 in. from either end. Then 3 in. from the ends mark a line across, and from either side of the intermediate space cut a strip $\frac{3}{8}$ in. broad. From each of the four corners of the end pieces thus formed cut a triangular piece, the equal sides being $\frac{3}{8}$ in. Then from the upper edge plane a facet at an angle of 45° the whole way round. Fix the lower stand to the feet thus made; place the top half of stand in the position it will occupy, and mark exactly where the mortises must be made. By doing this a more correct fixing is secured, preventing the danger of any of the parts being thrown out of square when fixed.

We have now in an unfinished state the principal part, in that upon it all the other depends; but without the remaining parts this would be of no use. If cost is to be curtailed, the bottom board may be of pine, stained; as it is below the level of the window, when in use not much of it will be seen. A board 2 ft. 11 in. × 8 in. × $\frac{1}{2}$ in. will allow of any shaped shelf being substituted the worker may desire for the one in the plan. At each end make two tenons 1 in. × $\frac{1}{2}$ in. × $\frac{1}{2}$ in., and 2 in. apart; then make mortises in each of the staves to correspond; that will leave 1 in. at each end of the staves. Lay the board flat, and at a distance of 4 in. from each end mark a transverse line. On each side within these lines cut off a piece 1 in. broad. We now have a board 2 ft. 10 in. long, each end 8 in. broad; the intermediate space 2 ft. 2 in., 6 in. broad. From each of the end oblongs, cut off a triangular piece, as was done with the feet, but now the equal sides being 1 in. Now fashion the length of each side edge with three facets of equal breadth. For the upper shelves six rails will be required, each 1 in. broad, $\frac{1}{2}$ in. in thickness; three for the lower shelf, 2 ft. 11 in. long; three for the upper one, 1 ft. 10 in. long. These are fixed into the end bars at an equal distance apart, leaving $\frac{3}{4}$ in. space between. In each of the end bars make three sockets, 1 in. × $\frac{1}{2}$ in. × $\frac{1}{2}$ in. and $\frac{3}{4}$ in. apart to receive the ends of rails. The brackets beneath the middle shelf are not absolutely necessary, but besides affording extra support and firmness, they give a finish to that part. The four brackets may be made from one of the pieces cut from the lower shelf. Cut four pieces each 4 in. × $\frac{1}{2}$ in. × $\frac{1}{2}$ in.; then take each one singly, and with a sharp knife or chisel, form an octagon in the centre $1\frac{3}{4}$ in. long; then make a mitred joint at each end. These brackets, if glued one end below the long bar, and the other to the leg, and firmly fastened with a long thin screw, add a graceful finish, and render the joints perfectly secure.

Now we come to that part which I always regard as the most tedious and troublesome—viz., smoothing with glass paper previous to polishing. It is well to have three sizes of glass paper handy, Nos. $1\frac{1}{2}$, 1, 0. First rub every piece smooth with No. 1; if any unevenness use $1\frac{1}{2}$ to rub down; then finish all off with the finest. Care must be exercised in smoothing edges and angles to avoid rounding the corners. The more pronounced the angles the greater the beauty of the whole when finished. It is unnecessary for me to describe the process of polishing. The pieces may be polished separately before being put together; and where polished pieces are to be glued, the polish lightly scraped off at the time. To put the stand together, first unite the two ends of lower part, securing them in the feet. Take the bottom board and two long side bars; fix them to one of the ends, and placing the other end in position a few sharp blows with a mallet will secure it. Unite the upper part in the same manner. It will be better to allow the glued joints to become quite set before fixing the upper part upon the lower, and then the brackets as before described; lastly, fixing the rails, which must be glued and secured with a screw at each end.

If the plants have been waiting for a suitable stand, they may now be shown to full advantage, until the panels are made. The panels are of equal height, $5\frac{1}{2}$ in., and $\frac{1}{8}$ in. or $\frac{3}{16}$ in. in thickness. Twelve in all will be wanted as follows:—Four, each $5\frac{1}{2}$ in. long; four, each 6 in.; and four, each 1 ft. 9 in. If the frame is walnut, the panels will form a pretty contrast if made in oak, or *vice versâ*. Every one may not know how the splashed work mentioned in the earlier part of this paper is done. A number of small leaves will be required. Those which have a fine crenate or serrate margin, as rose or birch, or the pinnate fronds of ferns are the most suitable. They must be carefully pressed and dried previous to being used. The panel, being well smoothed with fine glass paper, should have a thin coat of linseed oil rubbed over and allowed to become quite dry. Lay the panel flat, and arrange the pressed leaves as desired, but not overlapping each other, and pin them in position. For splashing, a fine-tooth comb (horn will do) and a tooth brush will be necessary; also some burnt umber ground in water, and a little old beer or a weak solution of potash (about a teaspoonful of liquor of potash to an ounce of water), to mix the colour with. Take a little of the colour upon the brush, by dipping it first into the solution and then upon the colour; draw the comb lightly but quickly over the bristles, holding the brush almost perpendicularly so as to throw the splashes upon the board. It will be better to practise upon a piece of paper first, for the knack is easily acquired. Make the splashes thickest, and therefore darkest, over the leaves, shading lighter and lighter to the edges of panel. When quite dry a thin coat of pale varnish may be applied. If the frame be of oak or light wood, the panels may contrast in dark, in which case the splashing would not answer. If fretworked, in which case more time would be required, each panel might be of a different design, or the long ones one, and the short ones another, as the worker may desire. I give (Fig. 1) a design such as is suitable for either of them. If the panels are made in fretwork, they should be carefully finished off and polished like the rest of the stand. The panels are fixed in slots, formed by fixing a narrow beading in front to the uprights at either end of the spaces, and a similar one at the back, allowing of the panel being easily slid in or out. The front beads should be just to the height of square—that is, 5 in., and flush with the edge. They are glued on, and fastened with very small brass or black nails.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

107.—Snaith's Patent Pin and Barrel for Pianos.

Mr. Thomas Snaith, Engineer, 20, Swarthmore Terrace, South Stockton-on-Tees, sends a model exhibiting the mode of appliance of his Patent Pin and Barrel for Pianos, and the Double Key that is used in order to screw down the pin and bring up the string to the required tension. Mr. Snaith regrets to say that he has not been able to induce pianoforte manufacturers to take to his invention. This, however, is no argument against its being a "good thing." The difficulty lies in the manipulation of the double key, which, to say the least of it, is very puzzling at first, because, in order to tighten the string, the outer key is used, and is turned one way, while, to fasten down the pin, the inner key is used, which is turned in the contrary direction. It took me some little time to comprehend and accomplish

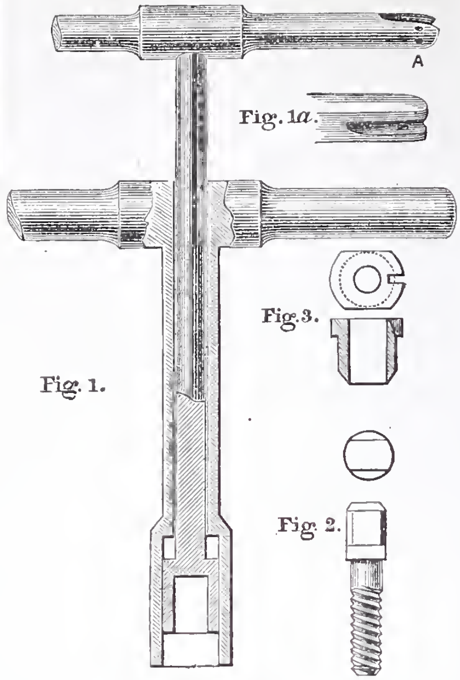


Fig. 1.—Double Key to fit Pin and Barrel with Provisions at End for Bending End of String to fit Barrel. Fig. 1a.—End, A, as seen from above. Fig. 2.—Screwed Pin with Left-hand Screw. Fig. 3.—Barrel with Notch for Strings.

the working of the double key, but when this has been got over, facility in its use will soon be brought about by practice. The engravings show very clearly the nature and use of the pin, barrel, and double key. Fig. 1 shows the double key to fit pin and barrel. In this, as will be seen from the illustration, one key works within the other, the inner and smaller key fitting on and turning the screw shown in elevation and plan in Fig. 2, and which passes through the barrel shown also in plan and section in Fig. 3, this barrel being turned by the outer key, and,

Fig. 4. — Wrest Plank, with Pin and Barrel in Position.

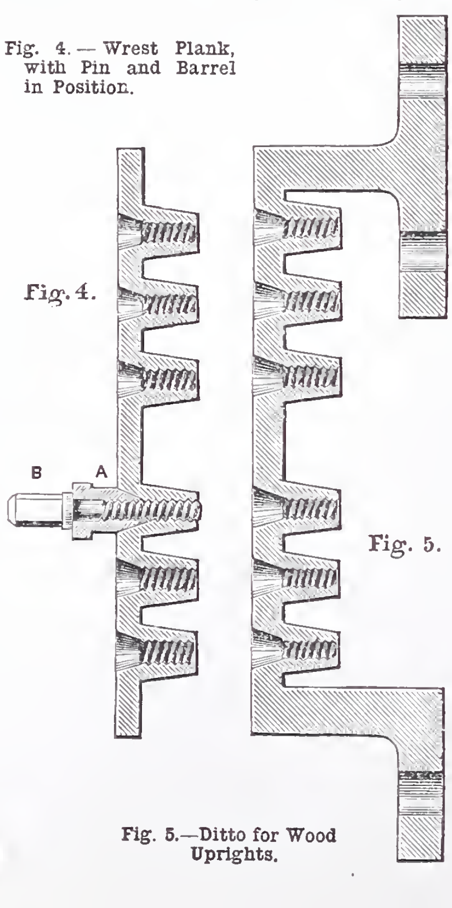


Fig. 5.—Ditto for Wood Uprights.

when turned, tightening the string or wire, the end of which is bent and fitted into a notch that appears on the right of both plan and section in Fig. 3. The right-hand end of the handle of the inner key in Fig. 1 is notched and perforated to afford ready means of bending the wire, as shown in the illustration. Fig. 1a is a view of this end of the handle seen from above. Fig. 4 shows the wrest plank with a barrel, A, and pin, B, in position. Fig. 5 shows a suitable form for wood uprights. Fig. 6 exhibits the arrangement of pins and barrels in wrest plank by means of a top view. When pin and barrel have been placed in position, as shown at B and A, Fig. 4, and the string has been properly attached to the barrel, the key is applied so that the outer part fits over the barrel, and the inner part over the pin. It will be noticed, on reference to Figs. 4 and 5, that the wrest pin is pierced to receive both pin and barrel, the conical end of the barrel fitting into the coned hole countersunk in the brass plate for the purpose of receiving it. The barrel moves freely in this conical depression, and is only fixed when the pin, which passes

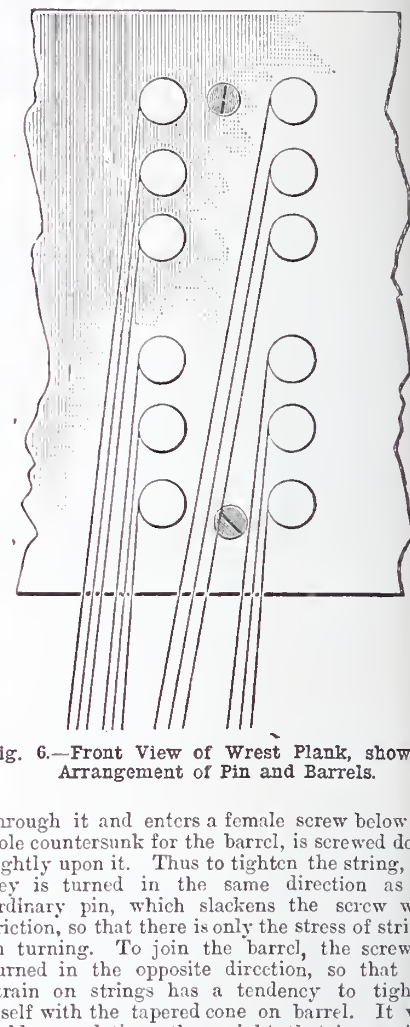


Fig. 6.—Front View of Wrest Plank, showing Arrangement of Pin and Barrels.

through it and enters a female screw below the hole countersunk for the barrel, is screwed down tightly upon it. Thus to tighten the string, the key is turned in the same direction as an ordinary pin, which slackens the screw with friction, so that there is only the stress of strings in turning. To join the barrel, the screw is turned in the opposite direction, so that the strain on strings has a tendency to tighten itself with the tapered cone on barrel. It will hold several times the weight that is required for pianoforte strings. The invention can be applied to iron frames as well as to wooden ones. Readers requiring further information, prices, etc., should apply to Mr. Snaith at the address given above.

As I have just intimated, I do not know the prices put by Mr. Snaith on his pins and barrels in the first place, and on his double key in the second. In all novelties of this kind, involving a departure from the original mode of going to work and the nature of the appliances used, much depends on whether or not the new appliances are cheaper than the old; and cheapness, other things being equal, constitutes a powerful lever to raise them into favour. I fear, however, that the new pin and barrel, etc., are not cheap.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Pit Frame Saws.—Pit Frame writes in reply to G. W. (*Bournemouth*) (see Work, No. 21, page 322):—"No doubt you will be surprised at my not answering your queries before, but the fact is I have only just seen them in September's monthly part. If you will look at the title page, you will see for whom these articles are written. The frame described in No. 15 is capable of having large and heavy 4 and 6 in. tired wheels both for lorries and carts. We frequently make them upon ours. Yes, when having my holidays, I have been in good shops both in London, Edinburgh, Glasgow, and in large towns in England, and I have invariably found the frame described is fast superseding the pit. You ask, 'is it intended for amateurs or "pros," as not one in five hundred will undertake such laborious ill-paid work as wheeling.' Indeed, who makes the wheels then? You also say that 'French prepared wood, etc.' This is indeed news to me, as all the prepared wood I know of comes from America, large cargoes of boxes packed with machine-dressed spokes, naves, and even wheels. The set-stick is fixed at the front of the nave, and in the centre with set screw should work about stiffly. Small holes are bored every inch between half-way down the stick from the top. A piece of whalebone is plugged through so far as required for 'dishing' the wheel. The way of securing the nave does not weaken the frame in the least. Evidently you have never seen or used a frame like this before (hence the advantage of taking Work in), so please just make one and have it made strong, so that it will not spring at every blow, as you are afraid it will. You say you could send a sketch of a cheap, simple, secure fastening for nave. By all means please send it, as we are not above learning off brother workers, and I think it would have been better had you sent it at the first instead of querying. I don't know whether you are an amateur or a 'pro,' but I am sure that you must be clever when you made three carriage bodies (carriages not specified) 'with nothing but a piece of hand-saw.' Are you your own master, or were you working for someone? If your other tools are on a par with your piece of saw, I don't wonder at you being disgusted with wheeling, therefore I think the sooner you keep pace with the times the better."

Pen for Dotted Lines.—W. R. R. (*Carlisle*) writes:—"I notice in 'Shop,' Vol. I., No. 31, page 492, a very flattering mention of a pen for ruling dotted lines. Allow me to inform your correspondent, H. C. S. (*London, S.E.*), that he is very late in the field, as I have made and used such an invention for over ten years. Like your correspondent, I am in the same fix *re* 'patenting and its multitudinous costs.' I have several ideas and rough models of self-inking pens for artistic purposes and marginal work, only awaiting some enterprising firm to take them up. I, too, would be glad of your advice, which is of such sterling quality to amateurs. Work is one of the best and cheapest papers extant for assisting the youth of the country in this technical age."

Heating Soldering Irons.—C. P. (*Wanstead*) writes:—"Seeing in the 'Shop' column, page 494 of Work, a paragraph headed 'Heating Soldering Irons,' I should like to give my experience upon the use of oil stoves for that purpose. I had long wanted an oil stove for soldering with, as I have so many small jobs in the summer which are not worth while lighting a fire for, and cannot use gas without a little inconvenience. Having by me a stove called the Beatrice with 4 in. cotton, I thought I would try an experiment with it, so I took the tulk out in front, which left room for two irons to go through to the flame, but to my great surprise as soon as I lit it it began to smoke. I could not turn it up sufficiently to get my iron hot, and the light bobbed up and down, which I think was on account of the tulk being removed. Therefore I replaced the tulk in front and substituted a piece of strong wire twisted so as to hold the iron in place, and let it down from the top of stove nearly to the flame, and I find it answers very much better, but there is still room for improvement."

An Easily-Made Fret Machine.—W. R. S. (*Brixton*) writes in reply to One in a Fix (see page 492):—"No doubt some time before you see this you will have read my reply to Anxious and Mancunian on this subject. I might add that if you live or are at any time near here (Brixton, the Editor has my address) I shall be pleased to show you the machine, from which I think you may get a better idea than from reading pages of instructions. Please let me know if there are any other points on which you require information, and also if you are successful, which I trust you will be."

Prize Competition.—The Editor of Work takes this opportunity to inform A. L. (*Hull*) and other readers of this Magazine that it was found impossible to give in No. 30 engravings of the prize bookcases that would be generally useful to workmen, and creditable as interpretations of the work of those who designed them. The designs with suitable descriptions will be issued in the course of the present volume.

Lathe for Wood.—H. A. (*London, E.C.*) writes:—"In No. 28 of Work, page 444, Stoker gives his opinion of Work, which I heartily endorse, and he tells us how be made, at a very small cost, a lathe for turning wood. I should be extremely obliged to Stoker if he would send particulars of that lathe. I have got a lathe wheel 21 inches in diameter, with crank, and a bit of a framework; it had originally been a jeweller's polishing lathe; the crank is about 16 inches long. If Stoker will kindly give me a few hints how to make it into a turning lathe, he will greatly oblige."

Pinhole Photography.—C. H. C. (*Strand, W.C.*) writes:—"I read with great interest an article in a recent number of Work on pinhole photography. I can add my testimony to that of the writer as to the clearness and good general effect of a photograph taken by this method, under favourable conditions. I recollect how much I was impressed once at a lecture given by Mr. Hepworth on elementary photography. Amongst others he showed on the screen (by limelight illumination) an image—at least 12 feet in diameter, I should think—projected from a slide of the usual size. The picture was of a statue; as far as I can recollect, of some great admiral, in one of our southern seaport towns. It came out beautifully clear, in spite of the loss that necessarily accompanies enlargement, and

I was never more surprised before than when I heard it was taken through a pinhole, the camera being an ordinary chimney-pot hat. I have only one suggestion to make; and that is, that better results, sharper images, etc., are obtained by having a hole perfectly clear from 'burr' round its edges. The writer recommends a visiting card as a good thing. A hole in such a surface, though, could scarcely be free from the above-mentioned defect. A better arrangement still, to the best of my belief, is that told me at a scientific society's meeting by a man who has practised the art a little. It is simply to substitute a thin sheet of copper, to repoussé a small part of it with a blunt point, and then finally make the hole in the thin part thus obtained with a fine pointed needle. The diagram which I append may possibly make things clearer.

II.—Questions Answered by Editor and Staff.

Saw Hammering.—T. O. (*Bootle*).—If any saw hammerer will make himself known to me, and offer to write on matters connected with his trade, I shall be pleased to arrange with him for such a paper as you require, but at present I am without a contributor on this subject, and am not acquainted with any one who could or would write on it. I am sincerely obliged to you for saying you would like Work to be twice the size and pay twice as much for it, but I fear all readers would not be of your opinion. It is true that there would be twice as much room for "Our Guide to Good Things" and "Shop," if the doubling system were entered on, but how about my time, which is pretty well taken up with Work as it is? Could you manage to insure me 120 minutes to the hour?

Turned Trellis Work.—H. C. T. (*Gateshead*).—On comparing the patterns of trellis work sent, you will see that they are so very much like those supplied by C. H. O., and have so much in common with them, that it will not be worth while to publish them in Work. C. H. O. explained that there could be but little divergence from the beaten track in this matter, and you will easily see this on consideration. As I have already explained, novel arrangements might be effected by the combination of blocks (*i.e.* flat pieces of wood in various shapes, such as triangles, squares, diamonds, hexagons, etc.) with turned spindles, but not with turned wood alone, at least I think not. When you have any decidedly original pattern let me have it, and I will publish it, and kindly let me have your name and full address that I may have it in my power to communicate with you if necessary.

Electric Pin.—H. E. (*Leicester*).—Those small scarf pin lamps are a speciality in incandescent lamps, and are sold under the names of "Gem" lamps and "Fairy" lamps. The lamps are lit with current from a small chloride of silver battery. If you can call on Messrs. T. Gent & Co., Braunstone Gate, Leicester, they will probably be able to show you one of the lamps, and instruct you how to fit it to a scarf pin. I see from their catalogue that they also sell a small lamp for special use in dentistry and surgery. I consider the chromic acid single-cell battery the most constant and powerful for your purpose in feeding a small lamp of from $2\frac{1}{2}$ to 5 c.p.—G. E. B.

Alarm Contact for Mat.—A Subscriber (*Stalybridge*).—An illustrated description of door-mat contacts is given in my sixth article on Burglar Alarms. I think this will fully meet your requirements.—G. E. B.

Battery for Induction Coil.—J. Prince.—A pint Bunsen, bichromate, or chromic acid cell is quite large enough to work a coil $4\frac{1}{2}$ in. long by $1\frac{3}{4}$ in. diameter. The number of cells required will depend upon the size of wire used in the primary coil. If No. 18 or 20, perhaps it will take two or three cells in series to fully develop the power of the coil.—G. E. B.

Tinsmith (*Great Grimsby*).—An article upon the construction of self-acting fountain is in hand, and will be published as soon as possible.—C. M. W.

Brazing and Coppersmith's Work.—J. A. (*Grimsby*).—Papers on these subjects will appear as soon as space and opportunity permit. Thanks for your good wishes.

Fronts for Bird Cages.—J. S. (*Coatbridge*).—I am not aware that fronts for bird cages are sold anywhere. At any rate I have never seen or heard of such an article being on sale. The material for cages, as far as wire is concerned, can be purchased, I should say, at any ironmonger's or wire worker's.—O. B.

Fixing Tortoiseshell.—W. J. M. (*Liverpool*).—Tortoiseshell can be fixed together by first filing the edges with a rasp, and then lapping one well over the other; you note that they are to lap, and are not to be placed with simply their edges touching. Then soften both the edges in boiling water, and when the surfaces are soft, place them together and grip them in the vice; but as you say it is for repairs that you want to know, I should advise you to be very careful how you apply the heat, or else you will find that your work has warped considerably.—H. S. G.

Ivory Stains.—W. J. M. (*Liverpool*).—Time stains can be taken out of ivory only if they are not very deep. You will have to remove the very outside of the surface with ground pumice stone and water; then place it in the sun under glass, and try that several times; then if it fails, try a wash of water, 10 parts, and nitric acid 1 part. There is yet another way used to bleach knife handles in Sheffield, where peroxide of hydrogen is the agent, but I don't know of this from any personal experience. If you have pumiced it, then to bring it back again to its former surface, rub it well with whiting and vinegar, or very weak vitriol and water and whiting.—H. S. G.

Soft Steel Solder.—W. J. M. (*Liverpool*).—Is it possible to soft solder steel? Of course it is, provided that you get your work perfectly clean—scraped clean I mean. Then brush the parts that are to come into contact over with chloride of zinc (perhaps you know it under one of these names—killed spirit, soldering solution, soldering acid, or soldering water, fake, etc.; there are any number of names given to it). After brushing it over with the solution, make it hot enough to drive off the moisture, taking care not to smoke, or in any way make the surfaces dirty; now, while it is hot, try and get your solder to hold on; if it will not, add a little Venice turpentine, and use the copper bit. It is a matter of proper application of heat and cleanliness chiefly. When you have it tinned all right, then tie your surfaces together, using a little Venice or solution as flux. Then blow at it, and add solder if necessary; if you do this you will be sure to get your work out all right and soundly soldered. Generally, merely brushing the surfaces with solution and drying them before tying them together goes all right, if your hands and all your soldering articles are clean and free from grease. I have found myself that it is best to use a spirit lamp instead of gas, it is so much cleaner.—H. S. G.

Loose Letters Tray.—G. H. P. (*Stourbridge*).—In reply to your query, the tray requires two pieces 2 and 2 A, two pieces 3. Each of these pairs to be cut in reverse—*i.e.*, one piece of each cut as the pattern, and one with the design reversed. One piece of Figs. 4 and 5. The reason why it is best to cut in reverse is that with a hand saw the two surfaces are not exact facsimiles, and therefore would show a right and wrong side in making up. If you use a machine saw the objection is less.—E. B. S.

Dimensions for Dulcimer.—J. A. (*Barrow-in-Furness*).—The dimensions for a D dulcimer, which is most suitable for playing with other instruments, are as follows:—Width at bottom, 2 ft. 10 in.; width at top, 1 ft. 4 in. Depth from back to front, 1 ft. 4 in. The best wood to use is beech for blocks and bridges, white or yellow pine for belly, redwood deal for back, braces, inside bridges, lining blocks, and top and bottom facings. Sound-hole frets are made of mahogany or any fancy wood.—R. F.

Parchment.—Drennan (*Kilmarnock*).—Before quoting the information relative to the supply of vegetable parchment, I wrote to Messrs. Barker and to Whiteley's, Westbourne Grove, who each quoted it to me as in ordinary sale. There should be no difficulty in procuring it. Wholesale chemists, I know, regularly supply it, and the jam pot covers sold everywhere are a more common variety of the same stuff. It is so infinitely superior to any substitute that it is worth while to be quite sure where it can be easily bought, and if I succeed in purchasing any I will make the result public in these columns.—E. B. S.

Wax.—Constant Reader (*Manchester*).—Although unable to bring any special knowledge or experience to bear upon the question submitted, I am inclined to believe that if, as I understand your letter, the sample of German work sent is such as you wish to get yourself, some composition of the nature of plaster of Paris is that which you must fall back on. In the first place, the colouring process requires a white and absorbent article, otherwise you might experiment with celluloid. This is an ivory-like preparation by which paper, camphor, and acids produce a substance which can be moulded into the most delicate forms, becoming hard when cold. It can be made pliable by soaking in methylated spirit, and is highly inflammable. I think, however, you must try the former composition, and scarcely see why the wax and plaster will not hold together. Is the wax all right? Perhaps the plaster you use is too fine, and sets with too smooth a face, in which case mix a little fine sand to keep a rough face, and thus provide a grip for the wax. Plaster might work more easily if gauged with weak size-water; it would give more time for manipulating. Whiting mixed stiff with strong clear size might be useful, but mixed with glue would be too impure for your tints. I expect that material in general use for your purpose is some composition obtained by trade experiments and practical experience.—F. P.

Jeweller's Soldering.—W. J. L. (*Jersey*) wants to know what hard solder to use to solder a diamond in with, and what will prevent it burning.—For solder, ordinary silver solder will do very well. This he can buy at any jeweller's material shop or refiner's for about 3d. per pennyweight. He need have no fear of burning his diamond, if he carefully paints it over with borax (ground up with water on a clean piece of slate until it is as thick as cream). This being the flux for the solder, it can be applied with the camel-hair pencil at the same time that he places his pieces of solder on the work. Now apply heat enough to properly flush the solder. Never mind about the colour the diamond becomes, but on no account quench it suddenly. It must be left to cool by itself gradually. When it is cold it can be boiled out in "pickle" to get rid of the borax. The diamond will then appear just as it was originally—not damaged in any way, unless there should be a flaw in it. Then that might possibly cause a fracture, but I myself have put some dozens through the fire, and so far without accident—so much so that I should not at all hesitate in this case if I had to do it. so W. J. L. can go ahead without fear. See that your work and your solder is scraped clean, and that your borax is also clean. "Pickle" is about 1 part oil of vitriol (sulphuric acid) and 40 parts water.—H. S. G.

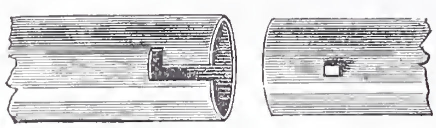
Desk.—W. H. (*Stockport*).—You ask for directions about making a good strong desk, but you have omitted to state the kind, so that I am unable to help you at present. Perhaps you are not aware that many different contrivances go by the name of desk. For example, there is the small portable form which folds up, and the large high clerk's desk. If you will be good enough to state your wants more fully, we will see what can be done to help you. Meanwhile it may interest you to know that papers on both the above-mentioned desks are on my list of subjects, and will be treated as soon as practicable.—D. A.

Camp Table.—J. A. B. (*West Ham*).—It is not possible to give the construction of a camp table within the limits of "Shop." It may be of some assistance to you to know that almost any table which can be folded may be roughly classed as a camp table. There are many arrangements by which the necessary portability can be attained. Perhaps the most general form is that in which the top is in two parts hinged together and attached to folding trestle legs. From the things you wish the table to hold I am by no means sure that you have not described it wrongly, and that what you really want is not a table but a stand of some kind. You might try Silver's in Cornhill, Pound's, or Goy's in Leadenhall Street. The work you name will receive due attention, but it is not so much required as some others which are of interest to the majority of readers. Ask anything you want to know about plumbing, and no doubt some member of the staff will be able to assist you.—D. A.

Bunsen Battery for Induction Coil.—V. R. (*Liverpool*).—(1) The break hammer for an induction coil 9 in. in length by 4 in. in diameter, with a core $\frac{3}{4}$ in. in diameter, may be made out of a disc of iron from $\frac{3}{8}$ to $\frac{1}{2}$ in. in diameter, and $\frac{1}{8}$ in. in thickness. This may be cut off the end of a soft iron rod with a hack saw, and riveted to the spring by means of a small brass rivet. (2) If you want a powerful battery to work the coil for two hours a day only, and then set it aside ready charged for the remainder of the twenty-four hours, do not use a Bunsen, which will require to be taken to pieces when done with, and set up again when wanted. Of course the same charge can be used several times if you follow the directions in my article on this subject. But I advise you to use a single fluid bichromate battery with lifting arrangements for the elements, as advised to J. R. for his electric light. Six cells would, I think, be too much for your coil. Try two at first, and increase the number if you require them. (3) $\frac{3}{4}$ in. is quite large enough for square of carbon. (4) Fill each cell to within $\frac{1}{2}$ in. of the top. (5) Do not put any mercury in the porous cell with the carbon block. A little in the outer cell with the zinc is useful.—G. E. B.

Worms in Wood.—R. J. W. (*Norwich*).—These are difficult to eradicate sometimes as they often arise from the use of improper wood, or wood which has not been properly seasoned. In this case, as the cause lies within the wood it is constantly liable to bring forth more. The worms you refer to seem to be of unusually large size. Are you sure they are not the grubs of some moth which may have found their way in? The best way to eradicate vermin in woodwork is to wash it thoroughly with naphtha or benzine, the latter being, perhaps, the better of the two. Of course you must well saturate the infested parts, as mere superficial washing will not do. Other substances are sometimes used, but if you can't manage with one or other of those named, I am afraid you must give it up as a bad job, or else submit the chairs to an experienced cabinet maker. He would, probably, be able to detect the cause or kind of worm from slight indications which, if you are not a cabinet maker, it is easy to understand might escape your notice.—D. A.

Fishing Rod.—C. H. (*Stockport*).—I almost fancy that one of the Japanese so-called walking-stick fishing rods would suit your purpose. They are light, fairly strong, and very portable. Of course they are no use for large fish, but, from your asking about a bamboo fishing rod and stating that you take long walks, I suppose you want something which can be carried without inconvenience. No doubt you know that these rods are made of a kind of bamboo, and that the pieces being hollow they may be enclosed in each other, the thick or handle piece being the outermost. These rods can be bought for much less money than you could make one. To describe the construction of a bamboo rod such as you could make for yourself without much outlay would require more space



Bayonet Catch.

than can be devoted to the subject just now in "Shop," but the following few hints may be of assistance to you till the subject can be treated at length. The bamboo can be got from Mr. Westbury, Great Dover Street, Borough, London. Either one piece of suitable length must be got and cut into convenient pieces, or you can get several short pieces. Effect the connection by means of wooden pegs fitting tightly into corresponding pieces, if necessary binding the ends of the bamboo, to prevent it splitting, with fine brass wire or even waxed thread. You can also adopt the method of fastening the pieces together by means of a bayonet catch, which I think will be sufficiently explained by the diagram. This joint may be easily formed of thin brass tubing, and is suitable for rods of bamboo or solid wood.—D. A.

Book Backs.—R. M. (*Hyde Park, London*).—To repair the book which has the back off, proceed in the following manner. Take the book and gently strip off all the previous lining from the back, and wash the back with warm water until all the old glue is cleaned off. Procure two pieces of paper, for end paper to the book. They may be white or coloured according to fancy; cut them twice the size of the book, and fold in the centre. If coloured, the coloured side in; paste them down the fold with flour paste (using the fingers) about $\frac{1}{4}$ in. broad, and place them carefully on the book, the fold of the paper flush with the edge of the joint—*i.e.*, the risen-up part of the back of the book. Rub the paper well into the joint, taking care not to cut or tear it any way. When these have become dry put a nice coating of warm thin glue over the back of the book, and allow it to dry. Now get a piece of thin calico or muslin, cut it the length of the book, and about two inches broader. Glue the back again, and lay the cloth on, allowing it to come over equally on both sides. Leave aside to dry after rubbing well to insure the cloth sticking to the back. In the meantime take the back, or as it should be termed the case of the book, and clean off any torn or ragged bits of the old paper or lining still adhering to it. Now take the book and fit it into the case, taking care that the front of the case and book agree. This done, open one of the boards of the book, and with a paste brush paste the end paper and the piece of cloth overlapping from the back; shut the board, turn over the book, and repeat the pasting up on the other side. Put it into a press, or under heavy weights, until dry. If this has all been properly done the book will be as firm as ever it was. I have given the *modus operandi* for repairing a book in the condition assumed from your description. If I have omitted anything or misunderstood you, if you write again as explicitly as possible, I will be glad to help you still further. I would have liked to have known if your book is half bound or full bound in cloth or leather.—G. C.

Fret Machine.—G. W. J. (*Sheffield*).—As you are able to get a straight cut with large saws, I presume the machine itself is all right, for I daresay you are aware that the saw clamps sometimes need adjustment. Very small blades are always more difficult to work with than those of larger sizes. There is such a small amount of metal that any irregularity in the wood has a great tendency to deflect them. Possibly, though not probably, you have got hold of a bad lot of blades, some of which have an undoubted bias towards one side or the other. It is rarely, however, that you will find many in a batch which are defective, and I am inclined to think that your want of success is either owing to your not having sufficient experience to enable you to use very small blades, or what is much the same thing, to your having endeavoured to cut stuff which is too thick, and therefore unsuitable for them. Suppose you try cutting a piece of veneer with as little variety as possible in its texture. Saw across the grain, and see whether the cut is deflected. Are you quite sure that you feed the wood to saw direct without any lateral pressure, and that you have the right amount of tension? Unless you have this latter, which, of course, cannot be as great with a small blade as with a large one, you must not expect to be able to cut to a line whatever the size of the saw may be. If you are doubtful about the quality of the blades you are using, and like to enclose two or three of each size, I will test them on a thoroughly reliable machine, and say what I think of them, in these columns. If you are a beginner, let me, however, advise you not to use very fine blades, say, nothing under No. 1, yet awhile. With a No. 1 or 2 even the finest work can generally be done, and unless you are a thoroughly skilled worker it is a mistake to use the thinnest blades. Practical marqueterie cutters seldom do so. If you are trying them for inlay purposes, as I suppose you are, remember that thicker blades can be used, without the joints showing more, by increasing the tilt of the table. I hope these few hints may assist you, though it certainly would have been a guide to me in advising you if you had stated the thickness and kind of wood you have been trying to cut with Nos. 00 and 000. With regard to overcoming the noise of which you complain, I fear I cannot assist you. Machines with movable wooden arms are more noisy than those with perpendicular movement, and I think it very likely that the noise of yours is no more than might be expected. If it is a new machine it may work more quietly after it has been used for a time. Perhaps lubrication may lessen the noise, as it probably will if this is of a creaking kind. If it is merely what may be called rattling of the parts together, you must decide whether it is only natural to the machine or is caused by defective screwing up. Were I to hear the machine I could soon tell you, but as this is impossible do the next best thing, and get a machinist, or someone accustomed to fit machines, to test it. Before doing so, it will, of course, occur to you that very little machinery of any kind is absolutely noiseless.—D. A.

Medical Battery.—W. E. (*Bath*).—There is a great deal of delusion and misconception afloat just now respecting the properties and virtues of so-called medical batteries. As a fact, batteries in themselves have no effect whatever on the human frame, either curative or otherwise. It has been proved by Dr. W. Stone that the human body presents a resistance of 1,320 ohms. Suppose, now, as you propose, we take a Leclanché battery of 40 cells, connected in series; the E.M.F. of each cell will be 1·60 volts, and the internal resistance of each cell will be 1·13 ohms. Now let us see what current you will be likely to get through your body by grasping the two poles of this large battery. We get the result by multiplying the voltage of each cell by the number of cells, and dividing this by all the resistances of the inner and the outer circuit. It stands thus:—

$$\frac{40 \times 1{\cdot}60 = \ 64 \text{ volts}}{40 \times 1{\cdot}13 + 1320 \text{ ohms}} = {\cdot}00468 \text{ ampères.}$$

I do not think this small quantity of current passing through your body can do you any good. The only result to you will be that you will be relieved of your surplus cash, for the battery will cost alone not less than £5. As you say that your purse is not a long one, in your interest I advise you to have nothing to do with medical batteries. Electricity can be applied as a remedial agent in some forms of disease, but its scope is very limited. When adopted as a remedial agent it is applied generally by means of the induction coil worked by a small battery, and this is named a medical coil, not a medical battery. It is sometimes useful in relieving neuralgic pains, in stimulating the nervous system deadened by partial paralysis, and in eliminating poisons from the body by electrolysis. If you will kindly tell me your ailments I will advise you with pleasure how to act to obtain relief, if electricity is needed at all.—G. E. B.

Gold Bath.—A R. (*Ipswich*).—To get a uniformly rich deposit of gold from an electro-gilding solution, it should be maintained at a standard richness, which may be anything from 15 dwts. to 2 oz. of gold to the gallon of solution. That is to say, if 15 dwts. of gold to the gallon deposits gold of a sufficiently rich colour, we should be careful to maintain it at this standard by paying attention to its condition, and adding gold or cyanide as required to keep this quantity of gold in solution. I suspect your solution has been worked low in metal, hence the poor, light colour of the deposit. Renew it by adding more double cyanide of gold and potassium dissolved in distilled water, until it has recovered its proper richness. Exhausted solutions are best reduced by evaporation to a thick syrup, drying in a shallow dish on a sand bath, and subsequent fusion in a large crucible. The button and grains of gold thus obtained may be alloyed with any other metals held in the solution, and must be refined in the usual way to get pure gold.—G. E. B.

Steam Engines.—SCRUTINEER.—A high-pressure non-condensing steam engine discharges its exhaust steam into the air, or the chimney of the boiler—the steam escaping in puffs; in the condensing engine the steam passes into a condenser, and no escape is seen or heard; the engine will also be fitted with an air-pump. To measure the diameter of cylinder you must have the cover off and measure with inside callipers, or a gauge. The length of stroke you may get from the travel of the piston rod guide block.—F. C.

Hydraulic Engine.—SCRUTINEER.—You have made a mistake, there is no such term as "horse-power pressure." Nominal horse-power is not used in this connection. In no case can n.h.p. be determined unless dimensions are given.—F. C.

Banjo without Brackets.—ALPHA (*Birkenhead*).—In reply to your query for an idea for a banjo without brackets, I beg to inform you that nothing has been invented to equal brackets for stretching the vellum. I heard some time ago of a banjo without brackets, invented, I believe, by a gentleman in Liverpool, but I cannot give any particulars as to the working of it, further than every time the vellum wanted tightening it (the vellum) had to be wetted with a sponge. The very act of wetting the vellum after it was put on would (in my idea) condemn it. I have experimented in that direction myself, but I have not, up to the present, succeeded in making anything to answer so well as the brackets. Therefore, if you want to save time and money, etc., go to work with the brackets. I am sure nothing could look neater than well-made and nicely-plated brackets. The principal thing is to get good ones with a well-cut screw thread, common brackets being dear at any price.—J. G. W.

Lathe for Grinding.—J. J. P. (*Malton*).—Not knowing from your question whether you are an amateur or a workman, I must reply as to an amateur. You do not require a lathe of any special form for grinding, polishing, and scratch brushing; all you want is an ordinary (very ordinary) rough lathe; the grinding wheels, buffs, scratch brushes, etc., can be mounted on mandrel nose, or on iron mandrel to run between the centres. Don't do such work as this on a good lathe; the dust of it is ruin to any kind of machinery with nicely fitted slides and journals. You don't really need a complete lathe at all; if you have the bed, crank, wheel, and treadle, you can fit a pair of wood uprights for headstocks, with a pointed screw through each, pointing inwards, to act as dead centres; then have a number of mandrels, each carrying one or two grinding wheels or buffs to run between these points, being driven by a wooden pulley, which would be provided upon the end of each of the mandrels to receive the band from the fly wheel. Any lathe maker could fit you up a grinding lathe of this kind.—F. A. M.

Patent for Compounds.—L. M.—It is not advisable to sell the compounds until your patent is complete, though there is no law to prevent your doing so. You can drop the patent any time you like; you are not compelled to keep it up.—F. C.

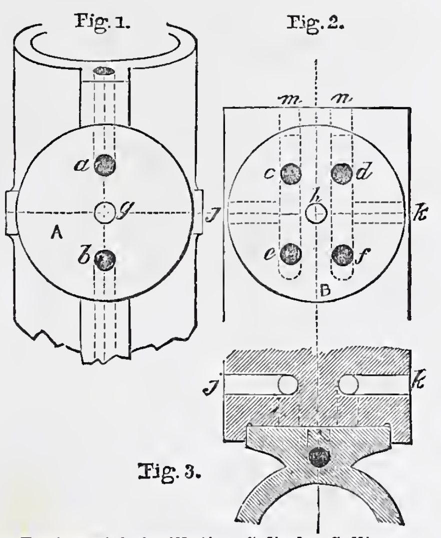
Microscopes.—WATCHMAKER.—I would recommend you to procure a catalogue of a well-known optician. If it is not invidious, I would say that for your purpose you could not do better than to get one of Mr. Lancaster, optician, Colemore Row, Birmingham. As to the price of lenses, a cheap set can be bought for 3s. 6d., but an object lens of short focus and fine quality will run into pounds, but the price of various qualities and powers will be found in any optician's catalogue. As to fitting the cell into the power-tube, if the said tubes were sent to Mr. Lancaster with instructions, it would be most courteously attended to—at least this has been my experience. He has done a good deal of such like work for me from time to time, and I have always found him kind, and his charges exceedingly moderate.—O. B.

Tondeur Photographic Developer.—E. L. H.—The formula for tondeur developer is a private formula, and unknown except to the compounders. If in one solution, the probability is that it is a hydroquinone developer, but without further information it is impossible to say.

Camera Bellows.—JACK OF ALL TRADES.—Several dealers supply parts of cameras. Mr. Tyler, of 58, High Street, Aston, Birmingham, will forward a price list on application.

Cost of Materials and Tools for Camera.—H. J.—The tools requisite are ordinary cabinet-making tools. The following list will be found sufficient: Tenon saw, planes, chisels, screwdrivers, drill, hammer, square, gimlet, and compasses. It is not the tools, but the manner in which they are used. A fit-out of cabinet-maker's tools varies from a few pounds to a few hundreds—there is no limit. As a workman gains in experience, he not only finds the advantage of a variety of pattern tools, but frequently designs special ones for the job he has in hand. It is bad policy to purchase new low-priced tools. Good second-hand ones, chosen with discretion, is probably the least expensive way of getting an outfit. Cheap or low-priced tools are generally deficient in temper, and are altogether a bad investment. The wood can be obtained of most timber merchants, and the metal work from Mr. Tyler, 58, High Street, Aston, Birmingham. Other dealers in photographic requisites also supply fittings. Obtain price list. Cost of completed articles probably two or three pounds; one from the regular makers eight or nine.

Engine with Oscillating Cylinder Callipers.—I think, if you wish to make an engine with oscillating cylinder, and do not know how to arrange the steam passages, you should get a book which treats on the subject, and so obtain more information than can well be given in "Shop" in answer to a query. You might get Powell's book from your nearest bookseller, or you might send 1s. to T. E. Hallewell, 50, Hanover Street, Dantzic Street, Manchester, and ask him to send his working drawing of oscillating engine. If you like it, you can afterwards get a set of castings for 5s. It is almost a pity to make a 1 in. cylinder without a slide valve, and I am afraid a slight sketch such as you ask for might not enlighten you much. The usual plan followed in small model oscillating engines is shown at Figs. 1 and 2. Fig. 1 represents the flange on the side of a double-acting cylinder; the face, A, is got up perfectly flat and parallel with the bore in the cylinder; port holes, *a* and *b*, are drilled leading to top and bottom of the



Engine with Oscillating Cylinder Callipers.

cylinder; also central hole, *g*, to fit the point, *h*, on which cylinder rocks, and which is certain to wear the hole larger and work loose. Now, if the face, A, be brought round and laid on face, B, the ports, *a*, *b*, will come exactly between *c*, *d*, and *e*, *f*, the cylinder being upright; this is the dead point when no steam passes. If *j* be the steam entrance and *k* the exhaust, then *c* and *e* will be steam ports and *d* and *f* exhaust; therefore, if the top of the cylinder swings to the left port, *a* will come over *c* and send steam to the top of the cylinder, whilst port *b* would come over *f* and allow the bottom of cylinder to exhaust. *m* and *n* are holes drilled down to meet the four portways, and are plugged at the top. I would not trust to the point *h* to support the cylinder, unless it were but ⅜ in. diameter, but would sink the surface, B, about ⅛ in., and turn the edge of the flange, A, to fit into the recess, as shown in the sectional plan, Fig. 3.—F. A. M.

Camera Bellows and Lens.—J. S. (*Dudley*) had better write for a price list to Mr. Tyler, 58, High Street, Aston, Birmingham. There is no lens specified. If J. S. would practise folding with a piece of paper, he would find bellows making very easy as soon as the knack was acquired.

Proportions of Quarter Plate and Whole Plate Camera.—G. S.—If G. S. will carefully read the article in question, he will see that "principal measurements" are mentioned, which is intended to mean that the frame of the body, the focussing screen, and dark slide must be made to work 4¼ by 3¼ plates, which is a fourth of the whole plate. The substance of the material may be to the taste of the maker. It is of very little consequence, so long as the inside measurements are right. Old-fashioned cameras used to be much larger and heavier than modern ones. It goes without saying that a small instrument does not require the same amount of strength as a large one. A clever workman will simplify whenever he can do so without interfering with the working capabilities—in fact, brains must be used.

Simple Lathe.—WELL-WISHER.—As you think you could make the lathe described in No. 17 by me, I would strongly advise you to do so, especially as you mean to learn the art of turning upon it. The simpler lathe to which I there referred is that known as a pole lathe, which is a sort justly going to the background. I trust in Part 3 of the series "Lathes for Everybody" to describe a unique lathe, which ought to be a great convenience to those amateurs whose space is very limited. I am glad to hear of your hopes. It brings so strongly to my mind what I felt when I began mechanics. I will be most happy to give you the right hand of fellowship in everything, and trust you will turn out, like me, a SELF-HELPER.

Banjo Making.—DARKIE.—In reply to your request for an article on banjo making, I am quite willing to do my best to oblige you in that direction, provided the Editor is agreeable, and can find room for it.—J. G. W.—[The Editor is agreeable, and will *make* room for it.—ED.]

Second-hand Headstocks, etc.—F. H. N. (*Malvern Wells*).—You can manage in either of two ways: by applying to second-hand dealers in machinery, or by advertisement. If you have plenty of time, go to the dealers in Worcester, or, better still, Birmingham, and suit yourself. If not, try an advertisement in the *Exchange and Mart*. The difficulty here is that the reply may come from so far off that you cannot go to see before you buy; but this is partly overcome by the system of deposit, whereby the price is sent to the manager of the paper, and held by him till the buyer is satisfied, or has returned the goods as unsuitable, when the money is forwarded or returned accordingly. You can easily find out second-hand dealers by inquiry at different hardware shops.—F. A. M.

Moulding Papier-Mâché.—C. H. C. (*Hornsey*).—The method of forming papier-mâché ornaments from pulp with which we are familiar is by using iron moulds, and subjecting the material to considerable pressure. Probably C. H. C. might do well to place himself in communication with the Papier-Mâché Company, London, whose work lies in this direction, and ascertain the process employed by them. We have not their full address to hand, but a Directory will supply it.—S. W.

Cutting Paper Tubes for Boxes.—KROW (*Glasgow*) has doubtless discovered ere this that his query has been answered. We would remind him that some time must necessarily intervene between the receipt of a question and the appearance of its answer in "Shop."—S. W.

Black Japan Varnish.—PAPIER-MÂCHÉ.—Some preparation of Brunswick black has probably been palmed on F. M. instead of the proper article. "Japan" is a word often used by manufacturers to convey the idea of blackness and brilliancy, as in "Japan blacking." He should apply to S. Thornicy, 6, Snow Hill, Birmingham, stating the purpose for which the "black japan" is required, and he will get the proper thing.—S. W.

Battery for Electric Light.—H. A. T. (*Bermondsey*).—Your battery is a single fluid chromic acid battery. Charge the cells with a liquid composed of 1 lb. of chromic acid and 2 oz. of chlorate of potash dissolved in 1 quart of warm water; then add to it 7 oz. of sulphuric acid. Allow this to get cool before charging the cell.—G. E. B.

Statical Electric Machine.—W. M. (*Liscard*).—A description of a statical electric machine would be far too long to be printed in "Shop," and would be almost useless apart from drawings illustrating each part. A series of illustrated articles on this subject will be given in WORK at some future time, but I must ask you to possess your soul in patience whilst waiting for the good time coming, since our "Shop" is now very full of work, and WORK is in danger of being filled with "Shop."—G. E. B.

Electric Belt Links.—TINMAN (*Homerton*).—Cut the links out of 24-gauge copper and zinc plates. The zinc lozenges should be plain oval pieces with a small transverse slit in each end. The copper lozenges should have a small tong or projection at each end, and these tongs must pass through the slits in the zinc lozenges, and then bent back to form a closed hook. The ends of these hooks may be soft soldered, but I do not think this necessary, as there will be no strain upon them when sewn into the flannel. I verily believe you would get as much benefit from wearing a piece of clock chain, or a piece of iron chain, inside a flannel belt, as you will from one of those galvanic chains. You will get more benefit from wearing a simple belt of new flannel than all these quack remedies put together. If you can tell me exactly what you want with such a belt, and what you hope for from it, I will give you some valuable advice from my own long experience. These advertisements are a delusion and a snare.—G. E. B.

Polishing.—M. J. (*Glasgow*).—The piece of work you name may as well be French polished, though if you prefer you may either wax or oil polish. The first-named method will give the highest gloss, and I shall confine my remarks to it. The mahogany you are using being old may be dark enough, but if not you can use a little stain. Oiling will, however, probably be sufficient. Use raw linseed oil, and apply it with a rag, rubbing it well in, and then letting the work stand for a day or two. Then stop the grain with a mixture of fine whiting, turpentine, and a little rose pink for colouring. Rub this well in with a rag, and clean off the surface before the composition gets hard. The wood is then ready for the polish. This you can make yourself, but it can be bought as cheaply. To use it, get some cotton wool or wadding and a piece of soft rag. Moisten the wool with the polish, and wrap it in the rag, taking care that there is only one fold of this between the wool and the wood. Avoid creases on the rubber where it comes in contact with the wood, or you will not get a good finish. The rubber being ready, touch the face of it with a very small quantity of oil, the smaller the better, just enough to make it work smoothly. The wood is then to be gone over with this rubber till there is a sufficient body of polish on it. This you can only learn by experience, but it may be a guide for you to say that the rubbing is continued till the wood has a polish on it, but only a smeary-looking one. After you have got a body on, let the job stand over, and if the polish seems to go or be absorbed after, say, a couple of days, repeat the bodying process. The smears are removed, and the final polish is got by "spiriting off," that is, using a similar rubber to that already described, but without any of the oil and French polish, for which methylated spirit is substituted. In doing this you will have to be very careful not to "spirit off" the body you have previously laid. Continue rubbing till you have sufficient gloss. Such in brief is the process which will be described at length in a series of exhaustive papers on polishing of various kinds as soon as practicable. You will find that the rubber cannot be effectively used on carved parts, which you had better finish with spirit varnish. Paint it on with a brush, and be careful not to lay it on too thickly, or you will get a coarse effect. You are, doubtless, aware that a very good appearance may be got by simply polishing the plain uncarved parts, and leaving the carved work dead by merely oiling it. This is a plan which, as a matter of taste, I should adopt.—D. A.

Aquarium Glass.—AQUARIUM (*Canning Town*).—For the glass for an aquarium 16 by 13 by 14 inches, you had better use what is known in the trade as "32 oz. sheet." For cement for the same see reply to TYRO, page 221.—C. M. W.

Fountain Aquarium. — OUVRIER (*Birmingham*).—The construction of an aquarium with an automatic fountain combined is quite within the reach of any one capable of doing ordinary sheet metal work, and a fully-illustrated article upon the subject appeared in No. 31 of WORK, page 481.—C. M. W.

Safety Cages.—E. J. J. (*Notting Hill Gate*).—There are several inventions patented and in use to arrest the fall of cages in coal and other mines, and in cases where the rope breaks; also similar appliances for securing the safety of passengers in warehouse lifts. There is a very effective arrangement of this kind on the Otis lifts in the Eifel Tower.—F. C.

What to Turn.—CAR (*Carmarthen*).—You have a Milnes' 5-in. lathe with slide rest and tools for wood and metal, also a good set of chucks and a circular saw and table—a very good set of tools let me say—and you wish for patterns, etc., of articles which you can turn. Now with such a good outfit you can make a great many things in wood and metal, but as you are a beginner, begin with wood, and learn to turn in soft wood and hard, laying aside the slide rest and metal-turning tools for awhile. You can hardly do better than begin with tool handles; then go on to boxes which have two parts to fit together, and require to be hollowed out; flat boxes and taller and deeper match-boxes, egg-shaped boxes to hold thimbles, etc.; then make some wooden candlesticks—small ones for wax tapers and large, tall ones. All these things are excellent practice. You might try some Egyptian trellis (see No. 7 of WORK)—very good practice; see also page 281 of No. 18. Holtzapffel's Vol. IV. is a most admirable book, and has many excellent designs.—F. A. M.

Choice of Lathe.—MEDUSA (*Leith*).—You ask advice as to your choice of a lathe for small metal work, including milling, and you mention the Britannia Co.'s No. 14, Barnes' 5½ in., and Price's Universal, which have all been noticed in WORK. Now these are all very good lathes, and it is, of course, a matter of opinion as to which is best, but if you want to do milling I must say that I should in your place go in for Price's lathe with the vertical slide. I would have a long leading screw, a clamp to fix the vertical slide at any height, a bored mandrel, and would ask them to increase the length of the front slide to give more bearing surface.—F. A. M.

Small Motor for Lathe and Sewing Machine.—J. B. (*Keighley*).—An electric motor will do what you want if you have the supply of electricity; if not, you would want a battery, which is far too costly to supply with zinc and acid to answer your purpose. If you can get water from the town main at 9d. per 1,000 gallons, and at 100 lb. pressure per square inch, you might use a "Thirlmere" wheel water motor, which is very cheap, and far the most convenient thing to have, but the water will cost a shilling or two per day. You might have a one-man gas engine, sometimes to be got second-hand for £10, but don't have it in a living room, as it thumps and smells. The gas for this costs a mere trifle.—F. A. M.

"Royal Mail" Cart.—PARENT (*Amen Corner, London*).—A paper on how to construct one of these popular carts for children is given in No. 30.—ED.

Watch and Clock Making.—GOVAN.—These papers were commenced in No. 20 of WORK, published August 3rd last.

Smithing.—I am in receipt of your letter with reference to smithing, and am pleased to find that the papers thereon give you satisfaction. They will be resumed in a very short time, and will include every branch of the trade.

Verge Watch.—W. B. (*Tipton*).—The paper on this subject will have met your eye long before it can light on this reply to your remarks on this subject. It by no means follows that because the first of a series of papers is commenced in any particular number that the second will of necessity appear in the number immediately following. Rest assured that there are always good reasons for doing all that is done in this way, but to give detailed explanation as to the why and the wherefore of the doing to all who ask it is neither necessary nor expedient.

Bookbinding. — BOOKBINDER. — The papers on bookbinding will be commenced very shortly, but I cannot name any precise time. It will not, however, be long now before a beginning is made. I am obliged to you for your good wishes and good opinion of the Magazine as it is.

Modelling in Wax.—WAX.—It will not be possible to give, at all events at present, any description of the methods of preparing anatomical subjects and facsimiles of natural objects in wax. Although it is sought to do as much as is practicable in WORK, still it is beyond my powers to take up every point in the great circle of the sciences as they at present exist.

American Organ.—WAX.—Instructions in building organs of this class will be given as soon as opportunity offers, but to go through every instrument of the kind from the barrel organ of the streets to church organs, and "also the kind to be seen at shows known as military organs," is utterly beyond my power and the purpose of WORK. The use of technical terms in WORK cannot be given up. Ask the meaning of any term that you do not understand.

Wood Screw Cutting Tool.—J. H. E. (*Shepherd's Bush*).—It has been already stated in "Shop" that the London agents for the sale of the specialities of Messrs. Peugeot Frères are Messrs. Alexander von Glehn & Co., 7, Idol Lane, London, E.C., but this, doubtless, has escaped your notice.

Index to Weekly Numbers of Work.—N. W. C. (*Manchester*).—The addition of an index to the contents of each weekly number of WORK is under consideration, but no change in the present form can well be made until the commencement of Vol. II., when, in all probability, many improvements will be effected. A. E. W. and MARKET WEIGHTON are referred to the above reply as an answer to their letters on this subject.

Index to Work.—ALARUM.—An index will be prepared for each volume of WORK. I am glad to find that you are among the many who have derived benefit from the Magazine.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Battlesden Cart. — R. B. (*Fife*) writes: — "Would HOMESPUN (*Tenterden*) give instructions for making wheels for Battlesden cart (see page 524)?"

Carving Woods and Patterns.—J. D. (*Broomhill*) writes: — "Where can different woods for carving be obtained? Also is there any one who enlarges designs according to patterns that may be sent, and from whom models may be hired at a charge per month?"

Terra-Cotta, Monumental, and Portrait Painting. — PIXIE (*Aberdeen*) writes: — "Would you kindly allow me a small space in 'Shop' of WORK to ask if any of the readers or your staff would kindly oblige me with an idea of how to do any of the below-named subjects:—1. A practical treatise on the manufacture of bricks, tiles, and terra cotta? [We cannot teach you how to write a popular treatise.—ED.] 2. How to hang the drapery on an urn for monumental stone-cutting, with a few sketches of the same? 3. How a portrait is painted? And for certain it would do good to more than me."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Pill Making.—PHARMACIST (*Kingstown*) writes in reply to J. C. (*Carlisle*) (see No. 31 of WORK, page 494): — "If J. C. (*Carlisle*) were to apply to Messrs. Maw, Son, & Thompson, 11, Aldersgate Street, London, they would gladly submit prices, and supply any article or machine used in pill making. There are various forms of pill-making machines in the market, and I feel certain that if J. C. were to call upon any of the chemists in or around Carlisle during their quietest time they would willingly let him see the various forms of pill tiles, rollers, coaters, silverers, etc. He would then be in a position to describe the kind he would require. An ordinary mahogany frame pill machine to roll and cut 24 pills at a time would cost from about £1 to £4, according to fittings. A Pindar's rotary pill machine would cost from 12 to 30 guineas, according to requirements. Graduated pill tiles may be had from 6d. upwards. When only a small quantity of pills have to be made, the simplest method is to weigh out a given quantity of the pill mass, and roll this with the blade of a knife upon a piece of glass or graduated tile to about the thickness of an ordinary writing pencil and divide into equal portions, and roll each between the thumb and forefinger until quite round and smooth. A little practice in this will soon make perfect. Except for very large quantities an ordinary mahogany-frame pill machine is sufficient."

Ink for Posters.—H. P. (*Plaistow*) writes in reply to A. J. (*Ilkeston*) (see page 494):—"You should get your stationer to order a sixpenny or shilling bottle of Mordan's waterproof ticket ink, F. Mordan, 326, City Road, London, E.C."

Lacquer for Iron and Steel.—R. G. (*Birmingham*) writes in reply to STEEL (see page 526):—"Tubbs & Wilkins, Hockley, Birmingham, make the above, all colours."

Working Drawing of Tramcar.—F. C. (*Leytonstone*) writes in reply to J. W. F. (*Lancaster*) (see page 526):—"I can supply you with a drawing of a tramcar as made by the best firm in London."

Trade Notes and Memoranda.

FIVE thousand plumbers are now enrolled on the register of the Plumbers' Company.

THE average number of men employed per diem on the Forth Bridge during the three months of the busiest time was 2,293. Only one fatal accident, and this we are informed was due to the workman's own want of caution, has occurred during the quarter.

THE directors of the Forth Bridge Railway Company recently visited the bridge by the aid of a gangway over the gap at the north girder, and walked on the bridge from the south to the north shore of the Forth. The first to cross were Mr. Thomson, chairman of the Forth Bridge Company and the Midland Company, and Miss Taylor, daughter of General Taylor. They were followed by Lord Colville, chairman of the Great Northern Railway, and Mr. Dent, the chairman of the North-Eastern Company. The party returned to Queensferry by steam barge.

ACCORDING to a recent publication of the Statistical Bureau at Berlin, four-fifths of the steam machinery in the world has been constructed within the last twenty-five years. France has 49,500 stationary boilers, 7,000 locomotives, and 1,700 ship boilers; Austro-Hungary, 12,000 stationary boilers and 2,400 locomotives. In the United States, the steam machinery, exclusive of locomotives, has 7,500,000 horse-power; in Germany, 4,500,000 horse-power; in France, 3,000,000 horse-power, and in Austro-Hungary, 1,500,000 horse-power. There are some 105,000 locomotives in the world.

THE London correspondent of the *Manchester Guardian* says a movement is on foot to establish a house-to-house heating supply, similar to that of gas and water. The system consists in the constant circulation of water at a high temperature and pressure (viz., at 400 degrees Fahrenheit and 250 lbs. on the square inch) from the batteries of boilers at a central station through the supply mains, and back to the boilers by return mains, the circulation being maintained by means of pumps. The loss of heat by radiation has been reduced to a minimum by covering the mains with a non-conducting material. Service boxes sufficient to heat three houses would be placed under the footpaths. From these boxes the house supply would be taken by means of copper pipes. At the end of the copper pipe, and inside the house, is fixed a vessel called a "converter," which permits the water to resolve itself into steam, the pressure of which is controlled by a reducing valve fixed on the copper pipe before it enters the "converter." From this "converter" the house service would be taken.

WORK

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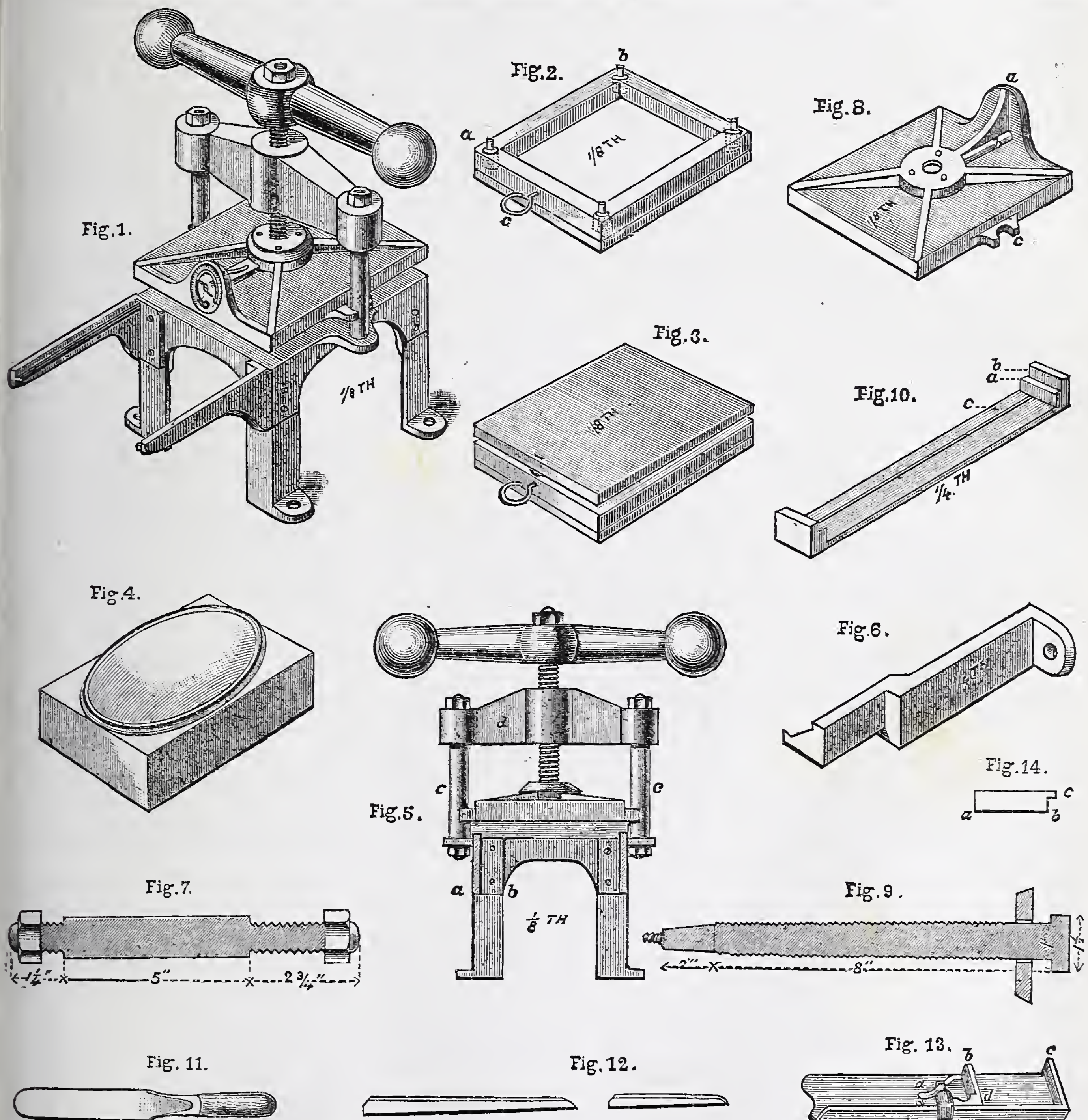


INDIARUBBER STAMP MAKING. (*For Description see next page*). Fig. 1.—Press for Moulding and Vulcanising. Fig. 2.—Spring Chase. Fig. 3.—Chase with Moulding Plate in Position. Fig. 4.—Oval Shape. Fig. 5.—Elevation of Press. Fig. 6.—Leg of Press. Fig. 7.—Section of Standard. Fig. 8.—Platen or Follower. Fig. 9.—Section of Main Screw of Press. Fig. 10.—Moulding Gauge. Fig. 11.—Palette Knife. Fig. 12.—Side Stick. Fig. 13.—Composing Stick. Fig. 14.—Setting Rule.

INDIARUBBER STAMP MAKING.

BY "QUI VIVE."

Introductory.

In these "go-ahead" days, when almost anything which promises to aid in the economy of time is eagerly welcomed, notwithstanding the fact that many of the most alluring promises are of the proverbial "pie-crust" kind, no excuse is needed for introducing the subject of rubber stamp making. Few offices, even of the most humble pretensions, are to be found without their complement of indiarubber stamps; and even in private life these extremly useful articles have won golden opinions, if one may judge from the numerous advertisements of monograms, linen-markers, note headings, etc. etc., which meet his eye in the periodicals which come under his notice.

The purposes for which india-rubber stamps may be advantageously used are almost numberless, and these handy instruments may be fairly regarded as valuable auxiliaries to the printing press, having their own special sphere of usefulness into which the printing press cannot profitably enter. For the purpose of repeating impressions of the same matter at irregular intervals and in varying situations the solid die has long stood in high favour, and, in the form of the now old-fashioned brass endorsing stamp, is still to be found occupying an honourable position. I am, however, inclined to the opinion that the introduction of indiarubber stamps struck a blow at the older instrument from which the latter cannot possibly recover, the rubber die being not only capable of doing any kind of work for which its predecessor was used, but having also the immense advantage of *elasticity*, by which it is enabled to adapt itself to surfaces so unlevel as to render the use of a rigid metal die altogether out of the question.

When a person handles a well-made indiarubber stamp for the first time, he is, if of an inquiring turn of mind, led to ask by what mysterious process such an apparently intractable substance as indiarubber has been made to yield such beautiful results, and his wonder does not cease if he is fortunate enough to elicit the information that rubber stamps are not engraved but moulded. Indiarubber stamps are not—indeed *cannot* be—made of pure rubber, but of a mixture of pure rubber and sulphur; the mixture being forced into a suitable mould by strong pressure, and in that state submitted to such a degree of heat as will bring about a chemical union of the sulphur with the rubber, and thus produce what is known as *vulcanised* rubber.

The essentials of an indiarubber stamp making plant, then, consist of some means of producing the requisite moulds, and afterwards applying pressure and heat simultaneously to the rubber compound placed therein.

Various attempts have been made to beguile the confiding amateur by offering "complete apparatus and full instructions" for the manufacture of india-rubber stamps, all of which have hitherto been of the nature of the conjurer's explanation of his astounding tricks. I do not, by this statement, intend to convey the idea that satisfactory rubber stamps cannot be produced by such apparatus, for I have personally made some very satisfactory stamps in this way; but, as a matter of fact, chance or good luck enters very largely into the case, and the amateur who succeeds in making a stamp *that will stand the test of hard wear* once out of every twenty trials may be considered exceptionally fortunate in his experience. I purpose in these papers giving such instructions as will enable any person of ordinary intelligence who carefully follows them, to produce stamps equal to any sold by professional makers, and if by inadvertence any point should be overlooked, or the details not made sufficiently clear, a query addressed to me through the Editor will receive due attention in "Shop."

Apparatus.

The apparatus which I am about to describe is adapted for the production of stamps up to six inches by four inches, a size which will probably suffice for most of my readers; but if any require apparatus of a larger size, corresponding additions to the horizontal dimensions given will be all that is needful. The apparatus consists of, (1) printing types and "shapes" of various kinds, according to the fancy of the stamp maker, and a few printers' sundries as detailed below; (2) a specially adapted "chase" to hold the type rigidly during the process of moulding; (3) a moulding plate on which to form the mould and retain the same during the subsequent process of vulcanising the rubber; (4) a moulding-gauge, by the aid of which the moulding composition is spread upon the moulding-plate in a thin and even layer, and (5) a press suitably arranged for use both in forming the mould and afterwards as a vulcaniser. These various pieces of apparatus we will now proceed to consider in order.

1. *The Printing Type and Shapes.*—These may be obtained of almost any printer's broker or type-founder. It is the best plan to confine one's selection to plain type—*i.e.*, type without shading or ornamentation—as, although the finest detail is faithfully reproduced by the rubber, the fine lines soon become choked with ink, and the stamps rendered practically useless. The "shapes" in common use are mostly oval in form, as shown full size in Fig. 4. They may be either solid brass or electrotyped, the latter being the cheaper, but the former the more useful and lasting. "Fancy" shapes to be used in conjunction with type are generally electrotyped, and in this form are substantial enough for the more limited use to which they will probably be subjected.

A supply of "quads" and "spaces"—blank pieces of metal of various thicknesses, and of widths corresponding to the type with which they are to be used—should be purchased at the same time as the type; also a couple of pounds of 4-to-pica "leads"—thin strips of type metal for separating the lines of type—and two or three lengths each of narrow "furniture," pica and nonparcil "reglet," pica "wood rule," and thin "brass rule." A "composing stick" (Fig. 13) will also be required. "Side sticks" (Fig. 12) may be either purchased or made at home. They are tapering pieces of hard wood, generally oak, which are used in conjunction with "quoins"—similar tapering pieces of wood about $1\frac{1}{2}$ in. in length—for firmly securing the type, etc., in the chase, described below, during the process of moulding. It is recommended that both side sticks and quoins be made in the following manner:—Carefully plane up a strip of oak 2 ft. in length, $1\frac{1}{4}$ in. wide, and $\frac{5}{8}$ in. thick, taking care to have the corners square; then divide this parallel strip into two tapering ones, $\frac{7}{8}$ in. wide at one end and $\frac{3}{8}$ in. at the other, and plane up the newly-sawn edges square and true. Now cut off four $1\frac{1}{2}$-in lengths from the smaller end of each strip, and divide the remaining portions into $4\frac{1}{2}$-in. and 6-in lengths respectively, and we have a supply of side sticks and quoins, which only require the removal of the rough edges left by the saw to fit them for use.

2. *The Chase.*—This is shown in Fig. 2, and consists of a plate of cast iron $\frac{3}{8}$ in. thick, planed on both sides, surmounted by a strong iron frame $7\frac{1}{2}$ in. long and $5\frac{1}{2}$ in. wide inside, the frame itself being $\frac{7}{8}$ in. wide and 1 in. deep, with the top, bottom, and inside planed true and square. At each of the corners of the frame and base plate a $\frac{5}{16}$-in. hole is drilled through from the top to the bottom, the holes in the frame being then counterbored to $\frac{5}{8}$ in. in diameter for $\frac{3}{4}$ in. in depth (see Fig. 2).

Four pins are then made of $\frac{3}{8}$-in. rod, about 2 in. in length, and reduced to $\frac{5}{16}$ in. in diameter for rather more than $\frac{5}{8}$ in. in length at one end. These pins are then riveted by their smaller ends into the holes which have been made in the corners of the frame and base plate, thus riveting them together and forming a tray having a flat bottom with the four sides at right angles thereto and to each other.

Before riveting in the pins the holes in the base plate should be slightly countersunk on the underside, and when the riveting has been satisfactorily completed the under surface should be filed level if necessary, and the free ends of the pins reduced so as to project barely $\frac{3}{8}$ in. above the level of the frame of the chase.

Four open spiral springs of steel wire $\frac{1}{16}$ in. thick are then fitted to the annular spaces around the springs in the corners of the chase, these springs being about $1\frac{1}{4}$ in. in length when open, but capable of being compressed level with the upper surface of the frame of the chase. A ring, *c*, is made of $\frac{1}{4}$-in. rod and screwed in the front edge of the chase to form a handle.

3. *The Moulding Plate* consists of a flat plate of iron, identical with that used for the base plate of the chase, with the exception that the holes in the corners are to be of such a size as will allow the guide pins in the chase to pass freely through with the least possible play. The correct position of these holes may be best secured by clamping the frame of the chase and the moulding plate together, and then drilling $\frac{3}{8}$-in. holes through the moulding plate and sufficiently far into the chase frame to serve as guides for subsequently drilling the holes proper to the chase and base plate, which should be clamped together in their turn and both drilled through at one operation. If this operation be properly done, the holes at each corner will exactly correspond, and a very little "easing" of the holes in the moulding plate by means of a reamer will afford sufficient play. The moulding plate in its working position on the chase is shown in Fig. 3. When properly fitted together some distinctive mark should be placed on the front edges of both chase and moulding plate, so that no time may be lost in fitting them together subsequently, when the least delay may be fatal to success, and cause the whole operation of moulding to be commenced anew. Before proceeding further with my description, let me say that the fitting of this part of the apparatus cannot be too carefully performed if the best results are expected.

4. *The Moulding Gauge* is formed as shown in Fig. 10, and may be made of either brass or iron, the former being preferable, not only because of its being readily cast from a

pattern, so as to require but a small amount of finishing, but also on account of its freedom from rust. It is made to ride by the seat *a* close to the edge of the moulding plate, on which it is retained by the guards *b*. The edge *c* is so adjusted that when placed in position on the moulding plate it will leave a clear even space of from $\frac{1}{12}$ in. to $\frac{1}{8}$ in. between itself and the plate.

5. *The Press.*—This is shown complete in Fig. 1, and is somewhat similar to an ordinary letter-copying press. It is, however, necessarily of much more massive construction than copying presses, so that it may be able to retain an approximately equal temperature during the process of vulcanisation. The table and platen, or follower, are each $9\frac{1}{2}$ in. from front to back, 8 in. wide, and 1 in. thick, with their opposing surfaces planed true. Dwarf standards $\frac{3}{8}$ in. thick depend from the corners of the table to the depth of 2 in. below its under surface, the width *a-b* in the elevation (Fig. 5) being $1\frac{1}{2}$ in. To these are screwed legs $4\frac{1}{2}$ in. in length as shown in Figs. 1 and 5. Fig 6 shows the leg in its entirety, and clearly indicates by what means it is attached to the table. The position of the feet, of course, varies as required by the position of the legs. Projecting lugs on the sides of the table support standards of round iron as shown in section in Fig. 7, in which is also shown the dimensions of the standard. These standards are mounted $9\frac{1}{2}$ in. apart from centre to centre, and midway between the front and back edges of the table. The platen, shown separately in Fig. 8, is formed with a central boss 3 in. in diameter, in which is formed a circular cavity $1\frac{1}{2}$ in. in diameter and $\frac{1}{2}$ in. deep for the reception of the head of the main screw, which, with the collar by which it is attached to the platen, is shown in Fig. 9. For the sake of appearance, ribs are made to radiate from the central boss to the corners of the platen. The projection shown at *a*, Fig. 8, is for the attachment of a thermometer, the bulb of which is to be inserted some 3 or 4 in. in a hole drilled lengthwise in the thickness of the platen, which may, if necessary, be made thicker at this part, as shown at *b* in the figure, the diameter of the hole being regulated by the size of the thermometer bulb. From $\frac{3}{8}$ to $\frac{1}{2}$ in. will, however, be large enough. The thermometer may, with advantage, be of the form known as an "oven" thermometer, the external appearance of which is shown in Fig. 1. It is attached to the platen by means of a small central screw, the bulb and that portion of the tube which is at right angles to the circular scale plate being inserted in the hole drilled for their reception. Midway in the length of the platen is placed, on each side, a guide-piece (*c*, Fig. 8), which, partially encircling the standard rising from the table, prevents the platen from twisting when raised or lowered by the screw. The standards (*c*, Fig. 5) are connected at the top by a crosshead, *d*, through the centre of which is formed a female screw to act as a nut to the main screw, which is threaded with not less than 8 threads per inch. Motion is conveyed to the main screw by a weighted lever, as shown, the lever being fitted to a tapering square on the end of the screw.

Brackets affixed to the front of the press, as shown in Fig. 1, will be found very useful to support the chase, etc., from time to time during the preparation of the mould, and also to support the mould whilst being dried.

Having now described the necessary apparatus, I will leave the reader to construct this before proceeding to describe the mode of working, which I will do in another paper.

ENGRAVING ON METAL.

BY NORMAN MACLEAN.

ENGRAVING ON BRASS AND ZINC.

ENGRAVING on brass includes door and window plates, memorial brasses, axle caps, saddlery mounts, beer engines, fender and fire brasses, etc. It is executed in two ways: for small and moderate-sized work with the graver in the usual manner, and for large work by means of the hammer (Fig. 22) and chisel. The latter process requires a greater outlay for outfit, but with this advantage, that the chisel will remove enormous quantities of metal in a very short time, which is, however, counterbalanced by the very great noise made in the operation, which renders the process unfit for home work.

For this reason many engravers prefer to cut the whole with the graver, and, certainly, more correct work can be done, even if it takes a longer time. It will be seen that the outfit for name-plate work includes some extras not required by the ordinary engraver, and possibly some workmen may have tools by them which by a little ingenuity can be utilised for brass engraving.

Brass plates may be obtained at a metal dealer's, cut to size, at the rate of 7d. per pound. They are not flat, and require hammering by a silversmith before they can be engraved. They should also be sand-buffed or rough polished on one side only. After having been made flat by the silversmith, true up the edges (and bevel them if required), using leaden clams in the vice to prevent unnecessary marks, and using the square and straightedge freely during the process. Then send it to be rough polished on one side only. If you prefer to do this yourself, procure a large piece of pumice-stone and plenty of water, and rub the plate (always in the same direction evenly all over the surface) till every scratch is removed. Finish with a large piece of water of Ayr stone, when you will have a fine surface to cut upon.

Now mark out the border, if one is desired. The border is generally a single line with the corners finished ornamentally, the said line and corners cut deeply to hold the wax. Having decided what style of lettering you will adopt, mark in the name with the pencil. To do this proceed as follows: Draw with the pencil a line down the centre of the plate, and also one across the centre of the plate; next count how many letters are contained in the name. Take the centre letter of the top line and roughly sketch it in midway between the centre pencil line and border. Continue to sketch roughly in the remaining letters each side of the centre until they are pretty evenly balanced. Now rule with the straightedge and point (Fig. 23) a line at the top and bottom of the roughly sketched in name, and proceed to draw carefully the whole name, seeing that each letter has plenty of room to stand in, and that the name itself is well balanced on the plate. A few words about the style of lettering for door plates. They should be very legible, and perhaps the best styles for this work are "block letters" and the "Italian," or "writing." I can illustrate my meaning by a little anecdote. At a well-known engraver's in this town there was, and is now, to be seen a large brass plate, with the name and trade of the owner engraved in the highest style of the art. On one occasion I was coming along past this brass plate, when I was stopped by a man carrying a large basketful of work, and who asked me to direct him to Mr. M——'s. (I had noticed the man looking at the plate as I came along the street, and had half suspected that he could not make out the lettering). "Why," said I, "you are looking at his name plate. That is Mr. M——'s place of business." "Well," said the man, "I have seen some thousands of door-plates, but I never came across one that I could not read in my life. This *beats* me." This plate was done in three styles; the name was ornamented Roman, the middle line in German text with flourishes, and the bottom line in Gothic lettering, and not at all easy to read.

The workman, having the plate properly set out in pencil, can now "point it in," using the steel point (Fig. 23). Use the rule for all straight and angular lines, and the dividers and rule for parallel lines, and keep the "block letters" upright, and the "writing" at a moderate angle. The sizes of brass plates vary greatly, from a small plate 4 in. × 2 in. × $\frac{1}{8}$ in., bearing the words "push," "ring," "knock," etc., to door plates 18 in. × 12 in. × $\frac{1}{4}$ in., and it is in engraving these large plates that chisel work comes in with advantage. The plate being "pointed in" ready for cutting, it will require to be mounted on the stone with cement. Before pouring the hot cement on the stone, brush off all the dust and sand that may be adhering to it, and place it before the fire to be thoroughly warmed through, then warm the plate, and lay it on the hot cement, pressing it down so as to make it solid to work upon. This will deaden the sound of the hammering, and resting the stone on the large sandbag will further deaden the sound, counteract the effect of the blows on the chisel, and enable the engraver to turn the work in any required direction (Fig. 21).

In order to outline the letters the operator must first take the chisel (Fig. 25), and whet it at a rather acute angle, and "set off" at about 30°. Commence with the perpendicular lines; outline them boldly as regards depth, holding the chisel slightly sideways, so as to "undercut" the letters. "Undercutting" makes the letter or figure slightly larger at the bottom of the cut than at the surface, and therefore holds the wax more securely. Having cut all the perpendicular lines in one direction, turn round the block and recut the same lines in the opposite direction; this will make the corners square. Then cut the cross lines in like manner. The straight lines will be much more easy to cut than the curved ones, so, until the workman has obtained full command of the chisel, he will do well to cut the curved lines with the graver. The outlining being done, take a chisel nearly the width of the lettering, and proceed to sink the letters to the depth of one-sixteenth of an inch (Figs. 26 and 27). Leave the bottom of the cut as rough as possible, as it tends to hold the wax. This being done, take the scraper (Fig. 24), and remove the "burr" or "fash" thrown up by the action of the chisel. Now take an ordinary graver with a wide facet, and square up the corners, and give a graceful outline to the curves. If the plate is to be mounted on a mahogany block, the four screw-holes must now be drilled and countersunk, which the workman can easily do with the handy Archimedean drill; but if the plate is to be put upon a door, it will be required to have soldered on the back two bolts, which will, by means of nuts, secure the plate on the inside of the door. This must be done before the waxing of the letters is proceeded with. The bolts now being attached, take some turpentine and clean rag, and thoroughly clean all the letters carefully.

The process of waxing requires to be conducted very carefully. The wax made specially for the purpose may be bought at an oilman's; take a sufficient quantity of wax of the desired colour, black or red, and pulverise it in a mortar. Have the plate quite clean, and fill all the cuts with sufficient of the powdered wax, being careful not to let the wax extend all over the plate; then take a camel-hair brush, and gather the wax in a little hillock above the surface of each cut to allow for sinking. Now put the plate into a hot oven and watch it carefully, turning the plate frequently so as to heat it evenly all over. Do not let the wax bubble or boil. As soon as the wax begins to melt take out the plate from the oven, and press the wax in the cuts with a piece of flat iron or steel. It is hardly possible to avoid getting the wax all over the plate, but while the plate is hot it can be wiped off, if it is not too close to the letters.

The plate must now be left to cool gradually. To remove the superfluous wax from the surface of the plate, the water of Ayr stone must be freely used with plenty of water. Rub the stone always in the same direction, lengthways being preferable. The wax being removed, dress the plate with a piece of leather, using crocus, and plenty of common oil to moisten the crocus. A final polish with a piece of soft leather—chamois will do—with lampblack as a polishing medium, will finish the plate and blacken the letters. The mahogany blocks for mounting the plates are made to order by a cabinet maker. But the engraver of small plates is supposed to be able to fix them himself, so that he should be prepared with the necessary tools. Zinc plates, it is scarcely necessary to say, are treated in a similar manner.

Before I conclude the subject of brass and zinc plate work, I must mention two matters which, although not of the greatest importance by themselves, yet, as a whole, will make or mar a brass or zinc name-plate. I allude to the filling of the letters. If a little extra expense be no object, use the very best black or red sealing wax; the appearance will fully repay the engraver for the extra expense involved. My London readers may obtain this best wax at most good stationers', and the cost is usually threepence per stick. The second quality sealing wax is used for very large plates, and is similar to that used by the post-office officials.

The other little matter I wish to impress on the memory of the young workman applies more particularly to cutting zinc. The peculiar nature of zinc tends to "clog" the point of the gravér. To obviate this, and to clear the point for the following cut, I usually have at my right hand a small flat piece of wood, pine or deal—in fact, any soft piece of wood will do—which is screwed down to the bench in a convenient position, so that the engraver may dig in the tool after each cut, and so clear the graver point from the zinc which is attracted by the action of the steel while cutting through the zinc.

Fig. 21.—Mode of cutting out Letters with Hammer and Chisel on Brass or Zinc Plate, the Metal being bedded on Stone supported by Sandbag.

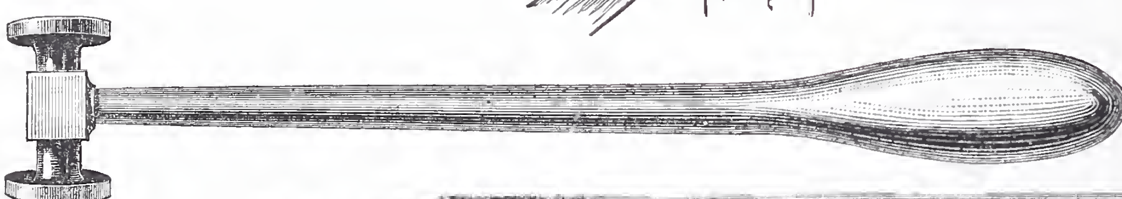


Fig. 22.—Hammer for Engraving on Brass and Zinc Plate.

Fig. 23.—Etching Needle or Tracing Point.

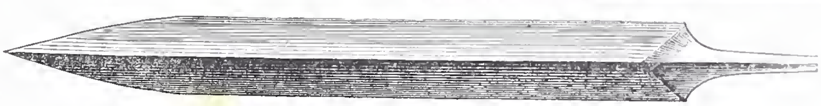


Fig. 24.—Scraper for removing Burr thrown up by Chisel.

Fig. 25.

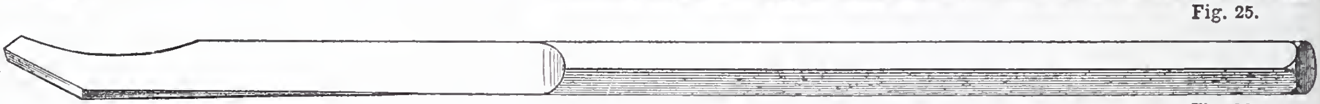


Fig. 26.

Fig. 27.

Fig. 25.—Outlining Chisel for Brass and Zinc, as for Door Plates, etc. Fig. 26.—Narrow flat Chisel for cutting out the metal from the Letters, etc. Fig. 27.—Broad flat Chisel for cutting out large Letters.

THE DULCIMER, AND HOW TO BUILD ONE.

BY R. F.

Completion of the Shell and Fitting of Soundboard.

Now take the blocks and gauge a mark 2 in. from the square edge on the under side, and screw the back on level with these marks with No. 6 screws $1\frac{1}{4}$ in. long. Put in screws at intervals of about 2 in., commencing at 2 in. from the bottom. Grease them before turning them in, as they must come out again before finally fixing on the back. Lay a straightedge across top and bottom, mark off projecting corners of the blocks, and saw and plane them off level, as shown in Fig. 3 by dotted lines.

Now take the back off again, and clean off all burrs or chips that may have got raised, and with some hot and strong—*not thick*—glue, quickly run over two inches of the edge of the back and the underside of the block, and, slipping them together, work them up and down a few times to get a good connection, and drive the screws home. Clean off all glue that has squeezed out, and repeat the operation on the other block. Now fit three blocks of the inch-square stuff $3\frac{1}{2}$ in. long accurately into the angles formed by the back and blocks on each side, glue them in, the first one at a distance of two inches from the bottom edge, A (Fig. 4), and set aside for a day or two to dry.

Our instrument is now beginning to take shape, but has yet to be strengthened by "bracing." First, for the front brace. For this cut a mortise in the front end of each block $1\frac{1}{2}$ in. long, 1 in. wide, and $\frac{3}{4}$ in. deep, D (Fig. 4). Take a piece of $\frac{3}{4}$ stuff, 2 in. wide, and of the necessary length, and cut it to fit accurately into each mortise, and, at the same time, fit perfectly level on the back. The top edges of this brace at each end must come exactly level with the lower edge of the groove, B (Fig. 4). It must not, however, be quite straight from end to end, but must rise $\frac{1}{2}$ in. in the centre, so that the top of the brace presents a slightly arched appearance. This will give the belly a rather convex surface, as it is found that this form gives a better tone, and also presents a greater resistance to the downward pressure of the strings.

When the brace is finished, fit it into its place, and bore a hole in each tenon to take a 2-in. cut clasp, and along the underside of the front edge of the back bore half a dozen holes to take $1\frac{1}{2}$-in. nails. Take the brace out again, and, quickly gluing the tenons and bottom edge of the brace, also the mortises, whip the brace into its place, drive the nails home, and punch the heads in. The back brace is made and fitted in exactly the same way, except that no curve or rise is given to the top edge.

At the risk of being thought too particular or fussy, here let me caution you to clean off all superfluous glue as you go along, or some may be left that will afterwards cause a deal of trouble by giving rise to an unpleasant jarring through cracking or warping off.

Back and front braces having been fixed, the next things to see about are the inside bridges. Without these the belly would not stand the pressure of the strings, but would "swamp," and most likely split. For the treble bridge, take a piece of the $\frac{3}{4}$ stuff $1\frac{1}{2}$ in. wide, and fit it between the front and back braces at a distance of $10\frac{1}{2}$ in. from the left bottom corner and 4 from the left top corner. It should be let into the inner sides of the braces about $\frac{1}{8}$ of an inch, and must be perfectly flush with the top edges of them. The bass bridge is fitted in exactly the same manner at a distance of 3 in. from, and parallel to, the right-hand block. These bridges must be considerably lightened by boring a series of holes through them with a $\frac{3}{4}$ centrebit. Draw a line down the centre of each side of the bridges, and mark off at intervals of $1\frac{1}{2}$ in.; then bore through till the bit pricks, reverse the bridge, and complete the operation, as in Fig. 5. Glue the bridges in and fix with two or three screws from the back.

The "shell" should now present the appearance shown in Fig. 6, in which A represents wrest-pin block; B, hitch-pin block; C, front brace; D, back brace; E, treble bridge; F, bass bridge; G, lining blocks.

Everything is now ready for the fitting of the most important part, the belly or sound board. First take your piece of pine, and carefully clean it up till the edges will just fit into the grooves in the blocks, B (Fig. 2). Now carefully draw a line on your blocks $\frac{5}{8}$ in. from the inner edge. This will exactly correspond with the depth of the grooves, and, laying your board over the shell, mark off the width from back to front, and reduce the board to within $\frac{1}{2}$ in. of this width; lay it on again, and mark off carefully to correspond with the marks on the blocks, and saw off to these marks. Fit the belly in the grooves by sliding it up from the front. You will find that the arched top of the front brace will make this rather difficult, but a little patience, gentle tapping, and easing where necessary, will soon ensure a good fit. It is not required to fit too tight, but only tight enough to prevent rattling; and, having effected this, remove the board again, and at a distance of 7 in. from the bottom edge and $4\frac{1}{2}$ in. from the left side make a dot for the centre of the treble sound hole, and $6\frac{1}{2}$ in. to the right of this make another for the bass. These sound holes are to be of $2\frac{1}{2}$ in. diameter, and may be cut with a pair of cutting compasses, a cutting-out bit, or a very fine-toothed pad saw. If a saw is used, great care must be taken to avoid splintering the edges. The belly must now be thoroughly sandpapered on both sides, and will then be ready for fixing. Glue the top edges of the front and back braces, and along the grooves and also the edges of the belly, and as quickly as possible slip it into its place and fasten it down with $\frac{3}{4}$ brads to the braces. Clean off the front and back edges level with the braces, and clean off also any inequalities of surface that may show. The front and back facings may now be put on. These consist simply of pieces of $\frac{3}{4}$-inch stuff fitted accurately over the front and back edges of the instrument, and when screwed and glued on forming an additional support. The top edges should be raised above the level of the belly $\frac{1}{2}$ in. and the ends must be cleaned off level with the blocks.

Fig. 7 shows front of instrument with facing on, under which dotted lines show outlines of belly, brace, and inside bridges. The description of the construction given above will be easily understood with the aid of the figures. I will show how to complete the dulcimer in another paper.

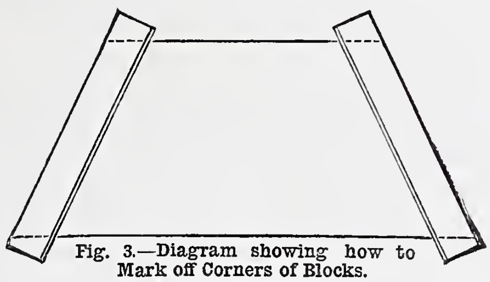


Fig. 3.—Diagram showing how to Mark off Corners of Blocks.

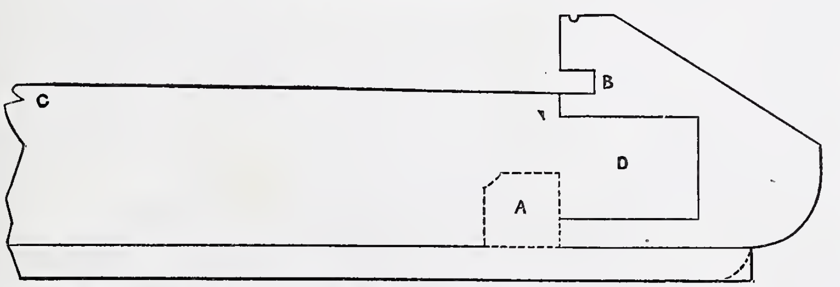


Fig. 4.—Diagram showing how to fit Blocks into Angles of Back and Blocks.

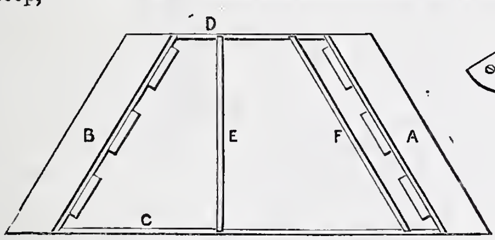


Fig. 6.—Shell of Dulcimer complete.

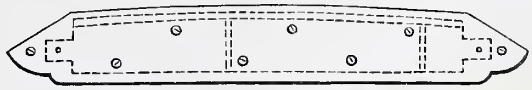


Fig. 7.—Front of Dulcimer with Facing on.

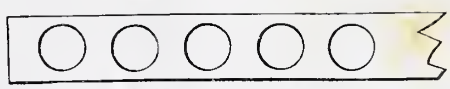


Fig. 5.—Side View of Inner Bridges.

BRASSING: ITS PRINCIPLES AND PRACTICE.

BY GEORGE EDWINSON BONNEY.

Brassing.—The art of electro-depositing brass upon iron, steel, copper, and zinc, is not only a most interesting subject to the student of electro-metallurgy, but is also of great commercial importance, since the value of articles made with any of those metals is considerably enhanced when coated with brass. This art has only been put to practical use in this country during the last twenty years, although it has been successfully practised in Germany and France for a much longer period. Much of the tinselled imitation gold wires, spangles, and threads used in England are only made of copper wires electro-brassed, and these are imported in large quantities from France and Germany. Brass was deposited by M. de Ruolz, in 1841, from solutions of the double cyanides of zinc and copper. In 1847 M. Charles de Salzede patented a process for brassing and bronzing steel, iron, zinc, lead, and tin. Although Messrs. Russell and Woolrich patented a process for brassing in 1849, Mr. Joseph Steel another in 1850, and Messrs. Morris and Johnson a good brassing solution in 1852, Mr. Napier writes of it in 1875 as being "a process very difficult, although we understand it is done very extensively by means not made public." All who have had to do electro-brassing agree in saying that the process is difficult. The difficulties usually experienced are a tendency on the part of the solution to deposit its copper or its zinc in excess when a very slight change is made in the depositing arrangements, and a tendency to become poor in metal after being worked for a short time.

The cause of these difficulties appears to be in—(1) The unequal resistance to the decomposing effect of the current offered by the copper and zinc salts held in solution. The copper salts are more easily decomposed than the zinc salts; hence, when a current of low E. M. F. is employed, the copper is deposited in excess. Zinc salts require a higher E. M. F. to effect their decomposition than those of copper. (2). The unequal solubility of copper and zinc as anodes in the depositing solution. It matters little whether the anodes are composed of brass or of plates of pure copper and pure zinc: the effect is the same in maintaining the solution at its proper metal strength. The oxide of copper formed at the anode is more readily dissolved in the menstruum of the solution than is the oxide of zinc, hence the solution soon becomes rich in copper, and correspondingly poor in zinc salts.

The remedy for the first difficulty is to employ a battery or other generator of electricity giving a current of sufficiently high E. M. F. to decompose both copper and zinc salts as required. Now, copper can be deposited from its solutions by a current having an E. M. F. of from half to one volt, but zinc salts require current at a pressure of at least one and three-quarters volts to decompose them. These pressures may be represented in the first case by the Smee and Daniell cells, whilst we must have recourse to the Bunsen cell to provide the latter. Hence the Bunsen has been proved to be the best for electro-brassing purposes, because its current has a sufficiently high E. M. F. to decompose both copper and zinc salts in a brassing solution. The relative proportions of the two metals deposited are also regulated by the volume of current or quantity of current passed through the solution in a given time. It has been proved in practice that when a brassing solution is depositing the alloy in proper condition, an alteration in the anode surface exposed to the action of the current will affect the character of the deposit—an augmented surface causing an excess of zinc, whilst a diminished surface causes an excess of copper. Copper is also deposited in excess when motion is given to the articles receiving the deposit, and this is increased with increase of speed. Zinc is deposited from its solutions at the rate of 18·5 grains of metal for each ampère of current passing through the solution in an hour. Copper is deposited at the rate of 18·1 grains per ampère per hour. Therefore an increase in the volume of current would tend to deposit zinc in excess of copper, and this would be brought about by lowering the anode in the solution, and so reducing the resistance of the circuit.

The second difficulty may be met by employing a solvent in the solution which will readily dissolve the oxide of zinc as it is formed on the anode, and form a double salt of zinc easily decomposed by the current at the cathode. In practice it has been found that liquid ammonia best fulfils the required conditions, since it readily dissolves the oxide of zinc, and then yields its metal up to the free cyanide of potasssium present in the solution, forming therewith the double cyanide of zinc and potassium. When, therefore, the workman perceives his anodes coated with a whitish deposit, or when a whitish powder is seen to fall from the anode to the bottom of the vat, he may be sure that the powder is oxide of zinc, and to dissolve this he must add liquid ammonia to the solution until the anodes again work clear.

When, by practice, the right conditions have been found to deposit the desired colour of brass, such as the E. M. F. needed to overcome resistances and force the proper quantity of current through the solution, the most suitable area of anode surface to the work in hand, and the best strength of the solution, these conditions should be carefully maintained, even to the employment of the same gauge of wire for the slinging wires.

Mr. John T. Sprague, in his book on "Electricity: its Theories, Sources, and Application," gives the following "Principles" as a guide to the deposition of brass and other alloys:—

"1. The object to be attained is the deposit of definite proportionate weights of two or more metals; but as the current knows nothing about weights, but measures its work by equivalents, the proportions by weight desired must be reduced to equivalent proportions, by dividing the weight by the electrical equivalent (of the metal). Thus a brass is required containing 64 copper to 36 zinc; $64 \div 31{\cdot}75 = 2{\cdot}02$ and $36 \div 32{\cdot}6 = 1{\cdot}08$ gives the proportion in which the current must divide itself between the salts of copper and zinc.

"2. The solution need not contain the two metals in either of the two proportions, weights, or equivalent; the relative degree can have no fixed law, as it must depend on several conditions, and mainly upon a combined consideration of the facility with which the two salts decompose, and the equivalent proportion required to be decomposed.

"3. Incompatible salts cannot be joined in one solution (that is to say, salts which exchange their constituents or throw down a portion as insoluble), unless another ingredient is to be added which will re-dissolve the precipitate; this latter is often the case when ammonia or cyanide of potassium is to be added, more especially ammonia. In such cases, however, it must be ascertained that these new conditions do not alter the relative conductivity or decomposability of the various metals in solution.

"4. It is of the utmost importance that the metals of which the alloy consists should not have any strong electric relations to each other in the solution to be used. It must be remembered that what is called the electric order of metals is a pure delusion, unless taken in a particular solution, for a metal may be positive to another metal in one solution, and negative to it in another, as this depends upon the affinities of the metals to the other radicals.

"5. It is *desirable* that the several salts should have nearly the same electric resistance, or that these resistances (which partly depend upon the quantity of each salt dissolved) should be proportioned to the relative currents required; but this is not essential.

"6. It is *essential* that the battery power be balanced against the decomposability of the several salts. This is distinct from their resistance. Each chemical combination needs a fixed force to decompose it, and this is effected by maintaining a sufficient electric tension at the plates to effect it. This may be called the *specific molecular resistance*, set up at the cathode only, while the electric resistance lies in the space between the plates. If there is a great difference between the specific molecular resistance of the different salts, the current will tend to reduce the lowest only, and that, perhaps, in a powdery state; in such cases, the only remedy is to have only a sufficiency of the weaker salt present to supply the required deposit, thus forcing the current to act sufficiently upon the more resisting salt."

Mr. Sprague presents in tabular form a list of eight brassing solutions, from which it will be seen that they all contain cyanide of potassium, with one exception. The decomposable salts in solution are, therefore, simply the double cyanides of copper, zinc, and potassium. In the following table the quantities are proportional to each other, and therefore may be taken as grains, ounces, or pounds.

TABLE OF BRASSING SOLUTIONS.

	1	2	3	4	5	6	7	8
Water .. .	5,000	5,000	1.280	50	400	160	10	2,000
Copper—								
Chloride..	25	15	—	—	2	—	—	10
Acetate ..	—	—	5	10	—	—	—	—
Cyanide..	—	—	—	—	—	2	—	—
Zinc—								
Sulphate	48	35	10	—	4	—	—	20
Acetate ..	—	—	—	1	—	—	—	—
Cyanide..	—	—	—	—	—	1	—	—
Potassium—								
Cyanide..	12	50	8	q. s.	—	16	1	24
Carbonate	610	500	72	—	50	—	—	160
Acetate ..	—	—	—	10	—	—	—	—
Ammonia—								
Liquid ..	—	—	—	40	—	—	—	q. s.
Carbonate	—	—	—	—	—	16	1	—
Nitrate ..	305	—	—	—	25	—	—	—

The solutions mentioned in the foregoing table are made up in the following manner:—

1. This is M. de Salzede's solution: Dissolve the cyanide of potassium in 120 parts of the water. Heat the remainder of the water to a temperature of 150° Fah., and add to it, whilst stirring well, the salts of potash, zinc, copper, and ammonia, each separately until all has been dissolved. Mix the cyanide solution with this, and allow the solution to stand exposed to the air for a few days, then work with a battery of two Bunsen cells giving a full current, and use an anode of brass.

2. This is also a solution introduced by M. de Salzede, and is made up and worked in a similar manner to No. 1.

3. Divide the water into two parts. Take one of these parts and divide into four parts, using each to dissolve the several salts in the following manner. First dissolve the copper salt, and add to it half of the ammonia. Secondly, dissolve the zinc salt in the water when heated to about 180° Fah., and add to it the rest of the ammonia. Thirdly, dissolve the potash in its part of water. Fourthly, heat the remaining part

of water to about 200° Fah., and dissolve therein the cyanide of potassium. Then mix solutions 1 and 2; add solution 3, then 4, stirring all the time; and finally add the remainder of the water. Work with a full battery power, using a brass anode, and add cyanide or ammonia when required.

4. This is the solution of Messrs. Russell and Woolrich. Dissolve the copper and zinc salts and the potassium acetate in part of the water; then add potassium cyanide until all the precipitate is dissolved. The potassium cyanide should be in excess, to form free cyanide. Work with a brass anode and a full battery.

5. Dissolve the salts separately, then mix together.

6. This is Messrs. Morris and Johnson's solution. Dissolve the salts separately and mix together, adding the cyanide of potassium last.

7. Dissolve the salts in the water and heat the solution to a temperature of 150° Fah. Suspend a large plate of brass in the solution, and connect to the positive pole of a strong Bunsen battery (three or four quart cells in series); suspend a small rod of copper in the solution and connect to the negative pole of the battery, and pass a current until the solution deposits brass freely on the copper rod. The temperature must be maintained throughout, and the solution worked hot. Add cyanide or ammonia carbonate as required.

8. This is Brunell's solution. Dissolve the salts separately. Add part of the potash solution to the copper and the zinc solutions until a precipitate has been formed, then add enough ammonia liquid to dissolve the precipitate; finally add the cyanide solution. Work with a large brass anode and two or more Bunsen cells, adding ammonia or cyanide as required.

Preference is given by Mr. A. Watt to solutions No. 3, 7, and 8, because these contain ammonia, and this dissolves the zinc oxide from off the anode. Whenever a white deposit is seen on the anode, add a little free ammonia liquid. Cyanide is added when the deposit appears to be deficient in copper, and zinc is in excess. When the solution appears to be deficient in metal strength—that is, holds less than a proper working quantity of both metals—it must be strengthened by adding to it a strong solution of the double cyanides of potassium, zinc, and copper. This deficiency is indicated when the alloy is deposited slowly, and has either an earthy or a greenish hue. When the deposited brass has a dull, dead, or matt appearance, the deposit may be improved by adding to the solution a small quantity of arsenious acid dissolved in a solution of cyanide of potassium. The effect of this addition to a brassing solution is similar to that of bisulphide of carbon on a silvering solution, as it gives to the deposit a bright and lustrous appearance. It should only be added in small quantities at a time when required. The arsenious solution is prepared in the following manner:—Dissolve $1\frac{1}{4}$ ounces of potassium cyanide in half a pint of distilled water made hot on a sand bath, then add, whilst the solution is still hot, 4 drams of white arsenic (arsenious acid), and stir until all the arsenic has dissolved. When cool, place the solution in a glass-stoppered bottle, and label it *Arsenious Solution,* VERY POISONOUS. This poison is even more virulent than cyanide of potassium alone.

Mr. A. Watt (who has had considerable experience in electro-brassing work) prefers a brassing solution made direct from brass. To do this he first dissolves good sheet brass in a mixture of 4 parts nitric acid to 2 parts water, by the aid of heat, until the acid solution ceases to dissolve any more brass. This solution is then diluted with four times its bulk of water, and to this add strong liquid ammonia until the green precipitate first formed is all dissolved, and the liquid assumes a beautiful clear blue tint. To this add a strong solution of cyanide of potassium until the blue colour disappears, and is followed first by a pinkish and then a yellow tint. After this add a little more to form free cyanide, and set the solution aside for twenty-four hours before using. It should contain one ounce of brass to the gallon, and is worked as directed in the preceding paragraph of this article.

Preparation of Metals to be Electro-Brassed.—The various metals intended to receive a coating of brass must each receive special treatment, since all do not receive the brass coating with equal facility. *Cast iron* should be pickled for half an hour in a mixture of sulphuric acid and water, in the proportion of 1 pint of acid to 1 gallon of water. It must then be rinsed in clean water and scoured well with a hard brush, coarse sand, and water, until quite free from black oxide and dirt. When quite clean it should be rinsed in clear water, then in a cold potash dip, again rinsed, and transferred at once to a very rich brassing solution, worked with current of extra high E. M. F. and volume. *Wrought iron* is prepared in a similar manner, but may be brassed in a weaker solution, and with a current of less strength. *Zinc* should be cleaned in a pickle only one-eighth the strength of the above, with two ounces of hydrochloric acid added to the gallon of pickle. It is then scoured in the same manner as cast iron, and immersed in a brassing bath suitable for brassing wrought iron. *Pewter* should be pickled for half an hour in a solution of nitric acid and water, in the proportion of half a pint of commercial acid to one gallon of water. It should then be scoured with a soft brush in fine sand and water, rinsed, and placed in a bath suitable to zinc or wrought iron. *Lead* should be treated in a manner similar to that for pewter, but must be brassed under conditions suitable to cast iron. Only one kind of metal should be placed at one time in the brassing bath, and the slinging wires should be of stout copper wire, so as to offer as little resistance as possible.

Finishing Electro-Brassed Work.—When the articles have received a sufficient coating of brass, they should be removed from the vat and rinsed at once in hot water. This will facilitate the drying, which should be further accelerated by placing the goods in hot boxwood or mahogany sawdust. They should then be brushed with a soft long-haired brush to remove the sawdust, and rubbed with a bunch of clean soft rag or a piece of chamois leather. The goods may now be lacquered or bronzed, or otherwise ornamented, as taste may dictate.

When electro-brassed goods are intended to be lacquered on a golden yellow coating, Mr. Watt recommends that they be finished in a special brassing bath, made up similar to No. 3 in the foregoing table, using copper sulphate instead of the acetate. A few minutes' immersion in this bath will suffice to give a finished yellow coating.

He also says that an indifferent coating on iron or steel articles may be improved by dipping them for a moment in one of the dipping acids for brass, and plunging them at once in cold water. When such metals have received an extra strong coating, they may be thus treated with advantage, the resulting colour of the deposit being equal to that of solid brass.

Much interesting matter respecting the electro-deposition of brass, together with full details of several brassing solutions, taken from French and American sources, and others not mentioned in this article, may be found in Mr. A. Watt's book on "Electro-deposition," pp. 366–394.

THE BUREAU IN GOTHIC STYLE.

BY D. ADAMSON.

HAVING given in previous papers the groundwork or construction of a plain bureau, let us now see how it may be enriched by ornamentation—how, in other words, it may be finished in any characteristic style that may be desired.

It is, of course, out of the question that every style or variety of style can be considered here, for to do so fully in even one of them would require far more space than can be devoted to the subject in its entirety. At the same time suggestions which will, no doubt, prove of service to the novice in directing him how to finish his bureau in a few of the more popular styles may be attempted. The salient features of these will be given, omitting little points which, however interesting to the antiquarian or student of old wood work, would only tend to embarrass the beginner, and perhaps unduly discourage him. For example, much might be said on the minute details by which the Early Tudor is distinguishable from the later Tudor or Elizabethan, and this again from the Jacobean. All are similar, and yet each has peculiarities of its own, not strongly marked in all cases, for it must not be forgotten that in the progress of any art there is no such thing as an abrupt transition from one characteristic style to another. No; the changes are gradual, so gradual that one scarcely observes them passing, and only recognises that there has been a modification by comparing the productions of different eras. Then indeed, the distinctions are apparent, but who can say when first the slight differences which by degrees eventuated in a distinct style were introduced? Even during the last twenty years, while fashions in wood work have been changing with unexampled rapidity, it has been impossible to note the subtle alterations by which one style has superseded another, though the most casual observer cannot have failed to notice that the furniture of to-day is very different from that of only ten years ago. Then the so-called Early English furniture was all the rage, now our leading designers are giving themselves more scope, and the stiff, severe "Early English" has been replaced by what it is hardly too much to say will result, if it has not already done so, in a style as characteristic of the present age as the Queen Anne—which, by the way, is somewhat vague—or the Elizabethan one of former reigns. It will thus be seen that styles, whether in architecture or in furniture—and the two are very much akin—glide into each other as it were. There is no abrupt transition.

Now, although only a few varieties of ornamentation can be dealt with here, the student must not imagine that a bureau, or other article of furniture, cannot be made or finished in any style desired, and as it is possible he may wish to try his hand at designing, the reference made above to architecture will supply the clue. Naturally enough the furniture of any period or country is in harmony with the style of the buildings within which it was placed, so that the designer in adapting old styles to modern articles can find a store of detail by studying the architecture of the corresponding period. This, it will be observed, is a very different matter from copying or reproducing as some might like to do. No doubt if this could be managed difficulties apply it to the modern contrivance, whether furniture or other articles, and lo, we have this in Gothic style, not a copy of a piece of Gothic work, but a piece of work in Gothic style. Herein consists the principle of making anything in any style. Now, let us see how we are to apply this principle in constructing a "Gothic" bureau, bearing in mind that no great elaboration can be attempted, but that the design must be such that an amateur of ordinary skill could execute it. This restriction, of course, confines us within very narrow limits, but not commend it as a suitable style for modern furniture. It may be said that the reason of its failure to do so is an evidence of want of taste; but it may almost, with greater show of reason, be urged that its rejection is a proof of instinctive artistic perception of its unfitness. It is essentially a style for stonework, and in adapting it to modern furniture much of its beauty is lost. Perhaps association of ideas may have something to do with the dislike to pure Gothic domestic fittings, but whether or not this is the case the style has never really taken

Fig. 1.—Gothic Form of Bureau.

would be diminished to some extent, at least so far as designing is concerned; but when furniture is in question it is altogether impracticable. Why? For the simple reason that furniture, as we understand it, is a modern invention. Even that of comparatively recent times is quite out of character with our ideas of taste and comfort, so that the mere copying of old examples would be useless, even if, indeed, there were any to copy. Take, for instance, the bureau. We may want to make one in Gothic style, but we shall look in vain for an example contemporary with it. That, however, does not prevent us making the bureau with Gothic characteristics, for these can be adapted to it. We seize a few, or it may be only one, of the leading features of Gothic ornament, as some compensation for this it must not be forgotten that simple ornamentation properly done is likely to be far more effective than more ambitious work badly executed. A simple rendering of any style can be given, for it is not necessary to crowd in every variety of detail which may be attributed to it, and this remark is, perhaps, peculiarly applicable to the Gothic, which, having been developed principally in work of an ecclesiastical character, is not so well fitted for reproduction in domestic furniture. Certainly Welby Pugin, and one or two other designers, have done their best to popularise it, and have given us sufficient evidence that it is adaptable to work of the highest excellence; but the fact remains that there is something about it which does any substantial position in our homes, and when it is seen in furniture it is generally in a very modified form. In Fig. 1 we see how we may give a slight Gothic character to the bureau without in any way departing from the structural details described, except that the cock-beading round the drawers is omitted. It will be noticed that the edges of the rails between the drawers, etc., are what is known as stop chamfered, an effective, and at the same time a simple, means of giving a semi-Gothic feeling to an otherwise plain piece of furniture. As will be seen by Fig. 2, which shows the chamfering on an enlarged scale, the edges are bevelled till within a short distance of the ends. The front edges of the ends are treated in a similar manner, a stop being made near ıe rails, except on the outer edges, where ıe chamfering runs through almost from ıe top to the bottom. To chamfer evenly nd neatly a special tool should be used, as n ordinary bull-nose plane, though effective ı practised hands, is likely to produce un- ıtisfactory results. The little contrivance epresented by Fig. 5 is so simple both in onstruction and manipulation that the mateur need not waste money on the more laborate planes specially prepared for cham- ering. It compares favourably with any of hem, except, perhaps, that it is not quite so uick in action. This is how it is made. 'wo pieces of wood, say, ½ in. thick, 2 in. or in. wide, and of any convenient length, ave a triangular piece cut out—the angle or ordinary, *i.e.*, square-edged, work eing 90°. Between these two pieces chisel is placed, with its cutting edge lling up the angle as shown by the haded portion of the diagram. The wo pieces of wood are then screwed ogether, and bind the blade tightly. f necessary a little space for this to e in, and prevent any tendency to ıteral play, may be cut. The depth to hich the chisel projects below the apex f the triangular space must be regu- ıted by the width of the intended evel. To use this handy little appli- nce it is only necessary to draw it ackwards and forwards along the edge f the board to be bevelled till it will emove no more stuff, when the bevel- ing is complete. It will hardly be ecessary to say that one of the sides f the triangular space of the stock must e kept continuously against the wood eing chamfered, and that if this ordi- ıary precaution is observed the cham- ers must be regular.

To elucidate the action more clearly o those who may not have grasped the dea in Fig. 5, the tool is shown against he section of the board, A, the edge of vhich has been bevelled to the full xtent of which the cutter is capable. The dotted lines may be said to repre- ent the portion of the chisel between he two pieces of wood which form the tock. The ends of the chamfer or the top must be finished off with a chisel, or neither the little arrangement de- scribed nor any other chamfering tool vill do this.

I do not know whether it will be ad- visable to remind beginners that this portion of the work, the chamfering, may be more conveniently managed before the parts are fixed together, though it may not be absolutely necessary. In Fig. 1 it will be noticed that the drawer fronts have bevelled edges, but if preferred they may be left plain. In this case they should be set back a little so as to clear the chamfers, for the effect would be anything but pleasing were they to be flush with the faces of the rails and ends. In Fig. 2 the relative correct position of the drawer front is indicated in section by B, the projection of the chamfered rail being unmistakable. In the same illustration C represents the section of the bevelled edge of a drawer front. It will be seen that the bevel is sunk slightly below the face of the front, as the trifling break gives a much better effect than if the bevel started direct from the flat. Besides which, it renders clean, true work more easy of accomplishment, especially if the bevel is a fairly wide one, when it would otherwise be a most difficult matter to get a sharp, clearly-defined line. To form the sunk bevel a rabbet plane will be indispensable, for unless the bevel can be cut regularly it should not be attempted, and it is almost impossible to do so by other means without a considerable amount of labour — more than the result is worth. In forming the bevel first mark it all round the front with a cutting gauge, then take a little off on the outside of the line with a chisel, taking care not to let this cut on to the flat front of the drawer. A guide is thus formed for the rabbet plane to work against as it cuts down the bevel, which on the end grain will probably have to be finished off with glass paper. This should be held round a flat, straight-edged piece of wood instead of on the ordinary cork rubber, in order to avoid rounding the edge of the break between the bevel and the flat surface. It is almost needless to say that the upper edge of the plinth should be simply bevelled off instead of being moulded as in the original bureau, and that the edges of the lid should be finished in a similar manner rather than be rounded off.

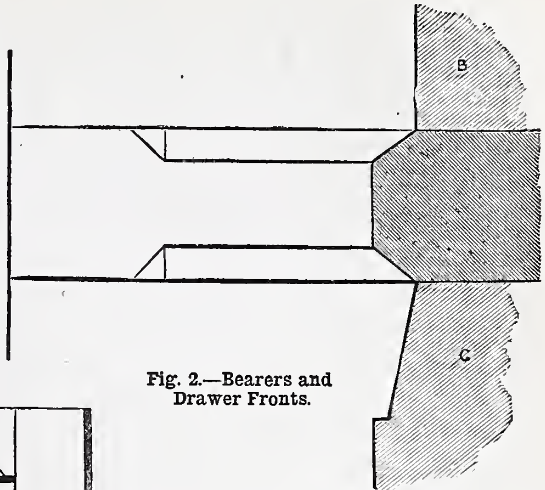


Fig. 2.—Bearers and Drawer Fronts.

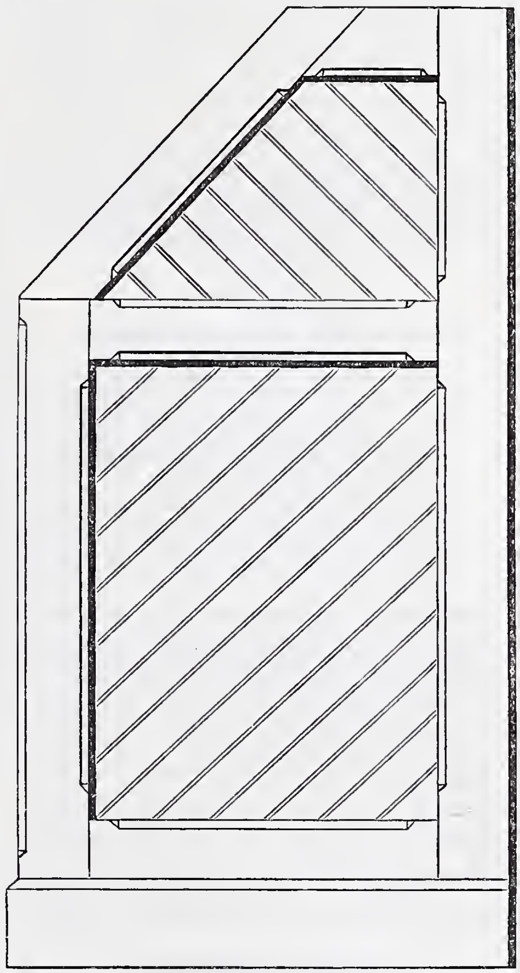


Fig. 3.—Panelled End of Gothic Bureau.

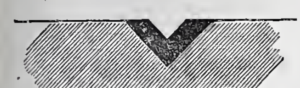


Fig. 4. — Section of V Groove.

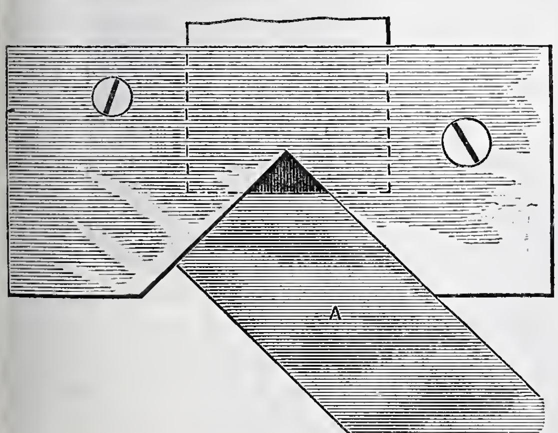


Fig. 5.—Chamfering Tool.

If further adornment to the bureau be desired, we see how it may be managed by referring to Fig. 1, where the lid or fall is represented with the panel sunk slightly below the framing, the edges of which are seen to be stop chamfered. Further, the panel itself may be channelled or grooved as shown by the diagonal lines, in which case it will be as well to let the grain of the wood run parallel with them, instead of from end to end of the lid. The section of the channels or V grooves, as they are commonly called, from their resemblance to that letter, is shown by Fig. 4. They may be easily formed by the use of a plane, the sole and iron of which are shaped to correspond, but as a grooving plane of this kind is hardly likely to form part of the amateur's outfit, the alternative of cutting the groove with a chisel will probably have to be resorted to. If, however, the plane is accessible to any who may not know how to work it when they have got it, it may be said that a guide in the form of a straight piece of wood will have to be temporarily fixed to the board to be channelled. There will then be no difficulty in ploughing the grooves straight and even. To cut the grooves with a chisel is certainly a more serious matter, but with care there is no reason why the work should not be as successfully accomplished. If it is considered to facilitate operations the channelling—which, by the way, should not be too wide, say not over ¼ in.—a small gouge may be used at first, the channel afterwards being brought to its proper shape with the chisel, or with a scratch or router, of which a full description was recently given in these pages. Those who possess a carver's V tool of rather large size may be reminded that they have a ready means of doing the required shaping; but even with its aid the grooves will very likely present an uneven appearance, unless some skill in handling it has been acquired. Provided the lines are straight, though, there is not much difficulty in reducing them to the regularity without which they will be but unsightly blemishes. The useful glass paper must be resorted to. Fit this over the edge of a piece of wood, which has been bevelled to correspond with the groove, and rub till a sufficiently clean channel has been got. By a moderate exercise of patience and even papering, a result which will compare favourably with the more speedy method may be obtained. Of course in rubbing down the groove with glass paper, the piece of wood on which this is wrapped must be held firmly, for if allowed to play from side to side, first sloping one way and then the other, it cannot be expected that a clean, sharp-edged V groove can be got. A little practice on a waste board is advisable before attempting to channel a valuable piece, for however simple the operation may be, a few experiments will show the necessity for care not only in getting the lines equal, *i.e.*, of the same depth and width, but equidistant from and parallel with each other.

For those who want a still more elaborated bureau a suggestion is given by Fig. 3. There, instead of the end being plain it is seen to be panelled, the edges of the framing being stop chamfered, and the panels themselves being V grooved to match the front of the work. The framing may be about 3 in. wide, and should hardly be of less than $1\frac{1}{4}$ in. stuff, which those who are familiar with wood working will know will be little, if at all, over 1 in. thick when finished up. If the framing is made from $1\frac{1}{2}$ in. stuff it will be all the better. The panels should not be of less than $\frac{1}{2}$ in. stuff, which will do very well, as they are not large, and instead of being channelled as shown, they may be bevelled to match the drawer fronts. The framing is fitted together by mortise and tenon joints, which those who have a craze for old-fashioned forms of working will probably think should be fastened by wooden pins running through instead of by the more modern, less barbarous, and equally efficient glue. The panels may be let into rebates run on the inner side of the framing, or be let into ploughed grooves. In the former case they should be fastened in with beads, in the latter the grooves hold them. No glue will be required; in fact, it should not be used to fasten in the panels, for the reasons given when the necessity for allowing for the natural contraction and expansion of wood was referred to. Fasten the panels into the grooves or in the rabbets with glue, and they are almost certain to split, but allow them play, and even moderately seasoned wood may be used without fear of splitting. Naturally, if there is an idea that the wood, from being green or unseasoned, will shrink to any great extent, the grooves or rabbets, as the case may be, must be deep enough to prevent the panels drawing right out of them.

Nothing more need be said about the construction of a "Gothic" bureau, but, no doubt, it will occur to those who intend to make one that pitch pine is the kind of wood which seems the most appropriate for this style. Not that there is any valid reason why it should not be made in any other wood, only somehow or other this plain Gothic wood work is generally associated in one's mind with pitch pine—or perhaps I should say in mine, for I don't know how the idea may strike others—much in the same way that Chippendale's work suggests choice old Spanish mahogany—only the association of ideas, nothing more. Well, if pitch pine is to be the material, see that it is dry and well seasoned, thoroughly so, for, unless it is, it is sure to split, and afford, in a marked degree, an evidence of the way wet stuff "goes." If the novice wants to know what this "going" means, he is informed that the vagaries of wet, *i.e.*, green, or, to use a less technical word, unseasoned wood, are so numerous that space forbids a detailed list of them. It may, however, be said that they are all annoying, and that "going" is only a colloquial abbreviation of "going wrong." Pitch pine is peculiarly afflicted with this tendency, though if care is exercised in the selection of sound dry stuff, it may be used with as little hesitation as any other wood. It only remains to be said that the brass handles and keyhole escutcheon plates, if any are used, should be in keeping with the Gothic character of the work, for unless they are they will, instead of improving it, rather be a detraction.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

108.—Patent Unbreakable Steel Pulp Ware.

The peculiar ware which I have the pleasure of bringing under the notice of the readers of Work in this number will, I think, be welcomed by all who desire to practise economy at home. It is known as the Patent Unbreakable Steel Pulp Ware, and as far as the word "unbreakable" goes, it certainly merits the name. It is sold wholesale by Messrs. W. B. Fordham & Sons, Limited, 36 to 40, York Road, King's Cross, London, N., who are the sole selling agents for the United Kingdom. It is designed, in a great measure, to take the place of earthenware, and certainly possesses considerable advantages over this material, for it is much lighter in weight,

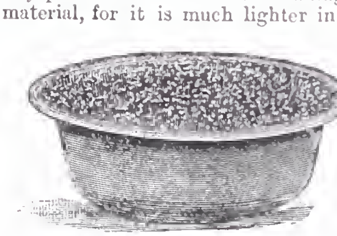


Fig. 1.—Shallow Basin.

and is not brittle or liable to chip. Indeed, it may be dropped from the hand, thrown about, or even dashed to the ground with considerable force without danger of breaking or fear of harm, and it will stand boiling water. At first sight, and on first handling it, it might be supposed to be a peculiar kind of papier-mâché, but this material is neither as strong nor as durable as the steel pulp ware, and will not stand the action of boiling water. Judging from its appearance, the foundation for the material seems to be a fine wire netting pressed into shape on suitable moulds, and then covered with a material which fills all the interstices, the whole being subsequently enamelled or japanned; and I am led to this conclusion by my knowledge of the substance sold as opaque wire roofing, which consists of sheets of wire netting covered on each side by some gelatinous substance. But this is mere conjecture on my part, for I have not yet had an op-

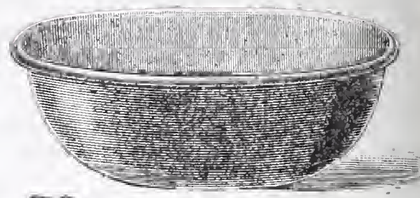


Fig. 2.—Oval Tub.

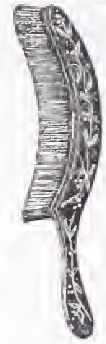


Fig. 3.—Crumb Brush. Fig. 4.—Crumb Tray.

portunity of breaking up a specimen to see whether or not I am right. The surface has the appearance of earthenware, and the patterns painted on it render it highly ornamental. All kinds of articles in general use in every household are made of it, bowls and basins of all kinds (Fig. 1), oval tubs for washing-up purposes (Fig. 2), crumb brushes and trays (Figs. 3 and 4), bread trays (Fig. 5), flower-vases or cache-pots (Fig. 6), waiters (round and oval), sponge dishes and show bowls, which may be supported on brackets sold for the purpose, finger plates, jugs, and all articles comprehended in toilet sets, and plaques, 6, 8, 10, and 12 in. in diameter, suitable for painting, and far easier to paint on than porcelain. Prices range low, and compare favourably with japanned goods and earthenware; thus the crumb brush and tray, shown in Figs. 3 and 4, are supplied at 36s. per dozen, or 3s. for

Fig. 5.—Round Bread Tray.

Fig. 6.—Flower Vase: latest shape.

the brush and tray, though I am not able to say whether this is the wholesale or retail price. Sellers of fancy goods would find these articles a valuable addition to their general stock, and likely to command a ready sale on account of the durability of the material as well as satisfactory appearance.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

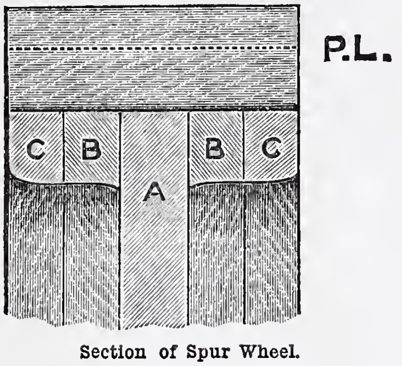
* Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

The Labour Laws.—"J" writes:—"From a recent report presented to the House of Lords on the laws affecting the hours of adult labour in various Continental and other countries, we gather a large amount of information on this deeply interesting question, and we are confirmed in our opinion that the average British workmen are better off all round than those in any Continental country. We subjoin a few notes jotted down in the course of perusal of this paper, thinking they will be read with interest by all those who, like ourselves, are personally interested in problems relating to the hours and conditions of labour. In Austria-Hungary the law limits the duration of work in mines to a shift of 12 hours, 10 only of which must be spent in actual labour. For factory hands the limit is 11 hours, exclusive of hours for rest and meals. Sunday rest is to be observed. These provisions may be subject to modifications in certain specified cases of emergency. In Hungary there is no general law affecting the hours of labour, and in some cases consequently they are excessive. A day's work of 10 to 12 hours is the normal, but in some industries and localities the working day extends from 12 to 15, and even 18 hours. Sunday rest is not prescribed, and the factories working on Sundays and holidays are 25 per cent. of the whole. There is no law in Belgium regulating or limiting the hours of adult labour, and great variations exist in consequence. In the mining districts the average day is 12 hours, but women are often employed 13 or 14 hours in loading trucks and similar heavy work. Cabinet makers at Ghent and Brussels often have to work 17 hours a day. Railway guards are often on duty for 15 or even 19½ hours at a stretch. Brussels tramway drivers work from 15 to 17 hours daily, Bremen from 10 to 17, and often half day Sundays. Brickmakers 16 hours in summer. In sugar refineries from 12 to 13 hours. Eleven hours is considered the average day's labour in the majority of trades in Belgium. There are a number of labour decrees in France, but as they mostly affect particular trades, no brief general statement can be given. But the report states that, as a rule, it may be said that Frenchmen in factories are present at least 14 hours out of every 24 in the shops. And it must be borne in mind that there is no compulsory observance of Sunday, and no day of habitual rest. Neither in Germany, Spain, Sweden, Turkey, nor in Denmark or Russia, are there any laws limiting the hours of labour. In Russia it is stated that they vary from 6 to 20 hours, but in the majority of cases, estimated at 80 per cent., the hours of labour are 12 and under. Manufactories with 12 hours daily labour number 36·8 per cent., those with 11 hours 20·8 per cent., those with 10 hours 18·1 per cent., with 8 hours 1·6 per cent., with 7 hours 0·4 per cent., and with 6 hours 0·2 per cent. Night work is pursued in 247 establishments. But the majority open at 5 a.m. and close not later than 9 p.m. In Saxony there are no laws affecting hours of adult labour, but the normal working day consists of 11 hours, exclusive of meals. In Switzerland the law limits the normal working day to 11 hours, reduced to 10 on Saturdays and holidays. There are numerous laws in the United States affecting the hours of labour, subject to various exceptions. We can only summarise a few of these. In New York mechanics work 8 hours; in most cities of the State nearly all mechanics and all connected with the building trade work 9 hours, except on Saturdays, when 8 hours is the rule. On the street and elevated railroads and in cities of over 500,000 inhabitants 10 hours is the normal day. In New Jersey hours range from 53 to 60 hours per week; in Rhode Island 10 hours daily; in Maryland an average of 10 hours; and the same in Virginia, North Carolina, Tennessee, Arkansas, Louisiana, and Missisippi, where there are, however, no legislative enactments. In California 8 hours is the day limited by statute, which statute, however, is constantly evaded, so that some of the trades which are unorganised work 12 or 14 hours daily. These examples are selected from a large number given in the report, and they take no account of exceptional cases which are recognised by the statutes. They also apply only to adult labour, but there are a large number of statutes regulating women and child labour, which in some countries is very severe. On the whole, the organised trades of this country may congratulate themselves on holding the best position among the European workmen, and second to none in the matters of hours of labour, second only in remuneration to that of the workmen in comparatively new countries like the States and our Australian colonies."

II.—Questions Answered by Editor and Staff.

Patterns of Spur Wheels.—H. L.—In reply to your inquiry "how to make patterns of wheel and pinion, wheel to have 44 teeth, pinion 13, pitch $\frac{5}{8}$ in., width $1\frac{1}{2}$ in.," you will cut the pinion pattern from solid mahogany, but not the wheel. The latter should be built up in overlapping segments, and the teeth glued on. The sizes of your gears will be thus:—wheel, 44 teeth $\times \frac{5}{8}$ in. pitch $=27\cdot5$ in. circumference $=8\frac{3}{4}$ in. pitch diameter; pinion, 13 teeth $\times \frac{5}{8}$ in. pitch $=8\cdot1$ in. circumference $=2\frac{5}{8}$ in. pitch diameter; your teeth will measure $\frac{5}{16}$ in. in length below pitch line, and $\frac{7}{32}$ in. in length above pitch line. The diameter of the wheel rim therefore before the teeth are put on will be $8\frac{1}{4}$ in. The wheel section is shown in the figure. The plate, A, may be made of a single thickness of wood, properly with one or two open joints, or it may be built in two thicknesses of segments with joints radiating towards the centre and overlapping—that is, made to break joints with one another like bricks in a wall. Upon each side of this plate build two thicknesses of sweeped segments, B and C, also with breaking joints. Then turn the rim to the section given, giving no taper, or at least no more than just sufficient to let the square touch tight and slack on top and bottom faces. The teeth will be either worked to shape first and fastened on afterwards, or glued on as rough blocks and marked out and worked in place. In the first method the teeth may be worked successively in a wooden templet block of the same



Section of Spur Wheel.

section, and glued to the rim by their centre lines, the rim being pitched out carefully. In the second the blocks will be glued on rough, turned when dry, flush with the wheel faces, and to the diameter of the tooth points; struck out on both sides and worked through with gouge and chisel, using a rebate plane for those portions of the faces which can be so got at. Their linear accuracy will be tested with a thin straightedge narrow enough to go between the teeth. A little very careful glasspapering will follow by way of finish. The pinion is best worked from a solid bit of stuff, the grain running in the same direction as the teeth. The block when turned will be therefore simply a solid wheel blank of $3\frac{3}{16}$ in. diameter, upon which the tooth shapes will be marked to be then cut through with gouge and chisel. The correct shapes of the teeth are obtained by the application of cycloidal curves. That is the pitch line of the wheel or pinion, as the case may be, is the base upon which a generating circle or circles are rolled for the development of suitable cycloidal curves for tooth flanks and faces. The dimensions of the generating circle may be properly varied with the sizes of the wheels and the nature of the gear desired. But a general rule is that it shall not be of larger diameter than the radius of the smallest wheel of a set. And a fundamental rule is that in mutual gears the same circle which strikes the flank curve for a wheel must be used to strike the face curve for its pinion, and that used for striking the flank curve of the pinion must be used for striking the face curve of the wheel. It is not necessary that both circles be alike, but a different circle may, if desired, be used for the flank and the face of the wheel, or of the pinion. In practice, however, it is usual to make use of a single describing circle throughout. Then any number of wheels in a set so designed will work together correctly. The best application for patterns for good delivery is common shellac varnish, made by dissolving shellac in methylated spirit, and applied with a brush. Vermillion, red lead, or lamp black are often mixed with the clear varnish to impart greater body, and render the surfaces of the pattern harder and more durable.—J.

Gilding.—B. P. (*Haverfordwest*).—Our friend wishes to know "how to finish mat gilding so that it will look bright and stand dusting." The question at once conveys to any experienced worker in gilding how very little the querist understands of the subject. To fully answer B. P.—however much one may desire to help and enlighten the perseverant worker in these columns—would occupy all "Shop" of this issue. Nevertheless, I trust he will appreciate the brief explanation, and that which only space herein will permit, hoping that, in time, room may be found in Work for a complete and exhaustive treatment of both "water" and "oil" gilding. Our correspondent's question refers to the former process, which involves a distinct trade and calling. Mat and burnish are the two treatments applied to picture-frame gilding, the former meaning a "dead" or dull surface of gilding, and the latter, as the word implies, gilding finished with a very high gloss or burnish. To obtain these two results special knowledge and personal experience is necessary—in fact, the tuition common to an apprenticeship—and the various stages through which mat and burnish gilding have to be brought ere arriving at a successful job are of such a nature that letterpress cannot practically teach them. Mat size and burnish size can be purchased from any dealer in gilders' materials; they are then in the form of a thick paste, the former a pink colour, and the burnish a slaty grey colour. Before a frame can be gilded it has to be gone over a great number of times. When the gilder receives it in the plain wood and "compo," he first coats it with "thin white," viz., prepared gilder's clear size with a little gilder's whiting added; then all dents and crevices are stopped with a putty made from whiting and strong size. After this the frame has four or five successive coats of white, but with a greater proportion of whiting than the first coat, care being taken to keep the shape of the frame clear. It will be understood that each coat has to be thoroughly dry ere adding another. The white will then be about the $\frac{1}{16}$ of an inch in thickness, when it is rubbed down to a smooth surface with water and pumice and other hard stone, shaped to suit the form of the members composing the design of the frame. This process requires care and experience especially. When dry it is rubbed with very fine sandpaper, and now it is ready for the coating with size—viz., the mat and burnish which has been already prepared and diluted with parchment size. Four or five consecutive coats of size is necessary to get a good surface, and this, when obtained, is washed with soft linen rag and water to get the parts to be left mat quite smooth. When the desired surface is obtained and thoroughly dry, the mat parts are gilded by wetting a small portion with a large camel-hair pencil and laying the gold leaf upon it. The gilder then blows with sufficient force to cause the water to pass from under the gold leaf, when, by the strength of the coatings of size underneath, the gold is firmly held when dry. Piece by piece the leaf is laid until the mat parts are finished, when, after careful examination and repairing of faulty little places, it is sized and thus finished. Burnish size—the only, so to speak, mysterious part of the business—is a curious compound of curious things, such as, I believe, pipeclay, blacklead, size, suet, red chalk, etc., the preparation of which is still one of those reminders of the "good old times"—namely, a "trade secret." Briefly, its nature is such that, when spread upon rounded surfaces and after the gold leaf has been laid, as in mat gilding, upon it and has become quite dry, it does not become hard and brittle, but allows its component parts to be rubbed and worked up under the gold to a very smooth and brilliant surface. As the brilliancy of any gilding depends solely upon the smoothness of the surface the gold leaf is laid upon, the burnish of water gilding is thus explained. The tool, or burnisher, used is a polished piece of flint or agate, mounted in a suitable handle and formed in various sizes to meet the different shapes of the frames. Ormolu, as gilders term it—in further answer to B. P.—is a richly coloured preparation of spirits of wine used for adding, in small proportion, to the last coat of parchment size which is given to all gilding with gold leaf, and for the purpose of giving the size a rich and golden colour. I trust our correspondent will appreciate this effort to explain a most difficult subject, and one, as before said, which cannot be taught by book.—F. P.

Cabinet in Fret Cutting.—A. D.—If you will re-read the paragraph at the top of column three, first page of Work, I think you will see how it is done. But in case that account is not clear I will repeat it. First line the back of the wood with a piece of printed matter, preferably a picture. Then having mounted your tracing of the design as usual for fretwork, drill the needful holes for the insertion of the saw, with a fine drill, and always in the corner or at an acute angle, close to the saw cut that is to be. Hold the saw rigidly upright in working, save all the pieces cut out, and having stained either all the bits, or the fretwork, as you prefer (not both, of course), replace the pieces after gluing the saw cut edge of each. If a fine saw is used, the glue itself will suffice to fill the crevices of the saw cut. The picture at the back is simply a guide, like a dissected puzzle, to assist in replacing. I should work the whole on a piece of glass to ensure a level surface, and put all the pieces in the back.—J. G. W.

American Organ Building.—W. S. J. (*Wandsworth*).—I have already sent in the first of my papers on American organ making, and it will appear as soon as arrangements can be made for commencing the subject. "The American Reed Board Agency," No. 2, Oseney Crescent, Camden Rd., N.W., will supply you with fittings. Write for price list.—G. N.

American Organ and Harmonium Building.—Vibrator.—See answer to W. S. J. (*Wandsworth*).—G. N.

Bellows for American Organ.—Organ.—See answer to W. S. J. (*Wandsworth*). The construction of the bellows will be fully dealt with in the first and second papers on "American organ making."—G. N.

Harmonium.—A BEGINNER.—It is impossible within the limits of this answer to give sufficient instruction to enable you to make a harmonium with two sets of reeds. If the Editor sees fit, I may possibly give a series of articles on the subject at some future date. But why not make up your mind to construct an American organ? It would prove a most interesting task, and papers on the subject will appear shortly.—G. N.—[At some future time.—ED.]

Organ and Harmonium Building, Book on. —SPECTATOR.—I do not think there is any work on American organ and harmonium making and repairing published. I have never heard of any book on the subject.—G. N.

American Reed Organ.—SHANG (*Scotland*).—The peculiar characteristic of the American reed organ is its sweetness of tone, and it is undoubtedly this feature which has made it such a popular favourite in this country. It would be difficult to name the principal makers without giving the whole list, as they all claim to be the best in the market. The best English organs are quite as good as the best American, and will generally last longer. I can supply you with the name of a good maker if you write to me through the Editor.—G. N.

Preparing Vellum.—PERSEVERANCE will find all his queries answered, at as much length as the limits of "Shop" columns will permit, in a recent reply to PUZZLED under the above heading, which appeared in No. 25, page 397.—M. M.

Leather for Concertina Bellows.—CONCERTINA.—You will get all the materials for concertina bellows from Messrs. Wallis & Son, Euston Road, London, Messrs. Kohler & Sons, Edinburgh, or through any music-seller who cares to order them for you.—H. D.

Hardening Steel. — TANCRED. — Please read carefully the remarks about working steel in article on "Swords," and try to fancy that there is a sort of law-governing inorganic matter which workers must be guided by. For instance, if you hammer one part of your tool much while cherry red hot, and another part much while black hot, you produce unequal tension of fibre of the steel; if you leave it to be chilled on the shop floor, this again affects the fibres — molecular structure is the scientific term. To heat a chisel thus damaged in the grain, and to chill it for hardening, and heat it again for tempering in that state is to ensure a twist in a flat thing, or a crook in a round thing. Follow the direction about heating and drawing sword blades if you forge your chisels. If they are forged already you must take the chance, but use a muffle—an old bit of iron pipe makes one—pack chisel with charcoal dust; when red-hot, pass it into a brine bath that has an inch of linseed oil floating on the top of the water, but the simple water bath ought to serve in most cases, if the steel has been fairly well worked, to make the chisel.—J. C. K.

Wood Carving Tools.—A. W. P. (*Leytonstone*). —Six cutting tools would be sufficient for carving wood picture frames: 3 gauges, a primer, and 2 narrow flat chisels. Most good tool shops keep an illustrated price list of Addis's carving tools, and by inquiring at one you could see at once the kind of tools you are likely to want.—F. M.

Hydraulic Motor.—C. G. O. (*Truro*).—Room cannot be spared in this department of WORK to give you a useful detailed account of how to make a hydraulic motor. I should advise you to fully study the subject by the aid of the lessons on hydrostatics in "Cassell's Popular Educator," and by reading such works as Mahan's "Water Wheels or Hydraulic Motors"; Donaldson's "Water Wheels"; or Cullen's "Practical Treatise on the Turbine." Any of these books can be obtained from Mr. Calvert, 99, Great Jackson Street, Manchester, if you cannot obtain them through your local bookseller. You may also learn much concerning the various types of hydraulic motors now in use by studying the illustrated catalogues of Messrs. W. H. Bailey & Co., Hydraulic Engineers, Albion Works, Salford, Manchester. Their little water motors are the pink of perfection, but you must have the water delivered to them at the right pressure to work them properly.—G. E. B.

Magneto Electric Bell.—NORTH (*Newcastle-on-Tyne*).—The generator for a magneto electric bell is simply a small magneto-dynamo with its armature wound with very fine wire, and made to revolve at a high rate of speed in the field of a powerful magnet. You may get such a machine from Messrs. T. Gent & Co., Braunstone Gate, Leicester. Space cannot be spared in "Shop" for a detailed and an illustrated description enabling you to make one.—G. E. B.

Improvement of WORK.—H. P. (*Kilmarnock*). —I am obliged to you for your kind suggestions about a cover, but as all these things naturally occur to us here as well as to readers in all parts of the country, I can assure you that all these matters are carefully considered and adopted if found to be feasible.

Eiffel Tower.—OHIO.—Reliable sketches of this structure will be found in the *Illustrated London News* and *Graphic*, if you search files of these papers.

Boat Building.—OHIO.—I cannot say with any certainty when papers on this subject will appear. As yet nothing has reached me, although I have been promised articles on building steam launch, canoe, etc. It will give me the utmost pleasure to redeem my promises on this point, when contributors who have undertaken to write on the subject enable me to do so.

Coal Mining.—COLLIERY DEPUTY.—I am afraid it will not be possible to go into coal mining in WORK, at all events just at present, in such an exhaustive way as you seem to require, but whenever any paper is sent me on improvements on the system at present in use, and on the appliances used, it shall be carefully considered with a view to insertion.

Kaleidoscope.—A. H. C. (*Birmingham*).—You must kindly bear in mind that the writer of the paper on his newly invented kaleidoscope is a busy man, and has but a very limited time for writing. His second paper, illustrated with very elaborate engravings, and his third paper also, have appeared before this reply meets your eye, because at the present moment it is simply impossible, owing to the demand for replies in "Shop," to find room enough to satisfy querists immediately. I greatly regret delays, and can only say that means of relieving the congestion are under consideration.

Bees and Hives.—J. J. B. (*Darlington*), BEE KEEPER, and other correspondents.—The series of papers on apiarian appliances, which I have now in hand, will include instructions for making hives, extractor, etc.—APIS.

Frustum of Cone. — CUBICAL CONTENTS (*Willesborough*). — Calculate the contents of the whole cone, and deduct the top. The rule is, divide the difference of the cubes of the two diameters by the difference of the diameters simply, and multiply the quotient by the height and by 0·2618. The cube of 14·5 is 3048·625, that of 7·5 is 421·875, and the difference of these cubes is 2626·75, which divided by 7 (the difference of diameters) gives 375·25, which multiplied by 0·2618 and 10 (height) is equal to 982·4 cubic inches.—F. C.

Engraving on Metal. — COUNTRY WATCHMAKER.—Articles descriptive of engraving on metal copiously illustrated are in my hands and will shortly appear. You must kindly bear in mind that where so much has to be done comparatively within narrow limits, it is not possible to deal with everything at once. Nor is it possible to give immediate answers to queries, owing to the great pressure on the space allowed, which is the utmost that can be given at present, and the necessity that exists for going to press some time in advance of publication. An answer has been given to your previous query on this subject, but the appearance of the answer in WORK depends, as I have said, on the space at command.

Printing.—T. E. N. (*Islington*).—Your letter contains a proposal to write a series of practical articles on this subject. It requires an answer by letter. You give your address, it is true, but append initials instead of full signature. Please write again giving name.

Gardening.—F. J. L. (*Chumleigh*).—It will not be possible to give directions either weekly or monthly for operations in the garden in WORK. There are many papers specially devoted to the subject, and then again there is Cassell's "Popular Gardening," a complete and exhaustive work, touching on every branch of the subject, which you might purchase with advantage, and which, if such a course be desirable to you, you might acquire by degrees, as it is published in monthly parts as well as in a complete form. WORK is a Magazine mainly dealing with construction and decoration. Appliances used in gardening come within its scope, but not the routine work of the garden.

Icing and Piping Cakes.—H. G. (*Paddington*). —You ask if I "have any idea of giving a few lessons on the ornamentation of cakes, technically called in the baking trade 'icing and piping,'" and you remind me that I "promised to give all kinds of work attention." It is true that I did so promise, but although WORK is a Magazine that treats principally of construction and decoration, there never was any intention of going into the construction and decoration of cakes. Moreover, if I mistake not, there is a special trade paper in which such subjects, I should think, would be fully and properly treated.

Model Ship.—J. B. W. (*Wolverhampton*).—There is so much pressure on the space allotted to descriptive papers and articles, that it is not possible to go into Model Shipbuilding, at all events at present. The best book you can have on the subject is "Model Yacht and Boatbuilding," published by Gill, 170, Strand, London, price 5s.

Glass.—W. H. (*Rawtenstall*).—To bore holes in glass use an ordinary drill, lubricating with turpentine and camphor.

Polishing Hall Chairs.—M. F. (*Balham*).—The best and most satisfactory way, if you are able to manage it, will be to re-polish your chairs entirely, cleaning and washing them well first. If the present polish is very bad it will be well to remove it by scraping, or with methylated spirits. So much depends on the condition of the chairs that without seeing them it is impossible to advise you definitely. Very probably a polisher might be able to renovate them by just touching up the defective parts with a rubber charged with polish in the usual way. Whichever course you adopt remember that no filling will be required, as the grain is already stopped. For the rest the process is just the same as if the chairs were "in the white," that is, unpolished. If the discolouration in the seats is caused by grease your best plan will be to scrape them, but from the doubt you imply as to the cause of this, I am almost inclined to think it may be owing to the natural darkening of the wood, in which case you need hardly try to remove it. By looking underneath you will probably be able to decide whether the discolouration is natural or not. You might lighten by washing with a solution of oxalic acid in water, after removing the polish, but you are more likely to do harm than good. If the marks are so conspicuous as to be an eyesore, suppose you darken the rest to match by mixing a little suitable colouring matter with the polish, or by staining, if you should be unable to get a deep enough tint without.—D. A.

Drills.—AMATEUR (*Edgware Road, W.*).—I am afraid you will find it useless to attempt to make these, as they can be bought so cheaply, and you are evidently not accustomed to the work. The material used is steel, which you can get of suitable quality and in quantity from Aird & Anderson, Whitechapel, Liverpool. After shaping the ends they must be brought to the proper degree of temper; so you will see as, you are only wanting a few drills, that the game is not worth the candle.

Blueing Gun Barrels.—AMATEUR (*Edgware Road, W.*). — This work is quite unsuited for an amateur. The barrels are prepared by oiling, and then placed in a chamber or receptacle where they are heated to a certain degree.—D. A.

Copying Apparatus.—W. C. B. (*Queenboro'*).—The process you ask about is evidently one of the "graphs." Any stationer will procure you the apparatus as well as the special ink required, but if you prefer to make it you can easily do so. The main ingredients are gelatine and glycerine with a certain amount of water, but to these several other ingredients are often added. For a few copies you will find ordinary glue melted as usual and a little glycerine do very well. The glue alone soon dries, and the glycerine is added to keep it moist, so you will see that proportions may be altered according to circumstances. I never use anything but this simple mixture, which can be re-melted whenever required, and a little more of either glue or glycerine added as desirable. The ink I always buy ready made as it is better, though it may be prepared by dissolving some aniline dye—purple is the best—in hot water. You will find the following a very good way of making a "graph." Soak some gelatine, obtainable from any grocer, or fine glue, in cold water till it becomes quite soft, and having poured off the surplus water melt it with heat. Take care not to burn it by placing the vessel directly on the fire. When quite melted add glycerine in about the proportion of four to one of the solid gelatine, and thoroughly incorporate by stirring. Pour the mixture into a shallow tin tray, such as the lid of a biscuit box and leave it till cold, when it is ready for use. Be careful to avoid the formation of air bubbles, which must be removed before the composition sets by pricking them. You will also find the following a reliable recipe, though more complicated:—Gelatine and sugar, 1 part each, 2 parts sulphate of barium, 4 parts water, and 6 parts glycerine. If you mix more than is required to fill your tray keep it in a tin canister for future use. After a time, what with washing off ink after printing and general deterioration of surface, the compo in the tray ceases to give good copies. It should then be scraped off, and re-melted either alone or with some of the fresh stuff with the tin, by letting this stand for some time in hot water. By this means you can use the compo over and over again. After using wash the surface over with a soft moist sponge to remove the ink, and when not in use keep the composition covered, both to keep it free from dust, and to prevent evaporation of the moisture.—D. A.

Copper Plating.—MINER (*North Wales*).—To copper plate with pure copper a number of large copper plates you will require a large vat filled with a solution of copper sulphate, a number of copper plates to be used as anodes, and a strong current of electricity obtained from very large battery cells, or a large electro-plating dynamo, the last being preferable. Before I can give you efficient advice, I must know the size and number of the plates to be coated. It will also be well to let me know whether you have access to a plating dynamo or not, and also what motive power you have at your command. If you do not know anything of the art, you should get a book and learn first how to deposit copper. Space cannot be spared in "Shop" for a full description, but the subject in all its details will be treated in WORK in a series of articles.—G. E. B.

Prints Transferred to Wood.—G. W. (*Chester*). —You must be prepared to encounter disadvantages if you seriously intend to pursue your idea of transferring prints from paper on to wood panels. (1) If you succeed in obtaining a satisfactory set-off the whole thing will be only a reversal, which will, in figure subjects, be very ridiculous. (2) The print which you use for the experiment will be irretrievably ruined. I have heard of a plan, but cannot vouch for its efficacy as I have not tried it: it is to saturate the paper on which the picture is printed, with tartrate of potass; then to pass a printer's roller charged with ink over the face of the print. The preparation of the paper is supposed to enable it to resist contact of the greasy ink, leaving the lines of the engraving fixed to receive it, and to transmit impressions. My reply to J. G. in No. 23 bears also upon this subject.—J. H. W.

Filter Bed for Conditioning Yarn.—W. B. (*Bolton*).—There are many forms of filter beds, or damp cellars, as they are called, but I will give the one that has given the best results out of many I have had to do with. It is rather an awkward thing to advise on, unless one could see the situation or the condition of things as they now stand, and I would suggest that persons asking questions that certain conditions would alter, should give the fullest particulars when asking the question. But to the question on hand: the first thing to do is to determine the floor line, then dig or clear out the soil to a depth of 2 feet below the proposed floor line. Should you now come to a good solid bottom of clay, you can commence to construct the bed, but should the bottom not be clay, or not a good clay bottom, then you must go 4 inches deeper. When that is done, you must puddle 4 inch of clay in, and level off, and lay in drain pipes to be connected with a pipe to the lodge. You will then lay in 3 inch of round stones, such as you see in brook beds. Should you get them from a brook, they must be washed before putting in your bed. They should be riddled with a riddle of $1\frac{3}{4}$ in. mesh, and the smaller ones that go through will be wanted later on. You now put a layer of sand about 1 inch deep, then comes the smaller pebbles or stones 3 inch deep. You now put 1 or 2 inch deep of charcoal or gas carbon, that can be got from the gas-works. You lay on 7 inch of sand, and the bed proper is made. You now put a brick floor on the sand, and the bricks must be put on their edge and laid half an inch apart from each other all round. You put fine pebbles, that have been washed, in the spaces between the bricks. You can now lay on your water supply, which must be a slow but constant one, at distances 16 ft. apart, and regulate the water so that you always have the top of the bricks level with the water. You will soon find out how to get at that. Should there be anything more you wish to know, ask.—J. W.

Gilding on Gilt Mounts.—L. M.—Gilt or bronze mounts are made by using good glue free from grit, which is spread evenly upon the card or surface to be gilt, and bronze powder dusted on through a sieve. It is a dangerous process to health, and I would advise the amateur to buy his boards ready bronzed. He will find it cheaper.—G. R.

Rust on Pianoforte Strings.—Cheviot wishes to know how to remove the rust from the strings of his piano. Take out the front or top door, also remove the bottom door, under the keyboard. Then unfasten the buttons, and pulling the action forward, lift it out carefully, then you will be able to get at the strings. Now provide yourself with a piece of soft leather, one pennyworth of flour emery, and a little paraffin oil. Slightly damp the leather with a few drops of paraffin, and sprinkle on the faintest suspicion of emery; rub up and down the steel wire. Do not touch the copper strings at the bass, except the ends which are steel. The rust on the coils round the wrest pins should be removed with a strip of leather put round the coils, and pulled up and down. Serve the bolt-heads in the same way. To prevent a recurrence of this, pulverise some camphor in a little lard free from salt, put a little on a piece of leather, and rub over the strings. Also see "Hints on Preservation of Pianos," in No. 9 of Work.—T. E.

Photographic Lens.—R. C. D. (*Aberdeen*).—You ask for a "tip" as to the making of a lens, and though I could throw my reply into the form of a *résumé* of the common process of grinding such a lens, I am sure that the reply would be of little practical value to you. For two or three shillings, Lancaster, of Birmingham, or any maker of cameras at popular prices, would sell you a lens that would be exactly what you want, and which it would take years of patient labour on your part, if I understand your letter rightly, to learn to make. Practically this is the best information I can give you. Evidently your idea as to the "various kinds of glasses, and how they ought to be placed in the tube," is of the simplest degree, and consequently any discussion with you as to the construction of a complicated photographic lens would have to be begun at its most elementary optical stage.—E. A. F.

Sign Writing.—F. W. B. (*Bristol*).—The specimens of old English lettering given in No. 19 of this journal were drawn expressly for publication in Work, and taken from the best available source. The example sent by F. W. B. is not true old English, but a cross between the old black letter and Anglo-Saxon. The formation of the various alphabets vary in almost every town in the kingdom, and each writer forms his letters according to his own individual taste. Controversial matters of this sort, however, do no good to any one, and I must decline to enter into them with F. W. B. At the same time, I am always willing to answer a plain and practical question. As to the £10 per week, there are many men in town who undertake the best contract work who earn more than this even, but, of course, 30s. is nearer the mark in the case of the ordinary country journeyman. It is, however, to the former ideal I hope to see the industrious student reach. The remarks about amateurs and outside competition is "baby's talk." It is the same in all trades, and nowadays it is simply the "survival of the fittest." If F. W. B. intends to insinuate I am writing for amateurs, he is mistaken, as I do not consider it work an amateur is likely to take up.—H. L. B.

Ink for Ticket Writing.—Paradox (*Southport*).—The following is a good receipt:—Rub thoroughly together eight parts lamp-black, sixty-four parts water, and four parts finely pulverised indigo. Boil until most of the water has evaporated, and then add five parts gum arabic, two parts glue, and one part extract of chicory. Boil again till the consistency of paste, then run into wooden moulds that are rubbed with olive oil. It is the addition of too much gum arabic that causes the ink to crack on the tickets.—H. L. B.

Mounting Pictures.—J. T. (*Burton*).—The best method, and one always adopted by good photograph mounters in the trade, is as follows: Damp your photograph upon clean glass face downwards, and starch the back evenly, which is prepared by putting, say, six pieces of best white starch, procurable from any respectable oilman, in a basin and mix to a thick paste with cold water, then pour sufficient water—must be boiling—to form a thick paste, and use when cool. Paste is fatal to photographs; when starched lay upon your card, and rub down with blotting-paper, and you will have it dry for use in five or ten minutes.—G. R.

Wood Mitre Cramp.—J. H. (*Blackburn*).—I cannot advise you with respect to making a wood mitre cramp. As a sort of substitute, I should suggest placing a cord round the frame when glued together, and laying on the bench, placing a piece of round wood like a hammer handle, and twist it up tight as you please. This is the best method I could devise, but perhaps some brother amateur on reading this will give you his experience of making a more practical home-made mitre cramp.—G. R.

Polishing Mahogany.—J. M. (*Glasgow*).—Some papers on polishing are in the printers' hands and will soon appear. Replies to all queries submitted are obtained as speedily as possible, and are then handed to the printers to be put into type for appearance in Work. Owing to its very large circulation, each number of the Magazine goes to press considerably in advance of its date, and hence it sometimes appears that an unreasonable time elapses before the inquirer gets his answer. If you could pass a week in the Editor's office you would find that everything that can be done to expedite matters is done.

Continuous Fountain in Small Aquarium.—J. M. (*Glasgow*).—Fountains must be supplied from a height considerably above themselves. Thus, supposing the aquarium to stand on the floor of a room, the cistern which serves as the source of supply should be somewhere near the ceiling. The fountain will work as long as there is water in the cistern, and the continuity will depend, therefore, on the maintenance of the supply.

Dulcimer.—Grandfather.—A series of papers, conveying instructions for making dulcimers, will be commenced shortly, and in these will be given information on every point on which you ask assistance. It will be useless to go over the ground twice, first in a detailed reply to yourself, and then in the articles.

Cock, How to Grind in.—S. G. (*London, S.E.*).—To grind in a cock, take out the plug and wipe off any grease that may adhere to it, and after dipping in water, sprinkle a little burnt sand on it. Now insert the plug in the shell of the tap, and turn it backwards and forwards, but be careful not to put pressure on the plug when turning it back. Take the plug out occasionally, and sprinkle more sand on when required, and continue this until the plug bears equally all round, which will easily be seen by the appearance of the metal. Finish off with a little whiting and water. Finely powdered Bath brick may be used if the sand is not procurable, but on no account use emery powder, as it cuts the metal.—T. W.

Disinfecting Books.—J. M. (*Edinburgh*).—Sulphur fumes will make an excellent disinfectant for books, but in using it you must not subject the books to any degree of heat, as the heat will spoil the binding. Leather-bound books will crack, and cloth will blister. It will be best to put the books in a box, and carry the fumes from the burning sulphur through a pipe into the box. The arrangement of the box, etc., will be an easy matter. After disinfecting, it will be well to wash the binding over with glaire—*i.e.*, white of eggs beaten up until quite thin. If you had stated the style of binding of your books, I could have given more definite information. Querists should be explicit with their questions, as it is sometimes difficult to get at what is really wanted.—G. C.

Cloth Binding, Restoration of.—Anthropos.—It is impossible to restore cloth covers of books that have become faded through use. Bookbinder's cloth is never washed, for the simple reason that washing spoils it. The best way to restore cloth-bound books is to re-bind them. The information necessary for doing this is forthcoming in the pages of Work. In the meantime you may freshen them up a little by coating them with glaire—*i.e.*, the whites of eggs beaten until quite thin. Do not attempt to dye the covers of your books.—G. C.

Book Cover, Best Material for.—W. H. B.—The best material for a book cover, whether it be red, green, or blue, is morocco. If the book is a small one, let the skin be as thin as is consistent with strength. The materials used for binding depend very much upon the nature of the book and the taste of the owner. I should have preferred a little more information in this respect than your query contains.—G. C.

Re-painting Clock Dials.—G. C. H. S.—There is no more difficulty in doing this than in engraving a dial, or painting the name on one. The chief thing required is that you have had practice enough beforehand to obtain some skill with your tools. You say you use a spirit varnish. If you mean a paint made with colour and varnish, such as Brunswick black or Aspinall's, then you should be able to get the fine lines all right, providing you have a good brush, and that you know how to draw or paint sufficiently well. For your present job, you might try and get a steady line by using a ruler to guide your pencil; but, after all, painting dials is a special line, and here in London they can be sent to a clockmaker's material shop, and they get it done. However, there is no reason why you should not paint a dial yourself properly, but you must practise first, and if you study Mr. Benwell's papers on Sign Writing, you will get a good many hints as to materials, etc., for really it is very nearly allied to a sign painter's job, is'nt it? Now, as to the solution that you have seen used to clean gold and silver work when tarnished by fire, it is composed of 1 part sulphuric acid, or vitriol, as it is also called, and 30 or 40 parts water. The same proportions of nitric acid (aquafortis) and water (1 in 30 or 40) are sometimes used, but the first here given is the best. They are usually known under the names of "vitriol pickle" or "nitric pickle" in the workshop.—H. S. G.

Colouring Small Bed-room.—J. C. (*Holloway*). Nothing is too trivial for "Shop" to reply to, providing a useful and reasonable question is asked. You say you understand making white-wash; then so also do you the making of blue-wash. Perhaps, however, your plan and the house-painter's may scarcely be identical, so I give you brief instructions on the mixing. Respecting your "unwelcome guests," a room so inhabited should have every particle of wall-paper stripped off it, and everything washed off the walls with hot soda-water until the plaster is quite clean. If the trouble is confined to certain spots, saturate the parts well with carbolic acid, or petroleum is useful. If general, give the walls—after all holes and crevices are stopped with plaster-of-paris—a coat of strong patent, or glue, size with some carbolic acid or turpentine in it (about 1 gill to 1 gallon of size). Then, for finishing coat for light blue or grey walls, you will want, say, 14 lb. whiting, say 6d.; 1 lb. of glue, 6d.; and $\frac{1}{2}$ lb. lime blue powder, about 3d., total 1s. 3d. Put the glue in 1 quart cold water, to soak over night, and when soft, stand over the fire until dissolved. If you can conveniently get ordinary double size, it is the simplest; 4 lbs. of this is necessary, and the cost about 4d., and it will only require dissolving with a little water added, but don't make it very hot. Put, say, one quart cold water into a vessel, then the whiting into it. When the latter is soaked and soft, pour off water from the top and put in the lime blue, well mixing with the hand or a stick. When the two are thoroughly incorporated, add the quart of warm size or diluted glue; thoroughly mix the lot, and then it is ready for use. Remember that all colours made from whiting dry nearly half as light as when wet; also that the distemper, or colouring, works best when cold. A half-pailful should do a small bedroom.—F. P.

Canvas and Cardboard for Painting on.—V. N. (*Manchester*).—I am not certain of the precise proportions of the paint with which the working side of canvas is covered, but it could be prepared without very much trouble, I believe. In the first place, however, the canvas, as it is called is made specially for the purpose, free from roughness and uneven surface. Again, the manufacturers do not coat it with a brush, as you or I should have to do, but the white paint is rolled on—hence, freedom from brush marks, and a perfectly distributed coating. The cost of good prepared canvas retail is about 2s. 9d. per yard of 27 in. wide, and so on in proportion to width. You will, therefore, see that, by the time you have bought the special fabric, purchased your materials, and accomplished your purpose, you would not effect much saving—in fact, the mounted canvases can be bought at so reasonable a price that I do not believe it would pay to prepare one's own, either in small or large quantities. Presuming, however, that you have a piece of canvas, or any similar fabric, it would require to be stretched, if only permanently, and then coated with strong, warm patent size. When thoroughly dry, one good coat of paint made from white lead and light copal varnish, well mixed to a stiff paste, and then diluted with turpentine to a consistency which we can spread freely, would give a non-absorbent surface suitable for oil-painting. Whether the amount of "body" the one coat contained would be sufficient to fill up the "grain" of canvas is, of course, entirely dependent upon its degree of texture. After spreading the colour generously with the brush, you would have to stipple it with a large tool to properly distribute the colour, or, better still, cover a paperhanger's roller with cloth, and roll the colour over quickly and evenly. Winsor & Newton, the royal artists' colourmen, make a prepared "Academy" board which is non-absorbent. It has a good hard and smooth surface, and appears only to be rolled with one or two coats of "flat" paint, such as above. If your boards are of a cheaper kind, and rougher and more porous in surface, you might with advantage give two good coats of size previous to painting. The paint can be stained to any desired colour, so long as little or no oil enters into the mixture, in which case you will get too glossy a surface, and it will not harden so well.—F. P.

Care of Bellows.—WHEELWRIGHT.—The proper way to keep your bellows in good order is to fill them with air, then chain the top up, leaving the bellows distended until you wish to work them. If they are new do not oil the leather, as it will only harden and cause the leather to be stiff. Dust the bellows often, especially in the crevices, as fine ash or grit settles in and causes the leather to wear into holes. In some shops they only suspend the bellows at the week end and holiday time, also dusting it often. Others leave theirs down, occasionally dusting it. The consequence is that the creases in the leather caused by constant pressure is the weakest part in the bellows. I presume the long bellows you have bought are second-hand ones, as those who now go in for new bellows buy the circular ones, as they are easier fixed and take up less room. If your bellows have been oiled and the leather is stiff, chain the top up and give a thorough good dusting, then wash the leather several times with warm water. When dry rub the leather well with dubbing made from the following recipe:—Get ½ lb. of tallow and melt it, then pour in the tallow 1 pint of train oil. Mix well together. Another recipe equally as good:—Get ½ lb. of mutton suet, melt in an earthen pot in the oven, then pour through a sieve into a large pot. Into this liquid fat pour 1 pint of raw linseed oil, and mix well together. In cold weather this dubbing should be warmed before using, and can be applied with a brush or a flannel rag. If the bellows are used from Monday to Saturday it can be cleaned and dubbed every twelve months.—W. P.

Small Lathe for Bench End.—E. W. M. G. (*Malvern Link*).—What use do you intend putting the lathe to? If you wish to turn pieces about the size of the first joint of your thumb, a lathe 8 inches long might do it, but for a larger piece of work it would be quite useless. However, I would be far from discouraging you, and, by all means, make a lathe, but let it be longer than 8 inches. Such a small thing, except after the manner of a watchmaker's throw, would never pay for the time spent on it. Why not make a lathe the whole length of the bench, and so that it could be removed when not wanted? something like the first I described in "Lathes for Everybody." If you make the heads of that very microscopic, it might be confined to a space 8 inches long. Although I am not the writer of the reply, page 332, WORK, yet I may be permitted to suggest that the table E E could be attached to a separate pillar and not to the guides, D, to which it appears to be fastened in the drawing. The pillar could be made in two, with a joint which could tilt the table, or a semi-circular piece of metal could be attached to the under side of the table with slots in which the fastening screws would work. It is not easy to make a tilting table which acts really well and scientifically.—SELF-HELPER.

Clocks in Fretwork Cases.—YOUNG CLOCKMAKER.—I am sorry to say that I do not understand your details at all. I gather you want to know if your cases are large enough to take chime quarter movements. To that I can say "yes, plenty," an ordinary chime movement being about 8½ by 7 by 4 bells in height, extra say 3 inches, and now beyond this I am fogged, as I do not see what you want mitre wheels on pin wheel and centre wheel, as these trains are made in the usual way, with a third train added generally on the left for the quarter work, and all three trains being inside the plates; but if you have never seen a chime quarter clock, let me advise you to get Britten's "Watchmaker's Handbook," as on page 259 there is a good drawing half full size of a movement showing all the dial work, etc., and trains, and on page 258 giving full details of trains, etc. The book consists of 384 pages of useful matter to all interested in watch or clock work, whether young or old, amateur or professor; the cost is 5s. If you cannot afford one, I will lend you mine for a week to copy out the necessary matter if you will pay postage both ways and return it.—A. B. C.

Sideboard.—A. J. (*Ingrow*).—Certainly, you are quite right to put any questions on matters coming within the scope of WORK to us, and I trust you, like many others, may derive increasing benefit both from answers and articles. We cannot, however, undertake to reply privately as you suggest may be done to you, the "Shop" columns being intended not only to help individual inquirers in any difficulty that may occur to them, but to be of utility to readers generally. I am glad you send sketches, for however rough they may be, drawings are of great assistance in enabling a suitable reply being given. It seems almost a pity to make such a piece of furniture as the sideboard of pine, but your reason for doing so is certainly a cogent one, and there is no reason why a pine job should not be sound and good. I certainly should not advise you to paint and grain it. This finish, which in any case I am not fond of, would make your sideboard suspiciously like a common kitchen dresser. If you must paint it, let the finish be plain—*i.e.*, ungrained; but I would much prefer the alternative of staining and French polishing. I am not sure whether you do not contemplate marking (or graining) with stain. In thoroughly practised hands this may occasionally be to a limited extent, allowable; but the effect is rarely good, as work so finished has generally a common tawdry appearance, especially when done by any one without great experience. The carved trusses under the drawers can be bought; but I do not think you will find them any improvement on some more simple ornamentation which you could make up yourself. They are, in fact, rather tawdry than otherwise. You might, for instance, substitute a flat or turned half pilaster planted on the doors. A flat pilaster would look better if finished with a few beads or flutes, either of which you can easily manage with the aid of the scratch described in No. 7 of WORK. The same tool you will also find useful in ornamenting the drawer front, which I think, you had better make flat instead of curved, as shown on your sketch. This, however, is more a matter for your personal consideration, and you will, of course, to some extent be guided in the details by those of the small cupboards you intend to put on the sideboard. The two doors in the centre will do very well with looking-glass panels, but it is entirely a matter of personal taste whether you have them of this or of wood. Glass looks brighter and lighter, but generally the doors of sideboard cupboards have wooden panels. Transparent panels of course would only be used if you wish the contents of the centre cupboard to be visible, and unless they are ornamental you would not want them to be seen. A suitable length (provided the space is sufficient) for the sideboard will be 6 ft. It may, however, be made as small as 5 ft. with the four doors shown. In anything under this you had better make it with only one in the centre, which should be wider than the ends. The depth from back to front on end of top should hardly be less than 1 ft. 8 in. for 6 ft. length. If it is shorter reduce depth say, 1 in. for each 6 in., down to 5 ft. If your room will take it, and you want plenty of cupboard space, these dimensions may be increased, as there is no definitely fixed rule of proportion, and those given are merely approximate. The height of top should be about, or a little more than, 3 ft. For the substance of the stuff I should say that 1 in. (in pine) will be best for most parts, panels, drawer insides, and such like being less. A good deal, however, depends on how you intend setting out the work, and I can only advise you generally. You may want a thick massive looking top all solid, in which case 2-in. stuff would not be too much, or you may prefer using a comparatively thin top lined up to give the appearance of thickness. In connection with this I need hardly tell you to study the article on lining up, which has appeared in our pages. You will also find the articles on artistic furniture, and jointing up of use in giving you many hints. I think you will find the appearance of your sideboard improved if you raise the cupboard a few inches on turned columns, instead of placing it direct on top as in sketch. The side brackets also strike me as paltry-looking, and you will find the whole look much better, and not involve a great amount of extra labour if you carry the sides up to the top of the small cupboard, finishing them off with a little carving or moulding to match that on the back of it. One or two shelves should be fitted, screwing them from behind and the inside of the cupboard. They will be useful for books or ornaments, and if you support them by brackets or columns at the corners, you will have a handsome piece of furniture. As a suggestion for you, and to make my meaning clear, a sketch is given, which, without going into details sufficiently shows the intention. Instead of turned columns to the shelves, these are shown with rounded corners, and supported by a small bracket. If there is anything else you want to know about as your work proceeds, send us word and we will do what we can to help you.—D. A.

Lathe and Joiner's Benches.—W. T. C. (*Dundee*).—Yes; both these subjects will be treated in due course.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Horse Power of a Windmill.—G. C. (*Nunhead, S.E.*) writes in reply to SCRUTINEER, see page 526:—"I send a simple formula for calculating this:—

HP.=Horse power.
V.=Velocity of wind in feet per second.
A.=Total area of sails in square feet.

$$HP. = \frac{A.\ V.^3}{108,000}.\ "$$

Lacquer for Iron and Steel, etc.—J. H. B. (*Kingstown*) writes in reply to STEEL (see page 526):—"On page 525, No. 33 of WORK, STEEL will find under heading 'Brass Lacquer' a formula for making a varnish which is called No. 1. If to this STEEL adds some aniline blue, previously dissolved in a little methylated spirit, he will have a very fair blue lacquer, which may be applied with a soft brush. The articles before being painted over must be perfectly clean. By using other shades of aniline instead of blue any colour lacquer may be produced."

Brass Lacquer.—BRASSOLINE (*Glasgow*) writes in reply to STEEL (see page 526):—"STEEL wants to know where to get blue lacquer for tin toys, etc. He can get blue or green; there are different grades. I think grade K K is the best at this address. The name of it is Brassoline. The Frederick Crane Chemical Company, 22, Newhall Hill, Birmingham."

Tuition in Carpentry.—G. W. M. (*Westbourne Park*) writes in reply to AMATEUR (*Bayswater*), see page 302:—"You can obtain tuition in carpentering at the Anchor Institute, Johnson Street, Notting Hill Gate (opposite the Free Library), during the winter session, which lasts from September to March. If you write to the secretary be will afford you every information."

Trade Notes and Memoranda.

WE take the following from the *Journal of Chemical Industry*:—Glycerine is used in tempering steel and iron. The specific gravity of the glycerine may be varied between 1·08, and 1·26 at 15 degrees Cent., by adding water, according to the composition of the steel. The quantity of glycerine should be from one to six times greater than the weight of the pieces to be plunged into it, and its temperature may be varied from 15 degrees to 200 degrees Cent., according to the hardness of the metal. The harder the steel to be tempered, the higher should be the temperature of the glycerine. To increase the quenching power of the bath various salts may be added. Thus, when a harder temper is required, protosulphate of magnesia may be added in quantity from 1 to 34 per cent. of the liquid, or from ¼ to 4 per cent. of sulphate of potassium. For a softer temper, 1 to 10 per cent. of chloride of manganese, and 1 to 4 per cent. of chloride of potassium may be added. The principal advantages to be derived from these methods are:—(1) The temperature of the aqueous solution of glycerine may be varied within wide limits, the boiling point of pure glycerine being 290 degrees Cent. (2) Owing to the fact that solution of glycerine dissolves most salts that are soluble in water, the quenching properties may be varied by readily dissolving in the bath such salts as suit the kind of metal to be tempered and the degree of temper required.

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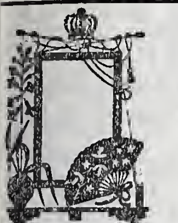

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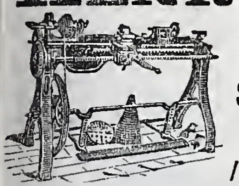

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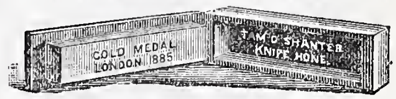

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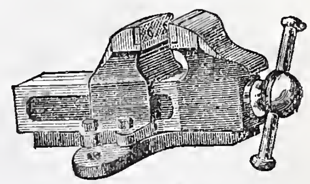

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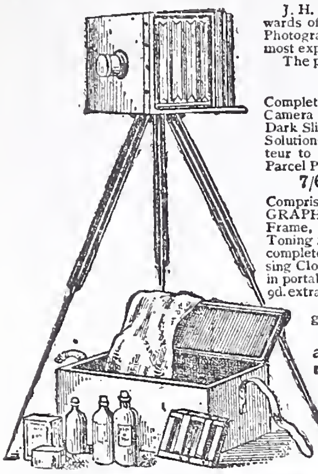

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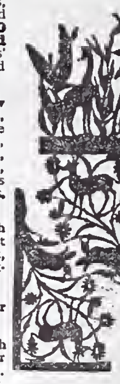

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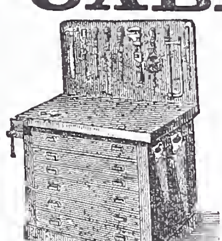

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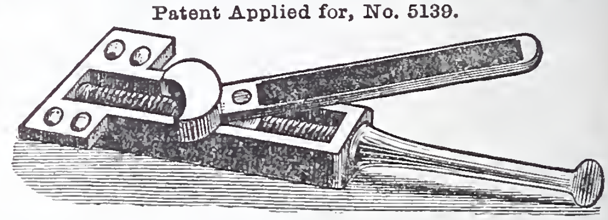

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Vol. I.—No. 39.] SATURDAY, DECEMBER 14, 1889. [Price One Penny.

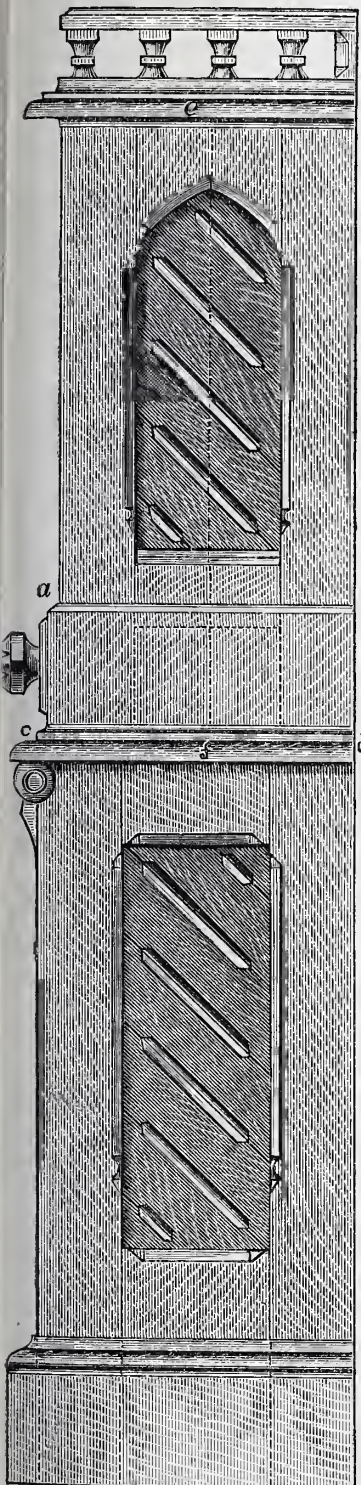


Fig. 2.—Side Elevation.

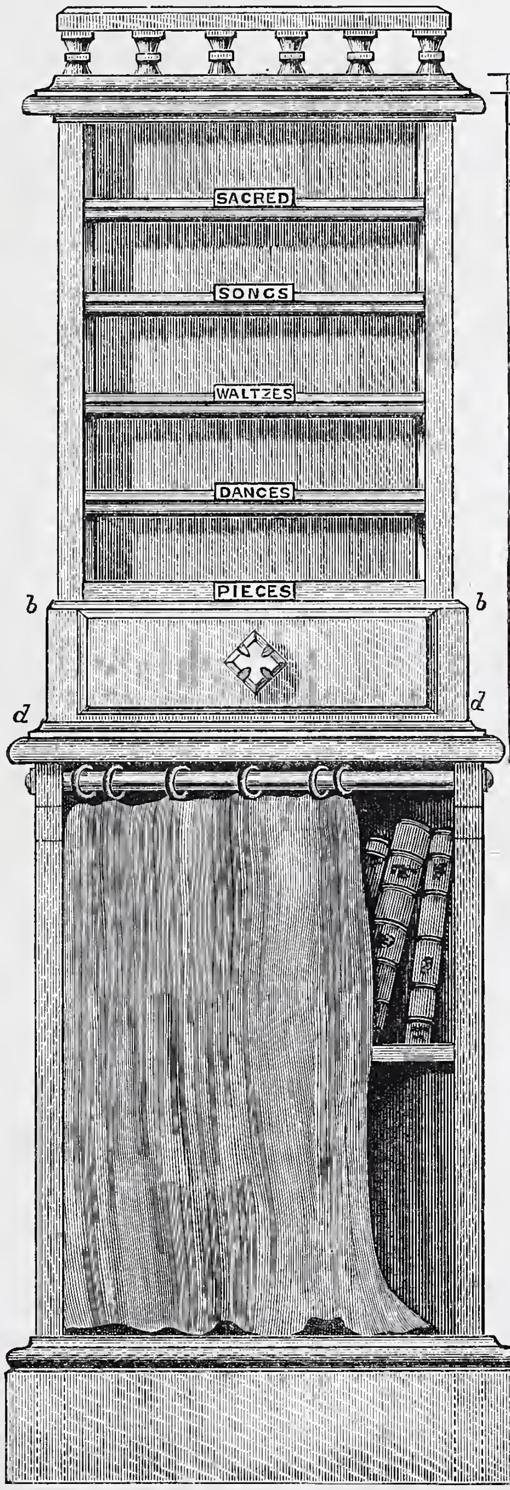


Fig. 1.—Music Cabinet: Front Elevation.

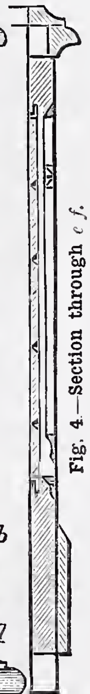


Fig. 4.—Section through e f.

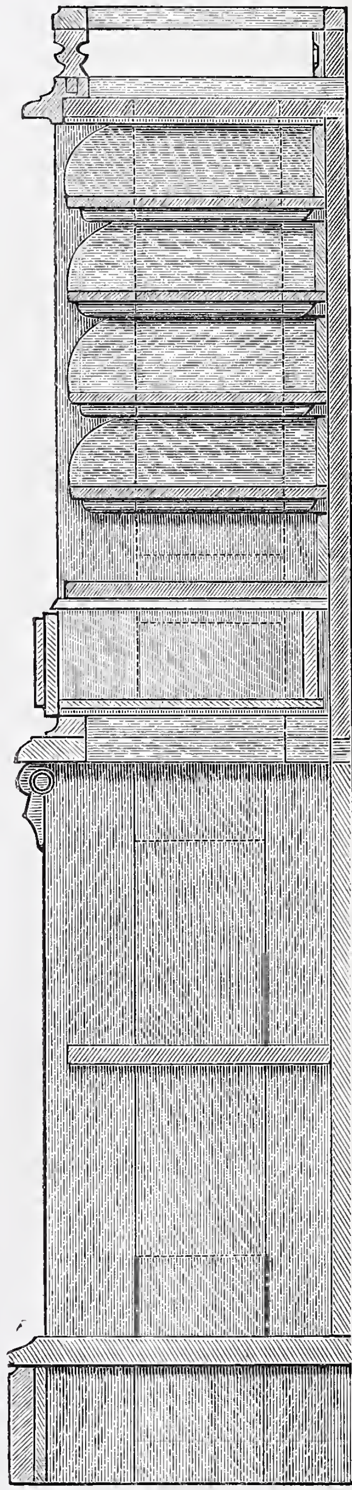


Fig. 3.—Section.

A SEMI-GOTHIC MUSIC CABINET: HOW TO MAKE IT.

BY JOHN W. HARLAND.

Every one who has experienced the difficulty of finding any particular piece of music or dance or song that may have been the topic of conversation or the subject of a request to play, must have concluded that instead of piling up a heap of music sheets in dire confusion it would be an infinite improvement to establish and preserve a system whereby any given piece could be instantly found.

The merest reflection will show that some receptacle which would permit of classification, as well as preserve the music clean and intact, alone fulfils these requirements. And here in passing let us record the unfitness of the ordinary paper upon which music is printed to withstand ordinary wear and tear, owing to its want of fibre.

The first governing consideration in planning a cabinet to hold music must of course be the exact size of sheet music, and the space that it will occupy in bulk. Now the average size is found to be very nearly $14\frac{1}{2}$ by $10\frac{1}{2}$ in.; and experiment will show that whilst some editions contain 4, others 6, 8, or 10, and some even 12 pages, that the average number of pieces laid one upon the other is about 30 to one inch in height. The next point to think about is how to classify the different sorts of music—as, *one*, sacred music, waltzes, other dances, songs, operatic music, pieces; or, if preferred, *two*, sacred songs, sacred pieces, waltzes, polkas and mazurkas, quadrilles, gavottes, and other pieces, comic songs, sentimental songs, &c., or any alternative classification, according to the exigencies of individual preference and the preponderance of any particular sorts.

By far the most convenient way of keeping music is to make a series of trays of the above size in which to lay the pieces one above the other—each tray devoted to some specific class, with the generic name on the front conspicuously painted on a slip of ivory or even written on a slip of paper pasted on and varnished.

These trays may be made—according to the taste of the individual or the facilities he or she possesses—of millboard covered with cloth with flaps similar to the cases used in the musicsellers' shops which keep the music free from dust, or of light hard wood such as mahogany or walnut, dovetailed together and polished, either with or without flaps to exclude dust.

Thus amateur bookbinders, apprentices to binding, or those who have relatives in these or similar branches, can more readily carry out our first suggestion; whilst amateur cabinet-makers, carvers and gilders, or other workers in wood, can select wood as their more convenient material.

In any case, the outer receptacle for receiving the trays must be, as it is an article of furniture, either of wood or its alternative papier-mâché.

This opens up an enormous field for originality of design—every conceivable style may be employed, every combination of finish called into requisition. Our province, however, is merely to indicate what we may term the base of construction, and to suggest ideas, leaving to our readers the option of carrying out their own deduced plans therefrom, and to stimulate them to strike out fresh designs on our skeleton models. Nor do we confine those who wish for even greater ingenuity and originality than this to our views, since we believe that the mere interchange of ideas is often, nay generally, "productive of wit in others," as our great and venerated Shakespeare says.

To those who are too immersed in other affairs, who are too young and inexperienced, we feel we are fulfilling our self-imposed duty in giving a comparatively easy design to carry out, suitable rather for the music-room, the school-room or library, reserving for another article the treatment of design suitable for drawing-rooms in the "Queen Anne" style.

Our illustration shows a side elevation, a front elevation, and a section of a semi-Gothic cabinet, severe in its simplicity, which may be easily carried out by any one who can use carpenters' tools, at a minimum cost for material; the more aspiring may go to the expense of walnut, brown oak, mahogany, or even rosewood; whilst those whose self-restraint empowers them to content themselves with plain deal—stained, ebonised or even painted—may do so, and thus economise sufficiently to carry out other projects suggested in Work, reaping twice the pleasure and double the self-improvement they would secure in lavishing upon one only of our suggestions all their spare cash and labour.

The upper part of our design shows the music cabinet proper, but as it would be extremely inconvenient to place it on the floor, as well as giving a very insignificant appearance to it as a piece of furniture, we place it on a stand or pedestal, utilised as a sort of cupboard for "*bound-up*" music, fitted with a shelf. There are now-a-days several valuable although cheap forms of music of smaller dimensions than ordinary sheet music, printed from type instead of plates, such as the *Musical Budget* and others, and another size termed "Bijou." To provide for these odd sizes—between the upper parts of our cabinet and the lower, or pedestal portion—we place a drawer into which these publications can be put, as also any MSS. sheets (which are invariably smaller than printed plates, averaging $10\frac{1}{2}$in. by $8\frac{1}{2}$in.). Students' music-slates and pencils may also find a convenient resting-place in this drawer. This breaks the elevation into two distinct portions, the drawer symmetrically forming a parallel to the plinth of the lower half, giving coherence to the design.

Any second storey, so to speak, of any construction, should be, of course, not so high as the first storey, but as the most important consideration as to height is governed by the second storey—*i.e.*, the tray-holder—we must now decide the height of the upper portion, which should be made separately so as to lift off the pedestal, being much more portable than if made in one piece. By making it separate we are enabled to make the lower portion wider, and thus add to the general symmetry of the whole, which might otherwise give an appearance of greatly excessive height accompanied by narrowness.

Frame up two frames of 3 in. by 1 in. stuff for styles, and $4\frac{1}{2}$ in. top rails, with 3 in. bottom rails, all grooved $\frac{1}{4}$ in., $\frac{1}{4}$ in. deep, also 1 in. thick.

Before gluing, make two panels, diagonal $\frac{1}{2}$ in. matched boarding, rebated $\frac{1}{4}$ in. to flush at back, so that when in place they may finish $\frac{1}{2}$ in. at reveal. Stop-chamfer 1 in. short of styles and rails, except at top, which, as shown in side elevation, is to be carved to a four-centre arch, taking care that the joint of the second board from the bottom of the panel bisects the angle of the lower back corner of the frame exactly; the rest will follow if the drawings—which are drawn to $1\frac{1}{2}$ in. scale, that is one-eighth full size—are carefully enlarged to full size.

Then proceed to frame up similarly two other frames for the pedestal, $3\frac{1}{2}$ by 1 in. styles, top rail $3\frac{1}{2}$ in. by 1 in., bottom rail 4 in. 1 in. Note that the styles should be left 6 inches longer than where the lower rails' lower edge comes, so as to afford fixing for the plinth, and allowing the mortise to be of the full depth of lower rail (or if preferred made into two mortises) to give superior strength.

This remark also applies to the frames of the upper portion, as the "orms" drop into the upper part of the pedestal, so as to retain it when so placed in its intended position, the upper mortises in both should be gauged at least an inch below the upper ends of the styles, so that the "orms" may be sawn off flush (see dotted lines in section). Instead of leaving the panel so long in the upper part and making the drawer an indistinct portion of it (see *b b* and *d d*) the "orms" may be left 5 in. longer and the panel be made 5 in. shorter, as is done in the drawings, and a sub-plinth planted on them $\frac{3}{4}$ in. in thickness. The "orms" at top of each, may, instead of being sawn off flush, extend advantageously one inch above the top edge of rail to allow of the moulds being planted on the rails' top edges, instead of their faces, thus giving double strength and concealing the joint so made (see dotted lines in elevations), but the moulds must then be of course 1 in. broader, and be recessed opposite the "orms" 1 in. back. Next make the frame for the top of the pedestal, which should be of inch stuff 2 in. broad, to allow of being wrought into a thumb-mould, at front and at sides, left plain at back except the rebates to receive the back boards above and below. The inner faces of this frame should be left square, the opening to be of exactly the same dimensions as those of the interior of the pedestal; it must be mortised to receive tenons made in the upper orms (as shown) of the side frames of pedestal to be afterwards glued and wedged thereon, and also recessed so that the lower orms of the upper portion may fit into it firmly and securely without shake.

The bottom of the pedestal requires no framing, being glued and screwed to under-side of the side frames on under-side of the bottom rails, recessed opposite the lower orms of these, to which the plinth, mitred at front corners, is fixed.

The top of the upper, or cabinet portion, will form sufficient frame, if it be mortised, to receive tenons cut in the upper orms of its side frames, and may be glued and screwed to the upper edges of the top rails of these. It should project at front and sides sufficient to allow it to be "stuck" into the mould shown, and to be thicknessed out by the upper members of the moulding previously got out and mitred, to be afterwards planted on, to form base for the parapet balusters. The bottom of the cabinet proper, which also forms the top of the drawer cell or compartment, need not be framed, but should consist of $\frac{1}{2}$ in. stuff like the top, cut through for the lower orms of side frames, and glued and screwed from below to the lower rails of same, projecting, as shown, in front and at sides, to be worked into a small thumb-mould, and should be thicknessed out to 1 in. at front flush with front face of side-frame styles underneath it, for the front of drawer to close upon.

The two portions, upper and lower, being thus put together, having at the back been rebated $\frac{1}{2}$ in. × $\frac{1}{2}$ in., the backs of the proper size, consisting of $\frac{1}{2}$ in. stuff, may be glued and screwed into the rebates. No stronger construction is possible: when put together, if the glue perishes, the various pieces are held together otherwise by being socketed, as it were, immovably into one another. The plinth at bottom of pedestal, and the sub-plinth of upper part, can now be planted on, glued, and, if desired, further secured by being screwed from inside to the orms against which they are planted. The plinth, as shown in section, however, should, for the sake of saving material, have between itself and the lower orms of the pedestal a piece of wood glued to both, through which the screws, if used, should pass, by which a ½ in. plinth will suffice. Both plinth and sub-plinth should be mitred at front, the sub-plinth only to short ends and to the rail alluded to, so as to leave an opening for the drawer; for which drawer runners should be made and provided, fixed flush at top with lower edge of sub-plinth.

It is advisable now to plant on to the upper part of the music-stand or cabinet the upper members of the moulding, which stands upon the thumb-mould, that forms the top frame of the pedestal. (See section.) The upper edge of this moulding must be flush with the under-side of runners for the drawer—*i.e.*, ¾ in. above the upper side of the thumb-mould framing which forms the top of pedestal, the join of this moulding effectually concealing the fact that the upper cabinet lifts off the pedestal between the thumb-mould and the upper members. Now make the drawer of the dimensions shown in the drawings, but, of course, modified by possible slight inaccuracies in previous work. It ought to *fit* its receptacle with that workmanlike truth that all good work exhibits, so as to exclude every particle of dust without being too tight to pull out easily, or so loose as to shake as it is pulled out. It should be made of ¾ in. stuff planed true to ⅝ in. sides, dovetail grooved into 1 in. front, finished to ⅞ in., grooved to receive ½ in. bottom, ¼ in. by ¼ in. groove, bottom tapered to enter, and slotted to receive ½ in. back, extending from top edges only to the said groove of bottom. It may also be grooved ⅛ in. deep and ¼ in. wide for a partition, if desired to separate "Bijou" from 'Bouquet" music; or it may contain a tray for slate, etc., music below.

We now come to the trays for upper portion, which consists of a bottom, ends, and back only. (See section.) These trays should be very accurately made, the sides and backs dovetailed together and planted on the bottoms, well glued on, and screwed from below while the glue is still hot. In the exact centre of the front of the bottom of each tray, glue inlet strip of wood (or ivory, if preferred), to carry the name of the class of music each tray is destined to hold; these trays, like the drawers, sliding in and out easily, but without shake, made so accurately as to ensure a workmanlike fit. Any tray may then be withdrawn, laid upon a table, pieces readily found therein, replaced, and the tray put back in any of the positions made in the cabinet. As shown in the drawing, these trays should be about 2¼ in. in depth, and rests may be inserted, glued and sprigged to the sides, ¼ in. square, to carry them and serve as runners, the under-sides of the runners being chamfered on their lower edges, as shown in drawings.

At any height preferred in the lower pedestal, a shelf may be fixed by letting it into a groove made to receive it in the sides, and further secured by a couple of screws through the backboard. The height shown in the drawings, however, appears to us to be the most appropriate to the design, as it does not divide it equally, but gradually reduces the interval of the spacing in an artistic ratio.

Crowning the whole piece comes the parapet, consisting of turned balusters (as shown) surmounted by a cap-moulding.

The front of the drawer which shuts against the previously described framing requires as a finish to be chamfered at the edges at an angle of 45°, and fitted with a handle or drawer-pull. The one shown in the drawings, being carved from a piece of 1½ in. wood, accommodates itself to the design better, perhaps, than a bought one.

This completes the construction; it only remains to finish the exterior. To give a bit of artistic colouring corresponding with the other furniture in the room, and also to keep dust from the pedestal's contents, make a curtain of any preferred material and colour, attach six rings to it of brass, electro, or turned of the same wood as the cabinet, and fix (as shown) a rod of same wood, of brass or electro-plated, by similarly recessing the top of the front edges of the styles at each side, and planting on ornamental brackets, similarly recessed, to hold the rods in position, finishing at each side with projecting button, turned of same wood, and at same time concealing ends of rod. Brass tube, either lacquered or plated, can be cheaply obtained from Evered's, Winfield's, or any other gas-chandelier makers; the rings at most ironmongers; and the brackets can be secured with one ornamental-headed screw at each side, enabling the rod to be removed and the curtain renewed, or, in some cases, as in that of chintz, washed, starched and ironed, and replaced.

IRON AND STEEL: ITS ANALYSIS.

BY CHEMICUS.

Determination of Carbon, Manganese, and Copper—Total Carbon.

Carbon may be contained in iron either in chemical combination—combined carbon—or in the free state—graphitic carbon, or graphite; and it is upon the conditions under which it exists, as also the amount present, that the classification of the metal into wrought iron, cast iron, and steel depends. When the metal containing the carbon in the two conditions is treated with a salt, the base of which is reduced or displaced by the iron, both the combined and graphitic carbon are deposited in a state of proximate purity, and may be collected, and the real amount of carbon determined, by combustion. Such forms the principle upon which the methods of determining the "total carbon" are based. The separation of the carbon may be effected by a large number of salts, amongst them a solution of the double chloride of ammonium and copper. The re-agent is prepared by dissolving 500 of the salt in a *litre* (1,000 cubic centimetres) of water.

For the analysis, ten grammes of the sample contained in a beaker are digested in the ammonium-copper chloride solution—twenty-five cubic centimetres of the re-agent to every gramme of the metal—until complete disintegration is effected. Should the liquid become colourless, or nearly so, a further addition of the ammonium-copper chloride solution is made. The action is accelerated by the application of a gentle heat, but care must be exercised that the liquid does not approach boiling, which would result in the silicon acquiring a gelatinous condition, which considerably retards the subsequent operation of filtering. The iron enters into solution as protochloride, while the combined and graphitic carbon, and invariably metallic copper, are deposited. To get rid of the latter, add a small portion of hydrochloric acid, more of the chloride solution, and digest. Complete solution of the copper having been attained, collect the carbonaceous residue on a filter constructed as follows: Take a piece of glass tubing, 1-in. diameter and 6-in. long; contract one end, and loosely plug up this narrowed portion with glass-wool, on the top of which place a layer of finely-divided asbestos, and wash with water, so long as any of the asbestos continues to run through. Wash the contents of the filter with a hot dilute solution of hydrochloric acid, and then with hot water, until the washings, when acidified with nitric acid, give no opalescence with silver nitrate.

For the determination of the real amount of carbon contained in the impure carbonaceous residue obtained as above, either a dry or moist process of combustion may be employed. The former method being the most complicated of the two, we shall employ the moist process due to Ahlgren, the principle of which is that upon treating the carbonaceous residue with sulphuric and chromic acids, carbonic acid gas, CO_2 is formed.

Rig up an apparatus similar to that shown in Fig. 2, and to flask D transfer the carbonaceous residue together with the asbestos filter. This is accomplished by inverting the filter tube in the neck of the flask and gently pushing it out, employing as little water as possible to rinse in the portions adhering to the sides. Having connected the flask with the rest of the apparatus, and closed the pinchcock A, add through the stopcock acid funnel 150 cubic centimetres of dilute sulphuric acid—one part acid to three of water—and 20 grammes of chromic acid crystals dissolved in a little water; close R, and apply a gentle heat. The carbonaceous residue is immediately attacked by the acids, with the production of carbonic acid gas, CO_2, which, as it escapes, is freed from any chlorine and moisture in passing through the tubes E, F, H, and is finally absorbed by the caustic potash solution—one part of the alkali to two of water—contained in the bulb tube K, the weight of which has been carefully determined and noted prior to the commencement of the experiment. As the evolution of the gas diminishes, gradually increase the heat until heavy white fumes make their appearance in the body of the flask, which may be taken as indicating that the operation is at an end. The operation ended, remove the source of heat, open pinchcock and draw a current of air, which, in passing through the tubes B, C, will be deprived of carbonic acid and moisture, through the apparatus by means of the aspirator P. When the apparatus is quite cold, detach the tube K, and weigh. The increase in weight represents the carbonic acid, CO_2, which contains 27·27 per cent. of carbon, on the weight of metal taken for analysis.

The tube M, containing calcium chloride, is attached to collect any water of the caustic potash solution which may be driven off by the heated gas. It is weighed prior to commencement of experiment, and also at conclusion, and any increase in weight deducted from first weight of potash tube.

To test the purity of the re-agents, it is advisable to perform a blank experiment.

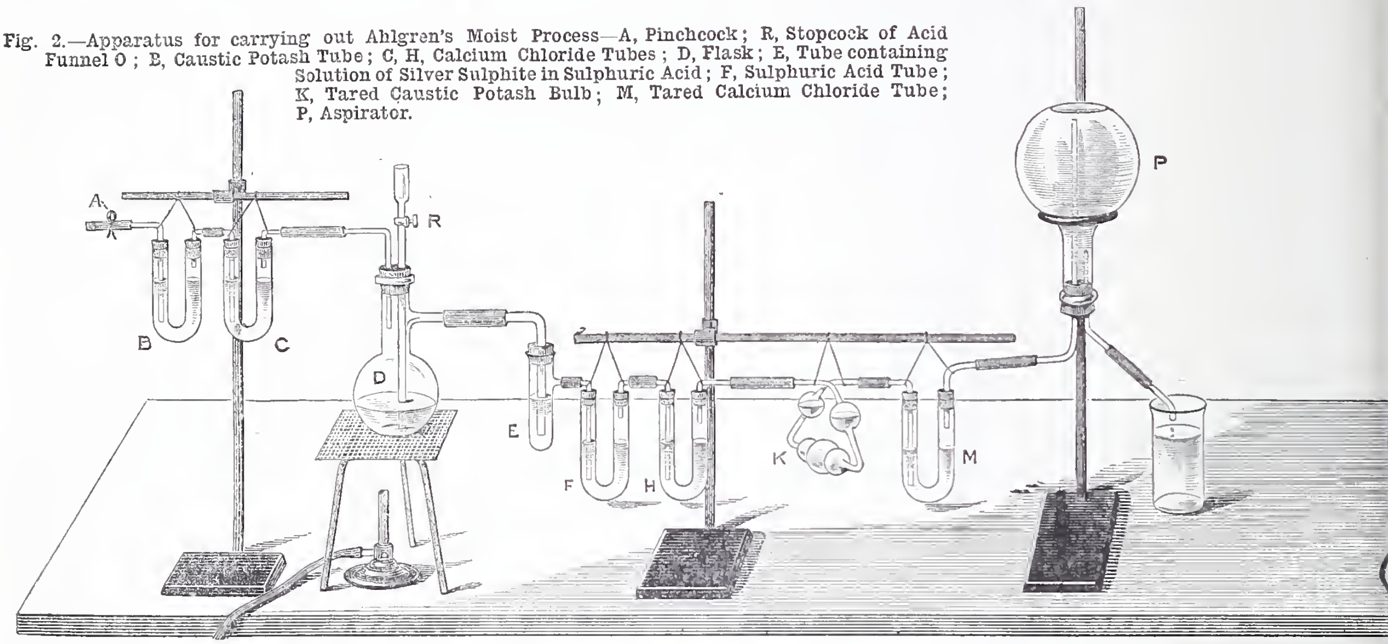
COLORIMETRIC DETERMINATION OF COMBINED CARBON.

The carbon in the state of chemical combination—combined carbon, as it is termed—possesses the property of imparting to a nitric acid solution of the metal a brown colour, varying in intensity in accordance with the amount contained in the metal. This forms the principle of Eggertz's colorimetric test: a rapid, easy, and fairly accurate method. As a means, however, of accurately determining the combined carbon the method is very limited, as the results obtained with specimens containing over ·75 per cent., or have been hardened, are untrustworthy. For the execution of the test it is necessary to possess "standard" steels, in which the combined carbon has been accurately determined, and these should be of the same make and contain as near as possible a like amount of carbon (combined) as the samples to be analysed.

The *modus operandi* of the method is as follows:—In a test tube $\frac{1}{2}$-inch in diameter, 6 inches long, place ·2 gramme of the steel to be analysed, and in a similar tube the same weight of the standard steel. To each add 5 cubic centimetres of nitric acid, sp. gr. 1·20 (free from chlorine), and when all action is at an end, immerse the tubes in a vessel containing water maintained at a boiling temperature. After the expiration of from fifteen to twenty minutes, simultaneously withdraw the tubes, dissolving any crust adhering to the insides by causing the hot solution to flow over it, and cool by immersion in a vessel containing cold water. Procure two graduated tubes, of 50 cubic centimetres capacity, divided into $\frac{1}{10}$th, of equal calibre, and pour into one of them the solution of the standard, rinsing in the last portions with cold water,* and dilute until the volume occupied is a power of the carbon contained in the same. Thus, a standard with ·40 per cent. of carbon would be diluted to a volume measuring 8 cubic centimetres, which is the ·05th power. After dilution, thoroughly mix the solution by closing open end of tube with thumb and inverting a few times. The solution of the steel being analysed is now transferred to the other graduated tube, the last portions rinsed in with the least possible quantity of water, and the liquid mixed *without dilution*. Upon comparing the colours of the two solutions by holding them side by side, the standard on the left, with a piece of white unglazed paper behind them, before a window, it will be found that the steel under examination is, in all probability, of a darker colour than the "standard" solution. Should such be the case, to the former water is cautiously added in small quantities at a time, the solution being mixed and the colour compared with each addition, until equality of tints is obtained. The number of cubic centimetres occupied by the solution, when this is obtained, multiplied by the power to which the "standard" is diluted, will equal the per centage of combined carbon.

Should it happen that the "standard" be darker than the solution of the sample under examination, the volume of the former is doubled, the tints made equal as before, and in reading off only half of the volume occupied by the steel under examination taken.

Fig. 2.—Apparatus for carrying out Ahlgren's Moist Process—A, Pinchcock; R, Stopcock of Acid Funnel O; B, Caustic Potash Tube; C, H, Calcium Chloride Tubes; D, Flask; E, Tube containing Solution of Silver Sulphite in Sulphuric Acid; F, Sulphuric Acid Tube; K, Tared Caustic Potash Bulb; M, Tared Calcium Chloride Tube; P, Aspirator.



GRAPHITE, OR GRAPHITIC CARBON.

A more accurate method of determining the graphitic carbon than the one described under the estimation of Silicon, is as follows:—Digest four grammes of the sample, contained in a beaker or dish, at a gentle heat for some considerable time with 150 cubic centimetres of dilute hydrochloric acid, and when the metal is nearly dissolved add a large volume of strong hydrochloric acid, and continue digestion. Upon complete solution of the metal, dilute and collect the insoluble matter, graphite, on a tared filter paper, which, together, with contents, wash with hot water, dilute hydrochloric acid, and a solution of potash to remove the silica; lastly, wash with alcohol and ether to remove any hydro-carbons; remove filter paper, etc., to the water oven, dry, and re-weigh to determine the graphite.

A small quantity of silica is invariably contained in the graphite obtained as above. To determine the same, the filter paper and contents, after weighing, contained in a platinum crucible, are ignited at a strong red heat for some time, and when cool the weight of any residue determined, and deducted from the first weight of the graphite.

MANGANESE.

For the determination of this constituent 2 grammes of the sample are dissolved, with the aid of a gentle heat, in 75 cubic centimetres of nitro-hydrochloric acid, the resulting solution transferred without loss to a flask of three litres capacity, and the liquid made up with hot water to a volume measuring two litres. To this solution is then cautiously added a solution of ammonium carbonate (dissolve one part in eight of water), in small quantities at a time, until it remains cloudy after brisk agitation. (Should a decided precipitate make it appearance, it is dissolved by the addition of a few drops of hydrochloric acid.) When this is obtained, add 150 cubic centimetre of hot ammonium acetate, bring the liquid to boiling (but do not boil for any length o time), and allow to stand at rest until th precipitate of basic acetate of iron has com pletely settled. Pass the clear supernatan liquid through a large English filter paper receiving the filtrate in a porcelain di throw on the precipitate with the la portions, and wash filter and contents* wi hot water containing a little ammoniu acetate. The filtrate contains the mangane but on account of the small quantit usually present in irou and steel, it advisable to cousiderably reduce, by evapo tion, the volume of the same before p ceeding with the precipitation (of cou any precipitate that may come down duri this operation is removed by filtratio This having been done, to the concent ted filtrate contaiued in a flask, wh quite cold, add a sufficient quantity bromine to cause it to acquire a dark bro colour, and to the brominated soluti ammonia until strongly ammoniacal, bris agitating the containing vessel upon t addition of each re-agent. This results the precipitation of the manganese hydrated peroxide. Heat the solutiou

* Throughout the determination *cold water* is employed.

* As the complete separation of iron and man nese is a difficult matter, it is advisable to disso in the least possible quantity of dilute hydrochlo acid the basic acetate of iron precipitate on filter, and alter dilution to re-precipitate the i with ammonium carbonate, etc., as before. T precipitate collected on a filter, well wash the filtrate mixed with the first and the combi filtrates concentrated, etc.

boiling, collect the precipitate on a filter paper and well wash with hot water. Transfer filter paper and contents to a platinum crucible, ignite at a strong red heat, whereby the precipitate loses water and is converted into tri-manganic-tetra-oxide, Mn_3O_4, every hundred parts of which is equivalent to seventy-two of manganese, and when cold, weigh.

Owing to the large bulk of iron through which the manganese is diffused, and also to the presence of organic matter in the re-agents, a small quantity of iron invariably remains in solution, and is precipitated along with the manganese. It is therefore necessary to test the precipitate for iron. This is done by dissolving it, after weighing, in a small quantity of hydrochloric acid, withdrawing a drop of the liquid at the end of a glass rod, and bringing in contact with a drop of a weak solution of ferrocyanide of potassium, spread on a white porcelain slab, when, if a blue coloration is formed, iron is present. Should such be the case, the remainder of the solution is diluted with the water, made neutral with ammonium carbonate, and the iron precipitated with ammonium acetate; the solution then heated to boiling, the basic acetate of iron collected on a filter, thoroughly washed, converted by ignition, contained in a crucible, into ferric oxide, Fe_2, O_3, and weighed as such. The weight of the ferric oxide thus obtained is deducted from the weight of manganese precipitate.

It is more satisfactory to determine the iron colorimetrically, which is performed as follows:—Prepare a nitric acid solution of iron of such a strength that one cubic centimetre contains ·0014 gramme of ferric oxide, Fe_2, O_3. This may be conveniently done by dissolving 1·004 grammes of pianoforte wire (containing 99·70 per cent. of iron) in nitric and diluting to one litre with water. Dissolve the manganese precipitate to be tested in a small quantity of nitric acid and a few drops of hydrochloric acid; transfer the resulting solution to a Nessler's cylinder, make up with cold water to a volume measuring 50 cubic centimetres, add four drops of a dilute solution of ferro-cyanide of potassium, and thoroughly mix the liquids. In another cylinder place one cubic centimetre of the standard iron solution, dilute to 50 cubic centimetres, add four drops of cyanide solution, and, after mixing, compare the tint with that of the manganese precipitate solution. Should the tints of the two solutions be unequal, a greater or less quantity of the standard iron solution is taken, diluted, etc., until the quantity required to produce equality is obtained.

Copper, if present, would be precipitated along with manganese, and its removal may be effected either previous to the precipitation of the manganese or from the precipitate itself. The former method is treated on under "Copper." If the separation of the copper be effected by the latter method, the manganese precipitate, after weighing, is dissolved in the least possible quantity of dilute sulphuric aeid, and to the resulting solution pure metallic zinc added; a mutual exchange takes place, the zinc entering into solution as sulphate, while the copper is deposited in the metallic state. Immediately the zinc has dissolved, decant off the liquid, wash the copper thoroughly (by decantation) with water, dry, and weigh.

COPPER.

Copper being, as a rule, present in such small quantities, a somewhat large quantity of the metal must be taken for the determination.

Dissolve at least ten grammes of the sample in nitro-hydrochloric acid, and separate the silicon by the method already described. Dilute the resulting filtrate to a volume measuring one litre, cool the solution, add sufficient sodium sulphite to reduce the whole of the iron from the ferric to the ferrous state,* and then heat to boiling, until all sulphur dioxide is expelled. Through the solution, while hot, pass a current of sulphuretted hydrogen to saturation, close the mouth of the containing vessel, and allow to stand in a moderately warm place for three or four hours. The copper is precipitated as sulphide, $Cu_2 S$; it is collected on a Swedish filter paper, and washed half a dozen times with water containing sulphuretted hydrogen. The filter paper is then pierced, and the precipitate completely rinsed by means of a fine stream of dilute nitric acid delivered from a wash bottle into a beaker or flask, some strong nitric acid added, and the whole digested at a gentle heat until all has entered into solution with, perhaps, the exception of a little free sulphur, which is removed after dilution of the liquid by filtering. The solution is now heated to boiling, and while at this temperature the copper precipitated, by the addition of a solution of caustic potash, as copper oxide, CuO, which is collected on a filter, well-washed with hot water until free from alkali, ignited, and weighed. Copper oxide contains 79·85 per cent. of copper (metallic).

*To determine whether reduction to the ferrous condition is complete, withdraw a drop of the solution, after the expelling of the sulphur dioxide, at the end of a glass rod, and bring in contact with a drop of sulphocyanide of potassium, when no red coloration will be formed should reduction be complete.

THE WATERBURY WATCH—LONG AND SHORT WIND.

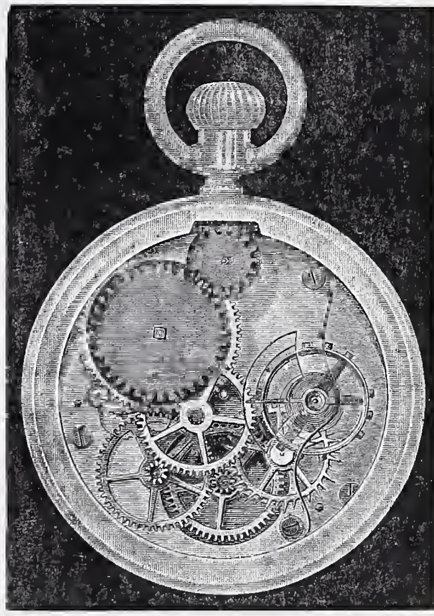
BY A PRACTICAL HAND.

This watch, now so well known, has the merit of cheapness. The long wind (see sketch) Waterbury is an excellent timekeeper—in fact, equal to watches costing ten times the price. The long wind has a peculiar motion; the whole movement turns round inside the cases—the plates, wheels, etc.—its long main spring being fixed in the centre, and the winding whereof is rather tiresome—a performance accomplished by turning the stem within the bow of watch, requiring 80 to 100 turns, unless you wind up several times during the day. But this plan is now surpassed by the short wind, thereby placing them equal to any other. They have a good clear dial, and a very superior style of case in nickel silver, which wears remarkably well if used with ordinary care; but no case will keep smooth if worn, as too many are, in a pocket with small articles, keys, coins, etc. A pocket lined with wash-leather is best—the watch is always bright, and will last years longer. But no one can expect these cheap watches to last like old verges and levers which have seen three and four generations; people now want changes different to their forefathers.

In that case these watches will fill all modern requirements, and they are extensively worn on both sides of the Atlantic.

How to clean and repair them. (Though the public are strictly enjoined on the inner dome "not to remove it by undoing the three screws unless you are a watchmaker"; but still, hundreds will and do look inside, like the lad who cut open the bellows to see where the wind came from.) First thing after the amateur unscrews those screws and raises the inner dome, out flies the immense spring, like a large serpent. This utterly astonishes them; many have been brought to me in this stage, with all tied up in a handkerchief or sheet of paper—they dare go no further; and the parties who sell them, agents in England, put up notices, that no one is authorised to clean or repair them, and, as a rule, will not sell you a duplicate part or spring; but I could always get them.

Well, to commence: unscrew the three screws and lift one side of the plate gradually up until you can slip a thin piece of steel or other article on the spring, holding it firmly down with your thumb; now lift off the dome entirely, and you will see how the centre of spring is adjusted to a notched stud; turn the stem winder to see how the ratchet works by holding the stud firmly and lifting out the click from the ratchet inside; you can now let it down, which is



New Waterbury Short Wind; J Series.

rather a tiresome process. When down, notice particularly how the outer end of the spring is fixed: in fact, just sketch it on a piece of paper, as you may forget, seeing that the extreme end is used to act as a stop in overwinding. Now lift it out and the centre—be very careful, or you may snap the end which hooks on. You have now its simple works before you; few wheels—the long spring saves the use of wheels. Put pressure on the main wheel, and see the duplex escape how it works; every other tooth goes into a detent in the staff of balance, the other tooth holding it until the next is ready, and so on until the thirty hours is complete. Now take off the glass front, and unscrew the screw that holds the stem winder, and the works will now come out. You see the simplicity of arrangement; this has gained it its great popularity, and the few wheels are here which you were cautioned not to look in at, for why? We in the trade know the reason.

Give every part a good study, and then proceed to unscrew, and, as in my previous description of the Horizontal, take and brush every wheel and the plates — you cannot injure their plates, for they have none; Of course it cannot be expected; no more can you find jewels, so see to the pivot holes if any are worn oval (this in time will be the drawback to the Waterbury); when all is clean and ready for fitting, examine all the teeth of wheels to see none are bent or grit in betwixt, clean the balance and its spring, as I previously stated (see former chapters), oil the pivot holes, and replace the few wheels. You cannot possibly make a mistake (except in the new Waterbury, which has a going barrel same as the American Lever; the only difference is the escapement.

After replacing wheels, adjust the top plate and balance, try it by pressure on centre wheel if the motion is all right. The class of long wind you can only test inside their cases; so re-fix the movement and pass the centre coil of spring around the hook. I must praise this hook, it is superior to our English small affairs. Now replace cover, hold it on with your thumb to keep spring in or it may bounce out and so trouble you; give it a good many turns with the stem winder, and now you will hear it tick, for they have really a good healthy beat. I remember the first I had; I wore it a week or two to try it. The first night I wound quite two minutes, and a cold night it was; I hung it up where I usually kept my gold centre seconds. But oh, what a row! I could not sleep, nor could my wife; so I placed it in a drawer of the dressing-table, but that helped the sound, so I got out again in the cold and thrust it into my slipper with sock after it, and now it was about equal to centre seconds; so I slept. I was told of one that they threw out of the window in disgust; but I fancy watches better than that.

Replace the three screws, spring on the back, press on the two hands at their proper time, for they do not turn one another. It will require regulating, the regulator you will see under one of the spaces around dial; it changes—you may find it at six or three o'clock, etc., that is through the movement revolving in the cases. The short wind is same as all watches.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

Colours Used by the Sign-writer.

I gave in a previous chapter a full list of tube colours as put up by the artists' colourmen, but a great many of these colours are hardly used by the sign-writer, nevertheless he has the list for reference and guide. I now append a short list of the colours which are absolutely in request by the sign-writer, and from which he can get, by mixing, a large assortment of other tints and shades.

THE SIGN-WRITER'S PALETTE.

Raw Sienna.	Gamboge.
Burnt Sienna.	Yellow Lake.
Raw Umber.	Green Lake, Nos. 1, 2, 3, 4.
Burnt Umber.	Emerald Green.
Vandyke Brown.	Vermilion.
Ultramarine.	Indian Red.
Prussian Blue.	Venetian Red.
Indigo.	Crimson Lake.
Yellow Chrome, Nos. 1, 2, 3, 4.	Scarlet Lake.
Yellow Ochre.	Rose Madder.
Ivory Black.	Flake White.
Vegetable Black.	White Zinc.

There are a few other colours which are best purchased in the dry state, in fact they are not always found in tube colour list. These are Chinese red, Persian red, orange lead, and a few more, and they can frequently be made good use of, and often save the use of some of the more expensive tube colours. It must be distinctly understood that this list of colours is for lettering only, not for painting the surface of sign-boards, and that it refers to tube colours. Of course, the workman can buy some of his colours in the dry state, but those which are most difficult to grind are always found purer and finer when purchased in tubes, than those procured ready ground in bulk. In looking down the above list, the novice must not for one moment suppose that he need purchase a full supply to commence with, in fact, he may only select those most useful to his individual taste and requirements, and add others as he wants them. There are again four shades in chrome yellow and green lake respectively; do not purchase all, however, but start with Nos. 1 and 3. By using discretion and practising economy in this way, may be the means of preventing a good few halfpence being thrown away on plant that cannot become of immediate use to its owner.

As every workman, to be perfect, and able to excel in good workmanship, must not only have a thorough knowledge of his tools, but also of the materials he manipulates, I shall now give a slight analytical description of the most common colours amongst those I have already enumerated, besides a few colours used for ground surfaces, which may be reckoned somewhat dangerous to the permanency of our work.

White Lead.—As this colour is one of the most frequently used colours in all kinds of painting, and also one of the most faulty, it deserves first notice here. It is made by suspending rolls of ordinary thin sheet lead over malt vinegar or pyroligneous acid, in close vessels, the evaporation from the acid being kept up by a steam bath underneath. The lead is thus reduced to a white powder ready for being ground up with linseed oil into a paste. White lead improves by keeping, and I would strongly advise sign-writers and others who undertake particular and delicate work, to stock it for at least twelve months after purchase. Very pale and old linseed oil should also be used in the thinning, otherwise it will probably soon discolour, which is its greatest fault. It is however, about the best pigment we have for preserving wood, etc., from the effects of the weather.

Flake White is a very pure white indeed, and not at all likely to discolour; it is on this account generally used as a finishing coat over previous ones of white lead.

Zinc White is an oxide of zinc, but it does not possess so much covering power as white lead. It however retains its colour, and is a very pure pigment. "Charlton white" manufactured by Messrs. J. B. Orr & Co., London, S.E., is, I believe, a species of zinc white which has the advantage of possessing as much covering power as white lead. This paint has been used with the best results.

Ivory-black is made from ivory turners' dust. This is placed in a covered crucible, and exposed to a great heat, which, after a certain period, turns it to a beautiful jet black. The inexperienced, like myself in such matters, must be cautious to see that they are not put off with a very inferior article when purchasing this pigment. This inferior colour is known in the trade as bone-black, and is made by treating bones in a similar way to the ivory, and it is very often sold as ivory-black by unprincipled tradesman for the sake of a largely increased profit. To make sure, therefore, of obtaining ivory-black, go to a good house, and pay the the best price. Mr. Callingham, a sign-writer of many years' experience, informs us that ivory-black, the deepest and purest of the blacks, being somewhat hard, requires very careful grinding, and that unless ground very fine it will spoil our work. It is best ground in turpentine, and diluted for use with turpentine, gold size, and a little varnish. In drying it will become dull, so that it should not be used unless it has afterwards to be varnished, which will bring it back to its original intensity. It is a difficult pigment to manage, as, if it is thinned down too much with turpentine it will not bind, so that when the varnish is applied it will rub off on to the rest of the work and spoil the whole. Ivory-black, when purchased unground, resembles "drops," and is sometimes called "drop-black," but bone-black is got up in the same way, so great caution is required.

Vegetable-black has now taken the place of lamp-black. It is sold in a very light powder and requires no grinding, being free from any gritty substance. Patent driers may be added for drying purposes, and it may be used on work that has not afterwards to be varnished.

Burnt Sienna is an earth of a very rich transparent red-brown, and is used for glazing over gold leaf and shading. It works well on gold leaf when mixed with a small quantity of ox-gall. It should be thinned with copal varnish, nót turpentine; and gold size may be used as a drier; it, however, dries better than raw sienna, and is very permanent, as it is not liable to change by the action of light and oxygen, nor by damp and impure air.

Raw Sienna is rather an impure yellow, but has more body than the ochres and is also more transparent. By burning it becomes deeper, and is then the burnt sienna mentioned above. It has also the same properties as burnt sienna.

Raw Umber is an ochre brought from Italy; it is a good drying colour, and does not injure other colours with which it is mixed. It is used in graining.

Burnt Umber is the former pigment burnt. It is a good drier in oil, and is therefore often used as such. It is very permanent, and is sometimes used instead of Vandyke brown.

Vandyke Brown is a rich deep transparent brown, a colour good for glazing and for "markings" on gold. It is a bog earth, and not a very good drier. It is permanent.

Ultramarine when perfectly pure is about the most expensive colour we have, but the sign-writer uses generally French ultramarine, an inferior product, which will, however, stand pretty fair when protected with oils and varnish. It may be deepened with vegetable-black, and when mixed with white makes a pure tint.

Prussian Blue is a good working and staining colour and a quick drier.

Indigo possesses great body, and is a good glazing colour. It is not very durable, and is injured by impure air.

Lemon and Orange Chrome.—These pigments, when of best quality, are chromates of lead, and are very pure and brilliant; they have good body and covering power, and make good tints when mixed with white. When used in oil they must be protected by varnishing, especially if exposed to impure air, which in time will turn them black. They make the so-called gold colours, but must on no account be intermixed with Prussian and some other blues in making greens, as chromate of lead will destroy these pigments. The yellow chromes are made in three shades, known as Nos. 1, 2, and 3; the No. 4 shade is the orange chrome, a deep rich colour. The shades are varied by increasing the chromate for deep orange, and lessening it for the pale yellows. These colours are injured by damp and impure air, sulphur fumes and hydrogen; but the orange chrome is said to have more lasting qualities than its near neighbour, orange oxide of lead. The chromes are useful colours, but require careful and skilful handling.

Yellow Ochre.—Not a very gay colour, and is best purchased in tubes, otherwise it is not thoroughly ground. It is an earth found in most countries, and of all shades, from the warm yellow of the Oxford ochre to the pale straw yellow of the French earth—the latter often used for "old gold" shades, etc. The ochres are not liable to change through any chemical actions, and may, therefore, be considered permanent.

Green Lakes.—These are very useful and powerful colours, sold in tubes; they are not noted for permanency, so want well protecting. They may also be purchased in bulk ready ground in oil.

Emerald Green is, perhaps, *the* sign-writer's green, the tube colour being the best to work with. It is a copper green upon a terrene base, very useful for brilliant work. It has not much covering power, and is a bad drier in oil, therefore requiring gold size or patent driers. It is a safe pigment for retaining its colour.

Vermilion can be had as a fine dry powder, free from grit, and is a very brilliant colour in oil. The best quality only is permanent, and that is a sulphuret of mercury. Chinese red, or vermilion, is of a deep crimson tone, but with bad covering power, and, unless well protected, will soon fade from the action of light and impure air.

Indian Red.—Peroxide of iron, procured from the iron ore mines of Bengal. It makes pleasant tints with white, is perfectly permanent, and possesses great body. It may also be used as a ground colour, or as a shade tint with vermilion. For a ground colour it may be mixed with turpentine, 4 parts; varnish, 1 part; when it will dry very quickly.

Venetian Red.—This colour is obtained as a native earth or as a bye product from sulphate of iron in the manufacture of acids. It is exceedingly cheap, but permanent, but must be procured ready ground in oil. It is useful as a ground colour.

Purple Brown, although not mentioned in the list, is much used by sign-writers as a ground and shading colour; insist, however, on having purple brown, and not common oxide of iron. It is rather a bad drier in raw oil, and requires the addition of patent driers or a little varnish. It has good covering powers, especially over a slate colour, but has little or no body.

Lakes, Crimson and Scarlet.—These are brilliant transparent colours, chiefly used as glazes. They make beautiful tints with white, such as carnation, and are then, of course, opaque. Strong light, however, soon discolours lake, and also the tints made therefrom. As a protection, a finishing coat of varnish should be given.

Rose Madder is a beautiful, rich, and permanent red, although very expensive. It is used on the very best work, and is procured in the usual tubes. It is a good tint colour.

I have now taken the pains to convey to the workman some idea of the bases and composition of the various pigments he works with. Although this has taken up the whole of a chapter, I feel it will be space well occupied, as unless the workman has a certain amount of knowledge concerning the colours he uses, and their liability to change or fade under certain conditions—or, on the other hand, their power of permanency, and the destructive qualities of some pigments towards others when coming in contact with them—no man can hope to execute permanent and satisfactory work. This subject is far from exhausted here; in fact, a book could be written upon this matter alone, and would prove, indeed, a great boon to the house and general decorator.

Some few years back a friend gave the writer a copy of Field and Davidson's "Grammar of Colouring" (Crosby Lockwood & Co., 2s. 6d.), but, unfortunately, it has, up to now, been hardly looked at by him, partly through pressure of work, and partly through so much other reading matter engaging his attention. In this book appears to be much matter of use and interest to the sign-writer, a very valuable feature being some tables of pigments showing at a glance—(1) Those pigments, the colours of which suffer different degrees of changes, by the action of light, oxygen, and pure air, but are little, or not at all, affected by shade, sulphuretted hydrogen, and foul air; (2) Pigments the colours of which are little, or not at all, changed by light, oxygen, and pure air, but are, more or less, injured by the action of shade, sulphuretted hydrogen, and impure air; (3) Pigments, the colours of which suffer from all of these causes; and (4) Pigments whose colours do not change from any of these actions, nor by the action of lead or iron.

Such information as this, it need hardly be said, is invaluable to the most simple worker in colours, and the sign-writer should certainly possess a copy of these interesting tables.

SOME HINTS ON WOOD-CARVING.

BY D. ADAMSON.

The suggestive ideas for carved panels, etc. shown by the illustrations will be welcome to many readers of Work, not only among amateurs, but among professionals who wish to get hold of good workable designs. These are from the clever drawings of Mr. John Law, a Liverpool carver of ability, and without entering into any long description of them or giving minute details of the way to work them up, a few general remarks may not be unappreciated by the younger portion of our readers.

Perhaps at first sight some of those who are not able to draw well may experience some disappointment at not finding the particular design they would like to carve of a suitable size for the panel they wish to decorate. They are hardly likely to want to reproduce it in a smaller size, though for some dainty piece of work in close-grained wood there is much scope for ability, and it must be remembered that the value of carved work does not depend altogether on its size. However, the well-known plan of dividing the design to be copied into sections by ruling lines each way, *i.e.*, from top to bottom and across, and marking the panel, or, the same thing, the paper on which the enlarged drawing is to be made, with an equal number of squares, but proportionally larger or smaller is equally applicable for reductions as for enlargements.

Necessarily the tools must be properly sharpened. Without wishing to find fault with amateurs, it cannot be denied that but few of them keep their tools in proper order, even if they have ever had them so. Carving tools as ground and sent out from ordinary tool-shops, or prepared for work by cabinet-makers, etc., are seldom as they should be. The sharpening of the edges is almost an art by itself, as, altogether apart from the keenness of the edge, the bevel is of the utmost importance. One often sees tools which, though sharp, are certainly not fit for the carver's use, simply because they have been ground and sharpened on the back only instead of being sharpened and bevelled away from the front as well.

Then the size of the tools, both blades and handles, supplied to amateurs is too small. I do not now refer so much to width across, because this must necessarily vary, as to length. Roughly speaking, to obtain proper command of the tool it should measure about 12 in., equally divided between blade and handle.

Another defect with unskilful carvers is the way in which they hold the tools when cutting. It is no use attempting to do good work by holding the tool in one hand only, whittling away the wood as though a penknife were being used. The tool should be firmly, yet freely, held with both hands, the left on the blade and the other on the handle. This should always be done by those who wish to carve the wood only; but if their intention is to spoil the work and test the cutting powers of the steel in their own fingers, let them hold the panel down with one hand, by preference in such a position that if the tool, weakly held in the other one slips it will go straight into the flesh. The design—after sticking-plaster has been used—can then be studied at leisure without a desire to proceed more actively towards its completion. In connection with this, may I caution amateurs against the dangerous practice many of them have of walking about their workroom with a tool in their hands? When the tool is not actually in use it should be be laid on the bench or table, and not be carried about. With a keen edge an accident soon happens, and, instead of, as one sometimes sees in classes where carving is taught, one pupil, perhaps going to speak to a fellow-worker with a tool in his hand, it should be laid down. Carrying a carving tool recklessly is almost as reprehensible as pointing a gun at a person on the chance that it is not loaded.

It is an oft-repeated piece of advice not to use glass-paper, either in preparing the wood to be carved on or for finishing the work; but in spite of all that has been said against it the temptation to smooth up with paper seems too strong to be resisted. I raise here no objection to the novice using as much glass-paper as he likes, only I do not say that it will be without serious detriment, both to the tools that are used subsequently, and to the work itself. Spoil the edges by using paper while the work proceeds, and spoil the work by papering it up after the tools are put away. It is useless to protest against glass-paper any more than it is to urge the necessity of keeping the tools sharp, so I don't attempt to do so just now, but I state what the consequences will be.

That tools should be learned by beginners is perhaps such an axiomatic bit of advice that it may be considered unnecessary. Instances are not wanting, however, that novices sometimes do aspire to carve without knowing anything more about the names and scope of the various tools than that one of them has a red bit of cotton tied round it, and that when they want to make a certain cut they must use the other with the white thread; such pupils don't advance much, unless gifted with an amount of ability which their bad memories seem to deny. Some people seem to find an insurmountable difficulty in distinguishing between a chisel and a gouge, as great as that which some—females chiefly, such as charwomen and domestics—have in knowing that the uses of a chisel and a screwdriver are not identical. Well, in case any would-be carver reading this does not know his tools let him learn them. It may take some time; still, the thing is to be done—with perseverance. As a young sky pilot was told lately when he asked if carving could not be learned without knowing the tools first: "It can't be done, and there is no artificial aid to memory."

I have touched on a few of the difficulties, absurd and commonplace as they may be, which sometimes occur, and in conclusion I may remind all that wood-carving is an art in which, though the rudiments may be imparted, proficiency can only be acquired by practice.

Although given ostensibly as designs for the carver's use, there is no reason why the repoussé worker should not avail himself of them, if not in their entirety at least by taking them as motives. Fig. 9, if nicely carried out, would make a panel equally as charming in hammered brass as in wood, and the same may be said of Fig. 7. In case the use of these or other designs as motives for other patterns, or, perhaps, shapes and sizes, has not been understood, this last-named (Fig. 7) affords an excellent illustration of what is meant. Let us assume that a drawer front, say one of much greater length in proportion to its breadth than that shown. All we have to do is to elongate the pattern, or perhaps repeat it twice without showing any break between the two, and we at once have what at first sight would appear to the casual observer to be a new design, but which after all is merely the original design treated to meet the exigencies of the case.

Fig. 1.

Fig. 2.

Figs. 1 and 2.—Corners, for Wood-Carving.

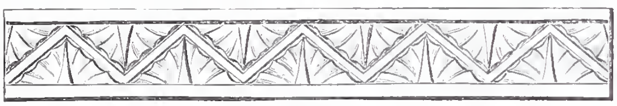


Fig. 3.

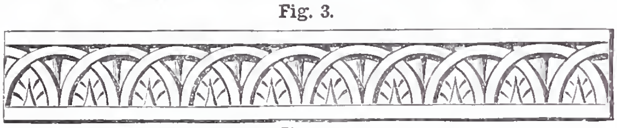


Fig. 4.

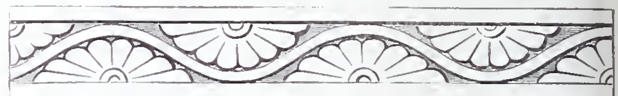


Fig. 5.

Fig. 6.

Figs. 3, 4, 5, and 6.—Borders and Edges in Carved Work.

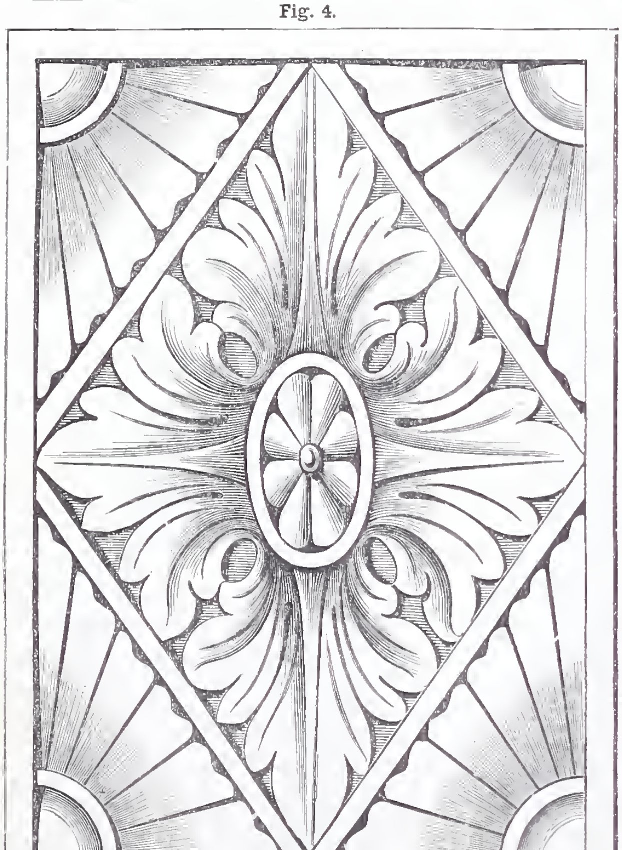


Fig. 7.—Panel in Wood-Carving: Ornamental.

Fig. 8.—Narrow Panel.

Fig. 9.—Panel in Wood-Carving: Fruit and Foliage.

MILNES' NEW SELF-ACTING SLIDE AND SCREW-CUTTING LATHE FOR FOOT POWER.

BY AN ENGINEER.

MR. H. MILNES, of Ingleby Works, Brown Royd, Bradford, has been making lathes for about thirty years; he makes for use in engineers' workshops a very sound and serviceable tool, which, for the 5-in. centres size, is £4 lower in price, and which he calls Class B. The lathe herewith illustrated is the 5-in. lathe of Class A; it has extra care bestowed upon it, and appears well worth the £28 charged. The maker's description of his new "Self-Acting Slide and Screw-Cutting Lathe, to be Worked by Foot-Power," is as follows:—Strong bed fitted with removable gap piece, and mounted on strong iron standards; double-geared headstock with eccentric motion to back-gear; steel mandrel of warranted accuracy, with adjustible *hardened* conical bearings running in *hardened* steel bushes; driver chuck, face plate, and cone centres; cylinder poppit-head with steel screw and accurately fitted spindle; strong self-acting sliding saddle with recessed cross-slide; hand surfacing motion, and quick return by rack and pinion; compound slide-rest graduated for turning taper or conical work to any desired angle; Willis' universal tool-holder; steel leading screw, full length of bed; full set of twenty-two machine-cut change wheels; calculated table of pitches for screw-cutting; reversing motion for cutting right and left hand threads; speed cone for gut band; strong turned crank-shaft running on anti-friction centres of hardened steel; chain and roller treadle motion and heavy turned driving wheel; hand rest with eccentric fastener and two top rests; travelling back stay; foot-board; driving band; and all the necessary spanners. The lathe can be used for cutting long spirals; its approximate weight is 8 cwt.

"These lathes are well proportioned and highly finished, and have been carefully designed and speeded especially for the use of scientific instrument makers, opticians, electricians, and any light engineering business where accuracy and delicacy is required; their parts are carefully balanced, and run easily. The leading and other screws are made of steel, and cut to Whitworth's standard; the sliding parts are got up to true surfaces with the scraping tool; the teeth of the wheels are cut by machine from the solid, and work smoothly, quietly and without tremor; the mandrel bearings being of hardened steel and carefully fitted, the friction is reduced to a minimum, whilst the durability and retention of accuracy is much increased."

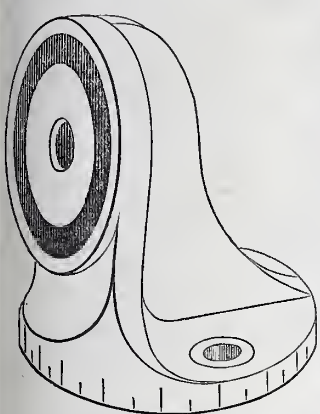


Fig. 2.—Swivelling Bracket for Holding Slide Rest in Vertical Position.

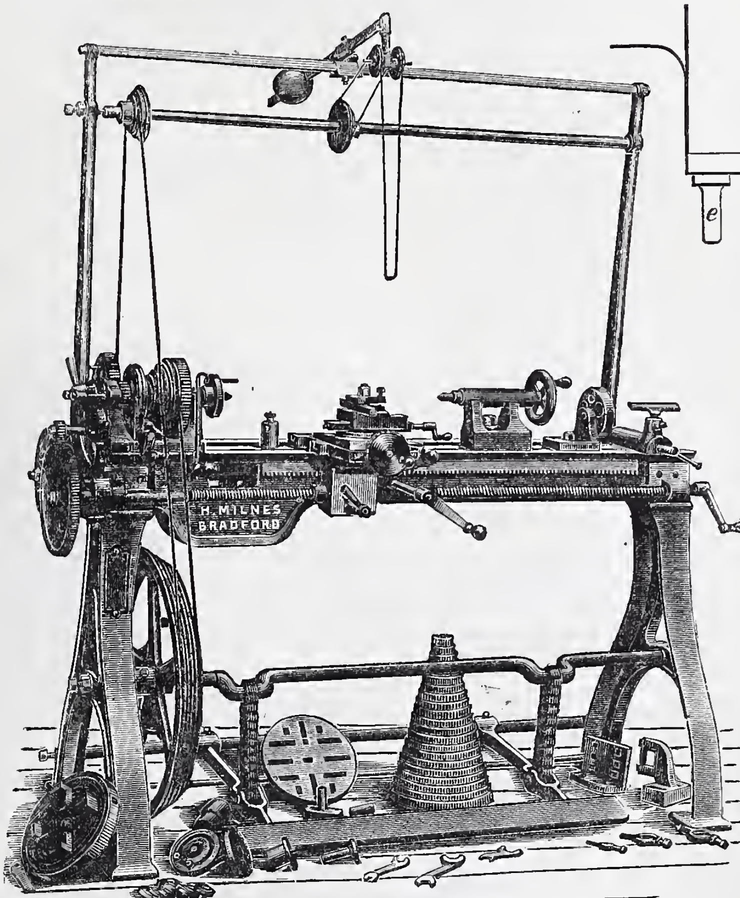


Fig. 1.—Milnes' Self-Acting Slide and Screw-Cutting Lathe for Foot Power.

The following apparatus can be added if desired:—Overhead for ornamental turning, £5; division plate and spring stop, £1 2s; worm-wheel and tangent screw, with micrometer head and index, £3 5s.; hollow mandrel, 14s.; cone plate or boring collar, £1 2s.; loose head centre, made to move sideways for turning long tapers, £1 15s.; quick withdraw motion (to withdraw tool in screw-cutting before running it back for another cut), with improved feed regulator, £1 12s. 6d.; angular and swivelling bracket for mounting top slide of rest vertically, £1.

Having been a customer of Mr. Milnes, the present writer feels pleasure in testifying to the honesty of his work and the straightforward way in which he conducts his business. One cannot expect to get the polish and high finish of the most expensive work at such a low figure, yet these lathes will do good and accurate work, turning and boring parallel and surfacing flat. The moving headstock fits well between the shears, and the cylinder fits into its place so closely that it is scarcely necessary to clamp it with the pinching screw. The necks of the mandrel, after being hardened, are ground on dead centres by a revolving lap, the thread of screw on mandrel nose is cut by a revolving cutter, and a $\frac{3}{8}$-in. hole can be bored through it. The reversing motion is so constructed that the largest change-wheel can be put upon the mandrel as required for cutting spirals of quick pitch; a spiral of one turn in six inches can be cut, and a screw as fine as ninety-six threads per inch. The 5-in. lathe with extras is shown at Fig. 1; it has a cone pulley with five grooves or rises in it, there being five grooves to match them on the fly-wheel; there is another groove in the fly-wheel turned in a ring, which gives a still slower speed, for this, a separate band is required, which runs to the largest speed on the cone pulley; so that there are altogether six speeds without and six speeds with the back-gear. The twelve speed ratios obtained are, from largest groove on wheel to smallest on pulley:—

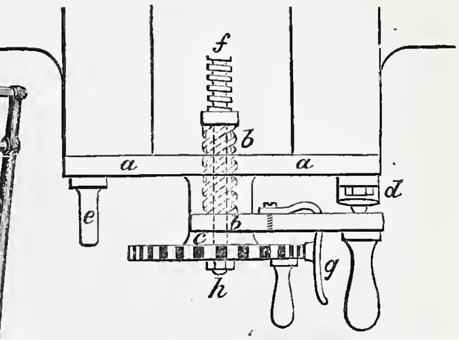


Fig. 3.—Apparatus for Quick Withdrawal and for Regulating Depth of Feed.

1st,	1 revolution of crank		to	8	of pulley.
2nd,	,,	,,	,,	6½	,,
3rd,	,,	,,	,,	5	,,
4th,	,,	,,	,,	4	,,
5th,	,,	,,	,,	3	,,
6th,	,,	,,	,,	2	,,

If the back gear be thrown in, the speeds are:—

1st, 1	revolution of crank		to	1	of pulley.
2nd, 1¼	,,	,,	,,	,,	,,
3rd, 1½	,,	,,	,,	,,	,,
4th, 2	,,	,,	,,	,,	,,
5th, 2½	,,	,,	,,	,,	,,
6th, 5	,,	,,	,,	,,	,,

Thus the fastest speed gives eight turns of the mandrel for one revolution of the crank, suitable for small work in wood; whilst the slowest requires five treads to make the mandrel turn once. Great care is taken to ensure easy running. The overhead motion adopted is similar to that made by Mr. Evans, and is far superior to the form Mr. Milnes formerly made, with the single tension pulley underneath the drum.

The bracket for mounting the top slide of the rest in a vertical position is a very useful addition; it is shown at Fig. 2. The upper part of the slide-rest having been taken off at the quadrant, it is bolted upon the vertical face of the bracket; the two are then placed upon the lower part of the slide-rest, so that the lower flange of the bracket is fixed where the quadrant flange of the rest was. The upper slide of the rest will now be vertical, and can be swivelled round to any angle in a vertical plane; whilst the bottom flange allows of its being swivelled round in a horizontal plane. Thus mounted, the slide-rest may hold a strong driller taking a slot drill, and drill out the slots in a face-plate, etc. Or, with the bracket turned round to a position parallel with the face-plate, it will hold the driller pointing across the lathe-bed, so that a round-edged milling cutter can be brought down upon a tap or rhymer (fixed between the centres) which it was required to flute; by swivelling round the bottom plate, the cutter might be placed at an angle as for fluting a twist-drill, the feed being given by the lead screw as in screw-cutting. A frame for holding cutters for the teeth of wheels could also be clamped to the slide-rest while in a vertical position, which could then be adjusted for height, or slewed round for bevil or skew gearing.

The quick-withdrawal is the last addition to be noticed. This is useful for two purposes. First, it enables the workman to set in his tool by a known quantity, measured in hundredths of an inch. Second, it enables him when screw-cutting, either outside or inside threads, to withdraw his tool before running it back for another cut, with the certainty of being able to restore it to exactly the same position. The old and clumsy way of making chalk marks on the boss of the screw or handle only admits of an approximation, and the wonder is it prevailed so long. Fig. 3 gives an idea of the arrangement as made by Mr. Milnes. On the front of the saddle is bolted a gun-metal casting *a*, *a*, which forms the foundation of the apparatus, and in the boss in the centre of this casting is cut a quick pitched screw thread; *b b b* is a crank handle, on the long boss of which is cut a screw to fit into this boss; these parts are so arranged that when this screw comes home up to the shoulder, a little half sphere carried by the spring *d* drops into a recess sunk in *b*, and so holds it from accidental displacement; yet not so firmly but that it can be raised by a moderate pressure of the hand. The traverse screw, *f*, passes through the boss of *b*, which forms the collar in which it works; endlong motion is prevented by a solid collar on *f* in one direction; and by the nut *h* in the other. The wheel *c* goes on to *f* and turns with it, being secured by nut *h*; this wheel has thirty notches cut in it, into which takes a tooth or spring *g*. The pitch of screw *f* is $\frac{1}{10}$th of an inch, so that if spring *g* be released, screw *f* can be moved by the handle on *c*; one turn equals $\frac{1}{10}$th-in.; one notch equals $\frac{1}{300}$ths of an inch, etc. To withdraw the tool in screw-cutting, so as to clear the thread before running back for another cut, lift the lever *b b* by means of its handle, and throw it over to the left till it rests on the pillar *e*; rack the saddle back to the beginning of the thread you are cutting, then restore *b b* to its first position, so that spring *d* snaps into its place; withdraw spring *d*, and pass two or three notches to give the depth of the next cut. For inside threads, the arm *d d* would rest on the pillar *e* while the cutting is done, and would be thrown over to the right to withdraw the tool from its cut. Perhaps it might be better to have a spring like *d* on each side.

With regard to the hollow mandrel, as some may not understand its value, it may be well to explain that when short articles, such as screws, are being turned from the end of a rod of iron or steel, if there is a hollow mandrel having a hole bored through it large enough to take the rod, it can be passed in through the chuck and lie in the hollow mandrel whilst only enough for one screw projects from the jaws of the chuck; when one screw is finished and cut off, the rod is simply pulled a little further out and grasped again, thus saving the wasted ends which result when the bar has to be cut into short pieces.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

109.—Stanley's "Odd Jobs."

Stanley's "Odd Jobs," as the curious-looking appliance shown in Fig. 1 is called, is about as useful a *multum-in-parvo* combination tool as a workman can find to add to the tools that he usually carries in his basket when he is sent for to do repairs of a general character in a house, or to the furniture that is found therein. If it be asked—what can be done with it, it may be pointed out that, when used in combination with a carpenter's rule, it embraces in itself no less than ten different tools which are constantly in use day by day and day after day—from Monday morning till noon-day on Saturday—in every town in the United Kingdom, inasmuch as it supplies in itself a try square, a mitre square, a T square, a marking gauge, a mortise gauge, a depth gauge, a mitre level, a spirit level and plumb, beam com. passes, and an inside square for making boxes and frames, thus performing the functions of ten different tools, as it has been already said. The form and appearance of the appliance will be gathered from

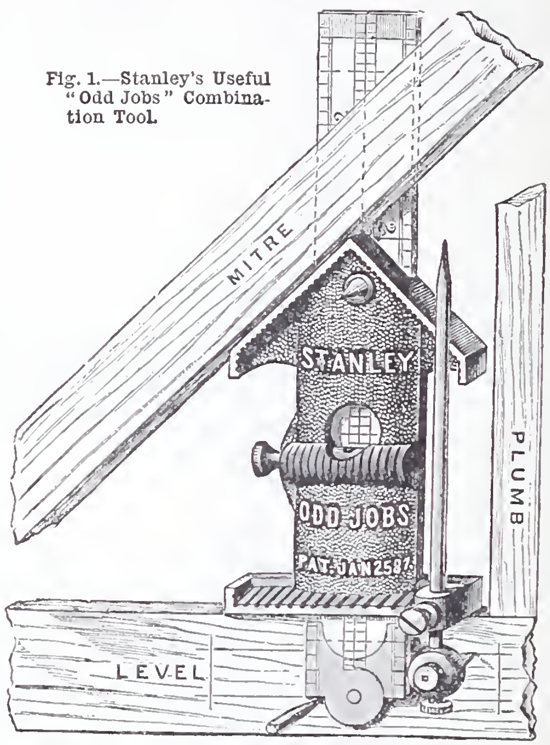


Fig. 1.—Stanley's Useful "Odd Jobs" Combination Tool.

Fig. 2.—Whitehouse's Patent Unbreakable Bits.

the illustration, so there is no occasion to make any remarks on these points here, beyond saying that it is nickel-plated, and as, when thus finished and furnished with a level, as in Fig. 1, is sold in America for 75 cents, so its value on this side of the Atlantic may be set down as being from 3s. to 4s., giving a margin for cost of freight and other charges on its passage from West to East. Its exact price, however, may be ascertained by sending a postcard to Mr. H. A. Hobday (late Hobday and Tovey), Tool Merchant, Cutter, and Hardware Factor, 46, High Street, Chatham, whose house has long been famous as an emporium of tools and appliances for the building trades of all kinds, good and cheap.

To return to the "Odd Jobs," the mode of attachment to a carpenter's rule will be seen from the illustration, the rule working in a broad groove formed in the back for its reception, and in the position shown it will be found to do duty as a try square or as a T square, with a long or short tongue, as may be required. It will be noticed that the top is so formed as to resemble a gable roof, the two sides forming a right angle; thus, when a piece of wood is laid on one or other of the sides, a right-hand or left-hand mitre can be marked on the wood, the tool, and rule, thus together forming a mitre square. The pointed steel rod on the right hand is a scratch awl. It is converted into a marking gauge by setting the point or pencil at any required distance from the square end of the stock. A mortise gauge also is obtained by putting an additional point or pencil in one of the angles on either side of the circular joints at the head of the rule. Thus, by moving the whole along the edge of the wood on which the square end of the stock rests in the illustration, two parallel lines are traced on its surface by the points, as shown. A graduated depth gauge is furnished by extending the rule downwards from the square end of the stock. It will be noticed that there is a steel point projecting from the face of the appliance at the mitred end, this forms a centre from which a circle can be described as with a beam compass ranging from $1\frac{1}{2}$ to 13 inches in diameter. The steel rod in question is shown on the right of the tool. When a small circle is required, this steel rod should be reversed and inserted in the arm bored for its reception the reverse way to that in which it is shown in the engraving; this brings the point or pencil nearer the centre-point. A circle ranging from 13 to 25 inches in diameter can be struck if the rule alone is used as radius with a pencil in the angle at its head. This explains its use as a beam compass. Its utility as a spirit level and plumb, and as an inside square, is too obvious to require explanation. A trial with the tool is the best way to judge of its merits.

110.—Whitehouse's Patent "Unbreakable" Bits.

These bits, which are also supplied by Mr. Hobday, of Chatham, are considered by American workmen to be "a perfect tool," and by English ironmongers to be "the bit of the future." It is said that one "unbreakable" will wear out several of the ordinary bits. The superiority to the latter in point of construction may be seen from Fig. 2, and a trial will soon convince the most sceptical of their value. They will start and finish clear, bore straighter, last longer, are much stronger, and are the only twist bits with which a hole can be enlarged. They are well adapted for boring felloes, and are invaluable for deep boring, as, by giving about two back turns to loosen the screw, they draw out the cut wood, thus saving much time in re-starting. They are made in ten sizes varying from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. in diameter, ranging in price from 1s. 6d. for the first four sizes to 2s. 10d. for the largest size. If sent by post, an extra charge of 3d. is made. The set of ten complete is supplied for 18s.

The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Oxyhydrogen Blowpipe.—OXYGEN writes in reply to T. W. B. (*Barnsley*), page 174:—"I note that up to the present no reply has appeared in WORK to the above query. No doubt T. W. B. has by now obtained the information he required elsewhere. But allow me, for the benefit of other readers of WORK whom it may interest, to say a few words on the subject of the oxyhydrogen blowpipe. As to the arrangement illustrated on page 174, I may simply say I should not care to be anywhere near it when tried. T. W. B. appears to be hardly aware of the dangerously explosive mixture he would get in the small chamber B. An oxyhydrogen blowpipe to be safe must not admit of any possible mixture of the gases before they reach the nozzle. Bad accidents have occurred through the explosion of such a mixture as T. W. B. would get. Readers of WORK can hardly improve on the oxyhydrogen blowpipe manufactured by Fletcher, of Warrington, and I do not think it would be possible for any one to make one for double Fletcher's prices. An oxyhydrogen blowpipe is a far more delicate instrument than T. W. B. appears to imagine. It will melt all metals, even platinum, and easily fuses silica, and such like almost infusible substances. To use one satisfactorily, the oxyhydrogen must be compressed in cylinders, as the pressure obtained with the old-fashioned gas bag, etc., is not sufficient. When using the blowpipe, first turn on the hydrogen gas (coal gas does equally well) and light it. Then very carefully turn on the oxygen, taking care not to turn on too much, or whatever is being heated will immediately catch fire, particularly if iron or brass. When heating metal the blowpipe should not be allowed to hiss. The smallest of Fletcher's oxyhydrogen blowpipes can make a piece of thick tool steel white-hot in a few minutes, and—if properly used—on cooling the metal will not be nearly so much burnt as it it had been heated in a forge. Should too much oxygen happen to be turned on, there would immediately be a very fine pyrotechnic display, the steel being on fire. I have seen holes an inch in diameter burnt in quarter-inch steel plate in two minutes, a splendid tool for burglars. From this it will be seen that an oxyhydrogen blowpipe is much different in use to an ordinary blowpipe."

Powerful Rip Saw.—ARTIST IN WOOD writes in reply to (*Highbury, N.*), page 411:—"The rod at the corner of the machine is part of the treadle, and is made firm to the cross rocking bar. The top end of this rod moves backward and forward when the machine is in motion. The D rod (for cut see page 348) moves with it and so moves the fly wheel. The treadle is down as shown in the sketch. I use this form of treadle for very heavy work that is a high speed machine. If you want the saw to cut 4-inch deal make the bench low and wide from back to front, so as to give more rise and fall to the treadle. The handle on C wheel should be fixed 3 in. over the edge of the wheel in such a way that it will clear the crank pin to give more leverage. The treadle should be made very strong.

Rubbing Down Oilstones.—A. G. (*Newcastle-on-Tyne*) writes:—"In your issue of October 19th, No. 31, on page 490, W. G. has an article on 'Rubbing Down Oilstones.' I think you will agree with me that it takes a lot of preparing, etc., although it may be very good in its effect, but I have a method which I learnt in dear old Norwich some years ago, which is this:—Get a piece of P. K. P. glass (which is rough on one side) about 12 in. or 14 in. square, which can be got for the asking, then stick 4 nails into the bench, 2 on either side, which will hold the glass while you rub the stone across it, and in five minutes you can rub the hardest stone perfectly level and true. One piece of glass will last for years."

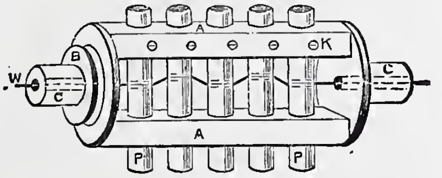
Ear Drums.—DEAFNESS (*Pallasgrean*) writes:—"If any of the readers of WORK have used or are using Nicholson's Patent Ear Drums, would they say in your valuable paper WORK if they are a success, and if there is any danger in using them? I have read so many cautions against putting anything into the ear that, although I much want a remedy for deafness, I fear to use them, although having them on hand. They are very expensive—£2 11s. 6d. for gold-plated ones."

Wire Thread Fret Saws.—Messrs. Moseley & Son, 323, High Holborn, W.C., write, for the information of all who have been making inquiries respecting them, that they now have them on sale. Inquiries as to sizes and prices must be made of Messrs. Moseley & Son, as they have not furnished me with these particulars.

Hair Spring Fixing.—A. B. C. writes:—"On page 525 (November 2nd), column 3, eleventh line from top, 'stock' should be 'clock.'"

Parts of a Lathe.—P. C. (*Bedfordshire*) writes in reply to S. G. D. (*London*), see page 508:—"I should like to know if fly wheel of lathe by S. G. D. is wood or iron, and if the axle is fixed to bench, and also if it is necessary to provide brass or any bearings for mandrel to run in?"

Straightening Bird-Cage Wire.—GIVE & TAKE writes:—"Reading through your editorial on the above in WORK, in 'Shop' No. 27, page 429, put me in mind of a simple tool used in America, but apparently not generally known here; and if my very crude sketch (I cannot draw) is deemed sufficiently clear, the following is a description and its use:—AA is cast from a wood pattern, in which B, pulley, and CC, shaft ends, are concluded. Through each end of shaft a ¼-inch hole is bored, which serves as centres upon which to truly turn up ends, so as to run smoothly in hardwood standards. PP are five hard wood round pegs to



Wire Straightener.

fit their respective holes in frame. KK are small screws to tighten on to pegs. Through centres of pegs a $\frac{1}{16}$-in. hole is bored for wire, W, to pass. For working, you commence by threading your wire through the left hand or pulley end of shaft, and on through pegs and right end of shaft (I conclude you have mounted machine in its standards). Gently tap the second, third, and fourth pegs, out of line, opposite directions, and tighten small screws down on pegs to keep in place. Set frame revolving by strap on pulley, whilst you steadily draw with pliers, the wire through pegs. No matter how crooked or kinky wire was previously it comes out perfectly straight. You can use any wire, or thickness, up to $\frac{1}{16}$ inch, I have not tried thicker. I like WORK very much, and send this on the chance of being useful to others, as I like to give and take."

Sheet Metal Working.—RODNEY (*Newport, Isle of Wight*) writes:—"I have carefully read WORK, and find it just what is wanted in these go-ahead times. I have derived a deal of knowledge in years gone by from Cassell's 'Working Man's Friend and Family Instructor.' I consider this quite a boon to the rising generation. Having worked in the sheet metal line myself, I was pleased with the drawings, etc., of various soldering irons in No. 17. We did not learn geometry. In handling our soldering irons we used to get out a small brass plate, thus—with a square hole to fit the shank, and fit this down on the ferrule and rivet, with burr at the bottom. This, of course, being larger than the

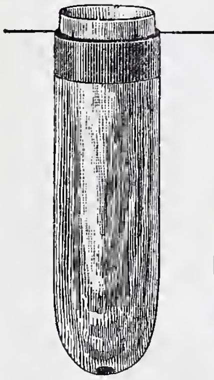


Fig. 1.—Ferrule.

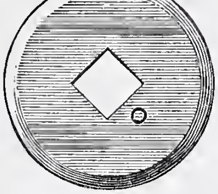


Fig. 2.—Brass Plate.

ferrule, secured it. Another way is to nail on the wooden handle before you drive on the ferrule a tin band, say, ½ in. longer than ferrule. After driving on ferrule rivet over on top end the ½ in. of tin, and that will secure the ferrule. I see in No. 20 St. Mungo (what's in a name?) wishes for a book that deals exhaustively with sheet metal. The best I know of can be obtained from Mr. R. H. Warn, 54, Marquis Road, Camden Square, N.W. This was the address where I obtained mine some twenty years ago. I may say the price of hook is 10s. 6d. (thirty-two plates). I wish you success in this useful WORK."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Tempering Steel.—J. T. (*Manchester*).—To take the temper out of steel, heat it to a low red, and allow it to cool gradually in air. To re-temper it again, heat to a low red, and quench in water; then if the article is small, raise the temperature on a bar of hot iron until it is of the shade of colour required, and quench in water or oil or other special hardening mixture.—J.

Swaging Square Iron into Round.—J. C. (*West Bromwich*).—The art of swaging consists in heating only that portion of the iron which requires to be swaged, and in first roughing to approximate shape with the hammer, and then finishing off between the top and bottom swages. In swaging by steam the shape would be first roughed out under the steam hammer, after which the swage tools would be put under the hammer.—J.

Blackening Zinc and Steel.—W. H. M. (*Accrington*).—Japanning is one mode of blacking which, if done at the right temperature, is very permanent, but it is not a stain. You may stain steel black by getting it hot in the flame of a Bunsen burner and then dipping it in oil. I do not know of any method of staining zinc and should therefore japan it.—J.

Oiling Parts of Watch.—E. B. (*Dartmouth*).—You are rather mixed about the watch, as there is no lever cylinder watch. Each is a separate escapement, the lever having an extra piece between the escape wheel and the staff in the cylinder watch. The escape wheel works directly in and on the part on which the balance is fitted. The scape wheel, too, is different, being of steel, and having the teeth raised on little stalks, so to speak, the lever scape wheel being nearly always of brass, and having radial teeth, or nearly so. But now as to oiling. Oil all pivots, including the barrel, where the barrel works round on the arbor (not where the arbor comes through the plate if a three-quarter plate); likewise the escape wheel teeth whether lever or cylinder (but not the ruby pin if a lever). Keep the hairspring and pins between which it beats perfectly free from oil, or you cannot regulate it. Do not oil the other wheel teeth nor the pinions, and above all do not give too much, especially to the balance staff or cylinder pivots, or to the scape teeth, and use good oil. If you use too much, and it is bad, it will run all over the place and away from the pivots, and then that is as bad as giving none, and if bad it will turn like glue and stick the wheels up that way. Use Ezra Kelley's watch oil. That I find to be best.—A. B. C.

Crests, Monograms, etc., Book for.—R. M. E. (*Sunderland*).—I do not know of any book in which is combined crests, monograms, coats of arms, and decorative border work, but I should recommend you to get Fairbairn's "Crests," published at 50s.; also either Renoir's or Lillie's "Monograms," sold at 9s. 6d. and 6s. respectively, by Rimell of 91, Oxford Street, W., where you can obtain Fairbairn's "Crests" for 30s. Books containing decorative borders are also to be had there. I advise you to try Burke's "Peerage," to be obtained secondhand at about 12s., or some work on "Heraldry," for coats of arms, etc. The best book I know of on water colours is Green's, published by Rowney & Co., Piccadilly, W., at 5s. in one volume (cloth) or in three separate volumes at 1s. each. Noble's is another good book at 1s. by the same publishers.

Anodes of Aluminium Nickel.—J. J. P. (*Malton*).—If you will communicate with the Secretary of the Aluminium Company, Limited, 115, Cannon Street, E.C., he may be able to give you some information respecting this alloy, and where it can be obtained. If you fail to get it there, try Messrs. Henry Wiggins & Co., Metal Refiners, Birmingham.—G. E. B.

Galvanic Battery and Coil.—F. D. (*London, E.C.*).—This subject shall receive my attention in an article or two at an early date.—G. E. B.

Garden Hammock.—BON FILS (*King's Norton*).—An illustrated paper giving full instructions on making netted hammocks will be forthcoming when room can be found in WORK for its publication. G. E. B.

Scale for Stops for Chamber Organ.—J. C. (*Leeds*).—The following would be a fair scale for the stops you mention suitable for a chamber organ:—

	C C.	Tenor C.	Middle C.
Open diapason	4¾ inch.	2⅝ inch.	1⅝ in.
Principal	2⅝ inch.	1⅝ inch.	⅞ in.

Octave couplers, etc., will be fully described in papers on organ building when they appear.—M. W.

Model Yacht Construction.—SPINAKER.—It is not possible to commence instructions on this subject yet awhile, but you may rely upon it that when the matter is taken in hand, it will be dealt with in a sufficiently comprehensive manner to embrace the three specialties of construction—hull, rig, and classification.

Wire for Coil.—COAL MINE.—The sample of wire sent is No. 28 B. W. G., equal to ·017 in decimal wire gauge. Two layers of this, if covered with silk, would do for the primary wire of your small coil, and you might then fill up with about 4 ounces of No. 38 B. W. G. silk-covered copper wire. You will not be able to get a very powerful coil on a bobbin only 3½ inches in length. The best results from this size will probably be obtained by using a ⅝ inch core of soft iron wires. Use No. 20 size, straighten them, make up into a compact bundle tied around with string, soak in melted paraffin, cool the bundle, then unwrap the string. For primary, use No. 20 B. W. G. silk-covered copper wire in two layers. For secondary, use from 4 to 6 ounces of No. 36 B. W. G. silk-covered copper wire wound on as a reel of cotton is wound. Insulate each layer with foreign post paper soaked in melted paraffin. The prices of the wires are as follows:—for silk-covered copper wire, No. 20, 5s. per lb.; No. 36, 1s. per oz.; No. 38, 1s. 4d. per oz.—G. E. B.

Indiarubber Stamps.—W. A. W. (*Redditch*).—You will have seen that a paper on Rubber Stamp making by a contributor has been given in No. 38 of WORK.

Pill Boxes—their Prices.—INVENTOR.—Write to Messrs. Maw & Co., Druggists' Sundrymen, Aldersgate Street, London, E.C., stating your requirements, and they will furnish you with prices of boxes in cardboard or in wood. You need not be at all afraid that any reader of WORK will think you are going to set up as a druggist because you want some pill boxes. You have not given me your name and I have not named the town in which you live, as you may see.

Process Blocks.—P. McL. (*Glasgow*).—You will find the method of making process blocks described in "Modern Methods of Illustrating Books" (The Book Lover's Library), published by Elliot Stock, 62, Paternoster Row, London, E.C.

Book, Stationery, and Fancy Goods Business.—CONSTANT READER.—I regret I cannot help you personally or through readers of WORK in the direction indicated.

Plaster Casts from Nature.—OMEGA.—This subject will, I trust, be taken up and effectively dealt with in Vol. II.

Brass Finishing and Relacquering.—PADDY.—I am glad to learn that WORK is so useful to you. The subject you mention will be taken up as soon as opportunity offers. Meanwhile, any question you wish to ask in relation to it shall be answered.

Property Repairing Company.—RANGOON.—I am afraid that neither I nor any of my staff can tell you where to obtain the prospectus of any company so named. The only property repairing companies that I know are building firms.

Lubricating Oil for Bicycle.—F. F. M. (*Edinburgh*).—Yes, neatsfoot oil is rather thick, and not so suitable for your purpose as sperm. To get rid of the sediment you had better try straining or pouring off the clear portion after prolonged exposure to sunlight, for the purification of oil by the ordinary commercial process is beyond an amateur's capability, but surely in such a place as Edinburgh there can be no inducement to prepare your own oil. You will be able to buy it quite as cheaply and far more satisfactorily than you can by refining a small quantity. Were you living in an out-of-the-way district I could understand you wishing to try your skill as an oil refiner, but for an inhabitant of "Auld Reekie" to do so seems as if the old proverb "Time is money" had lost its force. With regard to your remarks on photography I think if you will turn to the back numbers of WORK you will find that you have no occasion to wait either patiently or otherwise for the subject to receive attention. Many important papers connected with it have appeared already. More will be given in due course, meanwhile as you confess to being "photographic mad" I can hardly wonder at your wanting them quickly, but "bide a wee ma frien'" Even the meenister ye ken canna cram a' his sairmon into a wee bittie talk but maun just tak it in three pairts, or aiblins wi' mony subdivisions an' we feel constrainit to dae the same wi' phōttōgraffy, which ye will allow is a subject which natterally divides itself, not only into three, but into a muckle number o' heads, sae mony in fac' that ilka ither subject wad hae to be pit aside for lang years to come were it to be "treated exhaustively" the noo. Aye echo as many suggestions as you like—we allow you.—D. A.

Paint for Blackboards.—W. T. (*Padham*).—Although I am not certain of the precise nature and component parts of the mixture used for blacking the boards by the manufacturers of school requisites, I have used the following kind of paint, and it has answered perfectly. Procure ivory drop black, ground in turpentine (retail, about 1s. per lb.), dilute this with japanner's gold size, or copal varnish—preferably the former—and a little turps. Being already ground in turps, you will find the black will not require a large quantity of gold size to reduce it to proper working consistency, which is that of a thin, watery paint. If you prepare the boards from the white wood, give them one good coat glue size, then afterwards two coats of oily, dark, lead-colour paint, or common black, and finish with one or two coats of the drop black as above; spread it quickly and don't let more than 24 hours intervene between the oily ground and the flat, lustreless black. At schools they usually freshen up the boards with writing ink and a cloth, but I have used the black above described for music boards, which had afterwards to be lined out into the five-bar staves. They have, therefore, not been touched or so rubbed up, and as the boards I did have been in use for years, I can recommend the above process and mixture as quite reliable, and such as one professional worker can offer to another. If you can't get drop black, use ordinary lamp-black, well mixing it first with gold size—japanner's, mind!—and then thinning down with turps.—F.P.

French Polishing in Lathe.—LEO.—The probable cause of the ridges of polish in places, and absence of polish in others is over-saturation of the rubber. Do not moisten the rubber so much and you will most likely find the result better. If not, describe your process in detail, that I may be enabled to locate the fault more precisely. At present I can only surmise it.—D. A.

Tool Dealer in Manchester.—H. M. D. (*Silsden*).—You might try Grimshaw, 71, Oxford Street, Manchester. If he has not got the things you want no doubt he would obtain them for you. I am afraid this information is too late to be of use to you on your present visit, but really with every wish to render assistance it is not possible to answer a question written on a Monday, and consequently not received before Tuesday morning, in the same week's issue.—D. A.

Box for Games.—A. F. S.—To give particulars in "Shop" would occupy far too much space, but your suggestion is noted, and in time will be acted on, as no doubt a description of the construction of a box for games would be of use to many readers. Thank you for your good wishes.—D. A.

Child's Cot.—T. L. (*New Brompton*).—This subject cannot be treated of sufficiently fully in "Shop," but it will be a satisfaction to you, and doubtless to many other young family men, to know that a paper on a "child's cot" is receiving the serious consideration it deserves. It is not, however, "similar to the beds in the sick bay on board ship," by which I suppose you mean a "swinging cot," but no doubt will be equally useful.—D. A.

Villa for Fret-cutting.—SEMAPHORE (*Newton St. Boswells*).—I do not remember ever having come across a fretwork design such as you want. I have looked over all the British and foreign design catalogues which I have, but the nearest thing I can find is one described as an "old German house as a cupboard." The size is 18 in. wide by 8 in. deep by 16 in. high. It appears as Nos. 810 and 815 in Zilles' No. 39 catalogue, which, as you go in for fret-cutting I would advise you to get, as you can hardly fail to find something to your taste. Thanks for your nice friendly letter.—D. A.

Inlaying Silver Stringing.—W. A. (*Blackburn*).—Real silver stringing may easily be imitated by using strips of pewter and placing them in lines or grooves cut in the wood foundation. The difficulty consists principally in making these incised lines, which of course, form the pattern. The metal being soft, is hammered till it completely fills and fits tightly within the grooves, a little glue being used to ensure perfect adhesion if necessary. You might also ornament your banjo handle with various coloured stringings of veneer or the so-called mosaic bandings, which I dare say you know are composed of pieces of veneer arranged to form a geometrical pattern. Quite right, continue to purchase WORK, and get the back numbers too. They will well repay you for the trifling outlay.—D. A.

Fixing Tiles in Framing.—MACDUFF.—I should think that the plaster of Paris will stand at least as much heat as the wooden frame and back. The tiles being held by the frame on one side do not require much support, but if you are not satisfied with plaster alone mix it with some size or glue. If the design permits of it being done the best plan is to have a rabbeted rail between the two rows. This, of course, would not look well if you have painted the tiles to form a complete picture, as I imagine you have.—D. A.

Secret Dovetailing.—MECHANIC (*Tue Brook*).—Yes, secret and other varieties of dovetail joint will all be described, and the instructions will doubtless be as useful as those on dowelled, etc., straight joints, which have recently been treated in these pages.—D. A.

Plate Shelf.—SIGNALMAN (*Bebington*).—No directions have yet been given for making a set of plate shelves, but the subject will be treated in due course, as it has been down on my list for some time awaiting a favourable opportunity. Glad to welcome you as a new reader, but why not get the back numbers? you will find them an invaluable aid in your mechanical pastimes.—D. A.

Marble Slab for Washstand.—COPSE (*Lewisham*).—For a single slab you will probably do better by going to a good cabinet maker than by going to a marble merchant, who would probably not care about letting you have one at wholesale price. I am supposing that you want to get it ready polished and finished, as you will hardly find it worth while to attempt this part of the work. If you wish to deal direct with the marble merchant I can recommend Mullis, Scrutton Street, Finsbury, or Wilkins & Sons, Pentonville Road, who both make a specialty of marble tops. Any marble mason in your own neighbourhood would, no doubt, supply you equally well. Price depends a good deal on quality, thickness, etc., but you might take 15s. to 20s. as approximate figures for the ordinary kind. St. Anne's, Rouge Royal, and the fancy varieties, would cost considerably more.—D. A.

Wax Ends.—COPSE (*Lewisham*).—Unless you have seen these being prepared it is not easy to convey the information. The bristles and thread are brought together and then twisted, the thread being of course waxed. Any cobbler will show you, and you will learn more from him in a couple of minutes than from a column here.—D. A.

Template for Bracket.—F. D. (*Liverpool*).—I hardly understand what it is you want to know, and at first was inclined to regard your letter as having been written ironically, for you draw the outlines of a template and then ask how to make and use it. I am, however, constrained to consider that you really do ask for information, and I am only sorry that you, like a good many others, have not put your full address. It is contrary to practice to write direct to correspondents, but in your case I should really like to have made an exception, and seen you when lately in your neighbourhood. I think it will be sufficient to say that to use a template you have only to lay it on the wood or other material of which it is to give the outline and mark round it. Thus a straight edge or flat ruler is a template for a straight line. Any material of convenient thickness will do to make the template of—cardboard, thin wood, thin metal, or even stout paper. If you still do not understand give your full address in next letter.—D. A.

Timber Seasoning.—LEO.—In preserving the timber of a tree, as ash or elm, for turning, I should think it would be best to cut first and then stack. Care must be taken in stacking to get all the laths used of even thickness, and placed exactly over each other. Stack in a dry place where the air can pass through the pile. I think it would be better to cut the trunk only into the boards, and not into the squares as required, as it will be better for stacking.—A. J. H.

Electro-plating, etc.—G. R. S. (*Plymouth*).—I shall have much pleasure in giving you advice on all matters relating to electro-plating. On turning to page 31, in our issue for March 30th, you will see an advertisement of the electro-plating and gilding outfit, noticed in "Our Guide to Good Things" of April 20th. It is there advertised as being sold by Richard Melhuish & Sons, Fetter Lane, London, E.C. for 25s., carriage free. You will find Mr. Watts' book on electro-metallargy, recently noticed in "Our Guide to Good Things," the most practical and cheapest text-book on electro-plating. I do not know the process for enamelling bicycles. Perhaps some of our readers who may know how to do this, will oblige G. R. S.—G. E. B.

Straightening Wire.—G. A. M. (*Walworth*).—To straighten long lengths of steel, iron, brass, or copper wire, draw them between rows of French nails or steel spikes driven into a board as shown by the following zigzag row of dots: ˙.˙.˙.˙.˙.˙ Pass the wire in and out the spikes and pull it through by means of a pair of pliers. If the wire is tinned, coppered, or plated, it will not stand such treatment. It should then be straightened by rubbing with a piece of canvas. A wire-worker once taught me to straighten wire in this way:—Fasten one end of the wire in a vice or to a firm bench; rub the bends and kinks out of it by rubbing the wire to and fro with a piece of canvas held in the right hand, whilst the wire is held in the left. By the exercise of pressure on one side or other of the wire as it is being rubbed, it may be made quite straight.—G. E. B.

School for Practical Electricity.—DESIRE (*Peckham*).—If you apply to the Secretary of the City and Guilds of London Institute, and tell him exactly what you want, and how you are situated, I think he will be able to advise you respecting the course you should take to get a knowledge of practical electricity and chemistry. A few winters ago I got some very good practical lessons through this source in the metallurgical laboratory at King's College. A course of lessons and lectures will be given there during this winter, but I do not know the fees for the special subjects you name. Information on this subject, however, will be freely given by the Secretary at King's College, Strand. Address him by letter, or see him personally at the office.—G. E. B.

Electrotypes, etc.—F. J. I. (*Bristol*).—1. The specimen of letter sent is not printed from an electrotype, but is reproduced by lithography, that is an impression or a copy of the letter is made on a lithographic stone and printed from this on paper. It could not be done so well or so cheaply by the electrotype process. 2. When taking an impression in wax from a forme of type, it is necessary to employ a machine to obtain equal pressure on all parts of the wax mould at the same time. 3. I use best blacklead or plumbago. I have not tried finely-powdered tin. If you wish to try it, this is the method for its preparation.—Grind up some tin foil very fine in a porcelain mortar with honey. Wash out the honey with boiling water, and collect the fine particles of tin, which must then be dried for use. I have tried with success the metallic mixture employed by bottlers of liquid to cool the corks of their bottles, etc. You cannot smelt pure copper in an ordinary fire. The temperature must be high enough to heat the crucible to a glowing whiteness. Dissolve the granules of pure copper in dilute sulphuric acid by the aid of heat, and continue the heat until all excess acid and water has been driven off in the form of steam. Set aside the liquid to cool, when it will form crystals of sulphate of copper, and you can use these in your coppering solutions. 5. I am not in the secret of how the diagrams that appear in "Shop," are made, but suppose they are drawn and engraved on boxwood blocks and printed from these, or printed from electros taken from those blocks. 6. I shall leave the Editor to deal with you in respect to what you have written about him, and shall not be surprised if you get a bad quarter of an hour. Respecting myself, I never forget that I am writing to amateurs and for amateurs, but I have to remember that professionals read WORK, and I have to write for them also. If I use technical terms not familiar to you I shall be obliged to you by your asking an explanation of them, and this I shall always be most happy to give in "Shop."—G. E. B.

Tempering Chisel.—CHISELLER.—Files ought to make good chisels; your mode of tempering is correct, and the obvious remedy for their softness is to quench at a darker straw approaching a tinge of brown or purple. You cannot get the precise grade of temper required, except by drawing or letting down.—J.

Organ Materials.—F. R. (*Manchester*).—Organ requisites of every description can be obtained of Mr. T. Willis, Tower Organ Works, Minories, London, but probably you could get them in Manchester, and thus save cost of carriage.—M. W.

Hand Power Dynamo.—J. J. P. (*Malton*).—This correspondent asks:—"Is there to be had a small dynamo electric machine equal in E. M. F. to six large cells of Bunsen battery, and which can be driven by hand power?" I am afraid this question does not convey to me the requirements of the writer. A dynamo may give a current equal in E. M. F. to six Bunsens, and yet be entirely unsuitable to the purpose required, as it may be anything between a small machine for giving shocks, firing a fuse, or working a telegraph instrument, and a large plating dynamo capable of depositing several pounds of nickel per hour. The first might be easily turned by a child, whilst the second would require motive power supplied by a steam engine. The querist must therefore tell me what he wants to do with his machine, or else tell me the volume of current in ampères, as well as the desired E. M. F. of the current required, before I can give him a useful reply. Small dynamo machines to be driven by hand may be had from Mr. Bottone, Carshalton, Surrey, or from Mr. Alfred Crofts, Dover. When ordering, state exactly what you want.—G. E. B.

Electric Work as a Means of Living.—J. C. F.—I fear you would not succeed in getting a living by the proposed means. The prime cost of fitting up a small electric light installation to light up even a very small village would far exceed the resources at your command, although you might obtain water power to drive the dynamos. You would also require more than an amateur's knowledge of electric bells to enable you to master the technical details of electric lighting. My advice to you (and others like you who have an idea that they can get a living by electric work) is, stick to your present employment as a means of living, and supplement this by doing small jobs in spare time, in fitting up electric bells, making and repairing small electrical instruments, and doing little jobs in electro-plating, such as may come to your hand. Get books meanwhile, and study the principles of the science whilst putting these into practice. After some time, if you find that the electric work increases enough to make a living out of it, then throw up the old work, and stick to the new entirely. I am writing a series of articles on this subject likely to be useful to you and others.—G. E. B.

Electric Alarum Clock.—HANDY MAN (*Southwark*).—A paper on this subject is now in the Editor's hands, awaiting space for publication. You will require a 2 inch or 2½ inch electric bell of the continuous ringing type; a switch to connect the bell with the battery at night, and to switch the bell off in the morning; a two-cell Leclanché or Gossner battery; a few yards of cotton-covered No. 18 or 20 copper wire; and a fairly good clock. This last will be most convenient for alteration if enclosed in a wood case. Two types of clock are illustrated in my article, and suggestions are given for fixing the alarum appliance to other types. If you have a system of electric bells already in the house, you may use the same battery to ring the alarum bell, but I advise a separate small bell with sharp tone distinct from that of other bells in the house.—G. E. B.

Enamelled Paper Letters.—JOINER (*Hull*).—If you had read our "Sale" advertisements from week to week you would have found that Beit's Patent Enamelled Adhesive Waterproof Advertising Paper Letters, Figures, etc., are to be obtained at the manufactory, 17, Arthur Street, New Oxford Street, London, W.C.

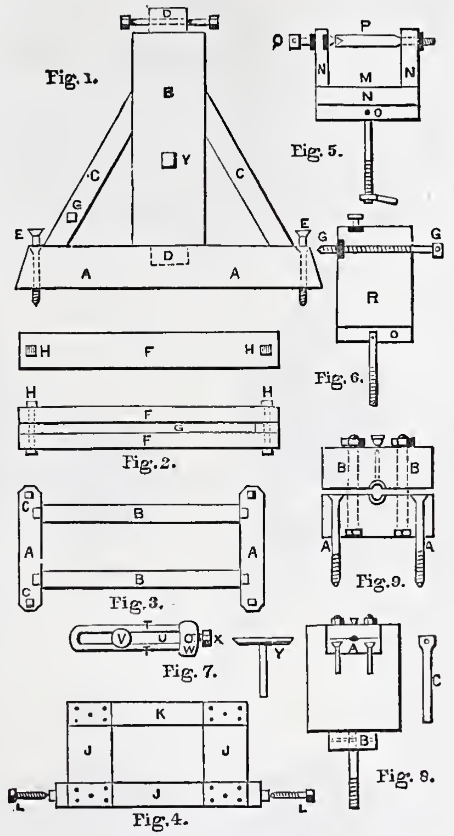
Sign Writing.—A. G. A. (*Primrose Hill, N.W.*).—The paper to which you refer is merely common tissue paper, rubbed over with white wax and pressed on to the gold leaf. I shall describe the method later on in the "Sign Writing" articles. It can be had ready prepared at any colour shop, and is known as "transfer gold leaf."—H. L. B.

Picture Framing Requisites.—J. H. (*Blackburn*).—I regret I do not at present know of any house near your town for picture framing requisites, but you should consult the local directory for the information required, and compare prices.—G. R.

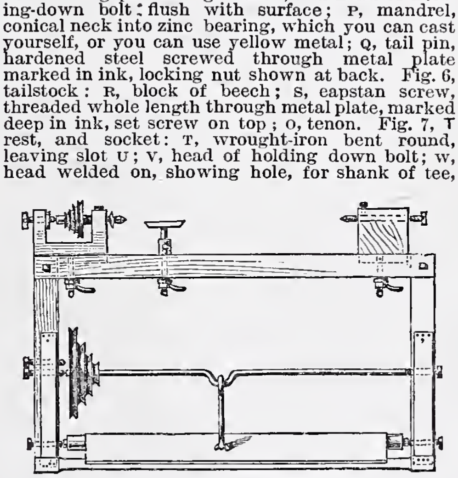
Knife for Mount Cutting.—J. H. (*Blackburn*).—There is a special knife made for mount cutting, which can be obtained, I think, for 1s. the blade, and 1s. 6d. the handle, from the City Frame Company, 29, Basinghall Street, London, E.C. This firm will doubtless forward readers of WORK a set of their moulding and mount samples on application if applicants will pay carriage.—G. R.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

A Rough Lathe.—J. H. N. (*Malvern Wells*) writes in answer to J. K. (*Richmond*) (see page 348):—"I send a few rough drawings of parts which he will understand, being an amateur carpenter. I hope it will not take too much room in 'Shop,' it may be useful to others that want such a thing. Fig. 1, end view of the standard: A, one of the feet; B, upright tenoned into A, at bottom D; D, on top of upright, tenon for bed to bolt to, showing bolt; E, bolts for floor. The two square heads of pins marked in ink—Y, for crank shaft, S, for treadle shaft. Fig. 2. F, bed, top and side view; G, slot between bed for tenons on bottom of headstocks to fit in; H, bolts for bolting bed to tenon, D, on upright, B. Fig. 3, showing stretcher bar: B, mortised into feet, A; C, bolts for floor. Fig. 4. I, treadle shaft; J, connecting pieces; K, footboard, dots showing screws; L, pins for hanging shaft points into holes, drilled in heads of coachscrews, screwed into ends. Fig. 5. M, wood, cut out of headstock for pulley, pulley not shown; N, showing shape to cut wood; O, tenon for bed, dot showing pin through tenon, and head of holding-down bolt flush with surface; P, mandrel, conical neck into zinc bearing, which you can cast yourself, or you can use yellow metal; Q, tail pin, hardened steel screwed through metal plate marked in ink, locking nut shown at back. Fig. 6, tailstock: R, block of beech; S, capstan screw, threaded whole length through metal plate, marked deep in ink, set screw on top; O, tenon. Fig. 7, T rest, and socket: T, wrought-iron bent round, leaving slot U; V, head of holding down bolt; W, head welded on, showing hole, for shank of tee, marked, Y; X, set screw. Fig. 8, front view of headstock: A, metal bearing, coned; B, tenon, dotted lines showing pin through holding-down bolt; C, holding-down bolt, showing hole for pin to fasten into tenon. Fig. 9, bearing for mandrel, in two parts: A, wood screws through bottom piece into headstock, heads countersunk; B, tightening bolts, square heads let into bottom piece, shank up through both bearings nutted at top, oil hole between, showing cup at top. If a slide rest is added, you will be able to do metal turning. There is a die chuck in No. 13 of WORK (page 204), which you can make, it would be useful for metal turning."



Parts of Lathe.



A Rough Lathe.

Lathe Work.—BRUM (*Keighley*) writes:—"In answer to a READER OF WORK (*London, N.W.*) on 'Lathe Work,' No. 24, page 382, I would say that to set a compound rest for taper turning all he has to do (providing his rest is marked in degrees) is to turn it around from left to right to any angle he wishes for male taper, and the opposite way, to the same angle, for female taper. In cutting 4½ threads to an inch, leading screw ½ pitch, the nut will gear right at every 5 inches of the leading screw, stopping lathe at end of cut before taking saddle back. But it would be easier and quicker in the case of short screws to have a reversing belt, and run the lathe backwards without taking the nut out of gear. To cut 7 or any whole number of threads to an inch the nut will close right at every inch of the leading screw, but the lathe must be stopped before taking nut out of gear. To keep the lathe going constant he must put a chalk mark on the leading screw near wheel plate, and one on the face or driving plate when the nut is in gear, and ready to take the first cut up the screw, and then he must take care to drop the nut in gear when the chalk marks are again in the same position. If a READER OF WORK does not understand this, or if his compound rest is not marked in degrees, I will try and make it clear to him if he will ask."

Polishing Vulcanite.—M. A. L. writes in reply to E. R., see page 493:—"First get all coarse marks out with F F emery paper, and then use Oakey's O paper, which will leave the vulcanite dull, but without any marks. Next get a piece of soft felt and glue it on to a piece of wood (the size of which is all according to the work to be done); rub a piece of candle upon the felt, and then sprinkle with powdered rotten-stone, and well rub the vulcanite with it, and a fairly good polish will be the result, which can be improved by again rubbing the vulcanite with a piece of soft cloth, using oil and rouge, which will bring a splendid polish; then rub all grease off with turpentine, using a soft rag, and finish by rubbing with soft part of the hand. Care must be taken not to make the vulcanite too hot by rubbing too hard, or else it will be spoilt."

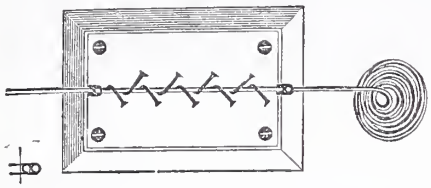
Band Saws.—C. S. B. (*Hoxton*) writes in reply to (*Nottingham*), see page 526:—"The causes of band saws breaking are manifold, the most frequent of which is the improper adjustment of guides, and the tension; also insufficiency of set causing saw to heat, and when no provision is made on the machine to take up the slackness caused by saw expanding, it sags so much above the guides that it is almost certain to go. This kind of breakage is also caused by top wheel overrunning the bottom or driving wheel when the wheels are heavy, but for some years there has been made a machine with built-up wheels similar to a bicycle wheel, being exceedingly light, so reducing this danger to a minimum. It is this cause probably which breaks your saws when finishing a cut, especially in heavy timber, and perhaps fresh also. As to brazing your saws, that is a very simple matter indeed, but one requiring some care to prevent your saw being overheated. I have seen a 30 ft. saw ¾ in. running well with five brazes in it, and the tools used for making the joints were a 1s. pair of bellows, four bricks, and a pennyworth of charcoal for fuel. But more depends upon the workman than the tools for this as many more jobs. The way to start a joint is to thoroughly clean the saw, then, without touching the ends where the braze is to be, lap them one inch, putting a little clean wet borax between, and binding joint firmly with iron wire (using as little as possible to keep the ends in place, as this has to be filed off afterwards). Now wind some brass binding wire over and amongst the iron, and wet all with your borax and water paste. I should have mentioned that you must hammer the set-down of your laps, so that the ends lie perfectly close together. Remember that the less brass you get between joint the stronger it will be. Now for heating your braze: this can be done in many different ways—best by a gas 'injector' blowpipe on charcoal. I find no perceptible difference in the quality of the steel afterwards, though it is said to do steel no good to use gas upon it. Another way is to use a foot blower or small bellows. Get four bricks or pieces of stone or iron, and arrange them thus. Lay two sides down on an iron plate with a space about 3 in. between them. Now lay your saw upon these two with the joint you wish to braze stretching across the space. Put the other bricks upon the saw to keep it in position, and pack charcoal round joint and blow till brass runs; gently draw saw tight, and let cool, take out and scarf down joint. Some recommend scarfing first, but I prefer doing it after brazing, as you stand a chance of getting a thin joint if done previously, and it slips ever so little. By this means you will soften but a very small length of saw beyond the actual braze if you are careful, and it will stand as long as any part of the saw."

Band Saws.—F. C. (*Leytonstone, E.*) writes:—"In reply to S. B. (*Nottingham*) *re* band saws (see page 526) I should think the cause of breaking after cutting through the wood would be contraction in cooling. The friction of cutting makes the saw hot, it lengthens, and the spring tightens it. After cutting it cools and contracts, but the saw breaks, as it is not strong enough to stand the resistance of the spring."

Copying Music.—See page 510. — A number of copies can be done from one copy by means of the autocopyist. The best of these apparatus is made by Fordham & Co., of London.

Fretwork Picture Frame.—W. B. (*Wigan*) writes in reply to AMATEUR (*Belfast*), (see page 510 'Shop'):—"I can inform AMATEUR where he can procure a very elaborate design for a fretwork picture frame, if he wishes to purchase one, size 18½ in. by 22 in., which can be enlarged if desired; price 9d., from J. A. Lambert, Bank Buildings, Carnforth; design No. F 47. I am making the frame now, so thought it might fall in with AMATEUR's wishes."

Straightening Wire.—W. J. W. (*Whetstone*) writes:—"In answer to query of G. C. in No. 27 of WORK, if he does not wish to go to the expense of a set of rollers, the enclosed sketch is a simple method of straightening wire, and can be made in a few moments. All that is required is a piece of mahogany or oak, 12 in. long by 6 in. wide, and about an inch thick, two staples (the exact width



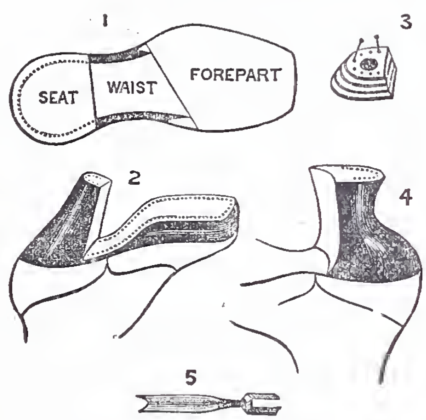
Wire Straightener.

of wire to be straightened) and some French nails, the staples to hold two pieces of wire, as per sketch. A staple is then fixed in each end of the board, and a piece of wire stretched between them and fixed at each end. This is a fixture (the wire to be straightened runs along the top of this). The nails can now be fixed each side of the fixed wire alternately, the board screwed to bench, and it is complete.

Attachment of Seams in Waterproof.—C. S. B. (*Hoxton*), see page 526, writes in reply to A CONSTANT READER:—"This is simply done by means of a solution of india rubber cuttings in naphtha or bisulphide of carbon. You can obtain it ready for use at any rubber dealers, if a small quantity only is required, cheaper than making it yourself."

Aquarium.—W. H. D. (*Bromley-by-Bow*).—See No. 31 of WORK. Alter measurements, and discard such details as you do not require.—C. M. W.

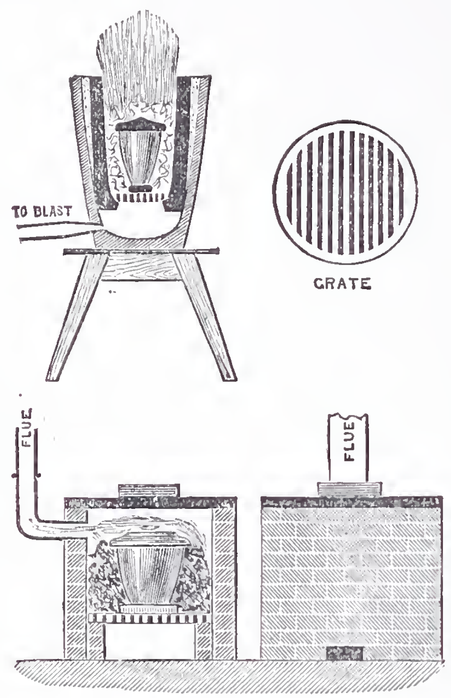
Cork Heel, etc.—H. G. (*Bishopsgate*) writes in reply to J. R., see page 526:—"J. R. does not state what description of boot he wants heel for. If it is for a person with a deformed foot, it would have to be made in proportion to the substance of the sole. If he is not in the trade, he will find it very difficult to make. I will give him the idea. Fig. 1 shows the sole, the dotted lines where the heel is to be built; the first lift should be the same size as the seat, and each succeeding lift should run gradually smaller. Supposing Fig. 2 is the heel desired, which is for a person with one foot shorter than the other—we will say shorter by 3 inches—then the heel would have to be built that height, that is 3 inches. By looking at the diagram you will see the



Cork Heel, etc.

shape required. Put on one split lift only. Fig. 3 shows 4 lifts in position, and the way the nails should be driven in. The breast of the heel should be slanted towards the forepart in proportion to the height. Should the heel be wanted light, punch through the lifts after the heel is built with a half round chisel (Fig. 5) and fill in with cork. Fig. 4 is a Wurtemberg heel. If you are to make the heel on wood lasts, put the first two lifts on with ⅝ pegs, next 4 lifts with inch heel-screws. Should the lifts be stout put three on with inch, and so on. Explain in next number what you mean by the draught of shank irons."

A Small Furnace.—H. B. S. (*Liverpool*) writes in reply to G. T. M. (*Liverpool*) (see page 253), and D. C. (*Huddersfield*) (see page 476):—"You wish to have a small furnace to melt iron and steel. If you can afford it, one of Fletcher's injector furnaces would be the best thing you could use, as it requires no fixing, would stand on any table on an iron plate, and is connected to a gas bracket; the fuel is gas, and air is blown into it by means of a foot-blower giving constant blast. The cost of small size is 11s. 6d. for furnace and 21s. for foot blower. But supposing you want to make your own furnace, there are two plans open to you. 1st, with draft; 2nd, with blast. 1st, with draft, you will require a cellar or outhouse of some kind to build your furnace, as it is not removable, and likewise you must have some means of putting up a long flue, and carrying it into the open air; your furnace will be one similar to those used by brass founders, only need not be sunk into the ground. You have not given me the amount of metal you want to melt, so that I cannot give you sizes; but you can, perhaps, make your own sizes. Build the furnace of fireclay bricks, and perfectly square is a good shape. Leave one brick out at the bottom for draft hole. Cement the bricks together with fireclay instead of mortar, build up a little inside the furnace on opposite sides only, to support the grate. The grate may simply rest on this. It should be a square grate and of strong make to withstand the heat. The flue will have to be of wrought iron for some distance up, but sheet iron will do for the most of it. The flue must be long enough to get up sufficient draft for a white heat. The top of the furnace may be made of a fireclay tile made in one piece with a square hole in the centre large enough to put in and take



A Small Furnace.

out the crucible, and through this hole the fuel is put, the hole must be covered with a fire clay tile when working. 2nd, with blast, get a brass-founder's pot of plumbago, to hold, we will say, 80 lb. of metal, and a smaller pot that will fit inside the large one, and rest within 2 in. of the bottom; these will cost about 10s. Drill a taper hole in the side of the larger pot just at the bottom, 1 in. at outside, and about ¾ in. inside (it is easily drilled with ordinary bits). Take the small pot, and knock the bottom out gently with hammer and chisel, leaving a rim about ½ in. wide all round; get a strong iron grate, such as are used for sewers, to fit the bottom, and rest on the rim. Place the small pot inside the larger one, and pour sand in between. Rest them on a stool covered with an iron plate or stone. All you want now is the bellows, which may be one of Fletcher's, a blacksmith's bellows, or a fan machine as figured in 'Shop' three or four times, and a nozzle tapered to fit the hole. By this arrangement the outer pot may last for ever practically, the inner one will require replacing now and again. I have used a furnace similar to the one last described, and I found that with sufficient draft, I could melt the fireclay crucibles easily. Plumbago crucibles are best, and one of the latter furnaces will melt 4 or 5 lbs. of metal at a time. Put a small fireclay tile on the bars to rest the crucible on, or it will be cooled down by the blast, and ironfounder's coke is the best to use. The latter is the better furnace, as you can get almost any heat by increasing the blast; besides, it is portable, and requires no chimney."

Band Saws.—F. C. (*Leytonstone*) wishes to add to his reply to S. B. (*Nottingham*) in page 621:—"I should judge your machine is of bad construction, saws of inferior quality, and your speed very limited, as your saws break so quickly. Have you an appliance for canting the top wheel transversely? Saws may be tight on the back or on the tooth edge, when the strain will be greatest on the tight edge. Cant the wheel if possible so as to get equal strain the whole width of saw. This is a very important point in the working of band saws. I hope remarks on band saws, which may reach your eye before this appears in 'Shop' will be useful to you and many others of our readers."

Trade Notes and Memoranda.

ONE of the most popular features of the meeting of the British Association was Mr. Baker's description of the Forth Bridge, a triumph of engineering skill, before which the Eiffel Tower almost sinks into insignificance. As a measure of its strength, Mr. Baker mentioned that six of the largest ironclads yet built, weighing each from 12,000 to 14,000 tons, might be safely suspended from its six great cantilevers, while the size of its spans is so great that two Eiffel Towers laid horizontally and joined together at the centre would just span one of its openings. This great work, we may add, is now complete.

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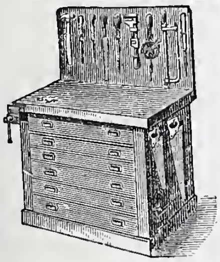

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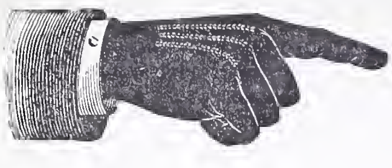

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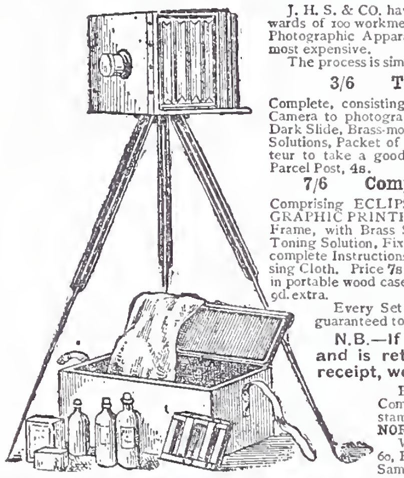

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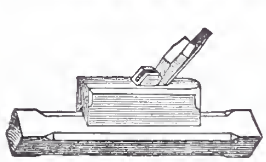

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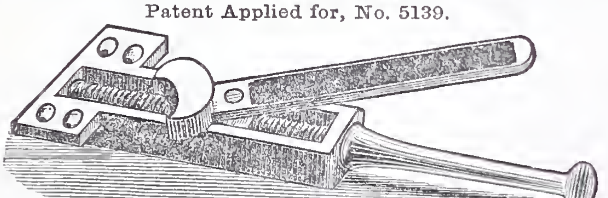

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 40.] SATURDAY, DECEMBER 21, 1889. [PRICE ONE PENNY.

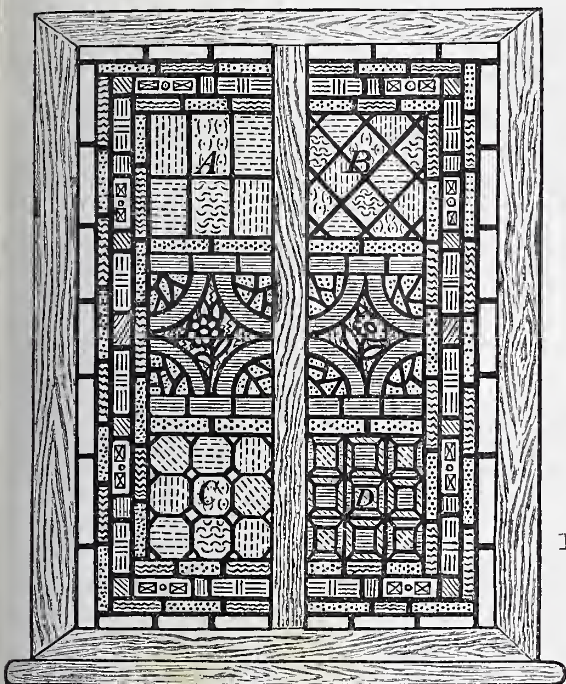


Fig. 1.

Fig. 2.

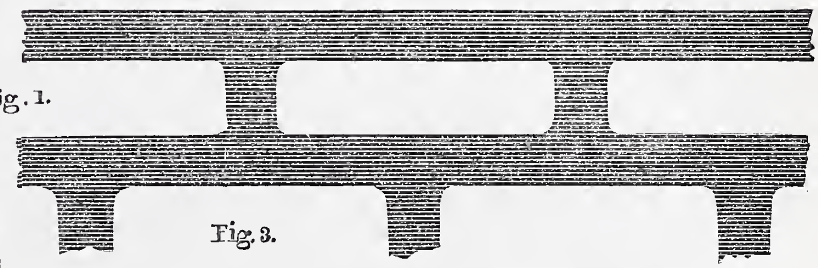


Fig. 3.

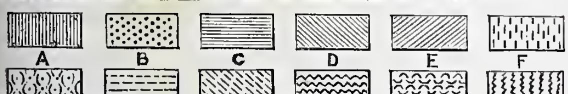


Fig. 1A.

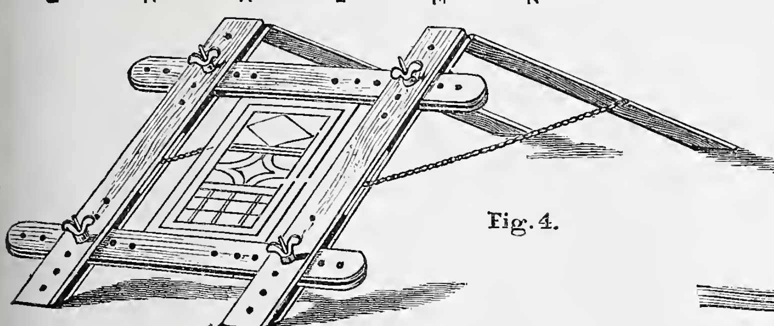


Fig. 4.

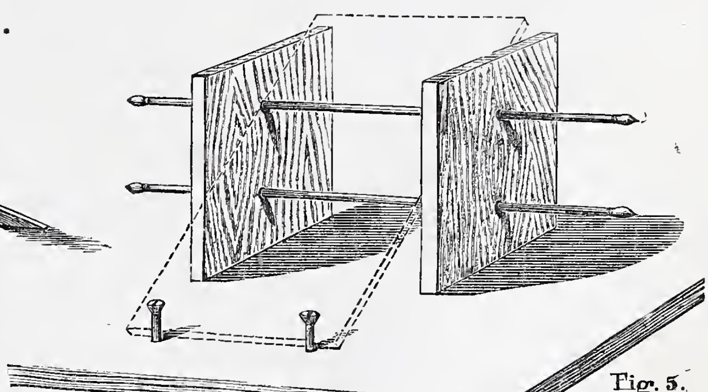


Fig. 5.

Fig. 1.—Design for Window, exhibiting Alternative Patterns. Fig. 1 A.—Explanation of Colours to be used according to Markings in Figs. 1 and 5—A, Scarlet; B, Yellow; C, Peacock Blue; D, Green; E, Purple; F, Pale Pink; G, Pale Yellow; H, Pale Blue; K, Pale Green; L, Light Brown; M, Pale Brown Tint. Fig. 2.—Design for Over-Light. Fig. 3.—Mode of Painting Broad Lines of Division between Colours. Fig. 4.—Easel. Fig. 5.—Substitute for Easel.

SILICINE GLASS PAINTING.

HOW TO PAINT A WINDOW IN IMITATION OF STAINED GLASS.

BY F. B.

MANY of the readers of WORK are, no doubt, acquainted with one or several of the various kinds of transparent coloured paper sheets which are now being sold for the purpose of being affixed to windows in imitation of stained glass. Some of these are highly artistic, and, if applied with taste, form a pretty decoration for windows. They are affixed without much trouble, and fairly permanent, provided proper care is used in laying them on. They are inexpensive, and answer their purpose admirably in all those cases where nothing is aimed at beyond shutting out an unpleasant view or effecting a temporary or unpretending decoration quickly, without any great expense, and without any great exertion. They will, however, scarcely satisfy those who wish to be original and to give play to their own artistic tastes and personal skill. It is to this class of readers that I will endeavour to describe briefly a method of decoration for windows, screens, etc., which was introduced some time ago as "Silicine Glass Painting," being, as the name implies, a process of actual painting. The effect is, as near as any imitation can be, that of real stained glass, but while, in the latter, the colouring matter is permanently fused with the glass by firing or baking in specially constructed kilns, in Silicine Glass Painting specially prepared paints are applied in the same manner as oil paints would be to canvas or water-colours to paper, but with the admixture of a certain vehicle, called "Silicine," which not only renders the colours perfectly transparent, thereby greatly adding to their brilliancy, but also firmly unites them with the surface of the glass.

This, in a few words, is the principle of the process. The *modus operandi* is simple enough :—

If you wish to paint a window, you will, first of all, have to choose your design. Much, of course, will depend on the situation of the window, its size, and also the degree of your aspirations.

You would, naturally, choose a very different design for a drawing-room window from that which you might think suitable for the hall or staircase. For large panes of a staircase window, a bold and heavy design would be more effective; while, in a dwarf blind of a sitting-room window, more detail might be introduced to advantage.

In the former general effect is wanted; in the latter repeated and closer inspection of the work may be anticipated. For a first trial I should recommend a simple geometrical design, to those especially who have not had a very extensive practice in the handling of the brush.

In accordance with the design, we must now decide on the kind of glass to be employed, for I may here mention that it is best to use separate sheets of glass, that can afterwards be fixed into the sash, in addition to the pane that is already there, and without disturbing the latter.

I have painted windows on the original glass in the sash, but sadly regretted having done so in each case.

Any kind of glass can be used, but I prefer to use the rough kind with a wavy surface, known as "Cathedral" glass, and I should certainly recommend the use of it, except in the case of designs with elaborate details. Cathedral glass is most effective, owing to its uneven surface, which breaks the rays of the light, whereby a remarkable amount of life is imparted to the colours, and, as it does not permit of objects behind being seen through it, the outline of the design is not disturbed by any foreign object shining through. In cases where the latter quality may be objected to—for instance, when the view into the street or garden is desired to be preserved by only partially painting the window—of course, ordinary window glass has to be used. For landscapes, flowers, or figures, painted minutely, ground glass is to be recommended. This material produces pleasing effects of great softness.

Let us assume we have chosen a geometrical design—say, something similar in character to Fig. 1—and decided on cathedral glass as the material. First of all, it is necessary to have the glass for each pane cut to the exact size, so as to fit readily into the sash. This is important, as it is difficult to cut the glass when painted without injuring the work. In cases where the existing panes are not puttied in, but held in place by means of beadings, the measurements should be taken after the beading has been removed, as the same beading will serve for fixing in the painted glass as well.

If there are more panes than one, they should be properly marked and numbered, as even panes of apparently the same size often vary just sufficiently to make an exchange disappointing. Now, having ascertained that the dimensions of our material are quite correct, we will proceed to trace the design on the glass. It is a good plan to draw the design on paper first, and to colour it in water-colours, in order to get an idea of the general effect. When the drawing on paper is ready place your glass on top of it (as indicated in the sketch of the easel used for this kind of work in Fig. 4), with the side to be painted on (that is, the side which will face the glass already in your window) downwards. Secure the paper to the glass by means of strips of gummed paper, or a drop of gum at the corners, to prevent the copy from shifting during the process of tracing. The latter is done with Indian ink and an ordinary drawing pen. If the glass has first received a coating of silicine medium very much reduced with spirits of turpentine, and the same has got quite dry, the ink will not run, as it is liable to do on glass not so prepared, especially when it has not been thoroughly cleaned. It will be noticed that the parts in Fig. 1 marked A, B, C, D, are all different. Of course it is not intended that they should be so painted, the idea being to show four different styles of easy groundwork in the same drawing. Any one of these four styles can be used throughout, or two of them in pairs; for instance, style A for the top of each pane, and style C for the bottom; or one each in reversed order, forming this figure—

A C.
C A.

When the outline is completed remove the copy, and the glass is now ready for painting.

The following colours and materials are required. They can be obtained through any respectable artists' colourman.

Colours for silicine glass painting—yellow (6d.), red (1s.), rose (6d.), blue (6d.), light brown (6d.), dark brown (6d.), black (6d.). Of rose, yellow, and black, it will be as well to get two tubes at once.

1 bottle of silicine medium (1s. 6d.).

1 bottle of silicine gloss (1s. 6d.).

1 flat camel-hair brush, in tin, 1 inch wide.

1 camel-hair mop, No. 6 or 7 size.

2 or 3 fitch hair brushes for oil colours, flat sizes, 4, 6, 10. These should be made of short hair, or what artists call "brights."

1 or 2 round fitch hair brushes (sizes 2 and 4).

2 ox-hair riggers, say, sizes 6 and 12.

1 china palette, 1 palette knife, 1 brush washer filled with turpentine.

Besides the above an easel of a peculiar construction and specially made for this kind of work, shown in Fig. 4, may be found useful, but can be dispensed with if economy is to be studied. The foregoing is all that is required for simple designs such as represented in Fig. 1. For more elaborate and minute work, a few fine red sable brushes, and a steel scraper for taking out high lights, and softening shades, would have to be added to the list, while for very large work a few large flat camel-hair or fitch hair brushes in tin would be required.

Now let us return to our work; we have left it ready for painting. We shall require good light, and should have a small table placed near a window, seating ourselves facing the same. The light must not, however, be too glaring, or it will have a bad effect on the eyes. If you have bought an easel, we will fix the glass into it, the side with the Indian ink outline downwards, and place it on the table, which should be covered with white paper or a white cloth, in such a way as to bring the glass into a desk-like slanting position. If you have no easel, a very simple rest is easily constructed by passing two stair-rods through two pieces of deal board, as shown in Fig. 5; the whole standing on the lid of a packing case, an old drawing board, or such like, two nails in front of the edge of the glass preventing it from slipping. An ordinary rest for fire-irons will form a ready-made rest for your glass, if you do not care for the stair-rod and deal board contrivance.

These preparations being completed, ascertain that the glass is scrupulously clean; if not, there is still time to give it another wipe without interfering with the outline, the latter being on the other side of the glass. Now prepare the first colour you intend to lay on (say the yellow in border of Fig. 1) by squeezing a small quantity on the palette, pour on a few drops of silicine medium, and well mix with a palette knife. This point is very important, as on it depends the general effect of your work. If the medium is used too sparingly or insufficiently united with the colours, the latter when dry present a dull and semi-opaque appearance, instead of being brilliant and perfectly transparent, as they will be when properly applied. Lay on the colour evenly and thinly with a flat fitch hair brush, taking care to completely fill the outline, especially the corners. Any little gaps left blank look very ugly, and quite spoil the effect when the work is finished. You may perhaps find at first, that by laying the colour on thinly you do not get the desired depth. If so, do not be tempted into loading the colour on, but allow the work to dry and then apply a second and even a third coat, until you get the desired depth of colour. This remark applies especially to rose and red, and as the manipulation of these two colours requires a little patience and practice, I have avoided large surfaces of deep scarlet in marking out the colours for Fig. 1. Where scarlet does appear it is produced by alternate layers of red and rose, until the desired depth is reached. The other full strength or flat colours are laid on in the same way as described above, and will offer no difficulty. Peacock blue is mixed with blue and a little yellow, purple is obtained by mixing about 10 parts of rose with 1 part of blue. I may here mention that blue is remarkably powerful, and whenever you have occasion to mix it with any other colour, you should add it little by little, or you may have to waste too much of the weaker colour in trying to counterbalance the excess of blue. Having filled in all the flat colours, we proceed to wash in the tints in the parts A, B, C, D, and also the groundwork in the centre, unless you prefer to let the flower appear on a blank ground. For producing the light shades, reduce the strength of the corresponding colours by adding more medium. For laying on these rather liquid shades a camel-hair mop is preferable. Apply as evenly and thinly as you can, and allow to dry a little, but not completely; then with the tip of your finger go over the painted surface, which should feel just a little sticky (tacky), dabbing it gently all over until every unevenness has disappeared. I need not say that this operation must be confined to one colour at the time, and that the tip of the finger must be well wiped before a fresh tint is begun.

The ground of the oblong spaces between the yellow and brown border is left blank, the thread line pattern being painted in dark brown with a fine fitch hair brush. Dark brown should be mixed with rather more medium than the other colours. At this stage the work should be left alone until it is absolutely dry. This will probably be the case in twenty-four hours, but under certain circumstances it may take two or three days. When quite dry, paint in all the lines or bars imitating leading with black, using an ox-hair rigger, but laying the colour on thick and solid, so as to be perfectly opaque when held up against the light. Special attention should be paid to this point, for it will be readily understood that leading partially transparent would be a poor imitation of the real article. The black lines may be broad and bold, and so far from disturbing the design they will add to the effect. This will soon be apparent if one half of a pane is quite finished off and compared with the other half without leading. The joints of lines should be painted without sharp angles, as shown in Fig. 3.

I may here mention that, in cases where one design is spread over a window with several panes, sash bars may be completely ignored. They will not to any extent interfere with the general effect. When the leading is absolutely dry and hard, give the whole a thin coating of silicine gloss, using a flat camel-hair brush or a large mop. The painting is now finished, and when dry is ready for glazing. The Indian ink lines can now be washed off, and the panes fixed into the sash by means of narrow beading. The painted side is of course to face the glass already in the window, so that the painting itself is really between two sheets of glass, but the latter should not touch. To prevent this, a few narrow strips of cardboard should be glued between the edges.

Fig. 2 is a design for an over-light, that could be adapted to almost any front door, giving either the number or the name of the house. In this case the outline of the figure or letters could be painted with flake white, or first with silicine black, and gold bronze enamel over it, so as to be visible also by daylight.

I shall be glad if many will be induced to try their hands at Silicine Glass Painting, and have no doubt that after having mastered the little difficulties that may present themselves at first, all will be pleased with the result of their labour and patience, and feel encouraged to attempt work of a more elaborate character. I shall be happy to answer any inquiries about Silicine Glass Painting in "Shop."

ON CAUSES OF FAILURE IN AMATEURS' AND APPRENTICES' WORK.

BY B. A. BAXTER.

In these days, when amateurs flourish and apprentices diminish in numbers, work good, bad, and indifferent is done in large quantity, and I feel sure, from a wide and long experience, that, in many things, the amateur has the advantage.

Such periodicals as this, and others, especially cater for him; so much so, that the professional worker is often able to obtain hints, helps, and often real instruction from such papers, while there are few exclusively professional papers or books that help the young apprentice who is desirous of obtaining a mastery over his work.

Beginners often—in fact, always—add to their own difficulties by indifferent performance of the previous operations.

This is an argument for carefulness in every department of work, for materials badly cut out are sure to be more trouble to make up, while the worker gains no extra result from his increased labour, and shaping the badly cut stuff may result in reducing it below the required dimensions. It would be well, therefore, if, taking one tool first, the apprentice gained a fair mastery over it before trying to succeed with another. The plane is, perhaps, the best tool for a commencement. Articles on its use have appeared in WORK, and a staff of enthusiastic helpers are always ready to give instructive replies to any definite queries.

In advising the use of the plane as the first tool to be mastered by a beginner, we are not ignoring the fact that the work must be sawn out before it can be planed, but merely suggest the advisability of getting some freedom in the use of one tool rather than endeavouring to master several tools at quite the onset. If, however, the use of the saw is first practised—as, indeed, it often is—let our young friend accept the decision of those who instruct him, and try as quickly as possible to become a good sawyer. He will be appreciated in any shop and by every workman, for a lad who saws well is all too rare.

If my young friends whom I am now addressing will try a simple experiment, they will be able to take a position which will enable them to saw truly, and, as the ability grows, they will be able to saw truly in any position and in any attitude. Let a plumb line be hung before the lamp, and the marked timber be so placed that the shadow of the plumb line coincides with the mark on the wood to be sawn. Now, if the saw is used in such a position that its shadow is a thin line falling along the mark on the timber, all is well, and the wood will be cut correctly. This method has the advantage of constantly giving an indication of the sawyer's accuracy or want of it, but it has the serious disadvantage of requiring artificial light, and supposes one light is in use. For those who work by daylight, the good old plan of trying with a square from time to time must be adopted, the only drawback being that its *sufficient* use is so tedious that it is very difficult to persuade beginners of its necessity.

A few trials made with its very frequent use, coupled with careful observation of the position of the elbow, will soon help the sawyer over the difficulty. He will find the elbow requires to be neither too close to the side of his body nor extended too far away, but must move in a path over the line marked on his timber. I have said nothing about saws and their characteristics, as "J. H." has recently given a full and correct description of these indispensable tools.

If the learner has to mark out as well as saw the wood, another source of difficulty is presented. A beginner never seems able to divide a board into a given number of equal parts. Even if he can saw on his line, he finds, after they are sawn, variations of width so considerable as to demand much reduction by planing before the pieces are reduced to uniformity of dimensions.

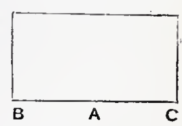
It stands to reason that, if lines, equidistant from the edges and from each other, are drawn on a board, and if the saw divides truly to the lines, that the outer strips will be a trifle wider than any of the inner ones, though the fact is often forgotten or not known. If the saw itself makes a "kerf" $\frac{1}{8}$ in. wide, the outer strips will be $\frac{1}{16}$ in. wider than the inner ones, supposing the marking and sawing both to have been done as accurately as possible. The reason is obvious on consideration. The board, being equally divided by lines, each strip may be expected to lose the thickness of the saw "kerf," except the outer strips, which only lose half that amount.

An easy way to divide a board into several pieces without calculation may not be known to the younger readers of WORK. Take your rule and decide on how many divisions you wish to make. Say the board is over 10 in. wide, and you wish to divide it into seven parts, lay the rule across at such an angle that 14 in. of the rule extend obliquely across the board, then prick off every 2 in., and you have the required division.

Never saw a little way and leave off to begin again at the other end, hoping to do better, for if you went astray before, cutting from the other end will not mend matters, whether the fault is in the workman, the material, or the saw. Even a trifling error in angle becomes a serious one when an opposite error is introduced at the other end of the same cut. The knowledge that an error in sawing is apt to increase, and that the saw-cut, though not the error, is to continue to the end, will help the beginner to endeavour to return to the line as soon as he perceives he has left it.

Some saws have a tendency to go wrong—a sort of obliquity of evil tendency; such saws are either "in-winding" through having been strained, or are badly sharpened or unevenly set. Frequently, however, amateurs cut against a nail which only touches one side of the saw, and takes therefore the set away from that side of the teeth. Have the saw sharpened as soon as possible; let not the amateur believe that saw is trustworthy after such treatment.

Passing over the planing of which we have treated, one other pitfall of beginners' handicraft is the want of system. We have often seen a beginner plane the edges of a piece of wood, having a square to guide him, and get first one angle right and then another which alters the first, or the opposite angle correct, although the sides are not parallel. Now, a beginner will never square a piece of wood in this way, but, by means of a system, he will soon be able to do it well. Let him do it in the following way, whether it is a long piece of square timber or a drawer front, or end of a packing case:



Plane edge A as correctly as possible, and mark the angles B and C square: then, if necessary, gauge the remaining side parallel to the first, but by no means alter A after you have squared either angle.

The beginner ought to remember that, as the angles of a four-sided figure added together amount to four right angles, deficiency in one angle causes redundancy in some other, and that want of parallelism in opposite sides causes variation of angle. Another golden rule is the principle of triangles. Remember that if the sides of a triangle remain unchangeable, the angles are also unchangeable. This, though so easily said, is of the greatest practical importance, and, when the learner is reminded that every four-sided figure may be regarded as two triangles, the importance of the foregoing will be seen to be much increased.

The workman who has any special line always tries to contrive some special tool or appliance that will help him. If the amateur or the beginner tries to do the same, the endeavour will be of the utmost benefit to him, and the result will be seen in increase of resource, in greater speed and facility of execution, and improvement in the quality of his work.

SMITHS' WORK.

BY J. H.

EARLY HINGES ON CHURCH DOORS—IRON GATES OF MEDIÆVAL AND MODERN TIMES.

THE study of the early hinges of our church doors is a deeply interesting one. They are a poem in iron, coming to us from times when every man did that which was right in his own eyes; times of lawless violence, times of fusion of Saxon and Norman, ages of warrior prelates, and periods of gradual settlement of races, and of growth of the arts of peace. Designed primarily to afford the greatest possible security and strength to the church doors against heathen invaders, they gradually developed, with the advent of more peaceful times, an overflowing wealth of floriated ornament. Originally rough, the work of the hammer and of the punch only, they acquired more and more finish as the file and the drill were brought into requisition.

There are no examples of Early English hinges so barbarously simple as our plain strap hinges formed of a single bar of iron clamping the door. The simplest type is that of a central strap flanked by a semicircle on each side—a crescentic form—and one which flourished during two or three centuries. There was good reason for the adoption of such a form. The church was the common sanctuary in turbulent Saxon and early Norman times; and since its doors were liable to be beaten in by insurgent hordes, the great hinges, stretching right across and covering almost the whole of the faces, sustained and strengthened the wood. Utility at the first, then, was the prime condition studied by the smith, and ornamentation was almost disregarded. The early hinges are therefore massive and rough—some of them very rough—the curves ungraceful, and the hammer marks everywhere apparent. But even then some rude scroll work or foliage was commonly formed at the termination of the straps. And this afterwards became developed into the highly ornate forms seen in the classic

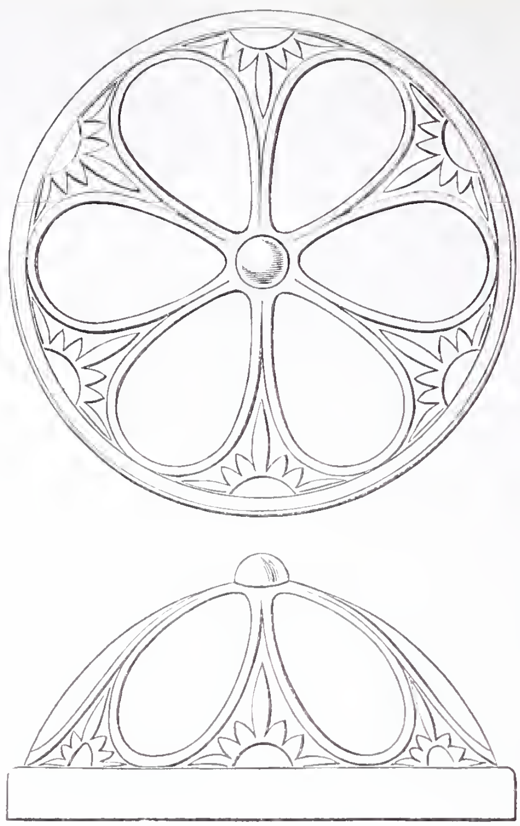


Fig. 4.—Boss on Nail Head.

English styles of the twelfth and later centuries.

It is believed that the elaborate wealth of scroll ornamentation of the classic style is a survival and evolution from an early period when the insides of the church doors were strengthened with a kind of armour plate, formed by the interlacing of bars, in the forms of scrolls and lozenge patterns. When the need for defence passed away, this wealth of ornament was transferred to the outside of the doors, often filling up and covering the whole of the space available between the hinges. An example of this elaborate ornament occurs in the cloister doors of Durham Cathedral.

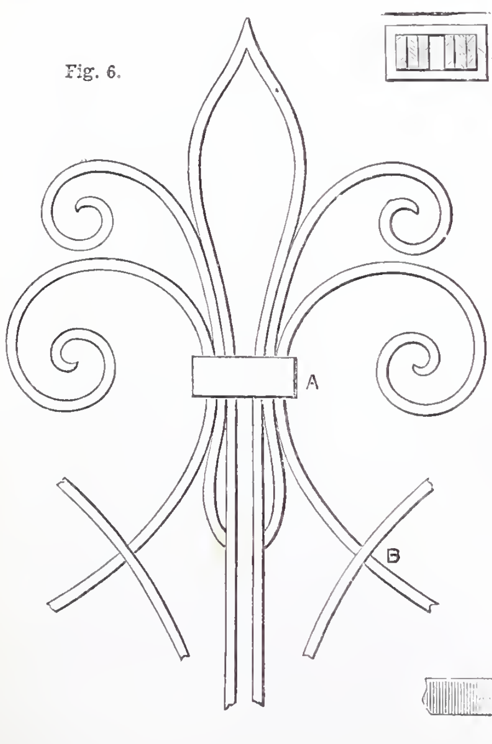
The ancient hinges were, therefore, not only beautiful but strong. Covering, as they did, the whole breadth of the door, they clamped its boards together so that there was neither any possibility of splitting the doors nor of wrenching them off their hinges.

There are three principal styles of these ancient hinges: one in which the main straps which clamp the door together are flanked by curved straps of semicircular form; another in which the flanking straps are in the form of flowing curves; and a third in which they are foliated. Examples of the first kind occur on the hall doorway of Merton College, Oxford, shown in Fig. 8; of the second on the Church of All Saints, Leighton Buzzard; and of the third at Liège. Birds, dragons, and animals appear on many of the hinges. Those of Dartmouth church are remarkable—two huge animals, lions or panthers, covering the whole breadth of the door. The idea of the artist is evidently to represent them as among the branches and foliage of a tree, and, though stiff and conventional, the effect is very striking.

The English classic type of hinge consists essentially of a central stem or strap with branching scrolls, with or without intermingled foliage. Sometimes the scrolls are suppressed, and floriated ornament predominates. The vine is the plant which in conventional forms appears chiefly. It occurs in the horse-shoe and scroll forms, was common in England and France, and excellent examples occur at Leighton Buzzard, Eton, Bray, Uffington, St. Mary's, Norwich, St. George's Chapel, Windsor, Chester Cathedral, and the Chapter House, York. By the eighteenth century the lily, the thistle, and the passion flower had nearly superseded the vine in hinge work.

From the fact that there is great similarity between the hinges of the English and of the French churches, Mr. Starkie Gardner argues that the French works were made in England and exported. It

Fig. 6.



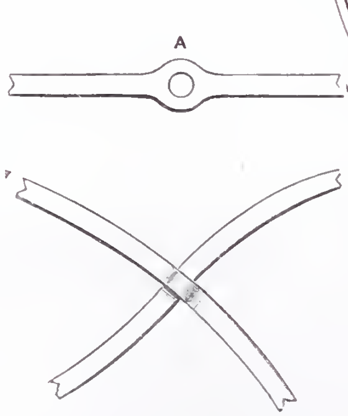


Fig. 5.

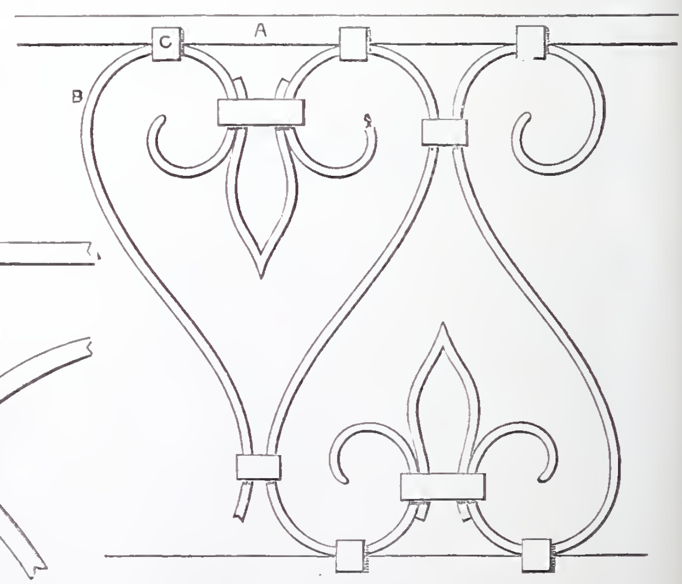


Fig. 7.

Fig. 5.—Perforated Bar—A, Perforation in Bar shown in Side View. Fig. 6.—Part of Italian Gate, Seventeenth Century—A, Section at A in Fig.; B, Indentation in Crossing Bars. Fig. 7.—Part of Italian Gate, Sixteenth Century, with Section across C.

is singular that no tradition exists of the origin of the vast hinges of Notre Dame in Paris, except that which ascribes them to the devil. If made in England, national pride might well cover their origin with oblivion.

Wyatt, however, says that the doors of Notre Dame were executed at the beginning of the thirteenth century. They are the largest in the world. In connection with these doors, Sauval, in his *Antiquités de Paris*, gives an account of Biscornette, a smith of the sixteenth century, who appears to have done some repairs to the doors of Notre Dame. He is said to have entered into a compact with the Evil One to obtain his assistance in the working of the hinges, but that when it was requisite to execute the centre door the diabolical help failed him, because through it the sacrament was wont to pass. This illustrates the wonder in which his productions were held by his contemporaries. The secret of his methods died with him, for nobody ever saw him work. Hinges similar to those of Notre Dame occur at Beauvais, Chartres, Nantes, Chalons-sur-Marne, and other towns.

It is often hard to say whether parts are drawn down out of the solid or welded. Both methods were in use, and different men would probably pursue different methods. Then there was a good deal of surface grooving, evidently done with a chisel, probably when the iron was cold or nearly so. The punch also must have been extensively used to produce the little depressions and tiny circular bosses which abound on the floriated ornament.

Examples of hinges occur all over England as well as on the Continent; few localities are without these relics of the past, and an hour may be profitably spent in a study of their details.

Fig. 8.

Fig. 9.

Fig. 8.—Upper Hinge on Door of Merton College, Oxford. The Lower Hinge being similar to the Upper Hinge, reduplication is unnecessary. Fig. 9.—Enlarged Sketch of one of the Bosses on Door.

More wonderful than the great hinges are the iron gates of mediæval and modern make. These are very abundant both in our own country and on the Continent. It is almost impossible to reproduce their lovely tracery except by photography. They must properly be seen and studied, for all description fails. The finest example in this country are the gates of the tomb of Edward IV. at Windsor, now inside St. George's Chapel, just beneath the Queen's pew, and within the altar rails. Formerly they stood without in the cloisters on the other side of the wall, and the sockets in the tombstone in the cloisters in which the gates were formerly stood are still visible, though now filled up. The work in these gates is of so elaborate and delicate a character that I am sorry not to be able to reproduce them entire as they stand.

Tenons and pins are the principal methods by which the several portions of these gates are held together. The main framework is very strong, and it is probably because of the massive character of the principal bars that cast iron has been thought to have entered into their construction. The vertical ribs are tenoned into the top rail or parapet.

Upon this strong framework the compartments and canopies with their delicate traceries are attached. These canopies are crowded with the finest and most beautiful tracery, and I cannot conceive how they were formed except by stamping or by casting. It is of course impossible to say by mere inspection of the surfaces whether these are cast or wrought. They may be either; they are very smooth, but they must have been either cast, or stamped in dies, because it would be impossible to forge them by any mere sleight of hand. Immediately behind each of these bays there is a sheet of iron of about $\frac{1}{16}$th in. thickness, and to these sheets horizontal plates are attached, and these become the backing or supports for the delicate columns and tracery. Oblong holes are punched through the sheets, and tenons from the plates pass through and are pinned upon the back side. Tenons stand out from the brackets of the pillars, and passing through the plates are secured with pins above. These details are not apparent at a casual examination from the front, but have to be searched for.

Although some gates have a much plainer appearance than others, it does not follow that the more ornate specimens necessarily demanded greater skill than the simpler ones. Even the most involved work, when we come to analyse it, becomes resolved, if we may use the term, into very simple elements. The groundwork once built up, the rest is a matter of detail; tedious it may be, but nevertheless a question of time mainly. Matters of detail are repetitive; bars, scrolls, foliage are bent, swaged, riveted, welded, and where panels are multiplied the general uniformity proves the use of templets or dies. But the smiths loved their work, and so was its tedium beguiled.

Fig. 4 represents a frequent method of ornamentation adopted. It is a boss, or nail head, from a door in the City of Toledo, and is fifteenth or sixteenth century date. It is about 4 in. in diameter. Specimens of such *repoussé* work in iron must have been very difficult to make, although it is possible that if several were made at one time, a pair of dies may have been laboriously manufactured.

A method of crossing tracery which I have observed in several instances in bars of round section is by perforation (Fig. 5). A hole is punched through one bar, into which the crossing bar is threaded. The act of punching would spread the metal, without removing any, but in some cases it would appear as though the punched bar had been slightly upset before punching to keep the cross sections on each side of the hole about equal to that of the original bar.

The crossing of bars whose edges are in the same plane is often effected by means of half lap joints. Notches are cut out of the bars, each notch to one half the width, and of the same breadth as the thickness of the bar, and these fitting into one another give the appearance as of scrolls growing out of one another (see Fig. 6, B), which is a portion of an Italian gate of the sixteenth century. Bars of circular as well as of flat section are treated in this manner, and the joints are so close that they are only discoverable by close scrutiny. In the figure, A is one of the belts so common in work of this kind.

The method of attachment of the fleur-de-lis panelling to the cross bars in Fig. 7, which is that of an Italian gate sixteenth century, is shown by the section at the top left hand corner; portions of bar are bent to pass through mortises in the bar A, and embrace that portion of the scroll work B in contact therewith.

Fig. 8 is the upper portion of the very fine hinges on the doorway of the hall of Merton College. The lower portion being nearly a duplicate of the upper part, it is omitted in the drawing.

Fig. 9 is an enlarged view of one of the floral bosses of the hinges (Fig. 8), and well illustrates the style of the work.

There are two beautiful specimens of recent smiths' work in the South Kensington Museum. They are of Prussian make, and were shown at the Paris Exhibition of 1878. They are truly magnificent specimens of workmanship. Their finish is perfect. But they are not a whit better in this respect than the gates of the tomb of Edward IV. This is saying a very great deal indeed; for we must bear in mind the vast difference in the appliances for work available at the present day in comparison with those of five or six centuries since. Moreover, the work in the gates at Windsor is very much more delicate than that in these Prussian gates. These are however beautiful specimens of which every workman or firm should well be proud. It is extremely difficult to detect the joints. The heavier parts appear to have been tenoned, and the scroll work is bound with loops or with rivets.

Park gates and railings were executed in wrought iron before the use of cast iron became common. Specimens of large and comparatively recent gates occur at the Clarendon Printing Office, Oxford, and at Hampton Court, and at several localities about London. But with these we are scarcely concerned at present.

INDIARUBBER STAMP MAKING.

BY "QUI VIVE."

Mode of Working.

Assuming that we are about to make a straight line stamp, we proceed to set up the requisite type in the composing stick. We first take a piece of thin brass rule and form it into a "setting rule" (Fig. 14, p. 593). It is best to have a set of these of the respective lengths of 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, and 4 in. from a to b in the figure, the corner c being left projecting so that the rule may be readily removed from time to time, as required. Grasping the composing stick in the left hand, the back of the hand being away from the body, we select a setting rule from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. longer on its shorter edge than the length of our intended stamp, measured in the direction of the lines, and drop it by its shorter edge into the "stick," the slide b of which is to be adjusted to the length of the rule by means of the thumb-screw, a. Holding the "stick" with the corner marked c somewhat elevated, we take the type answering to the first letter of the stamp we are about to make and insert it, face upward and with the nick or nicks which will be found on one side of the type towards the open side of the "stick," in the corner of the "stick" marked d. The type so placed is retained in its place by the thumb of the left hand while the type next required is selected and placed in position, and so on until the first word is completed, when a "space" of medium thickness is placed in the stick to separate the first word from the second, which is set up or "composed" in the same way. When all the words forming the first line have been set up we "justify" the line by inserting "quads" or "spaces" as may be required at each end of the line so that both ends of the line of type may be equi-distant from the sides of the composing stick. We now insert a "lead" of suitable length, and then removing the setting rule from its original position we place it upon the "lead" just placed, and proceed with the setting up of the next line, and so on until the entire stamp or series of stamps has been set up. If any adjustment of the spaces between the lines should be considered necessary, this may now be done by inserting additional leads or pieces of "reglet" where required. Great care must be taken to set the type upright on their "feet," as the end opposite to the face is called.

The type has now to be transferred to the "chase," which is prepared to receive it as follows. The chase is placed on an inclined plane, such as a desk lid, with the corner a (Fig. 2, p. 593) uppermost, that is, in the position occupied in the figure by the corner b. A 6-in. length of the narrow "furniture" is then laid against the left-hand side of the chase—inside, of course—followed by a similar length of "wood rule." Pieces of "furniture," "wood rule," and pica "reglet" of the same length as the setting rule we have been using are next laid in order against the bottom side of the chase. The setting rule is now placed in its first position in the composing stick and a lead placed against the line of type last set. The type, etc., are now firmly grasped between the fore-fingers and thumbs of both hands and carefully slid out of the composing stick, the remaining fingers being used to prevent the type from falling sideways out of their proper place. Still grasping the type firmly they are steadily lowered into their position in the lower corner of the chase. We next apply lengths of reglet, wood rule, and furniture similar to those already used to the unprotected sides of the type, and then proceed to fill up the vacant portion of the chase to within 1 in. or $1\frac{1}{4}$ in. of the upper side and end, taking care to so arrange matters that the type shall be as nearly as possible central in the chase. Finally, we place "side sticks," broad ends towards the lower sides and taper edges outward, against what we already have in the chase, and with a couple of suitable "quoins" to each side stick wedge the whole together slightly with the fingers. Our work must now be carefully examined to discover and rectify any mistakes which may have been hitherto overlooked, after which the "forme" of type is "planed" by placing thereon a perfectly level piece of some hard wood, such as beech, and while moving it about on the face of the type, gently striking it with a wooden mallet. Any leads or spaces which may have risen during the planing operation are now to be carefully pushed down and the "forme" firmly "locked up" by driving the quoins with the mallet, a spare side stick being used in the absence of a proper "shooting stick" for the mallet to strike upon. A little petroleum is now lightly brushed over and into the interstices of the type, and we are ready for the next operation.

We have now to prepare the mould. For this purpose we shall require a supply of the finest plaster of Paris, and of the "moulding composition" sold for the purpose by all the wholesale stamp-making firms, also a thin solution of dextrine in water. We must also provide ourselves with a "palette knife" (Fig. 11, p. 593), a jam pot or some similar article, and a flat piece of slate, with a piece of fine cambric or muslin, a little smaller than the inside of the chase in which our type has been secured. Having all our materials by us, we take a small lump of the moulding composition and knead it well on the piece of slate. This done, we take about as much plaster as we have of compo, and mix it in the jam pot with sufficient dextrine solution to form a thick cream, which must be immediately well mixed with the kneaded compo by means of the palette knife. This mixture should be moderately stiff, but not so hard as to crumble, and should be capable of being spread on the *under* surface of the moulding plate with the palette knife. This we now proceed to do, the moulding plate being turned "wrong side up" for the purpose. The layer of composition should be laid fairly level, and about $\frac{1}{8}$ in. in thickness. A little petroleum should now be applied to the bevelled faces of the moulding gauge, which should then be placed on the moulding plate and slid backward and forward over the composition until the layer of compo is rendered perfectly level and free from cracks or holes. The piece of cambric or muslin must now be laid on the face of the type, and the moulding plate with the composition on its under surface placed in position on the chase. Both chase and moulding plate are then placed in the press, and the platen lowered until a light impression, showing the general outline of the stamp, is produced. The cambric will, of course, prevent anything like a *clear* impression; but this must now be removed, the type once more oiled, and an impression taken with the naked type. This should be repeated several times, each impression being made slightly deeper than the preceding one. The entire operation should be so timed that the final impression is taken when the compo is beginning to set, but the actual time required can only be learned by experience, as it varies with the condition and mode of preparation of the materials, the temperature and dryness, or humidity of the air. Assuming our operations to have been successful, we shall now be in possession of a mould which is the exact counterpart of the type from which it was taken. This mould should now be carefully examined for errors, for although a careful examination of the forme was made before we began our moulding operations, such an error as the reversal of a type may have escaped our notice through the forme being itself reversed. Now, however, the mould shows everything right way up, and so enables us more readily to detect errors which may have escaped previous notice. Should an error be discovered another mould must be made. The mould is not yet fit for use, but must be most thoroughly dried, as any moisture remaining in it would most probably lead to its destruction during the vulcanising process. The drying must be done very gradually to prevent the splitting of the mould by the too rapid generation of steam. It is effected by placing the plate bearing the mould face upward on the brackets attached to the press, and placing a suitable gas-burner underneath; one of Fletcher's numerous patterns will be found to answer the purpose admirably. Another burner may with advantage be used to heat the press simultaneously with the drying of the mould. In order to protect the mould from dust during the drying process, it is advisable to cover it with a bent piece of sheet iron or tin. When perfectly dry—which may be tested by laying any cold polished surface in momentary contact with the mould, and observing whether or not there is any appearance of steam on it upon its removal—the irregularities of the surface, if any, are rubbed down with a file or a piece of sand paper wrapped round a flat piece of wood or cork as used by cabinet makers in smoothing their work. All dust produced in this levelling process must be carefully brushed and blown away. This done, the mould is lightly but thoroughly brushed over with a little French chalk, all traces of dust being carefully removed as before.

Our mould is now ready for the rubber. This is prepared in sheets about $\frac{1}{8}$ in. in thickness, and may be procured from the same sources as the moulding composition. Take a piece of the prepared rubber, somewhat larger than the required die, and brush it carefully on both sides with French chalk. Take also a piece of smooth tin plate about $6\frac{1}{2}$ in. by $4\frac{1}{2}$ in., and well rub it also with French chalk. The heat of the apparatus should now be looked to. The press, the platen of which should have been firmly screwed down, should be heated to about 290° F., and the moulding plate should be so hot that drops of water allowed to fall on it from the finger tips roll off without spreading or leaving any trace, but should not be hot enough to blacken a shred of the rubber compo laid thereon. Both press and moulding plate being properly heated, the platen of the press should be raised about an inch. The prepared piece of rubber is then to be laid on the mould and the smooth piece of tin plate on the rubber. Now slide the whole into the press, and as soon as the temperature, as shown by the thermometer, has fallen to 285° F., screw the platen down into gentle contact with the tin plate, and gradually increase the pressure as the rubber is felt to yield. When well pressed down leave the press untouched for from twelve to fifteen minutes, unless the temperature shows a tendency to rise, in which case extinguish the gas-burner, and complete the operation without the gas being further used. The rubber should now be removed from the mould, and will probably be found of a dark drab or slate colour, solid, and extremely elastic, showing that the operation has been successful. If, however, the rubber remains light-coloured and soft, readily retaining the impression of the finger-nail, the temperature has been too low; if black or hard, the temperature has been too high; if spongy, the pressure has been insufficient. In either case the vulcanising process must be repeated with a fresh piece of rubber, and such modifications of the process as are indicated by our previous experiment. The finished die may be washed, if necessary, with water and a moderately stiff nail-brush. It is now ready for mounting, which may be effected by the aid of a solution of shellac, such as that used for fastening down linoleum, a small addition of methylated spirit being made if the solution should be found too thick. The mounts may be procured at any of the wholesale stamp shops.

My task is now complete, and I conclude with the hope that all who attempt the manufacture of indiarubber stamps from the foregoing instructions will be as successful as I have been; they are certain to find it a fascinating occupation.

LATHES FOR EVERYBODY.

BY SELF-HELPER.

A Good Wooden Lathe for Carpenters—The Fixed Headstock, Poppet, and Hand-rest.

I will take for the subject of this second paper on lathes one which I designed, and partly constructed, for a clever carpenter of my acquaintance. He wished to have something more beautiful-looking and better finished than the somewhat crude machine I described in the first paper of this series, and I was willing to comply with his wishes. For the woodwork I recommend good seasoned mahogany, thoroughly baked, so that there will be little chance of its shrinking and warping when the machine is finished. Every part should be most carefully made, and worked at with plane, file, and sandpaper until it is as smooth and true as the finest piece of cabinet work. It should then be French-polished, which will serve the double purpose of giving it a nice finish and stopping the pores of the wood to prevent them from absorbing moisture, and thus swelling and throwing things out of truth. If mahogany is judged to be too expensive for the entire lathe, the headstocks, or at least the running headstock, might be made of it, and the rest of some less expensive wood—beech, say, or any other hard wood not prone to warp.

My friend used beech largely, and the machine is giving every satisfaction after more than two years' work.

The important thing is to have the wood quite dry, so that it will not warp, and, when finished, to French polish, or varnish, so as to stop the pores.

I will not enter here upon the various advantages and disadvantages of wood and iron as materials for lathes. It will be very evident to any one who considers the matter carefully that many people would be debarred entirely from the possession of a lathe if it had to be made of cast iron, while others of an engineering turn would find it equally difficult to make a good job of wood.

The entire efficacy of a wood-turner's lathe depends upon the truth of a few parts, and, if these are right, it matters little as to what the rest is made of.

I will be somewhat more particular in describing this lathe than I was in the first paper, both because it is a more worthy subject, and also one or two correspondents complained that, in my last, I did not enter enough into details. I will, therefore, describe in order the construction of the (1) fixed headstock, (2) the poppet, (3) the hand-rest, (4) and the stand, including fly wheel, treadle, etc. I follow this order because the first mentioned is the most difficult; and, therefore, if a man succeeds with it, he will find the rest of the work comparatively easy; while, if he finds it beyond his power, he can pitch it into the fire and get rid of the whole thing without having the mortification of breaking up the stand also. If he began with the stand, he would probably succeed in making it, and perhaps not find, until too late, that the headstock was beyond his power.

If any of my readers, however, are fairly handy with tools and persevering, there is no fear of their failing. I may say that the height of centres is 5 in. and the bed is 5 ft. long. Figs. 1 and 2 are side and end views respectively of the headstock. It consists of four pieces of wood, all truly planed to 2 in. thick. Two of the pieces are like Fig. 2; of the other two, one is 12 in. long and 5 in. wide, and one is 12 in. long and 4 in. wide. The figures show how these pieces are mortised together. The wide piece has two tenons passing into each end, and the narrow piece at right angles to that has two others, so that there are four mortises at each end, each mortise being about $\frac{3}{4}$ in. by $1\frac{3}{8}$ in. This work cannot be too carefully done, as on it depends the whole perfection of the lathe when completed.

The two long pieces which are at right

angles and form the base of the headstock should fit closely together, and be glued, and, as an additional security, I passed a couple of $\frac{1}{4}$ in. bolts from the top down, as shown in Fig. 1. I may mention, in passing, that I used engineers' bolts with hexagon heads, which were turned and burnished.

When my carpenter friend brought this job to me (for I got him to do the woodwork at home, I acting as architect and engineer), it did not please me at all.

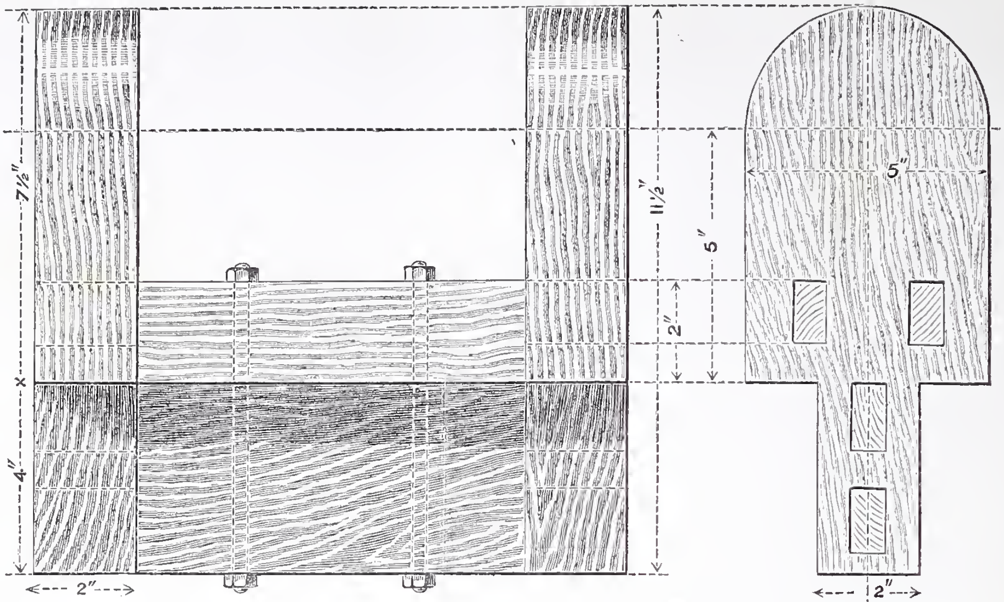


Fig. 1.—Fixed Headstock: Side View. Fig. 2.—Ditto: End View (two like this). Scale, 3 in. to 1 foot.

The tenons did not fit perfectly, as they should do, and the shoulders were in some places so far from their bedding that I could put the corner of a sheet of paper between; the whole, in fact, was not as one piece.

I accordingly, after growling a bit, sent him to the forge to get two pieces of iron made like Fig. 3. I then set him at them with a file until they were quite flat and smooth, and with the edges nicely bevelled at one side of each, so that they could be placed one at each side of the headstock. They were secured by six $\frac{3}{8}$ in. engineers' bolts. I may mention here that when the headstock was finished all but the polishing, I took the iron plates off and japanned them while the woodwork was being polished. This japanning I executed by covering the irons thickly with black japan and putting them in the kitchen stove until they were quite hard, black, and shiny. They were very satisfactory.

The holes for the bolts I drilled in the lathe, half from each side of the headstock, as it requires some care to have the plates exactly in the correct positions. Some would prefer to sink these into the wood, but I let them stand out. They are made of iron $1\frac{1}{2}$ in. by $\frac{3}{8}$ in. If the mortising of the parts of the headstock be properly done, these iron strengthening plates would be unnecessary. I mention them here lest any one should make a mess of his work and be tempted to give it up. The mortising will be of secondary importance if the plates are used.

The next part which I shall describe was most distinctly my own work. It is shown in Fig. 4, and consists of the mandrel, collar, tail screw, and its two screwed plates.

The mandrel (M) was turned from a solid piece of Bessemer steel $8\frac{3}{4}$ in. long. The dimensions are as follows:—

Nose, $\frac{3}{4}$ in. long, $\frac{3}{4}$ in. diameter, screwed Whitworth; front cone, $1\frac{3}{4}$ in. long, tapering from 1 in. to $1\frac{1}{4}$ in.; next cone $\frac{1}{2}$ in. long, tapering from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in.; body, 6 in. long, $\frac{7}{8}$ in. diameter.

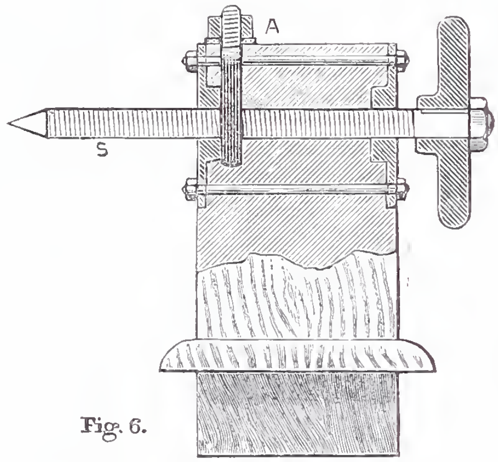
The tail screw is cast steel, 6 in. long and $\frac{3}{4}$ in. diameter.

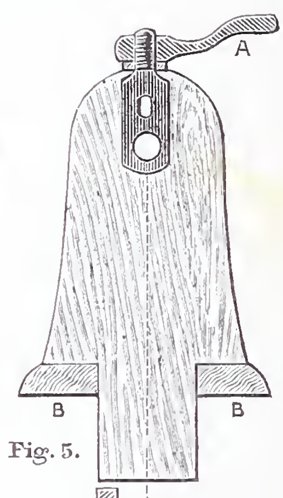
The collar (C) is made of gun-metal; the hole is coned to fit mandrel perfectly, and turned to $1\frac{3}{4}$ in. in the front parallel part, while the flange is 4 in. in circumference and $\frac{3}{8}$ in. thick.

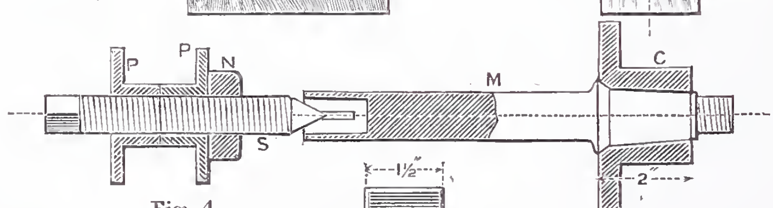
The two plates for the tail pin are also gun-metal, the flanges being 3 in. diameter by $\frac{1}{4}$ in. thick, and the body $1\frac{1}{8}$ in. bored out for $\frac{3}{4}$ in. screw. All the flanges are round, so that they could be turned in the lathe. They were also nicely finished with beer and a burnisher.

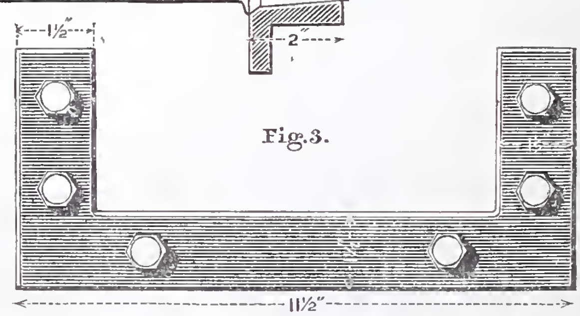
The mandrel has a piece of cast steel let into the tail end, which is hardened, and thus wears much longer than the soft Bessemer steel would. Note the small hole in the centre so that the point of the screw (S) would not wear away.

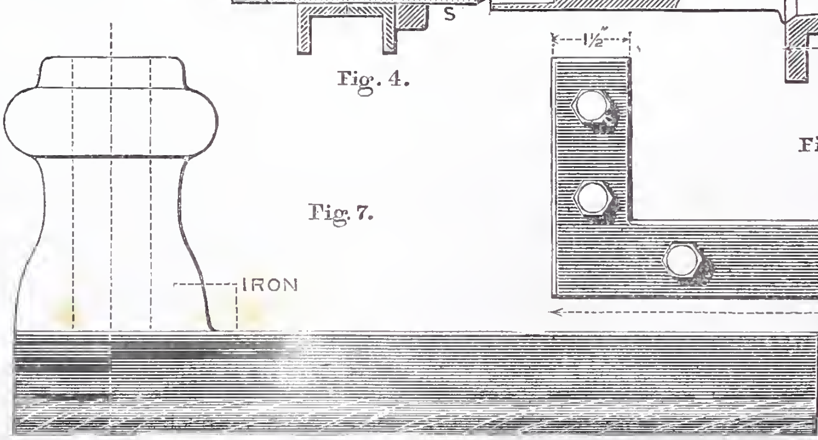
To make the mandrel, cut off a piece of steel or iron the required length, viz., $8\frac{3}{4}$ in.; then centre it truly at both ends, bore a $\frac{3}{8}$ in. hole 1 in. deep, and plug it with a piece of the best cast steel, turned, and with the centre upon which it was turned outwards. Then enlarge the











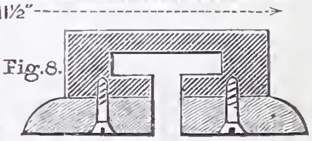


Fig. 3.—Iron Stay for each side of Headstock, $\frac{3}{8}$ in. thick. Fig. 4.—Mandrel, etc.—M, Mandrel; C, Collar; S, Tail Screw; P P, Plates; N, Lock Nut. Fig. 5.—Poppet: End View—A, Locking Handle: B B, Slip. Fig. 6.—Ditto: Front View—S, Screw. Fig. 7.—Hand-rest. Fig. 8.—Section of Hand-rest. Figs. 3, 4, 5, 6, scale, 3 in. to 1 ft. Figs. 7, 8, half full size.

ole in the cast steel until it is about in. outside and tapering to an angle of 5°. The little hole in the centre should previously have been bored about $\frac{1}{8}$ in. liameter and $\frac{3}{4}$ in. deep. The best way to aper the hole is with a rosebit made to the orrect angle and running truly in the lathe.

Next harden the centre by heating the nd of the bar to a bright cherry red and lunging into water. All that remains to lo now is to turn the mandrel to the required dimensions given above.

The casting for the collar (C) is chucked n a wooden chuck, bored out inside to fit he mandrel, and then the outside is turned while it is running on its mandrel. If there s a tendency to loosen, as there probably will be, a nut and washer could be put on he nose during most of the turning, and it will effectually prevent the collar becoming oose.

The tail screw is turned from 6 in. of in. square steel; $\frac{3}{4}$ in. is left square at one end, and the other end is tapered to 55°. The screw ought to be cut in a screwing athe.

The plates are of gun-metal, and are turned like the collar on their own screw, or they might be run on the nose of the mandrel and turned there, the screw being the same. I may mention that four of these plates will be required, two for the poppet and two for this part.

The collar is let in flush with the wood of the headstock, so that its two inches of length will bring the front end flush also with the front of the headstock.

I may mention here that the mandrel projects nearly $\frac{1}{8}$ in. beyond the collar before the shoulder is reached. This is shown plainly in Fig. 4, but it is not quite so plain that the mandrel is sunk in at the back what it projects at the front.

The pulley was made of a piece of ebony, the largest of the four speeds being 5 in. and the smallest 2 in. It was covered at each side with a plate of gun-metal 2 in. diameter, and nicely turned and polished; the speeds were each $\frac{1}{2}$ in. wide, and would take $\frac{3}{8}$ in. gut, but $\frac{1}{4}$ in. was quite enough.

The mandrel, with its collar and tail screw, might now be inserted in the headstock, but there would be a greater chance of accurate work if this were postponed until the framework is completed, which we will therefore do.

I may say that, if the mandrel and the other engineering part of the work are beyond the power of any of my readers, most engineering firms would supply them complete for a comparatively small sum. The Britannia Company, Colchester, will send an estimate on referring them to the number of Work in which this appears.

The Poppet.—This is simply a block of wood 4 in. by $3\frac{1}{2}$ in. and 9 in. long. It is shaped somewhat more beautifully than the fixed headstock, as can be seen in Fig. 5.

The screwed plates can be seen in Fig. 6, through which the long tightening screw passes, the latter 8 in. long, $\frac{3}{4}$ in. diameter, with a hand wheel keyed and nutted at one end and tapered at the other. It would be better if the bosses were turned out instead of in, as shown, and the castings need not be sunk into the wood; they are secured by a couple of $\frac{1}{4}$-in. bolts passing through both. The locking arrangement is peculiar and satisfactory. A piece of iron $1\frac{1}{2}$ in. × $\frac{3}{8}$ in. fits into a mortise cut in the poppet to receive it, as shown in both figures, and the screw passes through a thread cut in it. It is evident that the tightening of the locking handle will effectually jamb the screw. It is well to have this arrangement near one of the washers, for, if it were half way between them, it would tend to bend the screw.

Another thing to be noted is the slips shown at the shoulders. I find that an end grain never runs very well along the bed, and so I hit on the plan of having a slip at each side with its grain at right angles to that of the poppet, which makes it run smoothly.

Every part of the poppet should be most carefully finished as before, the woodwork as smooth as glass and highly polished, and the iron and brasswork burnished, the spokes of the hand wheel being japanned.

I have gone somewhat too quickly, though, in describing the poppet with metal work all complete. The position of the screw can best be found, as in the other headstock, when the frame is made. I will, therefore, suppose that the iron and woodwork are separate until then.

The Hand-rest.—It is difficult, if not impossible, to make a satisfactory hand-rest socket of wood only. I therefore got castings for the socket and T's., but an ordinary $4\frac{1}{2}$ in. socket, price about 1s. 6d., would do very well. I got the sole filed true, and the entire casting cleaned nicely. Then I bored the hole $\frac{3}{4}$ in. diameter for T's, and fitted a $\frac{1}{4}$ in. set screw, and japanned. I was afraid that the iron sole would bruise the bed, and so I fitted strips of wood $\frac{1}{2}$ in. thick to the sole, fastening them on with screws tapped into the casting. This effectually prevented any bruising taking place. The T's were turned in the shank and then filed up and japanned, the shanks and tops being left bright. One was 8 in. long and the other 4 in., the shanks being 4 in. long in each case.

Figs. 7 and 8 show the socket all except the set screw, which is partly at the side, fitting into the ring seen near the top.

In another paper I hope to describe the frame, fly wheel, treadle, and how the position of mandrel and screw are to be determined, and to give a drawing of the complete lathe.

WATCH REPAIRING.

HINTS FOR AMATEURS WITH FEW TOOLS.

Should a lever watch go too fast or slow when the regulator is at the extreme point, unscrew the cock, and unpin the spring from stud; if too slow, gently turn the collet (that part which holds hair spring to balance staff) so that the point end of spring goes $\frac{1}{4}$ of an inch, say, nearer to A from B (Fig. 1), then replace so that end of spring will be that distance also from the mark you made on plate, as stated in the cleaning of watch, in pages 517 and 583. Now repin it to stud on top plate, and replace cock, and screw down; listen now if it is in beat—your ear will be in practice now, and should be able to detect when out of beat. When I go into a friend's house and hear at once the clock out of beat, how it jars on my nerves! I must set it right before I can rest. How people can endure or not know passes my comprehension. I need scarcely tell you if the watch goes too fast; do the reverse to what I state above: turn towards B.

Should the spring be pinned in extreme length, the best plan is to unpin spring at collet—this is risky for amateurs, but try it; a new one will only cost a trifle—and with a small cork pointed just press it on the inner coil on a fine oilstone; a few rubs will reduce it, and, of course, weaken it; now repin it carefully and level; do not turn collet; now refix to stud on top plate to mark made, and screw down cock; it will now go slower and require regulating. Lever watch rubbing causes it to stop and go on again, thereby destroying its time-keeping qualities; listen to it, and you will hear a rubbing and chafing noise: this often proceeds from the one side of hair spring being set out of truth, not level all round the balance, and, of course, touching occasionally the balance in its vibrations, gives an unsteady motion and occasionally stops the balance, which in a short period, by motion of the wearer in walking, starts it again with perhaps a loss of time, several minutes. It is very annoying to the wearer. The remedy is a very easy matter. Draw out the pin and cast it away; proceed, and make a neat, carefully-pointed new one,

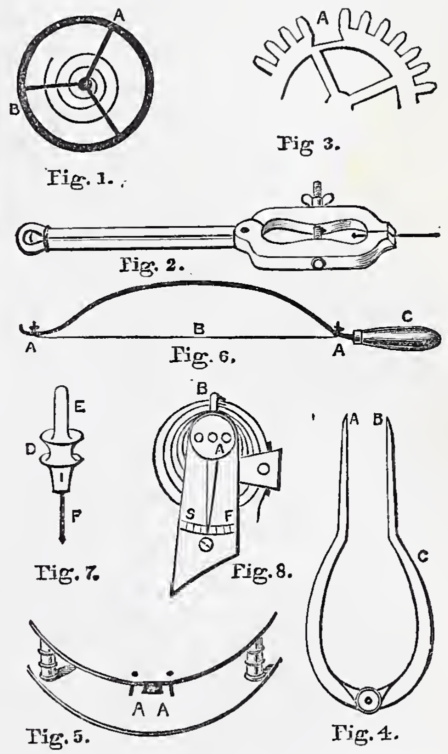


Fig. 1.—Hair Spring and Balance Staff. Fig. 2.—Pin Vice. Fig. 3.—Repairing Broken Tooth of Toothed Wheel. Fig. 4.—Tool made of Common Soft Compasses for adjusting Escape Wheel. Fig. 5.—Top Plate—A A, Banking Pins. Fig. 6.—Drill Bow—A A, Holes for Gut; B, Gut; C, Handle. Fig. 7.—Drill—D, Reel; E, Top; F, Drill. Fig. 8.—Regulator—A, Circular Part; B, Pin.

nice taper, not stunted: this is done by filing well back; see that hair spring now lies level; if it does not, when unpinned take balance and spring out, and gently draw down the side until level; when at rest, use the tweezers, not your fingers, or moisture may rust the spring. Now replace and fix with new pin, and it will be, no doubt, quite level; replace cock gently on to top pivot, screw down while the balance is vibrating, as this ensures you that the pivot is not being injured. Listen to the movement at work, and the rubbing will be gone.

Same applies to horizontal movements as well, except spring is on the top of balance; in this case it often happens that spring rubs against the cock.

Broken Ruby Pin.—This job an amateur cannot do; but take it out as described in page 583, and hand it over to the watch tool shop jeweller, who in nearly all cases does them for the trade; the charge will be reasonable, being quickly done by those accustomed to that special work.

Broken Pivots.—Do as above, because you could not make a clean job even if you had the tools, which are costly. Many who have served their apprenticeship cannot make a clean job, often a botch; so have a pivot drilled in on a new pinion, but it will require movement for the depth.

Broken Teeth.—By accident (but how often astonishes me; nevertheless it does occur) a tooth or two may be damaged or broken; this work the amateur can manage. You may not have a small vice, but the useful tool, the pin vice (Fig. 2), will hold the wheel as well. This appliance for making new pins costs 1s. 3d. and 1s. 6d., according to size. Place the damaged wheel with teeth injured to front, just clear at the mouth, and proceed with a fine-cut narrow file; cut away the damaged teeth (do not press too hard, or you may break the file), and so cut it dovetail, as at A in Fig. 3. Now take a piece of old broken wheel same size of teeth, etc., if you have such; if not, any watchmaker will oblige you with one, as we have abundance in the trade. Cut it exact size, finish neatly, and fit in; then clean both on the *underside*, being the side which will not show; now solder with blow-pipe and pure solder; do this neatly, without a heavy patch of white on the wheel. File up, and make the best job you can of it by burnishing, etc. Should you be unable to procure a piece of old wheel, take a piece of brass, hammer it well, file smooth, and then fit and solder as above. You will only have two teeth to cut, which, if care is used, will be a neat job. Be sure to burnish new teeth well, so that they run as easy as any of the others. Try the mended wheel with the wheel that runs next to it; if no stop is observable, then all is right.

Broken Chain.—Take it up and examine how neatly it is made; use your eye-glass, see that every other link is double, and then single: the single one is sure to be the one whose eye is broken; so take next single and double link joined, and file the rivet head; then place it upon hammered lead, and with a fine blunted needle tap with hammer until the rivet comes out; do same with the other link. Now you can join the two, single betwixt the double, and with a piece of fine steel wire or a softened needle, put through holes, cut off close, and rivet on smooth piece of steel; trim up neat, and no one can tell where repaired, and the odd link or two minus will be no detriment to the movement. Should a hook be broken, take chain and get a new one right size, then rivet as above. They cost 1d.; cheaper by the dozen, of course.

Bent Teeth, Hands, and Pivots.—Sometimes a tooth or two get bent, so that in trying motion of movement every turn of a certain wheel there is a sort of brake power on. Notice wheel in its revolution: at what part, make a dot with ink; now take out wheel and see it at that place with eye-glass. You will find a tooth or two bent; such is often the case with present make of watches. Not so old verge watches; the wheels in last century were made of metal that had been used for years in smelting fat, etc. So careful were our forefathers that this metal was also well hammered before using it; and then, as you find in old verges, the wheels are firm and good, neither easily bent or broken. The verge is the best made watch; yet, except its escapement, some even have such a preference, they have them converted to levers; and they are worth it if of nice shape, and not damaged by careless usage. Wheels are cast and cut by machinery with such rapidity that it would astonish old watchmakers long since at rest.

To set the teeth perpendicular pass a thin knife blade to the root of adjoining sound tooth, and gently raise the faulty one, and so on with the next, until all are perfect; now replace, and try it; if all runs sweetly, the job is complete.

Bent pivot — not often so, except escape wheel or balance. This is done by carelessly trying to force the watch to go, using anything handy, pin, nail, or pencil, thereby casting balance or escape wheel out of truth; the horizontal is generally the sort injured; the balance has a *wobble;* when in motion take it out, and with the tweezers very carefully raise it to the perpendicular position it ought to have; now try it thus. There is a tool for the purpose, but an amateur need not go to the expense; buy a pair of common compasses, such as schoolboys use, costing 1d. or 2d. per pair; they are soft, so will bend any shape; make them the shape shown in Fig. 4, and at A and B dint or drill a hole slightly at the inside, *exactly* opposite; now place in the cylinder pivots of balance, and just close so as not to press too tight, but sufficient to keep it from dropping out; now at C, to nearly touch the rim of balance, hold a small neat piece of wire, and see, when turning balance around, which part of rim comes nearest; mark that place and take it out, and bend the pivot at that side (under or top as the case may be) from the marked part. Now try it, and if rim nearly touches alike all round, the trouble is removed; replace it in the movement, and it will run even now. Before injury, always remember in bending a pivot to do slightly once or twice instead of too much at once, it will save a breakage and expense.

In the trade we use a small piece of brass with a hole drilled to fit the pivot, and by holding this in small pliers, and raising pivot, no injury is done to the smooth surface, but with care the tweezers will do.

Bent hands you can rectify with the tweezers, and a good eye for straight lines; if it is the seconds hand which may not be level on the barrel part, raise or lower the side as the case may be; this often stops a watch; by touching the dial at one side also causes it to go inaccurately. Sometimes, in fact, nearly always, the pivot is bent upon which the barrel of seconds hand goes; straighten it as previously stated.

Should a pivot hole be worn egg-shape or too large, rind it out a little larger, then procure at the watch material and tool shop ready-prepared bushes, pivot-drilled; fit in, cut off even, and gently tap with small hammer until level and neat; pass the point of fine needle in the bush hole to free it from any irregularity.

Broken Main Spring.—Should the spring be only broken at the outer coil, in or near say to $\frac{3}{4}$ of an inch of the hole, you can use such spring again; hold the end in small gas flame to temper equal, for say 1 to $1\frac{1}{2}$ in. up it, then punch or drill a hole to fit the pin inside spring barrel; we use a special spring punch in the trade, but an amateur's time is not of that value, and he need not go to the expense; dress up round the damaged end neatly and workmanlike, and fit in as previously described; should it require a new spring by being broke at the inner coil, which is generally the case, take it to the tool shop, and get one same strength, width, etc., and when in the barrel, if it more than half fills it, you will have to take it out; break off the quantity you consider will fit; don't take off too much, or it will not work the thirty hours; so also if too large it has not room to expand; surest way is to notice the old one before removing drill-hole, and fit as above stated.

Some amateurs might desire to go to the expense of a spring winder; it has a nose-piece similar to the centre piece, holding inner coil of spring, called the barrel arbor; this rotates by turning a handle, and so winds up spring small enough to drop into the barrel; when it catches the outer hook it is done quickly, and the spring is not injured as in the other plan.

Broken Square.—To set hands with, take off the dial and dial wheels; pass it out from dial side; being, of course, a horizontal or Swiss lever, the inside centre wheel will not be disturbed; that you must already know, if you have cleaned one; then take old part and movement to procure one same size; it will cost you a mere trifle; press it in, using the small steel washer again; then fix on dial wheels and dial; the minute hand may not quite fit; file end a little or rind the hand; it cannot be far from fitting; refix in case, and the job is complete.

Should a lever watch have too large a swing—in fact, if an American one—it will overturn, being so powerful, and having club-shaped scape teeth, so stop the movement; to remedy, draw the two banking pins a little nearer so that the pallets are not in full play; do not close them too much or you go to the other extreme—just the merest shade; if the swing is greater when movement is in a horizontal position, the ruby pin must touch.

In watch or clock repairing a drill is very useful, and the bow, though old-fashioned, is the best; the archimedean drill is not so good; amateurs can easily fit up a cheap drilling apparatus. Procure a stout piece of wire 15 or 18 in. long, shaped as in Fig. 6, and drill or punch holes at A and B; fix in a first violin string, and fit on handle at C, costing 1d. or $1\frac{1}{2}$d.; bow is complete. Now take a small empty silk reel, plug a piece of hard wood, E, as per sketch, through hole in D, and drive a strong sewing needle, shaped at point as a drill; you may do this neat with your eye-glass; you can fit up three or four various sizes for watches and clocks. For the holder and presser left hand, take a square of wood (hard), $1\frac{1}{2}$ by 3 in., 1 in. thick; dent a small hollow in the middle for E to work in when drilling; now wrap bow string once round D, and place top square of wood on; gently press while drilling; it is a mistake *to press too hard*—you may break the best of drill-points thus; you will be fit up at a small cost.

Broken Click or Ratchet.—At winding-up part take it out; have a new one, do not tinker with the old one by repointing, etc.; a new one costs so little; it is best plan to get same size, and you can easily fix it on.

Lost dial wheel is a very awkward job, so is a damaged dial, but care will remedy both, even by an amateur. Take off dial and procure a wheel to fit, as all sizes are kept; with patience this can be got over. There are two points to study, this wheel doing double duty.

For a new dial take old one, and from the stock on hand, if you can fit it; it will only cost 1s.; if a new dial specially made, 3s. Notice if centre hole and seconds hole are correct, and outer circumference feet; of course you cannot expect to be right, so drill two holes in plate for them. For appearance to a watch, a new dial is worth cost and trouble; many a good lever looks ıltry with chipped or cracked dial; new al in retail shop is 7s. 6d. to 10s. Of ourse, time in fitting, but charges are eavy. If a silver or gilt dial, being only fit on surface plate, it is an easier job, as ıey are only pressed on to old frame; it is ardly worth while regilding or silvering, ıey never look so well as new, the figures re botchy.

Broken Regulator in Part.—Holding last oil of spring, unscrew the two small screws olding circular part on (but previously ake cock off, or you may slip and break alance) at A, Fig. 8, and file top head of roken pin at B, for it will be that which is ıjured; then draw it out and make a new ne; rivet it in at top, having it fixed in nall pin vice; sometimes, but very rarely, ıe index point is broken by someone not t to handle a watch; if so, get a new one t tool shop to fit cock, very reasonable in rice. This completes what I think an mateur is capable of doing.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

111.—New Patent Extending Clothes Prop.

This is another speciality of Messrs. W. B. Fordham & Sons, Limited, an illustration of which is given in Fig. 1. It consists of two pieces of wood about 6 ft. long, 2 in. wide, and 1 in. thick, one end of one piece being cut into a point so as to enter and hold in the ground when in use, and one end of the other in a notch to receive the clothes line. The two pieces slide one on the other in zinc bends, and may be extended from 6 ft. to any length, by 6 in. up to 11 ft. When drawn out to the desired length the pieces are fixed by means of a peg, which passes through holes bored in each slip, 6 in. apart. The material of which the prop is made is white deal. It occupies but little room, and may be put away in any spare corner. When not in use it may be taken apart and the two slips laid on the back of two chairs, thus making up a handy drying horse. The props are sold at 9s. per dozen.

Fig. 1.—New Extending Clothes Prop.

112.—Economy and Advantages of Gas.

Any one who is interested in the subject of heating and cooking by gas, will do well to send to Messrs. Thomas Fletcher and Co., Thyrma Street, Warrington, for a small pamphlet written by Mr. Fletcher himself, and entitled, "Economy and other Advantages of Gas as a Fuel for General Domestic Use." It proves very clearly the value of gas as a heating medium, and supplies illustrations of all kinds of appliances used in warming, cooking, laundry work of all kinds, and apparatus for coffee roasting at home, heating water for baths, and many appliances used in mechanical arts and trades. Much useful information may be gathered from its pages.

Several of our readers engaged in soldering, who have from time to time inquired for heating apparatuses, might turn their thoughts more towards gas. THE EDITOR.

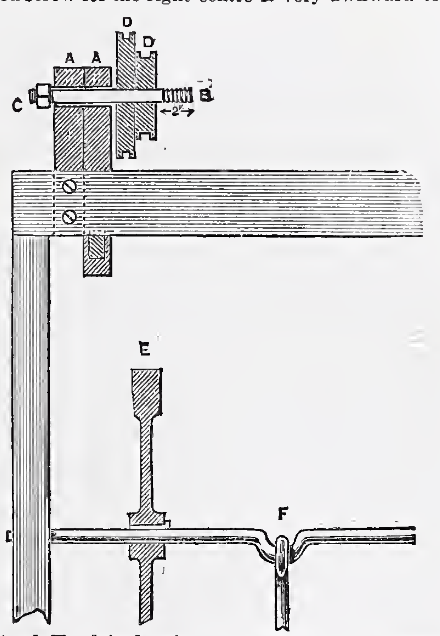
SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Lathe Making.—Bernardo writes:—"I and a friend of mine have constructed a lathe with arrangements very similar to that one previously illustrated and described in Work. Instead of using a grindstone we use an iron fly-wheel and crank shaft with treadle. The mandrel is of steel with a thread cut on it for 2 in. at right end and 1 in. at the left end. On the mandrel a pulley with two grooves is fixed by driving in wooden keys, flats having first been filed on the mandrel. A nut is placed on the left end of the mandrel. This is the only thing to keep the mandrel in its place. Can you suggest a means of preventing the mandrel moving endways to the right without causing much friction? We put an iron washer between the pulleys and the fixed headstock, but this causes a good deal of friction. The length of brass tube encasing the mandrel and forming its bearing is five inches. Is this too long, for the bearing gets very warm when the lathe has been going for five minutes at 650 revolutions a minute? We drilled two holes from the top of the headstock down to the brass tube, and then drilled a small hole through the brass tube for oiling. Would it be advisable to file a channel in the upper part of the inside of the brass tube so that the oil could flow all along the top of the bearing? Is 650 revolutions per minute a sufficiently high speed? Can you give me any guide for speed for different kinds of wood and metal? Is it advisable to harden the nose of the mandrel (I mean the right-hand end) so that it may cut a thread for itself in a wooden chuck, and if so how must it be hardened, and how must the end of the thread he finished so as best to cut its way into the wood for the chuck? I find the bed screw for the right centre is very awkward to



Fixed Headstock, etc., of Lathe—A A, Oil holes drilled to Mandrel; B, Mandrel; C, Nut; D D, Wood Pulleys fixed on Mandrel; E, Fly Wheel; F, Crank.

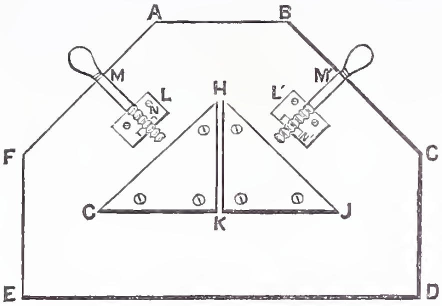
get to correspond to the centre of the mandrel, and that if it is correct when just the point is out, when screwed out an inch or so it is wrong again. I suppose I am in fault for not having drilled the hole for the bed screw straight, but I tried several times, having plugged the previous holes with a pin of wood. Could you suggest a simple and cheap easily-constructed centre, where the point itself might slide in a bearing, and be only pushed, not directed, by the screw? These are all the questions I am going to ask you. I expect you will exclaim 'I should just think they were enough.' I hope I shall not have trespassed too much on your valuable time and space, but having had no previous experience at this sort of work, save a little turning on lathes driven from shafting, I am rather at a loss in the above matters."—[To the above questions put by Bernardo the following reply is given by F. A. M.:—"You and your friend have exercised considerable originality, and, though I must find fault with your arrangement, do not on that account be discouraged, since you may learn more from a mistake sometimes than from a success. You have taken your ideas chiefly from the lathe described on page 261, which is called a 'dead-centre' lathe, because both centres are still, or 'dead,' whilst the work revolves upon and between those centres. Now the dead-centre lathe is by far the easiest of construction, and it is very good for one kind of work, viz., that kind which is turned between centres, such as tool handles, spindles, as of watches, little shafts, etc., but you have evidently perceived that it is unsuitable for what is called 'chuck work'—that is, hollow and other work turned without the support of the backcentre; *en l'air*, as the French turners call it, because it turns in the air with no support but the chuck which holds it. Therefore, instead of bringing the mandrel to a point, fixing it firmly in the head, and allowing the pulley to turn upon it, as advised by Self-Helper, you have screwed the end of the mandrel, fixed the pulley upon it, bushed the headstock with brass, and arranged a kind of running centre, or ordinary lathe, of bad form. Having gone so far, you should have gone further still by separating the two blocks of which your headstock is made, and fitting the pulley between them, to avoid the unnecessary overhang of your nose-screw. No wonder your mandrel moves endways. You want a turned collar between the pulley (as you have it) and the brass bush, then at the other end a second nut to lock with the other, and between these and the back end of the bush a washer fitted on a feather so as to turn with the mandrel. I would cut away all the middle part of your 5 in. length of bush, and have only 1 in. at each end. I fear, however, it will be difficult for you to make a good job this way. It would have been easier to make a back-centre headstock. You are 'falling between two stools,' as the saying is. 650 revolutions per minute is fast enough for large work in wood, but rather slow for chessmen, handles, etc. The speed must be reckoned according to the diameter of the work. Have mandrel pulley $\frac{1}{8}$ or $\frac{1}{10}$ the diameter of largest speed on fly-wheel for wood turning. Speeds for turning a 1 in. bar in brass, 450 revolutions; cast-iron, 140; wrought iron, 130; steel, 70. You ask whether it would be a good plan to harden the mandrel nose and form it like a tap so that it might cut its way into wood chucks. Rather startling! Still, if the nose were quite small, say, half an inch diameter, it might be possible, especially if you make it 2 in. long. The usual length would be $\frac{5}{8}$ in. However, you might try it 1 in. long with that object, and file 3 deep grooves in the end with a round file, the grooves to extend $\frac{3}{4}$ in. so as to leave $\frac{1}{4}$ in. of full threads; then harden only the end, as far as the grooves extend. When fitting a chuck, stop when it is screwed up as far as the grooves on the nose, and use a narrow chisel to true up that part of the chuck which comes up against the shoulder of the nose-screw. You seem to have no shoulder to screw the chucks up to. This shoulder is essential; it is called the face of the mandrel, and the part of the chuck which comes up to it the face of the chuck. As to the alignment of the headstocks read my paper on 'How to Test a Lathe' on page 50."—F. A. M.]

Purchasing Timber.—A. R. (*Scorrier Saw Mills*) writes:—"I was pleased with some remarks in No. 33, page 522, of Work, by A. J. H. on the purchasing of timber. I hope A. J. H. will excuse me for correcting an error made in reference to 3 in. deals. A. J. H. said if you want 12 ft. 1 in. by 9 in., ask for 12 ft. 3 in. by 9 in. with 2 equal cuts. Deals are generally cut in deal frame, the saws wasting from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. full. This means in 2 cuts $\frac{1}{4}$ in. full waste of timber, therefore each plank or board would be but $\frac{7}{8}$ in. full, and 5 cuts in a 3 in. deal. Instead of there being six $\frac{1}{2}$ in. plank there would be six $\frac{3}{8}$ in. full. Often tradesmen come into the yard, and want four $\frac{3}{4}$ in. boards from a 3 in. deal. It's absurd. If it was possible to cut the deal with saws not stouter than a cobweb, there would be some waste. Such men, I think, leave their thinking caps at home—that is, if they have any to leave."

Folding Stove and Oven.—Dealer (*Leeds*) writes:—"As a common-sense reader, I wish to make a few remarks in reference to Mr. James Scott's folding combined cooking stove and oven. I certainly agree with the construction and dimensions of it, but my experience leads me to think it would be better made of light sheet iron and done over with Brunswick black or some other preparation, instead of made of tin, as the heat would disfigure its appearance, especially if it is to be carried about as Mr. Scott says. And, as for the brackets, I should think they would be much better riveted on instead of soldered on, because where there is heat enough to cook anything there is heat enough to melt the solder off, and they would be an everlasting trouble."

Brazing Band Saw.—A. X. E. (*Nottingham*) writes in reply to G. (*Salop*), page 396, No. 25:—"I may say I braze about four or five a week on an average with a machine by Duncan & Mills, of Oldham, who deal in a variety of setting and sharpening machines for hand saws, etc. I have used it for about two months now, and never had one bad joint. Mr. Duncan himself taught me how to use it; he travels with the machines and teaches all purchasers. The price of a brazing machine I may say is under 30s., and I can braze one joint in half an hour, more or less."

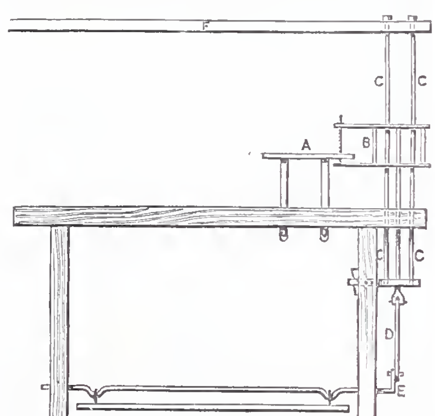
Combined Mitre Block and Corner Cramp.—KILDONAN writes:—"The following makes no pretence of being anything else than a 'means to an end,' and experienced craftsmen are respectfully requested to shut their eyes if they are inclined to be critical. Having some pictures to frame, and having neither a vice nor corner cramp to aid me, I hit upon the expedient now humbly offered. By its help I have



Combined Mitre Block and Cramp.

been enabled to mitre my corners perfectly, and the most expensive and complicated tool can do no more. A B C D E F is a piece of well-seasoned beech or other hard wood, about 1 in. thick. This forms the base of the block. G H J is a triangular piece of similar hard wood screwed firmly to the base by stout screws. The angle, G H J, is a perfect right angle. H K is a saw kerf perpendicular to G J, and bisecting the angle, G H J. It is evident that a piece of moulding laid along H G, while the saw runs in the kerf, H K, will make a perfect joint with another piece laid along H J, and sawn in the same way. Getting hold of two half-inch bolts, M and M', with nuts an inch square, while the length of the screw thread just allowed an inch of play, I sunk the nuts, N and N', into the two short pieces of hard wood, L and L', through which holes are bored to allow the bolts through. L and L' are then firmly attached to the base at a convenient distance from and perfectly parallel to the sides of the block, H G and H J. The diagram is not drawn to scale. Every man can suit the dimensions to his means and requirements. My own block is not even planed, the essential points being accuracy in the angles and edges. If, as in my case, the screws are short, and narrow mouldings to be joined, blocks of wood can be placed between them and the screws. Having applied the glue, bring the corners carefully together, screw up tight, drive in a nail at each side, and your corner is complete."

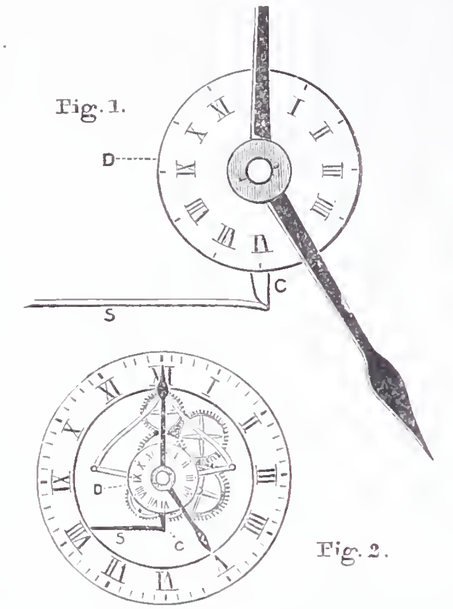
Fret Saw.—A. A. (*Coventry*) writes:—"It appears to me that ARTIST IN WOOD and W. R. S. have taken great pains to give us methods of fitting up saws for fret cutting that will not work. For instance, what gives the up stroke in ARTIST IN WOOD'S saw, and how does W. R. S. get over the throw of his crank? I enclose a sketch of one that



Fret Saw—A, Table; B, Saw Frame; C, Guide Rods; D, Piston Rod; E, Crank; F, Beam.

will work, and work well too. It is entirely home-made, the guide rods being old brass bedstead tubing, the piston the rod of a beer engine pump. The saw I made out of a watch spring. The frame of the saw is ¾ in. ash, and the piece at the bottom of guide rods to steady the piston is ash also, firmly mortised into the upright and wedged. When the saw is not in use I unscrew the top of D, and push the saw up to the beam out of the way. It has a stroke of ten inches."

Electric Time Alarum.—J. W. O. (*Paddington*) writes:—"Having seen in WORK No. 32, page 497, Mr. Bonney's description of how to make an electric time alarum, I have taken the liberty to write to you and try to explain how I have made one for myself, which I have had in use for this last six months, and it has never failed. The clock is one in which the works are visible in a wood case. First of all, I cut a small circular disc of brass one inch in diameter, except at one part. I have left a small piece protruding barely ¼ inch long, so as to make a connection with a small brass spring. On this disc I have marked the hours the same as you often see on an alarum clock, with six o'clock exactly over the little catch. I have drilled a hole through the centre of this disc, and fastened it on to the back of the hour hand firmly, but so that I can easily turn it round to any time I wish. To set it I turn the disc round till the hour I want is opposite the hour hand. The spring is made of a narrow thin strip of brass. This I have fixed to the inside of the case and bent it out, taking care it does not touch the metal work of the clock, but so that the end (which is slightly bent downward to allow of the catch rising on it easily) is exactly under six o'clock, and will press



Electric Time Alarum. Fig. 1.—D, is the Disc full size; S, the Spring; C, the Catch. Fig. 2.—Disc fitted on Clock.

gently against the catch when it comes round, so as to connect the current, but so that the catch can pass easily over it without stopping the hands. It is about 35 to 40 minutes passing over (quite long enough to wake anybody). I have brought the wire which is connected to the works and the other from the spring inside the case to two small metal plates let into the bottom of the case at the back, and these stand on two similar ones with a slight spring in them, to which the line wires are attached. These last two are fixed on the mantelpiece, so that the clock can be shifted at any time without having to disconnect any wires or disfiguring the case with terminals, etc. It is joined up to the bell, which I made myself, with a switch; so all I have to do is to switch it on or off. I have drawn a rough sketch of the disc and the clock face to show how it is fixed. I mostly employ my spare time of an evening in this way. I have taken in WORK from the beginning, and have found it very useful, and I wish it every success. I hope I have not encroached too much on your valuable time and space."

Jewel Case Tools.—C. T. (*Edinburgh*).—The best place for you to go for the tools you require is Buck's, Tottenham Court Road, London.—G. R.

Violin Making.—VIOL (*Cork*) writes:—"I complain that you are keeping the fiddle-makers a long time in suspense. We expected the violin article sooner."—[The articles cannot appear until the second volume of WORK.—ED.]

Dulcimer Instruction.—J. McF. (*Edinburgh*) writes:—"I am glad to see a little more about how to make a dulcimer. I may say I have one, but I cannot make a start to play it. May I ask R. F. if there is an instructor for the dulcimer? If not, could R. F. or ALPHA tell me where I could get a few tunes marked out, which I would gladly pay for?"

Levelling Oilstones.—W. H. D. (*Birmingham*) writes:—"Your issue of October 9th gives a description of a board prepared with emery for levelling oilstones. The method is no doubt an effective one, but I think it would not find much favour with amateurs owing to the trouble of making the board. The plan I have had in use for a number of years is as follows:—Get a sheet of coarse emery cloth, say 2½ in. size, which may be bought at an ironmonger's for one penny; tack it to a flat board by the four corners, or it may be glued to the board. You have then a board ready for use quite as good as the board mentioned above. A few minutes' rubbing will soon show its effect on an uneven oilstone."

Dresser, Perambulator, and Mirror.—H. (*Bishopsgate*) writes:—"I notice in WORK th you take an interest in those who persevere, s thought I would send you some rough sketches what I have made as an amateur. By trade I an bootmaker. Fig. 1 is a dresser which hold tea-service of 48 pieces. I made this of deal, w the aid of a keyhole saw, an iron chisel, and shoemaker's knife. The spindles are of mahoga I then stained it and polished it. I have be

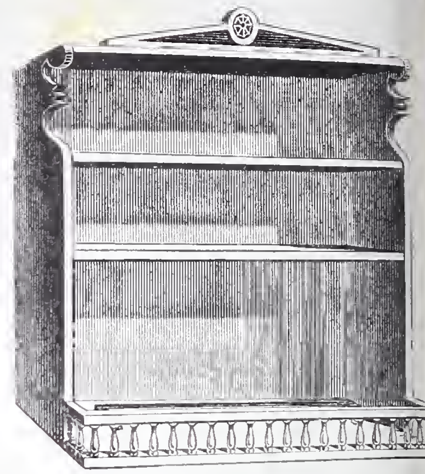


Fig. 1.—Dresser.

offered 20s. for it. Fig. 2 is a clockwork peraml lator. The wheels, which are iron, and 5 in. diameter, I bought, made the carriage, enamell it black, and lined it red. The handles are ma

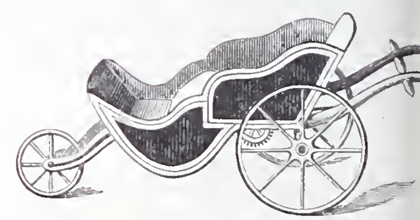


Fig. 2.—Clockwork Perambulator.

for a doll to run behind it. Fig. 3 is one of a pair mirrors covered in red plush, with a gilt frame in. by 11 in. I am also pleased to inform you tha have made a deal table with flaps, turned legs, a casters, which is 56 in. long and 51 in. wi and as solid as a rock. I have also a linnet's ca which I made of mahogany. If I want a waistco I purchase the cloth and make it myself; or a s of clothes for my little boys, I make it myself. N

Fig. 3.—Mirror in Red Plush.

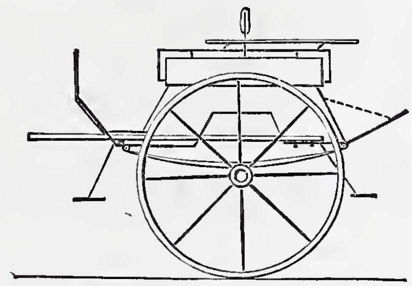
I am waiting to see the design of the bookcas which you gave a prize for, so as I can make myself. I have never worked at any of these trades they are all my first attempts, and they have turne out successful, and if you can find space in you journal for this letter, I think it will encourag your readers to try to do likewise. It often puts shilling or two in my pocket when my own trad is slack."

.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Engraving Door Plates.—X. L. S. R. (*Falrk*).—I should advise you, before you commence riously to try and engrave, to wait until some papers i the subject make their appearance, which I trust ill be shortly. To help you meanwhile I give you a iort sketch of the method used. First, of course, ou must prepare your metal. This is done by filing ie surface off the brass, then using pumice stone remove the file marks, and finishing with emery oth. You then have your plate ready for work. he tools you must use are chisels specially made r the purpose, which can be had at Buck's, in ottenham Court Road, or any other tool wareouse. You must sharpen the end of your chisel ist as you would your knife, and then rub the ce until it is the shape of a diamond. We should lvise you to get an engraver to show you his iols; you would then understand the setting of iem better than by any description we could give. ext draw your name on the brass with a steel oint. We should advise you to commence with lock letters, these being easier to engrave. You ust then outline your letters with your graver, eing careful not to use your hammer too hard, or ou will cut too deep. When you have engraved ie outline, next cut out with a broad chisel sold r the purpose, and touch up the letters with a and graver. To wax in, heat the brass from nderneath, and put the wax on till you have overed the letters, being careful it does not boil. ou must then pumice off the wax, and polish your rass by using fine emery, rotten stone, and oil. I annot tell you more in the space at my disposal, ut will answer any questions you like to ask on ie subject.

Gilding on Satin.—T. P. (*Redditch*).—I must wn that unless it were possible to see the kind of rticles your inquiry refers to, it is hardly safe to ffer you very definite instructions both for hand nd press. I have, however, gilded monograms nd so forth upon morocco leather, fancy cases, tc., so that the subjoined may be of assistance to ou. Draw the design upon a thin piece of white aper, then carefully prick through the lines with a in, and pounce the design through with chalk, f upon dark surface, or with finely-powdered charoal if upon light, the powder being contained in little muslin bag, the texture of which, when apped over the design, will allow the contents scaping through the pinholes, marking the patern upon the article. Care must be taken that he pounce—that is, the pricked drawing—does not hift in the least. If you wish to paint or gild ipon silk or satin the same directions will suit; ut, of course, the fabric would have to be evenly xtended upon a flat surface, or by some kind of tretching frame. Having successfully transmitted he design to the article we must make the surface ion-absorbent before gilding upon it. Procure ither japanners' gold size or quick-drying variish—that made specially for baths—and rub up inely with a palette knife, a little dry middle hrome, and mix it thoroughly with the vehicle ised. Now, with a fine sable pencil carefully paint n the design, if necessary using a few drops of urpentine with it to enable you to work it the etter. It is not advisable to use much chrome, nly sufficient to well stain the varnish or size so hat we can see nicely where we are going with the rush. When thoroughly dry we can pencil on the old size which is to hold the gold leaf. You can ither use japanners' gold size or gilders' oil gold ize. The first is cheapest and quickest; the latter as more burnish, and is more durable. In either ase add a very little of lemon chrome, so that we see that nothing is missed, and paint it on in the same manner as before, but only a bare coat. If japanners' is used it will be ready for gilding in about half an hour; if oil size, the work is sized one lay and gilded the next. In pencilling on the gold size keep just within the edge, if possible, of the first coating. Use English beat gold leaf, about ls. 3d. per book. If you are not able to use the tip and cushion, let the leaf of gold drop gently on to the size, slightly press it down with cotton wool, and after standing for a little time give a final gentle rub to burnish it, and clean off the superfluous gold. If I had a quantity of small fancy articles to gild—leather or satin—I should draw the design on thick note paper, cut out a stencil of it with a very fine and sharp penknife upon glass, and thus stencil the pattern on, if necessary putting in any fine strokes with a sable pencil afterwards. All this you will see requires a little art and much careful and practised manipulation. I hope you may find this useful to you.—F. P.

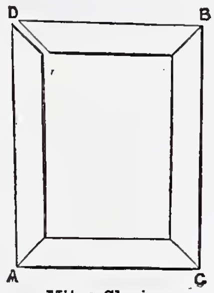
Village Cart, Dimensions.—AN AMATEUR.—The name "village cart" is applied to vehicles of various patterns, but I assume that the one you require is something like the annexed sketch; also that you require a medium, or "cob" size, as your description, "a cart for four persons," might apply to a vehicle for a small pony, or to one for a large horse. The directions for building a Battlesden Cart, No. 19, page 295, will serve for a vehicle of this pattern with a little adaptation. The supplementary sides are rectangular, and are set perpendicularly to the sides, instead of being "pitched," as in the Battlesden. The front foot-board is also different, being much deeper, and attached by two strong stays running the full depth of foot-board, and under the body about 18 in. The length of sides at top should be about 3 ft., and at bottom 5 ft., their greatest depth being 16 in. The bottom should be about 28 in. wide inside measurement. The sides to be pitched at an angle of about 97 degrees with bottom, which, with the same arrangement for supplementing the seatage, as in Battlesden, will give ample width at top. The supplementary sides to be about 9 in. deep



Sketch of Side Elevation of Village Cart on $\frac{1}{4}$ in. scale.

by 3 ft. 4 in. long. Two straight springs 4 ft. long, $1\frac{1}{2}$ in. wide, with 5 plates, will, I think, be sufficiently strong for this trap. The shafts should be 6 ft. in front of the transom, and sufficiently long to run back almost the full length of the body, as in Battlesden.—OPIFEX.

Mitre Cutting.—AMATEUR.—Mouldings are usually of a long length, and not moved in machine with such ease. It is well to cut them at required lengths first, and then trim with the machine, being careful to sight them up exact—that is, place sight edge (or that which is nearest picture when framed) to edge, and see that they are both of an exact length, long and short sides. The machine has regulating screws to get the exact pitch of 45°, or it is as well to join the short sides to the long at A and B, and let them set. Then, in the third joint at C, you can see if it requires a little off. When the third joint is made, the fourth, at D, should meet within $\frac{1}{4}$ in. It will then close in making the last joint, as shown in accompanying diagram.—G. R.



Mitre Closing.

Removing Old Paint.—THREE LEGS.—Glad to learn you find WORK so useful, and hope this may further assist you. By the way, if you find it difficult to get your weekly issue, why not subscribe direct—three months for 1s. 8d., including postage. The article you mention is one of the ordinary house-painter's charcoal-burners. Respecting the lime and soda method, this process, especially for wood that was required to be stained afterwards and not painted, would have been undoubtedly the best. As to the mess, house-painting isn't usually the cleanest of work for one's hands; but with ordinary care to prevent the hands getting burned there is nothing very unpleasant about the task of removing paint. If the woodwork has mouldings on it, the lime is by far the best, since with the burner the most prominent parts would get burned before the heat could perish the whole of the paint on more recessed portions. If you have any more to treat, mind you get fresh dry lime, use plenty of soda, and put the mixture on with a palette, or broad knife, in the form of a paste; after standing a few hours it should then easily scrape off clean to the wood. Well wash the woodwork with cold water, and when dry, coat it with vinegar, using a brush as in painting. The vinegar is to kill the chemical action of any of the resolvent that may be still left in the grain of the wood, and which would otherwise perish the new paint, etc., put upon it. The usual difference in the appearance of the burnt-off work is that some of the priming remains in the grain of the wood, and therefore the surface would not be so absorbent as the lime treated portion, and you would find yourself unable to get a uniform colour. I rather advise painting and graining (plain-combing) in your case, but if you must have stain, try the following:—Rub it all down with glasspaper, and coat the lime-burnt portion with vinegar; when dry give it all a good coat of warm glue, or patent size; this will make all the surface non-absorbent. Purchase some ordinary oak varnish (remembering the price should govern quality); or, better still, that known as "hard-drying," or "church oak," also some turpentine and a few pennyworth of burnt umber in oil. Take equal parts of varnish and turps, mix and stain with umber to desired colour; if you want a more yellow colour use raw sienna for staining; strain before using, and spread carefully and evenly, brushing it the way of the grain. When dry, finish with one or two coats of varnish, or you may give it two coats of stain. Water stain is out of the question under the circumstances of the two surfaces; but were it cleaned right off to the wood by lime, etc., then after vinegaring, you can stain with water stain, and after this two coats of size and one of varnish. Any paint brush, as large as suits the size of your surfaces, will do, providing that it is quite free from dust or paint, and that the hairs don't come out in using. The darker the stain the better the job in your case, I feel sure.—F. P.

Angular Advance of Eccentric.—W. R. W. (*Blaenavon*).—You can work the position out geometrically, or determine it by the following formula:—

Let $a°$ = angular lead of eccentric.
d = distance in inches passed over by valve when piston is at top of stroke.
t = travel of valve in inches.

Then

$$\text{Cosine } a° = 1 - \frac{2d}{t}$$

To use this find the value of $1 - \frac{2d}{t}$ and look out the result in a table of cosines; the angle opposite it will be that required.—F. C.

Water-Wheels.—SCRUTINEER (*Bolton*).—You may find the horse-power (h.p.) of water-wheels from the following rules:—

Undershot Wheel.

Let V = velocity of water in feet per second before acting on wheel.
V = velocity of water in feet per second after acting on wheel.
Q = quantity of water in pounds per minute passing wheel.

(Note.—One cubic foot of water weighs 62·3 lbs.)

$$\text{H.P.} = \frac{Q}{6,440,000}\left\{V^2 - v^2\right\} \text{ for radial floats and}$$

$$\text{H.P.} = \frac{Q}{4,000,000}\left\{V^2 - v^2\right\} \text{ for curved floats}$$

Overshot Water Wheels.

Let h = height in feet of water in pen-trough above that in tail race.

$$\text{H.P.} = \frac{Q.h}{55,000}$$

Breast or pitch-back wheels.

$$\text{H.P.} = \frac{Q.h}{44,000}$$

Turbines.

$$\text{H.P.} = \frac{Q.h}{50,000}$$

F. C.

Bronzing Ferrules.—ANGLER.—To bronze ferrules, reels, etc., for fishing rods, the brass should be turned smooth and bright. The best results cannot be obtained without a lathe finish. The parts must be perfectly free from taint or grease, so should not be handled. Use fine emery cloth and a good speed, and hold the work when finished with a perfectly clean piece of old linen, etc. To make the bronzing mixture, take some new iron filings—about as much as will fit on a shilling—1 oz. of hydrochloric acid (spirits of salts) and $\frac{1}{2}$ drachm of arsenic. Pour the acid upon the iron filings in an earthenware vessel or glass, and let it stand for half an hour. Dissolve the arsenic in a tablespoonful of strong vinegar, and mix with the acid and iron. Strain the mixture through a piece of linen, and bottle for use. As a little of this liquid goes a long way, the above quantity will be sufficient for a good many articles. Now heat the brass moderately by holding it over the flame of a spirit lamp, or better, let the flame play upon the metal while running in the lathe, and while hot apply the bronzing mixture. The best way to do this is to make a small pad of clean rag, and tie it on the end of a piece of wood, wet the pad in the mixture, and hold it to the work as it revolves. The colour will immediately appear, and the pad should be applied until the desired shade is obtained. When sufficiently dark, hold a piece of dry rag to the work until it assumes a good polish, when it may be removed from the lathe and is ready for lacquering. Procure some pale gold lacquer and a flat camel-hair brush, heat the work slightly, dip the brush in the lacquer, and remove excess by drawing the brush across the edge of the cup, etc. Give an even coat, avoiding passing the brush over the same place twice. When dry, again heat, give another coat of lacquer, and hold near a hot fire, or place in a moderately hot oven for a few minutes, and then lay aside till cold. During the process of lacquering the fingers must not touch the surface to be lacquered, but when finished and cold the work may be handled freely. Should a lathe not be available, clean and polish the work with fine emery cloth, dip in a strong solution of pearl ash or washing soda, rinse well in clean hot water, and when dry dip the work in a mixture of strong nitric acid, 2 parts, sulphuric acid, 1 part, to which add a pinch of common salt. Dip for two seconds, and then rinse well in a pailful of clean cold water. If at all cloudy, dip again as quickly as possible, and again rinse. Dry the work in hot boxwood or beech sawdust, and then apply the bronzing mixture with a brush, from which point the operations are the same as in the first process.—OPIFEX.

School for Practical Electricity.—DESIRE (*Peckham*).—The City and Guilds of London Institute has opened an evening department at the Technical College, Finsbury, for instruction in mechanical and electrical engineering, technical chemistry, applied art, etc. The session commenced on September 30th, and the fees range from 6s. to 30s. for the session, inclusive of charges for use of laboratories and workshops. For further particulars apply at the College, Leonard Street, City Road, E.C.—G. E. B.

French Polishing.—J. P. (*Hackney*).—There are one or two books on French polishing, but they are better adapted to professional than to amateur polishers, and I think you will derive at least as much information from reading the hints given in these columns as from any book I know of. You see in "Shop" the little difficulties which beset an amateur are brought forward week by week, and many of them are such as could hardly be anticipated by any one writing a treatise, although they can be explained and errors pointed out. Thus the mistake you have made seems to be that you have used the same rubber for both bodying and the final spiriting off. Try a fresh one for the latter, with a very little spirit, without polish or oil. Use a few, say, four or five, layers of the covering rag between the wood and the moistened wadding. As the outer one dries, remove it, and so on with each in turn till you get a smooth and permanently brilliant surface. Of course you can hardly expect to get this without practice, but by attention you will no doubt see a marked improvement by degrees. Never be afraid to tell us of your difficulties in any description of work, and describe your procedure fully. You may be assured that if one member of the staff cannot assist you another will.—D. A.

Nominal Horse-Power.—SCRUTINEER (*Bolton*).—In these days nominal horse-power is a very uncertain and unsatisfactory expression, as there is no fixed rule about it; in the English Admiralty it is dropped altogether. Formerly when engines ran at low pressures and fixed speeds, the term was commercially convenient. In the Mercantile Marine the rule is very uncertain, most makers having their own, and all of them being arbitrary. Before the introduction of compound engines and high boiler pressure, it was a common rule to allow 30 circular inches of piston area per N.H.P.:—

$$\text{N.H.P.} = \frac{(\text{Diameter of piston in inches})^2}{30}$$

After that period, for compound engines where D = diameter in inches of low-pressure piston and d = diameter in the same of high pressure piston—

$$\text{N.H.P.} = \frac{D^2 + d^2}{33}$$

Neither of these rules takes any account of length of stroke or boiler pressure. To allow for the latter some makers reduced the divisor from 33 to 30, as the steam pressure was increased from 60 to 80 lbs. per square inch. For high-pressure engines the following rule has been used: let D = diameter of cylinder in inches, and S = stroke in feet:—

$$\text{N.H.P.} = \frac{D^2 \times \sqrt[3]{S}}{20}$$

For your first example, compound engine, cylinders 24 in. and 38 in. diameter

$$\text{N.H.P.} = \frac{D^2 \times d^2}{33} = \frac{1444 \times 576}{33} = 61{\cdot}2\text{—N.H.P.}$$

2nd, Condensing engine, cylinder 15 in. diameter—

$$\text{N.H.P.} = \frac{D^2}{30} = \frac{225}{30} = 7{\cdot}5 \text{ N.H.P.}$$

3rd, High pressure engine, cylinder 18 in. diameter, stroke 4 ft.

$$\text{N.H.P.} = \frac{D^2 \times \sqrt[3]{S}}{20} = \frac{324 \times 1{\cdot}58'}{20} = 25{\cdot}59 \text{ N.H.P.}$$

F. C.

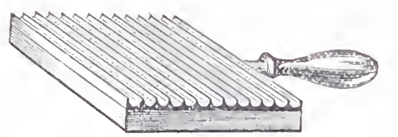
Materials for Oak Graining.—J. H. G. (*Bridgwater*).—The processes and materials used in all kinds of imitations of wood will duly be described later on. As you understand "plain painting thoroughly"—which I am pleased to know—it will only be necessary for me to give you a general idea of the ingredients used in mixing graining colour, so that you can adapt them to your particular requirements. Whether light or dark oak is desired, the colour of the ground, that is, the last coat of oil paint, must be in tone with the graining colour; if the former is made a decided yellow cast the latter should be of a rich or golden shade, and not too hard a contrast of shade between the two. There are many different methods of mixing graining colour for producing the best class of work, but for ordinary work the subjoined will do. Graining colour should always be clean and semi-transparent, easily used with the ordinary paint brushes, so that one can first spread a fair quantity, and then be able to manipulate it with combs, etc., before it commences to set. Procure two ounces of patent or liquid driers; add equal quantities of raw linseed oil and turpentine, up to nearly one pound; thoroughly mix, and then stain to the desired colour by adding ochre and burnt Turkey umber ground in oil. For medium oak, burnt umber alone gives a rich, transparent colour, whilst some grainers will substitute raw sienna (Terra-di-Sienna) for the ochre. Raw umber alone makes a good stainer for very light oak, and very rich tones—seldom advisable or necessary, however—can be obtained by introducing a little burnt sienna. I recommend mixing the liquids and driers together first, and afterwards staining to the desired colour for two reasons. We can judge how much we want for our purpose, and thus prevent waste, whilst the plan of staining the mixture and trying it until satisfactory, gives us thorough control over the colour and shade. The average painter will take a quantity of umber, driers, and usual liquids, and knock it up together with the usual result of having to thin it down to double the quantity before it works freely, and is right in colour, thus having a lot left, and probably wasted. The proportions given make a graining colour which will stand, if necessary, for about two hours before being combed, and should then dry in about eight hours (indoors). If desired to set and dry more quickly, use more turps, and, of course, driers. It should be about the consistency of thin soup, and be strained through muslin before use. I should think you could get graining combs in Bridgwater at any dealer in painters' goods; if not, there are plenty of shops in Bristol. If preferring to obtain through the post, write to Pavitt & Sons, 70, Southampton Row, London; or to Crowden & Garrod, 62, Southwark Street, London, S.E. Steel graining combs are sold in various widths—from 1 in. to 3 in.—and degrees of fine and coarse vein; they are usually retailed at 1½d. per inch and 2s. 6d. per set of twelve in tin case. I wish you every success, and also advise you to look out for the articles now being written on your subject.—F. P.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Flour Paste Souring.—DILETTANTE (*Glasgow*) writes in reply to J. R. (*Skerries*) (see page 398):—"Though rather late I will give him a recipe which I am sure he will value. I have seen many paragraphs on paste in your paper, but have never noticed the preservative I use mentioned. The substance is corrosive sublimate; 15 grains to a pint of paste is, I think, the proportion. Mode of use, crush to powder and dissolve in a little hot water; then pour paste over it from your pot or saucepan, stirring briskly to mix well. Of course, corrosive sublimate is a deadly poison, and is difficult to procure, but it is worth the trouble. As to danger, I have used paste so prepared for years, and never had a mishap, though I always apply it with my fingers. This should not be done if any cuts are about the hands. I believe my paste would keep good for years—certainly till it is far too hard to use."

Wheels.—R. B. (*Largoward*) writes in reply to G. W. (*Bournemouth*) (see page 332):—"You say that machine-made materials for wheels can be bought almost as cheap as in the rough. Will you kindly give address where material can be had?"

Pill Making.—B. C. D. (*Kilburn*) writes in reply to J. C. (*Carlisle*) (see No. 31 of WORK, page 491):—"I don't know much about the subject, but I saw a man making pills about a dozen years ago. The apparatus that he used was very simple. It was made of two pieces of wood about 6 inches square and 1 inch thick, with a piece of brass let into one face of each piece. The brass was scooped out in a series of semi-circular grooves. Each tool was provided with a handle, as shown in the sketch, which



Pill-Making Machine.

represents one of the tools. The way he used the tools was to first flatten out the paste, and then put it between the brass faces so that the grooves came just opposite each other; then press both tools together so as to cut the paste into a series of round bars; the bars were then taken out and put across the grooves, and the process repeated so as to cut the bars into little bits; then they were worked about between the tools till they were made as round as was possible."

A Cutting Drift.

Drilling Square Holes.—The Britannia Company (*Colchester*) writes (see page 270):—"It is one of those ideas which some may think of value, but it is much easier and quicker to drill a round hole and then drive a drift into it, to cut it square, than to drill a square hole. Some unfortunate inventor patented the above mentioned appliance, and, like many a hundred other victims of the inventive faculty, found only the honour of being a patentee to result from it."

Spirit Level.—G. M. (*Sheffield*) writes in reply to D. J. (*Oldham*) (see page 510):—"If the slot you mention is in the wood, you will require a 4-in. tube ⅝ in. thick; although called 4 in., the length, with the nipple at each end, is nearly 4½ in. You fix it as follows:—Fix a board quite level, place your level on it, put some putty or plaster in the slot, and press the tube in. Then screw on the top piece of brass, taking care not to shift the tube; if it does move you may press the high end down a little."

An Easily-Made Fret Machine.—W. R. S. writes in reply to W. W. M., BLOCKHEAD, G. P., NEMO, and A. H. H. (see page 508):—"The wheel is fastened to the axle in the ordinary way, and made to revolve in either direction. The connection of the treadle to the wheel is the same as that of an ordinary sewing machine, except that the bottom part of C is also fastened by a bolt to the wheel; the top part is only fastened to the pipe A. The size of the table is immaterial, but it will be better to carry it back as far as the slide D."

Trade Notes and Memoranda.

M. YVES GUYOT, Minister of Public Works, has prepared a scheme for a Paris underground railway, which he intends to present to the Chamber early in January. This scheme differs widely from that prepared by M. Bailhaut, and rejected by Parliament. It is far less gigantic than the scheme presented by his predecessor, and does not comprise any State subvention. A syndicate of credit establishments have, he affirms, presented themselves offering to carry out the scheme without any support from Government. The proposed line would start from the Place de la Madeleine, and, passing under the main boulevards, would reach the Place de la Bastille and the Vincennes Station. Thence it would be carried as far as the terminus of the Paris, Lyons, and Mediterranean Railway. Then, crossing the Seine, a little above the Isle St. Louis, follow the Rue de Rivoli, and thus reach the Place de la Concorde and its starting point, the Place de la Madeleine.

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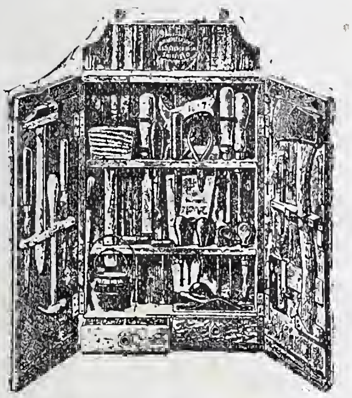

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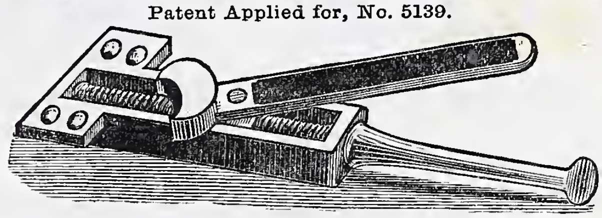

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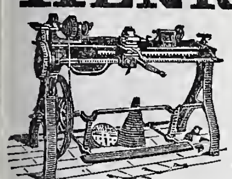

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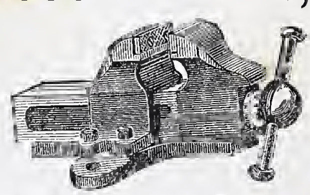

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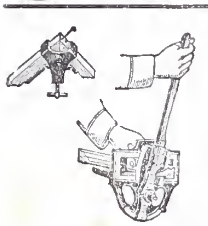

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 41.] SATURDAY, DECEMBER 28, 1889. [Price One Penny.

TWO FOLDING ARM CHAIRS.

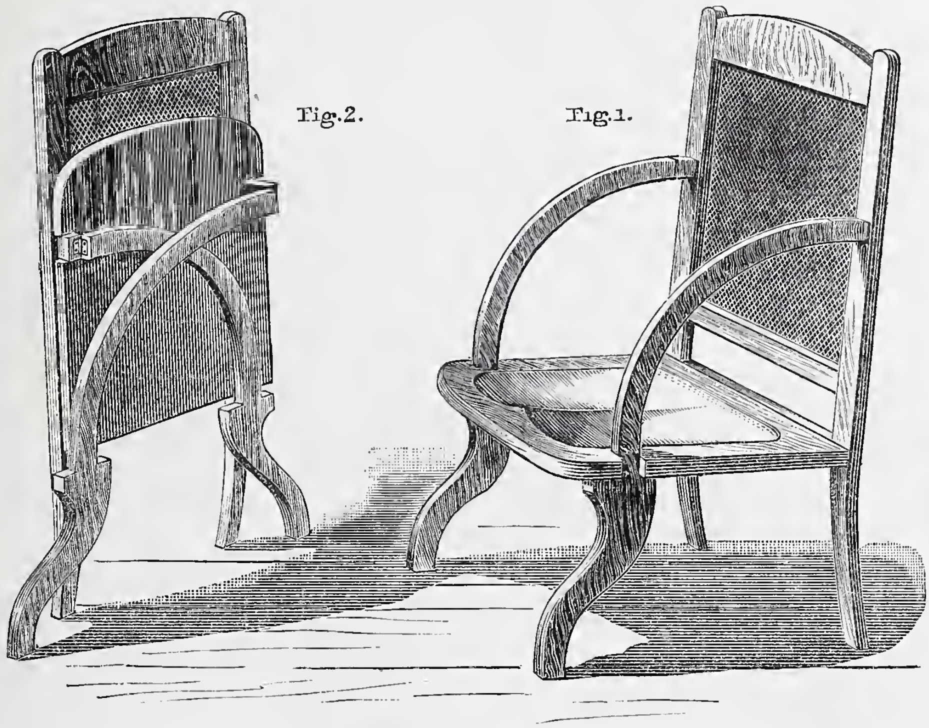
BY JAMES SCOTT.

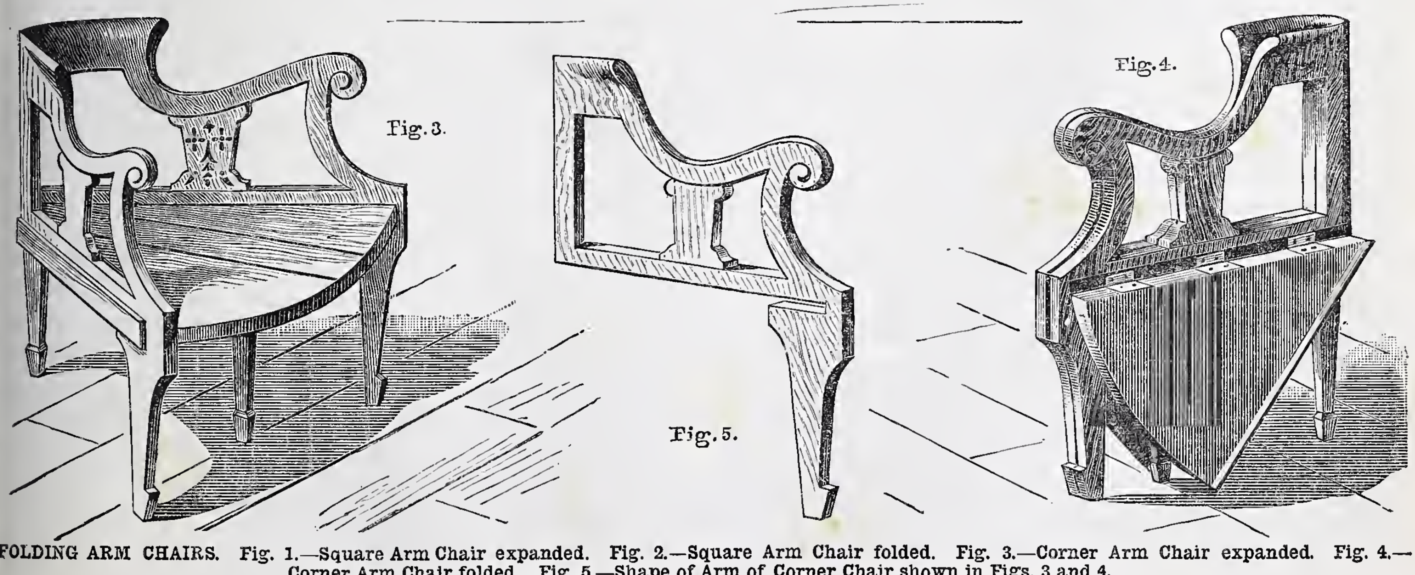
There are to be found among that mysterious community called the Public certain persons who declare that they really detest such things as folding chairs. If, however, the truth could be extracted from them, I think it would be found that the true reason is not because they *are* folding chairs, but because they always have a nasty habit of squeaking when being sat upon.

Now, in the sketches here shown are two folding chairs which will not be so liable to give way to this objectionable habit, as I have designed them to work upon hinges; and the bending of these will not create so much noise as wooden connections do. There is nothing particularly new in the patterns of these two arm chairs; the originality consists in their method of folding.

Dealing with Fig. 1, I will give what I consider the most accommodating sizes; it must be remembered, however, that if made for personal use, dimensions should be studied a little, and altered accordingly. The height from the floor to the seat is 16 in.; length from the back to front of seat, 18 in.; width of seat, 20 in.; height of back from seat, 22 in.

The back should be prepared first, and should be the same width from top to bottom. The seat is next made in two pieces, one piece to fit between the two back feet, and the other forming the seat proper; these are securely hinged to each other. Each arm is in one piece with each front foot, the shaping of which will be the most difficult part; but as it is not my purpose here to give instructions on wood working, I shall presume that my readers can handle a few tools skilfully. The arms can be of any size, but whatever they are, it must be borne in mind that each will have to be a quarter of a circle in shape. If they are 12 in. distance from the back, they will have to be cut out of a circle 24 in. in diameter: and if at 15 in. from the back, the circle from which they must be cut will be 30 in. in diameter; these are outside measurements. Whatever the dimensions of these arms may be, a piece must be cut out of the seat on each side to admit them; and it is by this means that the seat is enabled to rise up against the back. The arms also have to be made to fold one over the other. This is effected by cutting one arm through at 1 in. distance from the back, and the other at 2 in., and hinging them. Fig. 2 shows the appearance of the chair when folded.





FOLDING ARM CHAIRS. Fig. 1.—Square Arm Chair expanded. Fig. 2.—Square Arm Chair folded. Fig. 3.—Corner Arm Chair expanded. Fig. 4.—Corner Arm Chair folded. Fig. 5.—Shape of Arm of Corner Chair shown in Figs. 3 and 4.

Fig. 3 has somewhat the look of what is termed a corner chair. A very comfortable chair can be made by following the design. As with Fig. 1, I will give the most appropriate sizes. The height from floor to seat is 16 in.; height of back from seat, 16 in.; height of arms, 9 in.; seat, from back to front, 18 in.

The seat should be made first, and must be some part of a circle. A circle should be drawn on the board to be used, and the size considered best marked off, from the centre to the outside, and cut out. A piece about 2 in. wide should then be cut out along the middle of the seat, making the seat into three pieces. The two larger parts are then hinged, one on each side, to the middle piece.

Underneath the middle piece, and a few inches from the centre of it, should be fitted a leg. A back-foot, in length from the floor to the top of the back, should also be joined into it. It should be fitted so that the ends of the arm pieces may close nicely against it when they are hinged. The length from back to front of these arms will be just a little more than that of the seat. Fig. 5 shows how they should be made.

At each end of the seat should be a rim, to prevent the arms from slipping off.

The banister under each arm is entirely a matter of choice. These chairs should be made in one of the hard woods, and polished; and if the hinges are in good working order, and strong, and are properly fitted, no complaint will be made of the chairs squeaking.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

STRINGING, TENSION, PITCH, AND CHIPPING UP.

THE pianos of to-day are strung much heavier than they were formerly, and consequently the back is made stronger to resist the greater tension of the strings. If I may say so, it has been a battle between the strength of the back and the tension of the strings. If the piano has to stand well in tune, of course the back must be the stronger. If one of the old pianos were strung with the wire we now use, it would simply collapse. The theory of stringing requires that each octave, starting from the treble, should double its length, but if that were carried out in the piano under our consideration, we should have a 16-ft. string for the lowest C. Of course, that is impossible in a cottage piano, so the difficulty is surmounted by increasing the thickness of the wire and obtaining lower notes. When a string is struck with the hammer in the piano, it causes it to vibrate a given number of times according to its length and tension, the higher the note, the greater number of times it vibrates. It is said by writers on acoustics that sonorous vibrations lie between 16 and 38,000 per second of time. This seems a large number of vibrations in so short a space of time, but it can be proved by at least six different methods. In a 7-octave pianoforte, the extreme bass A corresponds to about 27 vibrations, and the extreme treble A to 3,480 vibrations per second. The theoretical pitch, as it is termed, is the pitch accepted by acousticians as the natural one, being 512 vibrations per second for pitch C, each octave lower decreasing by half: thus, 512, 256, 128, 64, 32, and each octave higher increasing by double the number in a second. The fork by which pianos are usually tuned is of a higher pitch than this, giving 519 vibrations per second, and called the philharmonic. Some use a higher pitch still, called the diapason normal, giving 522 vibrations per second.

Before commencing to string the instrument, take a strip of cloth listing (such as tailors cut off the edges of their cloth) and glue on the top of slip, which is round the bent side, and also glue a strip on the top edge of bottom plate; this is for the strings to lie on to prevent jarring. Now take a pen and ink and mark the gamut over each note, commencing with A at the bass end, and marking it the same as the marking off slip. The treble and tenor notes of the piano are strung with steel wire, and the bass notes are steel with copper wire wound round them. The steel wire and the bass strings can be had from the ironmonger before mentioned. Now mark under the notes the sizes of your wire, count 6 notes from the treble and mark 13, and then mark again in the following order:—10 notes of 14 wire, 6 notes of 15, 6 notes of 16, 21 notes of 17, 3 notes of 18, 2 notes of 19, 2 notes of 20, 1 note of 21. You will require a $\frac{1}{4}$ lb. of all these sizes, with the exception of 17; of this you will require $\frac{3}{4}$ lb. Now you will require to take a scale from your back for the covered bass strings; this you do with a sheet of newspaper. Lay it on the back so that it covers the short bridge in its width from the bass end, and is over the top bridge and the bottom plate; now take your heel-ball and rub over the pins gently on your top bridge, short bridge, and bottom plate; this will give the size for the string-maker.

When ordering your strings, say you want them about 4 lbs. weight. You may now commence to string your back; see that it is laid evenly on your trestles, one under your wrest plank, and the other under the bottom. You will require a tuning-hammer to turn the pins, also a pair of pliers to cut the steel wire. The best place to obtain these or any tool for pianoforte making is at Buck's, Tottenham Court Road, W.C. You will also have to use a hammer to drive in the pins. As you will know by marking the wrest plank, you start at the treble end with No. 13 wire, the first 22 notes being trichord. Your centre string will need a loop on the end; this is looped on the front row of pins. Take your wire, and having put a piece of wire of the thickness of the hitch pin in your bench vice, hold the end of it with your pliers, and give it a couple of turns round the wire, and then slip it off the wire, and while holding the loop thus made, finish it off by turning the short end round it. Now put your loop on the first pin in the front row on the bent side, pull it tight with your pliers, carry it over the bridges, and three inches over the hole where you require the pin, if you make a mark with a file or your pliers three inches from the point, you can measure your wire to this mark. Having cut your wire, put the end in the hole in your wrest pin and turn the pin round to the right until the wire is coiled round it two or three times; then drive the pin into the wrest plank with your hammer until the coil is a quarter of an inch from the plank, then tighten it by turning to the right; now put the end of your wire in a wrest pin and repeat the operation of coiling. Drive this pin into the first hole in your wrest plank, and take the wire round the first pin in the second row in the bent side and over the bridges; cut off and put round a wrest pin, and drive it in your third hole of the wrest plank; this will complete one note. The remainder are done in the same way until you get to the bichord; of course the middle string is left out. Take care the sizes are put on as you marked them on the plank; the sizes will be marked on the paper the wire is wrapped in.

When you have got all the steel wire on, then put on the covered bass strings; these you will find are threaded on a wire, with loops on the ends. Take off one note of two strings from the end where they are the thinnest; put the two loops together, and the one that is farthest away from the copper put on the bottom pin on the plate; carry over bridges, and pin the same as before. Take care to take them off the wire in rotation, as they are not all the same size; of course, the last seven are single; these are thicker than the others, being double-covered with copper. Now you must run a piece of listing in and out of the strings below the bridges, and a piece of red cloth or braid over the top bridge. This is done to damp the sound in all parts except between the bridges. You can now stand the back on its bottom, leaning against the wall, and see that the coils are all nice and even round the pins; if not to your satisfaction, you can draw them close by slacking a little with your tuning-hammer, and drawing up with a button-hook. Now the maker, no doubt, would wish to hear the tone of his instrument, but of course he can only do this in a small measure until the hammers are in.

There is an operation which is called chipping up. This is really giving the piano its first rough tuning. You will want a C tuning-fork: this gives the note for pitch C. It is the third C from the treble end. Put your tuning-hammer on the treble pin of your note, strike the prongs of your fork, then place the end on your back. When it gives the note, pull up your string until it sounds the same as your fork; when you can hear the two sounding together as one note, that is right or in unison with the fork; but if it is not right, you will hear what are called beats, which I can only describe by saying they sound like "Woo, woo, woo;" the more it is out of tune the quicker will you hear the beats; you must tune until the beats cease, and sound like one note. Having got this right with the fork, you chip the other string of your note with a small piece of brass until it is in unison with the string you pulled up to the fork. Now you pull up your C below the pitch C; this is an octave below; when this is in tune and both C's are chipped, it will sound like one note, and very agreeable to the ear. Now pull up the G below; this is called a fourth; you can hear when the beats cease. Now pull up the D above; this is called a fifth, chipping the two notes together; then from D to A below, then A to E above, then E to B below, then B to F sharp; then get the octave F sharp below; then from F sharp to C sharp above, C sharp to G sharp below, G sharp to D sharp above, D sharp to A sharp below, then C to F below. Try the following chords G C E when you have tuned the E; G B D after tuning B; A D F sharp after tuning F sharp; and F A C after tuning F. If the reader has a musical ear and some perseverance, no doubt he will be able to master it. This is called the scale, being the basis from which the piano is tuned. There is a small instrument sold at music shops called the chromatic pitch-pipe; by moving a slide it gives all the notes in the chromatic scale. This would be found a great help to beginners in tuning. When you have chipped up the scale, you can go on with the octaves above; your irst note to pull up will be F below pitch C, to be pulled up an octave higher than the F below it, and so you can take each succeeding note until you have done the treble, then you tune the octaves below your scale, your first note to tune being E, going down to the bass. I need scarcely tell you that an octave would be from doh to doh, running up the scale or down. This having been done, you take a piece of hard wood with a slight groove in the end, and press all the steel strings singly, and pull out the copper strings. This is done to stretch the strings so that they stand in tune. Now you can chip it up again, repeating this operation several times at convenient opportunities, remembering that you are doing the instrument good (if you do not work the pin backwards so as to make it loose) and improving your ear. If you pull a note a shade too sharp, it is better to press it down. I may say you must keep the back in a dry place after it is strung to prevent rust. This completes the operation of stringing.

BRONZE AND BRONZING.

BY GEORGE EDWINSON BONNEY.

BRONZE—BRONZE PICKLES—BRONZING—BRONZING ELECTRO-BRASSED WORK—WARM BRONZE—BLACK BRONZE — STEEL BRONZE — GREEN BRONZE—GREEN ANTIQUE BRONZE.

Bronze.—Bronze is an alloy composed of copper, zinc, and tin in various proportions. When other metals are associated with copper to form a bronze-like alloy, a prefix is added to the word, and thus indicates the composition of the alloy. These alloys are found to possess characteristic properties quite distinct from those of ordinary bronze; not the least important differences to the electro-plater being those relating to their conductivity and resistance. Aluminium bronze, for instance (composed of copper 90 parts, and aluminium 10 parts), has a conductivity as compared with pure copper, represented by 12·6 to 100. Silicium bronze, composed of copper with a small percentage of silicon, as used for telegraph wires, has a relative conductivity of 98, whilst a larger percentage of silicon (in an alloy used for telephonic wires) pulls down the conductivity to 35. Phosphor bronze (as used for telephone wires) is composed of copper alloyed with a small quantity of phosphorus, and its relative conductivity is 29, whilst phosphor bronze, with 10 per cent. of tin, has only a relative conductivity of 6·5. An ordinary bronze, such as used in light castings, composed of copper 80 per cent. and tin 20 per cent., has a relative conductivity of 8·4. The following table will show at a glance the composition of some of the more common kinds of bronze.

TABLE OF BRONZE ALLOYS.

Name.	Copper.	Tin.	Zinc.
Coinage bronze	95·	4·	1
Pale bell metal..	96·	4·	0
Common bronze	94·3	5·7	0
Do. do.	91·5	8·5	0
Gun metal	90·	10·	0
Bell metal	79·	21·	0
Gong metal	78·	22·	0
Speculum metal	68·5	31·5	0

There are several other modifications of bronze used for particular purposes, but it is not desirable to examine them in these notes, nor to go thoroughly into the metallurgy of brass and bronze. Enough has been written to show the plater that both alloys differ very much in their composition when made for various purposes, and these differences may affect the deposition of metals upon them, on account of the varying resistances of the alloys themselves. These remarks apply particularly to the choice of a brass or a bronze to be used as an anode in the operations of brassing and bronzing.

Bronze Pickles.—Bronze may be pickled in any of the "acid dips" used for cleaning brass, but preference should be given to those which do not contain strong nitric acid in a large quantity, since the tin of the alloy does not form a soluble salt with this acid. The addition of some hydrochloric acid will assist the action of the pickle on bronze. (See *Brass Pickles*, page 597.)

Bronzing.—This term is generally applied to processes for giving a so-called bronze appearance to brass and copper. The electro deposition of bronze itself is rarely practised, since most brassing solutions can be made to yield a deposit resembling real bronze in tint, by merely increasing the quantity of copper in the deposit. Bronze solutions are made up in a similar manner and of similar ingredients to those used in brass solutions, the only difference being the substitution of chloride of tin for the sulphate of zinc used in those solutions. They are also worked in a similar manner, but the density of the current must be regulated to meet the higher electrical equivalent of tin—viz., 59, as against 32·6 of zinc; since 33·5 grains of tin will be deposited in an hour by the same current that will deposit only 18·5 grains of zinc. For further information, see note on *Brassing* and Mr. J. T. Sprague's remarks on the deposition of alloys.

Bronzing Electro-Brassed Work.—When it is intended to impart an ornamental effect to electro-brassed work by means of certain stains and varnishes, the process is termed "bronzing." The effects named below are produced as follows:—

Warm Bronze.—When a warm bronze or chocolate tint is desired on brass, it should be painted with a mixture composed of blacklead, 1 oz.; Sienna powder, 2 oz.; rouge, ½ oz.; made into a paste with a little water, to which has been added a few drops of sulphide of ammonium, or of chloride of platinum solution. The proportions of the various ingredients may be varied to suit the taste of the artist, just as he may desire to have a dark or a ruddy tone on the brass.

Black Bronze effects are produced by painting the brass with chloride of platinum dissolved in spirits of wine; or a mixture of blacklead with the chloride of platinum solution; or the same ingredient made into a paste with sulphide of ammonium solution. Mr. Watt prefers the platinum solution, because it produces a more brilliant and lasting effect.

Steel Bronze effects are produced by slightly heating the articles after being painted with the chloride of platinum solution used for black bronze.

Green Bronze.—A mixture for producing green bronze tints on electro-brassed work, is composed of chromate of lead (chrome yellow), 2 oz.; Prussian blue, 2 oz.; plumbago, ½ lb.; Sienna powder, ¼ lb.; lac carmine, ¼ lb.; made into a paste with water containing a small quantity of sulphide of ammonium, or of chloride of platinum.

Green Antique Bronze. — These effects may be produced by smearing the brassed articles with a mixture composed of acetate of copper, 10 parts; cream of tartar, 10 parts; common salt, 10 parts; carbonate of ammonia, or muriate of ammonia, 30 parts; dissolved in 100 parts of acetic acid, or in 200 parts of good vinegar. To this add a little water and mix well. The parts painted with this mixture must be allowed to dry at an ordinary temperature, and at the end of some twenty-four or forty-eight hours will be found to be covered with a green verdigris. This must be brushed with a soft brush previously rubbed on a lump of beeswax. A blue shade may be given to parts of the work by touching them with a little dilute ammonia liquor, and the green tints may be deepened by touching them with a solution of ammonia carbonate. As the dry powder brushed off from this dried bronzing mixture is poisonous, the workman should wear a piece of muslin over the mouth and nostrils whilst polishing work that has been coated with bronzing powders. The first four mixtures mentioned above should be polished with a soft long-haired brush when nearly dry. If it is desired to show the brass in parts, these may be touched up afterwards with a piece of chamois leather dipped in spirits of wine and rubbed on a lump of chalk or whiting. When finished, the work may be made moderately warm and varnished thinly with a quick-drying hard varnish.

PANELS IN GESSO WORK.

BY E. C.

PANELS may be put to so many uses that amateurs can hardly do better than decorate some for the sake of practice. Few persons, especially non-professionals, care to throw aside all their early attempts in any art-work. Unless, as students, they are resolved to go thoroughly in for any particular branch of art, when their work for a time consists of "studies" only, they prefer to utilise, as far as possible, all they do. And, indeed, the gesso worker who has a fair knowledge of drawing and painting already, will be unlikely to fail, even in his earliest productions.

Still, the panel is advisable to commence on. It is not heart-rending if it does not prove altogether presentable when finished; it is, or may be, small, and so takes little time to decorate; whilst the problem where to place it if the decoration is satisfactory is easily solved.

Here are a few positions which a panel decorated in gesso will fill with advantage: it will greatly improve the appearance of a door of a cabinet, and, if small borders are added about an inch or so beyond the outer edge of the panel, leaving a narrow band of plain wood between, the richness of effect will be enhanced. Naturally the design of the borders must be in keeping with the centre piece, and the separation will be increased or diminished according to the size of door. A bracket cupboard used for medicine or for books will be far more attractive if a well-executed "gessoed" panel is introduced in the door in place of the plain or commonly carved one often seen in these useful articles.

Some very inexpensive standing corner cupboards are to be bought now made of plain wood, and ready for staining or enamelling. The adaptation of an artistically designed panel would be the making of one of these, and turn it into an object worthy to figure in a handsomely furnished room. It will possess an interest through being the work of the owner that it could never have if merely purchased complete for use; but, then, the panel must be well done, or I, for one, would infinitely prefer that it should remain without ornamentation of any kind. Then there is the mahogany coal box with its sloping door, that might well be beautified by a good design in gesso; the fire-screen, with its one, two, or three panels; the flower-stand with panels in lieu of tiles; the fancy ebonised writing table, that might have a long narrow panel extending across the upright back, and the drawers enriched with delicate diaper patterns. And when a high standard is reached, the artist may execute panels bearing figure subjects that will be of sufficient interest to frame and hang on a wall. For there are pictorial effects to be secured of no mean worth by clever gesso workers.

I will now suggest two or three styles in which the accompanying illustrations can be carried out. Fig. 1 shows how gesso work can be employed with charming results for the decoration of a fire-screen. If we have a fancy for producing something uncommon, here is a fine opportunity. The framework of the screen is of white enamelled wood, and the carved mount of the gesso panels stained rosewood or mahogany. The combination of white enamel and mahogany will be found extremely pleasing; it is seldom seen, though now and again first-class decorators indulge in its use. Perhaps its rarity is in some respects a good thing, for unless due regard is taken of its surroundings, it may prove anything but attractive. As a foil to gesso work it is admirable.

Fig. 1.—Fire-Screen, Central Panel in Gesso Work, set in Carved Frame.

The whole of the panel should be laid with gesso, then the figure, birds, and foliage carefully modelled, the highest relief being reserved for the figure. The latter requires the greatest care, for by the manner in which it is rendered the skill of the artist will be judged. Colour may hide a multitude of sins, but cannot atone for inaccurate modelling. When the gesso is ready for tinting the figure may be treated first, though it is well not to finish it entirely until the foliage is somewhat advanced, as the tints react on one another, and we cannot produce a perfect harmony unless we work up all the subject gradually.

In a replica we can, of course, follow either plan. The first scheme of colour I propose is white, green, and gold, with touches of copper red. The drapery is white with soft reflections shown in th folds, the foliage a delicate gree veined with gold; in the frui and in the pot the touches o copper red are introduced; whils the plumage of the birds is give in tints of gold with copper re The ground is of gold, pure an simple, without a hint of coppe

It must be remembered tha gesso work is in its essence decorative art, and we must n attempt to portray naturalist effects; in the colouring w should fail utterly were we t try to follow Nature servilel A conventional decoration is wh we should aim at if we wish t be successful.

Now for the second suggestic for Fig. 1, which I must giv briefly: For the drapery use tl beautiful copper red tint; for tl foliage, emerald veined wit gold; repeat the copper red in modified tint in the pot, frui and birds, or let the foliage l rendered in copper and the p and birds in a bluish purp tint; and, lastly, gild the bac ground.

For Fig. 2 I should recommen that the dragons be wrought o in gold, the wings commenci with blue that is presently lo in purple, and continued in gol and copper; the ground in silve In modelling the wings of tl dragons cotton-wool will be foun to produce a delicate cobwebl texture that is wonderfully effe tive, and I cannot too strong advise the worker to try There probably will be a litt difficulty experienced in manipulating it at first, but the greater the cred when success is attained, and patient e deavour is never thrown away. We *mu* succeed if we resolve to do so.

Fig. 2.—Panel in Gesso Work: Dragons Guarding the Sacred Tree.

That the studen may acquire tl habit of working different styles, l should practise orn menting stained an polished wood. this decoration would have the reli lower than in the la mentioned, and tl painting principal relied on for attai ing an effective pie of gesso work. Tl amateur worker making his or h first essay in ges work may not l pleased with tl effect produce This, however, is tl natural outcome want of experien and lack of practic I am sure that little steady, pain taking, conscientio work will give bett and better result and eventually cau considerable pleasu in following up th branch of decorati art.

THE DULCIMER, AND HOW TO BUILD ONE.

BY R. F.

VENEERING, VARNISHING, STRINGING, AND TUNING.

HE back facing having been fitted, the ioulding has to be placed round the belly. he best kind of moulding to use for this urpose is a plain one, which can easily be iade by taking a piece of 1 in. stuff and iaking a half-round bead, which is then it off and divided down the centre (Fig. 5). When your moulding is ready, fit it irefully into its place, commencing with ie longest side, and glue and fasten it own with $\frac{7}{8}$ in. brads—of course, taking ire to bore the holes for the brads first.

Now we are ready for the veneering. 'rocure a piece of mahogany, walnut, or ny other veneer that suits your incy, and cut strips rather longer and ider than the facings of your intrument, and, having gone over he facings with a toothing plane (first noting that the screws are well below the surface), glue on with the best glue, and, squeezing and pressing out as much of the glue as possible, weight down, and allow to dry. When dry, the top edges may be veneered, and, after allowing another interval to elapse, may be cleaned off and gone over with a scraper. We have now a most important part of the work before us, viz., the "setting out" of the blocks for the "wrest" and "hitch-pins." Four lines, at distances of $\frac{1}{2}$ in. from each other, must be drawn from top to bottom of the centre of each block, and on the front, or inner, line of the right-hand block, at a distance of 2 in. from the front, make a dot, and another dot on the same line, at a distance of $1\frac{1}{2}$ in. from the back edge. Now divide the distance between these two into exactly nineteen spaces (twenty dots in all); $\frac{1}{8}$ in. higher on line No. 2 commence another series, and the same with Nos. 3 and 4. The hitch-pin block is marked in the same manner, but in the reverse order, the lowest dot coming on the *outside* line (Fig. 9).

The next operation is that of polishing or varnishing. I prefer polishing, as it stands better, and gives a brighter finish; but, if it is intended to varnish, first go over the belly carefully with Stephens' Ebony Stain, taking care not to come above the level of the blocks. Stain also inside the sound-holes as far as you can, and also the *back* of the blocks, and for about an inch round the outer edge of the back itself. When dry, if the colour is satisfactory, give a coat all over with size, made of glue one part, *warm* water six parts, and, when this is firmly set, varnish with good copal, which must be very lightly and evenly applied; and then the instrument may be set on one side for a few days for the varnish to get thoroughly set and hard.

While all these drying operations are going on, opportunities are afforded for getting out the wrest-pins, the hitch-pins, the bridges, the sound-hole frets or rings, the feet, and the stand; and here I may as well say that all these are better and cheaper bought ready-made, as they take some amount of time and patience in preparing. Messrs. Chilvers & Co., St. Stephen's, Norwich, supply every requisite at a very cheap rate. But we will suppose that you have both these indispensables at command; very well, commence then with the wrest-pins. Of these, eighty will be required. Get a piece of No. 6 B.W.G.—by-the-bye, this means Birmingham Wire Gauge—iron wire of the necessary length—that is, about 12 ft.—and cut it into $1\frac{3}{4}$ in. lengths, either with a hard chisel and hammer, with a hack-saw, or the sharp edge of a half-round file. Round up the top and bottom of these lengths, and file one end taper on both sides for about $\frac{1}{2}$ in. down. At the bottom of the taper thus formed, drill a small hole to receive the end of the string. Thread these pins on a piece of wire, and stretch it between two points, and black them for about half their length with Brunswick black, and the pin is complete (Fig. 8). The greatest difficulty will be in drilling the holes, and, if this is beyond you, a simpler plan can be adopted by using loops of thread, which method I will explain when we come to the stringing. The sound-hole frets are simply ornamental rings turned to fit the sound-holes, but are very often filled in with fretwork, carved work, inlaid stars, or other designs. The bridges (Fig. 11) are made of beech, turned as shown, and cut on the dotted lines with a chisel. Across the edge thus formed a V-shaped groove is made to take a piece of brass wire for the strings to pass over. These bridges may be either varnished in the natural colour, bronzed, or gilded. The feet are four flat balls of 1 in. diameter and $\frac{3}{4}$ in. thick, and are screwed on one at each corner of the back, after it has been covered with blue or other coloured paper. The stand is made of $\frac{3}{8}$ in. stuff, veneered on both sides *diagonally*, so that the grain of one side crosses that of the other, and both run in a different direction to that of the wood. The stand is 9 in. long and 5 in. high, and may be shaped to fancy; that usually adopted is shown at Fig. 10. This is screwed on to the back with a pair of 1 in. butts, at a distance of 2 in. from the back edge. Two pieces of brass wire, $\frac{1}{8}$ in. diameter, will be wanted for the grooves in the blocks, and about 2 ft. of No. 18 brass for the tops of the bridges. Also get a yard of velvet ribbon, about $\frac{1}{4}$ in. wide, for the block dampers. Cut off your brass wire to exactly the length of the grooves in the blocks, round up the ends, and polish them. *Outside* these fasten lightly with small tacks strips of your ribbon, one on each block. Cut off forty pieces of the No. 18 brass wire; file the ends level and to fit the tops of bridges. Fit and glue in your sound-hole frets or rings, and proceed to ornament the belly. This so obviously depends upon your own taste and style that I need hardly say a word about it, except that you must be sure that the varnish is *perfectly* dry and hard, not in the *slightest* degree tacky, or your gold leaf or bronze powder will assuredly stick where most you *don't* want it. But stop! I am

Fig. 8.

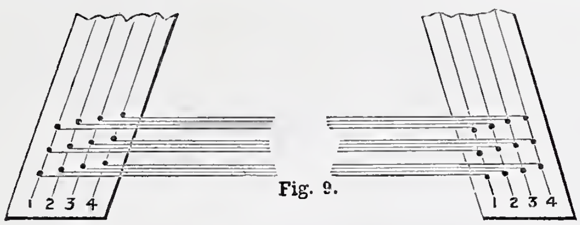
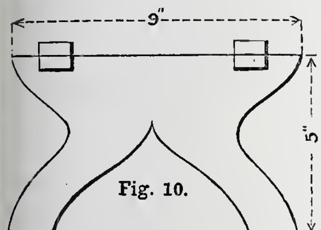


Fig. 13.



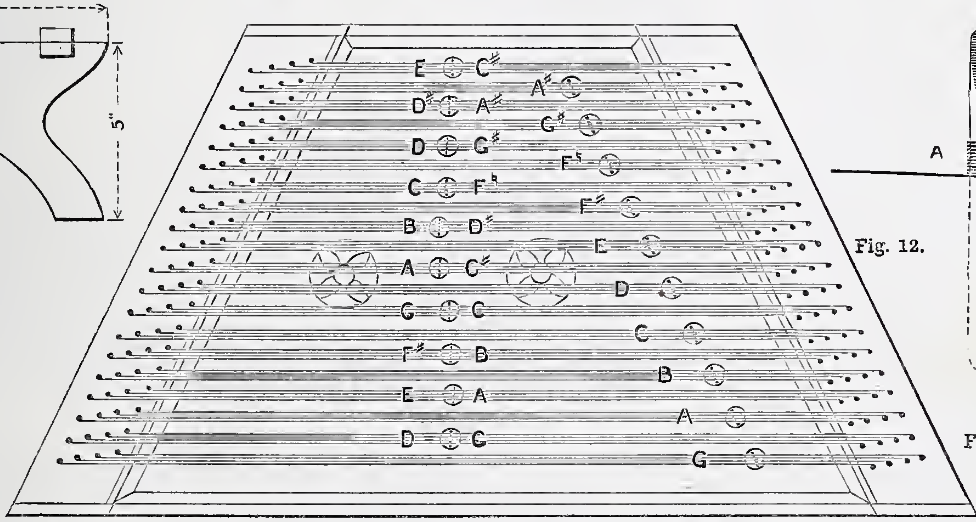


Fig. 12.

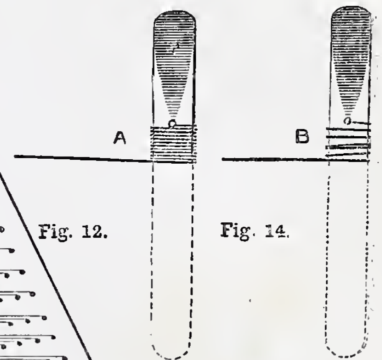


Fig. 14.

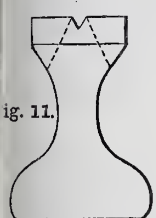


Fig. 11.

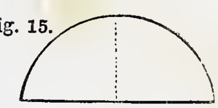


Fig. 15.

Fig. 8.—Wrest-Pin (full size). Fig. 9.—Method of "setting out" Blocks for Pinning. Fig. 10.—Stand. Fig. 11.—Bridge (full size). Fig. 12.—Diagram, showing Scale and Approximate Position of Bridge. Fig. 13.—Eye for String. Fig. 14.—Pin properly wound (A) and badly wound (B). Fig. 15.—Mode of making Moulding round Belly.

running on too fast—our blocks are not yet pinned. Well, then, just remove those pieces of ribbon again, and commence to bore the wrest-pin block. No. 6 wire measures $\frac{3}{16}$ in. diameter, consequently you must have holes considerably smaller than this for your pegs to work in, or in a very short time, what with the tuning and the pressure caused by the "draught" of the strings, they would soon work loose and the "pitch" run down. Take, therefore, a $\frac{5}{32}$ in. spoon bit, and on it fit a "stop" that leaves exactly 1 in. of the bit for boring. This stop may be made either by boring a hole lengthways through a piece of wood which is allowed to remain on the bit, and which leaves the necessary 1 in. protruding; or by binding three or four turns of copper wire round the bit in the place required. This stop is necessary to regulate the depth of the holes. Start by boring the lowest hole, and be very careful to hold the bit at right angles to the *face* of the block. When the first hole is bored, place in it a piece of wood like a small pencil, about $2\frac{1}{2}$ in. long, which just fits sufficiently tight to be easily shifted. This is to act as a guide for the boring of the succeeding holes, and should be shifted as each is bored, or you will have an irregular arrangement which will not add to the appearance of the instrument. When all are bored out, they must be *slightly* countersunk and the borings carefully removed; they are then ready to receive the pins, which must be *turned* not *hammered* in. This is done with the tuning key.

The hitch-pins are made of brass or iron wire, $\frac{3}{32}$ in. diameter, pointed at one end, and are $\frac{3}{4}$ in. long. A hole is bored with a small bradawl for about $\frac{1}{4}$ in. into the block, and the pin is then driven in till $\frac{1}{4}$ in. is left out. Then go over the tops with a large flat file, so as to get them all quite level, and the instrument is ready for stringing. The blocks may be bored and pinned at any time, but it is better to put it off till after the polishing is done, so as to avoid the possibility of any grease getting into the holes. Get 2 oz. of No. 9 brass wire and 1 oz. No. 8, 2 oz. No. 8 steel and 1 oz. No. 7. This is M.W.G. (music wire gauge). If your wrest-pins are drilled, well and good. If not, make a loop of black thread $1\frac{1}{2}$ in. long, and fasten on each pin at a distance of $\frac{1}{2}$ in. from the top, by passing the loop round the pin and threading the knotted end through it. When the pin is turned to the right this loop will tighten up and gather round. Now that ribbon may go on again, and the pressure bars be laid in their grooves.

Take the No. 9 brass wire, and, holding it in the left hand, unwind sufficient to make one string and twist an eye $\frac{1}{2}$ in. long; finish this eye off by turning the free end of the wire twice round the string, and cut off this free end, leaving $\frac{1}{4}$ in. of "tail" at right angles (Fig. 13). Put this eye on the hitch-pin, and cut off the string 4 in. beyond the corresponding wrest-pin. If the wrest-pin is drilled, insert the end in the hole so that it just peeps through; if not, make a small hook of the end of the wire and insert in the loop. Turn the pin to the right, and see that the string gathers regularly round (Fig. 14). Arrange so that each succeeding string lies on the "tail" of the previous one, and, when the note is complete, place a bridge under it (with one of the pieces of wire previously prepared on top), at a distance of $2\frac{1}{2}$ in. from the right side. Use No. 9 brass wire for the first five notes, and finish the remaining five with No. 8. Get all the brass strings on first, and be careful not to put them on the pegs intended for the steel.

The steel strings are put on in precisely the same manner, and the first bridge is placed *about* 10 in. from the left-hand side. Its *true* position cannot be determined until the instrument is tuned. The row of bridges under the brass strings should stand in a line parallel with the block, but those under the steel strings follow a somewhat erratic course, owing to the intervals into which they divide the strings being unequal. The *scale* is shown at Fig. 12, and also the *approximate* places for the bridges. If when the instrument is raised to pitch the notes given do not exactly correspond with the notes shown in the scale, the bridges must be shifted to right or left till the correct place is found. All that is now required is a pair of sticks or beaters to play the instrument with. Take a piece of stoutish cane, about 15 in. long, and split it into four lengthwise; taper these gradually along their whole length till the thinnest end will easily curl round into an oval; fasten this with strong thread, and round the lower side for about 2 in. bind Berlin wool or yarn till the required degree of softness is obtained. Fasten off with thread, and cut the beater to a length of 11 in. from bow to butt. It is as well to have two pairs, one clothed more lightly than the other, as with these a different quality of tone can be obtained.

One word as to preserving the instrument. It is almost essential that a wood case be made for it, as not only does it keep damp and dust away, but it also makes an excellent resonator to stand the instrument upon when playing; and it is *quite* essential that it be kept as free from dust as possible, and never put it away after using without first wiping the strings with a soft rag to remove any damp that may have got on.

One more—keep it well up to pitch, and don't allow it to get out of tune.

HINTS TO YOUNG JOINERS ON SETTING OUT AND MORTISING.

BY B. A. BAXTER.

The readers of Work remember some hints on planing which appeared a short time ago. I should like to explain how the preceding hints may be made useful, and carry forward the instruction given into the region of practical joinery.

We have all read with interest and profit the explanation of plain, tongued, and dowelled joints, and it is unnecessary to repeat instructions given so recently; any of my fellow readers who have not read those articles, are recommended to do so at their earliest convenience.

The beginner, however, ought not to be discouraged if he cannot succeed at first in making a plain joint; when he can do so, he is considerably advanced towards being a practical workman.

The chief difference between preparing stuff for frames, etc., and joining boards, is in the use of the square. It matters nothing if the edges of a joined board were not square when glued together, if only the angle of one is complementary to the other; therefore, in shooting, the same ends of the boards are kept towards the same ends of the bench—the face sides of the boards are in *one* case towards the bench when in the screw, and in the *other* towards the workman.

If upon trial the boards are not in the same plane, the angle must be altered; if the boards appear to stand correctly on trial, care must be taken that the plane is set truly, or by the time the boards are in contact all along (which is of course to be secured) the angle will be incorrect, and the boards when glued will be very much as in Fig. 1.

Now in preparing wood for mortising, we must adopt a plan. First plane one of the largest surfaces truly, mark it, and "shoot" one edge squarely, using the square frequently to test the accuracy of the work. It is of the greatest importance to the beginner to commence rightly.

The reason why he is recommended to carefully surface one of the largest sides of his timber is because he needs to have a data, a starting-point, a standard to which to refer. In all the arts this is the same. The musician must have his standard of pitch and his key-note. The optician must determine on some standard that he may compare various refractive media to each other. The surveyor must have his bench marks, and the artist his horizontal line. The joiner's best plan is to get one surface as accurate as possible, in order that by the aid of squares and gauges he may get the other surfaces true also. Always put a mark on the tried surface.

We will suppose this done, and having set our marking gauges, one to the width and the other to the thickness, and that we have marked with a pencil the already prepared surfaces, mark with gauges and reduce to the stroke, principally or entirely, with jack plane. If there are any mouldings to be "stuck" or grooves to be "ploughed," be careful to select the shot edge and the face side with a view to smooth and satisfactory finish, which will be secured by noticing the direction of the grain; it makes an immense difference to the ease and the appearance of the work of moulding if this is always remembered.

To set out "styles," that is the upright members of a framing, place them *face to face*, the inner edges the same way, which secures the top ends being together; the places for the rails can then be marked on the edges of one pair, or several pairs at once, with a square and pencil or striking-out knife.

The rails do not always so absolutely require being face to face, but it is better to place them so, especially if there are muntings, sash bars, etc., to be inserted. In the case of work with moulded edges, the place for the mortise must be determined by the moulding: the square central portion on the edge of the frame must contain the mortise, unless indeed the whole of the moulding can be cut away where the joints occur. In such a case two parallel mortises can be made, but it is never necessary unless the work is over two inches in thickness.

If there are panels in the framing, then the size of the mortise ought to depend upon the thickness of the panel, or, more correctly, upon the groove into which the panel is inserted. May I repeat in other words? The distance of the first or nearest stroke of the mortise gauge from the face side depends on any moulding that be used; the distance of the second depends upon the size of the chisel used, which should be the same as the width of the plough-groove, if any is present.

In setting out the rails, if any moulding is present, the shoulders wherever the moulding intersects must be as much longer as the moulding reduces the "styles," and the net width of the styles subtracted from the finished width will be the guide to the actual dimensions required. The best plan to set out a framing is to draw on a strip of wood a section of the length, and on the reverse side a section of the width to a scale of 12 in. to the foot, being careful to put in all panels, grooves, mouldings, muntings, rebates, etc.: having done this, the dimensions of the shoulders can be seen at once.

Having determined the position and width of the mortise, we will examine the chisel and see if it is in good condition; if not a visit to the grindstone is advisable, for a mortise cannot be made well by a beginner, unless the whole of the conditions are favourable.

The chisel should be ground so that the ground surface is flat or hollow, the edge square and straight, and the angle produced by rubbing on the oilstone not very different from the ground portion.

The angle between the ground portion and the back of the chisel should have no burr or roughness, and the extreme edges may be rubbed enough to remove any roughness that may be left from the grindstone. Our first endeavour to make a mortise can now be made. A mortise is a rectangular chamber excavated in a piece of wood, generally for the insertion of a "tenon"; the chisel usually gives the width of the mortise, and the mortise may be of any length or depth.

In this, as in every mechanical operation, attitude is of importance. Every one knows that a circular disc does not appear to have a circular boundary unless every portion of the outline is equally drawn from the eye; we all know that a circle drawn on a piece of paper and viewed obliquely gives the appearance of an ellipse. We know too that any three points may be regarded as in one plane, or in other words a plane surface (of suitable dimensions) may be adjusted to touch any three points wherever they may be placed. Now apply these two pieces of knowledge to our humble operation of making a mortise.

Let the centre line of the tool be imagined, and the centre line of the mortise be also either drawn or imagined; these should cross each other at right angles. When the tool is in a correct position to cut, the eye of the workman should be in the same plane as the two imaginary lines we have supposed.

Have I made myself clear in this description? Let me try once more. Stretch a chalk line between two points; at any point on the line stretch another to a point above, or preferably, let a plumb-line cut the horizontal chalk line. You *can* stand so that these two lines range in one line; when it is your habit to do so, you have learnt the true attitude to assume with respect to a mortise.

I fear I have not made this important matter quite clear, but those who already grasp my meaning will, I hope, pardon my effort to make it more simple.

Let us try a simple experiment: Take a piece of wood, draw on it a straight line, on this line stick a straight wire—a mattress needle or a long knitting pin will do; let us now light a lamp or a candle; the needle will cast a shadow which by a little adjustment can be made to lie along the line; the flame of the candle is now in the plane of both the lines; if the learner stick the pin obliquely, he will find it is still possible to make the shadow range, but in that case the light is not *on* or *over* the central line we have supposed, as it ought to be. No beginner can *rely* on making a true mortise unless he can assume this position, in which he can see the direction of his chisel.

There is one other consideration which ought to be mentioned, that is, that if the edges of the wood are not square (and some workmen leave the outer edges to be planed to finished sizes after the work is glued up), the mortise may be made apparently true, perpendicular to the bench or mortise stool, and yet, because the work is not properly prepared, the mortise is not parallel to the face of the work, as it should be.

Fig. 1.

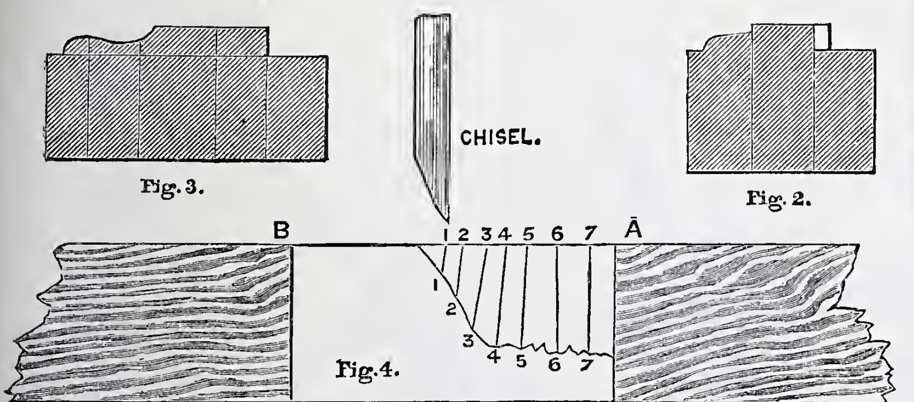


Fig. 3. Fig. 2. Fig. 4.

Fig. 1.—Section of Boards badly joined. Fig. 2.—Section of Sash Mortise situated between Moulding and Rebate. Fig. 3.—Section of Sash Style having Double Mortise. Fig. 4.—Diagram showing how to begin Mortise in Middle, cutting towards end A: reverse Chisel and cut from Centre to B.

Now a few words on the actual work, the manual part I mean. Beginners invariably make their mortises somewhat larger than they intend, because they scatter their energy over the whole mortise, and the core is an embarrassment to them. Let me advise a method. Begin the mortise in the middle, making the two first cuts remove a small piece of the core, then taking cuts towards one end about $\frac{1}{4}$ in. at each cut, and as soon as possible take each cut as deep as necessary; the flat side of the chisel is to be towards the end of the mortise to which you are proceeding. Having arrived at the line, turn the chisel; again begin in the middle, and advance in like manner to the other extremity.

Let the diagram given in Fig. 4 represent a section of the mortise, and the figures the results of each stroke.

I am supposing you can turn the style to finish from the other side. The cut marked 1 may be deepened from time to time; this will remove the core, so that when the mortise is finished, there will not be much left, and what there is will be in the middle, where it is most easily removed. If the mortise is right through, it is better to use a core-driver than to pick out the core with a chisel or other tool, but if it does not go right through, use a sharp chisel somewhat smaller than the mortise chisel.

Mortises that are intended for a tenon that passes through the style usually have the outer portion enlarged for wedging, not of course in width, but in the length; this enlargement for the wedges ought to be a very gentle taper, because taper wedges hold better than abrupt ones. An engineer's key in a cog wheel may serve as an excellent example, or the wedge of a plane is about a correct angle for wedge of tenon; these wedges, when glued and driven, convert the tenon into a dovetail, and also give a little opportunity of adjustment in putting together the work.

It is not always necessary that the tenon should go through; in such cases, care should be taken as to the direction of the mortise; neglect of this would, in case of narrow bars like sash bars, cause them to appear bent; in fact, would bend them.

Although I have said that the size of the mortise depends upon the size of the plough-groove (if present), and the position upon the size of any moulding that may be worked upon the styles, yet the cutting of the mortises is not to be left until these operations are accomplished. The mortises are best cut before either are done, although of course allowances are necessary to be made according to these. If our pupil will draw on the inner edge of styles a section of each rail in its right position, he will not be likely to make any mistake in the planning of his mortises. Every groove, rebate, moulding, etc., should be drawn, and it would be well if a section of styles, muntings, or bars were similarly drawn upon the rails—this would at once give the shoulders, and suggest where either mitring or scribing is necessary.

In all this, I have supposed that the beginner has ordinary woods to deal with, for many woodworkers, as coachbuilders, etc., do not make mortises in this manner. Among these a mortise is formed after marking out by boring away as much as possible of the timber from the centre of the mortise and paring the rest away with sharp chisels. This method is excellent for ash, oak, beech, or other hard woods, saving a large amount of work with the mallet, but a learner must exercise all his care or he will pare away too much in finishing.

About cutting tenons I shall say nothing at present, but our little experiment with the light, line, and needle may again be useful. The shoulders of the tenons in careful work ought to be marked with a knife or chisel, and the tenon saw kept the right side of the line, that is to leave the knife-cut line to form the actual joint, otherwise the saw kerf robs the length of the rail by an amount equal to its thickness.

If any question arises as to insufficient description or unintelligible explanation, it will be welcome, as many of these operations are more easily performed than explained.

In Figs. 2 and 3 are represented, in section, a single and double sash mortise. I have said that the shoulders of tenons should be marked with a knife or chisel. A chisel is, perhaps, the handiest tool by far for this kind of work for the skilled workman, but for amateurs of average capacity, an old dinner or dessert knife that has been broken across the blade, about the middle, leaving a square, or almost square, end to the blade, will be found excellent as a marker.

THE BROOCH: HOW TO MAKE IT.

BY H. S. GOLDSMITH.

BROOCH TONGUES.

THIS is the first of a series of papers on matters connected with the manufacture of jewellery and goldsmiths' work, and it is devoted to the consideration of the making of brooch tongues.

But before I enter on the subject I have chosen for my initial article, I think it will be desirable to put clearly before my readers the objects and aim that I have in view in writing these papers.

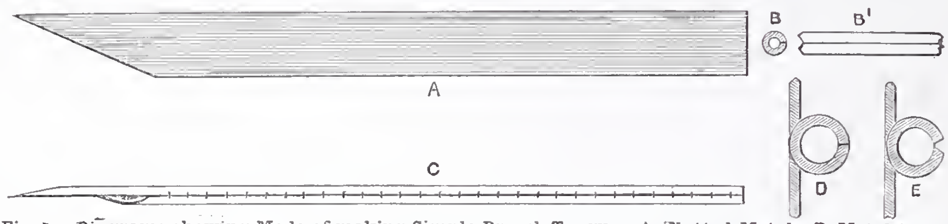


Fig. 1.—Diagrams showing Mode of making Simple Brooch Tongue—A, Flatted Metal; B, Metal turned up, transverse section; B', Ditto, Elevation showing Joint; C, Tongue complete; D, Joint rightly made; E, Joint badly made.

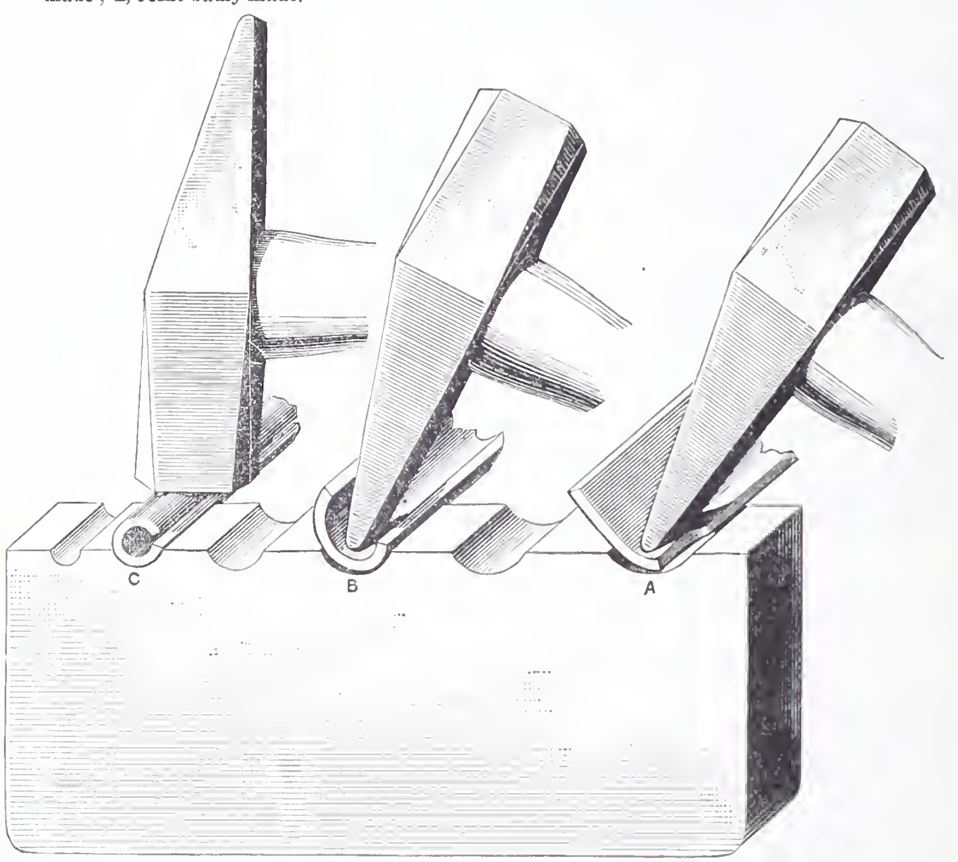


Fig. 2.—Hammering Plate on Bending Block in First Stage (A), Second Stage (B), and Third Stage (C).

In the first place, the objects are to help the younger members in the knowledge of their trade, and to give them some of the principles on which they should set about their work.

The method will be that of describing the manufacture of every-day articles, beginning with the simplest, and gradually advancing until we get to important pieces of work, such as, for example, bracelets and tiaras in gem work, and caskets, etc. etc., in all gold work.

My aim is to interest and, I hope, to instruct those who wish to improve themselves in the art of manufacturing jewellery and goldsmiths' work of every kind.

If I were to ask ten of my fellow-workmen what was the first article that they tried to make or were taught to make, I feel sure that nine would say in reply: a brooch tongue; and as we must make a beginning somewhere, I thought that would do as well as anything to start with.

Everybody knows what they are, and that they can be bought ready-made for very little money; but the fact of being able to *buy* things used in our trade will not carry much weight with the writer of these papers, for he holds that a workman should thoroughly know how to do things right out, from start to finish; not that we shall always have to do the things treated on, but that the knowledge *how* to do these things is useful knowledge, and, what is more important still, we shall be gaining experience in the materials in which we have to gain our living.

What sort of a living that will be depends on the things we have been taught *and learnt*, on the things we have picked up from fellow-workmen and from books, and the uses to which all these can be put. Therefore you apprentices, for whom these papers are principally written, not only get all the knowledge you can, but try and *think* about your work as well, for it is the lining of your head that will either bring you profit or the reverse—according to the way you have packed it yourself.

First of all, our materials to make the simplest brooch tongue are tubing, or chenier and wire.

The chenier will be made from flat plate of a thickness suitable to the size tube required—it is rarely as thin as size 3, Shakespear Gauge, and may be made size 10, or even size 15 for very large brooches, where a fancy shape such as a barley-corn joint is used.

Our piece of metal, either gold, silver, German silver, etc., will be first flattened to a suitable thickness. Secondly, cut to length and width required, as in A in Fig. 1. The width of plate is easily calculated by making our plate three times the width the tube is to be, or—to put it in another way—the plate is as wide as three diameters of the chenier. Cut the end off as in A in Fig. 1: make it perfectly flat, and with the borders quite parallel. While filing to regulate the borders, you can at the same time take a little more off the inner edge (Fig. 1, C), so that when the plate is turned up we shall get it to draw quite close, as shown in the same diagram (Fig. 1, D), and not like Fig. 1, E, as it will be sure to come if no provision is made for the different diameters, inside and outside of tube.

This direction is not of much importance in small chenier, but it is very necessary to have that allowance made in large chenier, in order to avoid that sign of bad workmanship. I mean filling up with solder. (I wonder how many of my readers have done that, not thinking it would be noticed by the master—but it was, wasn't it ?) Now that our plate is quite flat and true, and with this level properly made, we will proceed to make it into chenier by the aid of a hammer and bending block.

This bending block is usually of hard wood or horn for small work, while for larger and heavier sizes, bronze, brass, or iron is necessary. It is merely grooved out in varying sizes, as Figs. 2 and 3, and is held in the large vice, or else the bottom of a sparrow-hawk block is grooved out and used.

Fig. 2, A, B, and C, gives the position and successive stages of formation; the only remarks I have to make in addition are first, that the metal should have been annealed; second, that the edges are got up before the centre; third, that the pane of the hammer is of a nice rounding form, and not sharp at the ends, where it might cause some nasty dents.

Fig. 3, A and B, is the wrong way of making this chenier. It is easy to see that the outside edges will get reduced considerably before the draw-plate is able to get our tube round on the outside, and even then the hole, instead of being round, will retain some of the pear shape it originally had. No amount of clearing the hole out with a joint-brooch will correct it, and altogether we shall not be able to get a smooth working joint, as we should do, and such as we do get, when the tubing is properly made. Chenier drawn over a mandrel will be dealt with later on, when we come to consider joints of boxes, lockets, etc.

In order to finish our chenier ready for soldering on, it should now only require to be drawn through a few holes in a draw-plate to get it to our size.

Perhaps even during this process we may find that the point is too weak to stand the strain of drawing down. If that is the case, we shall have to strengthen it by soldering it up, or else by introducing a piece of wire.

ıd soldering that as well. 'ou must use your own ıdgment whether the latter ıethod is necessary; gene- ılly, neither is required for ıe common run of brooch ɔint.

It is then annealed in rder to clean it from any rease it may have picked p in its passage through ıe draw-plate, and put in ıe pickle (vitriol, 1 part; vater, about 30 parts). Varm is best, but cold will o if you are not waiting for our work. Take it out of pickle" when clean, rinse ; well in clean water, and ry it. If the metal we are vorking is rather hard, it vould be as well to tie everal pieces of iron bind- ng-wire round it in order o keep the seam closed up; r else, as we shall do later n, to wind iron binding- vire all round from one end o the other.

After drying it, score it ıcross the join or soldering eam with a saw or three- quare file, like Fig. 1, C, when t will be ready for use.

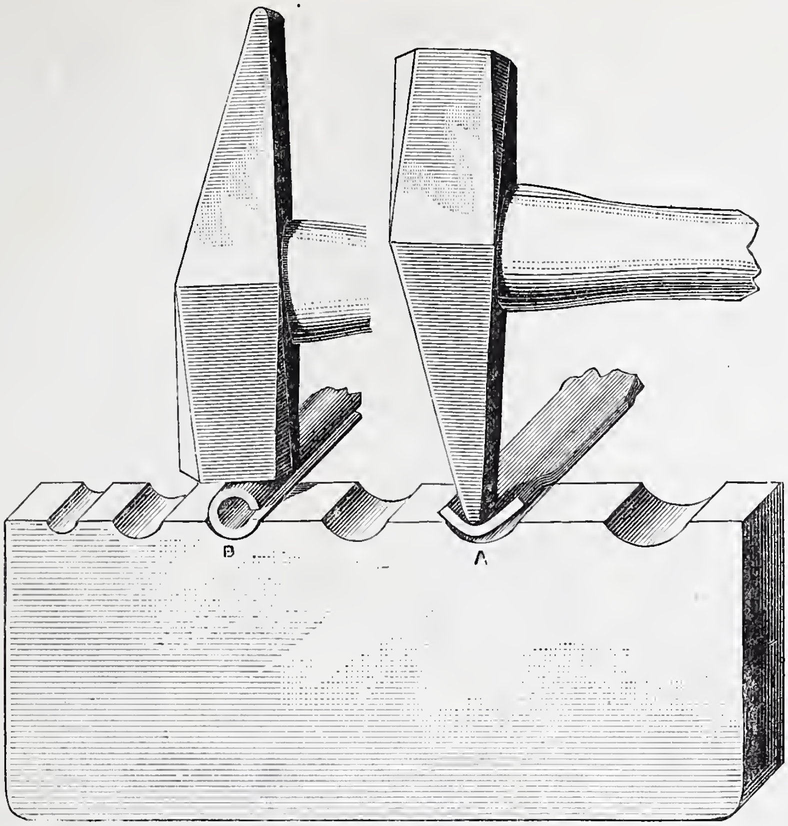


Fig. 3.—Diagram exemplifying at A and B the wrong way of making Chenier.

The wire out of which we ıre to fashion the tongue hould be drawn down to he proper size, and should ıot have been annealed for the last six to welve holes, so as to have it rather hard.

Now to make the tongue, which, after all, onsists merely of soldering a piece of wire ɔn a piece of tube. Cut a piece off the henier and place it on a piece of flat charcoal ɔr pumice-stone, in which a notch has been ut or filed to keep it from running away; ınd see that the seam is just where the wire vill cross it (Fig 4, B), and that this part is craped clean, else the solder will not hold.

The part of the wire that crosses the henier should be hammered just a little, so as to get a slight flat surface to rest on the chenier. Scrape the part that comes in contact perfectly clean, and then proceed to solder it, only don't make it red hot all along. Remember that we have drawn it down hard, for a reason that will appear presently.

Having soldered it, I hope you have done this without filling up the hole with solder. You can always prevent this by placing a single horse hair through the hole. It will not be necessary after a time, but new hands do the very things you do not want them to do whenever you give them the slightest opportunity to go wrong.

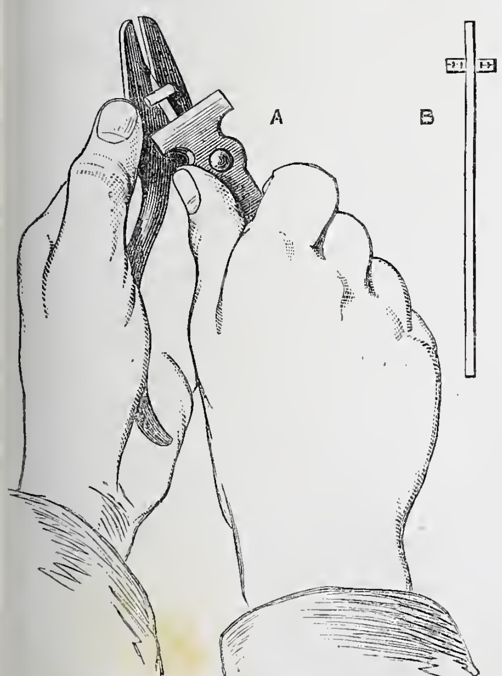


Fig. 4.—Twisting before Hammering (A); Metal before Twisting with Top attached (B).

Is it necessary to tell you that if your piece of joint is long, you must take care to solder the seam right to the ends; or should I leave such common-sense matters to you? I now and then see this left undone, therefore I here speak of it; but when I do meet with this, I can tell you I don't think much of the fellow that does it—or, rather, that does not do it—he is almost past praying for.

Now to finish the tongue. First it has to be boiled out, or "pickled," to remove the charred borax, etc. Then it has to be hardened, and, thirdly, fitted to the joint, filed up, and given the proper shape ready for the polisher.

The second stage only concerns us now. We have had to pickle the chenier, so you know what that means. And please remember, now and henceforth, that work from the boiling-out pan or pickle pan must always be rinsed in the clean water pan that should stand beside it under the soldering jets; or, if they are fixed to the board, then on the pickle shelf. A good deal of bother would be saved if this were always done.

If the tongue we are making be a 9-carat gold one, merely hammering it round and round on the flat iron, small anvil, sparrow-hawk, or beck iron, or whatever you use in your shop, will be sufficient; but if we are dealing with German silver or gold of a better quality, then it should be twisted (Fig 4, A) as well before we hammer it, else we shall find it is not hard enough. You see in Fig 4 that it is being twisted *only* near where it has been soldered; the other part that is held in the vice was drawn down hard purposely, as you will remember, in order to save trouble in doing work twice over.

The fitting into the joint is so simple that it wants no description; but it will need care and skill, too, to get it to fit well.

Now, as to filing up, it should be given a good shape in section; generally, it is either round or oval, although occasionally I have met with them triangular or bayonet shape.

The points should be filed the shape of Fig. 5, A, B, C, D, E, F, G; not the shape of Fig. 5, H, I, J.

I don't think any words are needed to point out the weakness of Fig. 5, H and I, or the clumsiness and ugliness of J. Just let me whisper that the end should be filed to a *point*, and not left partly done, as you do sometimes.

In reference to the shape or curve (if any) that a tongue should take, the illustrations are surely sufficient, particularly if you remember the work it has to do is like that of a bayonet or sword, not like a corkscrew.

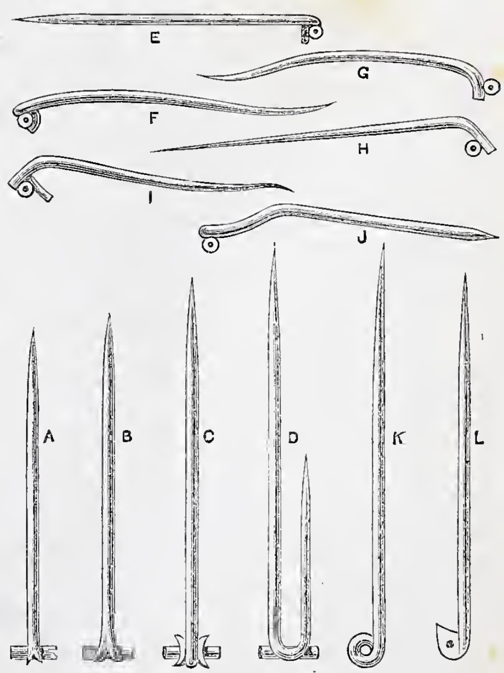


Fig. 5.—Right way of filing Point, A, B, C, D, E, F, G; wrong way of ditto, H, J, K; Wire turned round and soldered, K, L.

It has to pierce, not to wriggle, through cloth or other dress material.

The different ways there shown are all matters of every-day occurrence and explain themselves, with perhaps the exception of the double one shown in Fig. 5, D, which is intended to prevent a top-heavy brooch from tilting forward.

At K, L, in Fig. 5, two brooch pins are shown which are made differently from any of the others spoken of. K is simply the wire turned round and soldered, and this is used with a joint to be shown in the next paper. The illustration to be then given is one form of so-called Etruscan joint.

The pin at L is made with a flat plate, which is afterwards drilled and filed into shape. This also will be further noticed in the paper on joints.

Hardening the tongue should have much more attention given to it than it generally gets; for on the power of the tongue to act as a spring always pressing against the top of the catch the safety of the brooch depends to a very great extent. Perhaps if notice is here taken of this matter it may help us to get these tongues made properly. Surely they are simple enough to do, yet I find many workmen will file up and finish a tongue in great style as far as appearance goes, but the lady, on placing her brooch in her dress for the first time, finds the tongue bend just as though it were made of lead or copper. Such men cannot but know the proper way to make them, but they are not conscientious, and I am afraid set a very bad example to the juniors. Shall I be saying too much if I say that those who skulk their work in these small matters are a disgrace to their trade?

The very men who leave undone the part of the work on which safety so often depends, and which would not take them another five minutes to do, are those that growl and think themselves hardly done by when the foreman recommends the retention of a more conscientious, and may be younger, man in their stead, if it is necessary to choose—as it sometimes is. The one may have less experience, and may not have such an all-round knowledge of work, yet he will improve; while my daily experience as foreman teaches me that a tendency to skulk or shirk once shown will increase until it is almost impossible to suggest that they be given another trial, after they have once been "sacked." It causes trouble to everybody, and I much fear sends them down a few steps lower, and mostly, if my observation is not entirely in error, through their own fault.

On the other hand, I have the pleasure of knowing many members of metal-working or engineering professions whom it has been a real pleasure to work with in their classes for teaching technical matters: they take such an interest in their work. Has the lack of technical education in matters connected with this trade anything to do with the scarcity of really first-class workmen, and the miserable way many of them turn out work just a little different from the usual run? I believe it has, and if the ruling body of the Goldsmiths' Company will only consider the possibility of forming such classes, I feel sure that many who are willing to learn will avail themselves of them; and as for the others who do not want to learn—well, they can go about their own pleasures. All I dare hope for is that opportunities may be given to those wishing to advance themselves, as is done in nearly all other trades except this one. To any one who really takes an interest in his business, the gift of a large sum of money a few months ago for technical classes, which *do not include* ours, by the Goldsmiths' Company causes a great feeling of injustice; and this thought will arise: Are those in authority there in any way connected with the trade? It surely is open to great doubt when they help members of other trades to rise, and by their lack of interest in their own trade they deprive its members of gaining knowledge, which they admit is right in other cases, but not in ours. Surely the trade of goldsmith and jeweller is an artistic and scientific profession, and should be encouraged more than by the few prizes given by the Society of Arts, and others, which are for the highest class of work, and for which there is no opportunity of preparing oneself.

It is the improvement in general work and a knowledge of the principles on which it should be done that is wanted most at the present time, and I regret very much that more powerful pens than mine have not taken the matter up long before this.

Enough of that for the present, but I hope I may be allowed the privilege of writing a few words on other matters to which, I think, attention should be called.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

113.—DALE'S NEW CHIMNEY TOP "EJECTOR."

AT this season of the year the wintry winds, blowing in fitful gusts from every quarter, too frequently remind us that we have not yet arrived at anything like perfection in the methods at our command for warming our rooms and getting rid of the smoke that escapes upward from our fuel by reason of imperfect combustion. A composition has been produced with which we are to doctor our coals and render them smokeless at the cost of 1s. 3d. per ton—a most excellent thing in its way, if the results to be obtained from its use are in accordance with the promises made by its proprietors. I have not yet had an opportunity of testing this new substance, but it is my intention to do so, and tell my readers my experience of it, with as little delay as possible. Meanwhile, however, let us consider Dale's New Chimney Top "Ejector," a variety of "tall-boy" which, from its construction, seems likely to facilitate the escape of smoke into the open air without being driven back again by a downward draught to the place whence it has come, to make its way into the room itself, to soil with unburnt carbon and nauseate with its objectionable odour. The external appearance of the "Ejector" is shown in Fig. 1, and a sectional view in Fig. 2. From these its construction and action may be easily understood. The invention, as applied to chimneys or as a ventilator, has for its object improvements in its make for maintaining in either a continuous upward current of air, thereby preventing the down blow by the sudden or accidental cessation or reversal of such current of air. The chimney top itself is made in two parts—namely, the lower or central pipe, A, which is surrounded by an outer or external case, B, sustained by four triangular supports, C, which act as guides or channels to assist the upward current of air between A and B. It will be noticed that the lower end of the upper part, B, is so constructed as to form a cone-shaped projection, and round the central part of the lower portion, A, a piece of zinc is soldered on so as to form another conical projection, the counterpart of the projection above, and placed in a reversed position. The supports, C, are attached to the cones, D, D, and form the connections between the upper and lower portions of the chimney top. Thus between each pair of adjacent supports is a space to admit the ingress of air from whatever quarter the wind may happen to blow. The smoke ascending from below enters the lower portion, A, and makes its way into the upper part, B, in the direction shown by the central arrow, and having attained this point it is driven onwards, upwards and outwards, by the current of air which enters the spaces between the triangular supports, C, and proceeds upwards between the lower and upper parts of the chimney top, as shown by the arrows on each side. Thus the return of smoke down the chimney is prevented, for any downward action of the wind, or down draught, is prevented by the up-rush through the spaces between the supports shown at C, C. Of course, it is not possible to speak with absolute certainty of the performance of any contrivance of this kind without trial, but as far as theory goes it seems all right enough, and sufficiently good to warrant its trial by any one who is unfortunate enough to have a smoky chimney, which has been pronounced incurable. The Chimney Top "Ejector" is the invention of and is made and supplied by Mr. Walter Dale, 22, Malvern Road, Kilburn, London, N.W. It should be said that it can be made to fit any existing chimney pot, or with a square base, as shown in Fig. 1, for building in with brickwork—14 in. by 9 in.—in zinc, or galvanised iron, as the purchaser may prefer.

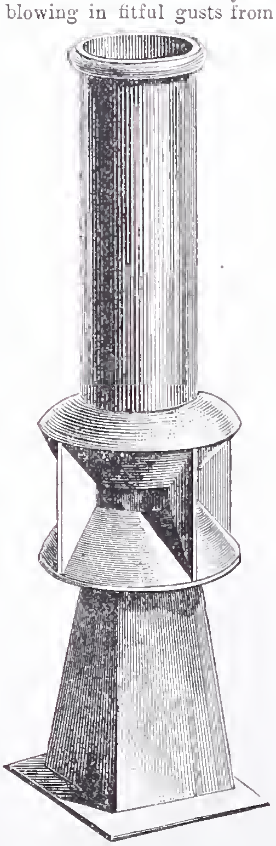


Fig. 1.—Dale's New Chimney Top "Ejector": external view.

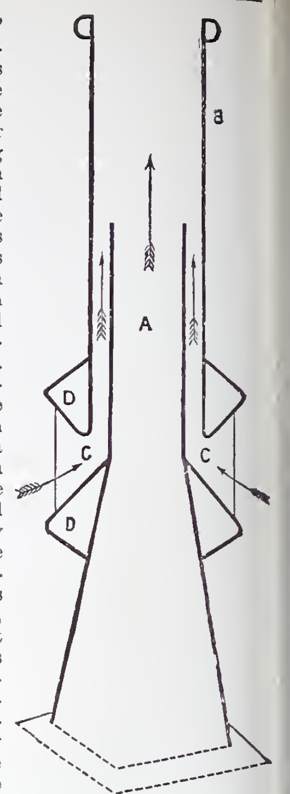


Fig. 2.—Dale's New Chimney Top "Ejector": section.

If any reader has tried the chimney top here described I shall be glad to hear the result of his experience, and to learn if its performance is equal in every respect to its promise.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

⁂ Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Bookbinding and Book Boxes.—R. W. S. (*Leeds*) writes:—"I hope you will soon be able to give us the articles on bookbinding, promised so long ago as May (in No. 7). The year is drawing to a close, and I daresay many of your readers, like myself, would like to bind their loose pamphlets and parts, etc.—the accumulations of the year—and place them upon their bookshelves. I have already tried my hands upon making book boxes, for keeping small papers, catalogues, etc., in a handy way for easy reference, and find them most useful. A friend procured me a number of cast-off cloth backs, removed from the books by the binder for enclosing them in more expensive bindings. These, with cardboard sides covered and lined with marbled and glazed papers, quite ornament the shelves, and cannot be detected from the genuine books. A loose index placed in the bookcase gets over the difficulty of the lettering not indicating the right contents. If you think that a description of how the boxes were made would interest the readers, I would be willing to forward an illustrated paper on the subject. I trust, when we do get the article on bookbinding, that we shall have the cheaper forms of bindings treated of at length, as I daresay the majority of amateurs would hardly care to tackle the expensive leather covers."—[The bookbinding papers will be given at the earliest possible date. Meanwhile cannot R. W. S. gather any useful hints from the articles "Binding Made Easy," in Nos. 6 and 9 of Work? I should be glad to see the paper to which you refer, if you will send it me on approval.—Ed.]

Printers' Rollers.—J. O. W. (*Bridgwater*) writes:—"I see a correspondent in No. 34 (see page 541) gives instructions for making printers' rollers, but he is certainly wrong. '1 lb. of glue to a gallon of treacle' would make a mess, but not a roller. Take 1 lb. of good glue, crack it up, soak in water a couple of hours, then put it on the fire to melt on the same principle as a carpenter's glue pot—vessel in a vessel. When melted, add 2 lb. of treacle, stirring it occasionally and letting it simmer together until well incorporated—about a couple of hours—when it will be ready (after scum is taken off) to pour into warm, oiled mould. Don't stir for a quarter of an hour or so before pouring, or you will get air-holes in roller. Let it stand till thoroughly cold (next day is best), when you may pull out. An amateur with a little ingenuity may easily make a small mould from tin, or a tin canister may be utilised. The quantities given are what I have used in practice, but rollers may be made harder or softer by adding more glue or treacle as the case may be. Printers' rollers are now extensively made from a different composition made of glycerine and gums, which composition may be bought ready for casting of any of the printers' brokers at from 1s. to 1s. 6d. per lb."

Working Drawing of Tramcar.—W. M. C. (*Glasgow*) writes:—"Would F. C. (*Leytonstone*) oblige me with tracing of above with measurements? I will gladly pay for it. Also drawing with measurements of the common cab."

Lacquer for Iron and Steel, etc.—A. J. L. (*London, N.W.*) writes:—"What Steel (see page 526) requires is, I think, either the 'Karnwood steel enamel,' or Koch & Co.'s 'varnish for metal and wood.' These are both of them blue and used cold. I cannot give the preparations, as I believe them to be secret."

A Simple Incubator.—W. H. J. (*Belper*) writes: "In No. 35, page 557, W. L. (*Kingsland*) writes how to make a simple incubator. Will W. L. please say, through 'Shop,' what size lamp is wanted, and what heat the sand should be kept? I hope to hear from W. L. soon."

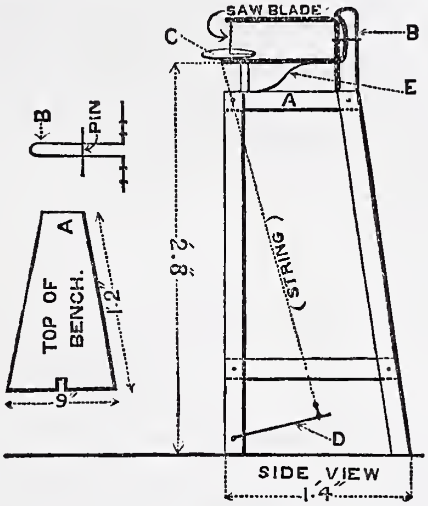
Wheeling.—G. W. (*Bournemouth*) writes:—"The mild effusion of Wheelwright's Clerk (see page 587) was partly caused by punctuation, or want of it. My meaning was for amateurs liking to try wheeling, to take the Editor's tip to Trench (page 237)—prepared wood, etc. It may be new to some (the fact, I admit, is not so old as the pit frame) that the major part of stamped forgings used in the trade comes from France. The average wheelers' trips to Glasgow, etc., are, or have been, on shanks' pony (see U. K. S. reports)."

Useful Scroll Saw.—Verdant writes:—"If Artist in Wood (see page 476) would kindly give a few more details concerning the above, I should feel greatly obliged. For instance, die of fly wheel, length of slide rods, how attached to saw? how is the saw strained or tightened? and how is the saw frame made?"

Small Foot-Power Bellows.—Medicus (*Hampstead*) writes:—"As many amateur mechanics like myself often have occasion to do some soldering or brazing, it would be a great assistance to us if you would give us a paper with sketches showing us how to make a small foot-power bellows with continuous blast to be used with the gas blowpipe. I have the latter, but I daresay a good many of your readers would be glad to know how to make this for themselves, if you would describe it in addition to the bellows."

Polishing Wheels—Tube Saws.—A Regular Subscriber (*Liverpool*) writes:—"I would like to ask Opifex through you which of the receipts for polishing wheels, given in No. 24 Work, page 371, he considers best suited for putting a fine edge on wood-turning tools. I would also like to ask S. M. (*Skelwith Bridge*) if he thinks the tube saws mentioned in his letter in 'Shop,' Work No. 27, page 428, would be suitable for cutting oak across the grain, say up to $2\frac{1}{2}$ in. diameter, in a 4-in. foot lathe."

Easily-Made Fret Machine.—A. J. P. (*London, S.W.*) writes:—"I send you sketch of one which I think much more simple than the one in No. 21, page 332. I made it myself; it is my own idea; I have had it in use for about four years, and



Fret Machine.

find it works well, and is very easily made. It consists of a small bench made of any pieces of wood of a suitable strength, and an ordinary hand frame of either 12 in., 15 in., or 18 in. from saw to back. First make a bench as shown at A, with three legs, a piece of hoop iron or wood, B, or small table, C, for working on treadle, D, and small steel spring, E. The cost of the whole is about 3s. If you do not quite understand the sketch I will send you a small model in cardboard."

Combined Bench and Tool Chest.—Tyro (*Hull*) writes:—"I notice in No. 33, page 524, of Work, a drawing of and instructions for making a Combined Bench and Tool Chest, by Mancuniam. I think it an excellent testimonial to the value of Work, as an assistant to the efforts of the amateur mechanic, that Mancuniam, from being—as he owns he was—only a tyro previous to the advent of Work, should, in the time that it has been before the public (33 weeks), be able by its aid to make such a useful article as the one he describes. Being somewhat of a 'wood-spoiler' myself, and having only a limited space in which to exercise my talent (?) in that line, and to stow away the tools I possess, I at once, on seeing Mancuniam's article, became fired with the ambition to construct such a one for myself. I should, therefore, esteem it a great favour if Mancuniam would, through your columns, state the quantity of wood required, and the probable cost, as hitherto my experience in wood-buying has been very limited."

Tool Wanted.—B. A. B. (*Hampstead*) writes in reply to Gauge Point (*Paris*) (see page 446):—"Two accurate 2-ft. rules will quickly and correctly measure any opening less than 4 ft. For wider ones Gauge Point might get one 3 ft. as well, or a pair of 5-ft. rods as used by surveyors. These will measure correctly and easily any dimensions between 5 ft. and 10 ft. I see nothing makeshift about it, and believe that if it were needed or if it were possible some simpler plan would soon be introduced. I do not see that any improved tool is called for. As to bevel for stair rail joints again, how can any tool be invented to fulfil conditions so varied, and which it is impossible to indicate beforehand! Gauge Point appears to want a universal template cheap and handy. A good plan to adopt for a square across hand rail if straight is a very thin steel straight edge made of clock spring steel. This, which must be wide to be correct, is very useful for squaring any rail that is straight and not tapering. As to a bench grip for veneer or a door, Gauge Point ought to consult the advertisement columns, looking for 'instantaneous grip vice.' There is now no difficulty about it. The only thing is to keep the thing in order when bought. Ordinary care will do this."

An Easily-Made Fret Machine.—H. S. R. (*Highbury*) writes:—"I notice in Work (see page 525) a reply to my inquiry of how the fret machine is to be worked, and must thank W. R. S. for his courteous reply, and shall be very pleased if you would give me his address so that I might be enabled to accept his invitation and see the machine at work. Since my letter to your most valuable paper, I have seen very many inquiries about this same machine, so that this shows that I was not the only one who could not see how it was to be worked. I am afraid I wrote a little prematurely about this machine, as I think I can see now what W. R. S. means, although there are a few little details for explanation which can only be explained by my seeing it at work. I should not have taken the trouble to write about this machine, only that I take a great interest in the paper and everything that is in it, and wait for its appearance with the same interest as I should the weekly part of a novel, as I consider it a most interesting and valuable paper, from which I have got many suggestions which have been of use to me. I might say that I have no intention of correcting the machine (could I do so), as I have little doubt that, from what W. R. S. says, it is perfectly feasible."

About Scrapers.—Scraper (*Cottingham*) writes:—"I have taken your paper from its commencement, and have gathered some very valuable information from it, which I should have taken an earlier opportunity to acknowledge, but I have seen so many letters of congratulation (and discontent) that I thought you would be tired of it. The article I more particularly wish to mention appeared in No. 24 of Work, entitled 'A Few Words about Scrapers,' by a Cabinet Maker. I had heard of this tool some time ago, and not knowing exactly what sort of thing it was, inquired at my tool shop, and bought one, but to my annoyance, when I tried to use it, I could make nothing of it. I scraped till the perspiration rolled off me, but not the slightest impression could I make, and at last threw it aside in disgust. I did not pay much attention to the article on scrapers when it appeared, as I think I had scarcely got over my previous annoyance; but having this week a little job on hand requiring a nice surface I thought of the article, and leaving my work, looked out the paper and read it carefully. I thought what a flat I must have been, for I knew that chisels and other cutting tools were not usually sold in working order, and I might have known that scrapers were the same, but I didn't. However, I went to work again, followed the instructions to the best of my ability, and to my great delight dressed up the wood to my entire satisfaction, and at once determined to write the first opportunity and thank the writer for his useful hints."

Index.—A. X. E. (*Nottingham*) writes:—"I think the suggestion of Barehead (see page 445) a very good one, although perhaps it might not be convenient on the first page, as he suggests. It might find a convenient corner somewhere, perhaps in place of the fly sheet I sometimes find snugly folded in my weekly copy."

Men Worth Knowing.—A. X. E. (*Nottingham*) writes:—"I can fully bear out Help Each Other's remarks on page 516, No 20, about Mr. Pool's tool warehouse being a good and cheap one. I have traded there several years, in fact, ever since he started in business on his own account. I was in his shop only last Saturday, and seeing a copy of Work on his counter, I remarked that I had seen his name mentioned in it, and he replied, 'Ah, you see what it is to have a good reputation!' And, being myself a native of Spalding, I can also bear him out in what he says about Mr. Massey. Perhaps cheap labour has something to do with cheap production thoro."

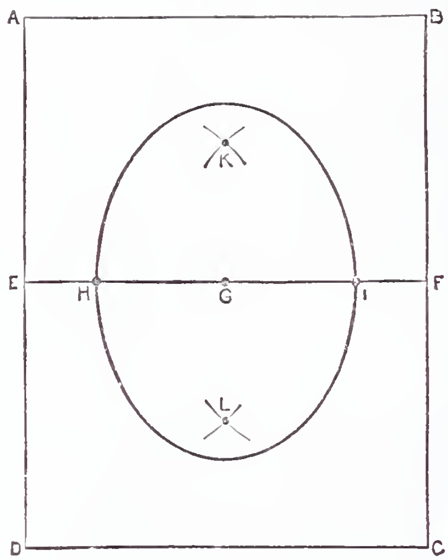
Plane Iron Bevel—An Amateur's Dodge.—R. H. (*Newcastle-on-Tyne*) writes:—"Finding a great difficulty in getting a straight, smooth, and even bevel on my plane iron, I found the following give a capital cutting edge, which worked very smoothly:—Take the iron out and unscrew the plate, set it $\frac{3}{4}$ to 1 in. from edge, and pass the whole through the sole of plane as far as it will go, depending on size of mouth. The iron will now project about $\frac{3}{4}$ in. Take sharpening stone in hand, and resting one end on back of plane work it over the projecting iron. The angle formed gives the cutting edge. I noticed some little time ago in Work instructions, etc., to sharpen a plane. It struck me at the time that perhaps my dodge would prove of service to many amateurs who have found a difficulty as I have in getting a straight and even bevel on the plane iron, so here it is."

Etching Mordant.—W. J. P. (*Tunbridge Wells*) writes:—"Having noticed the reply to Cupid (see page 541), wherein the informant says he never heard of such a compound as an etching mordant, I beg to offer the following information. The mordants used in etching vary much both in strength and materials. I have never used but one mordant, and that consists of about half nitrous acid and half water. This is rather a rapid bath, and I should say the biting in would be accomplished in about half an hour in all. The nitrous acid should be purchased in a stoppered bottle, and should be of a yellowish colour. I shall be pleased to furnish your correspondent with a further list of baths if required, and any other information in my power on the subject."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Artificial Wood (Willesden Paper, etc.).—G. P. (*Openshaw*).—I imagine what you have in your mind is the welded Willesden paper, the manufacture of which depends on the following considerations:—It has long been known that a solution of cuprammonium hydroxide has the power of dissolving (or apparently dissolving) cellulose. I say apparently dissolving, for many chemists doubt whether a true solution takes place. At any rate, when paper, cotton-wool, and similar celluloidal substances are digested in such solution they disappear, and whether they are actually dissolved, or simply gelatinised and diffused through the liquid, is of little practical moment. In fact, the discovery itself, like so many others, was for a long time simply an interesting laboratory experiment. Scientific chemists were assailed with the usual, "Oh! very pretty, no doubt, but what is the use of it?" and had no reply till an ingenious chemist conceived the idea of taking canvas, paper, etc., through the solution at such a rate as to simply gelatinise the exterior of the fibres without disintegrating them, by which means, on subsequent drying, the film of gelatinised cellulose would be converted into an elastic varnish in which the copper would be taken up in the form of cupro-cellulose, thus rendering the article perfectly proof against water, rot, or mildew. The above process, with such modification as experience has suggested, has been for some time worked on a commercial scale by the Waterproof Paper Company, Willesden, and the verb to Willesdenise has found ready acceptance in this connection. The Willesden goods are broadly divisible into two general classes: (1) Round or made-up goods, such as cordage; and (2) flat goods turned out in the roll. Goods of the first class are simply dipped into a bath of the solution, the strength of which and the period of immersion varying according to the article. In addition to the water-resisting, etc., properties thus conferred, it is also found that the treatment adds to the strength of the material by more or less cementing the fibres together. Goods of the second class form by far the more important section, and are subdivided into canvas, screen, and paper. Of the two former little need be said, the treatment being but little different from that described above, except the goods are usually unwound from one roll, pass successively through the bath and a series of drying rolls, and are finally rewound on to another. Coming now to Willesden paper, this is either welded or unwelded, the former being simply a roll of paper, treated as above, and applicable to innumerable useful purposes, as waterproof packing paper, lining for damp walls, waterproof stationery, etc. Welded Willesden paper is formed by simply pressing one or more layers of the unwelded while still superficially gelatinised by the action of the solution into one compact solid sheet or panel of indefinite length. These sheets may be of any desired thickness, and are known as 2-ply, 4-ply, and 8-ply respectively, from the thicknesses most in use. For 2-ply, two rolls of materials, either alike or dissimilar (say two of paper, or one paper and one calico), are simultaneously passed through the bath, and then pressed and dried as a whole. Two rolls of 2-ply passed through the bath a second time, pressed together, and dried form 4-ply; while two rolls of 4-ply similarly treated produce the 8-ply. The 2-ply is mostly used as a floor covering, and it has been found to wear fully as well as kamptulicon, linoleum, and similar preparations while immensely cheaper. It is also found to serve a useful purpose for laying on or under floor boards as a damp and draught excluder, as also as a packing, for damp walls and leaky roofs, and for internal decoration; 4-ply has come into extensive use as a building material, especially in cases where a combination in the same material of strength, lightness, and flexibility is a prime consideration. Another strong point in its favour is that, being entirely weather-proof—neither damp, nor frost, nor tropical heat affecting it in the least—it requires no painting (though for decorative purposes it will take paint readily enough). It also possesses many advantages over galvanised iron. Being a comparatively poor conductor of heat, buildings thus constructed will be warmer in winter and cooler in summer than those constructed of iron, while being so much lighter, the cost of transit is correspondingly reduced; 8-ply is mostly used for panelling where extra strength is required, the entire absence of the slightest tendency to split or crack being not the least of the many advantages claimed for this material over ordinary panel boards. It is also strongly recommended as a material for boat and ship-building, as vessels thus constructed would be both light and very easy to repair. I should, therefore, imagine that this is just the material you require, and could readily be obtained with such further information and advice as might be necessary from the company named. Unless for the sake of the experience to be thus acquired, I do not think it would be worth your while to experiment personally, as so much nicety is required in adjusting the strength of solution, timing the duration of immersion, etc., to say nothing of the presumed absence of suitable appliances. The cuprammonium hydroxide solution is made by the action of strong ammonia on copper turnings in a current of air. It was early suggested that the corresponding zinc compound (zinc-ammonium hydroxide) might be substituted for the above, but its action was found to be both too slow and too feeble to make it capable of replacing the other with advantage. Inasmuch, however, as the presence of zinc in the finished product would, in some cases, be desirable, further experiments were made, and it was found that by combining the two solutions, or, better still, by making a compound solution (using brass turnings instead of copper), some advantages were gained, zinc-copper cellulose instead of simple copper cellulose being thus secured. Of course, there are other forms of artificial wood known and in use, and one of these I will now mention. This process, though invented fully twenty years ago, has only comparatively recently come into extensive use. It consists simply in mixing very fine sawdust with bullock's blood (whence its name "hæmosite"), and submitting the same to hydraulic pressure. A great variety of articles having all the appearance of the most beautiful ebony carvings can thus be pressed in strong suitable moulds. Quite recently I learn the process has been utilised in the manufacture of brushes. The hair is set into the paste while still soft. This is then covered with the perforated plate to permit the passage of the hair; pressure is now applied, whereby brushes of one piece are formed, which are more durable and cheaper than those produced by the old process. The composition is also largely used for the production of door knobs and smaller articles.—P. W. S.

Cutting Mounts.—R. H. (*Lancaster*).—In cutting mounts the professional man depends upon a steady hand and sharp eye for cutting ovals, domes, or any fancy shapes, and usually keeps an assortment of his old centres for marking out new ones. See answer in "Shop," August 10th, page 333, for cutting square mounts. The plan illustrated cost sixpence. To mark an oval, the following is always the way a professional mount cutter proceeds: Trim your board upon which the mount



Mode of Drawing Ovals for Mounts.

is to be cut square, as marked in accompanying diagram. Draw a line across the centre, from E to F, then take the dividing compasses at half the width of your oval required, and place pin leg in centre, and mark width, H and I. Then measure your compasses half the length, and place pin leg in point H, and draw half circle, and again pin leg at point I, and draw again. Knock pins or wire nails in points where lines cross K and L and H, tie a piece of cotton tight round the three nails, withdraw nail H, and place your lead pencil in its place. Keeping it perpendicular, draw the line at full stretch of the cotton, and the oval is struck. Withdraw pins or nails, and proceed to cut round pencil line.—G. R.

Generation of Electricity in Dynamos.—J. H. H. (*Rochdale*).—You know, of course, that the armature of a dynamo is whirled rapidly round in the field of two electro-magnets. The iron in those magnets have some residual magnetism—that is, permanent magnetism remaining in them. As the armature revolves, the coils of wire with which it is wound cut across the lines of magnetic force, which always extend from one pole of one magnet to the other pole of the other magnet. This action on the part of the armature in the field of magnetic force induces a current of electricity in the coil of wire wound on the armature, which is communicated by the brushes to the outer circuit of the machine. Space cannot be spared in "Shop" to fully describe and illustrate "the passage of the current through helix and magnets," but you will find it fully described and illustrated in Parts 4, 5, and 6 of "Electricity in the Service of Man," now being issued by the publishers of WORK. A volt is the unit measure of electromotive force given by the current from one standard Daniell cell. An ohm is the unit measure of resistance given to the passage of an electric current by a 10 feet length of ·01 inch copper wire of 95 per cent. conductivity, or any other piece of wire offering an equal resistance. An ampère is the unit measure of current volume. It is that volume of current which will liberate ·000159 grains of hydrogen per second, or the equivalent proportion of any other substance in the same time. For full information on this subject, see my "Notes for Electro-Platers," section on ampères, page 130. You will learn much by the study of Professor Thompson's book on "Dynamo-Electric Machinery," and also "Electricity in the Service of Man," just mentioned. Shall be pleased to help you with advice at any time.—G. E. B.

Bronzers' Manual.—J. W. V. T. (*Frome*).—I do not think such a work as you mention is published in this country. Paris being the seat of a vast industry of bronze and other fancy metal ornaments, would naturally furnish the demand for it, since, I take it, the work you know of would refer to the bronze metal and not the imitation work. Concerning the latter, I am pleased to be able to help you, having at one time expended much pains and time in collecting and bronzing a collection of uncommon plaster cameos, busts, etc. All colours of bronze can be purchased in powder form or in solution under various makers' names, of methylated spirits and shellac, or spirits of salts, etc. If bought in liquid form they are applied with a suitable brush. The effect of this kind of liquid bronze is but second rate, so I advise you to purchase the powder from a dealer in gilders' material, and one who has a large and varied assortment of dry bronzes for you to select from. As the subject of gilding and bronzing will be thoroughly treated in WORK, I will ask you to be content with a few brief instructions. Well dust your plaster castings, and then give two successive coats of strong patent size; when thoroughly dry and hard give a coat of hard-drying copal varnish, and when this again is hard another good coat. This last coat we rub the powder bronze on to, using a little piece of new wash leather. Apply the bronzes when there is a good amount of tack—that is, stickiness—upon the varnish, but the surface must be comparatively dry and not at all soft. Some fine effects of imitation copper and dark green bronzes can be made by bronzing the article all over with gold bronze. When hard give a thin coat of varnish, and after paint it with a mixture of varnish and bronze green or copper paint, wiping the paint off the raised parts with rag, which show the gold through the paint. Bronze powders are best protected by a last coat over of copal varnish. There are numberless methods of getting fine imitations by the use of gilding and transparent lacquers, but these must wait for the present. "Shop" is developing so rapidly that the space is becoming most valuable. Shall be pleased to help you later on if desired.—F. P.

Castings for Ornamental Slide Rest.—'ARRY.—Apply to E. Hines, Griffin Works, Norwich.—F. A. M.

Sand for Brass Casting.—'ARRY.—I believe the best sand for amateurs is obtainable from dealers in dentists' appliances.—F. A. M.

Boat Building.—BOAT.—I quite agree with you that papers on boat building will be generally acceptable. There is so much, however, in hand that they cannot be commenced in the present volume, though if any of the promised single papers on canoe building, etc., reach me, they shall appear.

Copy from Fretwork Pattern.—TO THE BITTER END.—If you want to avoid the trouble of tracing your copy from pattern, which, I presume, is printed, you cannot do better than adopt the cyanotype or blue printing process of photography. This you will find fully described in No. 13 of WORK. A still simpler plan is to sensitise the paper with a solution of bichromate of potash, instead of the chemicals used in the blue process, though the resulting prints (the copies which are brown) are not so distinct. In either case the copy will be got more quickly by oiling the pattern so as to render the paper less opaque. When you have a piece of fretwork to copy from, I suppose you are aware the simplest plan is to take a rubbing from it with heelball.—D. A.

Lawn Mowers, Sharpening of.—J. S. (*Spilsby*).—Lawn mowers on the Archimedean principle may be sharpened by reversing the direction of the blades and applying very fine emery powder and oil. There is a small iron handle, usually supplied with each machine, which screws into one of the driving wheels, and by which the reversed motion is imparted to the cutters. The spiral blades are set as closely as possible to the fixed horizontal blade, along which the emery and oil is smeared, and the blades are then made to revolve as quickly as possible. You ask how to "grind and set" a lawn mower "by hand?" This is, as you say, sometimes attempted by unskilled workmen with the invariable result, which you also point out, that "lots of lawn mowers are spoiled." The fact is that it is impossible to grind spiral cutters true without the aid of machinery.—OPIFEX.

Inlaying.—H. G. W. (*Bridgwater*).—The centre ovals for inlaying, of which you send sketch, are made of veneers. The coloured pieces are white wood dyed through their entire thickness, while the lighter pieces are of box or some other light wood, shaded with hot sand. Veneers ready dyed are to be had from such people as D. Witt & Palmer, Drummond Street, Euston Square, N.W., much better and at less cost than you can prepare them for yourself in small quantities. Each piece, whether plain, shaded, or dyed, must be accurately cut to fit the position it is to occupy, either by fret saw or other means, straight edges being shot true. To shade, take a pan or dish containing sand, which must be heated sufficiently to brown any wood put into it. Care must be taken not to make the sand so hot as to char or burn the wood. Put the edge of the piece to be shaded into the sand, carefully watching the effect produced, and continue doing so till the desired tint is obtained. Though not difficult to manage after a fashion, care is necessary to get the gradations equal. When all the pieces are ready, glue them either direct on the work they are to ornament, or adopt the usual course of gluing them down on a piece of paper along with the surrounding veneer. The whole can then be laid in one piece with the paper, which is afterwards to be removed, uppermost. Before laying the veneer, but after the glued paper has dried, go over it on the uncovered side with a toothed plane or file to remove inequalities in thickness, and to slightly roughen the surface. Lay with a caul. Any fret saw will do for cutting inlays. Marquetry cutters generally make their own saws, but you will probably find it more convenient to buy them ready made. You will find a No. 2 blade do very well, but you may use either much coarser or finer if you prefer for such work as the centres you refer to.—D. A.

Bevelled Ends of Wash-Tub.—J. G. (*Glasgow*).—To bevel the ends of a wash-tub without first bevelling the top and bottom edges, all that is necessary to be done is to bevel the edges of the blade of bevel as described on page 173, to the same angle as you have decided to splay your sides, and mark your joints on the square edges of same in that direction (Fig. 1), fixing the blade of the bevel blade square across the stock, as the butt joint would be square if the sides of the tub were upright and not splayed. A good way to thoroughly understand this would be to bevel an edge of a waste piece of stuff to the angle or splay determined, and mark on the face the splay, and on the edge the bevel of butt joint (given by above bevel). Then make a saw cut down about $\frac{3}{4}$ of an inch. If you now plane the bevelled edge down square again and apply the bevel, you will at once see what I mean. Should you find any difficulty in determining the splay of your sides you will find a simple method given on page 414, but I have generally found in practice that it is more important to work to a certain width of stuff without jointing. For example, let us suppose you want to make a washing-tub, and you have some pieces of stuff that will work, say, 14 in. wide and 1 in. thick when planed up; all that you have to do is make a mark across the width of stuff to any angle, bearing in mind that the nearer the angle is to 90° the deeper the tub will be when finished. If the depth is not of much consequence, this is the right line to cut to without any further trouble, whether the edges are square or bevelled (Fig. 3).

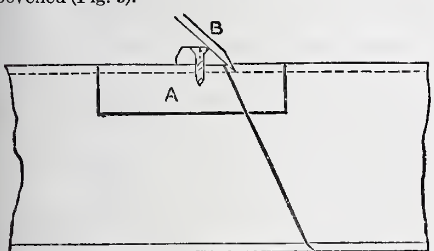


Fig. 1.

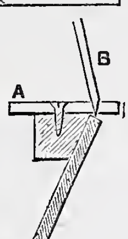


Fig. 2.

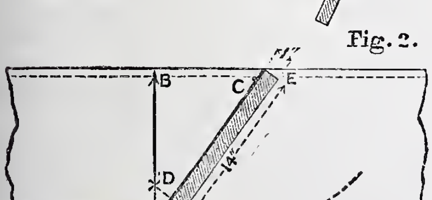
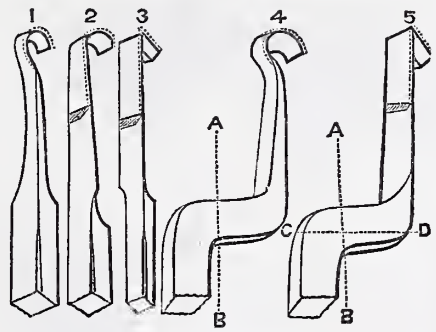


Fig. 3.

Bevelled Ends of Wash-Tub.

Should you wish to know how deep the tub would be if cut to this angle, you can easily find out by setting off the width and thickness of your stuff on this line (hatched on diagram), then mark off the two dotted lines, which will indicate the width the sides would be if the top and bottom were bevelled. Now square a line across the board from A to B, and from C, with width of board (which we will assume is bevelled) as radius, describe an arc, cutting A B in D; B D will then be the depth inside if the edges were bevelled. Should they not be bevelled it would be as much deeper as the stuff E E you do not plane off, and, if a line were drawn from D to C, that would give the bevel in elevation as explained by B. A. B., page 414; but I always endeavour, if possible, to keep away from elevations, etc., of oblique lines, as they are apt to be confusing, especially in connection with wash-tubs.—E. D.

Turning Inside Work in Soft Wood and Polishing Ivory.—Tyro (*Liverpool*).—You can, of course, turn your soft wood boxes inside with gouge and chisel, but if you want to make tooth-powder boxes by the score you will require hook tools, and must learn to use them. The chisel scrapes inside work, which answers perfectly for hard woods such as box-wood, but tears and leaves a rough surface in soft wood, requiring sand-paper to finish. The hook tools, Figs. 1, 2, 3, 4, 5, which are traced from the fourth volume of Holtzapffel's work on Turning, will cut and not scrape an inside surface, and the work is done with rapidity and smoothness. I have put dots round the cutting edge to distinguish it. Figs. 1, 2, and 4 act as gouges, Figs. 3 and 5 as chisels for flat surfaces, and these two last have an angle which is a little less than a right angle, and is very difficult to keep



Hook-Turning Tools.

quite sharp. Figs. 4 and 5 are called cranked tools; they can be used with the cranked part lying on the rest turned across the lathe-bed (as usual in inside work) along the line C D, which steadies and prevents their catching in; or they can be laid on the rest while it is still parallel with the bed along the lines A B, so that the hollowing can be done without even stopping to turn the top of the rest round. No. 1 costs 3s. 6d., and No. 3 costs 4s. 6d. from Holtzapffel. Ivory is scratched with sand-paper, and it may be turned extremely smooth with a sharp tool; if you must use sand-paper rub together two pieces of the finest grade before using them on the work, or you can use Dutch rush. To polish, make a cream of washed whiting, and apply it with a rubber of folded rag, moving it about to avoid marking the work with rings.—F. A. M.

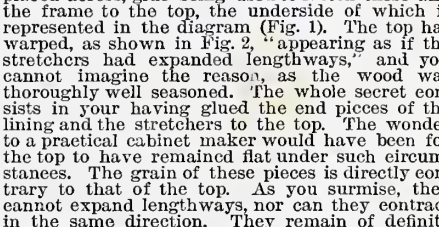
Polishing Fretwork.—N. M. (*Norwich*).—Do not be discouraged at your partial want of success in getting a fine bright polish on your fretwork, for the spiriting off is the most difficult part of the process. To manage it properly requires practice. You are probably correct in supposing that the cause of the polish being rubbed off is the use of too much spirit when "spiriting off." You should have the spirit rubber just moist enough to soften the surface of the shellac, and so remove the previous rubber marks. By having an excess of spirit in the rubber, you, of course, dissolve too much of the shellac, which is thus washed away. "Briskly" is hardly the way to apply the spirit rubber, as it rather implies that you have scrubbed too hard. Try an equable gentle movement, with what I may almost call a dainty touch, and by exercising your powers of observation, of which you are not deficient, you will soon note an improvement. Do you know that you should use a clean rubber for spiriting, and not the one you have bodied in with? Yes, you can move the rubber in any direction. Suppose you were to try glazing instead of spiriting. It is much quicker and simpler, and does well enough on fretwork, which, as a rule, is not subject to the wear and tear of ordinary furniture. As you are not an experienced polisher, you will probably get better results than by the superior method of legitimate French polishing. Now for the planing problem which you submit. With a fine set plane you should be able to smooth the edge of the board from whichever end you start, but it is almost impossible to say that this could always be done. A little "dodging" is sometimes necessary, and an experienced person would manipulate according to circumstances—in fact, it is just in cases of this sort that experience is most valuable, by showing when departure from a general rule is advisable, and may be practised with benefit. The jack is not the best plane for you to have used. The trying plane would have been better. If you have not got one of these, you might have managed with a smoothing plane, though, as this is short, very likely you would have experienced a difficulty in getting the edge perfectly straight. Don't think you are troubling. It is a pleasure to assist any one who evidently uses his brains along with his fingers and tools.—D. A.

Oak Stain for Pine Bookcase.—H. M. (*Glasgow*).—It is impossible to answer questions in the "first issue" after receipt, as the pages are made up some time in advance, that the enormous number of copies of Work may be printed and ready for publication by the date they bear. Hence the reason for answer to your query not having appeared ere now. You do not say whether you want a light or dark oak colour to your bookcase, but the following mixture allows of great latitude in shade as well as in actual colour, according to the quantity of water: Vandyke brown mixed with liquid ammonia, and then diluted with water, a little Bismarck brown being added to give the reddish tint required. Another good stain may be made by dissolving bichromate of potash in water, and adding some of Stephens' walnut stain to reduce the orange colour of the bichromate. If the putty which you have used to fill up (a bad plan) shows too prominently, paint it over with the stain till it corresponds with the wood.—D. A.

Ebonising and Polishing Picture Frames.—Chemicus (*Hammersmith*).—It will be better for you to buy a black stain ready prepared. You can get this from any oilshop where polish is sold, and it is not only more economical but more satisfactory to do so. If, however, you prefer to make your own stain, here is a recipe. Boil some log-wood chips in the proportion of, say, $\frac{1}{2}$ lb. to a pint of water, till all the colour is extracted. Apply the decoction to the wood, and when dry wash over with iron liquor made with steel filings, or scraps and vinegar. This turns the wood black, and when dry it is ready for French polishing in the usual way, which, I presume, you are acquainted with. Very likely the grain of the wood has been raised by the moisture of the stain. It should be rubbed down with very fine glass-paper till the surface is quite smooth again. As you do not say what wood your frames are of, I am unable to particularise on the details of polishing, but assuming this to have been done, and that a dull or dead black is wanted, the gloss is removed by emery or pumice powder dusted over with a brush or soft rag. For ebonising it is better, especially if the stain is not intensely black, to blacken the polish by mixing some gas black in it. This, however, is not always considered necessary, though it is a safe plan to adopt. The black polish should be strained before using.—D. A.

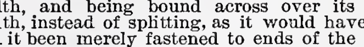
Warping of Table Top.—Somerset.—The cause of your table top having warped is very evident, and the lesson to be learned from it is so important that, for the benefit of other amateurs, I answer you as fully as the limits of "Shop" will allow. For the benefit of others the case is stated. A table top $\frac{5}{8}$ in. thick is lined up to 1 in. In addition to the framing, A, stretchers, B, were placed across, glue being used to fasten these and the frame to the top, the underside of which is represented in the diagram (Fig. 1). The top has warped, as shown in Fig. 2, "appearing as if the stretchers had expanded lengthways," and you cannot imagine the reason, as the wood was thoroughly well seasoned. The whole secret consists in your having glued the end pieces of the lining and the stretchers to the top. The wonder to a practical cabinet maker would have been for the top to have remained flat under such circumstances. The grain of these pieces is directly contrary to that of the top. As you surmise, they cannot expand lengthways, nor can they contract in the same direction. They remain of definite length. The table top, however, has contracted in width, and being bound across over its whole width, instead of splitting, as it would have done had it been merely fastened to ends of the pieces referred to, it has simply curved in the direction it has. I presume you have not read the articles on "Lining up," and "Lessons from an Old Bureau," which have appeared in our pages, and I should

Fig. 1.



Underside of Top.

Fig. 2.



FRAME

Warping of Table Top—A, Frame; B, Stretchers. All Glued on.

strongly advise you and other amateur cabinet makers to do so. Had you studied them before you made your table, you would have avoided the error, by no means a common one among amateurs, into which you have fallen. If you bind wood across the grain by transverse pieces, with the grain running in the contrary direction, one of two things is almost sure to happen. Either the wood will warp, as in your case, or split. If you had done as directed in the articles on lining up, screwed the ends of the frames and cross stretchers, leaving the screw necks loose, probably no such disaster would have happened. As the lining extends all round you should, even with screws, have cut the transverse pieces a trifle short—not much; $\frac{1}{16}$th would have been ample, for you can easily see that were they to fit tightly within the longer parts of the frame, the natural play of the top would be prevented almost as much as by glue, the chief difference being that it would probably have split instead of warping. If you preferred to use glue, you could have done so with safety by having the grain of the lining and stretchers in the same direction as that of the top. Look at the leaf of any good dining-table, and you will find the lining is glued on in this direction. You do not say the size of your table top, but as you say it is only small, I think you might safely dispense with the stretchers, B, unless the legs are fitted into them, in which case you can use screws to attach the top, as their grain will then naturally run across. The end linings will be better glued on, of course with grain coincident with that of the top. I trust I have made the cause of warping clear not only to yourself, but to others who may have met with similar mishaps, and I shall be glad to hear how you get on.—D. A.

III.—Questions Submitted to Correspondents.

Californian Red Wood.—Redwood asks:—"Having just fitted up a room with Californian red wood, which looks beautiful and neither requires paint nor varnish to improve it, I am anxious to know from any reader if anything can be done to preserve the colour, which I find since mine was finished has faded in the houses of others where it has been for some years."

Railway Carriage Building.—R. C. C. (*Plaistow*) writes:—"I shall be glad to hear of the best published book on railway carriage and waggon building, with price."

Fairy Bells.—Subscriber (*Bristol*).—Sorry I cannot answer your question as to the "Interior of a Fairy Bell." Possibly some reader may like to give you information.—W. F.

Bell Metronome.—Fiddler (*Glasgow*) writes:—"Would any kind reader please tell me how to make a metronome with bell?"

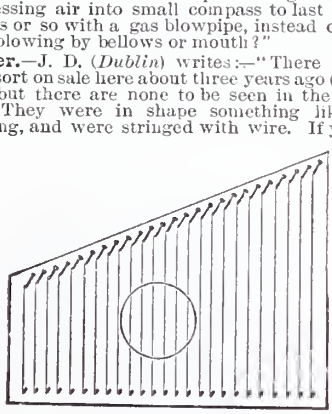
Chemistry Tests.—(*Cwmdn, Swansea*) writes:—"Please inform me through columns of 'Shop' if there is a book published 'Eggertz' Method Colour Tests for Chemistry'; where, and what price?"

Pitch of Roofs.—C. M. (*Hornsey Park Road*) writes:—"None of my building friends can really help me in this matter. When glassing the roof of a greenhouse or tiling a shed, I can only get an oracular 'That's too low,' or 'That's not high enough,' but none can give me any definite rule as to the necessary angle to be allowed. Will some of our Work friends kindly help me in the matter?"

Tarring Fence.—C. M. (*Hornsey Park Road*) writes:—"Will some obliging subscriber to Work tell me how to set to work on the above? What tar must I use, and how prepare it for use, and also how lay it on? Some of the tarring I see about remains wet for months, and gets half washed off by the rain."

Compressing Air.—Dealer (*Leeds*) writes:—"Would you or any of your staff be so kind as to give me dimensions of a simple arrangement for compressing air into small compass to last fifteen minutes or so with a gas blowpipe, instead of continual blowing by bellows or mouth?"

Zither.—J. D. (*Dublin*) writes:—"There was a cheap sort on sale here about three years ago (7s. 6d. each), but there are none to be seen in the shops now. They were in shape something like the following, and were stringed with wire. If you do



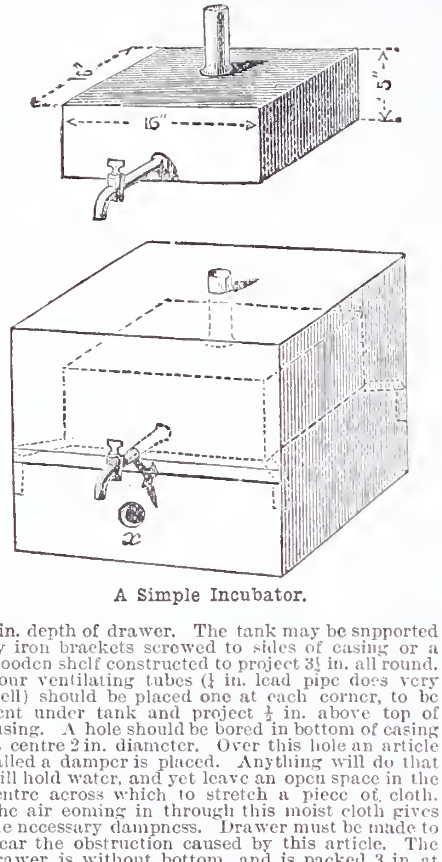
Zither.

not intend publishing a paper, perhaps you or some of your correspondents would let me know the proper angle at which to make frame with the length of strings, size of sound-holes, etc. By an early answer you will greatly oblige."

IV.—Questions Answered by Correspondents.

Tramcar Working Drawings.—X. Z. Y. writes:—"In reply to your correspondent J. W. F. (*Lancaster*), No. 33, page 526, working drawing of tramcar—Mr. J. J. Jones, 28, Overdale Road, King's Road, Chelsea, S.W., will give him what information he requires."

A Simple Incubator.—J. T. R. (*Walker, near Newcastle-on-Tyne*) writes in reply to B. F. (*Liverpool*) (see page 302):—"Regarding plan for incubator of a simple construction, I beg to offer him a few suggestions derived from a very successful experience in the matter of hatching out. I am only afraid that the space allowed by the Editor for reply to his question will hardly suffice to explain all that is desirable as to the proper management of this interesting 'tin hen.' If permitted, I shall be pleased to give the readers of Work the benefit of my experience at some future time, should the Editor deem the subject a suitable one for his all-round paper. First, the large tin box must be soldered tight. By this I mean there must not be any leak. If B. F. does not wish the incubator to cost him anything after he has it all made, he will adopt what may be termed the 'kettle of water' system, the heat being kept up by periodical fillings of hot water. Therefore the tank (tin box) will require a tube inserted on top, say, $1\frac{1}{2}$ in. diameter and about 4 in. high. A tap will also be required at front, about 1 in. above bottom of tank, to project, say, $4\frac{1}{2}$ in. Secondly, having proved the soundness of the tank, the outside casing may be made. This is a box built round tank, but 3 in. bigger at each side and top—viz., a 16 in. square tank will require casing to be 22 in. square. The height of the casing for tank of 5 in. depth would be 14 in., arrived at as follows:—3 in. for packing above tank, 5 in. depth of tank, and



A Simple Incubator.

6 in. depth of drawer. The tank may be supported by iron brackets screwed to sides of casing or a wooden shelf constructed to project $3\frac{1}{2}$ in. all round. Four ventilating tubes ($\frac{1}{2}$ in. lead pipe does very well) should be placed one at each corner, to be bent under tank and project $\frac{1}{2}$ in. above top of casing. A hole should be bored in bottom of casing at centre 2 in. diameter. Over this hole an article called a damper is placed. Anything will do that will hold water, and yet leave an open space in the centre across which to stretch a piece of cloth. The air coming in through this moist cloth gives the necessary dampness. Drawer must be made to clear the obstruction caused by this article. The drawer is without bottom, and is packed 3 in. at front with flocks. The best packing at the price is flocks, and the 3 in. space round tank and at top must be closely packed. There must also be 3 in. of packing at sides and back of drawer space, cased off. The front of drawer should be $\frac{1}{2}$ in. bigger each way (length and breadth), and felt placed round the projecting edge. A thermometer is required to project into drawer, and be able to be withdrawn without having to open drawer. My experience is that tin is of little use, the water quickly making its way to the outside. Black iron, and the tank galvanised after made, is best. I keep the heat up without aid of kettle, running a tube through tank, and using a small lamp, which is kept burning. Heat as near 104 degrees as possible for good results."

Varnish for Drawings.—M. T. C. C. (*Carrickfergus*) writes in reply to A. M. (*Glasgow*) (see page 508):—"I think the varnish A. M. wants is clear paper varnish; it is the only varnish that I know that is almost colourless; but he must first size his drawings, or when he puts the varnish on they will turn almost black. Let him give his drawings two coats of glue size, then varnish, and all will be well. Varnish can be had from any oil and paint merchants."

Cleaning Engravings.—M. T. C. C. (*Carrickfergus*) writes in reply to Ivor (*Bradford*) (see page 494):—"Ordinary paint will not stand the action of lime. But most enamels will. Brunswick black and black japan stand the lime pretty well too, if allowed to dry hard."

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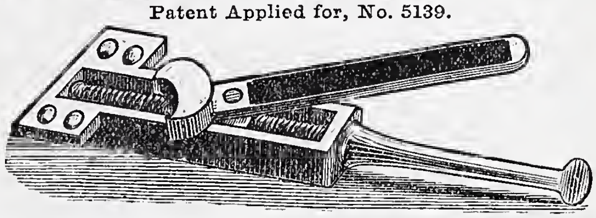

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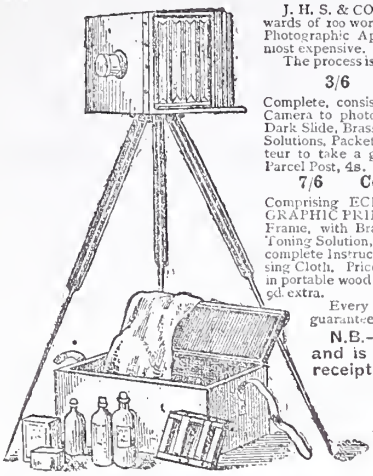

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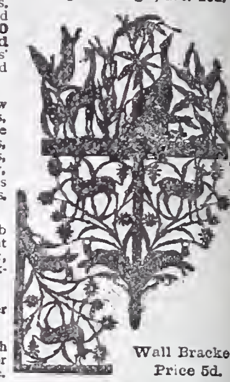

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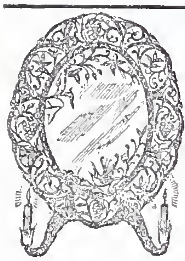

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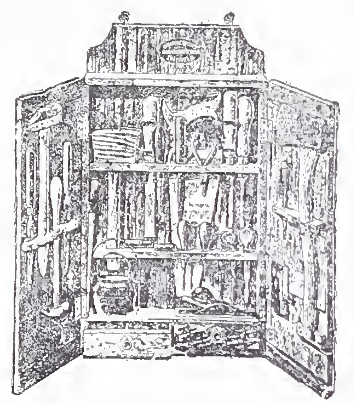

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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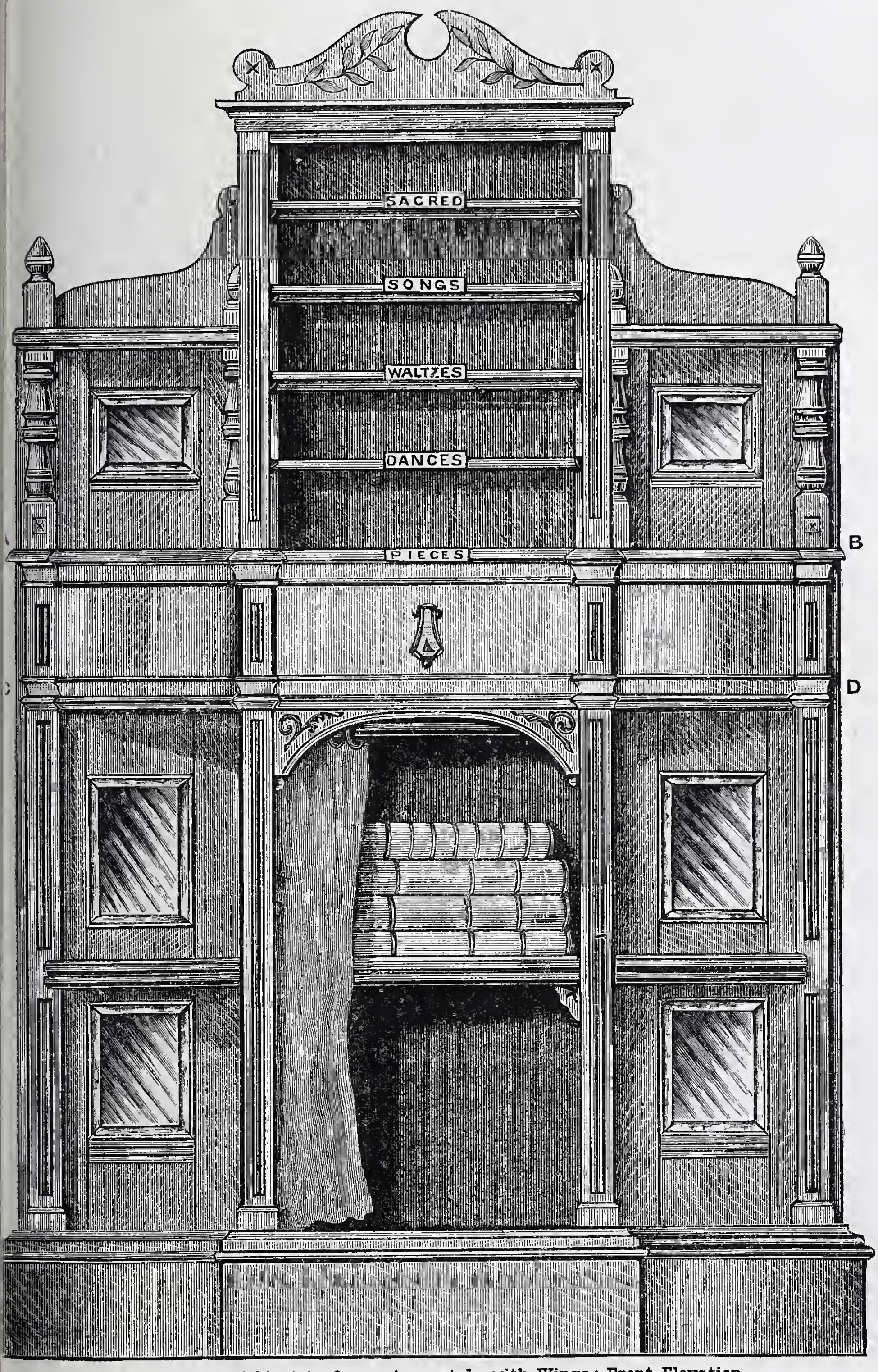

Fig. 1.—Music Cabinet in Queen Anne style with Wings: Front Elevation.

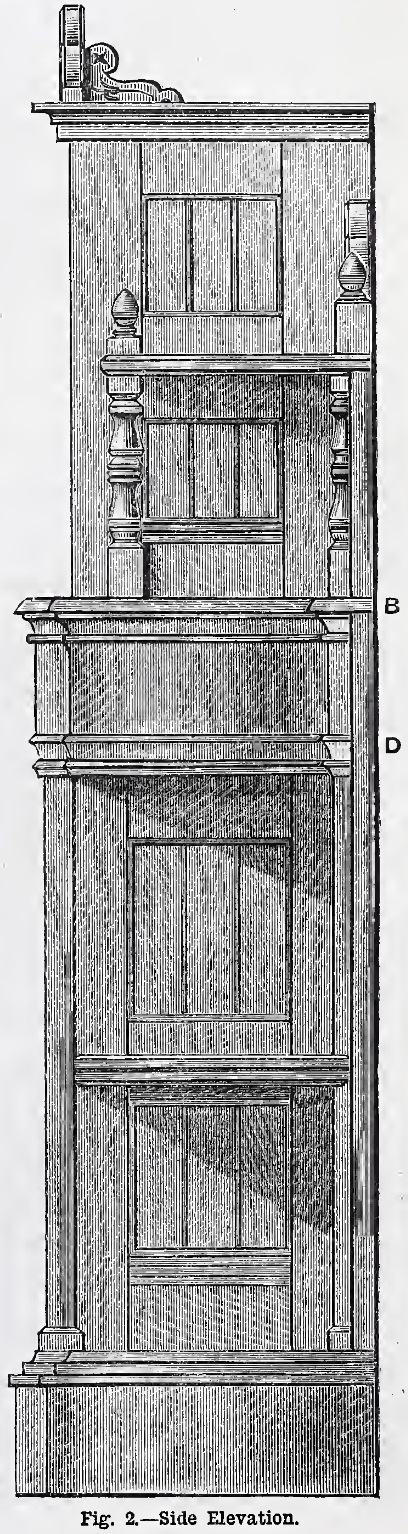

Fig. 2.—Side Elevation.

A MUSIC CABINET IN QUEEN ANNE STYLE.

AN ALTERNATIVE METHOD AND DESIGN.

BY JOHN W. HARLAND.

In continuation of my subject commenced in No. 39, I now give a design in the Queen Anne style, as more suitable for modern drawing rooms than the semi-Gothic, but simpler, cabinet shown and described in No. 39, which, as I then said, was more suitable to the school room and morning room than to the more expensively decorated rooms devoted to the reception of and entertainment of guests.

A reference to the drawings and a comparison with the first design, even if cursory, will show that, supplementing the same usefulness and the same actual proportions, a pair of wings are added for the display of the inevitable "bric-à-brac," the English translation of which, curiously enough, is found in the rhyming word "knick-nack," although derived as they are from distinct and wide-apart seats of language.

The height and narrowness of the former design are here dissipated by the means I have employed to give breadth and importance to the cabinet as a decorative piece of furniture, whilst its cost, so far as labour only goes, is augmented, the extra quantity of material being almost nominal.

Preserving the previous dimensions and the same construction, which is the strongest possible so far, the centre portion of both cabinet and pedestal, and also of the drawer and lower plinth, I must first show how the new design can be made so as to lift off the upper part from the lower, for convenience in removing it from one place to another—a great desideratum in London. This can either be done at A, B, B, or at C, D, D (see drawings), according to individual choice; the latter is my own preference, and the following construction will refer to this mode; any change therefrom will have to be modified somewhat by the individual carrying it out. Let us premise that our drawings are $\frac{1}{8}$th full size, *i.e.*, $1\frac{1}{2}$ in. equal 1 foot, and that the first step in the attempt to make it is to enlarge these scale drawings to full size, either on paper or upon a working drawing board.

Here note that, for the sake of symmetry, any article of furniture brought into juxtaposition with a pianoforte, organ, or even the ordinary furniture of a drawing room, should reproduce proportionately the relative heights of other furniture in the sub-division as to stages. The keyboard of a piano, organ, or harmonium, the mantel-shelf or board, the brackets round the walls, or any other principal projections, should have some ratio to one another, or there will be a distinct, though perhaps an unconscious, impression conveyed of incongruity, scarcely accounted for, but undoubtedly present. This has governed us in the height of the top of our pedestal and the commencement of the superimposed cabinet, both in the present and in the former design. Hence, if placed side by side it will be seen that the levels A, B, B, and C, D, D, are the same identically in both.

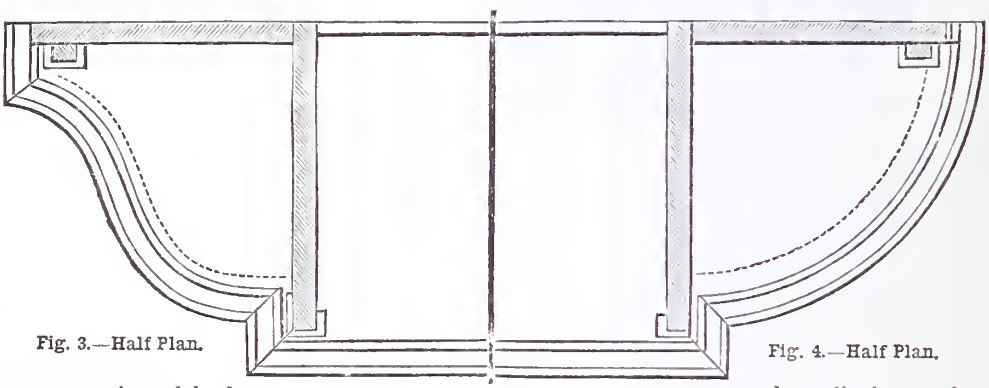

Fig. 3.—Half Plan. Fig. 4.—Half Plan.

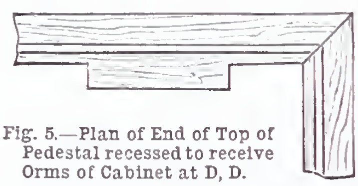

Fig. 5.—Plan of End of Top of Pedestal recessed to receive Orms of Cabinet at D, D.

Having framed together the two pairs of frames, with their panels made as shown, which constitute the sides of the centre portion of the design, in the same way as those described in my last—so far as the remarks then made can be adapted to the present design—proceed to frame a winged entablature with drawer in centre as shown, made to carry the wing-style next to be described.

On the extreme left and right of the back of the cabinet to support the ends of the entablature, to receive the ends of the plinth, and to carry the shelf for "bric-à-brac" above the entablature, at the same time affording a style for the panelling of the back boards of the wings, should be a corner post, $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in., sawn into two at the level of D (so as to part there in lifting off the upper portion), but fitted with a dowel, to maintain its position, one end of which dowel should fit into a hole to correspond, but not of course glued, except where it is fitted into the lower part of this corner post, which should descend to the floor, and carry the end of the plinth, which should die into it, being tenoned and wedged into a mortise cut for its reception. These corner posts should be ploughed $\frac{1}{4}$ in. wide and $\frac{1}{4}$ in. deep on their interior sides, to receive the back panel frames, a similar and opposite groove being ploughed into the back styles of the bottom of cabinet proper, and the semi-table tops of the two wings must be made. This will consist of a rail the whole width of the back 6 in. deep, as shown, into which are mortised the two sub-plinths that form the sides of the receptacle for the drawer, and the curved wing rails also mortised into it at its extremities at one of their ends, their other ends being tenoned into mortises in the front ends of the drawer-rails or sub-plinths of the entablature, all these being of equal depth, viz.: 6 in. Similarly the plinth or base should be framed together, but instead of making this frame so deep as the former, it will suffice to make it 1 in. thick, left large enough to work it into the fillet and bead moulding shown in the drawings, the plinth itself fitting underneath it, and secured to the orms of the pedestal side frames, as before described (see Work, No. 39), in front and mitred and returned round them, again mitred inversely, and taking the curve of the entablature above, though larger than it, by the projection beyond it as shown in the drawings, the ends of this curved plinth will die into and be secured to the cabinet and pedestal side frames, to berth the other sides of the back panel-frames both above and below the entablature back rail. These back panels are shown in the drawings as bevelled glass in a frame of wood with a fancy beading to keep the glass in place; the glass may be either a mirror, a plain crystal, showing the wall through it, or backed by panels, faced with water-colour drawings with cut through mounts, with photographs, plaques, or other decorative designs; or instead of glass, china hand-painted plaques, or even wood panels, carved or plain, may be used as variations in all, or any of them. The curved rails of the entablature, and, of course, the under and upper shelves, may be either quadrants or circles or O G in form, according to which alternative half plan be chosen, as shown in Figs. 3 and 4. The table tops of both base and entablature should project as shown beyond the plinths in one case, and the entablature rails in the other, to be worked into one of the members of the mouldings, of which they form part, which should be mitred and returned round the square projections as shown, and the neck-beadings likewise. The top of the cabinet at front and the top of each wing at back should be finished as shown with shaped rails, whilst the sides of centre piece should finish with a rail, worked into a rather large bead on upper edge. The fronts of the corner posts and the fronts of the cabinet and pedestal styles should be fluted and stopped as drawn to match each other and small elongated panels carved in them where they traverse the entablature, above which the two corner posts may be turned with squares left on, rounded at their top and finished with turned knobs or "acorns," a third piece being turned to match, cut in halves, and planted each on each side-style of cabinet to carry shelf and correspond with the corner posts. The front edges of the styles being 1 in. thick only, should be thicknessed out by planting on them, outside, $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. strips forming the return of the pilasters below the entablature and above it, to take the half of the turned counterpart of the corner posts.

A curved rail, as shown at top of pedestal forming an arch, conceals partially the curtain rod, which drops into its place at end in notches cut for it, before the top is put in place, which when in place keeps the rod from rising. At each end of book-shelf in pedestal is a small corner bracket shaped to form shown. The drawer is fitted with a brass or plated drop handle, with or without a keyhole and lock.

The cabinet contains trays of millboard covered with cloth or leather, with flaps as described before or wooden trays as shown with tablets for the different classes of music. In the design, both above and below the cabinet is left open; it may, however, be fitted top and bottom by single or double glass-panelled doors; if so, the side frames of both should be made $\frac{3}{4}$ in. wider for these to shut into; the top rail of the lower door or doors should be arched so as to carry out the idea of the design.

In this cabinet, as well as the former drawing, instead of a tray in the division j t above the drawer a space is left without a tray, but if preferred, one may be intro-duced.

[should have mentioned in my former per that various portions shown in draw-ings may be ebonised, the rest being ma-hogany, walnut, or other wood polished, the ebonised parts being of best pine or American whitewood for cheapness. In e manner, these parts might be en-amelled white, pale pink, or other tint picked out with gilding, the other parts being treated similarly, but paler, if tinted, in the rest, in which case all the wood ed might be whitewood or pine, which ain might be used for construction and neered, and inlaid even if wished.

Again, if required, a drawer might be fitted the front of the base plinth for MSS., usic, etc.

Such cabinets as these would contain when ll about 75 pieces in each tray, or 375 in , besides a dozen or more volumes of bound usic, and a quantity of MSS. and odd-ed sheets in the drawer; would keep it good order, and ensure any one or more eces being instantly found.

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ERETOFORE we have considered the solids d pigments most useful to the house inter; we will now briefly occupy our-lves with oils and other fluids which, mpounded with those pigments, are in-spensable to the worker in mixing paint.

Oils are usually divided into two classes, d are termed *fixed oils* and *volatile oils.* xed oils are further distinguished, by eir nature and source, into *fat oils* and *ying oils.* Fat oils are those which con-in an excess of oleic acid, or stearine, as e animal and fish oils, and these are con-quently non-drying oils. Drying oils are ose which harden into a solid form, as, for stance, linseed, poppy, and nut oils.

With the first only of these latter—linseed need we here concern ourselves. Its source d appearance are matters familiar to all of ; but its qualities and properties, from e painter's point of view, is a matter it is cessary to dwell upon. Drying oils and iseed oil particularly, amongst that class, ve this characteristic of "drying" to their cess of resinous properties, and therefore, ien used under the influence of oxygen, they y or harden into a horny substance or film.

Good and reliable fluids, it will readily be iderstood, are as necessary in the mixing paint as are good pigments. Linseed oil cupies a premier position amongst its nd, similarly as genuine white lead takes at place amongst the solids; and further an this, just as white lead forms the basis nearly all light colour paints, so "linseed" the principal solvent in the preparation of rnishes and other vehicles.

The few imperfections common to good iseed oil are such as do not materially ect the work of the house painter. Least any, amongst all the articles used in the ide, should it be tampered with; the addi-on of fish oils especially, with which and pe it may occasionally be adulterated, ing inimical to its drying quality and rability. It should always be transparent, e from any rancid smell or taste, and of a ht yellow or amber colour.

With a well-stocked market of linseed to supply our wants at a very reasonable price, we have little occasion for using any of the other expressed oils; *boiled oil*—viz., boiled linseed oil—is, however, a very serviceable preparation we must notice.

As its name implies, boiled oil is the ultimate product of the raw linseed boiled with *litharge*—oxide of lead—or some simi-lar article. By this process the oxidising or drying qualities of the litharge are communi-cated to the oil, which latter furthermore gains body and brilliancy. Notwithstanding these considerable advantages, the boiling of linseed oil causes it to become much darker, and hence it is seldom used for light colours, and but rarely for interior painting. For preservative work boiled oil is almost indispensable, and especially with dark pig-ments; its colour is then no disadvantage, whilst its extra body and hardening qualities are a decided gain.

Gilders' Fat Oil is another condition of linseed oil, and is the chief factor used in making gilders' and decorators' *oil gold size.* It may be prepared by keeping raw oil in a closed vessel for a considerable length of time, by which it acquires a special bril-liancy and drying quality, when prepared as oil gold size with certain pigments. I have made good fat oil for gilding by keeping the accumulated skins and scrapings of gold size in a clay jar, and covering them with about a quart of best raw oil. After being exposed to the atmosphere, but protected from rain, etc., with occasional stirring, the oil, by the oxidising action of the old size skins and the exposure to air, has been converted into good fat oil after about a twelvemonth. Doubtless there are more expeditious ways of artificially preparing it, but the above gives a fairly quick and reliable result.

Oil of Turpentine, commonly, but incor-rectly, termed *spirit* of turpentine, ranks next to linseed for the painter's use. It is usually called, by an abbreviation, "turps," and its colourless appearance and strong pungent odour, as well as its inflammable nature, are items doubtless familiar to my readers. Although turpentine contains a slight proportion of resin and other matter which will not evaporate by exposure or heat, and which fact demonstrates the fallacy of calling it a spirit, its volatile nature makes it invaluable to the painter for thinning the drying oils and for making "flatting" paint. Since oil of turpentine contains but a small proportion of the resinous properties common to the expressed oils, it follows that its binding quality is very poor, and paint compounded with turps alone can be rubbed away by friction. Like linseed oil, that of turpentine is largely used in the manufacture of varnishes and other painters' vehicles The most important of such liquids we will now notice.

Varnishing is the last process of house painting, and consists in covering our pig-ments and paint with a film of a transparent resinous nature, which not only preserves the paint from the ill effects of the atmo-sphere and handling, but brings out the colour of the paint to its fullest extent. Where paint is prepared with an excess of raw linseed or boiled oil, varnishing is not necessary, since the oil itself encases and protects the particles of the pigment or solid used, and by its smoothness and body maintains a good gloss. For all better class work, however, and necessarily, for graining and marbling, a protective body of oil varnish is desirable, but experience and knowledge here are necessary to discriminate between the varied kinds that are made.

Varnishes may, for my present purpose, be considered in three classes, as *expressed oil varnishes, volatile oil varnishes*, and *spirit varnishes*, and from which nomencla-ture some notion of the solvents or liquids they are compounded from is gathered. It is customary in the trade to further distin-guish them by the substance or resin they contain, such as *copal* varnish and *mastic* varnish, and again to almost absurd ex-tremes by their probable use as *oak* varnish and *maple* varnish.

For whatever purpose varnish is required, it is most unwise for a novice to attempt to prepare it himself. Thirty years ago, when a painter's apprentice was necessarily initiated into the making of boiled oil, japanners' gold size, etc., the price of varnish was so high as to excuse the experiment, but nowadays, when varnish is about half the price it then was, the attempt can only be considered, under ordinary circum-stances, as a *dangerous* waste of time and material. Keen competition has now reduced varnish-making to a matter of fair profits, and my sole motive in briefly con-sidering here the articles they are com-pounded from is for the better and more intelligent use of the varnishes.

That there are to be purchased, otherwise useful, volumes containing receipts for making varnish, I am fully aware, but dis-cretion and experience alike teaches one to look lightly upon them. On the direct authority of one of our largest and most eminent varnish and colour-making firms—Messrs. Mander Bros., of Wolverhampton—I have it that "very little has been written upon the subject," and that the bulk of that little is "trash," and therefore, noticing several queries on the subject in "Shop" recently, I venture to commend this inform-ation to those would-be economists.

The best and most serviceable varnishes for use in connection with painting belong to the first of the three classes I have enumerated, namely, *oil varnishes;* and these are further usually known by the term "copal"—the name given to the gum principally used in their manufacture. This substance, which in appearance somewhat resembles amber, is imported from tropical parts, and is the product of certain trees. When a firm of varnish makers purchase what we may term a "parcel" of gums, it is very carefully assorted into various degrees of lightness and transparency. The whitest variety of the gum is usually the scarcest; and, as it follows that the colour of the copal must exercise a considerable influence over that of the ultimate product, white copal varnish is, consequently, a very expensive preparation.

In the manufacture of copal varnishes, the gum, generally, is first dissolved by heat, and then converted by turpentine into the liquid form, with the addition of linseed oil to give the copal elasticity; the colour of the oil used is, therefore, a further important factor. Colourless varnish, such as that known as *mastic*, can be simply made by dissolving the picked gum in oil of turpen-tine, but since the absence of linseed oil causes the liquid to set and harden very rapidly, such a preparation would be practically useless for the house painter, besides lacking in that elasticity and body which it is the special property of linseed oil to contribute.

The exigencies of space, etc., and the necessity for respecting these in every way, compel me to reserve the continua-tion of this part of my subject for another paper.

TINNING COPPER, BRASS, ETC., AND BRAZING.

BY R. ALEXANDER.

Articles made of copper and brass frequently have to be tinned, sometimes on one side only, sometimes on both sides. In some cases, such as stew-pans, tea-urns, and the like, they are tinned after they are made; but many things are made of sheet copper and brass tinned before working up. To do this proceed as follows:—

The sheets or pieces of the metal to be tinned must first be got clean; sheet copper or brass when procured from the makers or factors is generally fairly clean, and will not want a great deal of labour to get it ready for tinning. First of all, get the sheets flat and even by passing them through rollers, or by means of a mallet on a flat plate of iron, but do not hammer them. They must next be pickled. In shops where there is a lot of tinning done, they have pickling vats and tubs to immerse sheets and articles that require tinning. These are usually of wood or wood lined with lead; but for ordinary work in small shops it is not worth while to go to the expense of these, so proceed as follows. Take a piece of stick or iron rod about 18 in. long, and twist tow or hemp round it to make a kind of mop or swab; tie it to prevent it slipping off. Pour into a dish or basin some raw spirits of salts, and dipping the swab into it, rub the pieces of metal to be tinned on both sides; wash off with water, and well scour with "scale" from the blacksmith's shop, using a piece of sacking or similar material to rub with. When judged sufficiently clean, wash off the dirt, and stand to drain while you get ready for tinning. You will require for this some tin run out in strips like solder, some sal-ammoniac pounded up fine in a mortar, a pair of close tongs to hold the sheet metal whilst on the fire, a tinning rod, and some tow for wiping off. Assuming that a forge is to be used for tinning, a few remarks on the same will not be out of place. A fire for tinning should be in the centre of the hearth, as unless it is, there is not room to manipulate large pieces. If the forge is not so constructed, you must bring the fire out farther by fitting a piece of iron gaspipe (say about 10 in. long) into the tuyere, or tue iron as most workmen call it, though incorrectly, that is, the hole in the cast plate at the back of the forge through which the blast comes. Fig. 1 will show more clearly what I mean. It represents a portable forge; P is the pipe from tuyere to centre of hearth; H, a frame of stout hoop iron 3 in. deep and about 12 in. square, with hole half-way down for pipe to go through; this frame is to keep the fire from being scattered about. The pipe should dip a little towards the fire, so that if any molten tin should get in, it would not run back into the bellows.

Gas can also be made use of for tinning, and it is very clean and handy The home-made gas stove shown in Fig. 9 in the first of these papers (page 257) will answer very well for moderate-sized pieces; and by using a larger two-burner stove of similar pattern, such as Fletcher's No. 14 S (Fig. 2), it will be easy to do any kind of flat tinning. The tinning rod previously mentioned is made by bending a piece of ¼ iron rod to the shape shown in Fig. 3; file it bright before bending, and it will then tin itself whilst being used. This article is to rub the tin on to the surface of the metal to be tinned. To proceed, take the sheet or piece of metal that is to be tinned, and place it on the fire or gas stove; have close by the sal-ammoniac in a jar, so that it is handy to dip out with the end of the tinning rod. Scatter a little on the sheet, and blowing the fire gently (which said fire should be of charcoal), rub on a little tin, commencing at the end of the sheet farthest from you. As the tin flows, rub well with the tinning rod, adding more tin as required, and a little sal-ammoniac now and then. Pushing the sheet away from you as you proceed, and holding it with the tongs when it gets too hot to handle, be careful not to blow too hard or you will burn the tin. You will know when it is burning by seeing the metal turn blue. Should this happen, withdraw it from the fire at once, dash a little sal-ammoniac on it, and rub on some fresh tin, and proceed more carefully. When it is well covered all over, the superfluous tin must then be wiped off. This is done with a handful of tow wrapped up tightly. Commence with the end nearest you, which will be the hottest part of the sheet. Warm it till the tin is well melted, sprinkle a dust of sal-ammoniac on, and commence wiping away from you in straight strokes. Continue drawing the sheet toward you, and heating and wiping till it is all wiped smooth and bright. It should then be scoured with silver sand, dried in sawdust, and polished.

Stew-pans and other kitchen utensils are done in a similar manner, but as they are greasy and the acid or pickle will not act on grease, this must be removed before proceeding further. This is done by placing them on the fire and gently heating them till the grease or fat melts and flares off; the articles must be made well hot, but must not be allowed to get red hot. The scouring process is then the same as just described; this scouring must be thoroughly well done, or it will cause a lot of trouble in tinning. All repairs required should be done before tinning, such as the rivetting of loose handles, shaping, taking out bruises, and so on. As the handles get very hot during the process of tinning, it is usual to use a sheath on the handles of the stew-pans and covers. Fig. 4 shows one of these; they are about 12 or 14 in. long, and made a little tapering so as to slip easily on the handles and wedge tight, leaving 3 or 4 in. beyond the handle, that is, just enough to grasp it by; they are made of sheet iron; 20 gauge will do very well. When the article is well covered with tin, get well hot and rapidly and lightly wipe out with a bunch of tow; should any part get set before it has been wiped, heat it again; the outsides of the articles should be rubbed over before tinning with salt and whiting mixed to a paste with water; this prevents the copper from tarnishing with the action of the fire, and the goods are easier to scour.

A very good way to tin small articles of wrought iron, and which dispenses in a great measure with filing them up bright, is to boil them in "killed" spirits of salts in a pipkin or old iron saucepan; they will, if recently forged and not allowed to get rusty, be ready for tinning in a few minutes; taken straight from this pickle into a bath of tin they will tin at once, or if not, a second dip in the pickle will put them right. This method is of course known to some, but there are many who do not know it. And it is a great saving of time in a jobbing shop, when a few of such things as milk-pail fittings, iron rings, staples, etc., have to be tinned. The articles should be well washed and dried in sawdust, or they will rust. I cannot enlarge further on this subject, as I wish to get on as quickly as possible to the repairing and manufacturing part of this series o articles, but to any question that I ca answer I will reply in "Shop."

I will now turn my attention to a fe remarks on

Brazing.

Brazing is somewhat similar to solderin inasmuch as it is a process by which meta are united by means of heat; it is, howeve different to soldering in the fact that the un ting metal or spelter, as it is called, is muc harder, and requires a greater degree of heat t melt it than does solder, neither can it be a plied with a soldering iron. Brazing is use where greater strength is required than can b given by solder, or when an article has to stan a degree of heat that would cause solder t melt. In brazing, as a great heat is require it is necessary to have either a forge or powerful blowpipe; formerly there was onl the forge available, and many jobs were th rendered very difficult, especially in copp or brass, owing to the difficulty of getting top heat equally efficacious with the botto With iron or steel this objection does n apply with such force; I should advi all beginners to experiment a little with iro before trying the softer metals. Let u suppose, for an example, that you ha that very ordinary job in a country sh —to lengthen a key, say, for a large pla lock commonly known as a stock lock. W will suppose that you have an old key similar size of stem and bow; cut your ke that has to be lengthened (say 1 in.) at Fig. 5; cut your old key bow 1¼ in. long than the bow you cut off, and if cut off wi a chisel, file the ends true, but a hack saw the proper thing to cut with. The ne thing is to dovetail the two pieces togethe Fig. 6 shows how this is done, and explanation is needed; it is done with warding file, and the edges must be ke square and true; a small ½ round file w assist in this. Test the fitting as you go, a when they fit fairly tight give a light rap two on the side of the inner piece, that wi as it were, rivet them; the beginner will n get a good fit the first time, but he will g one thing—that is a lot of experience how go on next time. Fig. 6 A shows the k fitted ready for brazing. Now twist rou the joint about seven or eight turns of bra binding wire; this acts equally as well spelter, in fact, in this case better, as it ca not drop off. Now powder up a little bor wet the key at the joint, and sprinkle a litt of the borax on it. Now blow a fire eith of charcoal or small coke, or cinders coal, either will do; charcoal is a go fuel, but expensive to use; the others w do equally as well; in fact, nine workm out of ten first blow up their ordinary fire wi smiths' coal; in this case, however, it mu be blown perfectly clear, or the smoke w get in the joint and spoil it. A little to called a spatula is very useful and necessa in jobs of brazing to add a little spelter borax to the melting spelter, to rub off surpl metal, and to rub it into the joints as it flo It is illustrated at Fig. 7; it is made of round rod flattened one end to the sha shown, with an eye at the other end; two three of them in different lengths from 12 20 in. will be handy. Now to braze the ke Hold it by the bit with a pair of tongs, a placing it on a clear part of the fire commen to blow steadily; the borax will swell and ri up; you can press it down gently with t spatula; dip the spatula in cold water ea time you lay it on the hot metal, or the bora etc., will cling to it and be dragged off. Wh you see the wire or spelter begin to ru

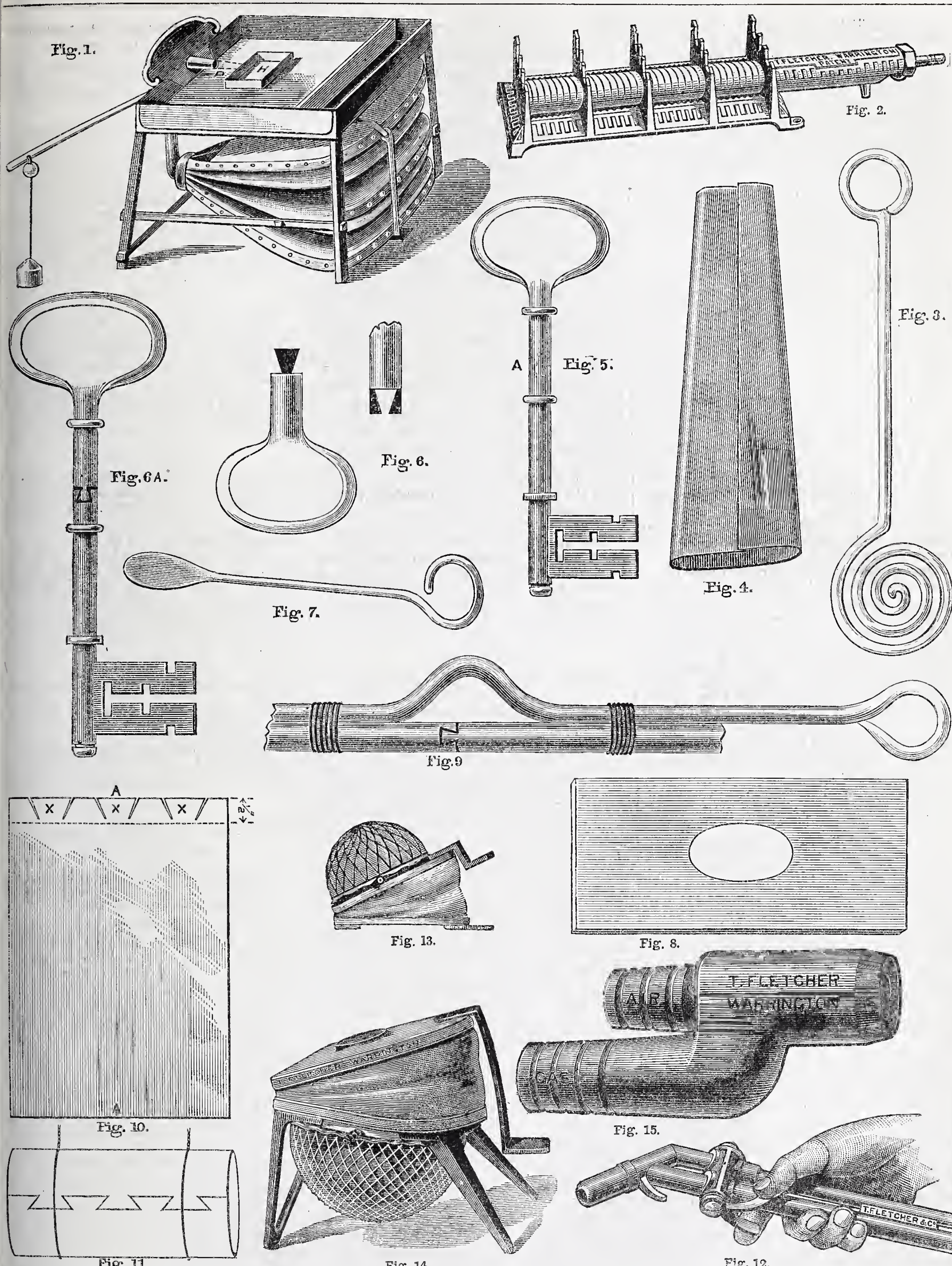


Fig. 1.—Portable Forge arranged for Tinning. Fig. 2.—Gas Stove for Tinning. Fig. 3.—Tinning Rod. Fig. 4.—Tinning Sheath. Fig. 5.—Plate Lock Key. Fig. 6.—Ditto, showing Dovetails. Fig. 6 A.—Ditto, prepared for Brazing. Fig. 7.—Spatula. Fig. 8.—Protection Plate. Fig. 9.—Mode of holding Two Pieces of Rod whilst Brazing. Fig. 10.—Piece of Copper Pipe cut out. Fig. 11.—Ditto, Tinned and prepared for Brazing. Fig. 12.—Automatic Blowpipe. Fig. 13.—Foot Blower. Fig. 14.—Larger Foot Blower. Fig. 15.—Fletcher's Injector Blowpipe.

sprinkle a little more powdered borax to help it flow, and when you see it all nicely running withdraw the key gently from the fire, rub off superfluous metal from the key (a little generally gathers underneath), and allow it to cool of itself; never cool a brazed joint suddenly, as the sudden contraction of metal is apt to injure the joint, though I know many who always dip a copper braze in the water directly it is taken off the fire. The key must now be filed up and cleaned so as to scarcely show, except by a thin mark of brass in the joint, where it has been joined. To lessen the trouble of cleaning a key or anything bright of a similar kind that has to be brazed, a guard (Fig. 8) is very useful.

It consists of a piece of stout plate iron about $1\frac{1}{16}$ in. thick, and of sufficient width and length to protect the article laid on it from the direct heat of the fire. A hole is cut in it about $1\frac{1}{2}$ in. long by 1 in. wide, and the key placed on the sheet iron in such a way that the joint comes over the hole as shown in the sketch. You can then blow away without fear of injuring the article by the fire. Some articles also require supporting and fixing, so that the joint will not shift while it is being brazed. Fig. 9 shows a way of holding a straight piece of rod or similar job. Many jobs will require a pin or rivet put through them as an additional security. Always get everything to fit as well as possible; it cannot be too good a fit; the spelter is sure to find its way in if the joint is clean.

How to braze a piece of copper pipe:—

Suppose for a trial job a piece of pipe 12 in. long and 4 in. diameter. Cut your stuff 12 by 13, thin down the edges, A A (Fig. 10), with a crosspane hammer about $\frac{3}{8}$ of an inch clear each side. Notch one side, as shown in sketch, turn it round, bend up the notched pieces X, and slip the other edge in as far as possible, and then knock the notches down and hammer together on a bick iron. Bind round at each end with iron wire as at Fig. 11. It is now ready for brazing. Mix equal parts of spelter and borax in a jar or tray with water, and with the spatula spread it on the joint (inside of course). Place on the fire and blow gently. Sprinkle a little powdered borax along the seam, and as the spelter melts rub along with the spatula, drawing out superfluous metal and putting more in if there should not happen to be enough at first. Be careful not to blow too fiercely, as copper will not stand near the heat that iron will, and brass less heat even than copper. It is sometimes very awkward to braze some articles with a forge, owing to the difficulty of directing the heat to the right place. But there is no need to despair of brazing the most difficult jobs, now that appliances for brazing by means of gas, etc., have been brought to such perfection, especially by Messrs. Fletcher & Co., of Warrington, and this article would not be complete if I did not mention some of them, as they are valuable alike to the professional workman and the amateur. Fig. 12 shows what they term their new automatic blowpipe, pattern C. It is a very simple and very efficient blowpipe for ordinary use. The medium size is C 40 for key brazing, small copper gaspipe, etc., and odd jobs not requiring much power. Where it is possible to do so, small articles should be placed on a piece of charcoal or pumice stone whilst brazing with the blowpipe, or carbon blocks made especially for the purpose by Messrs. Fletcher, in various sizes and shapes. These substances are used because they are fire-resisting, and do not rob the article of the heat imparted to it by the flame of the blowpipe. C 80 is a large blowpipe, same pattern; this will braze $\frac{1}{2}$-in. thick flanges on $1\frac{1}{2}$-in. wrought iron pipe and copper work up to about 2lb to the square foot. These blowpipes require a greater pressure of air than can be given by the mouth, so a means must be found of giving a supply of air under pressure, either by connecting them to a smith's bellows or using a foot blower (Fig. 13). The reason is that it is the pressure of air that rules the temperature of the flame, and, consequently, the power or heat thereby obtained. Thus, to get a sharp, concentrated heat, an air pressure of from 1 to $1\frac{1}{2}$ lbs. on the square inch is required. These blowers will give this with a steady pressure. The small sizes 3 and 5 (Fig. 13) can be worked by the foot or under the arm. Fig. 14, known as 9B, 3, and 5, are for foot use only, and are generally recommended for all purposes.

The same firm also supply very powerful blowpipes for heavy brazing, such as repairing copper pipes without removing, repairs to machinery, etc. No. 1, Fig. 15, requires a smith's bellows or a fan and $1\frac{1}{2}$-in. gas supply. It will burn up to 300 cubic feet of gas per hour, and will heat a 3-in. wrought iron pipe up to brazing heat in a few minutes. No. 2 is a similar blowpipe, but can be used with the foot blower, thus enabling it to be taken and used in positions where to use an ordinary smith's bellows would be a matter of difficulty. There are other useful blowpipes, but space will not allow me to describe them here, and I wish to get on as quickly as possible to the repairing and manufacture of tin goods, etc. My next article will illustrate and describe some further repairs, and the tools and material used for the same.

MEANS, MODES, AND METHODS.

Luminous Paint.

This is so recent an invention that it has not yet been taken into the category of applied science. It is as yet only a novelty; like the old phosphoric writing, visible in the dark, was a half a century ago. The Paris Exhibition has brought into prominence a variety of new ideas and useful inventions, which but for that display with fifty-three thousand exhibitors with a hundred times that number of varied exhibits might have been lurking unnoticed by the world in rooms and workshops; luminous paints amongst the number. Here it had a prominence, its display makes at once easy and manifest. Thousands of square cards were given away, showing the luminous paint on one side. They were thus in the hands of each recipient to test, and they fully established its title to luminosity in the dark so vivid that, by writing any word in Roman letters one-eighth of an inch thick on it, the word was visible. Dipping the card in water, so far from affecting the action of the paint injuriously, made it brighter; exposure to daylight does not deteriorate it.

Now for its practical value. If it is found to be enduring, the names of thoroughfares might be painted with it, and finger-posts at cross-roads, so useless to the benighted traveller who has to take out the lamp of his trap and throw its rays on to the direction; for stairways, and passages, and corridors; on walls of dark offices to add more light, to save the sight of the plodders of the pen. Its uses have to be found out by practical trials and more general knowledge of how it is best applied. It has already won sixteen medals of merit. W. C. Horne, 6, Dowgate Hill, London, E.C., is agent for it.—J. C. K.

To darken Common Mahogany to represent Old Spanish.

To 1 oz. of bichromate of potash dissolved in 1 pint of boiling water. Apply with a brush and allow to turn colour by action of the air.—H. T. N.

Brown Hard Spirit Varnish.

To 1 pint of spirits of wine (meth.), $2\frac{1}{2}$ ozs. best orange shellac, 1 oz. gum benzoin, $\frac{1}{2}$ oz. gum thust, $\frac{1}{4}$ oz. powdered resin, and size of a marble of gum sandarach.

Mode.—Let macerate for two days in a warm place, shaking often and strain.

Note.—Work should be warm but not hot to ensure a good polish with spirit varnish.—H. T. N.

Polish Reviver.

To $\frac{1}{2}$ pint cold-drawn linseed oil, $\frac{1}{2}$ pint spirits of wine (meth.), $\frac{1}{4}$ pint good vinegar and 2 pennyworth of butter of antimony.

Mode.—Mix the above and well shake. Should be used with a soft cloth, well rubbed in, and not a great deal used at the time; continue for one or two days, when a good polish will be obtained.—H. T. N.

Walnut Stain.

To 2 ozs. Vandyke brown, 2 ozs. American potash, 1 oz. bichromate of potash, size of walnut of soda, size of walnut of sulphate of copper, size of marble sulphate of iron, 2 ozs. nitric acid, and 1 gallon of water.

Mode.—Boil the water, brown, bichromate, soda, and sulphates until melted and well mixed. Then add the American potash, which must be melted first in a little water, otherwise it will effervesce over the sides of the pot. When lukewarm add the acid.—H. T. N.

Dark Oak Stain

To 4 ozs. American potash, 4 ozs. Vandyke brown.

Mode.—Proceed as above with the potash using 1 gallon of water.

The above are well tried, practical receipts, which I have used in the furniture trade (antique) for several years.—H. T. N.

SOME PHOTOGRAPHIC APPLIANCES

BY AN OLD HAND.

Backgrounds—Reflectors—Dark-Room Lantern—Small Folding Lantern—Dishes—Oscillating Developing Table.

Backgrounds are plain or scenic, made to roll up after the fashion of a blind, or stretched on a frame like a painter's canvas. Providing there is the necessary space at disposal, those of canvas on frames are decidedly the best, as by this means creases and markings produced by rolling and unrolling are avoided. They may be prepared either in oils or distemper. Although rather more trouble to prepare, those painted with oil paint, either flatted or bright, are the most serviceable, as in case of leakage from the roof or other accidental soil, it can be readily sponged off without damage, when a background in distemper would be irretrievably spoiled. Again, a distemper background is more easily made and less expensive, and the effect in the photograph is equally good to that of the oil-painted one. We will now proceed to make the foundation for one which will be the same whatever method may be selected for colouring it. Procure some battens the length and breadth the completed background is desired to be. We will suppose one of about 8 ft. high by 7 ft. wide, which is a moderate size, and sufficiently large for two or three figures. The wood should be ¾-in. deal, 3 in. wide, the corners cut to overlap, and strongly screwed together, as Fig. 1, additional strength being imparted by corner pieces (B, B, B, B), also screwed on. A bar across the centre—narrow way of the frame—mortised into each side, gives additional rigidity, and affords a convenient hand-hold in moving it, as it goes without saying the face of the background should be handled as little as possible. The frame will now appear as in Fig. 1. The reason for making the corners strong is that, when the canvas is stretched upon the frame, the least giving way would cause the material to pucker and crease, entirely spoiling the effect. Extra bars are sometimes put diagonally across the corners (Fig. 1, A, A, A, A) from the centre bar to outside. Of course, this adds to the weight, and is unnecessary with a background of the size given. The idea is to get a perfectly stiff framing. The lower bar of the frame may be provided with small wooden rollers let into the lower edge as W, W, in Fig. 2. The frame now being ready, it must be covered tightly with calico, which is sold under the name of sheeting, and may be had of various widths. If it can be procured sufficiently wide to do without a join, so much the better; but, if joining is imperative, the seam must be simply sewn and not felled, or an objectionable ridge would be made that no amount of colour would obliterate. Fig. 3 shows how the edges should be put together. The seams must always be vertical, and not across the background. The join being regularly and neatly made, and well rubbed down, spread the sheet on the floor and lay the frame on centrally; turn over one end of the sheet and tack it with tin tacks about 2 in. apart, taking great care to keep it level; do the same to one side, pulling slightly from the already tacked end. Now proceed to tack on the opposite side with a firm, steady pull and a diagonal direction. Keep the sheet as smooth as possible whilst it is being fastened. Lastly tack on the bottom, using a steady pull from the top during the time. Now raise the frame covered with the calico on end. It ought to be quite smooth and free from wrinkles; if not, make it so by altering the tacking, then, with a sponge or large brush, thoroughly wet it all over, and let it dry, when it will be found strained as tightly as a drumhead. Prepare some size—about 1 lb. of size to a gallon of water—and give it a good even coating, and let it dry, when it will be ready to paint. With a piece of charcoal draw two lines diagonally across, as in Fig. 4, to act as guides in the shading. Of course, if only a flat, even tint is required, this is unnecessary; but a shaded background is much better for all purposes than an absolutely flat one. Provide three pots of paint of different shades of grey by mixing lamp or ivory black with white lead. The depth of colour is decided in a great measure by the amount of light that will fall on it when set up for use. A light studio will require a darker set of tints than one in which the light is but moderate. Something also depends on personal taste, whether a light or dark background is required. With a brush well charged with colour of the lightest tint, begin at the left-hand top corner and paint down to the first charcoal line. Scrape the brush, and paint the middle division with the second tint, well softening the two together at the junction; then, with the darkest, fill up the lowest division, well amalgamating the tints where they meet. As soon as all the surface is painted over, work well over it with a softener until the background shows an even graduated tint from one corner to the other. In case of a flatted paint being used, it is almost necessary that the softening should proceed simultaneously with the painting, for, if it is left till the whole is covered, it becomes too dry to make a good job of it. Two persons may very well manage this, one to paint and the other to soften. The background, when dry, is finished, and ought not to show any definite lines of colour, but be one continuous tint, from light to dark. If distemper is used, the same precautions must be taken, the colour being thoroughly brushed into the material, which need not be sized first, the size being mixed with the colour. A little soap dissolved in it is also an advantage, keeping it more flexible. The distemper colour must look considerably darker a tint when wet, as it dries up very much lighter. There is plenty of opportunity for the exercise of individual taste in the preparation of backgrounds. The shading may be varied, or landscapes or interiors painted on it; but, whatever it may be, to be artistic, it must be rather suggestive than definite, and the central part free from any decided pattern or design which would interfere with the lines of the portrait. For genuine work, a design consisting of a panel surrounded with a slight moulding is as useful as any. Simplicity must be always aimed at, for elaborately patterned backgrounds are generally disappointing when partly hidden by the model—a matter more frequently overlooked than it ought to be.

Reflectors partake of something of the nature of backgrounds, being canvas covered with white paper on light frames, fixed on stands adjustable to any angle, for the purpose of reflecting light into the shadows. Fig. 5 represents a reflector ready for use; it consists of a light deal frame 4 ft. by 2½ ft. in size, to the central bar of which is fastened two semi-circular pieces of wood with holes through them (Fig. 6). The upright (Fig. 5, C) may very conveniently be made of an ordinary brush handle, 3 ft. 8 in. in length, cut flat at one end to work in the slot formed by the two semi-circular pieces of wood; a rivet with a screw thread on one end fastens them together, and the screw is kept in position by a winged nut on it. The foot is made of a circular piece of heavy wood 3 in. thick, turned somewhat ornamentally as Fig. 5, D; to the bottom a thick piece of stout lead is screwed to give additional weight and steadiness, three small knob feet are screwed in, and the reflector is finished; it, of course, may be stained, polished, or painted at the taste of the maker; different sizes may also be made, and attached by a ball and socket-joint instead of rivet and nut, or made in metal instead of wood; an old-fashioned iron head rest can easily be converted for this purpose.

The Dark-room Lantern is a very necessary piece of apparatus, and is of two species: one for a permanent fixture, and the other for travelling, or rather for occasional use and portability. The forms in which they are made are very varied, the object in all being to get a good safe light of convenient form, and to be used either with candle, paraffin, or gas. Within a reasonable degree, the greater the volume of light the more comfortable for the worker, providing the quality of the light is such as to have no action on the sensitive surface that will of necessity be exposed to it. Correctly speaking, no light is absolutely without action, and sufficiently long exposure to the most safe light we are acquainted with will produce decided photographic action. If a sensitive plate, exposed for a quarter of an hour to the full action of such light, and can then be developed without fog, the light may be considered safe in practice; this is a very much longer time than there is any necessity for submitting a plate to, but still the caution holds good—never to expose a sensitive film to any light longer than absolutely necessary. A very small subdued red light is very injurious to the eyesight if frequently used, and many workers under such conditions suffer considerable pain, besides permanent injury to the eyesight.

The disadvantages of working in such darkness, for it is little else, are numerous; upsets and breakages are of common occurrence, and development must be somewhat out of the control of the operator when he can, by the utmost straining of the eyesight, have but a faint glimmer of the developing image. All this points in one direction—to have as much light as can be safely used. Owing to the varying sensitiveness of different makes of plates, a light quite safe with one kind would not be so with another. Orthochromatic plates cannot be worked in any except a deep red light, without fogging, but for other kinds, two or three thicknesses of golden fabric will be quite safe for a candle or lamp, besides giving a comfortable flood of light all over the room. In order to obtain a large volume of safe light, a very much larger lantern may be used at home, where it would be more or less of a permanency than would be convenient for travelling. We will proceed to make one as follows: Cut out of oak 1 in. thick a piece the shape and size shown in Fig. 7; this will form the bottom of the lantern, and its weight help to prevent accidental overturning. Now get a sheet of tin plate, sufficient to bend round the curved side of the wood, and turn over half an inch in front on each side, and of the height of 18 in. Fig 8 shows the lantern in its complete state. Solder an L-shaped strip of tin down each side to form a groove, and from this strip, another one 1 in. wide across the curve at the top. A piece of glass, E, can now be slipped down in the grooves, and rest on the rebate of the wooden bottom. After ascertaining if the groove is of proper width in which the glass can slip easily, solder another slip of tin across the top from the outside edge of the groove before the other. Make a tin plate lid, F, with a hole 1½ in. in diameter in the centre, over which a tin cap, G, is fastened. The projecting pieces, H, H, H, are made to pass through the tin lid and act as supports, in case the solder should get melted by the heat of the lamp. The cap is intended as a light trap, and is therefore much larger than the aperture it covers; to the straight edge of the front of the lid is hinged a flap, J, made to fall over the opening through which the glass is inserted, and to prevent any unguarded light from the lantern getting into the room. The lower part of the body of the lantern is pierced with a number of small holes to permit access of air, over which on the inside of lantern is a strip of tin, K, soldered, sloping down towards the light to about ¼ of an inch from the bottom. The bottom itself may be covered with tin, which, if intended for a candle, may be provided with a shallow socket for it. Two pieces of glass, one deep ruby and the other orange, over which has been pasted two thicknesses of golden fabric, to slip into the grooves and either used as required, and if the groove is made of sufficient width both may be used together; a coat of black japan over the outside will complete it.

A Small Folding Lantern for travelling may be made of cardboard with a tin lid and base, as Fig. 9. Procure some short cardboard (other material can be used), and cut three pieces 6 in. by 12 in.; in one of them cut an opening 8 in. by 4 in.; lay them side by side on the table, and separated about $\frac{1}{16}$ of an inch; paste over them a is a very simple and useful lamp for travelling, and not likely to get broken. Cardboard is light, and perhaps as good a material as can be used; the fabric adheres better to it than to either wood or metal after it has been subjected to the heat of the light for a little time, from which it is liable to peel off. The projecting $\frac{3}{4}$ of an inch of fabric is to fold over the crack left; when the sides are set up, two strips are glued to the grooves with some ground white and re lead, and slide in a piece of stout glass; the fix on the end; when dry, go over the whol with one or two coats of shellac varnish.

The appliances that have been describe here, and, indeed, all that have been brougl under the reader's notice in previous paper can be easily made by any one who happe to be tolerably handy in the use of a fe of the most ordinary tools that are us

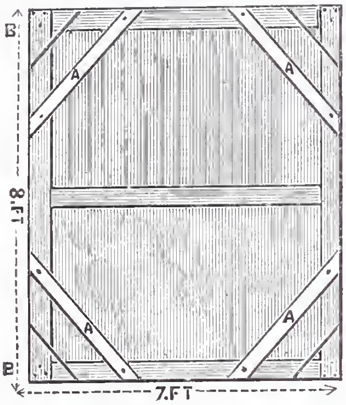


Fig. 1.

Fig. 2.

Fig. 3.

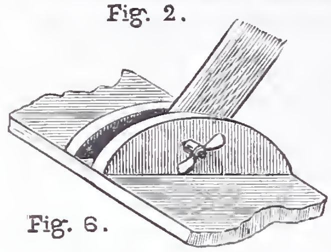


Fig. 6.

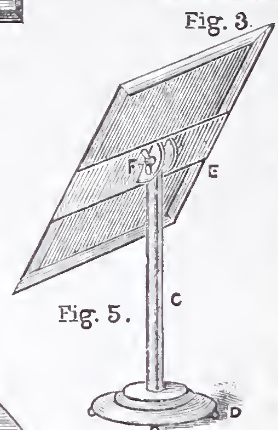


Fig. 5.

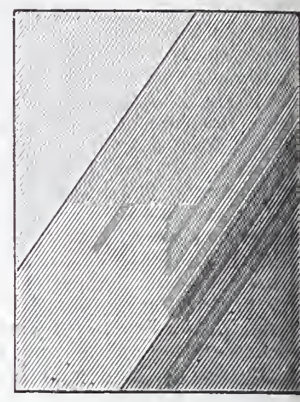


Fig. 4.

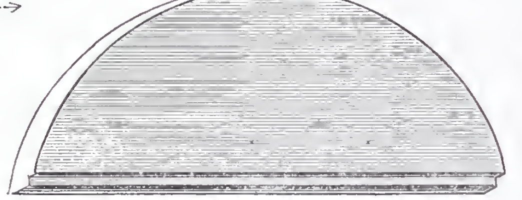


Fig. 7.

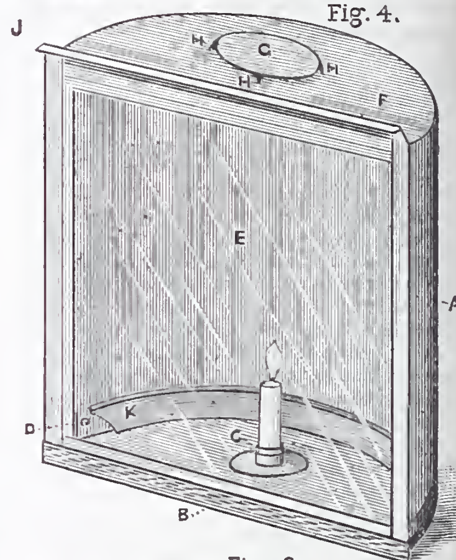


Fig. 8.

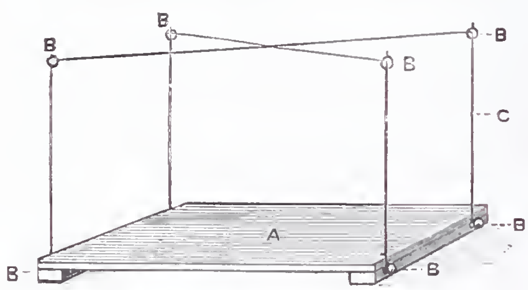


Fig. 12.

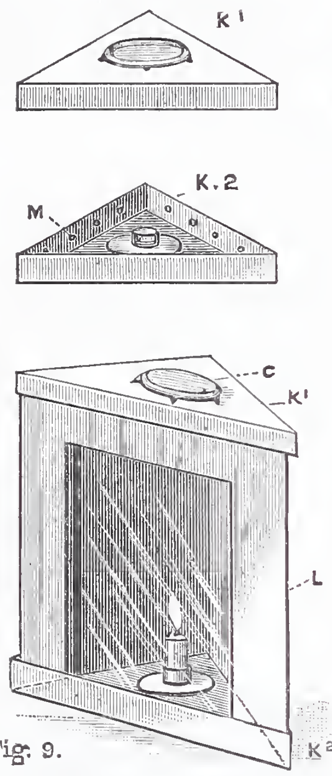


Fig. 9.

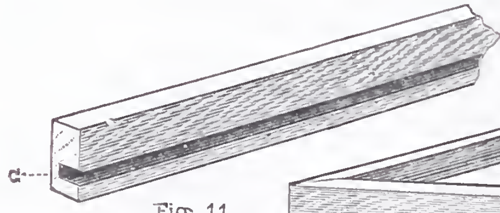


Fig. 11.

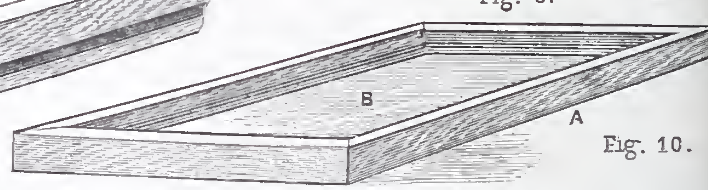


Fig. 10.

Fig. 1.—Background Frame—A A, Struts; B B, Corner Pieces. Fig. 2.—Bottom Bar, showing Wheels, W W. Fig. 3.—Diagram showing Mode of Sewin Canvas together. Fig. 4.—Background spaced for Colouring. Fig. 5.—Reflector—C, Pillar; D, Foot; E, Frame; F, Attachment. Fig. 6.—Attach ment. Fig. 7.—Bottom of Lantern. Fig. 8.—Lantern—A, Back of Tin, curved; B, Wood Bottom; C, Candle Socket; D, Air Holes; E, Glass; F, Ti Cap; G, Cover to Chimney; H, H, H, Supports of Cover; J, Hinged Flap to let fall over top of Glass. Fig. 9.—Portable Lantern—K, Tin Cap K¹, Top Cap; K², Bottom Cap; C, Chimney Cap. Fig. 10.—Wood and Glass Tray—A, Frame; B, Glass. Fig. 11.—Section of Side of Tray—G, Groove Fig. 12.—Developing Table—A, Table; B, Eyes; C, Endless Cord.

piece of ruby cloth; turn over, and cover the other side with golden fabric in the same manner, allowing both materials to project $\frac{3}{4}$ of an inch beyond the side of the card. Make two tin caps (Fig. 9, K^1, K^2), one of which has an aperture about $1\frac{1}{2}$ in. in diameter (capped over as in the other lantern), for the top and bottom. The cardboard sides can now be folded into a triangular form and put over the light, set on the lower lid in a socket (nothing is better than an ordinary night-light), and the top slipped on. This the outside at bottom to fall loosely over the air-holes, M.

Dishes useful for many purposes may be made of wood and glass, as Fig. 10. Suppose a dish is required that will conveniently hold a 15 by 12 plate. Prepare two pieces of $\frac{3}{4}$-in. pitch pine, $2\frac{1}{2}$ in. wide and 17 in. long, and two pieces 14 in. long; cut a groove $\frac{3}{8}$ of an inch deep and $\frac{3}{16}$ in. wide (Fig. 11); about $\frac{3}{4}$ of an inch from one side of each strip of wood mitre and glue two of the corners, partially fill in in carpentry, and the small amount o metal work, principally the tin-plate worl described above, will occasion no difficulty There are yet a few articles that the amateu or professional photographer may make fo his own use, but these must be reserved fo another paper. Abundant means of worl for the long evenings of winter have beer afforded any one who is desirous of supplyin himself with his own photographic appli ances in making those which have alread been brought under his notice.

THE BEE-HIVE TENT.

INVENTED BY CAPT. H. R. NEWBURGH-STEWART, R.N., WINDSOR.

BY JOHN CHARLES KING.

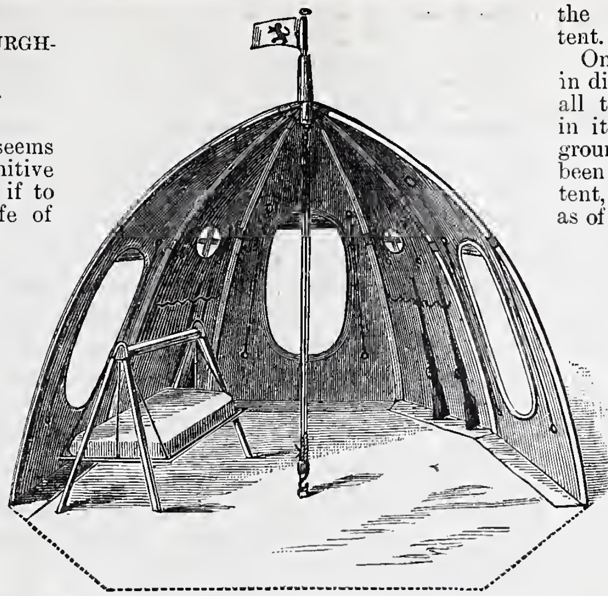


Fig. 1.—Section of Bee-Hive Tent exhibiting Interior.

The highest range of civilisation seems often to voluntarily revert to primitive methods of arrangement of life, as if to renew with pristine vigour the strife of man with the elements as in early ages of the world. Our Alpine clubs, exploring expeditions to unknown parts in the arctic and tropic zones; the chase of wild animals, with its hardships and perils; all seem to lend a charm to cultured existence, and give a healthy relief to the monotony of a life of ease and the plodding after gain of wealth that often debases existence. Even the exhilaration of a cross-country gallop to the ring of hounds' notes that enliven the chase, which is sure to bring falls, fractures, and sometimes death, to some of the best of the votaries of this manly recreation, yet which is followed with ever-increasing ardour. But the gaps in the ranks thus caused are filled by young men and women who keep life at high pressure enjoyment at the hazard of all risks. But in thus becoming nomads in travel and athletes at sports, there is mostly a stable reliance on a banker's balance, and the world's best resources it commands. The weapons, equipments, cattle, and human help, this balance commands, are a factor which must be estimated at its value here.

The canoe of bark, with its outer covering of skins of early ages, is for our modern tourist converted into a house-boat. For land-travel, tenting-out is popular just now. The tents of all peoples have been the homes and nurseries of nations. How picturesque is a tent, whether of leaves, skins, or canvas! Armies rest beneath them; but adventure and enterprise, as well as war, claim the use of the tent—the untaxed dwelling of the hunter, the tourist, and the emigrant.

Every one thinks he could pitch a tent. Doubtless many who tried would not be quite satisfied with the first attempt. Like everything else, it requires just that handy knowledge of ropes and canvas which few but seamen have. The only landsmen, not of the army, perhaps likely to do the work deftly would be the farm labourers, used to putting up rick-cloths over stacks. Even these men are falling off in their former general handiness, and nineteen out of twenty of them boggle over their rick-cloth raising. Machinery is making them more inert clods than ever, instead of raising their standard of technical excellence. There is an old saying, "He who knows nothing is readiest to learn," presumably because he has not to unlearn error or misteaching.

Tents vary in two essentials, shape and material. Skins form the covering in cold climates, grass and leaves in hot climates. Canvas, from its lightness and strength combined, is the main tent-covering of armies and most of the settlers and travellers who use tents. It is so well known as to need no description, the pole being the central support, and the lines and pegs, the stays to sustain it against the stress of weather.

The shape being conical, gives the least amount of convenient room for the occupant, if moving about in it upright. The middle has a post which may not be pressed against too violently by user or his luggage, or it may snap off, then down comes the fabric, and there it settles till a new post is upreared. This post is the ticklish part of the concern. Move it, and down flops your tent. "It's twelve feet across," says the tent man. He walks round it, and finds it is only about half that for upright range; a sort of no-man's-land is beyond the six feet head-room limit, which is only to be got at by crouching. It is valuable space wasted, where every foot counts for or against comfort. In a storm, beware of letting things touch the tent-cover and draw the rain through the canvas into the tent.

One who spent nine years under canvas in different parts of the world has changed all this. He does away with the post, and in its place puts a cord to a staple in the ground where the post-hole would have been; this cord reaches to the apex of the tent, which is furnished with a "rib-ring," as of an umbrella; this "rib-ring" has spurs with holes to take as many ends of "tent ribs" as may be used. A pin secures each top end of the "ribs," which for convenience are made in two pieces of American elm, or other flexible wood, joined by a simple square-edged oblong socket which retains the jointed ribs securely under any strain, and allows packing away in half lengths.

The tent, when first raised, is a true cone till the pull of the light tackle on the "rib-ring" and mid-staple in the ground brings down the apex to a dome shape, bracing the ribs securely on their bearing on the ground, the canvas preventing their out-spreading there, and the whole being as taut as if it were an expanded balloon.

The no-man's-land of the conical tent becomes exploited, as economists would say, and the bell tent converted to a bee-hive, that makes the user feel there is science in shape which yields the comfort of increased space, security from the elements, and less lumber weight to be carried about in tent moving. The door-openings are covered or opened by the canvas being raised or lowered blind fashion. Ventilators the same way; even the tent may be rolled up all round two feet from the ground for tropical use to gain more air.

To those who do not know anything of the weight of tent fittings, it will surprise them to learn that the conical tents for Indian service require each 100 iron pegs, weighing 300 lbs. The bee-hive tent requires only the iron hold-fasts, and four pegs for storm stays to be put on if wanted; 2,000 ft. of rope is saved. It is estimated that for a regiment with 100 tents, twenty tons' weight may be saved, and the more perfect form of tent for all purposes be secured with great economy of cost and durability. It is about to be brought before the notice of the Minister of War in France, when, if adopted in the French army, it may be noticed and adopted by other nations. But it is as a tourist's or emigrant's tent that we notice its merits.

The principle of the tent is as follows:—Fig. 1 exhibits a section showing the room gained, and manner of bracing the rib-ring to the staple in the ground, and Fig. 2 the tent set with two entrances left open. These openings afford convenient means for entering or quitting the tent. On the right of this illustration an entrance is shown closed up, and in each side means of ventilation can be seen which are entirely independent of the larger entrances, which are placed opposite each other in alternate sides of the tent.

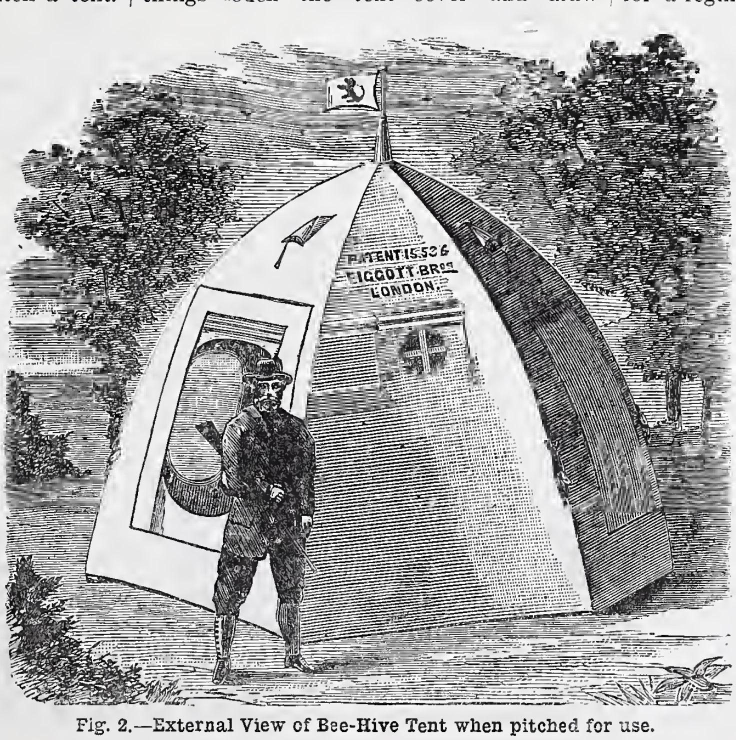


Fig. 2.—External View of Bee-Hive Tent when pitched for use.

BRITANNIA METAL, BRUSHES, BUFFS, ETC.

BY GEORGE EDWINSON BONNEY.

BRITANNIA METAL—BRIGHT PLATING—BRIGHTENING SOLUTIONS—BRUSHES—BUFFS—BUNSEN BATTERY—BUNSEN BURNER.

Britannia Metal.—This is an alloy composed of tin, 92; antimony, 6·2; and copper, 1·8 parts. This greyish-white alloy, nearly resembling pewter in colour and softness, is employed as the base for a large class of cheap, showy, electro-plated goods. These may be readily distinguished from best electro-plate by the softness of the metal, the thinness of the silver, the low price, and the sound given forth by the article when struck. Best plated goods are made of some hard alloy, such as German silver, and will give forth a sonorous sound when struck, whereas Britannia metal and pewter give out a dull sound. As such plated goods often come to the electro-plater to be replated, it is advisable to know how to treat the goods. After all the old silver has been stripped from the articles in the acid-stripping solution, rinse and scratch-brush them, then soak them in the potash dip for half an hour. Rinse them in a clean, diluted potash dip, transfer at once to a good plating solution rich in metal, and pass at first a strong current, so as to strike them at once with a coat of silver all over. As the deposit thickens, the density of the current should be reduced, or the silver will go on too fast at the finish. Great care must be taken in burnishing a coat of silver deposited on this alloy, or the coat will strip from too much pressure being applied to the burnisher. Whenever practicable, avoid burnishing this alloy, but finish off with soft scratch brushes and the "dolly."

Bright Plating.—It often happens that the silver plater has to electro-plate the insides of tea-pots, coffee-pots, and similar vessels, and he is expected to turn these out of hand in a bright and finished condition in every part. It is quite possible to reach the insides of ordinary sized and shaped vessels with suitably-designed scratch brushes, but there are always some interstices in ornamental and chased work that cannot be possibly reached by mechanical means, and it would never do to leave those parts with the dull white or "matt" coating left upon them when finished in an ordinary silver-plating solution. It is, therefore, usual to make up a special brightening solution to deposit a bright coat of silver on the finished article. The solution for bright plating is made up as follows:—

Brightening Solution.—Take 1 pint of old silver-plating (cyanide) solution, and add to it from 2 to 3 ounces of bisulphide of carbon. Put this in a glass-stoppered bottle capable of holding half a gallon of liquid, and add to it 3 pints more of the old plating solution; then shake the bottle well for a few minutes, and set aside to rest for twenty-four hours or more. Carefully decant the bright liquid into another similar bottle without disturbing the sediment, and add from 2 to 3 ounces of good cyanide of potassium dissolved in distilled water. Shake up the contents of the bottle to mix them, and when all is settled down again, the mixture will be fit for use. The daily dose of this liquid to the bright-plating solution must only be in the proportion of 2 fluid ounces to each 20 gallons of solution. This should be added at the close of each day's work, and well stirred into the plating solution. If too much brightening solution is added, the deposit will be brown, or streaked with black or brown streaks, and the solution spoiled. It should never be added to the ordinary plating solutions, since they are apt to be spoiled for other work by the addition of the brightening solution. The work bring brightened should be closely watched. The brightening effects will commence at the bottom of the article and spread upwards; when the article is covered, it should be removed at once, and quickly rinsed in warm water. *Caution.*—As bisulphide of carbon is a nasty, stinking, poisonous liquid, of a volatile nature, great care must be exercised in its use, so as not to breathe the fœtid vapour, the odour of which resembles that of rotting cabbage. This alone should warn amateurs against sniffing at the bottle containing it or the brightening solution.

Brushes.—In large plating establishments, a number of various kinds and shapes of brushes are employed in the process of scouring the goods preparatory to plating, and finishing them after they have been plated. The brushes employed in scouring the work are made of hog hair, containing one, two, three, four, or more rows of hair,

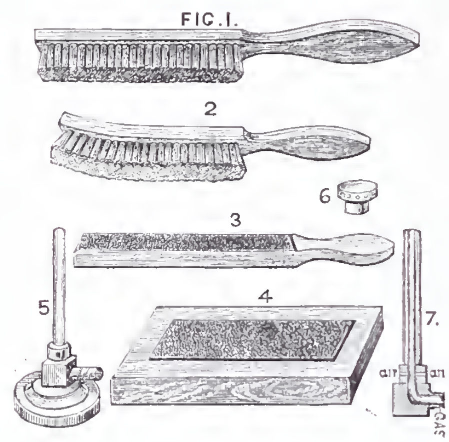


Fig. 1.—Scouring Brush. Fig. 2.—Curved Back Plate Brush. Fig. 3.—Buff Stick. Fig. 4.—Buff for Polishing Burnishers. Fig. 5.—Bunsen Burner. Fig. 6.—Rose Cap for Bunsen Burner. Fig. 7.—Section of Interior of Bunsen Burner Tube.

with solid wood backs (as shown at Fig. 1), in sizes suitable to the requirements of the plater. When first received from the maker, they should be dipped for a moment in the potash dip, to remove any grease there may be on the hair, well rinsed in clear water, and then kept exclusively for the purpose of scouring. Brushes made from cow hair are used to polish steel articles preparatory to being plated with nickel. Camel-hair brushes are used in ornamenting gilded and plated work with coloured varnishes and other colouring mixtures. Ordinary plate brushes with curved backs (as shown at Fig. 2) are very useful tools for brushing the insides of cylinders. Wire brushes are also used in scouring and cleaning iron and steel goods when these are coated with dirt and much corroded or pitted. It is sometimes necessary to use a steel-wire brush for cleaning iron castings before being brassed. The kind of wire brush, known as a scratch brush, will be noticed under the head of *Scratch Brushes* and *Scratch Brushing*.

Buffs.—These are sticks like hand brushes without hair, but with buff leather firmly glued to the wood (see Fig. 3). This buff leather is the tough, rough-grained leather used in soldiers' belts. Buff sticks, like scouring brushes, are made in various widths to suit the work in hand, the broad buffs being used for polishing broad plane surfaces; and the narrow, thin buff sticks for giving a polish to grooves and hollows. They are used with finely-powdered rottenstone and oil, or with finely-powdered crocus, to give a finishing polish by hand to articles about to be plated. Where polishing lathes are available, the buffs consist of discs of wood, faced with various qualities of leather to suit the several classes of work and the several stages of the polishing process. Buffs are also used to impart a perfectly smooth polish to steel and blood-stone burnishers. When used for this purpose, the strip of buff leather is first boiled in water and dried quickly, then glued to a flat piece of wood a little larger than itself, and weighted with heavy weights until quite firm. The buff then resembles a mounted hone or oilstone, such as is used in carpenters' shops (see Fig. 4). Its use will be explained in the notes on *Burnishers* and *Burnishing*.

Bunsen Battery.—The Bunsen battery as used in this country is made up of an outer containing cell of stoneware, containing a cylinder of amalgamated zinc, inside which is a cell of porous earthenware containing a square bar of carbon. The outer cell is charged with sulphuric acid diluted with from eight to fifteen parts of water, and the inner cell is charged with strong commercial nitric acid. The electro-motive force given by this arrangement is variously stated by authorities as 1·85 to 1·95 volts. The internal resistance of the cells varies with their size, the condition of the porous cell, and the condition of the acid charges; the resistance being variously given as 0·30, 0·08, and 0·06 ohms. These probably represent respectively the pint, quart, and half-gallon sizes of cells used by the persons testing them. The E.M.F. of the quart Bunsen when charged with sulphuric acid diluted with twelve parts of water in the outer cell, and strong nitric acid in the inner cell, may be put down at 1·86 volts, and its internal resistance at 0·08 ohm. This will give a current of about 23 ampères on a short circuit, or 1·72 ampères through an external resistance of 1 ohm. As gold is deposited from its solutions at the rate of 37·31 grains per ampère hour, this current will deposit 64·17 grains per hour. It will also deposit 105·50 grains of silver in the same time. As, however, silver is best deposited with a low E.M.F. of from 1·5 to 1·6 volts, and gold with an E.M.F. of 1·2 volts, the Bunsen has a tendency to deposit both of these metals in a rough condition, unsuited to work that must be burnished. It has been found in practice that the Bunsen cell is well suited to gilding and silvering small articles, such as chains and trinkets, slung to fine wires offering a high resistance; but, for spoon and fork work, and plating or gilding on large surfaces, the current from a large Daniell, Smee, or Wollaston is preferable, because it deposits a coat more amenable to the action of the burnisher. The Bunsen cell, however, has become a favourite with platers and gilders working in a small way on trinket work, because it is easy to set up and cleanly in working, thus causing very little labour in setting up and putting away. French platers charge the inner cell with strong sulphuric acid, and thus get a milder current with an entire absence of those nitrous fumes which render the presence of the Bunsen intolerable in close workshops. The current from the French Bunsen has an E.M.F. of 1·8 volts at starting, but it soon falls to 1·6 or 1·5 volts when the circuit is closed, because the sulphuric acid is inferior to nitric acid as a depolariser. Readers interested in the working of this battery are referred to the articles on this subject, in Nos. 1, 2, and 3 of this volume of WORK. In large plating establishments, dynamo machines are largely superseding the use of batteries. (See also note on *Batteries.*)

Bunsen Burner.—This useful gas burner (shown at Fig. 5) should be found in every work-shop. It is composed of a small short burner inside a piece of gas barrel some five or six inches in length, to which air is admitted at the lower end. The air mixes with the incoming gas in the barrel (see sectional sketch, Fig. 7), and the mixture burns together at the top with an intensely hot, smokeless, and non-luminous flame. This flame is well suited to the operations of soldering, brazing, and other blowpipe work, and also for heating and fusing small quantities of material. When the tube of the burner is surmounted with the cap shown at Fig. 6, the flame spurts out of the holes, and forms a "rose burner," to heat a sand bath or boil water.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

114.—WATKINS' NEW PATENT SOLDERING FLUX.

THIS new flux, invented by Mr. J. H. Watkins, 29, Alma Street, Eccles, near Manchester, is intended to supersede resin, spirits of salts, etc., for soldering electric light, telegraph and telephone cable joints, as well as ordinary work in tinplate, brass, copper, zinc, and lead. The inventor represents it as being a solution of resin in a volatile solvent which has no corroding effects on metal, and which, on the application of heat, volatilises and leaves a coating of resin on each part of the work to which it has been applied, and being in a liquid form easily permeates any joint. Mr. Alexander, who tested the flux for me, says:—"It appears to be resin dissolved in either benzoline or methylated spirit. I find that it can be used for soldering tin, lead, copper, brass, zinc, etc., but as to its superseding spirits of salts for general work, I do not think it will. My experiments go to show that on lead, pewter, and other soft metals it acts very well indeed, but on copper, brass, tin, and zinc it is not to be compared with spirits of salts. The reason of this is plain. The patent flux is a flux and that only, but spirits of salts, either raw, as in the case of zinc, or 'killed' and diluted for the other metals, has a cleaning effect as well as being a flux. This difference was very marked in the experiments with copperplate, the spirits causing the solder to flow on and thoroughly join two pieces of uncleaned copper, just as it was cut from a sheet, better than the patent flux did on two pieces with cleaned surfaces. Experimenting with tinplate work, I find it acts well, and has an advantage over spirits in the fact that it is non-corrosive. But then we have always had a non-corrosive flux in the old-fashioned resin and oil, which has an advantage over the patent flux for tinware in the fact that it can be easily wiped off, which the patent flux cannot be, as the solvent evaporates and leaves the resin, etc., on the work. This, of course, in the case of electrical work, is a distinct advantage, and I am pleased to be able to say that I think very well of it for this class of work, being really convenient, effective, and economical." THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

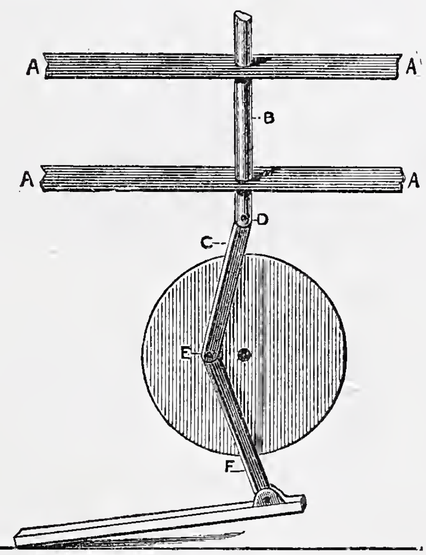
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—LETTERS FROM CORRESPONDENTS.

An Easily-Made Fret Machine and Wounds.—MEDICUS (*Hampstead*) writes:—"I thought perhaps it might be that I was extra stupid as I could not understand how the fret machine described by W. R. S. could possibly be made to work, but as I see, from the numerous inquiries with regard to this, that others are in the same position as myself, I begin to think I am perhaps not such a fool after all. The general idea of the machine sketched by W. R. S. is certainly good, and I am very much obliged to him. I intend to make one for myself, but I think in one or two details it may be considerably improved. He says his machine works well. If it does, the sketch he gives on page 332 of WORK must be at fault, for it is morally certain that if constructed as there depicted, the wheel could not possibly revolve. I imagine that the upper end of the piece marked C, which is hinged to the shaft, A, ought to have been placed on the inner side of the shaft, viz., between it and the wheel. With this arrangement the friction between the lower bearing and the shaft must be tremendous, as the latter must be bent out of the perpendicular at each revolution of the wheel. I enclose a rough sketch of the alterations I intend to make to obviate this. The wheel will be of wood, with



An Easily-made Fret Machine.

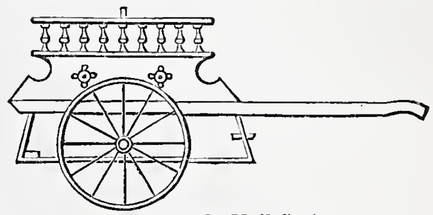
A, A, Guides; B, Shaft connected above with saw below hinged at D with C, a flat strip of iron, the lower end of which is fastened to the wheel and the treadle crank, F, by a pin at E, which passes through both and is bolted to the wheel.

strips of lead nailed round the circumference to give the requisite weight and driving power. Now to touch on another matter on which I do not write as an amateur. I refer to the bad advice given in your issue of September 14th with regard to treatment of cuts. If this advice is followed, I beg to point out that it will, in many instances, be productive of very serious results. To get a cut to heal, it should first be thoroughly cleansed with warm water, then the edges brought together if the wound is small by strips of sticking plaster, or strapping, if large, by as many stitches as may be necessary of silk or silver wire. The wound should then be bound up with a clean bandage, and the part be subsequently kept at rest if possible. Absolute cleanliness and rest are essential to insure rapid healing of a wound. The use of such remedies as French polish, glue, which is often in a state of decomposition, and common pins, is simply barbarous. They are only calculated to cause irritation, set up inflammation which spreads, and often renders it necessary to remove the affected limb in order to save the patient's life. This, I can assure you, from an experience of many years at one of the largest London hospitals, is no infrequent termination to a wound which, though slight at first, was neglected or improperly treated."

Noisy Fret Machine.—W. J. S. (*London, E.C.*) writes:—"I notice that G. W. J. (*Sheffield*) (see page 588) complains of his fret machine making a noise. If he will place rubber pads under the feet (as I do mine) they will materially deaden the sound, and thus remove some of the mischief."

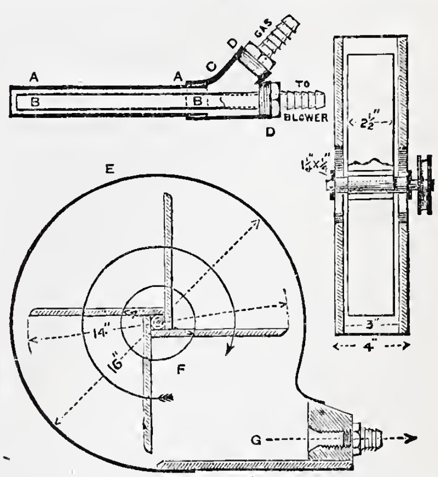
Lock Repairing and Key Fitting—Erratum.—MR. THOS. WILSON writes:—"I see your engraver has made a mistake in copying Fig. 5, which appeared in No. 24 of WORK. It should be as per figure in the margin. It is made out of a single piece of wire. The text is quite correct, but the inscription should be 'Lock Pin,' and not 'Mode of Repairing Pin.' They cannot be repaired. Inscription of Fig. 6 should be 'Desk,' and not 'Drop Lock Bolt.'"—[All contributors should be careful to write inscriptions under all figures sent. Not one in ten does so, and they have to be gathered from the text. In future all diagrams, etc., sent without inscriptions will be returned, that they may be filled in.—ED.]

Mail Carts.—R. H. (*Newcastle-on-Tyne*) writes:—"I notice in WORK No. 30 sketches of mail carts. I have just finished one, as below. There is one point that I think is of general importance. The steel spring is not necessary, but can be advantageously replaced by frame of pitch pine 1 in. square, to which axle is bolted."



Home-made Mail Cart.

Blowpipe and Fan.—ANIMO ET FIDE (*Loughboro', Leicestershire*) writes:—"I desire to thank A. S. P. very much for his lengthy and exhaustive answer to my query *re* bicycle repairs tools, which has been of great help to me, and taking advantage of his kind offer to give further help and information through 'Shop,' have enclosed tracings of blowpipe and fan I have constructed, and should be glad of his opinion as to their capabilities; and if they would be suitable for brazing up a bicycle, the fan driven from about a 16 in. diameter pulley; and as I have not seen any brazing done by blowpipe, I should be glad of a few hints regarding procedure. Also, can anything be soldered that has been hardened without softening it at all?"—[I can hardly speak with confidence regarding the capabilities of the blowpipe shown in drawing by ANIMO ET FIDE, as I braze only with charcoal furnace. A good blowpipe, however, is preferable, as it makes a cleaner job, and the work is much easier cleaned and filed up; besides, there is less danger of burning the thin tubes. I have not seen a blowpipe of the form shown by ANIMO ET FIDE. It would be an improvement to curve the nozzle to one side, so as to throw the flame down on the work



Blowpipe and Fan.

A, A, Ordinary ½ in. iron gaspipe; B, B, ordinary ⅜ in. (outside diameter) brass tube; C, Malleable iron T piece; D, D, Brass unions for indiarubber tube; E, Sheet iron casing; F, Air inlet; G, ½ in. gaspipe.

being brazed, while the tool is held conveniently in the hand. With regard to the fan, I should have the blades of a 16 in. fan not less than 3½ in. or 4 in. broad, and curved to a radius of about 12 in. The curved blades would be driven backwards, that is curving away from, not towards, the outlet, the backs of the blades thus driving or beating the air outwards towards the circumference. Such a fan and pipe ought to braze all the parts of bicycle frames. It should be used with a lump of charcoal under the work to be brazed. For some of the joints where solid stampings are inserted to be brazed into the tubes it may be necessary to make a clear charcoal fire in conjunction with the blowpipe, the charcoal being brought up to a good red glow under the work. The blowpipe, acting on the upper side, would bring up the necessary heat much quicker. To braze a hardened article would certainly soften it, but it would be hardened again considerably by plunging in cold water while yet red hot, but it would depend very much on the nature or use of the part thus treated whether or not it was not spoiled. For instance, a ball-bearing case would almost certainly be warped off the truth by such an operation.—A. S. P.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Dulcimer Dimensions. — WILL (*Norwich*). — You will find the subject most exhaustively treated in the articles on the Dulcimer commenced in WORK No. 31. The only allowance you will be obliged to make will be in the position of the inner and outer bridges, and the sound-holes. These will be 2 inches further from the sides than in the description, and your instrument would be tuned in the key of D. The proper dimensions of such an instrument would be, width at bottom 2 ft. 10 in., width at top 1 ft. 4 in., back to front 1 ft. 4 in., but if you desire to build one 3 ft. wide at bottom, then the top must be 1 ft. 6 in., and the depth 1 ft. 4 in., and strung with one size stouter wire.—R. F.

Pencils for Lettering, etc.—X.M.T.C.C. (*Belfast*).—Sable pencils, either for decorative painting or for sign writing, are named from the bird which the quill holding the hair is supposed to be taken from — thus lark, crow, duck, goose, and swan quills. The goose, or full-goose size, would be a medium quill, and its cost would be: goose, about ninepence, and large goose fifteen pence. These two sizes with a duck quill, costing about sixpence, would suit for almost anything up to six-inch work, using a flat long-hair fitch for filling in the letters. The best place to get them is of a large dealer; there are several in Belfast. Observe that the quill is well filled and the hair securely fastened. The brush should taper to a fine point, and should maintain the point unbroken when in use. When buying, wet the brush (they usually go into the mouth), and then whilst wet and the hair thus holding together, test the point by twisting it upon one's nail, making all sorts of imaginary circles and turns. If the point keeps firmly together and the brush works with spring and solidity it is a good article, but if the point splits up and the hair spreads about, try another one. Recently a good class of pencil for writing and so forth has been introduced which is made from brown ox hair, some call them "Taurus" pencils. They are not so fine as sable, but are considerably cheaper, and answer capitally for general use. Gilding and embossing on glass is almost a distinct art and craft, and would take much space and painstaking description to explain thoroughly. Doubtless it will appear in due time. For the embossing, acids and a thorough knowledge of the matter are necessary, whilst the gilding is done by weak isinglass medium, and then backed with black japan. You will surely now agree that, however sorry we are to refuse any inquirer, this time you have asked "too much at once."—F. P.

Smithing. — (*Birmingham*). — The articles on Smithing have already been resumed, and several branches of the art treated in an exhaustive manner. I think our papers will be far more useful to men of your trade than the book you name, and of which you say "the information you get out of it is not worth 2d." It requires a practical man, you know, and not a mere theorist, to write usefully and with effect on manual labour of any kind, and the way in which it is best done. There is no other cheap work on the subject that I can recommend to you and your friends except "Steel and Iron," by William Henry Greenwood, F.C.S., M.I.M.E., one of Cassell's excellent Manuals of Technology. It is sold at 5s. Possibly you might be able to get a look at it in the Free Library, if such exists, at Birmingham, or the library belonging to any workmen's institute there.

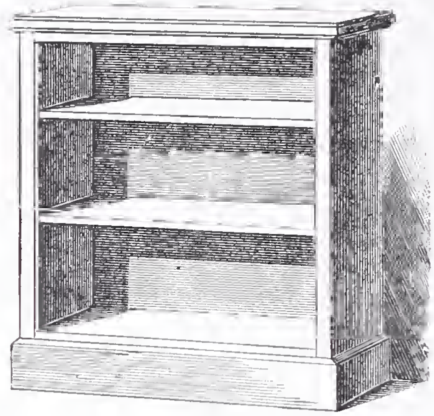
Prices of Batteries.—MANAGER ELECTRICAL CO. (*Crewkerne*).—I am obliged by your communication. Your company should advertise their goods in the sale column of WORK. MANAGER gives the following as a list of prices of Leclanché batteries supplied by the Electrical Company, Crewkerne :—

No.	Complete.	Zinc Rods.	Carbons Capped.	Porous Cells, Charged.	Glass Jars.
1.	1s. 6d.	2½d.	6d.	1s. 0d.	4d.
2.	2s. 0d.	3d.	7d.	1s. 5d.	5d.
3.	3s. 0d.	4d.	8d.	1s. 9d.	7d.

Sal-ammoniac is also supplied at 8d. per lb.

The prices quoted in the article were certainly the top prices from the price list of a London firm. Several country firms, including your own, supply the goods at lower prices, but all are not of equally good quality. I must repeat, do not hide your lights under the obscurity of your provincial towns, but advertise them through the world-wide circulation of WORK.—G. E. B.

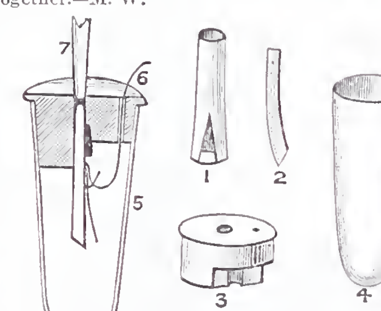
Dwarf Bookcase.—H. J. (*Bradford*).—I presume you mean a dwarf bookcase, though the sizes you give are very small even for one of these. Without going into full details, which cannot be given in "Shop," the following details may help you in making a plain one. Connect the ends together with a board of the same width at the bottom and at the top either with a couple of stays, one at the back, the other in front, or with a piece the same as the bottom. Use the lap dovetail form of joint. Below the bottom board fasten a plinth, for making which you will find directions in the articles on "Lessons from an Old Bureau." Fasten either a plain or lined-up top, using screws through the stays referred to. "Lining up" has been exhaustively treated, and if you do not understand this work, you should read the articles about it before proceeding. It is usual for dwarf bookcases



Dwarf Bookcase.

to have the front edges of the ends thickened up by adding a pilaster to them. This forms a rebate within which is the front rack, by means of which the shelves are made movable to any distance required from each other. It will, however, be simpler for you either to nail the shelves or to support them on slips of wood nailed to the ends. The back should be munted, but plain jointed stuff if dry would do very well for such a small job as you contemplate. Thickness of material throughout for ends, top, and shelves may very suitably be ¾ in., but there is no definite rule to go by, and even ½ in. stuff with judicious lining up might be used. The illustration shows the kind of bookcase. You will easily be able to add a door if you wish to have an "enclosed" job.—D. A.

Reed in Organ Pipe. — AMATEUR ORGAN BUILDER.—The reed in a reed pipe of an organ is the small metal tube in or against which the flat metal tongue vibrates. As it would appear that you have had no previous practice in this work, I think you would do well to buy the parts ready made, and even then you will have a very troublesome job before you succeed in getting the pipes to sound properly. The following sketches will explain how the various parts of a reed pipe are put together.—M. W.



Reed in Organ Pipe.

Fig. 1.—The Reed. Fig. 2.—The tongue. Fig. 3.—The block. Fig. 4.—The boot. Fig. 5.—Showing reed and tongue fixed in block by wedge. Fig. 6.—Tuning wire pressing against the tongue. Fig. 7.—Foot of pipe standing in hole over the reed.

Retinning of Stewpans, etc.—G. S. (*Langley, Bucks*).—To reply fully to your query would take up more space in "Shop" than could be spared for it, but I will endeavour to give you as much information in a small space as I possibly can. With regard to the tinning of copper stewpans and other kitchen utensils, you must proceed as follows:—First do all the needful repairs, such as taking out the bruises from the sides and bottoms by means of a hammer on the proper tools, viz., side stake and bottom stake; see that all the handles are tightly fixed, if not, rivet them up a bit; they must next be freed from grease. This process is called burning off, and is done by placing them on a forge over a good fire of charcoal, and gently blowing till the grease is all melted and burnt off. Care must be taken not to allow them to get red hot whilst doing this. Procure some strong spirits of salts and pour some into a dish or basin. Make a kind of swab by wrapping some cloth, sacking, or canvas round a stick; dip this in the spirits and rub the stewpan all over, inside and out. After this, well wash them with water, then take some blacksmith's "scale"—that is the iron that flakes off the red hot work as the smith hammers it on his anvil—and with a piece of old carpet well scour them all over. You must do this disagreeable job thoroughly, for on this your success or failure will depend; there must be no shirking it; scour handles as well; they will have to be done again, but it makes it easier to do them a bit at this period. Having finished scouring, rub the outsides all over with salt or salt and whiting mixed to a paste; this protects the copper, and prevents the fire tarnishing them so much. They are then ready for tinning. Several other things must be got ready. Some pieces of sheet iron must be turned to slip on the handles to take hold of while tinning. A tinning rod will also be wanted. This can be made by bending a piece of 3-16th or quarter rod in a series of rings, like a hair-spring of a watch. Leave the handle about 18 in. long with an eye at the end to hold by. Pound up some sal-ammoniac in a mortar, and get a wad of tan to wipe the tin off with. You will also have to rig up some arrangement to blow the fire with your feet; an old stump hung on the handle with a piece of chain is the usual thing. Have your tin run out in strips like solder; I find this the handiest form to have it in. Now place everything ready to hand, and commence to tin. Place a stewpan on the fire (sheath on handle); hold it in the left hand. Throw a little sal-ammoniac in and blow gently, and rub a stick of tin against the part that is over the fire. When a little has melted into the stewpan rub it about with the tinning rod, applying a little more sal-ammoniac and tin occasionally as required. The sal-ammoniac will turn black, but that will not hurt. Keep rubbing, and you will find it greatly helps to tin. Do not get the things too hot and burn the tin, but keep a nice heat so that the metal flows easily. Having gone all over it, and supposing it well covered, run it round once more, getting it well hot, then quickly take it off the fire, dust in a little sal-ammoniac, and then with a ball of tow wipe it round, drawing all the superfluous tin out. This will require some practice before you can hope to do it well. They are then well scoured all over again, inside and out, with silver sand, using tow as a rubber. Do not use the same piece for the inside as you do for the outside, or it will turn them black. Use plenty of water. Do one at a time; do the outside last, and dry off quickly in dry sawdust. Polish up the insides with flour, and the outside with crocus. With regard to retinning tin dishes I advise you not to attempt it. If they are small ones it would be a waste of time and stuff, as it would cost more than new ones, and if large dishes, such as milk coolers, etc., it would be best to send to a firm that does such things, as they could not be done over a fire, but would require a large bath of tin of several hundredweights, which I presume you have not got. Some more information on tinning that may be of service to you will appear in my next article. I know of no work on the subject of tinning, but trust the above instructions will afford you all the information required. If not quite clear on any part write again. My object is to help all those who are anxious to learn.—R. A.

Battlesden Cart.—H. P. (*Canterbury*).—I was glad to get your letter on the subject of Battlesden Cart, particularly as I see from it that you are a practical worker. You are quite right in your stricture on the hind step. It should undoubtedly have been represented rounded to match front. With regard to the wings, I think they present too much of a "paddlebox" appearance when carried down behind, as you suggest, and there is no danger of mud being splashed upon the occupants of the back seat. However, this is altogether a matter of taste. Many thanks for your kind words of appreciation of WORK. I hope you will be able to carry out your intention of getting a lathe. Get a good one when you go about it. I have just got a Britannia Company's No. 14, and am delighted with it.—OPIFEX.

Printing Ink.—E. C. M. (*Ipswich*).—You will find no book which will tell you how to make up various tints, as there are, up to the present, no standard colours; and you will find every maker's colours differ a little, and very often even the same maker will not be able to match exactly the shade of colour as previously supplied, therefore experience alone can teach you. You can buy all the dry colours ready for mixing nowadays from the very cheapest to the best.—J. F. W.

Crystoleum Outfit Cost.—CARP DIEM asks the cost of an outfit for crystoleum painting, and says Reeves' prices are high. I have not the slightest interest in recommending this particular house, further than this, that I have purchased material there, and have found them as cheap and good as any other house offers. I think that perhaps C. D. asked the price of an outfit which would include everything that an expert would require. The fact is a beginner does not require such a full set as would be comprised in an outfit. The ten colours I have mentioned will not cost more than about 3s., and can be obtained at any good stationer's or art dealer's. And really there is no need to purchase all those I have mentioned for a beginning. I should say 5s. would purchase all that would be required to begin with, which is not a very large sum. C. D. says he thinks he can get them cheaper. Perhaps he will try and let others know if he succeeds. I would recommend C. D. to procure a catalogue from Reeves, Newton & Wiltons, or some other dealer in artists' material; then he will see price of what he requires.—O. B.

Paraffin Wax. — GLU (*Manchester*). — I think you will find no difficulty in incorporating either your pigments or tube colours in the wax, if you will proceed as follows: Melt the wax in a water bath, then introduce your colour; stir till amalgamated, remove from fire, and continue stirring till nearly set. This is the plan druggists use to colour their ointments, etc.—P. W. S.

Sale of Fretwork.—George L.—You say, "I have taken very kindly to fretwork, and have bought a fret machine. I now want to recover what I paid for it, by selling the work I do with it. Can you put me in the way of disposing of it?" You do not say where you live. If you reside in a small town there is not much chance for you, but if your tent is pitched in a large one you might try the dealers in fancy goods, or start a window somewhere on your own account, giving the proprietor of said window a commission on everything sold, as remuneration, or as hire of window and for services rendered. Again, you might try to get orders for fret cutting from upholsterers and others in the town.

Tempering Chisels.—Chiseller.—No, my friend, your query has not been overlooked; but as, owing to the pressure of correspondence and the impossibility of putting more into the space allotted to "Shop" than "Shop" will contain, coupled with the fact that "Shop" was full up to No. 30, and there was yet more to be used before your letter arrived, it is manifest that in the common course of nature your want could not be met by the date of your second letter. Tell your friend to read reply below to E. L. (*Reading*) *re* Steam Launch. I cannot deal with "what are known as examination catch questions in Applied and Theoretical Mechanics, Steam and Steam Engine, etc.," except through "Shop." If you are in any difficulty, and want a leg over the stile with regard to any question, send the question, and, if possible, you shall have help.

Steam Launch.—E. L. (*Reading*).—The contributor who was to write on the construction of a steam launch has had his hands full ever since Work was commenced, but he assures me that if he cannot manage to tackle the job himself during the coming winter, somebody who is competent to do it shall be found to take his place. From this you will see that it is not in my power to say with any exactness when the papers will appear, nor can I attempt to say what may be the "dimensions, speed, number of passengers, and probable cost" of the launch to be described. One word more both to yourself and others who send *noms de plume* to be prefixed to replies to their queries—choose short ones. Such lengthy affairs as "One who is anxious to know" take up more room than is necessary. Anxiety for knowledge is most praiseworthy, but this is implied by the fact of your writing. For this reason I have replied to you under your initials, and name of town in which you live.

Silk Winder.—D. B. S.—Unless you understand the work of unwinding the cocoons, which you presumably do not, it would be useless to give such a description of a winder as would be of any service to you. However, it may be said that you do not require to accelerate the speed, and that a simple drum or reel, which can be turned, is all that is indispensable, and that it must not be turned too quickly. A rough outline of the process may assist you, and after reading it you will be able to judge for yourself whether it is worth while pursuing the subject further. The cocoons must be soaked in warm water to dissolve the gummy substance in them. The loose ends are then to be caught and passed through small eyes of some polished smooth material such as glass. During their passage through these, of which there are a series, they are gradually united till they form one thread which is then wound round the drum. This must be at such a distance from the vessel containing the cocoons that the silk is dry before reaching it. The operation altogether is a very troublesome and tedious one, and the result—with a small quantity—not commensurate with the labour.—D. A.

Plush Frames.—Plush.—A paper describing the construction of easily-made plush-covered frames is under consideration, meanwhile I may refer you to the various hints already given in Work *re* frame making generally.—D. A.

Boy's Barrow, Cage, and Secretaire.—Round O.—I am afraid the first subject is hardly within the scope of Work, but the others are, and papers on them will be given. With regard to the latter, let me tell you that secretaire is a generic term for writing tables of various kinds, and that by itself it conveys no meaning of the special shape or arrangement desired, so that I am unable to say whether any of those which are contemplated for early consideration will be exactly the thing you want. I may, however, tell you that the plain pedestal table will be among the first, but as you say you are only a "third-rate amateur" it will be a difficult job for you to tackle. I am afraid though that with characteristic Scottish modesty you have mistaken your capacity, which is, no doubt, equal to making—well, say lots of things. It grieved me sair when I read that Work does not reach your ideal, which is doubtless high, but on proceeding I was, in some degree, consoled by seeing that you consider it of much value. It undoubtedly is, and the intention expressed is a laudable one, which, if carried out, will soon cause you to rank as an A 1 amateur. You are by no means too old to make progress in mechanical arts. Really, no, we do not give "snubs to those who dare to ask too much." It is a pleasure to help them in any way we can through "Shop," and no one need be afraid of asking questions when it comes within the scope of this magazine to answer. You must kindly make allowance, and remember that we cannot always evince the grace and general *suaviter in modo* peculiar to your countrymen. Glad to hear you preserve Work. Please keep general business matters separate from remarks for "Shop."—D. A.

Xylophone.—Musicus.—The straw ropes are fixed on the top of the pieces of wood you saw, and are for the purpose of insulating the pieces of wood; they are generally on a sort of table, which may increase the tone. Fig. 1 is a plan view, and Fig. 2 a section, which I hope you will be able to make

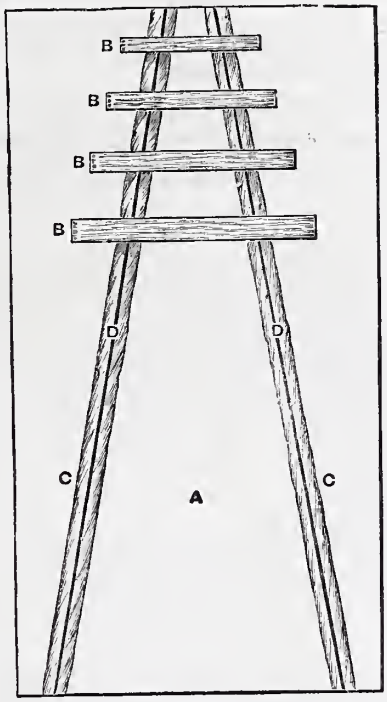


Fig. 1.

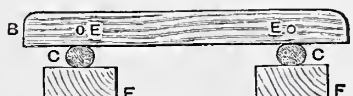


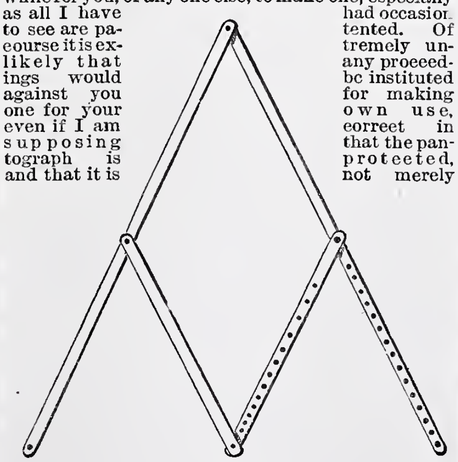
Fig. 2.

Fig. 1.—Plan of Xylophone. Fig. 2.—Section of Xylophone.

A, Table; B, Pieces of Wood; C, Straw Rope; D, Cord through bars; E, Hole for cord; F, Strips of wood on which straw rope is sometimes placed.

out; you had better try to see one, when you could take any measurements. I have seen one of pitch pine hung by the cords alone, and played, but I think the tone is better when on the straw ropes. You can tune them by cutting the pieces shorter. Rosewood is said to be the best wood.—J. T.

Pantograph.—W. M. G. (*Hull*).—As a pantograph can be had for 6d., it hardly seems worth while for you, or any one else, to make one, especially as all I have had occasion to see are patented. Of course it is extremely unlikely that any proceedings would be instituted against you for making one for your own use, even if I am correct in supposing that the pantograph is protected, and that it is not merely



Pantograph.

improvements which are covered, but it is just as well in case of doubt that you should be warned of the existence of a possible infringement. In construction the pantograph is simplicity itself, or rather may be, for expensive fittings are by no means necessary, though often employed on the more costly forms. To go into the whole subject of panta- or panto-graphs here is out of the question, but having made one on the lines indicated here, you will have no difficulty in finding out how to apply it. I believe this form of it is not patented. Size must depend on kind of work intended, but my advice to you is to get a small one first. Four pieces of wood, two of which are, say, 1 foot long each, and two of half that length, will be required (see figure herewith). The stuff need not be thicker than $\frac{1}{8}$ in., or wider than about $\frac{1}{2}$ in. Fasten them, or rather, hinge them together, as shown in the diagram. Small screws, or even pieces of wire, will do for the purpose. At the ends you will require hole for pencil, fastening pin, and guiding point. For the pin you can use an ordinary carpet or drugget stud, and for the guiding point a small French nail. What you have to remember is to make the parts work freely and yet not shakily. By altering the position of the joint on one side you can alter the proportion of your copy. If you want exact work you will, however, do better by buying one ready made.—D. D.

Parlour Floor: How to Polish.—Magister.—A paper on this subject will be given ere long, and if you will kindly wait till it appears you will gather more information from it than from any details which could be given within the limited space of these columns. With regard to articles of a more simple character being given in Work, I need only remind you that experienced men must be catered for as well as beginners. No doubt these latter experience difficulties in making things, however plain and simple, but members of the staff are always pleased to assist through "Shop." If you look through the numbers which have appeared, you will see that a very large proportion of articles suitable for beginners have been given, the desire being to encourage novices and others to undertake healthy, wholesome recreation in mechanical pursuits, as well as to advance the skilled professional worker. Thanks for the interest you have taken by bringing Work under the notice of your friends, and if those who find some of the articles "too technical" will just send along a note saying what they want to know, they will soon find what now seems too technical the natural language to express the work of the various handicrafts.—D. A.

Drawing.—A. J. T. (*Holborn*).—Apply to the secretary of any one of the following institutions:—The Birkbeck Institute, Chancery Lane, E.C.; the Polytechnic Institution, Regent Street, W.; West London School of Art, Great Portland Street, W.; Working Men's College, Great Ormond Street, W.C.—F. J. C.

Redressing Sandpapering Bands.—No Name.—Make a weak solution of glue, and spread upon your bands, then cover thickly with powdered glass. You will require two different sorts, one fine and the other coarse, although the coarse will work itself fine soon enough. You will be able to buy your powdered glass off any sandpaper manufacturer, whose name and address you will find at the back of one of their sheets. If, however, you wish to make it yourself, procure some thin broken window glass, and pound up with a piece of hard gritty stone, then sift through a fine wire sieve, and dust upon the wet glue before it sets as above mentioned. If the above is too much trouble I should advise you to cut sandpaper up in strips the required width, and glue on the bands, touch up the jointings with glue, and dust a little powdered glass over; use when thoroughly dry.—W. P.

Tube of Refracting Telescope — Driving Clock.—J. A. Sinclair (*Hammersmith*).—I have read your letter very carefully, and I do not quite see what telescope you are trying to make. But I can see that your acquaintance with the subject is very slight, and that you have a great deal of the simplest to learn before you can hope to understand "driving clocks." You must discard all idea of private inventions in the way of some apparatus on the object glass end of the telescope until you have succeeded in neatly mounting your telescope in the plainest possible manner. In trying to devise paper and tin tubes you will waste as much money and labour as would buy for you the necessary length of mandrel-drawn brass tubing, which is the proper thing to use. I can direct you how to mount your lens therein with no other aid than a file, a drill, a few brass screws, and a set square, so that your scarcity of tools need not make you despair. But there is not the least necessity for your main telescope tube to be cylindrical, though this fact seems always to escape the detection of folk unused to telescopes. You may employ your wood-spoiling capacities in the making of a neat piece of joinery in the form of a square-sectioned wooden tube of the required length of mahogany, which might be afterwards polished, or of plain deal. The term a "wood-spoiler" I use because you have used it, and not at all because I agree with you that it is synonymous with amateur. In this one private matter of astronomical telescope making, the art has ever been in the hands of amateurs. By-and-by, being amateurs in the truest sense—see the English Dictionary—they made their hobby and art their life-work, but that does not affect the question. Tell me whether you intend mounting your lens in metal or in wood, and then I will tell you how to proceed. Whatever merit for neatness your mechanical drawing may possess, your idea of a driving clock is so very crude that I cannot even undertake to tell you where it is wrong—it is wrong everywhere. The American clock you speak of would not do for you what you are presuming that it would do. Moreover, assuming for the moment that it had the necessary force, you have applied it to the wrong axis of the telescope. The very carelessness of you is shown by your question, "What do you think of the clock-work motion for the telescope? *not as anything at all accurate*" (the italics are mine). If the clock-work be not accurate it is absolutely, utterly, and entirely useless and absurd. That is what I think of it! Set to and learn somewhere the simplest theory of the refracting telescope, and then mount your lens humbly, and plainly, and neatly, and well. You will learn more of real art in one month by so doing, than you would be likely to learn in a year by trying to construct intricate apparatus. When you have made your telescope simply, and have used it awhile, you will discover that all intricate apparatus used in practical astronomy is used only in exceptional circumstances for exceptional purposes, and is never used when it can be dispensed with. WORK is always here to help and guide you, but as a true teacher and guide, it must ask you to do the simple work well before it may teach you the difficult work.—E. A. F.

Damaged Frames, How to Repair.—F. M. G. (*Stanningley*).—I am afraid you would find it laborious and expensive. What I should advise is to take your pictures out of the frames, and send frames to a maker to have them repaired and corner set on, or, if they are old-fashioned, chip off level and buy a set of compo corners. All that is necessary is to clean the corners, and place your new ones over steam for a few seconds—a cloth over a jug of boiling water—lay your corners on, take off, and place in position on frame. It does no harm to glue the part of frame first. Do not press corner too much, as you lose sharpness of pattern. Secondly, when corners are dry and hard, evenly spread with a camel-hair brush oil of gold size, let dry to tacky, then with a tip apply gold, using a cotton-wool dabber to press it on; then thoroughly dry off with clean cotton wool.—G. R.

Combination Couch and Bedstead.—COUCH BEDSTEAD.—Full particulars cannot be given in the limited space of "Shop," and this piece of furniture is hardly one that many readers would care to make, so that as there are so many subjects which are more popular, I fear a paper cannot be given, at any rate for some time. Of course, you can use any couch as a bedstead by making up the bed on it, but, I suppose, you want a thing which, in the day-time, will look like a couch, and when required as a bedstead can be increased in width. There have been several patent contrivances of this kind, but so far as I am aware none of them have met with anything like general acceptance. Such an article is less frequently met with than even the combination of cupboard and bedstead, a description of which is in the Editor's hands, and will appear shortly. My advice to you is not to waste time with a couch bedstead of the kind I suppose you want, but if you wish to try and make one, the hint that the seat frame, or rather an extra frame, is made to extend may be useful to you. Another way is to make the back so that it may be laid level with the seat when required.—D. A.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Simple Incubator.—J. M. (*Glasgow*) writes:—"Would W. L. (*Kingsland*) (see page 557) kindly say at about what temperature the heat should be kept at in the box; and what kind of lamp may be used?"

Rivetting China.—A. JONES has not sent his address with his MS. and diagrams. Will he please do so?—ED.

Machinery for Making Surgical Plasters.—G. H. S. (*Manchester*) writes:—"Would any reader be kind enough to name a firm who makes a speciality of these machines, notably for producing the ordinary surgical sticking plaster—not court plaster?"

Flux for Welding Steel Spindles.—G. H. S. (*Manchester*) writes:—"Will any reader be kind enough to furnish a good flux, specially adapted for welding steel spindles of flax spinning machines? I have tried borax and sand, but they do not answer well."

Horse-shoeing.—A. R. (*Scorrier*) would like a practical paper or two on this subject.—[Will any competent writer volunteer to take the matter in hand?—ED.]

Waggon Brace Bits.—A. B. (*Northwich, Cheshire*) writes:—"Will you do me the kindness, in the way of letting me know the address of Mr. Leadbeater? He used to live in Spring Street, Birmingham, but he has a partner now. He is the maker of waggon brace bits. At present I have to walk about twelve miles to get the above bits, and when I get there sometimes the tradesman has none in."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Complaint.—C. H. (*Bloomsbury*).—I do not insert your letter. J. H. knows perfectly well what he is about, and you are, or ought to be, aware of this.

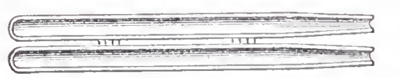
Tin Ovals.—H. S. W. (*Wakefield*) writes in reply to A. N. (*Airdrie*) (see page 540):—"I purchased one of your papers called WORK, and while looking over the same found a reader asking for particulars regarding tin ovals, etc. If A. N. would write, giving particulars of tin ovals, etc., wanted to J. Rhodes and Sons, Grove Works, Wakefield, England, no doubt he would obtain the price and particulars wanted either to work by hand or by power."

Barnes' Foot-Power Saw.—A. M. (*Bethnal Green Road*) writes in reply to REMINGTON (see page 558):—"These are very good tools, and cut up to 2 in. I would suggest that you see one of the patent saws made by Britannia Company, 100, Houndsditch, and compare. These cut up to 4½ in."

Parchment.—W. H. (*London, E.C.*) writes in reply to DRENNAN (*Kilmarnock*):—"Vegetable parchment can be obtained of Henry Hymans, St. Bride Street, Ludgate Circus."

Small Pump.—H. A. B. (*Ashton-under-Lyne*) writes in reply to W. R. S. (*Brixton*) (see page 558):—"You will be able to get a set of pump castings from Theo. Tomlin, Model Engineer, Breeze Hill Terrace, Oldham. Having fitted up several model engines (both for pleasure and profit), I can recommend his castings as the best I can meet with, as regards the price and quality."

Machine for Making Cigarettes.—THOMASO writes in reply to S. B. R. (*Blackheath*) (see page 494):—"As I understand your question, you want a cigarette machine, something after the style of a coffee mill, one into which you can put tobacco and cigarette papers by the bucketful, turn a handle, and cigarettes fall out on the floor. That machine may be looked for about the time when that famous American sausage machine comes into the market, into one side of which live pigs were driven, reappearing on the other as pork sausages! The best way I know, and in fact one method adopted by manufacturers, where perfect uniformity in size is desired, is the following:—Roll the paper round a blacklead pencil, or anything of the desired size; gum down the edge and slide it off. You now want a piece of brass



Machine for Making Cigarettes.

tube about 6 inches long, made to open lengthwise on small hinges as in the figure. One end of this is to be tapered off gradually, and made small enough to just slip a little way into the end of the paper tube you have rolled. You open the brass tube, lay about twice as much tobacco in it as will be wanted (putting the fine in the middle); close it, insert small end into the paper; hold the paper on, and keep the tube shut with one hand, while with the other you push the tobacco out of the tube into the paper with a small stick. When you see the tobacco emerge from the end of the paper, cease holding it on the tube; continue to push with the stick, and the paper with the tobacco in it will drop off, only needing the application of the scissors at each end to leave it a perfectly formed cigarette. The tube is best made of sheet brass, and must be perfectly smooth inside; the two halves should fit well together. The small hinges sold for fretwork purposes will do, soldered on. The end of the tube can be tapered with the mallet on a piece of iron rod previously filed taper."

Gas Stove.—D. M. J. (*Portsmouth*) writes:—"If your correspondent, S. P. (*West Bromwich*) (see page 526) will communicate his address to me, I shall be pleased to send him sketches of stoves that might suit him, if he will kindly state if he has any chimney flue from his lecture room, as in any case it is advisable to carry the fumes of the gas out of the room. The local gas company may be pleased to give him all information."

Insurance of Tools.—A. N. E. (*Nottingham*) writes:—"In answer to J. K., page 366, No. 23 of WORK, and also T. T., page 429, No. 27, I may say that I insured my tools some few years ago with a most unsatisfactory result. I first insured with a company for £10 at a premium (annual) of 5s. In eighteen months the company wound up, or burst up, and transferred all business to company No. 2, annual premium 4s. 6d. In about eighteen months after, company No. 2 handed business over to company No. 3. I received a form to fill up signifying my consent to the transfer, or if on the contrary, I was to receive the amount of premium applicable to the unexpired portion of that year. However, I signed the form filled up duly and truly, and sent it to Mr. Secretary somewhere in London—I have forgot the address, and destroyed the papers as rubbish by now—but I never received a policy or anything else from that day to this. I once wrote asking for one, but received no reply, so now I invest my penny a week in WORK, and get my penn'orth, and a good one too! So, if J. K. and T. T. will take my advice about insurance, I say—Don't. Possibly something of the kind on the lines you suggest, in answer to T. T., page 429, might answer, but such is my experience of the companies I have dealt with."—[You may insure, I think, with perfect confidence in the "Hearts of Oak," which appears to be an old and well-established benefit society.—ED.]

Trade Notes and Memoranda.

A VERY good idea of the perfection to which the making of ships' chronometers has attained is gained by noting the performance of a chronometer which accompanied the ill-fated Polaris expedition which set out in 1871 on an Arctic expedition. When Captain Hall perished—some time in 1872—the chronometer was abandoned, and lay buried in the snow for four winters, when it was found by some members of an English expedition, dug out and wound up, when it started up as usual, losing at a uniform rate of about one second per day. It had been subjected to temperatures ranging as low as 100° below zero. The chronometer was made in America, and has been sent from the British Admiralty Office as a present to this country, being now in possession of the Navy Department.—*American Machinist.*

A CURIOUS and noteworthy specimen of expert foundry work has been recently executed. It consists of three plates of cast iron about one-fourth of an inch thick, and seven by five inches in surface, covered with writing indented in the iron. This specimen of skilled workmanship was done by John Farrar, foreman at an American foundry, a life-long workman in an iron foundry. The impression on the iron is made by writing backwards on thin paper, pinning the paper in a mould, and then pouring on the iron. The writing thus transferred to the plates, when the iron is cooled, is wonderfully clear and distinct, and is so deeply imprinted as to defy any attempt at erasure.

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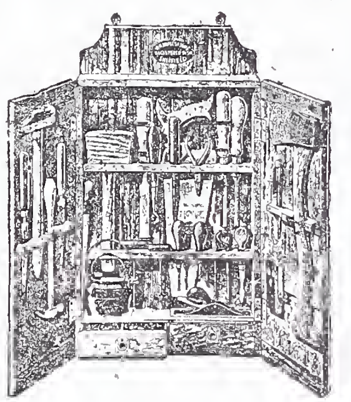

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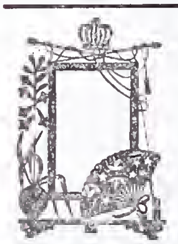

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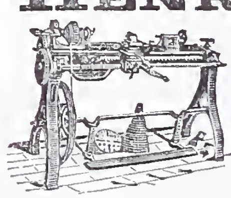

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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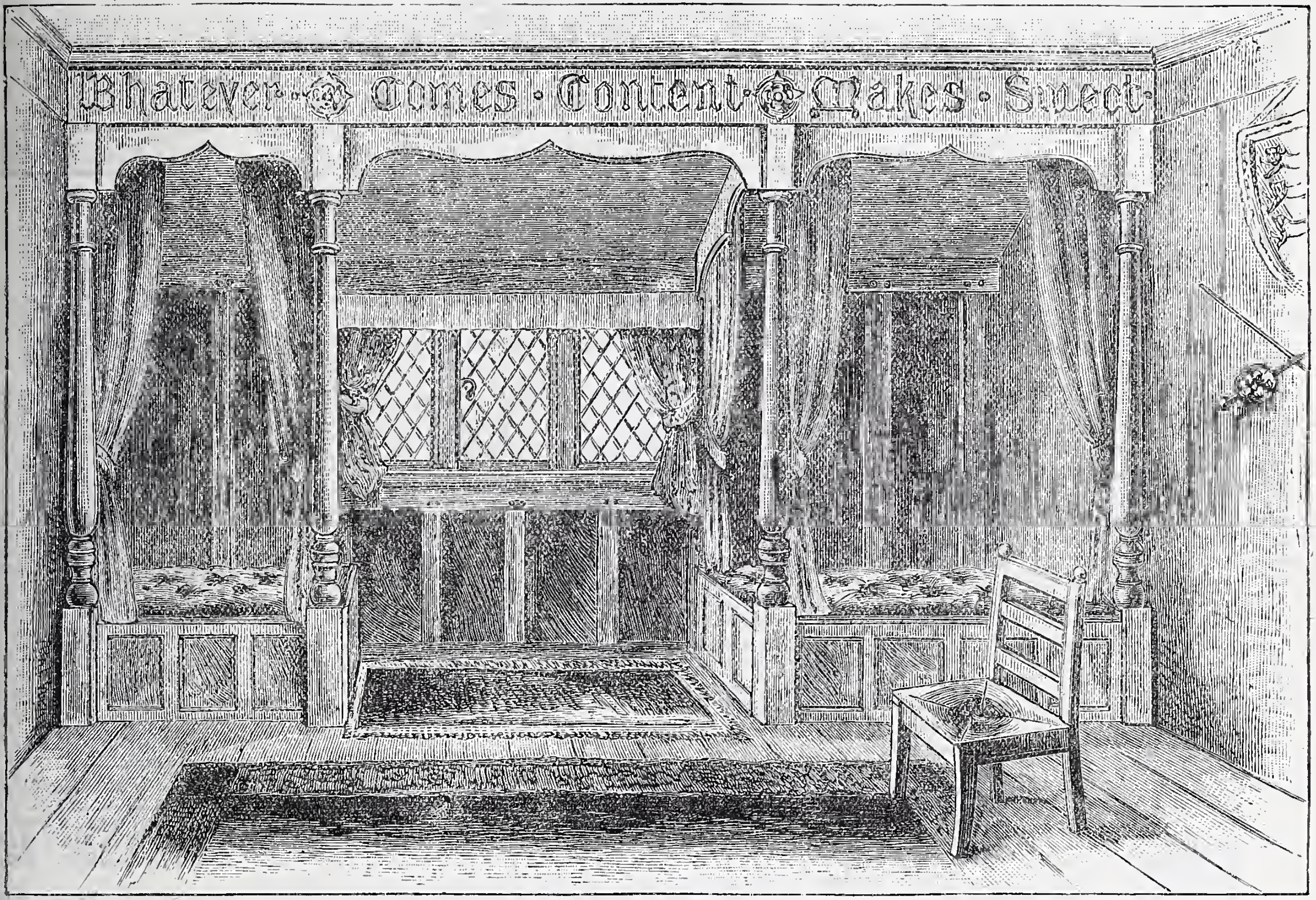


Fig. 1.—Perspective Sketch, showing Treatment of Room with Sloping Ceiling.

HOW TO TREAT A SLOPING CEILING.

A SIMPLE METHOD OF UTILISING BED-POSTS.

BY F. W. KINNEIR TARTE, M.S.A.

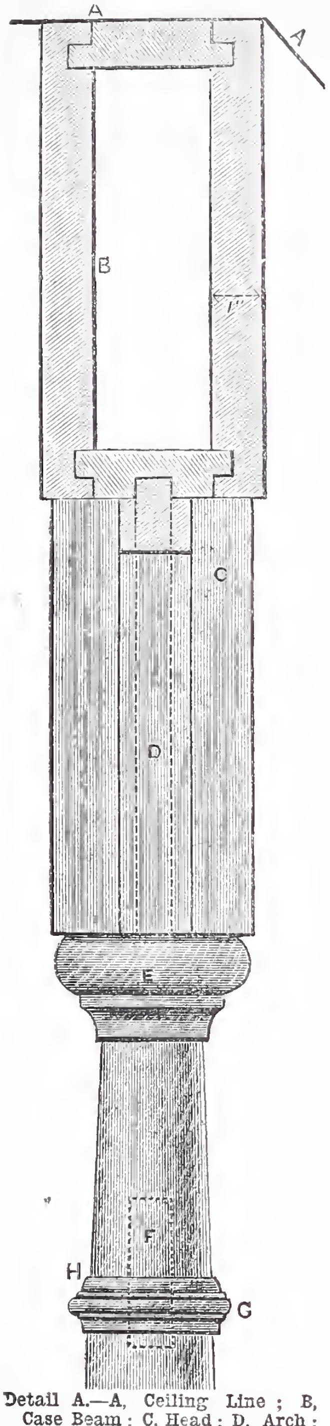
'CAN you suggest a way of improving this ıseful but ugly room?" said a friend to ne not so very long ago. The room he re-ferred to was about 12 ft. wide by, perhaps, 15 ft. long, and about 7 ft. high, with a slop-ng ceiling along the window end. The slope extends 2 ft. back from the face of the plaster.

The home we were in was a snug and uxuriously furnished cottage, with massive imbers showing on the inside of the rooms. The shape of the room was certainly incon-venient, but at the same time it was wished that it should be made into a snug and com-fortable sitting- and smoking-room. My friend being an enthusiastic collector of old oak work, he had amongst other things a num-ber of exceedingly handsome *oak* bedposts; accordingly, it occurred to me that these could in some way be utilised in making a picturesque gallery at the sloping end of this room. Fig. 1 is a perspective sketch of the way in which the room was eventually treated. Should the reader not consider himself capable of carrying out this himself —which I certainly hope will not be the case—he will find the cost very trifling in comparison with the effect gained by the addition of the "gallery." The whole of the work has in this case been executed in old oak as the posts were of this wood, but I see no reason for oak, and should not my-self hesitate to have the work carried out in the softer woods, and painted afterwards. I am inclined to favour a rich brown colour for painted work in most reception rooms; excepting, of course, drawing-rooms, and it is not likely that a room with a sloping ceiling would be set apart for this pur-pose. When the right tint is obtained, brown is a colour of which it takes a con-siderable time to grow weary.

I shall, therefore, consider that my reader intends to paint the work at completion. Fig. 2 is an elevation of the "gallery." Fig. 3 is a plan, and Fig. 4 a section of the same. Detail A is a section through the beam and arch, showing a side elevation of the addition to the bedposts. Detail B is a section through the seat. All of these drawings are drawn to scale.

In describing the way to carry out this work, I will commence with the beam across the room. This need not necessarily be solid, a case will serve the purpose equally well, and should be constructed with two 1 in. deal boards 10 in. wide, and as long as the width of the room. These will be the front and the back of the beam. The top and bottom pieces will be the same length and 2 in. less than the required total width of the beam. These should be tongued and grooved together as shown in Detail A, and the bottom piece, or underside, of the beam should also be grooved to receive the heads of the posts and the tongues of the arches.

When the beam has been constructed, it should be fixed to the wall at either end by holdfasts driven into the walls from the underside of the beam, and, if possible, made additionally secure by being screwed into the ceiling joists; these screws will be eventually concealed by the cornice moulding which will afterwards be described. The back edge of the beam should be in the angle formed by the flat and sloping portion of the ceiling.



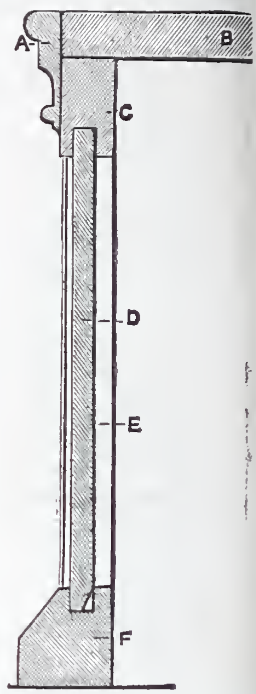
Detail A.—A, Ceiling Line; B, Case Beam; C, Head; D, Arch; E, Capital; F, Oak Dowel; G, Necking; H, Joint.

Next, the posts must be considered. It will be found that bedposts are not more than 5 ft. 6 in. long. This is the length of the posts I am writing about; and it was found necessary to increase them 6 ft. 6 in. This was done by fixing a short portion of shaft, a small turned capital and head dowelled and glued to the old posts with 1 in. by 3 in. long circular oak dowels immediately above the neckings (see Detail A). The joint thus is practically concealed. In lengthening the posts, of course, the total length when finished must be equal to the height between the floor and the underside of the beam, and the head 9 in. long, or equal to the depth of the arches. In addition to this there should be a tongue on the top of the head, to fit into the groove on the underside of the beam. The head should be grooved to receive the arches on either side; and the central heads should be grooved on three faces, so as to receive, in addition, the arches shown in Fig. 4. A post should be placed at the extremities of the beam, and the intermediate posts should be equidistant, or, as in this instance, opposite the window frames. Should the window not be in the centre of the room, as in the case in the accompanying drawings, the arches will be of different lengths; but this need not be considered, as it will add to the picturesque effect of the whole when completed. The head should be screwed into the beam from the sides. The feet should either be screwed to the floor, or inserted into square compartments formed with half round deal, mitred, and then screwed to the floor, by this means forming sockets for the reception of the posts.

The position of the posts having been arranged, it will be necessary to set out the arches. These should be of a length equal to the distance between the posts. The arches should have a tongue along the top and sides to fit into the grooves already described along the underside of the beam and the sides of the heads. In cutting out the arches the wood should be $9\frac{1}{2}$ in. wide, the half inch being the tongue. Care should be taken to keep the shape of the arch flat. Do not get a "*fat*" curve on any account. Three different widths of arches are given in the elevation, and the reader cannot do better than follow these lines. The arch shown in the section (Fig. 4) will depend entirely on the length of the slope of the ceiling. And should the room be as shown in the drawings, it should be cut from 12-in. stuff, with a tongue on the edge next the post head. This tongue should be inserted into the groove already described, and screwed to the upright post forming part of the window framing. Should the ceiling be uneven, as is very often the case in old houses, a moulding should be fixed to the arch along the ceiling line both back and front. The seat should next be formed. This is shown 14 in. in height and formed with panelling, the styles being moulded and 3 in. wide, pegged to sill and top rail, and grooved to receive the panelling. The moulding along the top of the seat is $2\frac{1}{2}$ in. deep; this should be secured with screws to the top rail, which should be made out of stuff $2\frac{1}{2}$ in. by 3 in. deep, grooved on the underside for styles and panelling, and rebated along the back edge, for the frame of the seat. The sill should be out of 2-in. by $2\frac{1}{2}$-in. stuff, grooved on the top to receive the panelling and styles and a splay should be worked along the front top edge. The Detail B shows the splay and the way to frame the fronts of the seats. The sill should be screwed at the back both to the floor and to the top rail, and mortised into the posts at either end. If it is thought necessary to simplify the front, a good way of doing this would be to have a $1\frac{1}{2}$ in. board 13 in. wide, and the length of the space between the posts, the 3 in. moulding being carried up 1 in. above the board to form a rebate for the seat-boards, with a small moulding nailed along the floor and front, to form a low skirting. This board could then have small panels formed by mitred mouldings, nailed on the face. This was frequently done in the 17th century, and the panels thus formed are rendered exceedingly fantastic by the methods of mitring.

Bearers must be secured to the walls along the sides and back, and 1-in. boards laid across from the rebate on the top rail to the bearer at the back. A cornice moulding $2\frac{1}{2}$ in. deep should be nailed along the ceiling line of the beams; and, should there be no cornice in the room, it will be better to carry this all round. The seat may be made in a variety of ways, and I must leave the reader to determine upon what suits his fancy. I should say that a movable cushion, about 2 in. to 3 in. thick, is probably the best form of seat, as it can easily be removed and dusted.

And now for the painting. I always use, and shall continue to recommend, "patent paints." The trouble that one has so frequently to go through in mixing up the tint for workmen is thus avoided, and the material used in patent paints may generally be relied upon as being first-class quality. In my own professional work I mix the tints required at the paint manufacturer's own works, and then it can be ordered in any quantity. Whatever paint is used, let it be *egg-shell gloss;* this is far more satisfactory than a highly glazed or enamel paint. And the *bastard or flatted* paints are rather too dull to be put on work in rooms for every-day use. If a patent paint is used, two coats will be found sufficient; if ordinary oil paint be preferred, it will be found necessary to have three coats. I have seen the process of painting described in back numbers of Work, and therefore consider it would be superfluous to again repeat a description of the operation.



Detail B.—A, Moulding, $2\frac{1}{2}$ in.; B, Boarding, 1 in.; C, Top Rail, 3 in. × $1\frac{1}{2}$ in.; D, Panels, $\frac{1}{2}$ in.; E, Styles, 3 in. × $1\frac{1}{2}$ in.; F, Splayed Sill, 2 in. × 2 in.

Mottoes are an old and excellent form of decoration, and more freely used as such in the 17th century, and, indeed, in the mediæval times. We never see a motto in a room but our gaze is arrested. Mottoes may be written in any language. But as we live in England, and there is no dearth of exceedingly appropriate lines, why depart from our own tongue? Probably the reason why mottoes are so rarely seen adorning the walls of our homes is because of the general want of knowledge of where they should be placed; and also, possibly, because of the abuse they receive in churches, where we see them written in plain block lettering, on sheets of tin, and nailed in the very places that would be better if left without them. But no mistake can be made if the motto is appropriate, the lettering good, and the frieze or beam of a room selected as its position. Shakespeare alone supplies a sufficient number of mottoes for the most fastidious to choose from. The one shown on the perspective view is from Herrick: "*Whatever comes, content makes sweet.*" And I have found that this line appeals to nearly every person who reads it. The lettering has been placed on the beam in gilded letters, the capitals 7 in. high, and the smaller letters $5\frac{1}{2}$ in. high, small gilded ornamental stops being placed between each of the words, and the whole well toned down with burnt sienna. The effect is that ts, room has been tnsformed from an ily and cheerless e into one where is delightful and reshing to sit.

The furniture has en purposely omitted in the perspecte, with the exception of one chair, in ler that as much the construction possible may be n. Perhaps I ght be allowed t say that the curtns shown are ng on rods at the ks of the arches. avy material is ter than light islin for curtains, it adds to the hness of the room a case of this sort, d is more inviting. r heavy material, ushette is the st expensive in the d, as it will wear a considerable

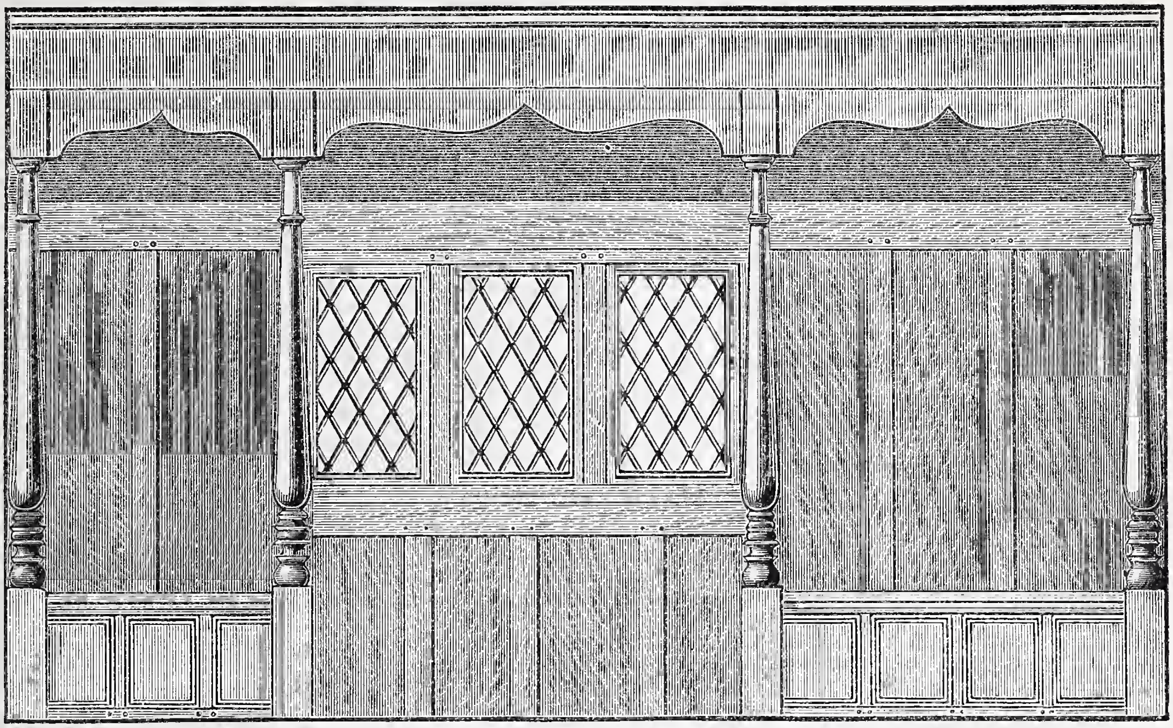
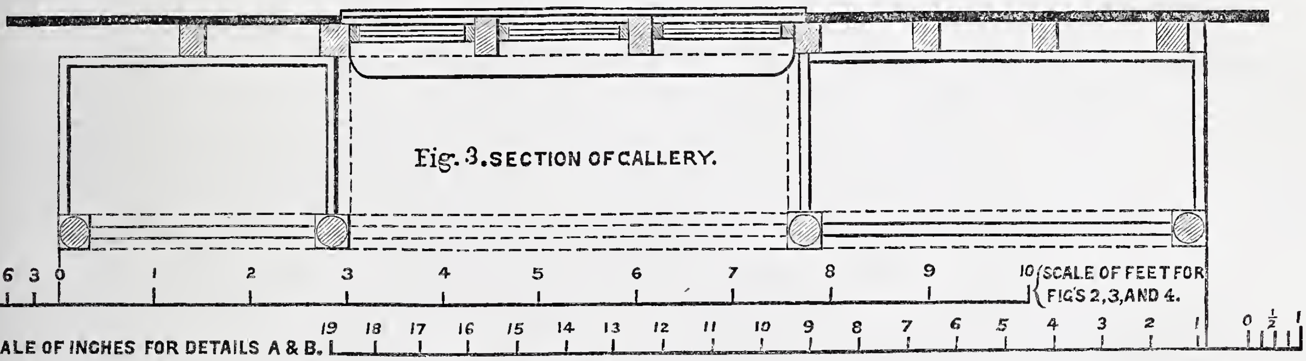


Fig. 2.—Elevation of Gallery.



iod without fading or looking seedy, d, even when it does fade, the colour is still ceedingly pleasant to see; but if economy a consideration, I know of nothing better in art serge, which can be bought at Burtt's in King Street, Covent Garden, at 2s. a rd, 54 in. wide, in many different colours, of which are very beautiful. If serge rtains are used, let the cushions on the its be made of the same material. A ort valance should be placed across the ndow.

In conclusion, perhaps I may be allowed say a few words with regard to the ndows of rooms where snugness is a conleration. In the first place, plate glass ay be considered as an article calculated destroy all attempted artistic feeling. gain, large squares of sheet glass may be aced in the same category. For artistic d, so far as I am aware, for lighting purses, the diamond shaped, or small squares lead lights, are much to be preferred. obably the first thing a person does after ving entered a room is to look at the ndow, and the room will afterwards be dged by the scale taken from the squares glass. This may seem a comparatively inor consideration to the uninitiated; but is not so to the artist, who is careful ver to overlook such a point as this in s work. The ceiling is another matter of portance, and its treatment may either ake or mar the general effect. Do not der any circumstances have a pattern

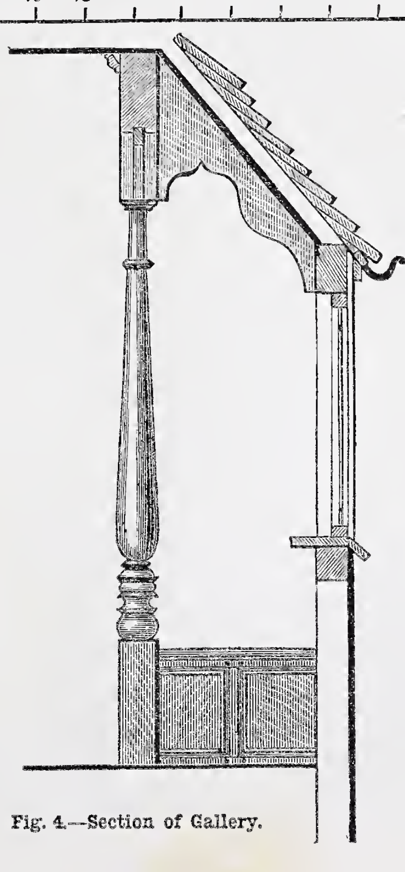


Fig. 4.—Section of Gallery.

paper on it. Plain white ceilings are usually preferable, but the whiteness may be toned down if wished to harmonise with the general scheme of colouring.

The floor should be stained with two coats of Jackson's walnut stain, wherever it is not covered by rugs or carpet. And to complete the whole, an Oriental rug may be laid on the floor below the window.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

Oils, Varnishes, and Other Vehicles: Solid and Liquid "Driers" (*continued*).

As a useful practical appendage to the remarks in No. 42 concerning the source and nature of painters' varnishes, the subjoined *résumé* of those particular varieties in general use will commend itself to the interested reader and worker.

For the finest interior work, *white oil varnish*, that is, a liquid which can be spread and worked upon broad surfaces, and such as will dry in about eight hours, is very requisite. Various eminent firms make such a varnish for decorators and painters, and sell it under such fanciful names as "Coburg," "Italian Oil," and "French Oil Varnish." The chief attributes aimed at are freedom from yellowness and the possession of good "hand-polishing" qualities—the latter process I will explain in the advanced part of the subject. The price of such a white interior varnish would be from 20s. to 30s. per gallon to the trade.

After this "polishing" varnish, a maker's list usually contains one or two varieties of what are termed *superfine copal* varnishes. These range in price from 16s. to 20s. per gallon, possessing different names and features, such as "polishing" and "extra hard-drying."

Lower down in the scale of costliness we find the best kinds of ordinary *copal varnish.* Many varieties are made of this quality, and for such purposes as the names *inside copal* and *outside copal* convey to the purchasers. The prices of these range from 12s. to 16s. per gallon.

The "cheap oaks," as they are usually termed in the trade, are generally a most serviceable class of varnish, and can be purchased, suitable for all kinds of interior and external surfaces, at from 8s. to 12s. per gallon.

If there is one article above the other "thousand and one" used by the house painter in which quality is *the* essential consideration, that article certainly is varnish. The prices given above are more for relative comparison than as any guide to purchasers, but they are well representative of the best makers' current prices.

Preparations of coarse oil and common resins are placed upon the market at much lower prices; such as these I would especially warn the worker against, and advise the inexperienced, especially, to purchase always an established maker's goods through—if necessary at all—a reliable retailer.

There are yet a few other varieties I must mention, and of these *hard drying* or *church oak* varnish is a "good friend" to us, although in copal oil varnish, quickness of hardening must generally be accompanied by a tendency to lose gloss and to crack from excess of resin. A preparation known under the above names is always to be had for seats of public buildings, stained floors, and common furniture, for which it is invaluable. This make of varnish, retailed at about 2s. per pint, is the "right stuff" for kitchen furniture and so forth; since, unlike many and even expensive painters' varnishes, it does not get soft and sticky by the warmth of the body, whilst its oily nature makes it very durable. The litharge or similar substance with which it is prepared, however, considerably darkens the oil, so that this would not do for light-coloured paint.

Maple varnish is but another name for a good quality of interior copal varnish, made from the lightest gums and refined oil, so that when coated over such delicate "figure" as the imitation of maple and satin wood, it shall not disadvantageously affect the colour of the grainer's work.

The varnishing of *wall papers* is a very important item of painters' work, and whilst the old paper-stainer's abominations, "sienna-marble" papers so-called, are being rapidly relegated to their proper—the *lowest*—sphere in the scale of æsthetic beauty and common sense, covering the walls of middle-class houses with pattern papers suitable for varnishing on staircase, bath-room, and kitchen walls especially, is a commendable and growing practice, consistent alike with sanitation, durability, and decorative effect. For all paper hangings on which the yellowness of copal varnish would not be detrimental to the colour of the design, a good quality of this variety is far preferable to the "paper" varnishes sold by the manufacturing houses. Whether used upon walls or woodwork, a moment's consideration will show that the colour of copal "oak" varnish would spoil such tints as French or green greys, delicate pinks or white; but for what we term "terra-cotta" shades, buffs, and "leather," or cinnamon colours, the yellowness would be no disadvantage.

Where *white* paper varnish is necessary, we use that which is termed *crystal paper* or *fine pale paper* varnish. The first is the whitest, and as it can contain but little linseed oil, it requires very expeditious and experienced working over large surfaces. *Crystal paper*, *copal cabinet*, and *quick furniture* varnishes come under the heading of volatile oil varnishes; so also does mastic varnish, used for varnishing paintings, maps, etc. Whilst genuine "mastic" costs about 50s. per gallon, the cheap substitutes given above range from 14s. to 20s., trade price.

Amongst the purely *spirit varnishes*, "white hard" and "brown hard spirit varnish" are the two most useful. They are similar in nature to French polish, all being prepared from various kinds of *lac*—shel-lac, etc.—and spirits of wine, or "methylated" spirit. The lustre they give is nearer to that of French polish and "softer" than that given by a "copal oil," hence "white" and "brown hard" are much used for furniture as a substitute for the more tedious process of French polishing, and also upon those portions where the "rubber" could not be used; they cost about 8s. per gallon.

Bath varnish is a very hard-drying, white liquid, similar in nature to the "enamels" now on the market, but is a more durable article, and resists the action of hot water to a greater extent than the other preparations. Its price is about 20s. per gallon.

Beyond all these herein enumerated, there is a further variety of "carriage," "boat," and "implement" varnishes. These are outside the scope of this paper, but any information concerning them will readily be given to any inquirer through the invaluable and entertaining columns of "Shop."

Before turning to the subject of "driers," there are a few *vehicles* and liquids used by the painter which scarcely come under the above heading of "oils and varnishes," but which are, nevertheless, indispensable to the trade. The word varnish is so identical with a glossy surface, that the name "flatting" or "lustreless" varnish, given to a preparation of oil of turpentine, copal, and wax, is somewhat a misnomer. It is not often called for, since it possesses very little body, but, upon timbered and ornamental wooden ceilings, can be used with decided advantage over ordinary copal, the small amount of wax gloss it gives out being far more restful and natural for such positions than a bright hard glitter. *Black japan* is a species of black copal varnish, made in various qualities, and the best for carriage painting. House painters seldom use it for other than blacking grates and ironwork, although there are many purposes it can be used for Thinned down with "turps," it makes a capital stain for wood of a rich brown colour. *Berlin black* is another preparation useful for various purposes, as it is a dense black, drying with only an egg-shell gloss; it is prepared, however, like Brunswick black, chiefly for ironwork. Cheaper black varnishes, similar in nature to "Brunswick," are also to be purchased at 4s. per gallon.

Patent knotting, or *knotting composition*, is a brown spirituous varnish, used chiefly for touching over the knots in woodwork previous to the "priming," or first coating, being spread. It is also useful for coating over stains and other effects of dampness on walls previous to their painting.

Varnish stains are liquids of similar nature and preparation to brown hard spirit varnish, but are coloured with permanent vegetable dyes to represent, when spread on clean white wood, the various colours of oak, walnut, mahogany, etc. When applied without any previous preparation, two coats are necessary to get a glossy effect upon new wood. As a varnish and stain combined, they are most useful and convenient for picture-frames, fret work, and other little matters.

Japan gold size, or "Japanners," is a liquid used for a great variety of purposes. Notwithstanding the name appears to connect it with processes of gilding, it is seldom used for that purpose, but rather as a liquid driers in combination with "turps" and "flatting" paint. Japan gold size is a preparation of linseed oil and litharge, and will usually dry in about half an hour. When nearly dry, it has to a slight degree that property of *tackiness* which is so characteristic of oil gold size, but with very little of the brilliancy of the latter. Only on out-door work, where it is advisable to complete the gilding forthwith, for temporary work, or for sign writing can it be recommended as a *gold size*.

In coach painting, engine work, and, to a minor extent, in house painting, "filling up" compositions, prepared with japan gold size for hardening it, are much used and in preparing "dead" black from *Ivory Black* ground in turpentine, this is also the best and safest binding liquid.

Having now reached the "binding" or drying agents, a few lines will suffice to complete my paper.

In noticing the properties of the expressed oils, the advisability, and generally the necessity, of adding some substance powerful in oxygen to our paints, in order to ensure their proper hardening, was briefly touched upon. Of these substances there is a considerable variety, which may be used to more or less advantage, according to their chemical nature and their effect upon the colour of our paint. *Red lead*, for instance is a good natural drier, but, of course, this would not do for assisting the *white* paint to oxidise. The subjoined articles, however represent the principal drying sources of all liquids and paints: viz., *sugar of lead sulphate of zinc*, *litharge* or *oxide of lead white copperas*, *white sulphate of manganese* and *white borate of manganese*, of which list the two last are the most expensive Nowadays, it is not necessary to "rub up" our own litharge or sugar of lead, for they are offered to us in the less pure, perhaps but far more convenient form of *liquid driers* and *patent driers* respectively.

Terebine, or liquid driers, is doubtless prepared in a manner similar to japan gold size, but with a greater proportion of the solvent oil of turpentine: in fact, almost substituted for the linseed used in the latter. Its price is about 10s. or 12s. per gallon, and it is most useful for the quick drying of all dark and outside paints Patent driers, in the paste form, is best for white lead paint. About one-tenth part weight or bulk, is enough for all ordinary work, and less under good drying conditions of the air, when one ounce to the pound is ample. Its price is a little above that of genuine white lead.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

PIGMENTS, GOOD AND BAD—TINT MIXING FOR SIGN-WRITING USES—TABLE OF THE PRINCIPAL TINTS, HUES, AND SHADES USED BY SIGN-WRITERS—"GROUND" AND "LETTER" COLOURS—EDGING LETTERS—COLOUR TABLE FOR BEGINNERS.

CONTINUING my remarks on colouring, we must now consider one or two practical subjects in connection therewith before leaving the subject. The general qualities of good pigments, technically called colours, are, according to the authority of Mr. George Field, as follows: (1) Beauty of colour, which includes pureness, brightness, and depth; (2) body; (3) transparency or opacity; (4) working well; (5) keeping their place; (6) drying well; and (7) durability. But few pigments possess all these qualities in equal perfection (I have already pointed this out in a previous chapter). Body, in opaque and white pigments, is the quality of efficient covering and hiding ground; but in transparent pigments it signifies richness of colour or tinting power; working well depends much on sufficient grinding, or fineness of quality; keeping their places and drying well depends greatly on the vehicles with which they are diluted or tempered. Durability also depends on the fine quality of both the pigments and the vehicles, and the varnish used as the finishing coat. Bad varnish, as every one knows, or ought to know, ruins a sign as quickly as bad oil and colours, and is the most general cause of premature deterioration of work in this direction. This being a subject which the student requires to have exceptional knowledge of, and space not permitting of its further extension here, I must ask him to continue his investigations by referring to Chapter IV. in "The Grammar of Colouring," and thereby well grounding himself in useful knowledge.

We now come to the mixing of tints, in which great care and caution are necessary, not only to be able to obtain a lasting colour, but also a bright and clear one; which, owing to insufficient knowledge and carelessness on the part of workmen, are generally those very qualities which are absent in home-made tinted colours. Now, as a rule, the ordinary house painter is a failure as a tint manipulator, mostly because he uses the wrong colours, or too many of them; is not sufficiently clean in his methods, and does not devote half the necessary time required for proper and thorough mixing. How often does one see a pure, bright, clean tint, and one which has not faded? But how can it be otherwise, when the one result of improper mixing, or, I should say, the insufficient amalgamation and blending of the colours used, is a muddy, impure, and uneven tint? Now this will not do for the high-class decorator and sign-writer; he must have bright, clean colours, or he will prove a failure. In compounding tints, one great consideration is to find out how to get the tint, shade, or hue required with the least number of colours; as, generally speaking, the less the number of colours used in making a tint, the purer it is. But it must be clearly understood that we must not depart from the proper colours necessary for the correct rendering of any tint and substitute others, for the simple reason that they are fewer in number than those given in the recognised formula. No; we should be as much wrong that way as the other; but there are often more ways than one for obtaining most tints, etc., and those which contain the least number of ingredients in the shape of colours often give the best results.

White is the basis of all tints, and here again it is upon the virgin purity of this basis which depends the success or failure of the resulting tint when the white is stained with colours. Of course, we must have the best and *palest* linseed oil for diluting and thinning, otherwise that fault alone would spoil our work. The theory and practice amongst workmen, in regard to compounding tints, is this. The very best white lead (or for indoor work, zinc white) is thinned down to a working consistency, or nearly so, and the requisite amount of driers added. The paint must here be well stirred, and left in this state long enough for the driers to incorporate with the oil, etc., say, for half an hour. Next, strain the paint carefully, and thin out the colours required for the tint; if these are to be added in certain proportions, which are given, such as three parts of one colour, two of another, and four of another, they should be measured, well mixed together, and gradually added to the white, which must be kept constantly and well stirred until the desired tint is obtained. The theory is, that there is a certain amount of white paint which we desire to transform into some delicate tint, and to do this we dye it, or, as it is technically called in the trade, "stain it." It will therefore be seen that this is a somewhat different proceeding to taking up certain portions of any two colours, such as red and yellow, and mixing together to obtain another colour—orange. Hence, certain transparent colours, such as Prussian blue, siennas, and lakes, are called "staining" colours because they are used to obtain certain tints, commonly called colours, by dyeing their basis white to the required tint.

The sign-writer seldom has occasion to mix tints but in very small quantities, and he often does this work on his palette by dipping his brush in first one colour and then the other, and rubbing them out on his palette and adding the white. This is a dirty, untidy method; it is much cleaner to take a little of each colour on the tip of a small palette knife, wiping it clean of one colour before introducing to it the next, and then mixing with the knife or brush. I now append a selection of tints specially used by sign-writers, taken from

THE SIGN-WRITER'S TABLE OF TINTS AND SHADES.

Buff.—This is a mixture of pale chrome yellow and white, tinged with a little Venetian red; carnation, lake, and white.

Chocolate.—Vegetable black and Venetian red; or white, Spanish brown, Venetian red, and vegetable black.

Claret.—Red, umber, and black.

Cream.—This is a mixture of chrome yellow, Venetian red, and much white.

Drab.—Raw or burnt umber and white, with a little Venetian red.

Common Flesh Colour.—Stain white lead with light red, and add a very little yellow ochre.

Fine Flesh Tint.—White, lake, vermilion, and Naples yellow, or yellow ochre.

Fawn.—White and burnt sienna, ground very fine; white, burnt umber, and Venetian red; white, stone ochre, and vermilion.

Grey Tints.—White and verditer, a blue hue; white and indigo, a blue hue; white, Indian red, and indigo, of a brown hue; white, light red, and Prussian blue, of a brown hue; white, burnt sienna, lake, and indigo, of a brown hue.

Green Tints. (These are somewhat important in fancy work.)—White, Italian pink, Prussian blue; Prussian blue, chrome yellow, and burnt umber (olive green); Prussian blue and yellow chrome (liable to fade); yellow ochre and indigo; raw umber and indigo; brown, pink, and indigo; raw umber and Prussian blue (sage green); white and Brunswick green (pea green).

Lead.—White, black, and indigo.

Peach.—Vermilion, Indian red, purple brown, and white; white lead tinged with orpiment; white, red, blue, and yellow.

Pink.—White, vermilion, and lake; white, crimson lake, or scarlet lake.

Pearl Grey.—Prussian blue and black, equal portions, and white.

Snuff.—Vandyke brown and yellow.

Sky.—Prussian blue and white.

Salmon.—White tinged with Venetian red; white tinged with vermilion; white tinged with yellow chrome, raw umber, and vermilion.

Silver.—Use white lead, indigo, and a little black, according to the shade that it is required to produce.

Straw.—White and pale chrome.

Violet.—Prussian blue, black, vermilion, and white; French ultramarine, white, and a little black.

Gold.—White, stone ochre, and red; pure light ochre; white, yellow chrome, and burnt sienna to desired shade.

Lilac, Lavender, and French Greys.—White, lake, and indigo; Indian red and Prussian blue; white, indigo, and rose pink; white, Prussian blue, and a little vermilion (French grey); white, with a little violet (lilac).

This list, which has been carefully compiled, will, I hope, be found of great service—to the young sign-writer just starting in business especially—to readers and workers alike. It must not, however, be taken as accurate throughout, and in some cases, even where it is perfectly so, the worker may fail for a long time in getting the desired tint, owing to the wrong proportions being added of the various colours composing the tint. These proportions can only be found out by repeated practical experiments, as of course the colours are not mixed in equal parts, but in such proportions as are necessary to give the tint or hue required. Mr. Field recommends the student to mix the various tints in different hues, giving in each experiment a predominance to one or other of the component parts. This is excellent advice, as I can prove from experience, as although I have only lately seen these remarks, it was a method I thought of, and practised when younger, and with good results. It will be found, when experimenting, that the smallest addition of any one colour gives the predominating tone of the tint, which also makes it warm or cold; by adding more white we produce a lighter tint, and by adding more of all the darker colours a deeper shade of the tint. But to thoroughly understand and grasp this subject, the student must study and understand the proper technical meanings of "tint," "shade," "hue," and "tone." The leading, or "key-colour," I may add, always gives the latter, which is the general effect of the colouring as influenced by what are called warm or cold colours. Warm colours, so called, are those in which red or yellow predominate; and cold colours those in which blue and green tints appear.

I have not yet spoken of neutral tints. Grey is termed, by way of eminence, the neutral tint, being the mean between black and white; but any two of the secondary colours will neutralise each other as well, also, as the primaries in due proportion. The neutralising or compensating power is the foundation of all agreement or harmony amongst colours. Another thing which requires much thought and study is *contrast*, which, fully explained, is the "opposition of any two things as to character, whether it be in lines, lights, shade, or colour," or to place figures, or colours, in such opposition or dissimilitude, that the one shall give greater visibility and effect to the other.

We have next to consider a few rules relating to the arrangement of the colours used for the letters, and their harmony and keeping with the ground colour upon which they are painted. In the first place, the ground colour should not be of a bright and glaring nature (except in special cases where a certain colour is used as a sort of trade mark or distinguishing sign); on the other hand, it must be of a subdued and quiet tone. A ground of some bright colour will not show up writing of a brilliant and showy description half so well as one of a quiet and neutral tone. Letters always stand out with greater prominence and distinctness on a quiet secondary or tertiary colour than on a primary colour, unmixed with white. Letters on a neutral subdued ground are brought or thrown forward; on a bright gaudy ground they are lost, the greatest prominence being given to the ground itself. Another thing to remember is that the style, arrangement, and colouring of a sign should be suitable and in taste with the trade, business, or profession which it represents; for instance, a sign with gold shaded letters on a lavender ground, surrounded with a black and gold moulding, although proving attractive enough for an undertaker's or a mourning warehouse, would look miserable and entirely out of place outside a gin palace, a confectioner's shop, or even a photographer's studio; although the latter is more or less associated with the "black art." The great point in colouring a sign is to make its colours, as far as possible, emblematic, and suggestive of the business indicated thereon. Of course, the style of lettering employed must also be chosen on the same lines, but with the alphabet we have, at present, nothing to do; suffice it to say that in every process it should be the earnest effort of the writer to emblematise in some way every sign he paints. The great thing to know is the exact effect a given combination of colours will produce as a finished whole. We frequently see a yellow and even a red letter on a black ground; now you must always pity the poor fellow who did that work, for he has not one atom of judgment or taste, and has in his own self his worst, bitterest enemy, as far as regards his advancement in his art. Such colouring always bears a common stamp, both of effect and workmanship. There is a given rule that one colour shall not ride over or overlap the other, so that it is necessary to divide the letter colour from the ground colour, with a thin line running round the edges of letters. Let us suppose we have painted some green letters on any dark ground with a reddish hue, such as, say, purple brown, and notice the harshness of the contrast; but outline the letters with white or gold colour, and see how all is softened down by this simple expedient. Again, put in an emerald green colour, and write your letters with vermilion or Chinese red: the result is worse than in the first case; but edge them with black or gold, and you are again safe. Mr. James Callingham, speaking on this subject in his work on "Glass Embossing and Writing,"* points out how important it is to bear in mind that coloured letters on a coloured ground should never be used unless they are at least invested with a white or gold edging; and if a gold thickness can be added, the effect will be heightened. A black cast-shade will throw the letters out, and help to give them a raised appearance. In some cases a coloured thickness may be rendered effective on a dark ground, so long as the indispensable gold or white line be not neglected; but it ought never to be allowed to impinge upon the colour of the letter itself, unless that colour be an imitation of, and a substitute for, gold; in which case it ought not really to be regarded as a colour at all, but as the thing for which it is substituted. This principle was exemplified by Mr. Owen Jones in the interior decoration of the Great Exhibition of 1851. Here, the primary colours were so arranged as to neutralise each other; and in order to avoid any harsh antagonism from their contact, or any undesired complementary secondaries arising from their immediate proximity, a line of white was interposed between them, which had the effect of softening and giving them their true value. I may add that the foregoing remarks do not apply to letters on a black ground, because black is not a colour, in the strict sense of the word. The edging round the letters must be boldly and neatly done, especially on gilded work, with the best sable pencils; it must show no sign of timidness or indecision, otherwise the line will have a rough, ragged appearance, and completely spoil the letters. Gold letters, in fact, show up an unequal line in an instant.

It will require some little time before the student finds out what coloured letters look best on the different grounds; but sign-writing is not by any means a hidden art, as we have only to perambulate the streets to find hundreds of practical examples. Mr. Callingham's book, just mentioned, also gives a host of information on this subject, and to which I must refer the more advanced student thirsting for further information on this subject. For immediate use I append a short table, each item being numbered for possible future reference.

A Table showing what Colours to Use for Lettering on Various Coloured Grounds.

	Ground Colour.	*Letter Colour.*	*Shadows.*
1	Stone colour	Black	White and dark stone colour
2	White	Any colour	Any colour
3	Black	White or gold	(Plain)
4	Light blue	Dark blue and vermilion	Light blue, dark shade, black, etc.
5	Bronze green	Gold, yellow, red	Vermilion, emerald green
6	Marble	White incised letters	—
7	Mahogany graining	Any light colour and gold	Various
8	Walnut	Any light colour and gold	Various
9	Oak graining, dark	Gold or red	Dark colour and black
10	Oak graining, light	White	Black
11	Chocolate	Pink, salmon, fawn, primrose	Letter colours and black
12	Dark blue	Gold, outline white	Plain
13	Medium blue	Gold	Orange and Vandyke
14	Vermilion	Gold or yellow	Green, white, and black
15	Sage green	White	Purple brown and black

* "Sign-writing and Glass Embossing" (Brodie & Middleton. 5s. 6d.)

The preceding is but a short list, inserted here for the special purpose of giving some slight assistance to the beginner having no knowledge on the subject, and refers mainly to simple plain lettering. The learner should now be able, from the directions given, to proceed with the practical application of his colours with some degree of success.

MEANS, MODES, AND METHODS.

A New Material for Bill-stickers' Paste.

Since Free Trade has cheapened the corn for the people, we hear less of adulteration of flour by salt, alum, ground bones, etc.; but, cheap as it is, it is a pity that tons of flour are used up for paste yearly by bill-stickers. It was said at the last School Board election for London, that the flour used for paste for the bills of the rival candidates would have supplied bread for many weeks for the famished children sent to the schools. Unfortunately, it is not the worthless flour that is used, but some of the best. Anything to prevent this scandalous waste of good food deserves a welcome from thoughtful persons.

A good substitute has been found by Messrs. Bull & Hofsten, natives of Norway. It is prepared from the whale's blubber. It is colourless, quick-drying, and very adhesive. Of its cost and continuity of supply, no statements are to hand. But from the seaweed that forms banks on our beaches an endless supply of gluten sufficient for bill-sticking could be made cheaply, and the by-products, by their utility and sale, would serve to make it cheaper even than flour.—J. C. K.

A Bright Red Varnish.

Procure some red sealing-wax, or any other colour, according to taste, and also some spirits of wine. Break the wax up into small pieces, about the size of peas; put these into the spirits, and put the bottle by in a warm place for a day or so. If, on examination, it is too thin, add more wax, and if too thick, a little more spirits. This is a capital varnish for iron or wicker-work, as it dries quickly, and with a good gloss. The varnish thus produced will be found useful for colouring or coating fishing floats, and a variety of like purposes.—E. A. P.

[Varnish of any colour, as it has been said, may be made in this way, by using sealing-wax of the colour required.—Ed.]

Imitation Coral.

Procure some acorns or gall-nuts; cut a little piece off each end, and bore a hole through them lengthways with a bradawl or short knitting-needle. Then take some of the red sealing-wax varnish, and dip the acorns or nuts well in it, rolling them about until they are evenly covered; then string them on wires until dry. They make very good imitation coral necklaces, and are useful for a great many decorative purposes. Small twigs can also be used, and are very like coral branches.—E. A. P.

[Smaller articles than acorns or gall-nuts should be used for imitating coral for a necklace.—Ed.]

Cheap Ink.

Take a 3d. packet of Judson's dye—any colour according to taste; dissolve in a small bottle with a little hot water, and when dissolved, fill the bottle with cold water. When required for use, pour a little into the ink-pot, and dilute with water to required weakness.—E. A. P.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

GUM DAMMAR—PREPARATION—GLYCERINE JELLY—FARRANT—MOUNTING SECTIONS.

As the method of preparing objects for mounting in gum dammar, as well as the actual process of mounting, does not differ from that employed for mounting in Canada balsam, it is hardly necessary to recapitulate, and I will content myself with just giving a few hints as to the best way of preparing the medium itself for use. It should be prepared as follows :—

Choose a few clean and clear pieces of the gum and drop them into a little pure benzine. When the gum is dissolved, if the solution is not perfectly clear, strain through several thicknesses of fine dry muslin which has previously been washed quite clean by passing through it a strong stream of cold water.

The solution should now be perfectly clear, and like the solution of balsam, of about the consistency of olive oil, or perhaps slightly thinner. It should be kept in a similar bottle, which, indeed, will be found a very convenient form for keeping all kinds of mounting media in, as it is important that all dust be most carefully excluded. This is almost impossible in the case of an ordinary corked or stoppered bottle, for when the medium is in use the cork or stopper is bound to be placed on the table on its side, or with the bottom turned up, in either of which positions it is sure to pick up fragments of fibre and dust from the atmosphere or the table, and these subsequently find their way into the medium.

Glycerine, as I think I have already said, is, in my opinion, one of the most useful mounting media we have, it is capable of such universal application and gives such beautiful results.

There are, of course, some objects such as diatoms and some crystals which cannot be successfully mounted in glycerine, but these are exceptions, and, as a general rule, every class of object is better displayed, and is seen to greater advantage in glycerine than when mounted in any other medium ; and it is an undoubted fact that there are many objects which from their very nature it would be absolutely impossible to mount successfully in anything else. It is in glycerine, too, that those beautiful preparations of insects are preserved which have of late attracted so much attention. I refer to those mounted in cells so as to retain as nearly as possible their natural form and colour.

Glycerine as a mounting medium is capable of such endless modification that it is almost impossible in the short space at my disposal to do more than indicate briefly a few of the principal forms in which it is used for mounting specific classes of objects, and how these objects are best prepared.

I have already referred to the preparation of glycerine jelly and Farrant's solution, and the two other forms in which I have found it most useful are in its natural state with the addition of a little pure carbolic acid, or diluted with water and a trace of carbolic acid.

Glycerine jelly is useful for mounting sections of green wood either stained or unstained, roots, leaves, some of the coarser forms of algæ, and, generally speaking, objects which without deterioration will bear the slight amount of heat requisite for mounting in the medium, but will not stand the drastic course of treatment necessary for preparation and mounting in Canada balsam.

The objects referred to above require very little preparation except just carefully washing in water, and then soaking in pure glycerine for a few hours previous to mounting; and when the object is thoroughly saturated with glycerine (which should be the strongest and purest obtainable) it should be transferred direct from the glycerine to the centre of a glass slip, all superfluous glycerine carefully removed with the help of a piece of blotting paper or rag placed at the side, and then, after gently warming the slip, a drop of warm glycerine jelly should be placed on the top of the object with a pointed glass rod, and the cover glass applied in the usual way.

Some workers prefer to get the object into position on the cover glass first and then invert it on the slip. If this plan is pursued, you should after carefully cleaning both cover glass and slip, breathe on the end of the slip and then place the cover glass on the condensed moisture ; it will adhere quite firmly enough to remain in position whilst you are arranging the object, and when this is done, the cover glass should be gently pushed with the tweezers to detach it from the slip and deftly inverted in the centre of the slide.

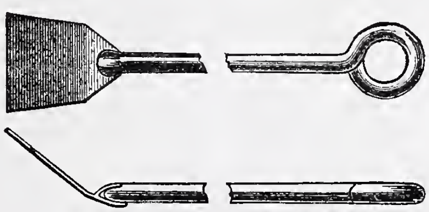


Fig. 3.—Spoon for Transferring Sections to Slide in—Front View (A) and Side View (B).

The glycerine jelly should now run out to the edge of the cover glass, but if it does not, another drop should be added at the edge, which will at once run in and fill up the vacant space. The slide should now be put aside to cool, and then it should be ringed with gold size, and finished off and labelled in the usual way. With a little practice, it is possible to make exceedingly neat mounts in this way, the great object being to get exactly the right amount of the medium on the cover glass, so as to avoid the necessity of cleaning away superfluous medium before ringing. I have some exceedingly pretty slides of fresh water algæ which I mounted in glycerine jelly fully ten years ago, and they look quite as well now as they did when newly mounted.

"Farrant" is an exceedingly useful medium for mounting the more delicate kinds of algæ in, and it is also used very largely for mounting delicate vegetable and animal sections. The latter will not stand much handling, and as a description of their preparation would take up more space than I have at my disposal at present, I will just defer giving it until a more convenient opportunity when treating of section cutting and staining, and give you here a few hints as to the methods I have found most successful in the mere process of mounting.

We will suppose that the sections are already cut and stained, and are now lying, either in spirit or in a solution of carbolic acid in water.

The chances are that the sections will be all curled up and mixed together in an almost indescribable mass. If this is the case, they should be emptied out into a basin of clean cold water, when they will gradually separate one from the other, and the most suitable ones for mounting can then be picked out with a dissecting needle.

As they are picked out, they should be dropped into clean spirit, and when they are thoroughly soaked in this, a watch glass or small porcelain tray should be filled with clean cold water. Having selected the section you wish to mount, it should be lifted out of the spirit on the point of a needle and placed upon the surface of this water. The result is almost marvellous ; no matter how much the section may be curled up in the spirit, as soon as it touches the surface of the water, it will lose all its folds instantaneously, and becoming *perfectly* flat, float upon the surface of the water.

This is exactly as it should be ; but now comes the question—"How am I going to transfer it to the slide without crumpling it up again ?" Fortunately, this difficulty is easily solved. Take a short piece of stout brass or copper wire and a piece of thin sheet brass or copper shaped as in Fig. 3, solder the two together as shown, and you will have a very convenient little instrument.

Now take this spoon, if I may so call it, and placing it gently underneath the section, lift it out of the water and slip it off on to the slip or cover glass prepared for it. A small camel's-hair brush will be of material assistance in making the transfer, and when the section is in position remove the superfluous water with blotting paper as before. Now place a drop or two of Farrant on the section and then apply the cover glass.

You will find that Farrant takes some few days to dry properly, and sometimes a mount which appeared to have no lack of medium when put aside will, a few days after, have some large vacant spaces at the edges. This can only be remedied by adding more Farrant in the usual way, and then when the edges are finally dry, the slide can be ringed with gold size and finished off as before.

It is necessary before ringing any glycerine mounts, to make quite sure that the surface of the cover glass and of the slip around the edges of the same are perfetly dry, otherwise the gold size will not adhere, and the result will be that after a certain time air bubbles will appear.

I have tried a great number of cements for the purpose of resisting the solvent power of glycerine, and my experience is that the ordinary gold size is, after all, the best, with, perhaps, the exception of an indiarubber cement made by dissolving pure rubber in wood naphtha. It is most important that the cement, whatever it is, should be very firm and adhesive, and not liable to crack when dry.

ENGRAVING ON METAL.

BY NORMAN MACLEAN.

ENGRAVING ON PEWTERS.

THIS branch of engraving is almost exclusively confined to London, as in no other place are pewter pots so extensively used. As a vigorous method is adopted in cleaning them by the use of silver or Calais sand, the engraving often wants renewing. Here, then, is an opening for some enterprising workman, who fails to find work in his own line of business, to qualify himself for re-engraving these pewters, and forming a connection at the various large inns and public-houses in and about the metropolis. As these articles are in constant use, the engraver would probably be required to do his work on the premises, and should fit up a small handbag with the few necessary tools for the purpose. I need hardly say that a respectable exterior in the applicant for work at such places goes a long way in his favour. If the workman can use the graver, but has not been used to lettering, he can easily drop into the style of work on pewter, which in most cases is simply Italian or ordinary writing (Fig. 31), which is easy enough. The inscription usually consists of the proprietor's name, with the name of the inn or hotel; sometimes it takes the form of a rather nice monogram (Fig. 29), engraved in ornamental cipher, which, with its sprigging or spraying, looks very pretty.* I have sometimes seen the legend, "Stolen from—" here follows the name of the innkeeper and name of the inn. I suppose his customers were rather doubtful characters. For this line of business a very few tools are required. A sandbag 6 in. in diameter, two or three gravers with corks on the points, a lead pencil, tracing point, oilstone, oilcan, small bottle of turpentine, paper, small pot of letterpress printing ink for taking black prints, pair of dividers, a short length of crinoline steel for ruling lines, and a few clean rags, are all that are likely to be required.

Fig. 29.—Initials for Pewter.

In renewing the engraving of a pewter, take the most legible and recut the lines as carefully as possible. Perhaps the engraving will be so far gone that it will require drawing afresh. Such being the case, draw a line down the pot opposite to the handle, and across this line rule with the flexible steel, parallel lines $\frac{3}{4}$ in. apart for the capital letters, and $\frac{1}{4}$ in. apart for the small letters. Rule these three lines in the centre, midway between top and bottom; the centre can be got by means of the dividers. Draw in the name carefully, balancing the inscription so that it will extend a given distance each side of the line opposite the handle. Now cut in carefully, making the curves graceful, and the turns of the letters oval, thickening the down strokes, not forgetting the dots to the "i's" or the stops at the proper places. See that every word is spelled correctly, and put in any small improvement your own taste may suggest. Having done the first one to your own satisfaction, the next thing is to take a "black print." Take on the end of your finger a small quantity of ink and rub it into every cut. Then take a piece of paper and wipe off the ink from the surface of the pot, leaving the ink in the cuts. Next damp a piece of paper—writing-paper will do—and lay it on the engraving; place another piece of paper on the top of the first, and a piece of parchment on top of the whole, and rub with the round end of the point (Fig. 23, page 596) on the parchment until the paper is forced into all the cuts, bringing away the ink in its course.

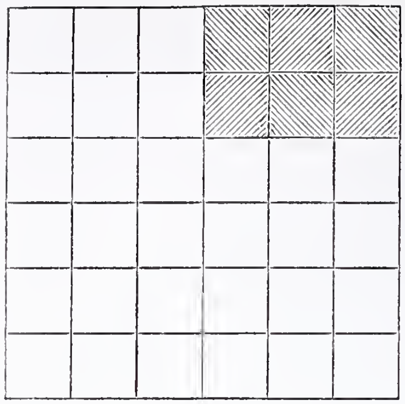


Fig. 23.—Example of "Colouring" Plate.

This is termed a "black print," and if properly taken will lay down a dozen or more impressions. As the impressions get faint, dust them over with the pounce bag, which will make them plainer. If the ink is very soft, mix a small quantity of finely powdered whiting with it; this will make it stiffer, and not so liable to smudge or smear. The print being taken, draw the line down the centre of all the pots to be engraved, mark with the dividers the height of the inscription, and proceed to "lay down" as many impressions as you can see from the print. From now, all "pointing in" is dispensed with, the inscription being *cut from the print.* This will no doubt be rather awkward at first, but with a little practice, and rather a longer graver than usual, soon becomes easy. The graver for this sort of work should be of an acute angle, and not "set off" more than five degrees, and should cut deep and narrow.

The other style of engraving on pewters—ornamental cipher—is the same Italian lettering embellished with sprays. It is usually entwined, which will be seen in Fig. 29. The work is done in a similar manner to that I have just described.

Pewter work is rather dirty, and owing to the presence of lead in the composition, care should be taken to wash the hands after work. It is also advisable to wear an apron with a "bib" or breastpiece, to avoid soiling the clothes, as the pewter, and most articles during the process of engraving, come in contact with the breast.

Having, I hope, successfully started the workmen in the brass plate, zinc, and pewter branches of engraving, I will now take up the young workman and endeavour to advance *him* a step. One side of the plate being engraved, it will be necessary to remount the plate on the block. Spring off the plate, and rub the dirty side over with a piece of tallow candle (this is the best thing I know of for removing cement), and warm the plate over the gas, holding one corner with a pair of pliers, and wipe clean with a piece of rag. Now warm the cement over the gas, and remount the plate as before. On the plate now rule parallel lines $\frac{1}{2}$ in. apart, again ruling cross lines to form $\frac{1}{2}$ in. squares, which may now be engraved. These lines being cut (noting, of course, from time to time the condition of the graver), fill in the squares with lines from corner to corner, the lines to be as nearly as possible $\frac{1}{32}$ in. apart, of the same depth. Each alternate square should be filled in with lines from corner to corner in the opposite direction (Fig. 28). This kind of "filling" is termed "colouring," and the style of ornament done in an irregular manner makes a good background for ecclesiastical lettering and ornament.

In making short cuts with the graver in line work, the graver is manipulated in a different manner to that used in cutting a long continuous line. This method or knack of springing the graver forward when within a short distance of the stopping line is peculiar and effective, and requires considerable practice to acquire it; but once acquired is used for finishing the cut on all kinds of work, whether colouring, veining, shading, or blacking out groundwork. The precision with which some engravers use this method is remarkable, never once slipping over the stopping line during a day's work.

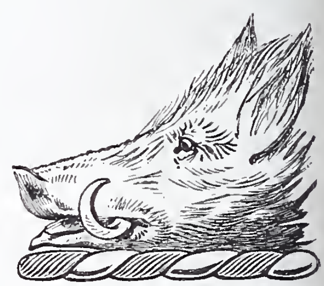


Fig. 30.—Crest for Pewter.

A few words about gravers. Sometimes we find in using a new graver that the point will persistently break off, or be rapidly rubbed away; in either case, the graver is of no use in its present state. When this occurs, do not think that the tool is a bad one, as it sometimes happens that the end has become overheated during the grinding or tempering. The best thing to do is to break off about $\frac{1}{2}$ in. and re-whet it. If the breaking of the point continues, let down the temper a shade or two, using for the purpose the end of a red-hot poker, and plunging into clean cold water immediately the colour has changed. For ordinary work I find a faint straw colour does best. In the case of the point of the graver rubbing away, it must be hardened and tempered again. Heat in a clear fire to a cherry red, plunge into cold water, rub one side of the graver with a piece of stone till bright, and temper as before directed. The breaking of a graver in the place required seems a simple matter, and there is a proper way of doing this. Place the graver intended to be shortened in a hand vice, with the end to be broken off above the jaws. Take a pair of pliers and nip the end firmly, and sharply twist the end of the graver off. The engraver having well practised the examples given for the practice plate, may now try something more ornamental in character, such as the outline of scroll work, etc. Excellent copies by Vere Foster, Esq., may be bought at any artists' material, etc., dealer's at twopence each, which includes ornament by

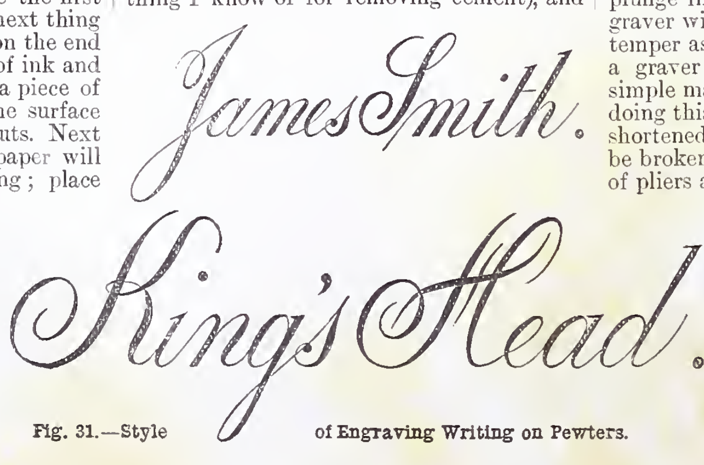


Fig. 31.—Style of Engraving Writing on Pewters.

* Occasionally, the engraving takes the form of a crest as in Fig. 30—the "Boar's Head."

. C. Hulme, Esq., I 1, 3, and 4; Flowers, 1 and 2; G 1 and 2; larine (for vignettes), [1, 2, 3, and 4; Ani- ials, 0 to 10. The vhole of the series may e had for nine shil- ngs, or ninepence per art, and will always be ound useful. The scroll vork may, if a change e desired, be put on ne side for a time, and etters and numerals be taken up. Vere Foster's A 2 drawing book will supply good opies. The workman at this point will do vell to consider which branch of engraving e likes best, as if he wishes to get his living y it he will require to devote all his time o perfect himself in the particular line he lesires to follow.

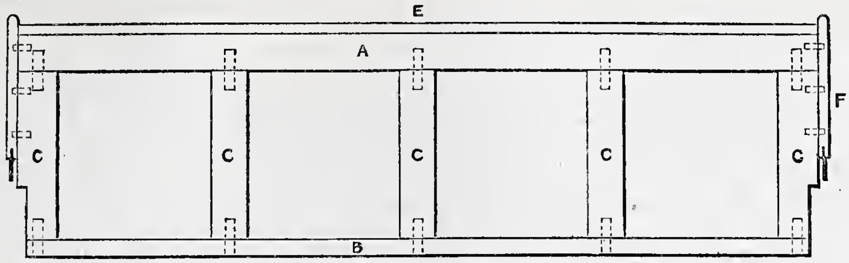


Fig. 1.—Plan of Key Bottom as seen from underneath.

A, Front rail; B, Back rail; C, Muntings, or cross rails; E, Lock front; F, Check. (Scale, 1 inch to 1 foot.)

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

THE CASE: ITS CONSTRUCTION AND PREPARATION FOR POLISHING.

WE have now arrived at the construction of the case or exterior, or, as it is technically termed, fitting up; it is so called because the parts of the case are fitted on the back after it has been strung and chipped up. The parts of the case are made for the fitter-up by a part maker, which in most factories is a distinct branch of the trade. You have, no doubt, observed, in perusing the papers on piano making, that I have taken one branch in each paper, but in this I will deal with part making and fitting up together. As the reader is aware, there are a variety of designs of exteriors, and I must leave it to the individual taste of the reader how he shall embellish his case; there is no rule for fancy: it is unlimited. Perhaps he would desire to make it so that it is in keeping with the furniture of the room where it is to occupy a position; or he may wish to paint panels for it, or plant mouldings on it, or put tiles or crewel-work in the front of it; whichever way he decides to adopt in making the case, so long as he is satisfied, I don't see that it is my place to grumble. I shall here give the names of the parts of the case as they are known in the trade, so that when I speak of the way in which they are put together he can follow me. They are named as follows: the ends, cheeks, top door, bottom door, top, back hollow, fall, lock front, plinth, trusses or brackets, truss toes, pilasters, and key bottom.

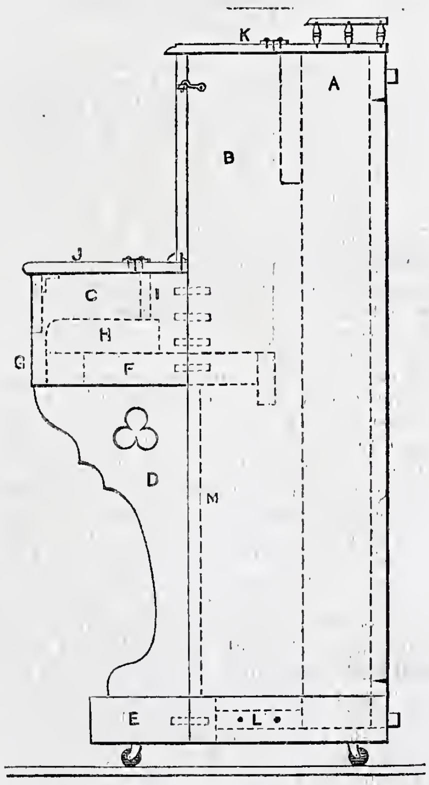


Fig. 2.—End Section of Case.

A, End of back; B, End of case to cheek; C, Cheek; D, Truss; E, Truss toe; F, End of key bottom; G, Lock front; H, Key block; I, Name board; J, Felted fall; K, Top with spindle rail; L, End of bottom board; M, End of pilaster.

The case I recommend the amateur to make is what is known as solid: that is, one that is not veneered. My reason for this is, that I think it would be difficult for him to manage the veneering of the parts of the case without appliances; of course I am aware that the veneer may be rubbed down with a veneering hammer. For a cabinet maker to do this it might be a simple matter, but to the amateur I am afraid it would be very difficult on so large a surface as a piano case, unless he has had experience in veneering. In a piano factory the flat parts are veneered by means of sheets of zinc one-eighth of an inch in thickness, made hot, and placed between each layer of veneer after being glued to the wood and pressed down with iron cramps; these press the glue out, and leave them perfectly flat and free from blisters. Now, the back hollow and fall of a veneered case are usually shaped; they are jointed up in ribs of pine, and worked to the shape with planes. Then there are what are named cauls; these are made of wood, and shaped one to fit outside of the fall and the other inside: these are lined with zinc, and the fall, with the veneer glued on inside and out, is pressed into the caul with iron cramps.

Having given a brief outline of the method of veneering, the reader will see that to be successful he would need appliances: that is my reason for recommending a solid case. I have sketched the simplest style of case from a mechanic's point of view, but when complete it is very effective, and leaves room for the amateur to display artistic taste in more than one direction. If you desire a black case, it would be as well to make it with American white wood and ebonise it, and have some gold lines incised on it to relieve it, but the case I introduce to your notice I intend to be made of English walnut, as it matches over-mantels and the prevailing style of light and artistic furniture; but, as I showed before, it is a matter for the maker's discretion.

Procure at a good timber merchant's some dry English walnut; you will require also a 10 ft. length of 2 in. square pine for your key bottom. If you will kindly refer to Fig. 1, you will see how this is made; it is 4 ft. 2 in. long and 14 in. wide. You plane one side of your pine over and square the edges, then cut off your muntings or cross rails 11 in. long: you will require five of these. Now cut your front rail off 4 ft. $2\frac{1}{2}$ in.; also you want a back rail the same length of 1 in. pine and 3 in. wide: these are dowelled together with round pegs of beech wood about $\frac{1}{2}$ in. diameter. I need hardly say that you use glue as well: when this is dry, you plane the top, side level across, and straight in its length. This key bottom is the portion of the case where the keyboard rests on. Now take the back of the piano, and plane each end of it straight and square, lay it on your trestles strings uppermost,

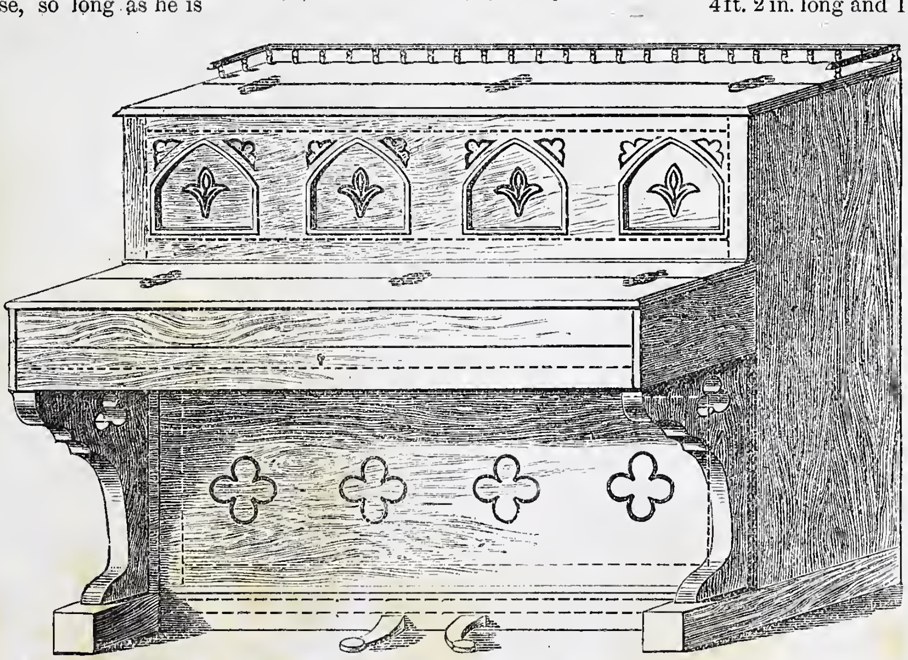


Fig. 3.—Case in Isometrical Perspective, Dotted Lines showing Top and Bottom Doors, Front of Key Bottom, and Bottom Board.

and cover it over with a sheet to keep the shavings and dust from it. Now you make the ends of the case; you will require two lengths of $\frac{3}{4}$-in. walnut 3 ft. 7 in. long × 12 in. wide: these are the finished measurements I will give you, so that you can allow a trifle over these for working. Plane the sides over nicely and shoot your front edges straight, and square the top ends. Now, if you look at the end section of the case, you will find that the end stands from the front edge of the end to the wrest plank 6 in.; select the best sides of your ends for the outsides, and put a small nail in 6 in. from the front at the top of each end, and one at the bottom of the treble end $7\frac{3}{8}$ in. from the front. These nails are only driven in temporarily, and allowed to stand out a little way for the ends to rest on the back; rest the treble end on the back, then take the bass end and rest the nail on the wrest plank. Stoop down and look across the top of the two edges of the ends, and either raise or lower the bottom end until it is level with the edges of the treble one; then make a mark and drive a nail in temporarily. Put some handscrews on, and see that they fit close to the back; if they do so, get your toothing plane and go over the parts to be glued. Now warm the ends and have your glue hot, so that it runs nicely from the brush, but not too thin; now glue one side and put your handscrews on as quickly as possible, then glue the other side in the same manner, keeping the square tops of your ends level with the top of the piano back. Having done this, you now prepare the cheeks, two pieces of walnut 10 in. long × 7 in. wide, and the same thickness as the ends; these are dowelled on the edges of the ends, at a distance of 1 ft. 9 in. from the top of the end to the bottom edge of the cheek. Put in four dowels $\frac{3}{8}$ in. diameter and 5 in. long; glue halfway in cheeks; you can mark for holes by making a template of a piece of thin wood the width of cheek; pierce four small holes in, and mark through on the ends of your cheeks and also on the edge of your ends to correspond, so that the dowels in your cheeks will enter the holes in your ends, and you will see by diagram that the cheeks are put on the end of the key bottom in the same way, with dowels. Having glued the dowels in your cheeks and holes in the ends, put them in their place temporarily; see that they are square with the ends; now take your key bottom and place the top side of it to the bottom edges of the cheeks, with the back rail resting on the ends; now having got the cheeks upright, make a mark inside the cheeks near the ends of the key bottom at each end, then square a line across from these marks, and plane the ends of your key bottom to these lines, so that it fits between the cheeks; keep the bottom level with the bottom edge of the cheeks, and 1 in. from the top end of the cheeks; put a handscrew on each side temporarily, and then you can mark across with a small square and pencil over the bottom edge of cheeks and key bottom the position for your dowels you will require, three in each; now if you take it out and gauge a line 1 in. from the bottom edges of key bottom and cheeks, and square across from lines previously made, it will give you the exact position for holes. Glue the dowels in the key bottom, leaving them to stand out $\frac{1}{2}$ an inch; try the cheeks on, and see that everything fits; now cut a piece out of each end of the key bottom $\frac{3}{4}$ in. wide, as per sketch, from the bottom of cheeks to the back: this is to give room for the pedals to work later on. Now make the ends of your key bottom warm and glue your cheeks on; put a couple of handscrews on; now glue the ends of your cheeks and the holes in your ends, and put the dowels in their respective places, and drive down with a mallet, having a piece of hard wood on the ends of the cheeks so that you do not bruise them; you will see that the cheeks and key bottom are put together at one operation. You now make a bottom board: this is fitted in between the ends, and level with the bottom of piano back, cutting a piece out to fit over the end of bent side and plate; it is glued on the bottom of the back and at the ends, and dowels are put through the ends into it: this is made of $1\frac{1}{4}$ in. pine, 4 ft. 2 in. long × 6 in. wide.

You now make the plinth: this runs along the edge of bottom board and runs through to outside of ends; you will have to cut a piece out of your ends to allow it to do so. This is 4 ft. $3\frac{1}{2}$ in. long, 3 in. wide, and $1\frac{1}{4}$ in. in thickness. You can glue a piece of $\frac{1}{4}$-in. walnut on 1-in. pine to make up the thickness. Now make the pilasters of walnut $2\frac{1}{2}$ in. wide; these are two in number, and are fitted one end under the cheeks at each side of the case, and the other end resting on the plinth, and the edge glued inside the end. Now, for the present, you may take your case off the trestles. To make the back flat and fall, you will require two pieces of walnut $\frac{3}{4}$ in. thick, and 4 ft. $4\frac{1}{2}$ in. long; the back flat to be 3 in. wide, and the fall 8 in. wide; the edges to be planed straight, and to fit on the top of the cheeks; the ends to stand over the cheeks at each end $\frac{1}{2}$ an inch and rounded; then you will want a name board of $\frac{3}{4}$-in. walnut: this is $2\frac{1}{2}$ in. wide, and is glued on the under side of the back flat, at the front edge: it lays behind the keyboard. Now make a front flap to fall: this is $3\frac{1}{2}$ in. wide, and fits between the cheeks under the front edge of the fall, and is hinged with small butt hinges to it. You can now fit the lock front: this is $3\frac{1}{2}$ in. wide, and also fits between the cheeks, and is glued to the front edge of the key bottom after being cleaned up with glass-paper. The top is now made: it is what is known as half-top; the back half is 7 in. wide and is glued to the top of the back; the front half is also 7 in. wide; allow it to stand over $\frac{1}{2}$ an inch at the ends and front, and bevel the edges. The two halves are joined together with fancy hinges to match hinges on the fall; in fitting these, it is only necessary to screw them on temporarily, as they will need to be taken apart to polish. You can now make the top and bottom doors. These are made in frames to fit the openings: the top door from the back flat to fit under the top, while the bottom door fits from the plinth to the key bottom, and between the two pilasters. The frames are to be made of $\frac{3}{4}$-in. walnut $1\frac{1}{2}$ in. wide. Plane the edges square and cut off to the length you require to fill the openings, the long rails to go between the short ones, and a couple of dowels put through each rail. When these are glued together and dry, plane the sides smooth, and then you can get some $\frac{1}{4}$-in. walnut: this is to make the panels to cover the frames above mentioned. The panels to be planed over smooth and cleaned up with glass-paper, and the openings may be cut out; the trefoils can be bored out with a centre-bit; then these panels are glued on the frames, with pressure from small handscrews along the edges. The edges of the openings are also to be cleaned up, either left square or bevelled. Behind these openings there are four smaller panels fitted: these are made square, to cover over the trefoils, and after being polished, a design can be incised and gilded, or painted on them, and screwed on from behind. The top door is screwed to the back flat from underneath, the back flat being placed on short dowels in the cheeks, the top door being fastened with small hooks inside the ends to eyes in the back of the door. The bottom door has short dowels in the bottom edge, which fit in a couple of holes in the plinth, while the top part is held in position by two small buttons. Now you can make the trusses or brackets; you can glue two pieces of $\frac{3}{4}$-in. walnut together to make up the thickness, or buy $1\frac{1}{2}$-in. walnut; these make 20 in. long. Now make the truss toes, 6 in. long and 3 in. thick; they are dowelled on to the plinth, and stand over the end $\frac{1}{4}$ of an inch. Then you make two end plinths, 3 in. wide, $\frac{3}{4}$ of an inch thick, to butt up to the truss toe, and glued to the bottom of the end. You now make a rail, $\frac{3}{4}$ in. wide and $\frac{1}{2}$ an inch thick, and procure from a wood turner $2\frac{1}{2}$ dozen spindles 3 in. long, with a $\frac{3}{8}$-in. pin at each end; then, after putting a $\frac{1}{4}$-in. bevel on each side of the rail, bore corresponding holes in the back edge of the top and rail, and mitre the corners for the short rails. Now you can fit in your lock. Mark the centre of your lock front, then set your gauge to the pin where the key fits on, from the top edge of lock; make a slight mark on the lock front to cross the other, gauging from the top edges; now you want an escutcheon of brass; bore with a small bit in the mark you have made, and fit your escutcheon in with a $\frac{1}{4}$-in. chisel. You now fit the lock in from the top edge by boring it out, and marking it so that the pin comes to where the escutcheon is let in; glue this in, and clean off level with a file; now, having fitted the lock, you will need to fit the link plate in the front flap of your fall. Take your key, and turn the bolt up as though you had locked it; now take some of the black oil from your oilstone and place on the bolt, turn the bolt down, and close your fall; now turn the key again, as though to lock it, and it will make the mark on the fall where you are to fit the link plates. You must now clean up the whole of your case, preparatory to polishing. Have your smoothing plane set fine and sharp; also you want a steel scraper and various sizes of glass-paper from Strong 2 down to No. 1, using the strong paper first, then using the other sizes until you finish with No. 1; you want a square piece of cork to wrap your glass-paper on: these are sold at most tool shops. Any small holes may be filled up with shellac, using a hot iron or old file to melt it in the holes; minute holes may be filled by rubbing over a piece of beeswax, and then papering level. Exercise great care in cleaning up the case, as it makes a better finish when it is polished.

OUR GUIDE TO GOOD THINGS.

⁂ Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.

115.—Bellars' Improved Burglar Alarum Contact.

When burglar alarum contacts are allowed to lie idle for many weeks or perhaps months hidden in a window frame or in a door post, the bearing parts are apt to become corroded and dusty. When the contact points are thus protected by a layer of dust or corrosion, the appliance fails to act until the protecting coat has been cleaned off. Many persons have experienced the annoyance of having to press a push button in hard several times before the bell can be got to ring, and this inconvenience is often caused by a dirty contact. We cannot expect the intending burglar to be so considerate as to take all this trouble in making an alarum bell ring, so must have the contact in working order when he calls. This condition cannot always be ensured with the old style pin and spot contacts, although tipped with platinum. Hence those appliances which are furnished with rubbing contacts are preferred before others. In the Improved Burglar Alarum Contact, invented by Mr. H. W. Bellars, a rubbing contact is ensured, and the working parts of the appliance are kept by this provision in working order. From Figs. 1 and 2 below, it will be seen that the rubbing motion is ensured by fixing one carved German silver spring to an insulated ebonite block on the base of the instrument, and causing the bent end of another German silver spring to rub against the other, when the door or window to which it is affixed is opened by the prowling thief. On comparing this with the contact shown at Fig. 53, page 485, a similarity in the mode of construction will be observed, but Mr. Bellars has given a longer rubbing contact to his springs. I prefer, however, a metal marble to a fixed lug of brass on the spring, because a ball or marble by its rolling motion causes less strain, wear, and tear on the spring and on the window sash. Mr. Bellars'

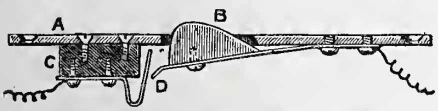


Fig. 1.—Bellars' Improved Burglar Contact in Section—A, Brass Plate; B, Brass Tongue; C, Ebonite or Hardwood Block; D, Rubbing Spring.

Fig. 2.—Ditto, in plan.

little appliance is strong and well made, and is very cheap at 12s. the dozen, the price at which they are now sold to the trade.

116.—Kristaline.

Under this name the firm of Messrs. J. & E. Hartley, Electro-platers, 13, St. Paul's Square, Birmingham, are importing and selling a colourless lacquer suitable as a protecting coat to electro-plated ornamental articles. The lacquer is made from a kind of celluloid or gun-cotton dissolved and held in some etherial solution which soon evaporates in a temperature of 90° Fahrenheit, and leaves an extremely thin but durable and almost invisible coat of protecting varnish on the article. The odour of the varnish resembles that of pine apple, or the well-known pear drops. It may be used for coating gilt or electro-brassed goods, or may be coloured if required for this purpose. The same firm also sell a cheaper article for lacquering brass. The price of kristaline is 16s. 6d. per gallon.

117.—Pool's Repoussé Worker's Album.

Repoussé workers will, I think, find a good shilling's-worth in Part 1 of the Repoussé Worker's Album, recently issued by Mr. Charles Pool, the Mechanics' Tool Depôt, 27, Hockley, Nottingham, and sent post free to any applicant for stamps to the value of 1s. 1d. The eight sheets contained in the part exhibit twenty good designs for door-plates, serviette rings, trays, crumb scoop, letter rack, pen tray, pipe rack, brush backs, photo frame, bellows plate, and stationery rack; affording an abundance of choice to those who are fond of this kind of work and may be on the look out for new patterns. Mr. Pool supplies in addition to general tools all tools and requisites for repoussé work, modelling, fretwork, wood carving, chip carving, engraving, and turning. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

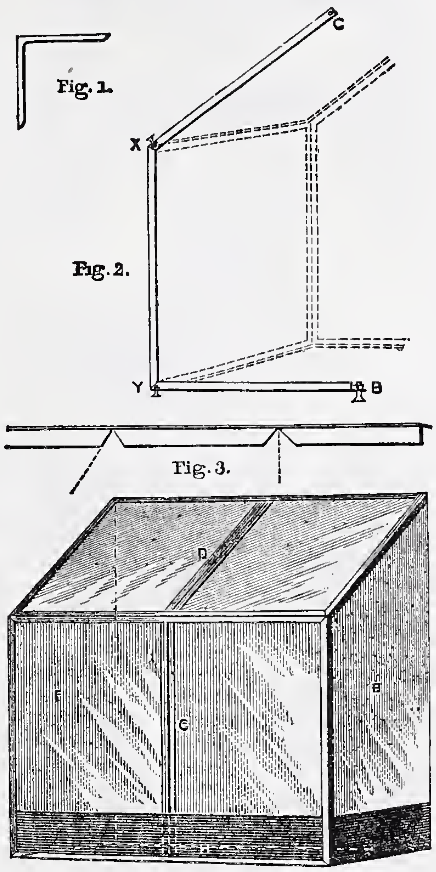
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Window Conservatory. — Sancho (*Glasgow*) writes:—"In No. 12 of Work, instructions are given in detail how to construct portable or tenants' greenhouses, which are well adapted for houses such as villas and cottages in country and suburban districts. But what are we residents of cities to



Window Conservatory. Fig. 1. — Angle Iron. Fig. 2.—Mode of Making Framing. Fig. 3.—Mode of Cutting Angle Iron. Fig. 4.—Window Frame or Case complete.

do, should our fancy lead us to the training of plants and flowers, where every available yard of ground is built on, leaving as little space for offices, etc., as possible, for building thereon, and where the houses are built so compact internally, that little or no space for a single pot and plant, either in the way of household duties, or in a place where it would not thrive if left on the window-sill outside without any protection, to die the first sign of winter? In the sketch given, I presume every workman will understand its use as a window conservatory. My mode of construction differs from the usual way of fitting up window conservatories, which are generally framed complete and laid on brackets, or brackets fixed and built in place. When removing (as workmen in cities very often do, like birds of passage, only to suit their respective employment) — I quote my own experience — the whole framework has to be taken asunder, or lifted out bodily, and seldom without mishap, and then, perhaps, it will not suit new premises without a deal of trouble. Then it is laid aside and neglected, and our hobby for flowers has flown, and the taste for the beautiful gone. To make one portable and in seetions, procure two pieces of angle iron as in Fig. 1, $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in. × $\frac{3}{16}$ in. Make two frames after the shape shown in Fig. 2, bent *vice versâ* for window sides, or instead of bending the angle iron cut inches out and bend the flat only, as in Fig. 3; after fitting exactly alike, have two pieces of angle iron to go across, as at X Y in Fig. 2. To fix frame outside window, the parts marked B must have a hole bored at end for a bolt run into stone with lead, and bound with nut on top. The parts marked C must have a hole bored at end to fix with iron rod screwed both ends, one screw longer than the other, to allow for slip into holes in stone side of window corresponding with holes in angle iron. The rod to slip through iron (angle) into stone brought back half and slipped through iron and stone opposite side, bound in place by jamb nuts or screws at ends of rods. The angle irons at X and Y must have holes in ends with holes corresponding, for fixing with small bolts and nuts. The frame complete is shown in Fig. 4. Next make the glass frames or cases. The top, D, neatly fitted in space; E and F, supporting top; G, additional support for top; H, sole, wood only, binding the three glass frames or cases on upright at bottom. For ventilation at any time when the lower sash of house window is closed, a small opening could be made in top or front glass frame to be opened and closed at will."

Spinning Wheel Mirror.—P. H. (*Allendale*) writes:—"I send a sketch, or rather photo, of a mirror which I made and have in possession for publication in Work, hoping it may be of use to some of its readers. The carvings are carved in wood $\frac{3}{8}$ in. thick, and the scrolls at the foot of pillars $\frac{1}{2}$ in. thick glued on to brown oak (the carved feet or claws are but 1 in. thick); the rim which runs round inside of wheel rim to form the rebate to hold the glass in is $\frac{1}{4}$ in. thick. The fretwork or carving on top of mirror is of stuff $\frac{1}{4}$ in. thick, and the front of stand is veneer. All the ornamental work is in black oak, or, to name it rightly, bog oak. The spinning wheel rim and rest of mirror are of old brown oak. The

Spinning Wheel Mirror.

whole in combination makes a splendid mirror, being, as I have said, of black and brown oak. I have made a variety of hanging mirrors with the rim only set with carvings, and some of a fretwork and carving pattern, of which I will enclose pattern, four of them to cover the rim. The pattern is of my own design. I think it is useless to attempt to describe it any plainer, as most people know, or at least can look at a swing mirror to see, how it is built. After you have purchased a little spinning wheel take the spokes out, and glue joints afresh if it needs it, and then commence to make your mirror, etc. The mirror stands 2 ft. 3 in. from table to top of carving, and bottom, 2 ft. to $1\frac{1}{4}$ in. from edge to edge of bottom mould."

Rubbing Down Oilstones.—C. H. M. (*Wylam*) writes:—"Under the heading of 'Means, Modes, and Methods,' in No. 31 of Work, I see W. G. shows how to prepare a board with emery to be used in rubbing down oilstones. His method seems unnecessarily long. I was taught in my apprenticeship days, twenty years ago, to use a sheet of coarse emery cloth tacked on to a board by the corners. It might be glued to the board, but, as the oilstone is always a little greasy owing to the oil sinking into the stone, the dust ground off is able to stick to the emery cloth. When the cloth is only tacked to the board, it can be taken off and be well beaten on the back. This gets rid of the dust so well that the sheet of emery cloth lasts a long time. A sheet of No. 2 or 3 is the best to use, and the hardest oilstone seems to rub off about as easily as chalk comes off on a piece of smooth wood. One would have supposed that so simple a plan would have long ago found its way among every one who used an oilstone, but as I have often come across workmen who still grind up their oilstones on a grindstone or flat sandstone, it may be worth publishing (probably for not the first time by a long way) the method of grinding by emery cloth."

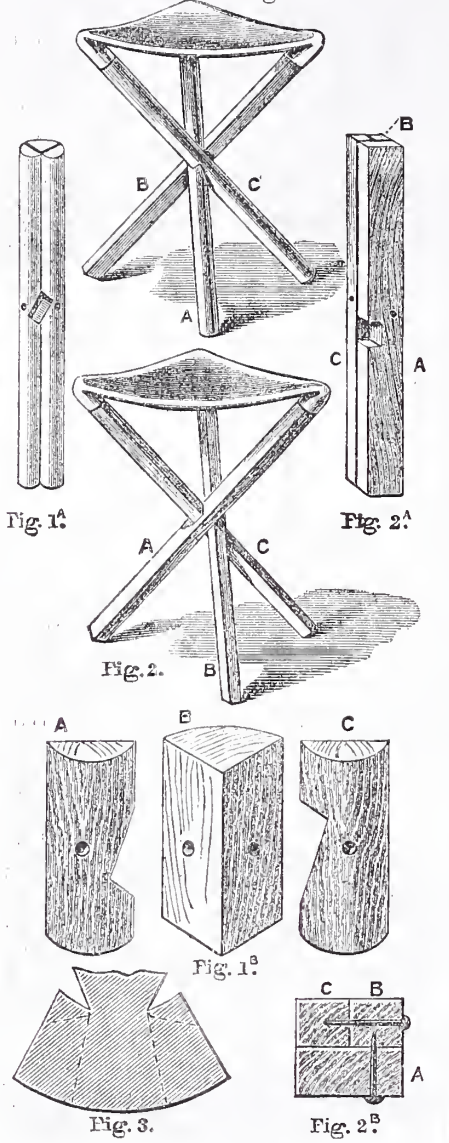
Simple Incubator.—T. T. (*Fulham*) writes in reply to W. L. (*Kingsland*) (see page 557):—"Could a thermometer be used in the incubator? If so, would it do to put it in the sand?"

Iron and Steel: Its Analysis.—A FOREMAN IN TIN WORKS writes:—"Owing to facilities afforded to the present generation for self-education, to the influence of Nonconformist ministers against drink being the one great object of life, and to the present rather high scale of wages at the Sydney Tin Works, a desire for scientific information has become established in classes where formerly the rule-of-thumb routine swamped all aspirations relating to the scientific processes in manufactures. Your above article is, it is to be hoped, only a prelude to a weekly series of similar information on such lines. May we ask for a percentage list or description of the slags resulting from modern iron and steel works, as we feel sure that if practical attention were directed to the subject that some commercial and profitable use could be brought about for the mountains of slag at present blocking up the works."

Combination Bedroom Suite.—F. C. writes:—"I am sure Mr. Scott will not be offended at T. B. R.'s suggestions—at least I hope not, as there is an old saying, 'two heads are better than one.' I, too, was so much pleased with the ingenuity of the suite that I took the first opportunity of my being in our nearest considerable provincial town to order the wood necessary for its construction, which, by the way, cost me in yellow pine £2 2s., which surprised me somewhat, as I had not thought it would take so much. As T. B. R. remarks (see page 555), I got 1¼ in. stuff for the frames, and here perhaps I may be permitted to remark that I am sure it would be a great convenience to the not very experienced amateur cabinet maker if a summary of the total amount of wood required were given at the end of the article. I would myself have done something by way of a start on this cabinet or wardrobe sooner, had I been able, without trouble, to say to the merchant what I exactly wanted. More experienced hands may be able to say at once what is needed for such a piece of work. Others who are beside the wood store can order it just as they want, but it is a different matter when you are at least sixty miles, as military men would say, from your basis. Though Mr. Scott expressly says he does not go into the construction, and his description of his excellent design is very full, there are undoubtedly several points which are not cleared up by the drawings, and, though I am by no means a tyro in such work, I fail to see how they are to be carried out. I have not the drawing before me now, so can from memory only speak of one point. The short drawer front on left in bottom compartment is drawn as a framed front. This for a drawer is, I think, a very unusual mode of construction, for unless the framing is mock—*i.e.*, merely slips pegged or glued on to front—the drawer sides cannot be dovetailed to the front, as they ought to be. What T. B. R. says of the looking-glass had struck me too. Also the risk, in case the spring catch for holding it up should at any time fail, of the glass falling down and being broken. I think the basin placed in a drawer, as suggested, would perhaps on the whole be the more convenient arrangement. Its jug might be placed sitting in it in the usual way, or else put in the central compartment right over the basin when closed in. Another point now occurs to me. I think Mr. Scott speaks of the drawer fronts as if they were to be flush with the case. In the drawing the edges seem as if bevelled off, so as to make the front project at least ⅛ in. or ¼ in. beyond the case. Is this so? I hope Mr. Scott will consider the suggestions given, and point out anything he may see against them before any of us commence work. I have often found that many would-be improvers, when they see anything they like, say, 'Oh, it would be a great deal better if it were so.' Whereas that very point with many another has been before the inventor's mind, and he has deliberately rejected it for some good reason. Now, while I do not see any objection to most of the suggestions of T. B. R., it may be the inventor does, and therefore we would be glad to have his views before us. Though I am struck with the ingenuity of the device for making the large panel serve as washhand table, I think it is attended with such disadvantages as make the drawer arrangement for basin much preferable—*e.g.*, unless you leave your clothes in the press open all day to dust. Whenever you wish to wash your hands, you have to open the door, let the panel down, arrange basin, etc., and then when done put all up again. This is a good deal to be done each time; besides, the panel is sure to be wet, and will shortly become discoloured and shabby if so used. If shut up wet or even damp, it is not good for whatever may be in the press. Instead of saying all stuff of ⅛ in. and styles of 1 in. or 1¼ in., would it not be well to say drawer fronts to be at least ⅞ in. or ⅝ in. in rough, division frames between large drawers to be 1 in? Half inch here would look skimpy. I question, too, whether ½ in. for vertical division of compartments will not look equally skimpy."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Camp Stools.—A. S. S. (*Cheshire*).—In answer to your query, I have attempted to describe two forms of camp stools. In both diagrams you will observe that I have only given three-legged articles, as I see that the four-legged ones are patented. I do not think you would be infringing any patent rights by making one for your own use (although my knowledge concerning the patent law is not very extensive), but I consider that, by publishing sketches and description of making it here, I should be acting far from right towards the patentee. Your letter induced me to try to make a model of a four-legged stool, shutting up into one length, but having a different joint; and if you do not care for either of the two here shown, I would be willing, when it is finished, to send you a rough sketch of it, through the Editor, although I see no reason to



Camp Stools.

object against either of these two. The section of the three legs of Fig. 1 is shown in Fig. 1A. The sides of B have to be cut at the angle shown (Fig. 1B), and thus it will be seen that when A and C are turned on their pivots, if they are exactly cut, they will cross one another at their joint. The seat will help to strengthen them. You will find it rather difficult to cut the notches exactly in this stool, but with Fig. 2 you will experience less trouble, and I think a stronger job can be made after this pattern. Two of the legs in Fig. 2 will be square in thickness, the other one being the same width as these two together, and the same thickness (Fig. 2B). A is riveted to B, and B to C. In this stool each leg will be exactly at right angles to the leg it crosses. A piece is cut out of A to receive C. In opening this stool, A is turned from left to right, and C is turned forward at the top. The way to fasten these three legs will be to cross B and C, and run a pivot through them, and then place A across B, so that its thickness is under C; you will then see where you will have to cut the piece out, and fasten A to B. The top of A can have a piece cut off one side, so as not to make the corner of the seat any wider than the others. The rails may be rounded on the sides, and so make them collectively circular in section, but if this is done, it will be necessary to cut a different shaped notch in A. The corners of the material to form the seat might be cut after the manner I have shown in Fig. 3. The piece is bent round and sewn through the two long dotted lines, the two corners above the other dotted lines being sewn to the underpart of the material. The seat can be carried separately, but it will be best to tack it to the legs.—J. S.

Polishing Chairs.—J. F. (*Manchester*).—Pleased to hear you have found WORK so useful. You do not say what wood the chairs you wish to stain and varnish are made of, but I suppose they are light-coloured, and "in the white." By "stained varnish" I assume that you want a coloured varnish, by which you can darken the things to walnut colour at one operation. This may be done, but it is not so satisfactory as staining and varnishing separately, for the simple reason that if the coloured varnish chips off, the wood under it shows its original colour. When the wood is previously stained this does not happen. However, if you wish a combined stain and varnish, or rather to use a varnish which will colour your chairs in imitation of walnut, all you have to do is to colour the varnish accordingly. You may do so by mixing a little gas black and Bismarck brown with the varnish, and straining through muslin previous to use. By altering the proportions of the black and brown you may get any shade of walnut. Use spirit varnish.—D. A.

Tools.—W. H. R. (*St. Peter's Park*).—Without knowing something more than I do about the class of work you intend to undertake, I cannot give you a list of tools which would be certain to cover all your wants, but for general light joinery or cabinet making, you will find the following ample:—Some you might do without—for example, the jack plane could be dispensed with, if your wood is bought ready planed; but if you get all the following you will have a very good kit with which you can manage almost anything you are likely to want as a beginner. Of course if you want to go in for carving, turning and shaping, or fretting, you would have to extend the list greatly—Jack plane, trying plane, smoothing plane, rabbet plane, hand saw, tenon saw, dovetail saw, chisels from ⅛ in. to 1 in., brace and bits, gimlets, bradawls, screwdrivers, scraper, cork rubber for glasspaper, hand screws, oilstone, hammer, mallet, square, cutting and marking gauges, etc. Lots of other things will come in useful as your skill increases, but you can add them as required. I am afraid this may be too late to be of much service to you.—D. A.

Veneering.—C. T. C. (*Brockley*).—The remarks to which you take objection are quite correct, and no mistake has been made by the writer. The heart side is the proper one on which to lay the veneer. It is also the side which tends to become convex, although you say that it would "surely be the other side, and that the formation of the wood is against the heart side becoming convex." Well, facts are stubborn things, and, however you have arrived at the decision you have, it will not alter them. I am afraid you have never tried practically to see whether your assertion is correct, for if you had you would never have made such a rash statement. Suppose you were to try the experiment of veneering one piece of a board on the heart side, and another piece on the other, and watch the result. The way the board bends is not a matter of opinion, but of fact, so that a test as proposed would be more convincing and intelligible to your comprehension than anything else. I quite agree with you that it is an important matter, but you know theory can't stand against practical experience, and I always advise amateurs and novices to try for themselves, if they think practical men wrong in their methods. As a rule, the practical artisan knows more of his own trade than any other people, and in the absence of very strong proof to the contrary, the assumption fairly must be that he is not altogether wrong, as you would imply he is in this instance. It would serve no good purpose to explain at present how the board goes as it does.—D. D.

White Acid for Glass Embossing.—NARPY (*Sheffield*).—The "white acid" mentioned by you is probably hydrofluoric acid, composed of hydrogen and fluorine in their combining proportions—namely, 19 parts of fluorine to 1 part of hydrogen. It is obtained by dissolving fluorspar in sulphuric acid, and condensing the acid fumes in water. It may be got through any chemist and druggist, in gutta-percha bottles. The acid is dangerously corrosive, and will cause painful wounds if allowed to touch the skin. It will dissolve glass, or any other substance containing silicon, as china and earthenware, by the action of the fluorine on the silicon in the glass, hence it must be kept in gutta-percha bottles, on which it has no action.—G. E. B.

Future Subjects.—W. F. R. (*Plymouth*).—Thanks for suggested subjects. Effect shall be given to your suggestions in Vol. II. of WORK.—ED.

Restoring Writing Desk.—A. B. (*London*).—I suppose it is only the polish of your desk which has been scorched, and that the wood itself is uninjured. If this is the case, all you have to do is to scrape or clean up with glass paper, and repolish. If the wood is injured it will be a more serious matter, and I must have further particulars before I can help you. If you want further advice from us say, if you can tell it, the kind of wood, and especially say whether it is veneered or solid. Give any details you may think important, for in this, as in many other cases, the more particulars we have the better, if an answer is to help you as much as it might. Do not be afraid of giving too many particulars, thinking they will be of no use. Possibly they will not all be useful, but those that are not so will be skipped, so do not think you cause us any trouble by writing too explicitly.—D. A.

Picture Frame.—Wun Mare.—You ask how you can decorate the top of a picture frame, of which you send a paper cutting. Now, how can I possibly tell you anything that is likely to be of the slightest assistance to you without knowing more than I do about your capabilities? For instance, if you can carve I should suggest that by carving you might vastly improve the appearance of the top, although so far as I can judge from the paper it is hardly worth while wasting much time on a thing which is fundamentally poor. As this, however, is a good deal a matter of opinion you may be inclined to lavish work on it, and I should certainly recommend carving. If you are unable to do this you might put pieces of silk plush at the back of the holes—or even pieces of a different kind of wood You do not tell me what wood the top of your frame is made of, nor the thickness, nor whether it is simply as an overlaid veneer that you have availed yourself of the piece as per paper. I might go on conjecturing for ever what would do for your purpose, and still fail to hit the point. It is really a pity that so many inquirers frustrate efforts to help them by withholding details which might be easily supplied.—D. D.

Polishing Music Cabinet.—W. H. C. (*South Norwood*).—Your music cabinet must, indeed, be an elaborately carved and moulded affair if you cannot get it polished for less than a sovereign, and I am inclined to think there has been a mistake somewhere. The figure is a ridiculous one for such a piece of furniture as a music cabinet; but are you sure that this is what a cabinet maker would call your contrivance? Is it not rather what he would call a cabinet—without the music—and consequently a much larger affair than ordinarily known as a music cabinet? If you wish to try the finishing yourself in the way you suggest, you cannet do better than use a mixture of whiting and turpentine, with rose pink for colouring. For varnish which "you could put on with a brush that would look better than ordinary varnish," all I can say is that much depends on what you call ordinary varnish. A spirit varnish is what you should use, but this is the ordinary varnish for such work. Of course you must not expect the same degree of finish as if your cabinet were to be properly French polished.—D. A.

Loadstone. — A. B. D. (*Whitburn*). — Natural loadstone (more properly lodestone) consists of a combination of the protoxide and peroxide of iron. It is found in considerable masses in iron mines in Scandinavia, Germany, Italy, Spain, China, and elsewhere. To procure it A. B. D. will probably have to go to some dealer in mineralogical specimens. Mr. W. Cutters (naturalists' agent), 35, Great Russell Street, Bloomsbury, London, W.C., would be able to supply him. He will get a serviceable lump for about 3s. Unless we are mistaken magnets are more commonly made at the present day by subjecting soft iron to a strong current of electricity.—M. M.

Bichromate of Potash v. Chromic Salt.—T. F. (*Manchester Square*).—Chromic salt or chromic acid in a battery gives more lasting strength to the battery than bichrome of potash.—G. E. B.

Reclining Chair.—Cabinet Maker (*Rawtenstall*).—The copper rivets you inquire about can be had from Stanton Bros., 73, Shoe Lane, E.C., or Faithfull, Boro', S.E. The cost is about 10d. to 1s. per lb. Both these firms are in London. I do not know of any place nearer your home where you can purchase rivets, but why not use iron instead; you can then have them made cheaply by your local blacksmith, or, if at all handy with tools, can easily make them yourself from a piece of iron rod, purchasing the necessary washers at the ironmongers. This would save you trouble, and economise postage or carriage.—G. le B.

Practical Electricity.—S. G. (*Norwich*).—An authoritative book on this subject is Ayrton's "Practical Electricity," 7s. 6d., Cassell & Co.—F. J. C.

Copying Press Makers. — Pickwick. — The following are good makers:—Hughes & Kimber, West Harding Street, London; Mordan & Co., 7, Cheapside, London. A book on engines and boiler construction is Wilson's "Treatise on Steam Boilers" (6s.), Lockwood & Co.—F. J. C.

Small Sideboard with Drawers and Cupboards.—Peahen.— You send a proper string of questions to be answered. Several of them need scarcely have been asked, as they are answered in the text accompanying the designs. But you want apparently to thoroughly understand what you are going to make, and some doubts are troubling you which you want set at rest. This very laudable ambition on your part I shall endeavour to assist you in attaining. First then, I presume you find a difficulty in carrying the moulding shown on the raking part of the pediment along the ends. After clamping the moulding on the pediment, and finishing it as seen in the front view, you must place a piece of wood behind the pediment to work the moulding on till it reaches the backmost part of the cornice moulding. This piece of moulding that is put on behind the pediment need not follow the rake of the pediment—it may be quite flat on its top edge (see Fig. 1). (2) The upper part consists of one frame with 6 panels in it—3 below the shelf and 3 above—on the top of which rests the canopy, and against which the shelf is screwed. The cornice, therefore, and the shelf and brackets are all screwed to this back frame, and are held together by that means. The two side parts of this large frame are dowelled, or pinned to the centre glass frame. (3) The panel under centre glass has a planted moulding round it of same section as that round glass. (4) The upper portion is secured to the lower portion by means of screws from below the top entering the bottom rail of upper part, and by the pins turned on the lower ends of the pillars. These pins should fit tightly into the holes bored for them in the top. Dowels should also be put into bottom edge of brackets to fit into top in same manner. (5) If the fillet shown behind moulding under top (Fig. 11) be the one you refer to, it is required to make the drawer work properly, and it is screwed at front and back to the gable. (6) The division between two top drawers is the same width and thickness as the drawer fore edges, and

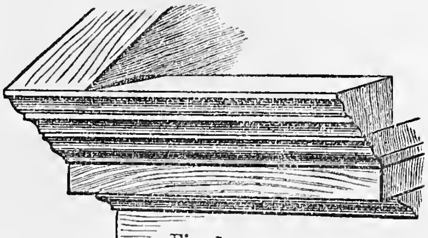


Fig. 1.

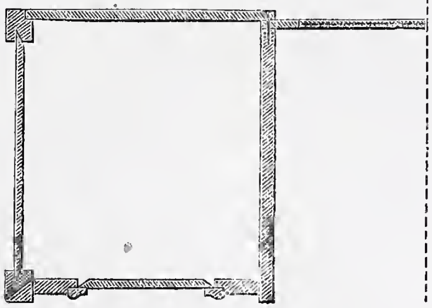


Fig. 2.

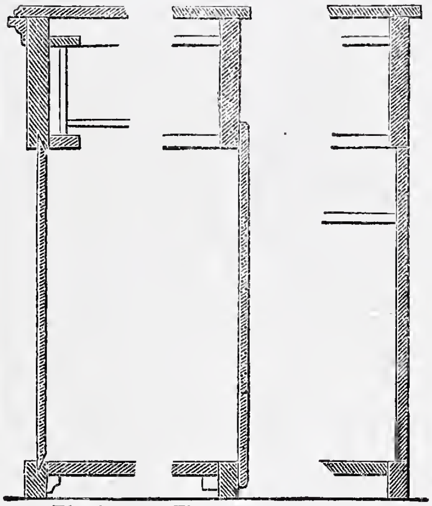


Fig. 3. Fig. 4. Fig. 5.

Small Sideboard with Drawers and Cupboards.

has two beads scratched on its face. It is mortised between the two fore edges. (7) The fore edge of centre drawer is mortised into the inner gables (8) which are ¾ in. thick. (9) The inner gables are fastened between bottom rail and fore edge by means of a pin or dowel. A fielded panel is one which has a broad shallow chamfer or bevel worked on its edges. Sometimes the fielded side is placed to the front and sometimes to the back. (10) The grain of bottom should run in the same direction as the top. It should be secured to end gable rails by means of dowels. There is not much fear of bottom splitting when it is blocked, if the wood is dry when you use it. (11) The shaded portion (in Fig. 12) under bottom rail refers, of course, to the little brackets underneath it. (12) The mouldings, shown in Fig. 2, in line with drawer fore edge consist of two beads scratched on top rail of gable, near its bottom edge. This top rail is broad enough to receive the drawer bearers on inside, so that it, therefore, appears in a line with the fore edge of drawer. A half-plan, showing horizontal sections of gables and carcase backs, etc., is given in Fig. 2, while an upright section of outer gable is given in Fig. 3, of carcase back behind cupboards in Fig. 4, and the same behind recess in Fig. 5. The inner gables being plain—not framed—an upright section is unnecessary.—A. M.

Silver Plating.—T. F. (*Manchester Square*).—When silver comes off from an article during the finishing process of scratch-brushing or burnishing, it shows either—(1) That the plating solution is not properly made up; (2) that the article was not properly prepared for plating; (3), or that the silver has been forced on too fast. The first fault you have certainly fallen into. You must not add the cyanide to the nitric acid solution of silver, as this will give you nitrate of potash in your plating solution, and thus cause the silver to go on in a loose condition. After dissolving the silver in nitric acid, diluted with one-fifth its bulk of distilled water, continue to heat the acid solution of silver until all the free acid has been driven off in the form of steam, and only a waxy paste remains. This paste will be nitrate of silver, and will form a solid lump when cool. Dissolve this in distilled water, and add to the nitrate of silver solution a solution of cyanide of potassium, a little at a time, stirring frequently with a glass rod, until the cyanide solution ceases to throw down white clots of silver cyanide. Allow it to rest for a few minutes, then pour away all the liquid from the silver cyanide precipitate, and pour in some clean water on the precipitate. Allow this to rest for a few minutes, then pour it off again. This is the way to wash the silver cyanide, and should be repeated two or three times to wash away all traces of nitrate of potash. When this is done, dissolve the silver cyanide in a solution of cyanide of potassium to form the plating solution. Note the weight of potassium cyanide used to completely dissolve the silver cyanide, and add one-fifth more to form free cyanide. Make up the solution with distilled water to contain at least 1 ounce of silver in each gallon of solution. The person whose instructions you followed, omitted those important details. Secondly, it is not enough to brush the article clean. By treating them thus, you have only made them mechanically clean, whereas they must be chemically clean to insure a perfect adherence of the silver coating. All mechanical cleaning still leaves on the article some particles of dust, or of loosened metal, and these must be dissolved off in a pickle before the article is placed in the bath. Dip them first in old nitric acid diluted with water, then in the cyanide dip, as you propose, before placing them in the plating bath. (See also my article on Brass for an account of pickles.) If they are to be burnished, they should also be quicked in a dilute solution of nitrate of mercury (½ oz. in 1 gallon of distilled water) before being put in the plating vat. Thirdly, if you use too much battery power and force on the silver too fast, it will strip off whilst being burnished. The current from one or two small Daniell cells, or Smee cells, in series, will be quite strong enough for your purpose. Let the silver anode exposed in the plating vat present the same surface as that of the article to be plated. I shall be pleased to advise you at any time.—G. E. B.

Acorn and Cone Work.—F. H. (*Darlington*).—For the work to which F. H. refers many objects which may be collected in country rambles will be found useful—all the many kinds of fir cones, acorns from the different species of oak, the beech-nut with its husk, grotesque and knotted twigs, etc. It is well to have plenty to select from before beginning work. These objects can be dried by putting them in an oven that is not too hot. Acorns will need to be taken from their cups and glued in again. For picture-frames, brackets, etc., the framework is best made of pine wood, which can be stained with umber to an oak colour. The smaller objects are merely glued on, the larger are secured either with small brass pins, the projecting ends of which are cut off with nippers, or with needle-points (which are sold by the pound for such purposes) the projecting ends of which are readily broken off. Another way is by breaking up large fir cones and gluing their scales over the entire surface of the wood so as to form a complete ground, and on this fixing the larger objects. In any case the whole, when finished, has to be varnished. Any good copal varnish will do, and by grinding burnt umber in it the work can be brought to the colour of old oak if desired. A camel-hair brush is used for putting on the varnish, and two thin coats are better than one thick one. While drying, the varnish must be kept from dust. Another method of utilising acorns is by piercing them from end to end, through cup and all, with a large needle (which must of course be done whilst they are yet soft), and threading them on wire. By a combination of such wires of acorns, baskets in which to suspend pots of ferns or flowers, and other half rustic matters, may be formed. These also need varnishing.—M. M.

Power of Daniell Battery.—Lineman.—If the cell in which the zinc element is placed is charged with a solution of zinc sulphate, and the cell in which the copper plate is placed is charged with a concentrated solution of copper sulphate maintained in this condition by a reservoir of copper sulphate crystals, the E.M.F. of each pair will be at starting about 1 volt, and this will probably work up to 1·07 volts, when the copper plate has been coated with electro-deposited copper. The E.M.F. of the 12-celled battery will, therefore, be 12 volts at starting, working up to 12·84 volts in the course of half an hour. The internal resistance of a Daniell battery varies considerably, and as the volume of current expressed in ampères depends upon the internal resistance of the cells, one cannot say exactly what the output of yours may be, apart from actual measurement. It is, probably, something between a quarter and a half ampère for the whole battery but not more. If copper is allowed to deposit on the porous partitions, the current will fail, not only on account of a higher internal resistance, but also because this short circuits the cells. To prevent this, keep the zinc, and also the zinc mud, from touching the porous partitions.—G. E. B.

Electro-deposition of Copper.—A. J. (*Manchester.*—(1) I do not know of a book devoted entirely to information respecting copper. "British Manufacturing Industries," Vol. IV., has an article devoted to Copper. In Bloxam's text book on metals, you will find an article on this subject. There are also some valuable lessons on copper working in Cassell's "Technical Educator." The electro-deposition of copper is fully treated in "Electro-deposition," by A. Watt, a book frequently mentioned in WORK. (2) It is possible to deposit a thin film of copper on both sides of a sheet of blotting-paper; but I do not know of any method apart from that of electro-deposition. Why do you object to this method? (3) There is no liquid which will soften a sheet of copper, either with or without dissolving it. A sheet of copper can be thoroughly softened by heating it to a dull red heat. (4) Copper will dissolve in sulphuric acid, and form copper sulphate; also in nitric acid, forming copper nitrate. (5) If you ask for annealed sheet copper you will get it soft; but if you want the softest copper obtainable, you will have to get pure sheet copper well annealed.—G. E. B.

Change Wheels.—E. G. (*Wolverhampton*).—Though your query was worded "chain" wheels, I perceive that you must have meant change wheels, and can picture your pleasure in coming upon the articles on page 438 of WORK, so clearly explaining how these are arranged. I hope you will thoroughly master that explanation. A very simple way to pick out the right wheels for the more ordinary threads is to put on the mandrel a wheel having ten times the number of teeth as there are threads per inch in the lead screw (in your case it would be twenty), then, on the lead screw, ten times the number of teeth as there are to be threads per inch in the screw you wish to cut. Thus, if you have two threads per inch in your lead screw, put twenty teeth on the mandrel; then if you want to cut six threads, put sixty on the lead screw; if ten, put 100 on the screw, etc.—F. A. M.

Screw-Cutting and Boring: Screw-Bore.—(*Warbleton*).—It weakens a screw such as the mandrel nose to cut a groove for the tool to run out into. You can avoid this either by drilling a little hole at the end of the thread, or by putting the left hand on the pulley of the mandrel to control its revolution at the end of the thread, and then gradually withdrawing the tool with the right hand by means of the feed screw. Of course this requires a little dexterity. The long hole in the casting of a poppet head must be very accurate indeed, and if you cannot use a bar to bore the heads in position on the bed, I should finish that hole with a parallel rhymer; a rose drill should do about as well if you leave very little for the last one to take off. I should use a ¾-in. boring bar in your case, turning up the cutter with the bar so as to ensure its cutting equally at each end.—F. A. M.

Picking Locks.—E. G. B. (*Rochester*).—Ordinary lever locks can be picked in the manner described in No. 26—*i.e.*, by raising the levers carefully one by one, and keeping sufficient pressure on the bolt to retain them in their position. This can be done with an instrument such as described, or with two small picks. It is, however, a tedious job, and it is usually much quicker to force the lock and repair it afterwards. Locks which have patented improvements, such as movable stumps, wedge, bolts, etc., etc., in addition to levers, are practically unpickable. The same may be said of a Bramah lock if it is in good condition, but the wards of this lock frequently get worn, and when this is the case they can generally be opened either with a blank or a goose quill. The ordinary letter padlocks are only made to open at one ward, so if you take down the letters off each drum, and put them on paper, you can see at a glance the different words the letters will make, and can try them in rotation. These can be bought for less than two shillings, so it does not pay to spend much time in trying to discover the ward, and the quickest way is to file the shackle off. The interchangeable ones, however, can only be opened by chance unless you know the combination. Letter locks are used extensively in America, but are not much in favour in this country, owing to the risk of forgetting the combination, being overlooked while setting the lock, or having it extorted by personal violence.—T. W.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Œolian Harp.—S. M. (*Gloucester*) writes in reply to G. L. G. (see page 476):—"I happen to have two recipes by me for the same, which I will submit for your perusal, and use if you think fit, though I can say nothing about the practical part of them. To construct an æolian harp, a box should be made of very thin cedar, pine, or other soft wood. It should be of a length exactly answering to the window in which it is intended to be placed, 4 or 5 inches in depth, and 5 or 6 inches in width. Glue on it, at the extremities of the top, two pieces of wainscot, about ½ an inch high and ¼ of an inch thick, to serve as bridges for the strings, and inside at each end glue two pieces of beech about an inch square, and of equal length to the width of the box, which is to hold the pegs. Into one of these bridges fix as many pegs (such as are used in a pianoforte, though not so large) as there are to be strings, and into the other fasten as many brass pins, to which attach one end of the strings. Then string the instrument with small catgut or first fiddle strings, fixing one end of them, and twisting the other round the opposite peg. These strings, which should not be drawn tight, must be tuned in unison. To procure the proper passage of the wind, a thin board, supported by four pegs, is placed over the strings at about 3 inches distance from the sounding-board. The instrument must be exposed to wind at a window partly open, and to increase the force of the current of air, either the door of the room, or any opposite window, should be opened. When the wind blows, the strings begin to sound in unison, but as the force of the current increases, the sound changes into a pleasing admixture of all the eight notes of the diatonic scale. An æolian harp is constructed after this manner: an oblong box of thin deal boards, about 5 or 6 inches deep, with a circle drawn in the middle of the upper side an inch and a half in diameter, around which are to be drilled small holes. Along the upper side of the box seven, ten, or more small strings of very fine gut are stretched over bridges near each end, like the bridges of a violin, and tightened or relaxed with screw pins. The strings must be tuned to one and the same note, and the instrument placed in some current of air where the wind can pass over its strings with freedom. A window which is exactly equal to the length of the harp, with the sash first raised to give the air admission, is a good situation. When the wind blows upon the strings, with various degrees of force different musical tones will be sounded. If G. L. G. adopts either of these methods, I should very much like to know the amount of success he meets with."

Battlesden Cart.—AN AMATEUR (*Paris*) writes in reply to W. W. W. (see page 414), who says "'he is astounded at some things said in reference to making a Battlesden Cart.' That feeling will subside as his intelligence expands. He says he is an improver. The few words I have to say will be of service to him, as he is obviously anxious for improvement, and desires it in a branch of his trade closely allied to the branches he is waiting to have explained in WORK. But first, to thank you for your courtesy in allowing adverse remarks to appear in your most useful columns, which, amongst other features of worth, enable workmen to express their views with unabridged freedom. This latitude will, I trust, teach the amenities of correspondence, and may be the starting-point of descriptive excellence, too often lacking in workmen's writing, which should make us bear and forbear, if some trivial mistakes in terms or omission of a word occurs to mar the completeness of good intentions in writing for others' guidance more than for their own gain. I know nothing of the writer of the article on 'Battlesden Cart Making,' so that I can say the few improving words to W. W. W. which, upon reflection, he will appreciate. First, as to it being written by a clerk—if so, it is to his credit. One of the leading writers on coachmaking, holder of prizes and certificates from the Coachmakers' Company and International and other Exhibitions for reports and improvements in carriages, was a workman like W. W. W., and was offered the position of clerk and manager at greatly increased wages. This did not detract from his competence to write on coachmaking, which is appreciated even in America, by the fact of seven different journals copying one of his articles as soon as it was seen in the States, and he is now supplying matter from the French Exposition for thirty journals, English and American, which are extensively copied into other journals. But to the part of my letter which I write specially for W. W. W.'s improvement. The writer on 'Battlesden Carts' spoke of shafts of American elm, which is different to the elm which seems to have come under his notice. It is extensively used for shafts in America, France, and, to a large extent, in England for cheap carts like those referred to. American elm is used for the sides, in alternate strips about four inches wide. Birch is used, but if the writer omitted that word, he would of course admit it, as W. W. W. must admit his quotation omitted the word 'American.' But it is to be of service in instructing the writer, and those who he said he asked about elm shafts, that I mainly write to inform him that there are about fifty-four varieties of elm, most of which grow in England, one extensively, which deserves the attention of W. W. W. It is the wych-elm, a straight-grained, tough, pale yellow wood, often with a small heart of dark brown colour. It bears the male and female blossoms on the same tree, and it is supposed the brown heart is due to the accidental impregnation of the female seed by the male seed of the brown or common elm. As this brown is not quite so tough as the yellow wood in some parts of England, the wych-elm is used for plough-beams, waggon and cart shafts, or parts where toughness or strength is essential. If cultivated with the same attention to pruning for straight growth as ash, it would be a useful wood for coachmakers, as it is now for wheelwrights in the country for waggon and cart work. It is a little dearer than the brown or common elm."

Simple Incubator.—NOVICE (*Johnstone*) writes in reply to W. L. (*Kingsland*) (see page 557):—"I find a very useful article under 'Simple Incubator,' which I mean to try. What kind of lamp would you advise, and how long will it burn? Is there nothing about regulating the heat, and has same to be kept constantly applied to it?"

Trade Notes and Memoranda.

THE following, as a flexible paint, is said to retain sufficient flexibility to enable a sheet coated with it to be rolled:—Soft soap, 2 oz.; boiling water, 12 oz. Dissolve and work well into usual oil paint.

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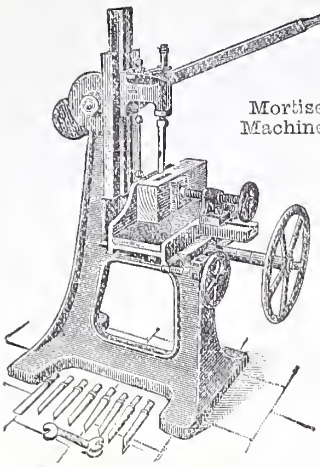

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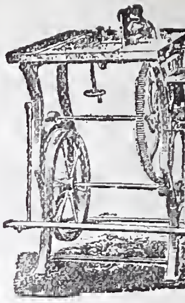

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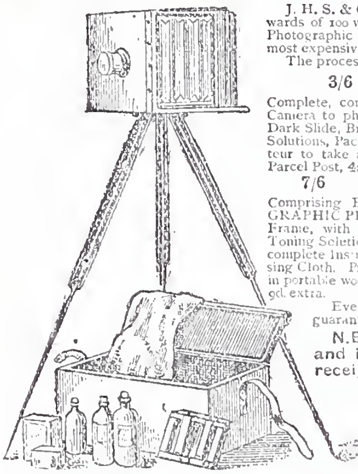

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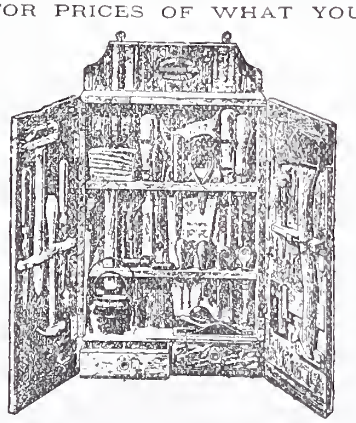

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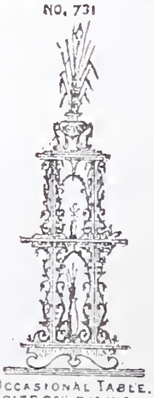

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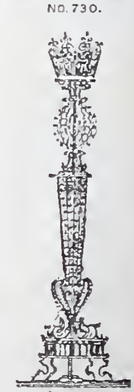

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 44.] SATURDAY, JANUARY 18, 1890. [PRICE ONE PENNY.

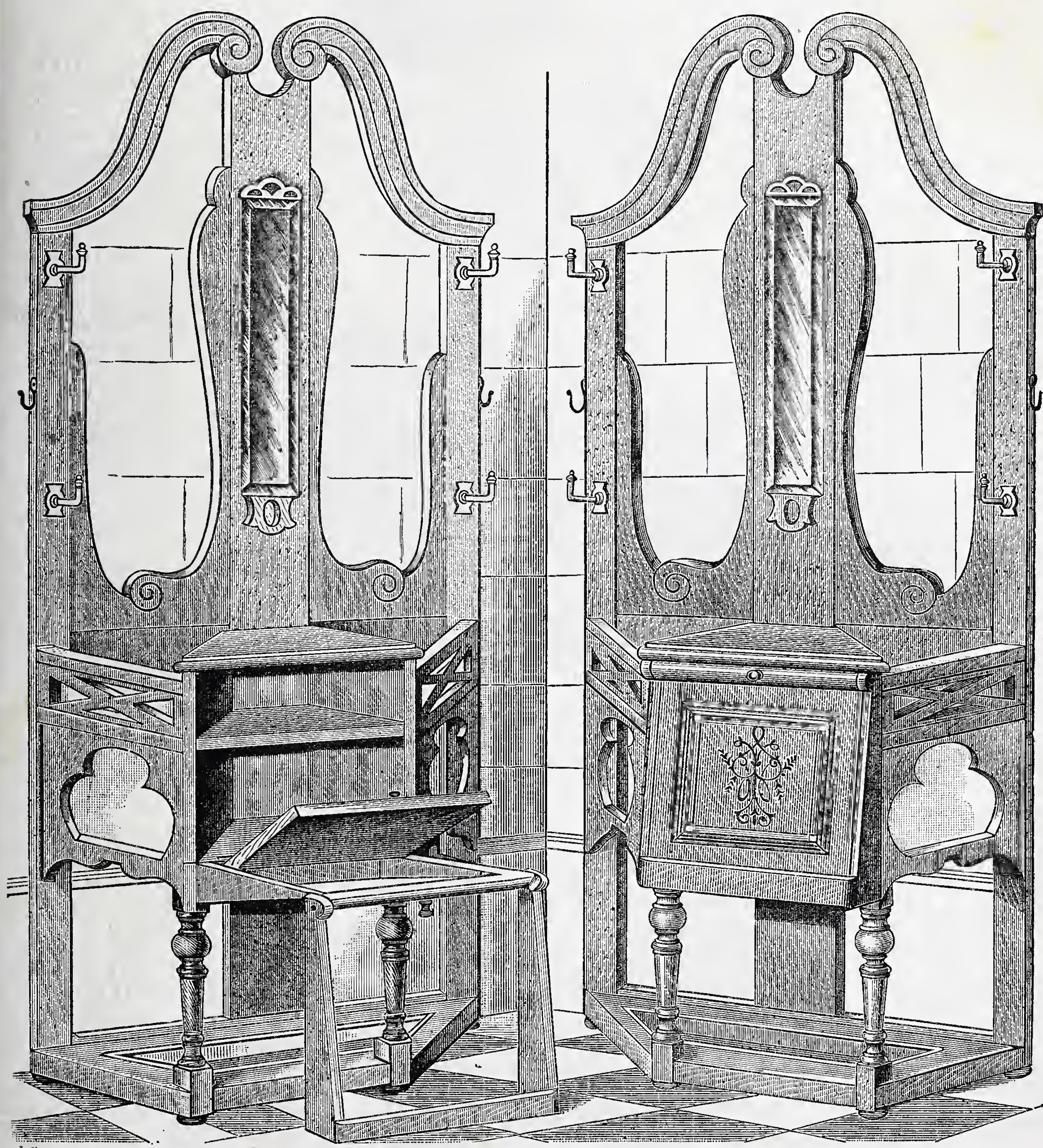


Fig. 1.—Combined Hat and Umbrella Stand with Cupboard open, showing Seat and Brush-Box. **Fig. 2.—Stand with Seat closed.**

A COMBINED HAT AND UMBRELLA STAND AND HALL-SEAT.

BY JAMES SCOTT.

It is supposed by some that, with regard to the building and furnishing of houses, our ancestors were much better off than we at the present day are; and that the "hall" has slowly, but surely, degenerated into the "passage;" but this is not so—at least, if one depends upon historical reports and pictures. By "hall" I mean the large entrance apartment represented in drawings of old English mansions; and by "passage," the small narrow entrance to be seen in most modern dwellings. True it is that our forefathers built massive, grand, and commodious mansions, possessing spacious halls, compared to those that are generally raised nowadays; but they were occupied by the aristocracy; and the lower and middle classes were not, I believe, so well off in the matter of space and accommodation as the lower and middle classes of to-day are. The majority of houses, although being extremely picturesque when viewed from the exterior, were exceedingly far from comfortable to live in, and very few of them indeed possessed either a hall or passage, the entrance door generally opening immediately into the front apartment.

Although the nineteenth-century lower- and middle-class dwellings—of course, I am not speaking of the "slums," that caused so much public commotion a short time back—are not to be compared to those erected two or three hundred years ago so far as external appearances are concerned, we have a great deal to be thankful for in regard to internal arrangement; and as improvements are rapidly increasing with every year that overtakes us, I think the present "passage" will eventually develop into the more convenient "hall."

But as most dwellings possess merely the former of these two, we must remain content to bestow our care and attention upon it, and wait patiently for its final development. It is a noticeable fact that very few householders pay much attention to this part of their houses, one reason being, I presume, that they consider hall-stands are too large and bulky. This, to a certain extent, is true, but there is no reason why something smaller than the usual thing should not be used. Perhaps another reason is on account of the numerous petty thefts committed by idle and vagabond men who make a continual practice of abstracting hats and coats from their temporary resting-places, by opening the street-door by means of a key that the landlord of the house never gave to them. And as so many street-doors can be opened by the same key, thus certainly making the chances of losing apparel very great, perhaps Mr. Bonney, the gentleman who has been giving the readers of Work so much good and useful electrical information lately, will give us something that will sound the alarm when a coat or hat is being appropriated by any other than the rightful possessor.

The "stand" that I show in the present illustrations I have designed to be of more use than ornament. It is smaller than the average article, and can be put to more uses than even the larger patterns can. The outside dimensions are:—Height, 6 ft. 6 in.; width, 2 ft. 6 in.; distance from back to front, 13 in. And yet we have an umbrella-stand, hat and coat pegs, glove and boot cupboard, brush-box, looking-glass, and hall-seat!

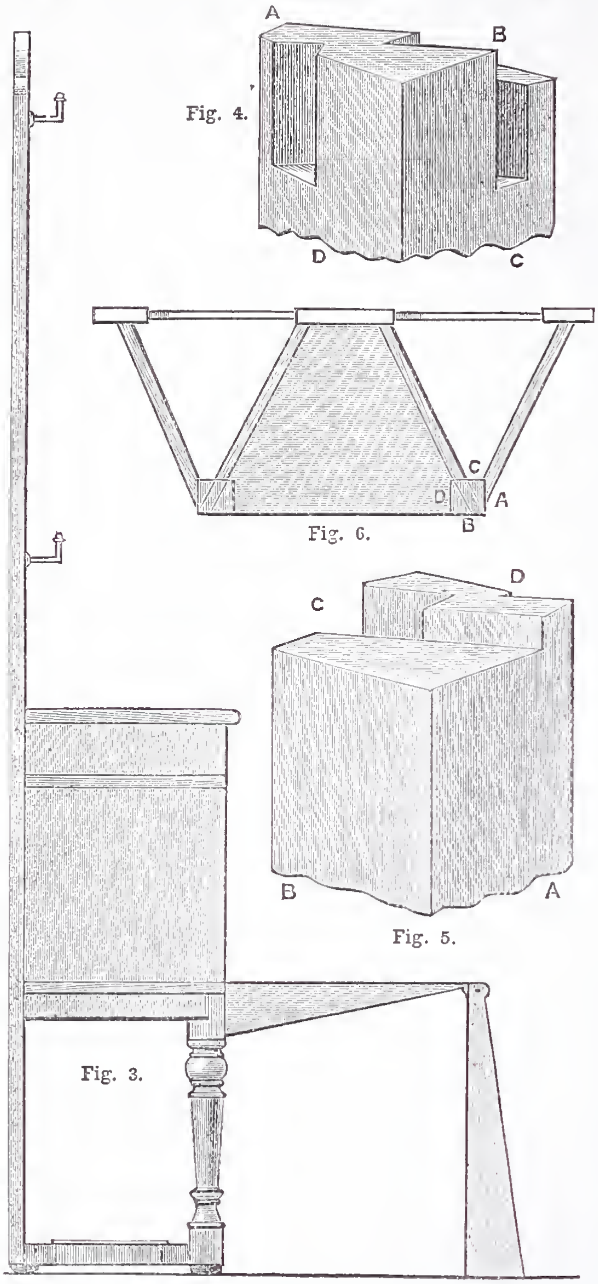


Fig. 3.—Sectional View of Stand (scale, 1 inch to 1 foot). Fig. 4.—Method of cutting Leg Blocks for Joining to Carcass: Back View. Fig. 5.—Ditto: Front View. Fig. 6.—Plan of Stand (1 in. scale). Letters in Figs. 4, 5, 6 show correspondence of Parts.

There are several wives who can testify to the exhaustion of their patience and good humour by the entrance into the parlour of their husbands with wet and muddy boots, after a day spent, perhaps, in travelling about the dirty streets in rainy weather. With a hall-stand after this style, there is little doubt that these petty but not unreasonable quarrels would arise, as, having a seat attached to it, the husband could take off his dirty boots and place them in the cupboard, and put on his slippers, which should be at hand in the same cupboard. "But," I fancy I hear one of the before-mentioned husbands murmuring, "I always like, and always have, my slippers nice and warm." That may be so; but still one cannot always combine comfort with convenience, and I trust that the present suggestions I have offered will not be discarded on that account.

It will, doubtless, be observed that the supports for the seat fall into position when the door is opened, so that no complaint can be lodged against the article of causing too much trouble.

The door is really a box having three sides and a lid. This will form a handy receptacle for a clothes brush or brushes, or any other small and necessary articles; and the lid need only have a small knob to facilitate opening it, as the inside shelf, or—if made without a shelf—the shape of the cupboard, will prevent it from falling down when the door is up, thus doing away with the need of a fastening. The bottom of this box projects a few inches, and, when it is down, adds a firmness to it as a seat, and with the supports will really be all that is required; but to prevent accidents that might sometimes arise from the supports slipping, I should advise some part of the back of the stand above the boxes to be fastened to the wall.

As the shape of the cupboard will prevent very much strength to be obtained by joining, I have inserted at each side of the stand, in addition to the necessary top rail, another rail, with fretwork between the two, and a shaped piece of wood beneath them, to add a solidity to it.

Of course, variations of the same suggestion could be utilised. For instance: the cupboard might be square, and have no box in front; and a straight piece at each side could be cut out and pivoted to the top in a similar manner to that shown in the present design, both pieces being connected at the bottom in precisely the same manner. But it is always advisable to give the whole of the conveniences, and leave it to the reader to modify them according to his taste and requirements. Having said thus much, I will proceed with the dimensions.

The back framing should be put together first. The centre board will be 6 ft. long and 6 in. wide; the two side rails, each 5 ft. 3 in. long and $2\frac{1}{2}$ in. wide; the bottom rail 2 ft. 1 in. long and $2\frac{1}{2}$ in. wide; and the two pieces fitting in between the centre part and side rails, each $9\frac{1}{2}$ in. long and 6 in. wide. The thickness of this framing should be about $\frac{3}{4}$ in. The centre part need not be cut for the glass, but a narrow frame with a rabbet on the inside cut for it, may be screwed on from the back of the centre piece. The glass might be 18 in. long and 4 in. wide. The shaped pediment need not consist of a moulding; a flat rail $2\frac{1}{2}$ in. wide, with a few lines along it, will answer the purpose. The length of it, measuring straight, will be about 1 ft. 9 in.

Coming to the front, the top of the cupboard will be 19 in. wide on the front, and 7 in. at the back, and $12\frac{1}{2}$ in. from back to front. The two sides will each be $13\frac{1}{2}$ in. wide, and 18 in. long; and if, as the cabinet makers say, "a good sound job" is required, the various boards should be either $\frac{5}{8}$ in. or $\frac{3}{4}$ in. thick. The length I have given for the sides of the cupboard allows for an inch or two to be joined into the pillar blocks. The shelf and the bottom of the cupboard will each be $16\frac{1}{2}$ in. wide on the front, and $4\frac{1}{2}$ in. wide at the back. The front of the brush-box will be $16\frac{1}{2}$ in. square, projecting to a distance of 3 in. or 4 in. at the bottom. Three narrow sides and a lid complete this box. This lid should not be hinged right at the back, but a few inches from it, to a narrow piece firmly joined there. The thicker the parts of this box, the better and stronger it will be when being used as a seat. At each side should be a triangular piece $\frac{3}{4}$ in. thick, with a small half-circular piece projecting at the narrow end and fastened to work on a pivot at the top. Both these rails should be united by another rail crossing them at the bottom.

One particular thing must be remembered concerning this movable part, and that is: the height to the top of the seat when down will be 18 in.; therefore the length of the supports will have to be the same, being a few inches longer than the front of the box.

Along the top of the outside of the door should be fixed a piece of wood, half-circular in section, to which the support is pivoted. When the door is opened, this support falls into position without any touching. The back of the brush-box will have to be very strongly hinged to the bottom of the cupboard; and the whole of the front will shut up *outside* the carcass. On the front the panel might be ornamented by having a little figuring incised or painted, which will add a finish to it.

The pillars should each be turned from $2\frac{1}{2}$ in. wood, and the length of each, including the blocks, will be 18 in.

The bottom board will be 2 ft. 6 in. long on the back, and 18 in. long on the front, and 12 in. wide. It should be $1\frac{1}{2}$ in. thick, and cut to admit a tin or zinc pan, which can be of any size and shape; therefore I leave it to the reader's option. Whatever shape he chooses, he will, doubtless, be able to obtain it at almost any tinsmith's; or, if not kept in stock, he will have no trouble in getting one made to order. But if he reads the instructions given lately on Soldering, etc., he will have no very great difficulty in making one himself. A rim should run round the top of each, and will be sufficient to support it in its place if made to fit accurately.

The side rails will each be $13\frac{1}{2}$ in. long and 1 in. thick. A piece of fretwork might be introduced between each pair, or even a few spindles would look well. The shaped pieces under these rails afford additional strength, and add to its appearance; and the shaped pieces at the back can claim the same advantages.

Four or six brass hat-hooks should be fastened on the front; and two smaller ones fastened one on each side to the thickness of the upright rails.

Being of a small size, I think it would be preferable if made in a dark wood or stained a dark colour.

Of course, the size of the entire article could be increased, but the sizes I have given for the seat should be carried out as nearly as possible. But it will be found that the shape of the cupboard and the position of the side rails allow for the introduction of a great number of umbrellas and walking-sticks; and that ample room for the purpose required will be found in the cupboard.

The side rails, too, instead of being quite straight, as I have shown them, could be curved; but unless the sides and top of the cupboard were curved in a similar manner, such a proceeding would spoil the symmetry of the article, upon which its appearance depends a great deal, and which I have been compelled to consider as secondary.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

PERSPECTIVE MODIFIED AND ADAPTED TO THE REQUIREMENTS OF THE SIGN-WRITER.

In the course of his every-day routine of business, the student will often have, not only to paint the various styles of perspective letters such as the examples given with this chapter, but he will also occasionally have to treat his whole subject from a perspective standpoint, and I am now going to show him how to practise for and execute this department of his work. In sign-writing we cannot, in many cases, carry out the strict rules of perspective, consequently a violation of those rules is the result; but, although we cannot follow the true laws of perspective as laid down by the writers in the various text-books on the subject, I would urge the sign-writer to make himself a complete master of the art, so that by having the various problems at his finger ends, he will readily be able to make them conform to sign-writing requirements.

Of course I am not going to attempt in these pages any instruction on the principles of perspective in general: that would require treatment as a separate subject; all I can do is to point out a few examples of sign-writers' perspective as they occur to my mind at the time of writing; but should the reader care to study the subject seriously, I can recommend a small handbook by the Rev. Henry Lewis, viz.: "The Principles of Perspective," explained and applied in a series of graduated exercises; and also the chapters on perspective for letter and sign-painters in Mr. Davidson's work, "House-Painting and Sign-writing." Those who followed my advice in the earlier chapters of this series, and made themselves a black-board—and I know there are many who have done so, from letters received—will be able to work out the various problems and practise the various letters with the greatest facility.

Most writers, I am bound to say, have but a very crude knowledge of perspective: just sufficient, in fact, to enable them to carry out their designs with a passable amount of truth; but occasionally we see a glaring slip, either through want of knowledge of or a wrong conception of the proper application of perspective lines to the purpose in view. Certainly, a little knowledge of this subject is better than none at all, but what little the student does learn he should take care to be perfect and correct in, and he then may get on fairly well. The best sign-writers use as few lines as possible in order to give themselves freedom of action and plenty of scope in carrying out their designs. The beginner should follow the same course, otherwise he will be considerably hampered in his movements, and an awkward stilted job the result. Both linear and aërial perspective may be applied to sign-writing, and with plenty of practice on the blackboard the student may become so proficient and expert as to be able to entirely dispense with the various complicated lines in putting letters in perspective on the sign, trusting to the educated eye alone. A difficult arrangement or design for a sign executed in perspective should always be drawn out in true perspective on paper, and to scale. This work is best done at home, where everything for use is at hand, including mathematical instruments, squares, and drawing board. When finished in this way, the workman may transfer his design in its enlarged form to the signboard, converting or adapting the perspective as the height and position of the signboard may require.

In sign-writing, as in picture-drawing, there is but one point of sight and one horizontal line for each line of letters. Now, only the other day I saw, in London above all places, a perspective sign which contained at least three points of sight, which is of course absurd, as the spectator can only be at one point at one and the same time, and cannot see the first row of letters from one point of view and the second row from another point all at once, yet the sign-writer in this instance must have thought so. In lettering of this description all the top and bottom lines must incline to one vanishing point, such point being situated on the horizontal line, which I will explain by the aid of a diagram (Fig. 61).

We will take an oblong piece of paper, and for simplicity draw the horizontal line right across the centre, from A to A. The vanishing point is next decided upon, and in this case it is at B, and in the case of raised or shaded letters there must necessarily be another vanishing point on the left, as the lines of the thicknesses run in an opposite direction. This point is at C. This second point has nothing to do with the actual body of the letters, and is only called into use for the shading, so it does not contradict the statement just made. The next thing is to decide upon the height of the first letter on the left, and having drawn this in, we strike two lines, D, D, from the top and bottom, respectively to the vanishing point, B, and between these two lines the letters must be kept. On referring to the diagram, it will be seen that the letters not only diminish in height but also in breadth as they recede towards the vanishing point, B. The outline of the thickness for each letter must retire towards the point C, as shown by the dotted lines. In Fig. 65 is given a specimen of work treated in the way just described: this is for an advertising sign over an office, but a much more effective way of treating a perspective subject of this class is by the method shown at Fig. 62. For some descriptions of work this way of treating a sign is superb, and it makes a most attractive and catching advertisement. In Fig. 64 we have an instance of the point of sight being in the centre of the board at A, and a vanishing point on either side at B, B. There being seven letters in the name *Higgins*, the second *g* is consequently the middle letter, and the size of this being determined upon, it is drawn exactly in the centre of the board, and the vanishing lines drawn on each side accordingly. A short sign, rendered necessary by cramped space, is a good subject upon which to apply this method, and it is made more showy and complete by the addition of an oval border. It is, I am aware, a very difficult proceeding to strike perspective lines on a signboard, when the vanishing points are situate some distance outside the margin of the sign—and in a great many cases it would be impossible to do so—but there is a method of transferring perspective lines from a scale drawing on to a larger surface, which is both easy and accurate. I have used this plan for some years in scene-painting, and although I have never done so, feel sure it could be put

A B C D E F G H I J K L
M N O P Q R S T U V W
X Y Z

Fig. 56.—Italic Alphabet: Capitals.

a b c d e f g h i j k l m n o p
q r s t u v w x y z

Fig. 57.—Italic Alphabet: Small Letters.

A B C D E F G H I J
K L M N O P Q R S T
U V W X Y Z

Fig. 58.—Egyptian Alphabet: Capitals.

to the same use in lettering, with a slight modification. It is with deep regret I cannot lay this plan before my readers, as I feel it would prove of immense use to all sign-writers, old and young; but as it would take much space to describe, and require two rather large diagrams, I can only say I may incorporate the subject in a separate article at some future date. Referring back to the point of sight, I should remind the student that in raised and shaded letters, this point is generally on the extreme right of the sign, and for this reason: By standing opposite the centre letter on a signboard, consisting of wooden projecting letters tacked on to the board, it will be noticed, on referring to Fig. 63, that we can only see the front surface of the centre letter, and not the sides; in the letters to the right we see only the front and left side of the letter, and in the letters to the left of the centre the front and right side of

Fig. 59.—Perspective Egyptian Alphabet: Capitals and Numerals.

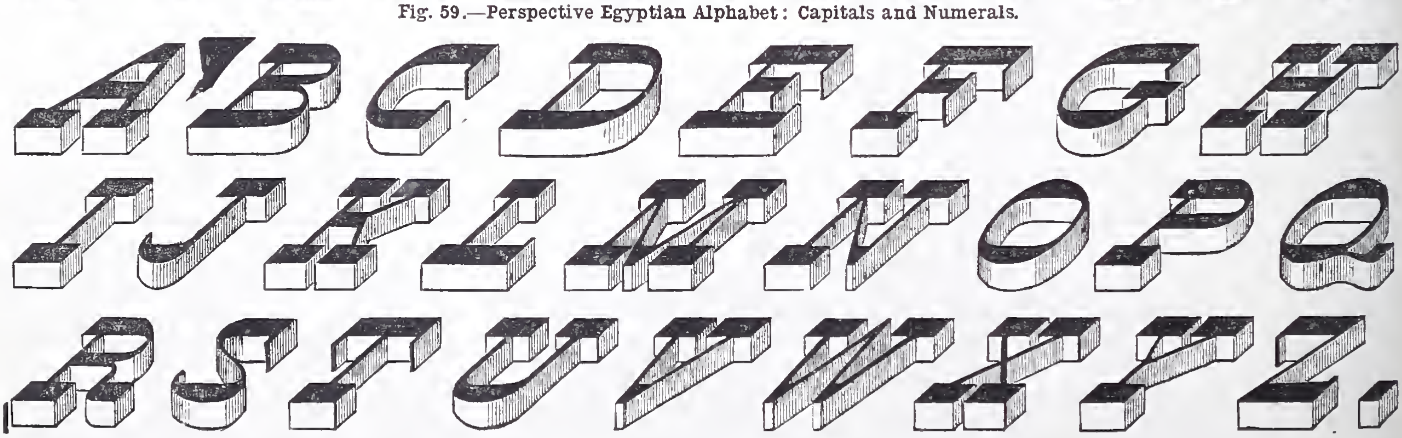


Fig. 60.—Perspective Italian Alphabet.

such letters. Now, this is of course perfectly true perspective, but we never see it, nor follow such a rule in lettering. If, however, we stand to the left of the sign, we at once catch all the left-hand edges, and if we go to the extreme right we see the right-hand thicknesses. This also is correct perspective, the point of sight being in the first case to the left and in the second to the right; we cannot have this point in the centre, but we may have it right or left, and the former is the one most general in use. But even here the sign-writer cannot follow the rules of true perspective in shading and raising his letters, for if, in this work—in contradistinction to the drawing of the body of letters in perspective, as described earlier in this chapter—he made use of one vanishing point only, which in this case would be the seat of the eye, situated much below the row of letters, and also in the first place arranged the thickness of the first or nearest letter, to slant off at an angle of 45°, arranging his vanishing point accordingly, and struck the perspective lines for the thickness of each letter, from this point, he would find each thickness, being a greater distance away than the preceding one, would have a greater angle, or become more oblique in each case; and moreover, if the letters were strictly drawn, the thicknesses or edges should be made narrower. It, therefore, follows that we cannot carry out this method on a signboard, as although perfectly correct for other art purposes, it would in this case entirely destroy the symmetrical appearance of the sign. The general practice, therefore, is to have a fresh vanishing point for each thickness, which in effect means that most sign-writers draw all their receding lines in shadows and thicknesses at an angle of 45°. A good practical man can do this with the eye alone, but I should advise the beginner to make use of a set-square for the purpose, as nothing looks worse or spoils a job quicker than badly shaded letters: nothing, in fact, puts a really perfect letter out of the perpendicular or gives it a tumble-down appearance more than a wrong raising or thickness, from a modified perspective standpoint. It should therefore be remembered that although each letter on the same line is blocked on perspective principles, these perspective lines are only applicable to each separate letter in the row.

Although blocked or raised letters must therefore of necessity be treated upon perspective lines, it may to a great extent be left to the writer's discretion as to what angle of perspective he uses for different sets of alphabets, but he must take care that all letters on the same line have the same angle or inclination. Most writers find the ordinary set-square with an angle of 45° to be the most useful for setting out the proper inclination of the thicknesses, and if the student will put the set-square on the top line of each row of letters with the slanting edge downwards, and just touch the top corner of the letters, he will get the best of perspective lines for his purpose, and if he then moves the set-square along so that it touches each corner in succession, he will get every part of the block on the same inclination of perspective. Mr. Wm. Sutherland recommends this plan as the best possible way for the student to educate both the eye and the hand, and upon this subject there can be no greater authority than this veteran in the decorative arts, who wrote upon sign-writing over forty years ago, and whose latest work, "The Art and Craft of Sign-writing," is now looked upon as the standard work upon the subject by the whole of the profession.

I have necessarily only touched upon a few simple questions in this chapter on perspective; to do so in a thorough and

Fig. 61.—Simple Method of Drawing Letters in Perspective.

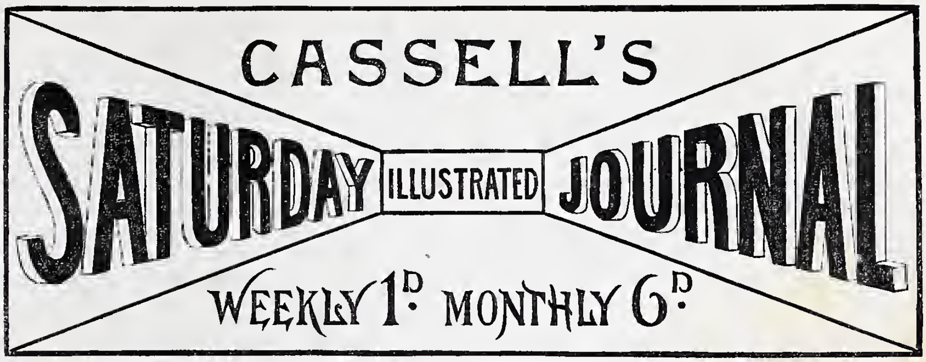


Fig. 62.—Simple Example of Perspective Treatment for a Sign or Advertising Board.

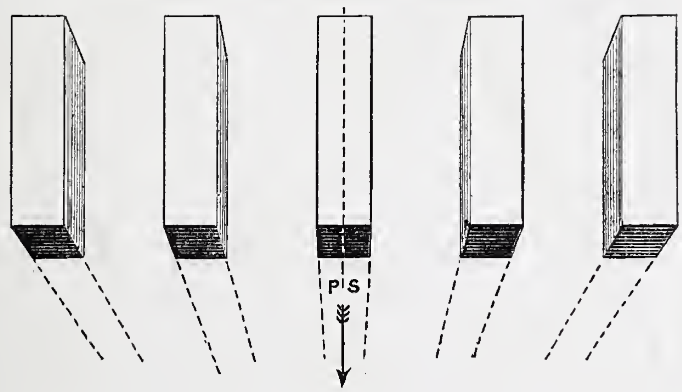


Fig. 63.—Perspective Lettering with Point of Sight in Centre. Fig. 64.—Letter I in Blocked Letters and its Variations of Perspective as viewed from Point of Sight in Centre as it recedes from that Point, showing impossibility of following the Strict Rules of Perspective in Sign-writing.

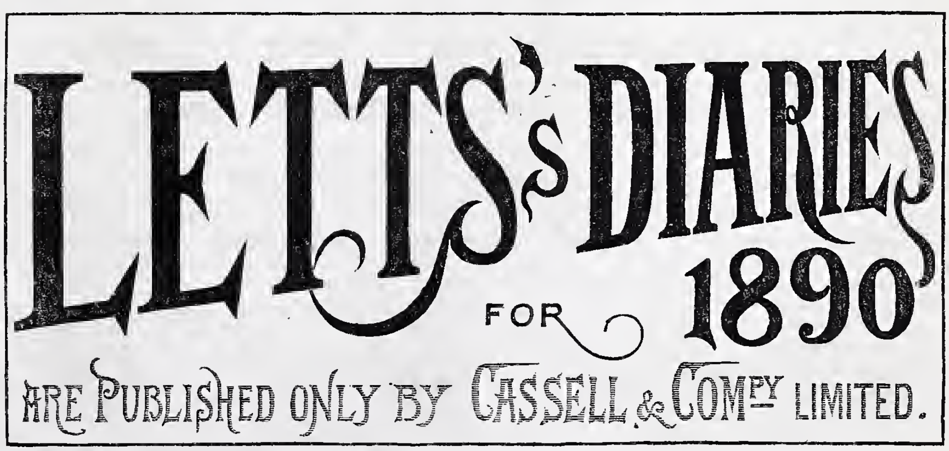


Fig. 65.—Treatment of Advertising Sign, etc., in Perspective, to be written in Black and Gold.

complete manner would be impossible with the limited and valuable space at my command, but my readers can find more advanced matter in the book mentioned above. In my next chapter on light and shade, my readers shall have the benefit of some portion of this gentleman's ideas, as far as I am able to express them in writing. I give with this chapter Italic and Egyptian alphabets and two complete perspective alphabets (Figs. 56-60), in accordance with the wish of several correspondents, which will, no doubt, prove of value in actual practice.

SOMETHING MORE ABOUT TAKING OUT A PATENT.

BY A CONSULTING ENGINEER.

[*⁎* The following has been sent to us by a Consulting Engineer of high standing and wide experience, and will be valuable to all who are interested in this subject, as it deals with certain aspects of "Taking Out a Patent" which were left untouched or nearly so in the previous paper under this title.—THE EDITOR.]

POPULAR IGNORANCE IN REGARD TO PATENTS—GRANT OF A PATENT NO PROOF THAT IT IS A PROPERTY—WHERE THE VALIDITY OF A PATENT IS ASCERTAINED—A SOUND AND VALID PATENT A VALUABLE PROPERTY—INVALIDITY ONLY DISCOVERED AT A LATER PERIOD—LEGAL OPINION OF A LEGAL WRITER ON SPECIFICATION—ANY ONE MAY PREPARE AND LODGE HIS SPECIFICATION—IMPORTANT POINTS UNKNOWN TO OR NEGLECTED BY SUCH—"UNPROFESSIONAL" AGENTS—DANGERS OF SUCH—ABSOLUTE NECESSITY FOR A CAREFUL SEARCH AS TO NOVELTY, AFTER SPECIFICATION IS PREPARED BUT BEFORE LODGING THE SAME, AND WHY—ILLUSTRATION OF COSTLY RESULTS OF NEGLECT OF THIS COURSE—GREAT INJURY DONE TO PATENT PROPERTY BY NEGLECT OF PROPER PRECAUTIONS AND THE WORK BEING DONE BY UNQUALIFIED PERSONS—IMMENSE AMOUNT OF VALUABLE PROPERTY AND MONEY WASTED—COST OF PATENTS INCREASED UNDER NEW LAW—HOW AND WHY—A USELESS AND INSUFFICIENT PATENT DEAR AT ANY PRICE—KNOWLEDGE, EXPERIENCE, SKILL, AND ABILITY SHOULD BE PAID FOR IN PATENT AS IN OTHER WORK—"CHEAP AND NASTY."

AMONGST the many popular fallacies of the present day, and one that is too often the cause of injury to the practitioner, and a great nuisance to other people, is the prevalent idea that *when* an "inventor" has contrived to get his "invention" accepted at the Patent Office, and obtained the grant and seal, he has *therefore* got a valuable *property!* The article of "C. C. C." in WORK, of Nov. 16, 1889, will evidently tend to perpetuate this fallacy, inasmuch as it omits to notice the principal and most important points relating to a patent; and would, without the admission of the writer, show to any man of practical experience and knowledge of the subject, that it could only have emanated from an "unprofessional patent agent," or a mere amateur, and is a good illustration of the truth of the old saying, that "a little knowledge is a dangerous thing," more especially when he illustrates his peculiar and profound knowledge of patent matters by telling us, that "if we require protection for the Colonies, as well as Great Britain, it will be marked A1." If this *were* true, it would be A1 indeed! It would have been thought, and expected, that, in these days of general and gratuitous information, and extensive and general setting forth of individual abilities as competent instructors of an unenlightened public, it would have been known that *each* colony of Great Britain has *its own Patent Laws*, entirely *independent* of the Mother Country, and *each* requires its own special treatment. Truly it may be said that the class the poet speaks of as not hesitating to do what angels fear is not yet extinct.

Now, it should never be forgotten that, in granting a patent in Great Britain, the Government does *not* in *any way* assume *any responsibility*, or *guarantee* the *validity* of the patent; this it throws on the applicant, who is presumed *before* he makes his application to know *exactly what he wants or requires*, to have *ascertained exactly what he may apply for*, to have made *suitable investigation* to have *decided this point*, and found whether his idea or plan is *anticipated*, and *how*, and to *what extent* he must *modify* them so as to prevent his patent from being *valueless*, and enable him to shape his demands, and *properly* to describe, illustrate, and secure that which he is entitled to, and to have had his title, specification, description, drawings, and claims, so *properly* and *fully* prepared, with *all* necessary points *so clearly explained and defined*, that when he has got the patent, he has *then* acquired a property.

The value and validity of a patent can only be ascertained and proved at a *later* period, if it has not been clearly ascertained before, either by the discovery that some other person has a *prior* claim to the "invention," that it has been *already published*, or that the *incorrect* or *insufficient* preparation of the title, specification, drawings, or claims, prevents it standing the test at the Law Courts, or else that the specification, etc., of the patent have *not* been made to cover the *most important parts* in the "invention."

A sound and valid patent for a really useful and practicable invention, when *well* considered, described, and illustrated, is of the greatest value, and an inventor should spare neither *time, trouble*, nor *expense* to obtain such; and if he has any confidence in his plan will most certainly do so, seeing that they are the title-deeds of what may prove to be a most valuable property. If a man purchase an estate, a house, or other property, he is generally extremely careful to have all the papers and documents prepared and examined with the greatest skill and care; but in the case of Letters Patent, this does not seem to be thought of, although they are in reality the title-deeds to prove his right to the invention, which make it a property, define its limits, explain its powers, and enable him to resist successfully any encroachments on his property or his rights.

It should never be forgotten that the discovery of the advantages which would have resulted from doing things in a *proper manner at the first*, is only obtained when the patent is *lost*, or its utility so damaged that it becomes virtually useless, and that *no expenditure at a later period*, unless only *a portion* of his invention may be wrong, when a disclaimer may be entered, can compensate for this deficiency at the commencement.

To show that this is true, and also how carefully such matters require to be done, inventors, "unprofessional patent agents," amateurs, law writers, law stationers, copying clerks, and the motley host of such as consider themselves quite qualified to advise on inventions, and prepare the documents, drawings, etc., should carefully bear in mind what a writer on the law of patents (Mr. C. Drewry, barrister-at-law) has said on this subject. "The most difficult perhaps of all legal documents to prepare is a specification of a patent; and for this reason, that it fulfils a *double* function. It is an explanatory direction to *workmen*, which must be couched in *language intelligible to them*, and sufficient to teach them *how* to produce the patented thing. It is *also* a document supporting *legal title*, and *as such* is subject to the same rules of construction of the language as are applied to any legal instrument."

It is quite true, as "C. C. C." states, that "any inventor who can express himself intelligibly in pen and ink, and can make a mechanical drawing, or who has a friend who can help in either or both ways, may get his patent without the intervention of an 'acknowledged agent,' and *secure* (?) his rights without running into any unnecessary or unknown expenditure," and *if* an inventor *did* or *could* do so, then no one would do wrong in following this course; but before doing so, he should carefully bear in mind that in law a specification is held to be *bad*. 1. If its *terms* are *ambiguous*. 2. If *necessary* descriptions are *omitted*. 3. If *parts* claimed are *not original*. 4. If things are inserted to *mislead*. 5. If the drawings are *imperfect* or *incorrect*. 6. If *one* of *different* ways or of different *ingredients* named *fails*. 7. If the *things* and *mode* described are *not the best known to the patentee*. 8. If the *old* parts are not *properly distinguished* from the *new*. 9. If the claims are *too wide* and not sufficiently explicit.

All these points, it must be remembered, are *not* decided by the employés at the Patent Office, but are considered and settled by *lawyers* who have to regard things in the manner described by Mr. Drewry, and here, and here only, the rights of an inventor, the value of his property and what he is entitled to, are inexorably defined and decided. From this it will be seen how little the results of the labours of "C. C. C."—whilst acting "in the capacity of agent, none of his work as such has failed, and he believes he has been successful chiefly because in his specifications and drawings he has kept in view the primary and fundamental objects of the patent laws," in getting the papers through the Patent Office—can influence in any degree the results of the ordeal such have to pass through under the rigorous sifting of the Law Courts. *When* he can produce *one* patent of which he has prepared the specification, drawings, etc., that shall have passed unscathed through this, *then* he may boast of being "successful," and of his understanding of the "primary and fundamental objects of the patent laws."

It is an imperative necessity for any one desiring to obtain a sound and valid patent, and to obtain a property therein, *after*, in the words of "C. C. C.," he has "decided on the most fitting title," and whether we are to speak of it as an "invention" or an "improvement," to "sit quietly down with a sheet of paper before us, and as simply, straightforwardly, and clearly as we can, draw up a description of it. If it will admit of such aids to verbal description, we should make rough drawings as we go on, marking them and our manuscript with letters, so as to render reference easy. While thus engaged, we should bear in mind the rule already laid down—that the object of our description and descriptive drawings is to so explain our invention that, from them alone, any person may, at any future time, be able to make the article, or to perform the process which we are describing. If we do this, we do all that the Patent Office requires of us. The most experienced agent can do no more;" he should *at once*, as he will *then* be in the position to do so, institute a most *careful* and *analytical* search through all the specifications *relating to the subject*, in order to ascertain how far his invention or improvement is novel, and how far it is not novel, so that he may protect himself and define and obtain his rights by lodging *proper documents*. If he *fail in doing this*, all the acceptances at the Patent Office, all the grants of a patent, will *not* create a *property* if he fails in this respect, as it will, undoubtedly, do in ninety-nine cases out of a hundred—and more especially when manipulated in the manner, and on the lines, laid down by an "unprofessional" agent.

Some few years since, an attempt was made to float a company to purchase a French "invention" for propelling tram cars by means of compressed air passed through a vessel of hot water just before it entered the cylinders, so that it became heated and expanded thereby; but, though a fabulous sum was to be given to the Frenchman for his "invention," and all stamps were paid for the whole term of the patent, *no search as to novelty was made;* but an "eminent" engineer, who was, evidently, profoundly ignorant of what had been done before in this direction, was mightily struck by it, and reported it as being one of the greatest inventions of modern times!

A short time after, the company was brought out, and prospectuses issued, but, in a few days, it was satisfactorily proved that this so-called "invention" of the Frenchman had been patented by an Englishman so far back as 1797 and 1801, and also by others at later dates, but *all long before* the Frenchman; consequently, the whole thing fell through, leaving the promoters, financiers, and the "eminent" engineer on the *wrong side* of several thousand pounds, with the chance of becoming wiser men for the future; but, whether they have, or will, use the chance, has not been ascertained.

Few persons can know how seriously the value of patent property has been, and is being, injured through "intelligent inventors," sometimes aided by "unprofessional" agents, or law stationers, or law writers, and copying clerks, preparing their own specifications, etc. The host of individuals of the above description who are ready, and push themselves forward as prepared, for the smallest consideration, to act the part of scientific mentors to "intelligent" and other inventors, and aid "unprofessional" agents, evidently, as well as the rest, participate, in most cases, in the popular belief that "anybody" can prepare a specification, and so create a property, and "everybody" is capable of advising thereon; and that if, after a little trouble, the papers are accepted at the Patent Office, all is right, and a great success at once achieved.

Where capitalists were once only too glad to invest in patent property as a safe and profitable proceeding, but few now will look at one, most having a just and wholesome dread of such articles, especially since we are flooded with the mass of "home manufacture," or the outcome of the transcendental abilities of "intelligent inventors," "unprofessional" agents, law stationers, law writers, copying clerks, etc., knowing full well that getting the papers through the Patent Office is *not* the *slightest proof* of the value of the property, nor a guarantee that it will pass through a trial at law.

Intending patentees should be extremely careful not to fall into the hands of the extensive fraternity who profess to obtain a patent for a *fixed sum before even they have seen the subject, know the mode, or what is proposed or requires to be done*, and have no idea beforehand of anything relating to the matter! A moment's reflection should satisfy any one of ordinary intelligence that such offers are about on a par with the benefits to be derived from falling into the clutches of those amiable and philanthropic individuals who offer pecuniary accommodation *without any security!*

An inventor, if he *really* has a good thing that is worth anything at all, will rarely fail in being able to find a reputable and respectable practitioner who will arrange terms with him for carrying out his wishes in a proper manner, and at a fair remuneration for his services; but, as every labourer is worthy of his hire, and few men of ability and experience work for the advantage of other people and their benefit, simply for amusement, it is only right that they should receive a *fair* return for their skill, experience, and labour.

It would, no doubt, astonish "unprofessional" agents and "intelligent" inventors if they could see, at one view, the immense amounts of valuable property and money that have been *lost* and *wasted* entirely through the absurd proceedings in regard to taking patents that have existed and still exist, far too generally, in the mind of the average public, "intelligent" inventors not excepted.

That there are incompetent and unprincipled parties occupying themselves about taking patents is well known, and too many "intelligent" inventors have been victimised by such; but a better means of maintaining and increasing the breed cannot be devised than that of considering that the work of a mechanic should not receive higher pay than that of the labourer; hence it will be found that there will be only labourers to do the work, and the value of the work done will be nearly equal to the amount expended in obtaining it.

So far as the *cost* and *labour* required in obtaining a patent goes, under the new law, instead of being *reduced*, experience shows that they are really *increased*, inasmuch as the waste of time encountered in combating and removing the "objections"—too often absurd and frivolous; the "suggestions" far too often impracticable; and the "improvements" in nine cases out of ten of anything but this kind—proposed to be made by the employés in the office must be paid for, or else the person undertaking the work must be at the loss; whereas, under the old law, it was *not* the province of the law officers to occupy themselves with anything of the kind. In fact, except in the reduction of the stamps, inventors, patentees, and those engaged in preparing the documents, drawings, etc., were far better off, inasmuch as they knew *what* they had to do; *how* to do it, and *did* it; whereas, now, it is extremely difficult—if not impossible—to know or foresee anything, or to work to any established precedent; in fact, we have seen by experience that apparently the best qualification for employment in the Patent Office is the least possible acquaintance with, if not a total ignorance of, all matters relating to patents and the kind of work that has to be performed.

It has well been asked, "Of what good is a 'patent' which does not fulfil what should be the chief object to be secured by obtaining one, however 'cheaply' or at a 'low-priced' rate it may have been obtained, and the specification drawings, etc., have been got through?"

Do "inventors" and "intending patentees" ever give this point a moment's consideration, or ever remember the results of being one's own lawyer? "Cheap and nasty," most truly applies here.

"Cheap and nasty" is an old and true saying, but is a very expensive amusement when it is patent property that is played with. How much ought I to pay to secure the services of a proper person to create me a property in my invention? should be the ruling principle of an inventor; *not* where can I get my papers put through "cheapest," or at the *lowest* price. Practical knowledge, skill, and ability ought to be worth more than the labour of a copying clerk or law writer, which requires no brains, but merely aptitude in copying what is put before them.

OUR PRIZE BOOKCASES.

I.—A Hanging Bookcase.

For which the First Prize was Awarded.

Before giving a description of how to make the above, I think it would be advisable to say a few words about the kind of wood that is most suitable; and as the cost of wood in this particular case is not of so much importance as the labour, I take this early opportunity of impressing upon my readers the desirability of using only the *very* best of stuff. It will be found for this class of work that the best material is always the cheapest in the end. For, if only one piece of stuff has to be thrown out on account of some defect after the time and labour have been spent on marking, sawing, planing, and setting out, it would most likely be found that it would have been cheaper to have given a penny or so a foot more for the wood in the first place, to say nothing of the delay. Where is the joiner or cabinet maker who has not, at some time or another, persuaded himself that a dead knot or shake would be either worked out, or come at the back, or that a bad edge would be rebated out, etc., in the working? and, at the last moment, when he had hoped to get his work glued up before knocking off, found that the knot did not come in the tenon, but right across the shoulder; or that the shake was just in the mortise; or, for some unaccountable reason, the sap was on the edge that was most seen, or that the bad edge was *all but* worked out by the moulding. And what is the result? let a piece in, and if it is hard wood the chances are that although it is cut out of the same piece of wood as the defective piece, it will come out a different colour when polished. One then sees the artistic polisher—with some mysterious compound in a receptacle concocted out of a piece of old glasspaper—endeavouring to match it by painting, but it is very seldom that it is matched properly. And the alternative is to get out a fresh piece, which means that it must be set out quite separately, after which it is found that the mortise-gauge, plough, fillister, etc., as the case may be, has just been shifted. Take my advice, use good stuff.

Now for a few precautions, tips, etc.

If it is made in walnut, oak, mahogany, or any hard wood and polished, be sure to have the spindles, finials, brackets, gallery rails, mouldings, etc., in fact everything possible, at least bodied up by the polisher before gluing up: should it be made in walnut, it would be better if it were dull, or fine polished.

If made in pine or American whitewood, stained, polished, or varnished, do as much staining, polishing, or varnishing, as you possibly can before gluing up.

It is also very necessary to take great

care that there is no glue left on any of the joints, mitres, etc. It is better to put the glue on very carefully than to have to clean it off after it is dry, which is not only rather troublesome, but very often far from satisfactory, especially where there are many internal mitres. It will be found easier to wash any superfluous glue off before it is dry with a clean piece of sponge, dipped in hot water and wiped thoroughly dry, making sure to get rid of all signs of glue or glue water, or size; the act of washing off the thick glue with water very often causes a coating of size round the joint, and wherever there is a trace of this, the stain, etc., will not take properly. This washing may very likely raise the grain of the wood, but a few rubs with a piece of fine glasspaper will soon put it all right. In working reeds, mouldings, etc., with a scratch, or router, especially in soft wood, it is a very good plan to damp the reeds, etc., after first working, which will cause the grain to swell; and when it is dry they can be papered down. This to a great extent anticipates the action of the stain, and the rubbing down can be done much more readily and with better effect before the work is glued up. If it is decided to varnish it after staining, give the work two coats of patent size, rubbing down between each coat with a piece of soft rag or brown paper (it is better not to use glasspaper after the wood is stained if it can be possibly avoided), and varnish with flatting varnish, for stained work of this description looks common if finished with a glossy surface.

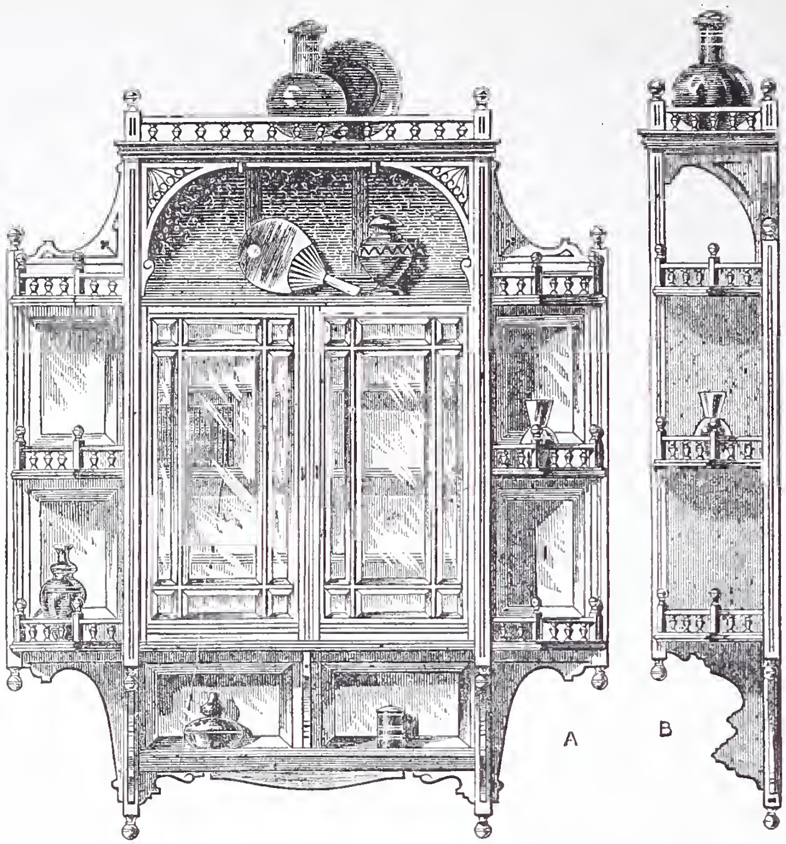


Fig. 1.—Prize Design for a Hanging Bookcase, to contain Two Hundred and Eight Volumes of "Cassell's National Library"—A, Front Elevation; B, Side Elevation ($\frac{3}{4}$ Scale).

On no account use sappy wood, for it is generally found to come out very bad when stained.

As American whitewood is very nearly the same price as best pine, it would be better to use it for stained work, being not only harder than pine, but more adapted for fine work; and it, moreover, takes any stain beautifully.

A cheaper way of finishing it would be to enamel or paint it in suitable colours, on account of the advantage of being able to use up any odd piece of stuff, either hard or soft, provided it is sound. But again let me say, do all you can before gluing up.

I hope the above precautions will not be considered out of place; for it is just these little things that go to make or mar a job.

Whichever wood was used, it should be cut off as soon as possible, and stood about to dry, even if it has been cut some time.

Let us now suppose it has been decided to make it in pine. The first and most important thing to do is to take two pieces of thin stuff, and plane up one side and one edge of each; chalk all over the planed sides, and glasspaper across the grain; and after dusting off any chalk, etc., that remains, set out on one the full-sized section marked height section on drawing, and the one marked width section on the other. These are called the rods.

To some, this may seem unnecessary labour, but I can assure you it is not, as will be seen as we go on.

Now, with the rods in front of you, mark off on a piece of paper every piece of stuff you require; clear the bench, keeping the rods ready for reference, and mark and cut out everything. If you take a shaving off all sides and edges before standing the pieces down, it will enable the air to get at the stuff better than if it were left rough; and the longer it stands about the better. This is the reason that I say, cut all the pieces out before doing anything else.

The next thing to do, is to properly plane and get out of winding one face of every piece, taking care that the edges or faces that have to have mouldings or rebates worked out of them are the best; and that the grain runs the way you wish to work the mouldings. Now square one edge, and put what is termed a tried-up mark on the face, as in Fig. 2.

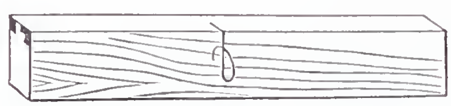


Fig. 2.—Wood for Moulding with "Tried-up" Mark on Face.

You cannot possibly get the grain always to work as you want it, but a great deal can be done with a little care.

Then again, if you get it to work right for moulding and rebating, the chances are very much against its being right for reeding. But, as it happens in this case that you can reed from either edge, seeing that the reeds are parallel to the edges and the stuff is gauged to a width, and not too wide to allow the scratch to work, it would be better to make provision for the moulding, as that can only be stuck one way. Great care should be taken that the above tried-up mark is put on every piece of stuff as it is tried up; for it not only indicates which side has been got straight and true, but shows on which edge you originally intended to work the moulding, and it is from this tried-up side that all squaring, gauging, moulding, etc., is done.

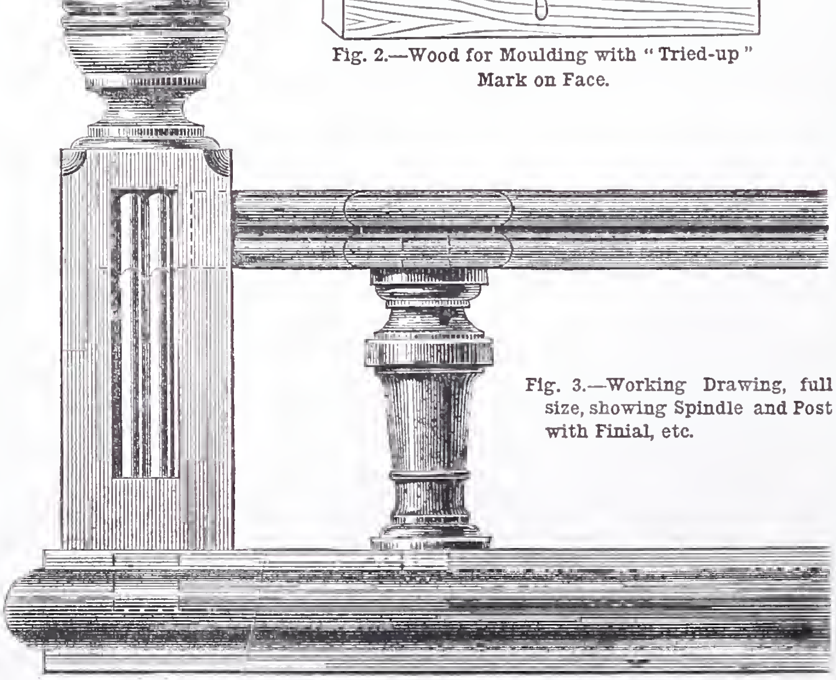


Fig. 3.—Working Drawing, full size, showing Spindle and Post with Finial, etc.

Now carefully examine the rods, and if they have been set out properly, they will at once show the exact section of nearly every piece. We now proceed to gauge the widths of the various pieces: let us take the width rod first; this will give the exact widths of all the uprights, styles, columns, posts, etc.; next follow with the height rod, and this gives the exact section of shelves, rails,

e. Each piece should be marked as it is g ıged, for instance, top rail of door—style o false back—f nt columns, e ,etc.; of course t se marks may b as brief as is c isistent with c ırness.

The front c umns, and the p ts marked A i Fig. 7, should n v be gauged to t exact thick-n ss; and, as they a square, they s ıuld be gauged v h the same g uge as the v lth before it is s fted. The small c ner posts can l got out in any l gths, and cut ı afterwards. 'is remark also a plies to the p ces for the s ndles, gallery ı ls, and termi-ı ls, or finials, at t top and bot-t n of columns. 'e shelves, up-ı hts, brackets, s les, rails, and l rs of doors, p nels, rails and ı llions, etc., of t se back should w be thick-ssed. The back umns and rails th the brackets, shown in Fig. need not be icknessed; for, they go against e wall, no pur-se would be rved.

We will now ke it for granted at every piece quisite has been auged and arked. The indles, termi-ıls, and corner sts, may now e set out and nt to the turner, e brackets sent the fret cutter d carver; for, though it is ery nice to do verything one's self, there appears to be such a great deal to do in a job of this kind, that have often noticed the interest seems to flag. This, of course, does not apply to every case. If one has a lathe and can use it, by all means do the turning at home; and again, if you possess a fret saw, the same remark holds good for the brackets. I should certainly not advise any one to cut them out with a bow saw, and spend a day in cleaning up, when the fret cutter would cut them beautifully for a few pence, and a rub or two here and there with a piece of glasspaper is all that is required.

Now set out the back, the half of which is shown in Fig. 5. This is done by laying the various pieces on the rods directly over their places, and marking the widths, etc., of the pieces that intersect them.

Next, with a mortise-gauge, gauge for tenoning and mortising the rails into the uprights, etc., but do not mortise right through the uprights. The tenons can be held in their places by screws put in from the back. The rails, C C, should run right through, having the pieces cut out as shown, and halved on to the uprights. This will greatly assist in strengthening the back until the front part is glued on. Before cutting the shoulders, work the mouldings and reeds, stopping the latter where shown. The moulding on the uprights marked D, Fig. 5, had better be planted on (that is got out separately, and glued and bradded in their place). Bore all the screw holes for screwing on the shelves, brackets, etc., likewise the tops and bottoms of uprights to take the pins of terminals. The shoulders can now be cut, and the whole thing fitted together. After comparing

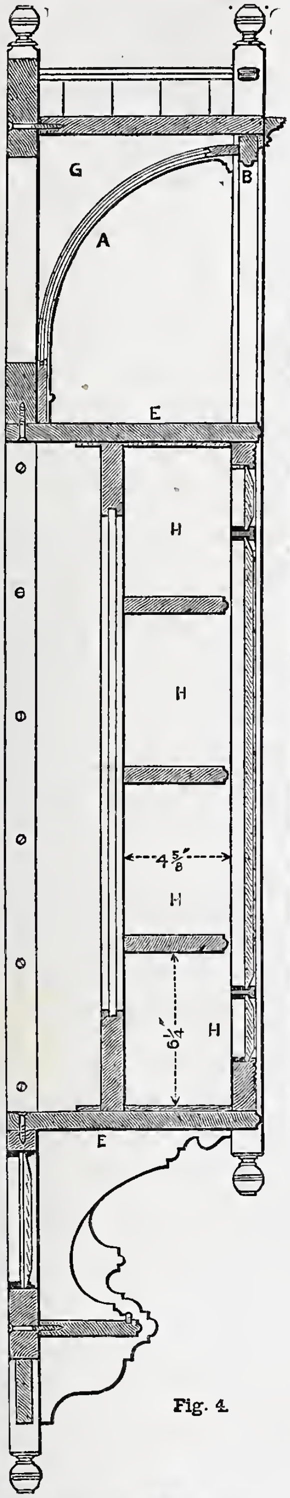


Fig. 4.

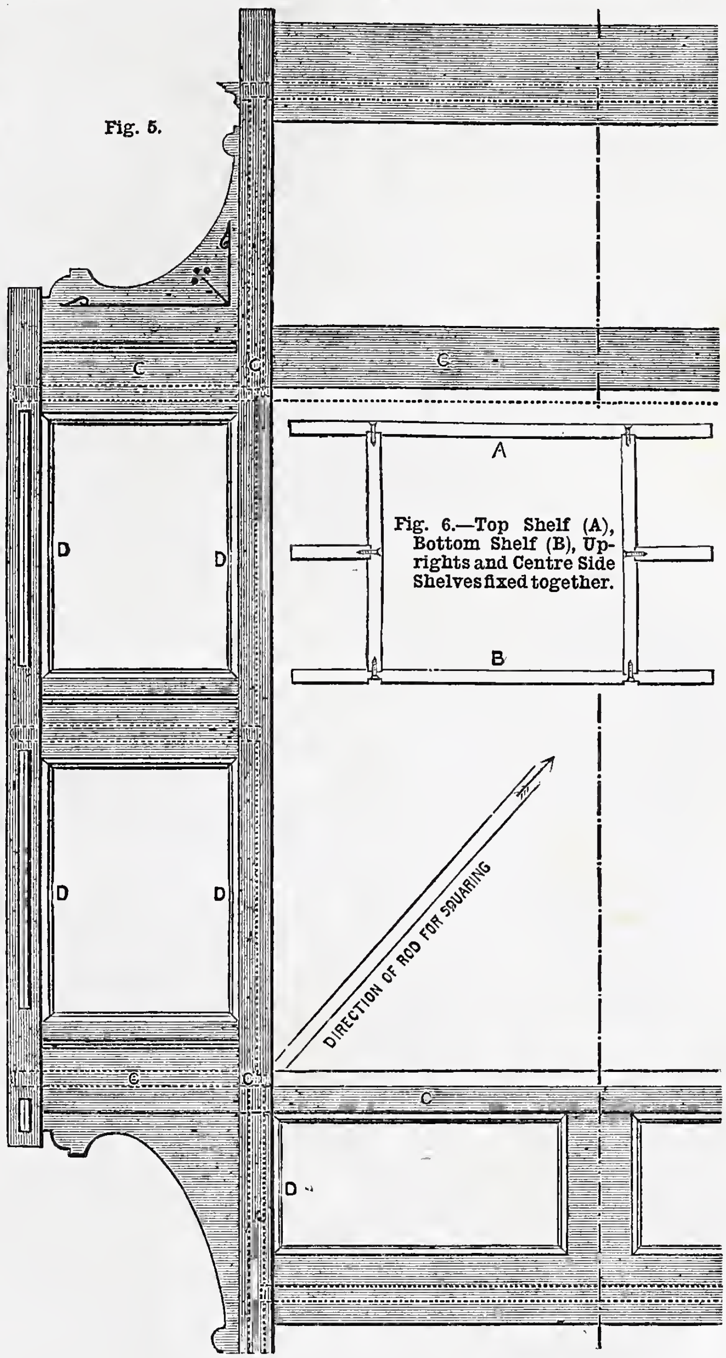
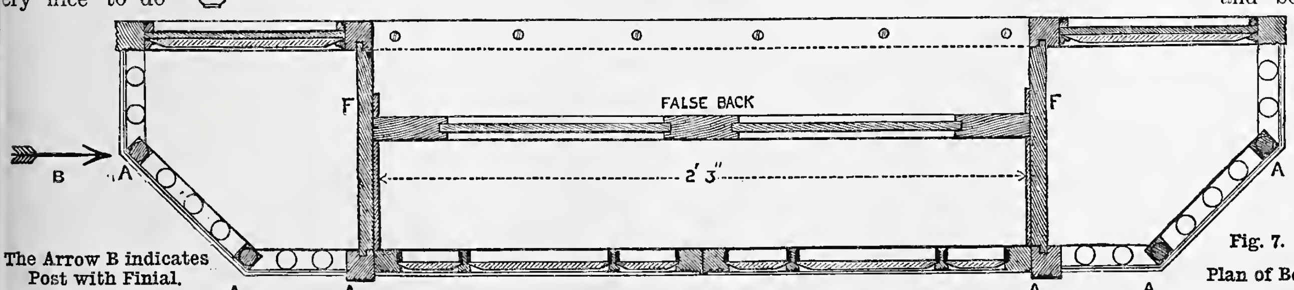


Fig. 5.

Fig. 6.—Top Shelf (A), Bottom Shelf (B), Uprights and Centre Side Shelves fixed together.

Fig. 4.—Height: Section—A, Cove covered with Stamped Plush or other approved Material. Fig. 5.—Diagram showing Method of preparing Back with Posts, Rails, etc., reeded, and Brackets fixed all ready to receive Case, Shelves, etc., dowelled and screwed on. Dotted Lines indicate Position of Shelves. (Scale, 1½ inches to 1 foot.)



The Arrow B indicates Post with Finial.

Fig. 7. Plan of Bookcase.

it with the rods, and trying a cramp across it to see if everything is all right, knock it to pieces, marking each piece as you take it apart, and stain and polish, etc., all the internal mouldings and edges that are seen. It can now be glued up and left to dry, care being taken that it is quite square and out of winding. The best way to square anything of this description is to try the length from corner to corner, and see if they are the same distance apart.

The directions taken by the rod for doing this are shown in Fig. 5.

The shelves directly above and below the doors marked E, and the uprights F in Figs. 4 and 5, should now be set out, letting the shelves, E, run by the uprights, taking notice that the shelves are wider than the uprights by the thickness of the back and front uprights. Groove the shelves to receive the uprights, and the underneath of bottom shelf to receive the brackets under uprights, also groove the uprights to receive the two outside middle shelves.

Now form the tongue on the front and back edges of the uprights to receive the front columns and to fix on to the back.

Although I show a tongue on these uprights, a cheaper and easier way would be to dowel them, especially at the back. Cut the corners off the shelves, set out and bore for the spindles, work the mouldings on the front edges, etc. (or plant them on). Prepare the two centre side shelves to match the overhanging part of shelves, E, bore for spindles and fit together, and it will then present the appearance shown in Fig. 6.

The lines of the mouldings are omitted, and the thickness of shelves and uprights exaggerated.

Now, clean off the face of the back, and fit these shelves, etc., in their places, screwing them on from the back, but do not glue them. All the rest of the work should now be got ready.

The doors and false back may now be framed up. Do not cut the bars of the doors through where they intersect, but halve them, giving the upright ones the appearance of running through. This may not at the first glance seem practical, but a little consideration will soon solve this difficulty. Bear in mind that the reeds should be worked before this is done or the shoulders cut. After fitting the doors together, take them to pieces, and stain and polish the edges, and let them stand till the last moment. The front columns should now be fitted on to the uprights, and the bottom and top shelves screwed on but not glued. Now fit in the cove. Although this is shown as if it were framed up, an easier method is to cut some rough brackets as at G in Fig. 4, and secure them to the under side of the top shelf and the back; now bend a thin board over them, and fasten it with screws, glued on and blocked from the back. Cut out and fasten and glue on false styles, rails, and mullions. Next, fit in the brackets at end of cove; these brackets should have a rough bracket fixed on the inside of them to carry the ends of cove. If the rest of the brackets are now fitted in, the whole may be taken to pieces and stained and polished on all visible faces. The cove brackets being only screwed to the rest of the work, but the thin board and the false styles, etc., being glued, will enable you to take the cove away entire, and the styles and rails can be stained and polished with the rest. For, as the panels are to be covered with plush, this will, to a certain extent, hide the inside edges where the polisher cannot get to polish.

The doors may now be glued up, and, whilst they are drying, get out the beads for the backs of the whole of the glass. Now clean up the doors; fit in the beads, which should be polished, etc., in the length before being cut (those behind the glass in the sides and bottom, of course, need not be polished). Next see that the moulding for the cornice (which, by the way, can be bought as well as the moulding round the edges of the shelves), gallery rails, spindles, corner-posts, terminals, etc., are all polished ready, and everything will be ready for fixing together. The more screwing and fitting you have done up to now, the easier you will get the whole together, for it is a great nuisance to have to bore holes or fit anything when you are gluing up.

In gluing the whole together, lay the back flat down, letting one part hang over the bench, to enable you to get a screw in here and there quickly when you put the front shelves, etc., on. Next cramp the two long shelves together, screwing the shelves up and down to the uprights. With a sharp chisel, scrape off any polish that may have run over the back edges, and also scrape the polish off the face of the back, or anywhere else where you wish to glue. Now screw the shelves and uprights on to the back, using but very little glue. Next follow with the cove, front columns, brackets, etc. The doors should now be fitted in and hung, taking care that the centres of the hinges project so that they are level with the face of the front columns, to allow the doors to open right back without straining. Next, fit in the shelves inside the bookcase, commencing from the bottom with the first piece of the linings marked H in Fig. 4, and build upwards.

As these linings also form the stops for the doors, close the doors from time to time, to see that they are all right. These side linings might run right up if desired, and not cut in between each shelf, thus saving a considerable amount of fitting where they meet in the centre and front of shelves. The shelves, in this case, could be supported on brass bookcase studs. Fit small flush bolts or any approved catch to the left-hand door, and a spring lock with fancy brass plate escutcheon to the right-hand door and drop handles, one on each door, for the sake of appearance. Hinge plates, screwed on the face of the doors, would be an improvement. Now unhang the doors, and stand them down ready for glazing, and fit and fix in the false back. The corner-posts and spindles should now be fitted in, and the gallery rails cut, bored, and fitted and glued on. It is hardly necessary to mortise and tenon or dowel these rails to the posts, etc., for, if they are fitted in tight and glued, a small pin driven in from the top will hold them. The bookcase is now ready for glazing. The plates of glass should be all blackened with a little size and lampblack on the edges along with the rebates, to hide the ragged edges. Two slips of baize glued on the front of backboards will prevent damage to the silvering. Next follow with the plush in panels of cove. One of the safest ways of fastening this to the panels is to glue the panels carefully with thin glue, and, just before it loses its stickiness, lay the plush on, patting it down with a soft brush. If the plush is put directly on to hot glue, the glue very often comes through and spoils the plush. Strong glass plates may now be screwed on to the back for fixing, and all that remains after glazing and rehanging the doors is to glue in the terminals to the front and back columns.

Although the above remarks are not written for the thoroughly practical mechanic, I have taken it for granted that any one who would commence to make a piece of furniture of this description at least understands a working drawing, and can use the ordinary bench tools.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

MIXING OIL PAINTS AND COMPOUNDING TINTS AND SHADES OF COLOURS FOR PRACTICAL USE.

THE chapters hitherto contributed to the pages of WORK upon this popular subject have necessarily been of that elementary nature which may not equally command the interest of professional and occasional workers in paint alike. It can scarcely be expected that the amateur—who is only desirous to know how, at the least cost, he may make wholesome or how embellish his own little "castle"—will consider it necessary to master such detail of "source and nature" to the fullest extent, and with the same painstaking effort, as it is most necessary the rising apprentice or improver to house painting should so do. The reader who may have "scamped" my previous explanatory papers, and yet desires to make practical use of the "working" ones, will, however, doubtless soon be turning up back numbers, since each forward movement we now make will prove the knowledge contained therein to be the only foundation the painter can with confidence and security work upon.

In preparing oil paint, for whatever purpose it may be required, the first question to be considered is the nature of the surface to be painted, whether of wood, stone, or metal, and to what degree it is absorbent. Second to this only, we must remember the conditions of circumstance and position of our work, such as refer to expense, durability, and drying qualities; and lastly, we have the all-important matter of appearance and colour to bear in mind, whether our paint is for the first or last coat. We will therefore proceed to an imaginary mixing of paint for these different substances, bringing in therewith a lesson on their application to the walls and woodwork of a building.

Let us suppose, for the purposes of this practical lesson, that you, my reader, are the fortunate possessor of a small modern (but not jerry) built villa-residence, and that the builder employed has just completed, according to his specification, an addition to your house in the shape of a billiard-room. Furthermore, let us suppose that the apartment is principally lighted by a ceiling light; that the remainder of ceiling and the walls have been plastered with the usual finishing coat of lime-putty and plaster; that the enriched plaster cornice which frames the ceiling is of fine plaster, and the skirting and reveals of recessed windows are of Keen's or Parian cement; that the side windows are glazed with combined English sheet and ornamental coloured glass; our doors are hung, and of well-seasoned wood; and that, finally, reader, I am going to paint it in a temporary but comfortable style for you, leaving for the future its permanent decoration, which, with the whole of your villa, we hope to undertake together later on.

"But how about the tools?" may be your first inquiry. As, however, you will, for the esent, but stand by and watch the worker, e can afford to have a special talk about em alone, confining our present remarks id attention to the mixing and suitability paint and colour, not only for this billiard-om, but for any other part of the house.

All our plaster work being thoroughly dry, e have decided to finish it in oil paint, ith the exception of the ceiling, which we iall distemper: that is, coat with water, or ze, colour. The plaster cornice, with its ist enrichment, is the most absorbent por-on; next to this comes the wall space, hich the trowelling to its surface has made ither less "thirsty." The skirting, etc., iade from Keen's or Parian—which are hite and "hard-faced" cements—if well nished off, will absorb but very little oil, nd therefore must be treated accordingly.

My first aim is now to stop the "suction" f cornice and walls before getting an in-rustation of lead paint upon its surface, nd to that end I break up genuine white ead and the best "patent driers," in pro-ortions of about fourteen to one respec-ively, with a small wooden spatula or flat-haped stick. Notice how, with a little raw nseed oil, I first get it to a thick batter, nd then, when well broken up, I make it o the very thin working consistency which ur first coating requires—of not more than our pounds of lead pigment to one pint of aw oil. As some of our cornice is rather laborately cast, I thin a part of this paint vith still more oil, and proceed to first coat he cornice only. In painting this portion, take every care not to break the delicate laster work, using light and suitable-sized aint tools to enable me to coat both re-essed and prominent parts.

Here, perhaps, you may remark, "Why iot use the same paint and cover the wall s far down as you can reach at the same ime as the cornice?" To which I reply, xplaining that "even then I could not each to such a height from the floor, whilst he plaster on your walls being well pre-ared and trowelled, I expect to use the aint slightly thicker—or 'rounder,' as it is alled in the trade—with advantage; and, urther than this, that a full-sized paint-rush will be necessary to spread it over a arge plain surface, whilst it will be advis-ible to strain my paint through a wire gauze aint strainer or piece of muslin before ising it on walls or woodwork."

I now carefully work the paint through he strainer into another vessel with an old aint tool, and, meanwhile, explain how it s nearly always necessary to previously xamine the walls and pick out the little listers which have formed on the face of he plaster, and then to well wet the lamaged place with water and make good vith plaster, but which is not necessary in his case.

Now, you having, like a good, sociable ellow, helped me to lower my plank a ouple of steps, so that I can reach half-vay down from cornice to skirting, I mount ny little scaffold, and once more start.

I first take a piece of partly-worn glass-aper, fine or middle 2, and lightly rub over he wall as far as my plank carries me; hen with a dusting-brush and downward novement, remove any dust which has ac-umulated thereon. With a full brush of olour I now make a start from the right-iand extremity, and, working towards the eft hand, cover about a yard in width at ach shift. Carefully note, my friend, how, fter taking a good dip of colour, I gently lraw the brush against the side of the paint-ot, and then carry the colour to the wall with an up-ended movement, and by which simple details I avoid wasting much in transit. See also how I spread each of these brushfuls of colour with a long up and down movement, about six inches apart, and then, when they extend about three or four feet in width, how I spread it evenly over with a repeated cross-brushing action. Now it is roughly distributed, but not sufficiently fine, since the marks of the brush-hairs show very distinctly; it there-fore has to be gone over again with the brush, but no more colour, first with the perpendicular, and then with horizontal brushing, and with a lighter hand each time, so that now, having finally drawn the tip of the brush down the work, starting each movement from the top and working across it still from right to left, we find the marks of the brush are not noticeable—in short, that the paint is properly "laid off." The pot is now shifted a little to the left. I again commence with laying on brushfuls, and spread and lay it off as before, until the top of one side of the wall is covered. I now descend and paint the lower half in a similar way, save that in the final laying off I finish with a light *upward* movement from skirt-ing to the join, whereby all sign of the latter is removed.

All house painters do not spread colour on this simple but regular plan, but for good and tradesmanlike work it cannot be excelled, and is far preferable to any hap-hazard system—or, rather, want of system —we often may see in vogue even with pro-fessed workers.

Our painted walls must now stand for at least a day, and, meanwhile, we turn our attention to the woodwork. This, by ar-rangement with the builder, has been left in the white, or plain wood, with the excep-tion of the sashes and window frames, which have to be primed before being glazed, and protected from the ill effects of wet weather before fixing.

Paint is something like charity in one re-spect—it covers a "multitude of sins;" and its absence on our principal woodwork has required good and well-finished doors from the contractor—which isn't always the case, even if paid for! The sooner, however, we get a coat of priming on new woodwork which is to be left in paint the better; so, after touching over any knots in the wood with one or two coats of quick-drying "patent knotting," and which article prevents the resin exuding and discolouring the work, I take some of my thin oil paint as used on the walls, and adding to it sufficient dry red lead to make it a full pink colour, prime the new woodwork. As with the wall, so with the woodwork—I first lightly rub it down with glasspaper, and carefully dust the work. Note that I paint first the edge of the door and panel mouldings, then the panels themselves from the top downwards, and finish off with the styles between panels, the top, lock, and bottom cross rails, all brushed in the direction of the grain, laying off, last of all, the outer rails, which reach from top to bottom of the entire door. Careful spreading and systematic working are just as necessary for woodwork as for wall, but whilst the latter is always laid off with the up-and-down movement, the former is finished with the grain of the wood.

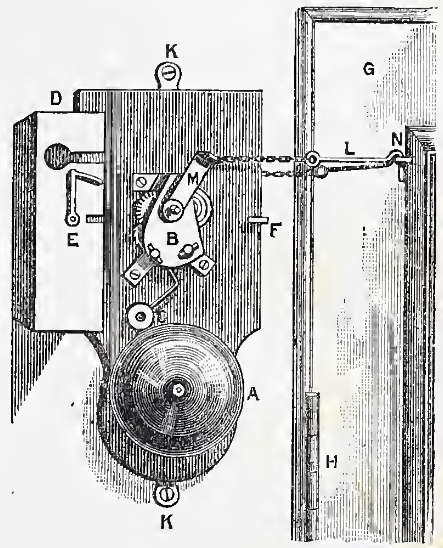
The first, or *priming*, coat being now completed to our satisfaction, we proceed to the second coating; but the consider-ation of this, through want of space to deal with it now, must be left for another chapter.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

118.—Galley's Patent Detective Alarm Bell.

The simplicity of the Patent Detective Alarm Bell, invented and recently introduced by Mr. A. R. Galley, of Torquay, renders it a desirable means of protection for tills, and a safeguard against burglarious entrance by door or window, for all who may not care to be put to the trouble of managing and maintaining a battery suited for putting in action an electric alarm. The entire appliance is well made, and presents a neat appearance, being similar, as far as outward look is concerned, to the electric appliances just



mentioned. The bell, A, is fixed to the lower part of a baseboard, as shown in the illustration, and the mechanism, B, by which the hammer, c, is actuated, is placed above it. The works, so to speak, are covered in by a casing, D, which is attached to the baseboard by brass hooks, E, which fasten into eyes, F, one on each side. This case is shown turned on one side in the illustration in order to display the works. To make the way in which the alarm bell is to be fixed and used perfectly clear, when attached to doors it may be said that G is the upper corner of a door on the side on which it is hinged to the adjacent jamb, the top hinge being shown at H. The alarm bell is fixed to the casing of the jamb if wide enough by screws passing through glass plates, K K, screwed to the back of the base-board, or, if not wide enough, to the wall by brass-headed nails. The wire hook, L, and the chain intervening between it and the lever, M, the chain and wire working freely through the hole and slot shown in the casing, D, should then be drawn out quite tight, bringing the lever, M, into the position shown. The hook, L, is then inserted into an eye, N, put into the door at such a distance as will allow the chain and wire to be kept as tightly strained as possible when the door is closed. On any attempt to open the door, the tension on the wire is relaxed, and the backward motion of the lever, M, sets the bell ringing. For windows the bell must be fixed at the top, and a sufficient length of chain or wire added to allow of the insertion of the hook in the eye, which must be fixed in the bottom sash. On testing the alarm I have found its action to be very satisfactory. THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

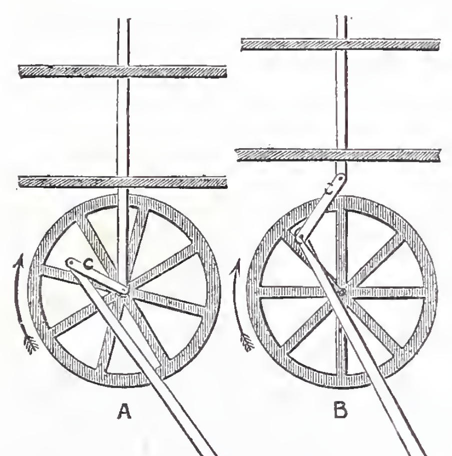
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Boot and Shoe Making.—W. S. (*Bury*) writes in sequence to LEATHER (see page 492):—"I am sorry you have decided not to say anything about shoe making. I have been a subscriber to WORK ever since it came out, and have derived great benefit from it. Though many would be inclined to mend their own boots, I don't think any would try their hand at tailoring or hatting. I am a married man with five children, and find it very expensive to keep all in clogs and shoes. I am able to sole my own every-day boots and clog my children's clogs, but am unable to tackle a Sunday pair to do them to look to my satisfaction, and I think if you could kindly undertake to give a paper in WORK on the subject you would confer a favour on me and a great many of your readers, because I know lots in the same predicament as myself. I sometimes hear you say 'get some tradesman to help you,' but that is rather difficult. Tradesmen don't care about you knobsticking and taking away their trade to their loss and your benefit. I have been trying several months to get some one to show me how to put a bristle on a wax end, and only managed the other day from some one not in the trade. I hope you will excuse this trespass on your time, and trust you will be able to give a few words on the subject, because there are lots of wrinkles it takes an amateur a long time to find out by himself."

Printers' Varnish.—J. W. H. (*Newington Butts*) writes:—"Messrs. Stanbury & Co., West Harding Street, London, E.C., inform me that they will supply small quantities of ink to amateurs in 2-oz. tins, and upwards, at their list prices, of any colour or shade, varnish also; and will send list free by post on application. They fully confirm our statement as to the danger of burning oil, and further inform us that any one attempting it within a certain distance of London is liable to imprisonment."

An Easily-Made Fret Machine.—H. W. (*Gateshead*) writes:—"In reference to an easily-made fret machine described in WORK by W. R. S. (see page 332), I notice that it is a bit of a puzzle to many readers as it was to myself. I found that the principle was right, but the drawing misleading, as to look at it you would think it would work like A in the enclosed drawing instead of like B, which, I think, W. R. S. means. I hope this will assist the puzzled ones, as with no disrespect to W. R. S., I might say that if this is not correct my machine will be wrong (not like his), for I have

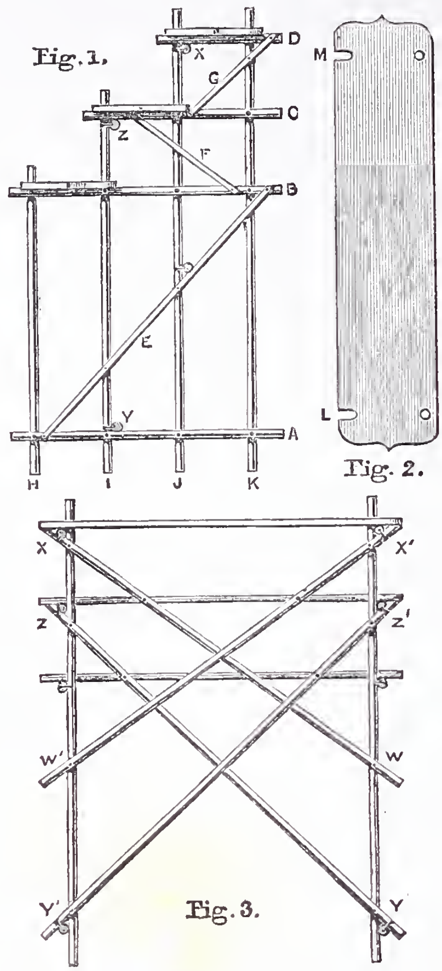


Easily-made Fret Machine.

made it like B, and find it works beautifully. I forgot to state that the throw of the machine is not measured from centre to centre of G, as W. R. S. says, but from centre of wheel to centre of crank, where it is connected with wheel."

Gas Meter Index.—E. L. F. (*Oxford*) writes:—"If you refer to WORK No. 34, November 9, page 541, second column of 'Shop,' I think you will find a slight mistake. In the letter to H. N. (*Chelsea*) 'How to Read the Index of a Gas Meter,' it is put in brackets 'bear in mind that it would have to go right round to be 1,090,' which should be 1,000. I think, instead of 1,090."—[Thank you for correcting the misprint.—ED.]

Bamboo Flower Stand for Window.—J. P. A. (*Walthamstow*) writes:—"Some time ago I, in a rash moment, offered to send a description of a flower stand I had made out of canes (garden canes I suppose they are called, as they are sold for the purpose of supporting flowers, etc., and can be



Bamboo Flower Stand for Window. Fig. 1.—End View. Fig. 2.—Shelf. Fig. 3.—Back View.

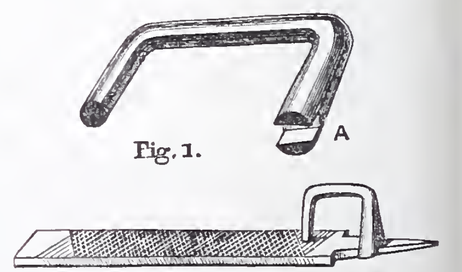
bought at seed shops, and I have seen them in oil shops). But since making that offer there have appeared several complaints about descriptions of various things not being clear enough to work from, and I have been on the side with those who have complained sometimes, though I have said nothing. Now, however, I see the difficulties of making everything quite clear when it has to be done in writing, and would suggest that you request those who cry out loudest to set to and give a description of something they have made or know well how to do. Those who now go in for a little bamboo work will not be in the same fix as I was, for I see the promised articles are commenced, and will certainly be a great help. I had decided to make some sort of a stand to put some flowers on in the window, but had not settled what it was to be, when coming across some canes I was surprised at their strength and lightness, and set about trying what could be done with them. I got a dozen about $\frac{3}{4}$ in. diameter for 9d., and a dozen $\frac{3}{8}$ in. diameter for $4\frac{1}{2}$d.; then sketched out the ends as shown in Fig. 1, and then decided on the sizes; the front shelf was put low enough for a 5-in. flower pot to be out of sight from the street; the others rise 6 in. The stoutest canes were used for uprights and horizontal pieces, and where they cross I filed notches in the uprights, and fastened them together with screws; the $\frac{3}{8}$-in. canes were used for diagonal pieces, and were let into the horizontal ones just through one side. I tried several plans to get the holes in at the proper angle, and thought I would have to give it up, for the cane split with drill or bit, and a knife or file seemed slow work. I then tried a piece of $\frac{5}{16}$-in. round iron, red hot, with a hole at the required angle, and just a fit (when the charred part was cleaned out), for the $\frac{3}{8}$ in. cane could be made. This tool is not mentioned by D. D.—perhaps he will give it a trial when a hole is wanted at an acute angle in a piece of bamboo—for though a rather primitive method of making holes in wood, I feel convinced that it is better than the ordinary boring tools, and much quicker than a knife or file for cane. Perhaps it will be best to give the lengths that suited my purpose, then others can suit their own. For the two ends four pieces were cut 22 in. long; they are for A and B; the two pieces for C are 16 in. long; and two, D, are 10 in. long. Then the four uprights, J and K, are 3 ft. long, and the two for I are 2 ft. 6 in. long; the two for H are 2 ft. long. These were then laid out as shown on Fig. 1, and the position of the holes for the diagonal stays marked and bored with the hot iron. The stays were then put in the holes, and all the lot fastened with screws. Having got the two ends made, the three shelves are next wanted; $\frac{1}{2}$ in. stuff $7\frac{1}{2}$ in. wide was used, and holes put in them a good fit for the cane; the top shelf can then be put on, but to get the other two on a piece must be cut out of the side, as shown at L, M. When the shelves are on, the stand will be pretty firm, but to make it more so, stays were put from W and W', to X and X', and from Y to Z; these pass the back of the shelves, and are screwed to them. The job is done, except the ornamenting of it, and the articles that are appearing will, I expect, give much better instructions than I can."

Linoleum Tiles for Roofing.—J. W. H. (*Newington Butts*) writes:—"In this connection Messrs. G. Glanvill & Co., Roupell Street, Blackfriars, S.E., write to me that they have a large accumulation of cuttings of well-seasoned, best quality linoleum, which they would dispose of very cheap, suitable for cutting up into tiles. They would also supply tiles ready cut, 13 in. by 6 in., 8s. 6d. per gross, or 9d. per dozen; 9 in. by 6 in., 6s. 6d. per gross, or 7d. per dozen; and 4 in. by 6 in. at 2s. 9d. per gross, or $3\frac{1}{2}$d. per dozen; or cut to other sizes to order at proportionate rates. Any readers at a distance should, of course, remit cash with order. With such material a roof with an occasional coating of oil would last many years."

Vulcanite.—RAPIER (*Edinburgh*) writes:—"In a recent number of WORK I noticed a paragraph on the casting or pressing of vulcanite in plaster moulds, which were then subjected to a heat of 310° Fahr., and continued from seventy-five to ninety minutes, being enclosed in metal cases during the process. Now this at once places it beyond the reach of any but the professional to mould in vulcanite, and I should like if some of our readers would inform me if this casting or moulding of vulcanite could not be done during the process of vulcanising, and also inform us if this making of vulcanite is a trade secret. I understand it is a mixture of india-rubber treated with sulphur. Will some one kindly explain the process, and tell me how to mould small articles in this material, or refer me to any work for the information? I have got a piece of black vulcanite, but I can make nothing of it, except by turning in the lathe, and this does not suit, as there is a great waste in turnings."

Mail Cart Wheels.—The Victor Cycle Company write:—"In your issue, No. 34, under 'Shop' heading (see page 540), you gave the addresses of firms in the North of England from whom mail cart wheels are obtainable. We beg to say that we supply a superior pair, $23\frac{1}{2}$ in. rubber tired wheels, brass caps, good axles, washers, pins complete, at 5s. 6d., and believe they are the best value in the market. Ours is a convenient town for people to obtain from who are near the east coast. We notice firms you mentioned are situated near the west coast."

Handy File Holder.—WORKER BEE (*Hertford*) writes:—"I have taken the war-path of criticism again, and wish first to deal with the handy file holder described by J. C. K. on page 554 of WORK. The illustration given by him does not coincide with the letterpress description, nor does it give a clear idea of the utility of this tool to many



Handy File Holder.

who have not seen it in use. I have given a rough sketch of mine, which I made fifteen years ago when I worked in a large erecting shop where there were scores of them in use. Fig. 1 will show that the slot at A should be cut the same taper as the tang of the file, and not as shown by J. C. K., or you create a difficulty when, having worn one side of your file, you wish to reverse it to use the other. Fig. 2 I have given to show that a file can be used on flat surfaces of metal by the aid of this handy file holder, much as a plane can be used on wood."

—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Taking out a Patent.—M. T. (*Brighton*).—A per on the above subject appears in WORK, No. 35.

Aquarium.—J. F. (*Portnall Road*).—The best aterial for the bottom of your aquarium will be te cut to measure after glass is fitted in—the te should be not less than ½ in. in thickness. The ater of the aquarium, when quite full, will weigh near as may be, 190 lbs.; add the weight of your aterial to this, and the result will give the weight the whole. I know of no special appliance for ling, but for emptying use a siphon pipe, which u can make by bending up a piece of compo pipe, a piece of stiff rubber tube will answer equally ell.—C. M. W.

Small Fountain.—B. T. (*Netherton*).—If you ant to keep your fountain going for so long a me as eight or nine hours, I would recommend u not to use springs, weights, or pumps, as you ould find either of them clumsy and laborious. our better plan would be to connect your aquarium your water supply, and the overflow pipe to the rain; but if this course is inconvenient you could rect a tank at a higher level, connect with quarium, catch the overflow in a vessel, and re-urn it to the tank. But why not be content with e fountain playing, say, one hour at a time? You ould then rig up a small tank to hold, say, a couple f gallons, suspend it over pulley wheel to ceiling, nd with a cord run it up as often as required, aking the connection to aquarium with flexible ubing, catching the overflow in a can, and regu-ating the height of jet by the height of your sus-ended tank above aquarium.—C. M. W.

Plumbing: Making Joints.—P. B. (*Pendle-on*).—You say that you are "a plumber's appren-ice, and want to learn how to make joints." The peration is described in a paper "On Soldering oints in Metal Pipes," which you will find in page 03, *et seq.* in No. 32 of WORK.

Steel and Florentine Bronze.—J. L. (*Glas-ow*).—I regret that it is not in my power to give an ntelligible or satisfactory answer to the query especting Florentine bronze. In conversation with a gentleman, who had spent some considerable ime in a large works in Birmingham a few years go, where candelabra, figures supporting lamps, etc., were made in Florentine bronze, I have learnt that this class of work was cast in what he termed stannate metal, which is of a leaden colour, and cheaper than brass. The casting was first coated with copper by electro-deposition, a dynamo supply-ing the necessary current; after this it was brushed over with some kind of bronze solution, and pro-minent parts of the surface were rubbed or burnished to give the effect of light and shade, and relieve its uniformity as suited the taste of the worker, who was a Frenchman, and very particular as to those he admitted to his workshop, the whole process being treated as somewhat of a trade secret. Evidently it requires costly apparatus and special qualifications to carry out the process.—T. R.

Bending Angle Iron.—(*Birmingham*).—The best method of bending or cranking angle and tee irons—if there are a great number required—is by pressing them in dies under the hydraulic press, but for a small number it would not pay to make the dies, and in such case you have no alternative to drawing it over a block. Some of the Welsh smiths are very clever at this work, and bend the iron without losing any of its strength.—F. C.

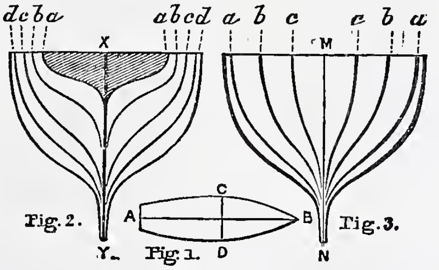
Printers' Varnish.—DURHAM.—The manufac-ture of varnish is not an operation that can be performed successfully without experience and without the necessary appliances. Messrs. Flem-ing, Caroline Park, Edinburgh; or, Mr. Horsell, 47, Meadow Road, Leeds, would, no doubt, supply a small quantity by parcels post, if applied to.—J. F. W.

Book on Loom Pattern Making.—J. P. H. (*Glasgow*).—A work on this subject is "A Practical Treatise on Pattern Making" (7s. 6d.), Lockwood and Co.—F. J. C.

Blackboards: How to Paint.—J. F. K. (*Car-diff*).—This question, or a very similar one, has been answered very recently; but as the subject appears to be one of more than individual interest, I append the best method for preparing and finish-ing new school blackboards. The board being quite smooth and well papered down, it must be painted with not less than three coats oil paint. The colour or shade is immaterial for the first two, but the last coating must be finished dark-lead colour, or with common black paint. You now procure ivory drop black, ground ready in turps, and mix with it some good oil varnish; best copal or carriage is as good as anything, and further dilute to working consistency with turps. The finishing black will dry hard in a few hours, and it should be without glass, otherwise the chalk will not bite on it. It would be best for a novice to try his black on the edge of a board and get it right for use, and aiming to get a good body of colour on, and for it to dry dead. The more varnish used the more gloss results, and, of course, *vice versâ.* Respecting your last item, I should say yellow pine before anything else. I might also note that an extra glue joint is better than using very wide stuff, and if you run a ¼ in. groove at each end, ¾ in. deep—across the grain of the wood this will be—and fill in with pieces of hoop iron of similar dimensions, you will get a good and lasting job I think.—W. P.

Working of Heating Apparatus.—THE BEADLE.—If the apparatus is made to work there must be two pipes from the boiler to the tank to secure circulation, one for the hot water to ascend, and the other for the cooler water to descend to the boiler, and be reheated. You regulate the heat by increasing the rapidity of the circulation, which depends upon the rate of firing. You need not be afraid of explosion, as your tank is open to the atmosphere; this tank, I presume, is self-feeding, with a ball-cock arrangement to prevent waste. The turncocks are for running out the apparatus to clean it, for otherwise the pipes and boiler would get choked up with sediment or scale according to the quality of water you use. A gauge would be of no use to you, but a thermometer in your tank would show the lowest temperature of your water, which should not fall below 100 degrees if you have to keep the church at 60 degrees, and then you must keep the doors shut. The supply of circulating pipes appears to me very scanty, and if the boiler is not tubular you will have great difficulty, unless it is a very large one, in keeping up the temperature to the point mentioned.—F. C.

Model Yacht.—MEDICAL (*Cambridge*).—Pre-suming that the sections which MEDICAL has are those of a cutter model, he should work from the following lines. Fig. 1 represents the deck plan, A, B being the centre line, and C, D the line amid-ships, which line should cross the beam or broadest part of the hull. Fig. 2 is a section amidships, with X, Y, sternpost, which, with the two sections *a* and *b*, are the only lines MEDICAL has to work from. There being no mathematical rule for arriving at the correct curves for the various pairs of ribs, the only way of proceeding is to decide on the shape of hull you intend working from, and to mould your



Model Yacht.

ribs to fit accordingly. The first pair for a cutter should be bent to the form of section *b*, Fig. 2, the second pair as section *c*, and the third as section *d*. If the lines are intended for a schooner model, the greater proportion of the length to the breadth of the hull will necessarily make the curves of the ribs less full than those of a cutter, but in all other respects the same lines will do for either. The above lines are the only ones for which MEDICAL asks, but I take it that he also requires the inter-mediate curves for the ribs between the beam and cutwater, which are shown in Fig. 3, M, N being the cutwater, and the thick curves section at beam. The ribs should be at intervals of ⅙ of the length of the hull, although if the model be a very large one, it will require the ribs to be placed closer, and of course a larger number of them, but this can easily be deduced from the above diagrams. I should warn MEDICAL, however, that he has chosen the most difficult way to build a model, and unless he is proficient in this kind of work, he will succeed better in one of the simpler methods.—G. J. E.

Bunsen Battery for Electric Light.—A. H. T. (*Padiham*).—As the voltage of 5-candle-power in-candescent lamps varies from 5 volts to 65 volts, it follows that I cannot answer your questions satis-factorily, since I do not know the voltage of your lamp. The number of Bunsen cells required to light a 5-c.p. lamp will depend upon the voltage of the lamp. If an 8-volt lamp, then 4 quart Bunsen cells will be enough if arranged in series. Find out the voltage of the lamp, and divide the figures by 1·86; the answer will give you the number of cells in series required to light the lamp.—G. E. B.

Magnetising Steel Articles.—ANXIOUS (*Liver-pool*).—See reply to V. R. (*Liverpool*) on Demag-netisation. Wind five layers of No. 18 cotton-covered copper wire in a hollow bobbin, having a thin papier-mâché tube for a body, and fill this with the steel articles to be magnetised. Send a current from 4-quart Bunsen cells through this coil, and proceed as advised to V. R. for mag-netising his bars.—G. E. B.

Steel Castings.—T. T. (*Newport*).—You will not get any information as to the making of steel castings from books, nor from any source except that of actual occupation in a steel foundry. This branch of trade is very exclusive. The making of good steel castings lies in the hands of a few firms only, who having achieved success through many failures, are jealous of giving others the benefit of their costly knowledge. Hence neither employers nor workmen will reveal their trade secrets, and those who, like the writer, have been permitted in the way of trade to observe the methods and processes followed in the steel foun-dries, feel bound in honour to say nothing. To understand steel moulding you must obtain work in a steel foundry, a difficult thing to do unless you know some one who might assist you in this respect. In reply to your other specific queries: The differences between moulding in iron, in steel, and in malleable iron are—steel has to be run at a much higher temperature than cast iron, and the moulds are, therefore, more refractory. Ganister is used, and ground crucibles, and they are faced with a tarry mixture, and dried so hard that you can stand upon them without breaking them, a thing impossible in green or dried sand moulds for iron. Then to prevent honeycombing, the castings are poured with large "heads;" and to prevent fracture due to the much higher percentage of shrinkage in iron than in steel, all sharp angles are avoided, curves, hollows, and brackets being inserted, whether required in the finished casting or no. The castings are annealed in malleable iron; the moulds are the same as in cast iron, but the castings are not poured from grey iron, but from white which contains no graphite, and the runners are not round, but flat and thin, to prevent shrinkage and fracture in their vicinity. After the castings are made they are decarbonised in pots, in contact with hematite iron ore. In malleable cast-ings the metal is melted in cupolas; steel is melted in pot furnaces, or if in large quantities, in the Bessemer converter, or more usually in the Siemens open hearth furnace. The composition of Sheffield ganister is as follows:—Silica, 89·01; alu-mina, 5·44; ferric oxide, 2·65; lime, 0·31; magnesia, 0·17.—J.

American Clock Cleaning.—A LOVER OF "WORK" (*London, E.C.*).—See that the balance swings perfectly clear of everything, that the pin working in the notch of lever when passing in or out of the notch is quite clear, that the scape teeth falls fair on the square, or dead part of the pallets, that it is quite in heat, and swings nearly a turn; if more it will strike the hanking, and so gain; if less it will vary; you will probably find that one or other of the above is wrong; see also that hair-spring is free between the pins or loop. I am rather afraid you have not got it in beat, and that it swings round and strikes the banking. Listen, and if it gives a kind of double tick, that is the cause. To put it in beat, take the power off scape wheel, and when the balance is at rest, the pivot of scape wheel, the balance pivot, and the pin in the notch should be exactly in line. See also that all pivots and scape teeth are oiled, but not the pin working the pallets. If no better, write again.—A. B. C.

Screen Escritoire.—F. A. F. (*Islington*).—With reference to your query for the screen escritoire, if the American white wood be the sort I know by that name, I think wood ⅝ in. thick would suffice for the sides. For the two long feet that keep the whole structure steady it is hard to give dimensions. I feel inclined to advise you to make them just as long as you can without giving an unsightly ap-pearance to the whole thing, or making the feet project so as to bring disaster upon unwary passers-by. In the original which gave the motive for the adaptation, the one weak part was this that you have noticed. I feel inclined to repeat the advice of a bookcase backing it, for if any one knows a heavier thing in nature than three or four shelves of ordinary literature, whether theology or fiction, they carefully guard the miserable secret.—G. W.

Overmantel, Dimensions of.—F. J. W. (*Wal-lington*).—The measurement given for the over-mantel, 4½ in. inclusive, is correct. If F. J. W. will try the width, he will see that 7 in. would be much too heavy. The design being in exaggerated perspective conveys a slightly untrue effect, for I have the structure in daily use, and can endorse the figures given. The shelf, marked K, is rounded on its under edge because it projects (which the others do not), and is a finish to the whole thing. Certainly add back to the cupboard. I rather object to doing so for the under portion as well, but it is of small moment. The effect of the whole is more pleasing than it appears in the engraving, where effect was sacrificed for clear explanatory diagrams. The bric-à-brac, which the engraver added, is also a wonder and a wild surprise to the designer, who certainly intended to suggest genuine native pottery—not the Lowther Arcadian horrors which somebody has substituted. But these groans only escape to show that even those who make the designs find the interpretation not quite clear, so can readily sympathise with outside queries.—J. G.-W.

Area of Ball.—FABER.—I suppose you require the surface of the ball: it is found by multiplying the square of the diameter by 3·1416; thus if the ball is 3½ in. diameter, its surface is $3·5 \times 3·5 \times 3·1416 = 38·4846$ square inches.—F. C.

Loose Spokes in Bicycle Wheels.—CARPEN-TER.—The four spokes are probably stripped in the screw. Repairers have a trick of hammering the screwed part of a spoke on an anvil, thereby flattening the end and broadening the screwed part, which often makes it take a hold in the hub, but it is a clumsy expedient and a lazy one. The proper way is to put in such spokes a size thicker, with the holes in the hub tapped afresh one size larger, or spokes the same thickness, but with the ends butted or thickened to screw a size or so larger than the old ones; or, if the screwing in the hub is uninjured, new spokes of the same thickness as the old ones will do. There is a small tool called a spoke grip sold by all the cycle dealers and makers for about 1s. 6d. This tool will screw or unscrew any size of spoke.—A. S.

Some Facts about Mahogany.—H. H. (*Liverpool*).—I am glad you liked Mr. Denning's paper on this subject. I daresay he will furnish similar articles on other woods used in cabinet making before long.

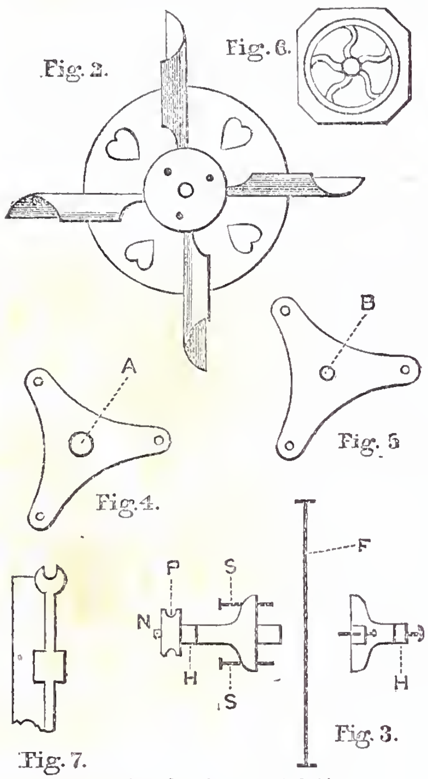
Numbers in Volume of WORK.—CARPE DIEM.—There will be fifty-two numbers in each volume of WORK.

Cheap Camera.—CARPE DIEM.—The camera you mention is good value for what is asked for it.

Honey Extractor.—J. J. BEE.—Your query relative to a honey extractor has been answered. There will be a paper on construction of apiarian appliances by-and-by.

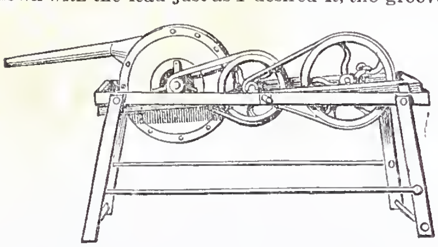
IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Machine for Current of Air.—CABINET MAKER (*Allendale*) writes in reply to BELLOWS (*Gloucester*), (see page 109):—"I enclose sketch of machine of my own invention which BELLOWS may easily make, as I found little trouble with it. The machine complete, as shown in Fig. 1, is 2 ft. 4 in. long, 8 in. wide, and 17½ in. high. Fig. 2 is a tin fan or blower, Fig 3 is axle of blower made of wood with brass hoop on each end, H; P, pulley fixed with half round-headed screw nail, N; S, screws to screw wood axle together after fan is fixed between; F,



Machine for Current of Air.

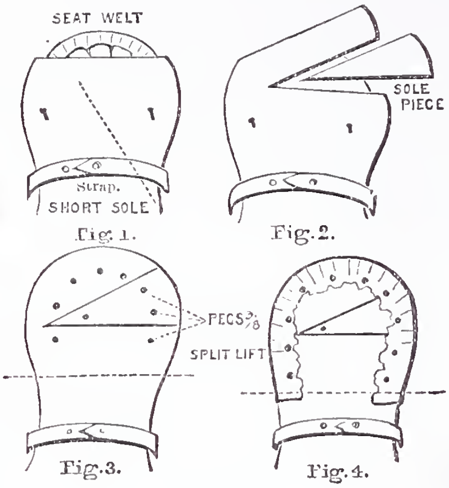
fan. Figs. 4 and 5 copper bearings for fan axle; hole, A, to receive hoop on fan axle on side next to the pulley; hole B, to receive half round-headed screw to screw in and answer as axle to run on. I made my wheels of lead and zinc, half and half, with brass centres cast in them. I made my moulds of wood, as in Fig. 6, so as to have only one side to dress, and the groove to turn out for belt. The moulds being of wood permitted me to turn wood down with the lead just as I desired it, the groove



Machine for Current of Air complete.

as shown in Fig. 7 being turned out last. It will be seen in Fig. 1 that the frame in which fan box and wheels are placed is working on two thumb screws, which pass through sides of the stand, to which fan box, etc., is fixed, so that the fan pipe can be lowered or raised to suit any height of fire as may be required, the thumb screws when screwed tight holding it firm to position required. The fan box is of sheet iron, 10 in. diameter inside by 2½ wide, fan or blower running at the rate of 2,560 revolutions per minute, the frame of 1 in. wood with stout ends to prevent warping; the stand of ¾ in. iron. The whole is painted in five colours, which makes it handsome enough to stand in any room. Should BELLOWS want more particulars I shall be glad to assist him in any way I can, or should he care to buy it I can sell it cheap, as it is perfectly new and of no use to myself. I only made it to keep my hand in."

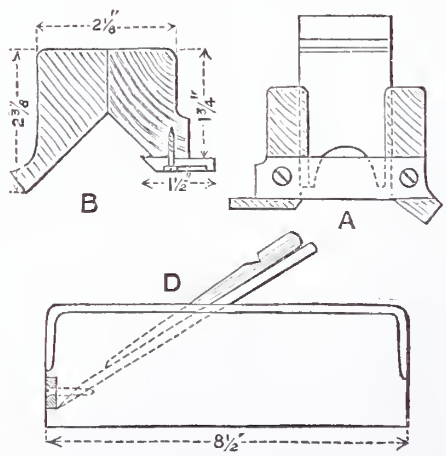
Cork Heel.—NITRAM writes in answer to J. R. (see page 526):—"I must confess that I am at a loss to grasp the whole meaning intended in some parts of his query. I presume you mean by a cork heel a particular shape of heel? If so, I am not cognisant of the term. To answer all your questions correctly would take up more space in 'Shop' than I could reasonably expect our Editor to grant. So with a few rough sketches I will attempt part this week and part later on, and so give all a



Cork Heel.

chance. Fig. 1, short sole. It is much better though to have the sole the proper length. The reason is obvious. Fig. 2, piece of same stuff let in. Fig. 3, pegged, rasped, and beat down with care all round. Fig. 4, with one splint left on, pegged with ⅜, taking care to use an American pegging, and sending your pegs in an oblique direction toward centre of seat of last. If your pegs be too long they will go into the last, so that you might have great difficulty in getting your lasts out when your boots are finished. Enough this week."

Chamfer Plane.—J. W. (*Burton-on-Trent*) writes in reply to APPRENTICE LAD (*Leicester*), No. 34, page 540:—"I have pleasure in forwarding sketch of chamfer plane. A is section of front end of plane, B, back end, D, side view. In making mine I found it very much handier by squaring up my piece, allowing about an eighth thicker, and then sawing it down; you can then face the insides, and cut out for the iron and wedge, and plane away the bevels to an angle of 45 degrees; it can then be glued together,



Chamfer Plane.

care being taken that they are exactly in place. The mouth is formed by a piece of iron or steel, about ⅜ in. by ¼ in. let in flush, and screwed on as shown. I used a broken 1½ in. chisel for an iron, which answers very well. The fence is secured by two screws, sunk in on slotted brass plates similar to a side fillister; the pitch of the iron should be more than 30 degrees."

Trade Notes and Memoranda.

IT was not said at the Institution of Electrical Engineers, but it is true, nevertheless, that nowhere is the application of electricity to the ordinary uses of life to be seen on a more interesting and extensive scale than at Hatfield House, the seat of Lord Salisbury. The electricity, generated by means of turbines in the River Lea, is transmitted to the house and over the estate for real work's sake. Pumps, ice-making machinery, and an air-propeller, fixed in the roof for ventilation, are all driven by the motors at the house. The motors are also used for elevating hay and corn sheaves to the top of the stacks at the farm, for threshing, grass-cutting, and for cutting chaff for ensilage. His lordship's corn is ground and his fodder made by electricity. He drives piles by electricity, dredges the river, and pumps the town sewage. And it is all his lordship's own scheming.

ACCORDING to the calculations of the Paris police, 5,000,000 provincials and 1,500,000 foreigners have visited the Exhibition. The foreigners include 380,000 English; 225,000 Swiss; 38,000 Italians; 32,000 Austrians; 7,000 Russians; 5,000 Greeks, Turks, and Roumanians; 3,500 Portuguese; 2,500 Scandinavians; 8,000 Asiatics; 12,000 Algerians and other Africans; 90,000 North Americans, and 25,000 South Americans.

WORK

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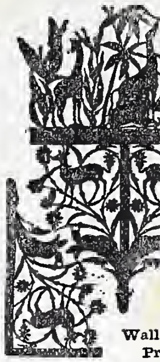

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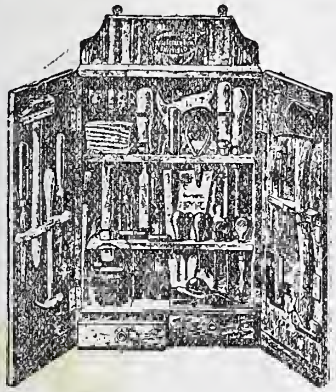

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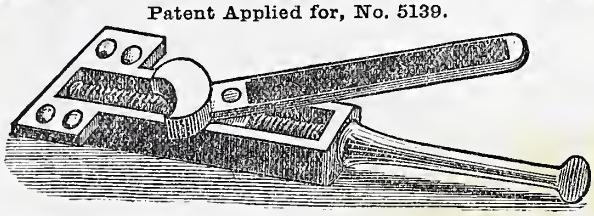

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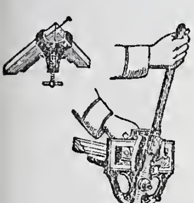

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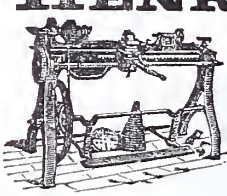

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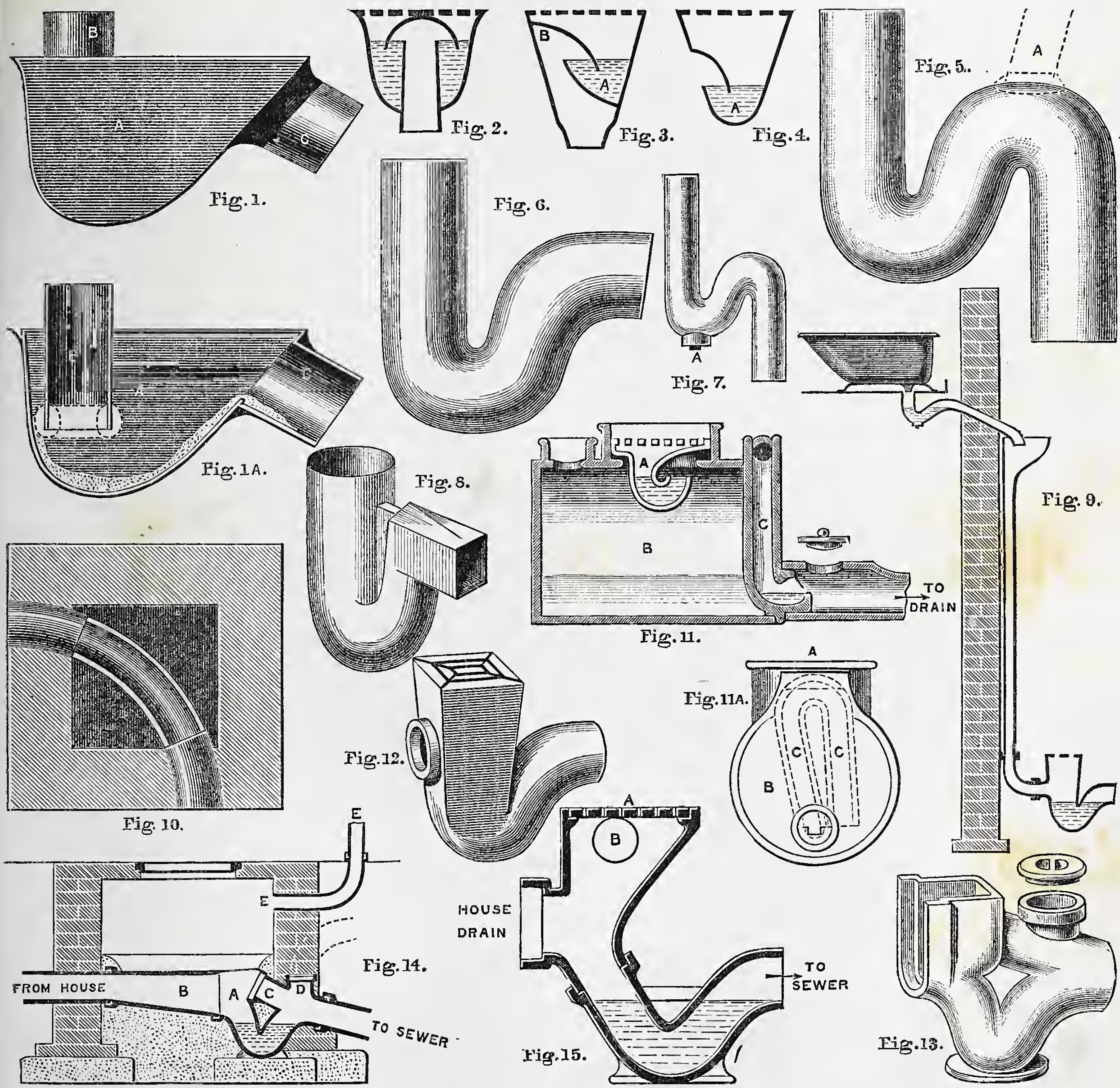


Fig. 1.—Lead D Trap. Fig. 1 A.—Section of ditto. Fig. 2.—Bell Trap: section. Fig. 3.—Iron Box Trap: section. Fig. 4.—Iron Box Trap, sometimes called D Trap: section. Fig. 5.—Lead S Trap, showing Place for connecting Air-Pipe. Fig. 6.—Lead P Trap. Fig. 7.—Small Lead S Trap, with Cleansing Screw A. Fig. 8.—Hellyer's Anti-D Trap with Square Outgo. Fig. 9.—Diagram showing Manner of conducting Wash from Bath into Drain through Open Gully-Traps. Fig. 10.—Open Channel Bend fixed in Brick Manhole for Inspection. Fig. 11.—Field's Flushing Tank for Drains. Fig. 11 A.—Side Section of ditto. Fig. 12.—Gully-Trap, with Inlet at Back. Fig. 13.—Hellyer's "Drain Sentinel." Fig. 14.—Disconnecting Air Chamber with Hellyer's "Drain Sentinel" Trap and Channel leading to it—A, Trap; B, Channel; C, Inspection Arm; D, Arm for Air Inlet; E, Air-Pipe to Manhole. Fig. 15.—Section of Hellyer's Ventilating Drain Syphon—A, Grating and Inlet for Air; B, Inlet for Air when A is covered.

TRAPS AND DRAIN SYPHONS.

BY W. R.

WHAT an exceedingly cautious man is the average British householder!

With what care he locks and bolts his doors at night, sets electric and all sorts of alarums, lets loose his dog, and takes every precaution to keep away that ingenious fellow, the enterprising burglar!

He sleeps in peace, and fancies he is safe, but how often do we find that an enemy worse than any burglar is stealing up from the underground regions through a pipe but a few inches in diameter, and finding its way into his very bedroom, robs him of that which is far more precious than his plate—his health!

He spends pounds freely to keep out the burglar, but if he has a plumber's bill of a few shillings for repairs to his water-closet or some such apparatus to keep off this enemy—sewer-gas—he storms and fumes under the conviction that he is being taken advantage of.

Every householder should know the state of all the sanitary arrangements in his house, so that he might understand the grave necessity for keeping them constantly cleansed and in good order, and also know what should be done when repairs are necessary. The most particular part of any sanitary fitting is its trap, which bears to it the same relation as the lock does to the door. As we ofttimes find a door guarded by a very poor lock, so do we very often discover a water-closet, a sink, a lavatory, or some such fitting, provided with a very ineffectual trap, and sometimes without one at all.

Now it should be laid down as a law of the "Medes and Persians," that every sanitary fitting should be disconnected from the drain by a proper and effectual trap.

The material of which a trap is made deserves important consideration. It should be either lead or earthenware; iron is sometimes used, but cannot be recommended even if coated as explained in a former paper or enamelled, for as it is holding water constantly and sometimes fæcal matter of a very corrosive nature, it is liable to rust and become rough and dirty.

For indoor work, lead traps are decidedly the best, but they need to be well ventilated, for I have seen a lead trap eaten in small holes like a sieve by the foul gases which had accumulated in the soil-pipe, in which no means of ventilation had been provided. For it must be remembered that effete organic matter begins to be decomposed immediately on passing into the drain, and gives off that foul and dangerous gas which we call sewer-gas.

For outdoor work, earthenware is best suited, as being fixed underground and of a non-corrosive nature, it is not liable to damage from a chance blow without, or from the foul air and matter within.

Sometimes, as explained in p. 516, we have to fix earthenware traps attached to w.c.'s within the house, and in such positions when fixed as explained therein, they give every satisfaction; but for traps immediately under housemaids' sinks, lavatory basins, baths, etc., lead should always be used.

One of the oldest traps now in use is the D trap, shown at Figs. 1, 1A. It was formerly extensively used for water-closets, and is very often found in combination with that abomination the pan-closet, though it is sometimes made in smaller sizes for sinks, lavatories, etc.

It consists of a lead body or box, A, with a dip or inlet-pipe, B, and an outlet C. The various parts are soldered together. As before stated, this trap is one of the oldest, and is at the same time one of the worst, traps in use, for despite the crusade against them, hundreds are still in use in various towns.

The body A soon becomes foul, for one flush from the closet never washes out all the excrement which has been deposited into it, and in a short time, if frequently used, it becomes a veritable cesspool.

The dip-pipe B is often fixed some distance from the band, as may be seen in the section Fig. 1, thus leaving a space for soil and any foul matter to collect, and it is generally either too short or too long; if the former, the trap soon ceases to act as one if there is the least syphonage; and if the latter, the soil and paper are more than ever impeded from leaving the trap.

The dotted line in the section shows where the foul matter chiefly settles and becomes hard and cement-like.

The air-pipe—if any—which is connected to this trap is usually either ¾ in. or 1 in. in diameter, and has so many turns and bends in it, that it is scarcely better than nothing at all.

And here, in passing, I may say that no soil air-pipe should be fixed less than 2 in. in diameter, for the plumber should know that the obstruction to the passage of the air caused by the friction, due to the velocity with which the air passes through a pipe, increases as the square of the velocity divided by the diameter of the pipe; thus the obstruction offered in a 1-in. pipe to a given volume of air passing through a given length in a given time is thirty-two times as great as in a 2-in. pipe.

By far the best plan is to carry a pipe the full bore of the soil-pipe up to the roof, and let it stand a little above the ridge, so as to keep all foul air escaping therefrom away from the windows.

Another trap whose sins are many is shown in section at Fig. 2, and is styled the "bell trap," on account of the bell which is fastened to the grating and which forms the "dip" or water-seal. It is used for sinks, and also for surface-water. The space all round the stand-pipe soon becomes filled with dirt, as the passage of the water through the trap is so sluggish that it cannot keep itself clean, and the inevitable result is the pulling up of the grating and knocking off the bell, when the water runs off merrily, and leaves a free vent for anything in the shape of bad air or gases which should chance that way.

Some makers have tried to improve this trap in many ways, but under whatever disguise they offer it to you, have nothing at all to do with it, for it soon ceases to be a trap and becomes a snare, while there are plenty of good traps to be had equally as cheap.

Figs. 3 and 4 show sections of traps which are as kings to the bell trap, but yet are far from perfect. They are both made on the same principle; one, however, empties itself at the side, while the other passes the water through the bottom. They are usually made of iron and are used for stone sinks, or on the ground-level for surface-water. They both suffer from one great defect, they are not self-cleansing, for in the angles marked A and B, dirt, soap, and slime will collect, impeding the passage of the water, and finally stopping it altogether, when the trap has to be lifted out and cleaned, and as it is very often merely dropped into its place and not cemented as it should be, this can easily be done, and to prevent a recurrence of the nuisance the trap is flung on one side, and a free exit for drain air is the consequence.

Since Messrs. Beard and Dent first introduced their patent cast lead traps, great strides have been made in this department of sanitary science. Figs. 5 and 6 show specimens of their S and P traps: they are made in any size from 1¼ in. to 4 in., and possess many advantages over the old D trap. They have no places in which filth can accumulate, they are smooth, without any joints or seams, and are very easily flushed. The "Dubois traps" are similar in appearance to Beard and Dent's; they are drawn by hydraulic machinery the same as lead soil-pipe, and to my mind are superior to the cast-lead traps, being absolutely of one thickness throughout, perfectly smooth, and there is no chance of finding any small holes in them as we sometimes do in cast goods. In using the smaller sizes of these traps, whether cast or drawn, it is always better to have them with a cleaning screw such as may be seen at A, Fig. 7, for facility in clearing, should they at any time become choked. Nothing less than a 4-in. trap should be used for fixing under a water-closet, and it should be soldered by a wiped joint to a lead branch pipe passing through the wall to the soil-pipe outside. If the closet be some distance away from the vertical soil-pipe, so that this branch exceeds 4 or 5 feet in length, it will be better to solder in a 2-in. lead pipe as shown in dotted lines at A, Fig. 5, for the purpose of ventilation. This pipe may be carried above the roof independently of the large soil-pipe ventilator, or may join that pipe at a point above the highest water-closet branch.

This minor air-pipe will prevent syphoning in the trap, and will also carry off any foul air which may accumulate in the branch pipe.

Not very unlike in appearance to these traps is Hellyer's "Anti-D trap," as may be seen at Fig. 8, but this has a square outgo, which renders the trap less liable to be unsyphoned.

Waste-pipes from baths, sinks, lavatories, etc., should pass at once, if possible, through the wall into the open air, and discharge—if they be fixed upstairs—into an open head, which in turn carries the water by means of an iron pipe to the ground level, where it is discharged into an open gully-trap; Fig. 9 illustrates plainly enough what I mean.

It will be seen that the short lead waste-pipe is trapped immediately under the bath. This is not absolutely necessary, as there is no danger to be feared from the air which might pass up through this pipe if left untrapped; but there is no doubt it will be very unpleasant to the sense of smell, for the soapy slime which will be sure to collect round the inside of the pipe smells very nasty.

Jennings has brought out a trap for baths, etc., which, in addition to the usual water-seal, has a ball which floats against the inlet pipe and prevents any back pressure of drain air from entering the house that way; but the security afforded by this trap is not needed if the waste-pipe discharges into the open air; and if it be feared that the wind will blow into the pipe, a copper hinged flap should be soldered to the end of it. If the waste-pipe has to be carried down inside the house, it should be entirely of lead, and an air-pipe of sufficient size should be carried from the highest point near the trap to the roof: at the foot a gully-trap should be fixed as before explained.

The traps which have been described up to now are only fit to be used in connection with the internal sanitary fittings of a house, and are, therefore, the only sort with which the plumber has really anything to do; but we often find that the plumber who has to fit up the interior, has also to superintend the laying of the drains outside, so it is well that he should thoroughly understand the work throughout.

In the first place, as regards the drain, the pipes should be made of stoneware well glazed, perfectly smooth within and accurately round.

All junctions or branches with the main house drain should be made at an acute angle running in the direction of the current. The joints are best made with cement, care being taken that the spigot end of one pipe goes tightly up to the end of the socket in the other, so as to leave no ridge or space inside to cause an obstruction. The drain should run straight from point to point, and at every change of direction some means of inspection should be provided.

This is best done by fixing an open channel bend as shown at Fig. 10, and carrying up a square brick manhole to the surface, covered by an iron grating or solid cover; such channels may be obtained of Messrs. Doulton & Co., Lambeth, who make them at a variety of angles.

As regards the size of house drains, as a general rule, 6-in. pipes for the main drain, and 4-in. pipes for the branches, are the most serviceable. In the case of a very large mansion, it may sometimes be desirable to lay 9-in. pipes, but it must be borne in mind that it takes a large quantity of water at a great velocity to thoroughly flush a drain of this size. For this purpose, an automatic flushing tank placed at the head of the drain answers capitally, as by this means rain-water, and the wastes from sinks, etc., may be collected and discharged with great force through the entire length of drainage. Every long drain with many branches should be thus flushed.

One of the best contrivances for this purpose is Mr. Field's tank, shown at Figs. 11, 11A. The wastes from the sinks, etc., should discharge over the grating into the small trap, A, which is movable, and thence to the body of the tank, B. The outgo is in the shape of a syphon, C, and, when the tank is full, the water overflows through the longer leg, starting the syphon and emptying the contents of the tank quickly into the drain. Messrs. Doulton & Co. also make a capital flushing tank, both in stoneware and galvanised wrought iron. These traps also act as grease-traps for preventing the kitchen grease from entering the drain in solution with hot water, as the cold water in the tank congeals the fat as it enters, and leaves it floating after each flush. The accumulated grease should be removed periodically, or the result will inevitably be a stoppage. A most serviceable trap for receiving surface-water, rain-water, and the various wastes from sinks, etc. (but not scullery sinks, as the water from these often carries grease with it, and which should be treated in the manner mentioned above), is the gully-trap shown at Fig. 12, and in section at Fig. 9. It should be provided with a galvanised iron grating, and, if possible, the rain-water and wastes should enter by means of a bend into an inlet at either the back or on one side of the trap. By this means the splashing, which is inevitable when they empty over the top of the grating, is prevented, and greater facility is offered for inspection and cleansing. The surface-water from the yard or area where it may be fixed can enter through the iron grating at the top of the trap.

The soil-pipe, or W.C. waste, should be connected with the drain by means of an obtuse bend at its foot, and the drain from this point should run in as direct a line as possible for the sewer. After the drain has passed all points of junction of branch drains, a syphon or trap should be fixed, to thoroughly disconnect all air communication between the house drains and sewer.

A large variety of traps are made for this purpose, but one of the best is Hellyer's "Drain Sentinel," shown at Fig. 13. The inlet is in the form of a channel, thus affording a large inlet for air to the house drains. This trap should be fixed in a disconnecting air chamber, as may be seen in section at Fig. 14. A manhole, or air chamber, of ample size is built up to the surface, of brickwork, and a channel-pipe, B, is laid at the bottom of it, receiving the house drain and emptying into the "Drain Sentinel," A.

This channel-pipe may be had with branches if necessary. The floor of the air chamber should be sloped from the sides to the middle, and the inspection arm, C, should be stopped with a plug or movable stopper. The arm at D may be similarly stopped, or a pipe may be carried from it to ventilate the drain on that side of the trap.

The top of the air chamber may be covered by an iron grating or a solid cover. In the latter case, one or two 4-in. pipes should be carried up from the air chamber as E (Fig. 14).

Messrs. Doulton & Co. have a trap which they call the "Kenon," in connection with which they make an air chamber floor of stoneware, well glazed, which has a 6-in. channel passing through the middle, with side inlets for branch drains, if necessary. It is very useful for places where the workman does not understand how to construct the floor himself.

Messrs. Dent & Hellyer have a trap, called the "Ventilating Drain Syphon and Sewer Interceptor," which will give great satisfaction, if properly fixed. It is shown at Fig. 15. It consists of a round pipe trap with a 2½-in. water-seal. The body of the trap is comparatively of much smaller diameter than the inlet, for the trap to hold as little water as practicable. The inlet is about 6 in. above the water in the trap, so that the discharges fall almost vertically, changing the water by a very small flush. The upper part of the trap is enlarged for the admission of air into the house drain, and is surmounted by an iron grating. When this syphon is situated near a window or door, it is better to replace the grating by a stopper, and a 4-in. air-pipe should be carried from the air chamber to a wall remote from the window or door.

It is not absolutely necessary to increase the size of the trap or syphon for the air inlet, and a very decent job and a cheap one may be made with a 6-in. stoneware P trap with an inlet at the back, using the upper inlet for ventilation.

In any case, the sanitary arrangements of a house should be so contrived and constructed in the best and simplest possible manner to use freely those deodorisers and disinfectants which Nature itself supplies: namely, water and air. These are, or ought to be, common to all in a pure state, though it too frequently happens that both the one and the other are contaminated by man's culpable agency.

LATHES FOR EVERYBODY

BY SELF-HELPER.

THE construction of the bed and frame will not be found to be difficult by anybody who has succeeded in making the heads, as I have described; but, to make a good job, none of the work must be carelessly executed, as want of steadiness in this part will prove fatal to all good work in the lathe.

For the bed and legs, it would be well to have the wood 4 in. × 3 in., but slightly lighter stuff could be made to act. It is well, however, to have everything rigid and very strong.

From Fig. 2 it will be seen that each leg consists of two pieces mortised together so as to form a T. To keep the legs as rigid as possible, I got stays forged from iron 1 in. × ⅜ in., and, having japanned them, fastened them to the woodwork with ⅜-in. bolts. These stays were made of one piece, bent into the shape of the letter V, and so high as to let the centre upon which the crank hangs pass through their apex. The tops of the legs must be carefully cut away from each side, leaving a shoulder, upon which the sides of the bed may rest.

Two bolts at each end will then secure the bed and legs in place. The top of the bed must now be perfectly flat and out of winding. Each cheek must be the same depth, so that the under part of the bed will be flat; and the shears must be exactly 2 in. apart, the same at each end, and at every point between. If the headstocks have been made exactly, the tenons will be found to fit nicely into the space for them in the bed.

The frame will now be found to be fairly steady, but it will require some stretchers connecting the legs together, so as to prevent the pressure of the centres on the crank axle from pushing them apart. The front one may be a piece of iron 1 in. × ¼ in., lying flat on the ground, and fastened to the bed with wood screws, as shown.

As the treadle will be hinged to the other stretcher, it will require to be somewhat stronger.

I used wood 1½ in. × 2½ in., and let it into the ends of the cross pieces of the legs, as seen in Fig. 2. A couple of little bolts secured it very firmly. The stand is now ready to mound the flywheel and crank shaft. That used for this lathe was bought, the flywheel being 27 in. diameter, with four speeds, and one small speed for metal work. The throw of the crank is 2½ in., which, doubled, makes 5 in. from the highest to the lowest point. Then the pitman comes to a point in the treadle halfway between the hinge and the place the foot rests on, so that the treadle rises 10 in. in front, which I find to be a fair allowance for a lathe of this size.

The centres on which the crank is hung can be purchased for about 1s. 6d. a pair, and it would not pay to make them at that rate. It is not a difficult job in any case. A piece of ⅝-in. steel is screwed, and a cone turned in the lathe. The point is then hardened. The centre holes in crank should be bored deeply with ⅛-in. drill, and it would be better if they were bushed with hard cast steel.

Instead of the bent crank shaft and pitman, a straight shaft and external cranks could be easily used. Bessemer steel 1⅜ in. diameter would do for the shaft. It should be hung on plummer blocks, which could be either purchased complete for 3s. 6d. each, having 1 in. bearing, to which the shaft would be turned down; or else cut from lignum vitæ, like Figs. 5 and 6; or else cast in patent metal like the same figures. Figs. 7 and 8 show the external cranks. They are best made in cast iron, but I have often used pieces of plain bar iron, about $\frac{5}{8}$ in. thick, for cranks.

If this plan is employed, the back stretcher should be so long as to project beyond the legs three or four inches at each end.

The treadles, one at each end, would be plain bars of wood, 3 in. × $1\frac{1}{2}$ in. × 2 ft. 6 in., hinged at one end to the stretcher, and attached to the pitmans at the middle. In this manner, both treadles would rise and fall simultaneously, and if a bar of sufficient length were screwed to both, we would have an efficient treadle the entire length of the lathe. Since the treadle thus formed would be supported at each end, there would be no tendency in it to get into winding by the pressure of the foot; but, when a treadle is supported by only one joint in the middle, the pressure of the foot on one corner tends to push down that corner and raise the one at the other end, and a treadle on this principle must be made very strong indeed to bear the irregular stresses upon it.

I supposed, in my former article, that the mandrels were not inserted in the headstocks until this stage of construction was reached, the reason being that it is difficult to ascertain their exact position in the headstocks. A templet of tin can now be made, like Fig. 2. The space in the lower part justs fits between the bed, and the point, C, is just over the middle and 5 in. from X.

To use this templet, the headstock is placed on the bed in the position which it is to occupy permanently, and the templet placed against one face. A point is then passed through a little hole at C, and marks in the headstock the position which the centre of the mandrel is to occupy finally.

The templet is then, *without turning it*, placed against the surface at the other end of the headstock, and the position of C transferred to that end likewise. The same operation is gone through with the other headstock, taking care to have the same surface of the templet always pointing towards the same end of the frame.

The treadle for the bent crank shaft is simply a frame like Fig. 1, about 18 in. shorter than the bed, and 2 ft. 3 in. wide. The position of the central member, M, is determined by that of the dip in crank axle. It should be directly under it. There is a mortise cut, through which the pitman passes, and a $\frac{3}{8}$-in. bolt across will serve as a pin, on which the latter hooks. The wood for this form of treadle would be $1\frac{1}{2}$ in. × 3 in. or 4 in.

The pitman I used was a plain rod of $\frac{1}{2}$-in. iron, bent at one end to embrace the crank, and, at the other, the pin I mentioned. It was filed flat at the bends, so as to afford a better bearing, and case-hardened. It was then japanned.

This lathe, as I have described it, worked remarkably well. It took a great deal of time, however, to make, as everything was finished in the best possible manner. If any of my readers wish to proceed more economically, all the woodwork may be made of beech, or even deal, and the lathe will still work well. Instead of the coned brass bush for the front mandrel bearing, I have used, on occasion, patent metal, pouring it into a hole in the headstock, the mandrel being held in its proper position. This is much easier to accomplish than boring a gun-metal bush, and works quite as well.

I trust that what I have said will induce many readers of Work to try their hands at lathe making, for, if they do, I am fully persuaded that it will be of the greatest possible benefit to them in their after life.

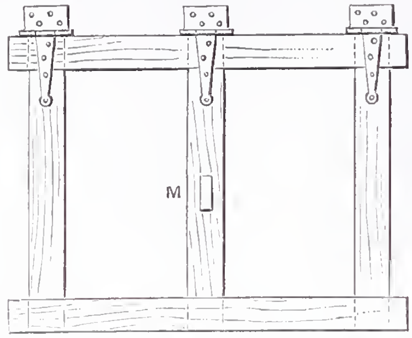


Fig. 1.—Plan of Treadle.

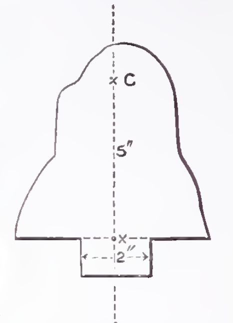
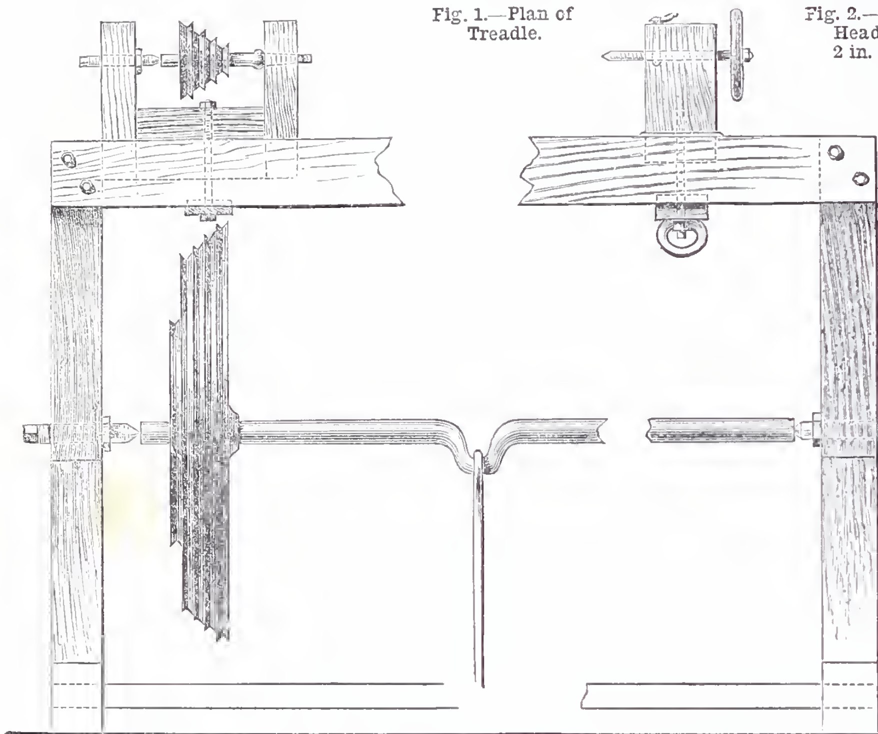


Fig. 2.—Tin Templet for Headstocks. (Scale, 2 in. to 1 ft.)



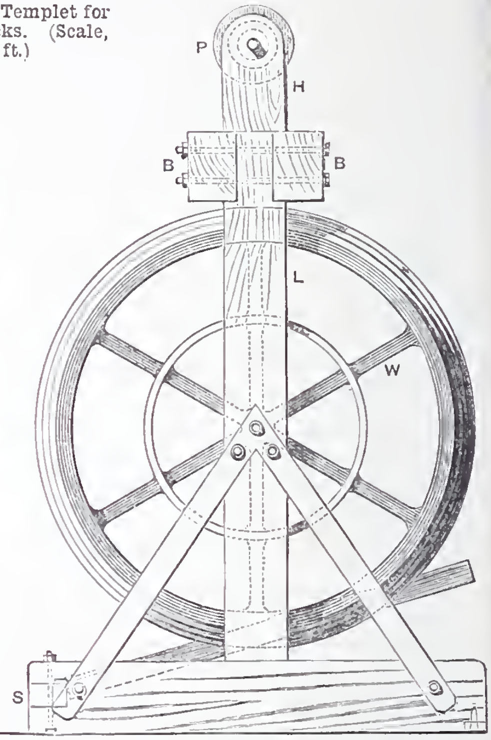


Fig. 3.—Front View of Lathe. Fig. 4.—End View of Lathe—P, Pulley; H, Headstock; B, Bed; L, Leg; W, Flywheel; S, Stretcher. (Scale, 1 in. to 1 ft.)

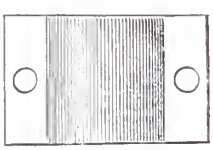


Fig. 6.

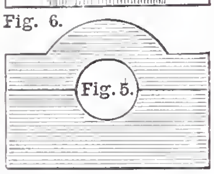


Fig. 5.

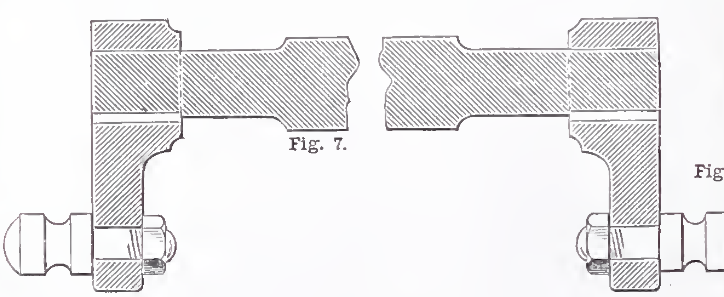


Fig. 7.

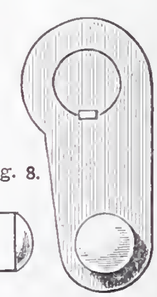


Fig. 8.

Figs. 5 and 6.—Plummer Blocks. Figs. 7 and 8.—External Cranks.

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

THE CASE AND INTERIOR MECHANISM OF THE COMPOUND KALEIDOSCOPE (*continued*).

(*For other Illustrations to which References are made in this Paper, see Pages 424, 425.*)

As arranged at the close of the last article, our next proceeding is to set out the fillets to which the sides of the case are to be screwed. They are $\frac{3}{8}$ in. thick, and are fixed flush with a line gauged all round $\frac{3}{16}$ in. from the edge, as shown in Fig. 2. As the interior of the plates are duplicates of each other, two sets are required, and the fillets at both ends are cut away in places, to clear the mechanism of the lower part of the arms (K K, Fig. 5), also on the front plate alone, to clear the lever, L. Having fixed the fillets, we next prepare the sides of the case, not forgetting a previous remark respecting the character of the wood to be used for the purpose. As this affords an opportunity for the display of good workmanship, I may here pause to remark that as, in many workshops, the same bench does duty for all classes of work, whether rough or smooth, it is just possible that the last job may have been of a coarse description—such as the repair of garden utensils or work of a like character—the consequence being that particles of a gritty nature have become embedded in the bench-top, rendering it extremely difficult to avoid scratching the surface of such work as that in hand. Presuming that the worker wishes to escape these troubles, he is hereby advised to procure a piece of deal, 3 ft. long, 11 in. wide, and 2 in. thick. Plane up one edge, and fix to the bench with screws at each end, the heads being sunk well beneath the surface, so as to clear the plane in trueing up for the present, and on any future occasion when necessary. Supposing the face to be true and level, we must provide a stop by cutting a dovetail, tapering groove $\frac{3}{8}$ in. deep across the grain about 2 in. from the end. Into this groove is to be tightly fitted a piece of hard beech, $\frac{5}{8}$ in. thick, $1\frac{1}{4}$ in. wide at one end and 1 in. at the other, the groove being dovetailed so that the bottom is $\frac{1}{4}$ in. wider than the top. When so fitted, the front edge of the stop against which the work is to abut must be rabbeted square with the front edge of the board, and perpendicular to its face.

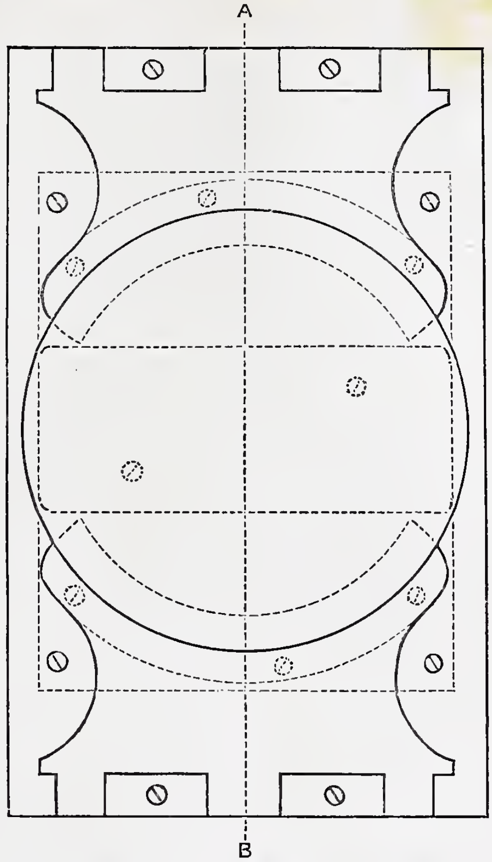


Fig. 6.—Diagram showing Method of Mounting Uprights and Segments in Lathe for turning them out of Solid Piece.

To proceed: The pieces composing the sides should not be less than 9 in. long and 4 in. wide; have a keen edge on the trying plane, with the back iron set close, and plane up each piece carefully to $\frac{1}{4}$ in. thick; then square one edge, and set off the rabbet at each end so as to support the ends of the case at a distance of $8\frac{1}{8}$ in. apart. As it is important to have all exactly of the same length, scribe a line across one end of each piece with the cutting end of the scriber; the distance from this to the second line is then gauged with a pair of compasses, and, having also gauged a line to the depth required, run a saw-cut across just outside the lines, and finish with a paring chisel. In order to shoot the edges to the correct angle, we must arrange matters as shown in Fig. 7, where the board already attached to the bench is utilised as a base on which to construct a suitable tool for the purpose. In the first place, observe that the stop is removed; the baseboard (A) is chamfered on its front edge, and to this is hinged a board (B), about 18 in. long, 5 in. wide, and $1\frac{1}{2}$ in. thick, the hinge being attached $\frac{1}{4}$ in. below the face of the board; over this another strip (C) is screwed, in order to raise the work within reach of the plane iron. In this latter piece a stop is required, similar to that in the baseboard; and the adjustment to the correct angle is effected by means of a pair of wedges (D, D), having each a mortise cut in the centre, so that they can be clamped to the bench by a round-headed screw and washer. The mode of using the above appliance will be obvious from the position of the hands as shown in the illustration, the work being held and pressed against the plane by the thumb of the left hand, whilst the plane is firmly kept to its work by the right as it slides in the angle formed by the bevelled edge of the board (C) and the base. In this way the sides can be truly planed to an angle of about 67°. As these will, probably, vary a trifle in width, it is only required, for the present, to bevel the edges which have already been straightened. They are

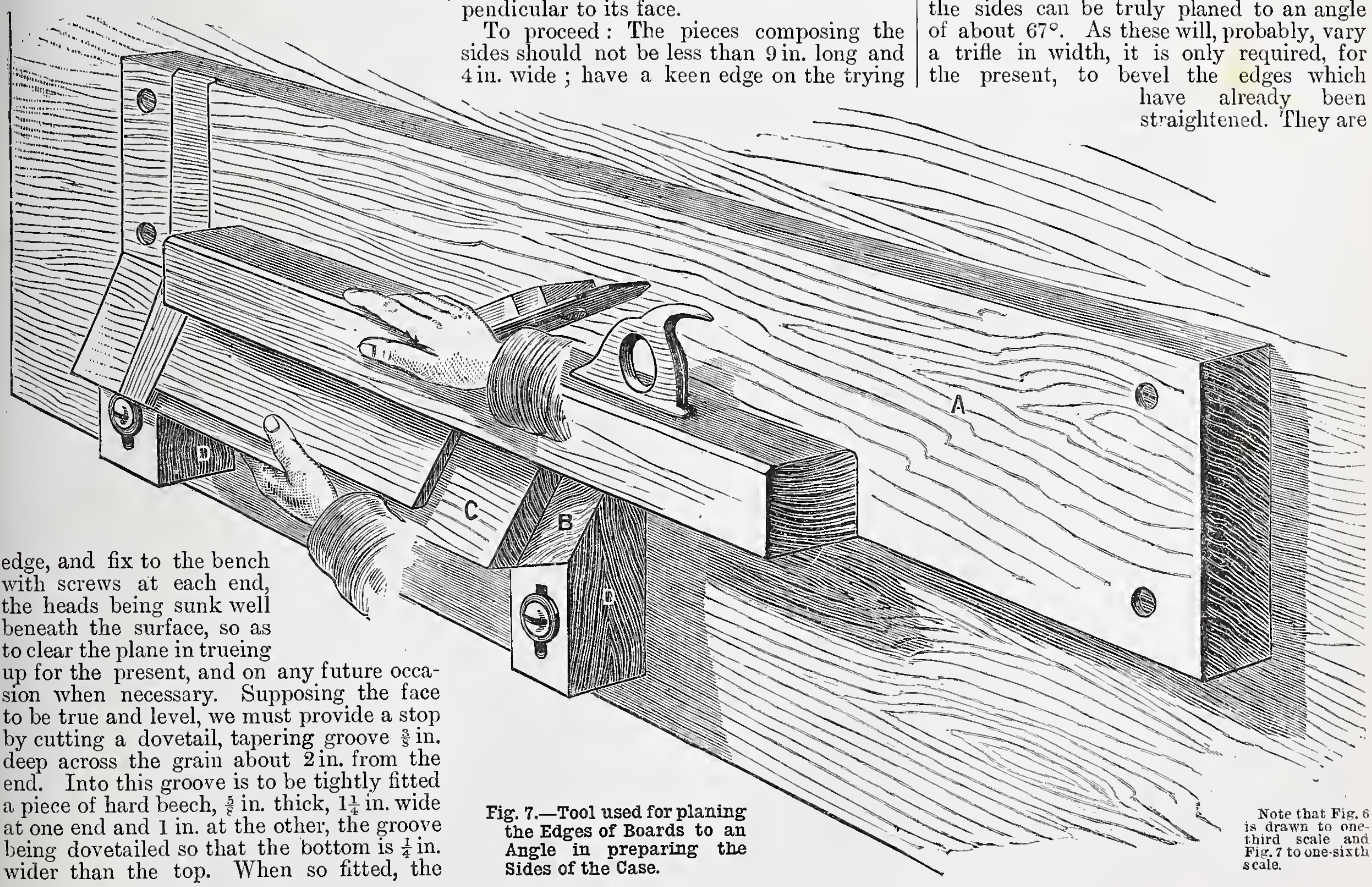


Fig. 7.—Tool used for planing the Edges of Boards to an Angle in preparing the Sides of the Case.

Note that Fig. 6 is drawn to one-third scale and Fig. 7 to one-sixth scale.

attached at each end by three round-headed brass screws, $\frac{1}{2}$ in. long, and it will ensure regularity, and greatly enhance the finished appearance, if the holes are set out with the square and compasses. In order to preserve the parallelism of the two plates while the sides are being fitted, we shall require a temporary piece to act as a stay; it is about 3 in. wide, rabbeted squarely at the ends to the correct length, and screwed to the flat at I (Fig. 2), its true edge being, of course, coincident with the angle of the plates. Now, secure the first side temporarily to the opposite flat with two screws at each end, its true edge being also carefully placed at the extreme angle on the right of Fig. 2. Here it will be noticed that an opportunity offers to rectify any little error or defect in the working of the slides, as hinted towards the close of the last article, seeing that the plates are now held parallel, and the interior is easy of access. When satisfied that each part works quite smooth and regular, we may pass on to fit another side below the first, with their true edges adjacent. Having produced a perfect joint, fix with a screw at each end next the true edge, and mark off the width at the angle below; then unwind the screws and bevel this edge to the mark. When this second side is secured in position we must return to the first, mark the width at the angle, and, having bevelled the edge, refix, and proceed in the same way with the third, and all the rest in turn until the last is reached, when, to make the joint between the seventh and eighth, it will be necessary to remove the first of the series out of the way until the joint between the last two sides is perfect; then replace it, and reduce the last edge very gradually, lest the piece be spoiled in the attempt, finishing by trimming the ends off flush and very slightly rounding the edges. As we still require access to the interior, the polishing, etc., must be deferred, and two sides each from the top and bottom of the case must be removed, the inside of each being marked with a $\frac{3}{8}$-in. chisel in Roman numerals to denote their respective places. Placing these out of reach of injury, the circles at X, X (Figs. 1, 2, and 5) now claim attention. They are prepared from half-inch close-grained mahogany, and the easiest method will be to turn them out of the solid, as shown, by mounting on a chuck with the screws passing through holes set out on a circle $6\frac{3}{8}$ in. diameter, the same being used eventually to attach them in position. All necessary holes are bored of the proper size before the surrounding substance is materially reduced, to avoid risk of splitting. To lessen waste of material, the interior portion may be removed with a thin parting tool, and reserved for constructing the eye-pieces later on. It is scarcely necessary to remind the worker that both sides of each ring should be trued up in the lathe, as it is of importance that they be of the same diameter externally and internally, and also of even thickness throughout, to ensure a smooth, even movement. By fitting a slip of wood in the opening at each end of the case, a centre may be found, and a circle described to coincide with the interior of the rings, and their correct appearance and position ascertained from Fig. 1.

The two uprights (V, V, Figs. 2 and 5) are turned out of one piece of mahogany, 12 in. long, 8 in. wide, and $\frac{1}{2}$ in. thick; one side is planed true and level, and also one edge; it is then secured to a chuck in the manner denoted by the *full* lines in Fig. 6, and a centre line (A B) scribed on the face parallel to the true edge through the centre found as it spins in the lathe. After being turned to the proper thickness, the opening is bored true and square to the same diameter as the outside of the rings, which may be used as gauges in the operation. In the preparation of the two segments (W, Fig. 2) we may economise the mahogany by attaching a piece of deal, $2\frac{1}{2}$ in. wide and 1 in. thick, across the centre of the opening in the uprights already on the chuck, and, on each side of this, a piece of mahogany $6\frac{1}{2}$ in. long, $2\frac{3}{4}$ in. wide, and $\frac{1}{2}$ in. thick, the position of each being indicated by the *dotted* lines in Fig. 6. The inner curve on these segments is the same as the rings, and the outer edge is rounded as in Fig. 5. When this is accomplished, two pieces of brass plate, $6\frac{1}{8}$ in. long, $\frac{3}{4}$ in. wide, and $\frac{1}{16}$ in. thick, are bent to the proper eurve, and fixed to the segments by fine $\frac{1}{2}$-in. screws, inserted about 1 in. apart. Now proceed with the base plate (U, Figs. 2 and 5): Plane to $\frac{1}{2}$ in. thick, and set out the mortises at each end, with the inner edges $\frac{1}{32}$ in. in excess of the length of the case; then the shoulders of the tenons are squared from the true edge of the piece and fitted to the base, to ensure their being firmly put together without fear of splitting; after which, a moulding is worked round the upper edge of the base, the case is laid on end on the bench, and the segments secured to the uprights, which have been well rubbed on the curves with blacklead, a slip of paper being interposed between the brass and the ring to avoid pinching. On removing the paper, the groove thus formed should slide smoothly over the rings. In providing the clamping action at F (Figs. 2 and 5), the instructions already given will apply to the milled head, which has a screw projecting about $\frac{1}{8}$ in. diameter, the small casting being tapped to suit, and the boss on the under-side let into the segment. The point of the screw bears on the free end of a thin spring of hard brass, $1\frac{1}{4}$ in. long and $\frac{3}{8}$ in. wide, secured in a recess by a small screw at the opposite end to that at which the pressure is applied. When all these little operations have been effected, the uprights can be cut to the outline in the figure, and finally glued to the base, especial care being exercised to be certain that they are exactly perpendicular to the base, after which, if deemed advisable, the joint may be further strengthened by passing a fine screw, about 1 in. long, obliquely upwards on each side of the central tenon, and $3\frac{1}{2}$ in. apart. This completes the stand and exterior of the case, with the exception of two brass clips, one of which is seen at Y (Fig. 2), which secure the object-box carrier to its seat; and four little handles, as at *m* (Fig. 1), having pins, which are fitted and glued in $\frac{1}{4}$-in. holes bored in the centre of the length and breadth of each alternate side.

We must now retrace our steps somewhat, and prepare the limbs (*a* and *b*) which compose the arms (K, K, Fig. 5). As there are four of each, we require for the lower set a piece of beech or hornbeam, 17 in. long, planed to $1\frac{3}{8}$ in. wide and $\frac{7}{8}$ in. thick; and, for the upper, a piece of the same thickness, but 14 in. long and $\frac{3}{4}$ in. wide. At $\frac{3}{8}$ in. from the front edge, a line is gauged on both sides, and on this the holes are set off and bored true and square, the upper set being bored to fit the tube which encloses the pinion, and those in the lower set to fit the tube enclosing the steel rods. One from each set must now be cut off, and pared to the form shown in the drawing, so that, on inserting a tube in the holes, they can be used as patterns from which the outlines of the rest can be marked, being careful to have each set of equal length, measuring from the edge of the hole to the point at which the two limbs are hinged together; and, in particular, the bevelled faces must be cut to the same angle; after which, grooves along the centre of these faces are set out, and cut $\frac{1}{2}$ in. wide, and a little over $\frac{3}{8}$ in. deep. Now halve the upper set at the top, as shown, removing sufficient to enable the inner edges to form an angle of 90°. A brass butt hinge connects the upper limb to the lower, and as the countersink is reversed in one set of holes, the screws must be replaced by those of a round or mushroom-headed pattern. If this is properly done, the upper limb will move freely round on the hinge when the lower is pressed flat on the bench, either side up. It will be well, therefore, to apply this test as each screw is inserted. Held against the lower edge of the hinge by a screw is a piece of brass having a slot cut the width of the screw at *d*, which is used to clamp the table (*c*, Fig. 5) to the arm after adjustment by the screw at *f*, the wood being mortised to match the slot in the plate, to allow of the necessary movement. To complete the arms, we require four brass brackets (*f*, *f*, Figs. 2 and 5), fitted with a screw $\frac{3}{4}$ in. long, and a spiral spring of hard drawn brass wire, about No. 18 B.W.G.

Our next business is the preparation of a table, or base, on which to mount the mirrors, and, at the same time, capable of slight motion up or down the inclined face of the arm, and of being securely clamped to the same. In dealing with this portion, we will take but one side, and assume that the two will proceed simultaneously, and we will further suppose that the stuff will be prepared in such a way that all similar pieces shall be cut from one length, which has been planed to a suitable width and thickness. The principal part of this mounting is the strip (*c*, Fig. 5). This is of mahogany, 8 in. long, 2 in. wide, and $\frac{3}{16}$ in. thick on the inner face, and at $\frac{5}{8}$ in. from each end a piece of mahogany $1\frac{15}{16}$ in. long, $2\frac{1}{2}$ in. wide, and $\frac{3}{16}$ in. thick, shown in section at *e*, and in elevation by the dotted lines in Fig. 5, is attached by four small screws. These latter pieces prevent warping and twisting of the table, to support which in a longitudinal direction, and also afford a hold for the screw at *f*, a strip of beech, $7\frac{1}{2}$ in. long, $\frac{1}{2}$ in. wide, and $\frac{5}{16}$ in. thick, is attached by eight screws, 1 in. apart, the outer screws being $\frac{1}{4}$ in. from the ends. Previous to fixing this in position, lines must be scribed square with the edge, and $\frac{11}{16}$ in. from each end of the strip *c*. Just within these lines, and abutting against the last-mentioned piece, are two slips of beech, $\frac{1}{8}$ in. thick, and of the same width as the grooves on the inclined face of the arm; these are held by a small screw at each end, and are slotted to match the mortises, and thus clear the screw at *d*. To support the lower edges of the reflectors, at *i*, *i*, are seen two pieces of beech, $\frac{3}{4}$ in. long, $\frac{7}{8}$ in. wide, and $\frac{1}{8}$ in. thick, which are screwed to the base (*c*), the upper edge being held by the slip of beech at *h*, 7 in. long, $\frac{9}{16}$ in. wide, and about $\frac{3}{32}$ in. thick. Any difficulty experienced in planing the edges of such thin pieces may be overcome by holding the slip of wood in the fingers and drawing it towards you over the sole of the trying plane, which is placed, bottom upwards, in the vice for the purpose. Blacklead must now be applied to the grooves and their corresponding guides, and the screws at *d* inserted, the relative position of the two portions being exactly denoted in Fig. 5. On clamping the screws, we can ascertain the lengths of the tubes and thickness of the washers which maintain the arms at the proper distance asunder; at the same time we can determine the thickness of the pieces of mahogany at *j*, *j* (Figs. 2 and 5), which occupy the space between the arms and the ends of the case. On reference to Fig. 5 it will be seen that the tubes and pinions are secured in their respective position by screws or rivets passing through them; after which, the back plate may be taken apart from the sides, and the milled heads can be attached to the pinions which pass through from the inside of the plate—not forgetting the brass washers, which bear on each side of the plate—before finally driving the heads on to the tapering ends of the pinions. The whole of the mechanism may now be connected in readiness for the reception of the optical portion, the preparation of which will be treated in my next paper.

ENGRAVING ON METAL.

BY NORMAN MACLEAN.

Engraving on Britannia Metal.

It will be, perhaps, of some assistance if I enumerate the various branches of engraving on metal. Brass, zinc, and pewter have already been alluded to. The easiest, perhaps, is Britannia metal engraving; but even this metal requires a certain style to make a little work look effective. The work, too, is done very cheaply, and at first sight would appear as if it were impossible to earn a living at the price; but as many engravers do nothing else but work on the above metal, if they have plenty of work they have nothing to complain of at the week's end. The principal articles made in Britannia metal are tea and coffee sets, hot and cold water jugs, biscuit boxes, etc. These are usually engraved, chased, and engine-turned.

At the present time there is not so much engraving, as chasing and embossed work, with fluting in the Queen Anne style, is most in fashion.

Then comes the "hollow ware" engraver, who ornaments trays and waiters, tea and coffee services, dish covers, ice pails and jugs, *entrée* dishes, soup tureens, all of which are made in silver and German silver.

Another branch is the engraving of small work, such as fish carvers and eaters, dessert knives and forks, forks and spoons (not lettering or cresting), and general "odd work," which is also made in silver and German silver. Heraldic engraving is a branch—the highest, I may say, as it requires a skilful and accurate draughtsman, a steady hand, and remarkable patience. It includes the engraving of coats of arms, crests, monograms, and inscriptions on metal, and lettering and cresting on pearl and ivory. There are also the watchcase and dial engraver and the jewellery engraver. The young workman will be able to select a branch of engraving from the foregoing, but I would strongly advise him to make an arrangement with some *boná-fide* workman who would be willing for a consideration to put him in the way of sound practice, or, what would be better still, to take him as an articled pupil for a time. There is no royal road to engraving; it is only to be learned by constant practice and competent tuition. These remarks apply, of course, to the more artistic branches.

I will now make a few remarks as to the form or condition of the work as it is given out to the workman to be engraved. In the case of Britannia metal goods, they are invariably "made up"—*i.e.*, the article is made throughout, as for a teapot, being fitted with handle, spout, lid, and is, with the exception of engraving, ready for electro-plating and finishing. Other articles, such as for chasing, embossing, and engine-turning, are not so "made up," the condition being the same as that in which they leave the spinning lathe, and otherwise rough polished or buffed. In German silver hollow ware, these are "made up" to a certain extent: thus, a teapot would have the spout, foot or feet, lid, and mounts for the reception of the ebony or ivory handle, which is fitted after plating; and where the handle is of metal, the necessity of non-conductors of ivory, etc., make it imperative that the handle should be fitted after plating, as the ivory will not stand the acid of the plating vat. With plated table cutlery, the blades and forks are sent to be engraved before they are handled, as they require to be electro-plated before the handles are attached. And with heraldic engraving, it is both finished and unfinished when it reaches the workman's hands. Presentation articles are usually made by the manufacturers, who generally receive the order and particulars of inscription at the same time; then the engraver's work is done before the article is finished. But in the case of a present having been bought from a silversmith, the workman has to do his work in a careful manner, so as not to spoil the finish of the article, and for which, by the way, he charges accordingly.

Probably the cheapest thing in the market for a workman to try his hand upon is a twelve-inch brass waiter, either round, oval, or octagon. These may be procured ready for engraving from Mr. Samuel Groves, Broad Street, Birmingham, at a low price. These waiters, well engraved, plated, and finished, *should* command a ready sale in bazaars, etc. Having procured the waiter, the next thing to be considered is the design, which should be pretty and effective, with just enough work in the design to well balance it. There are many styles to choose from, but at present the workman will perhaps prefer to try the one found in Fig. 32, and which may be engraved in five sections. To "set out" the waiter, first warm the centre of the waiter, and rub a little beeswax thereon, and place a small piece of zinc—say, one-half inch square—on the wax while it is hot. This will cause the zinc to adhere, and prevent any marks consequent on the action of the legs of the compasses.

Now, with the compasses strike *faintly* all the circles needed for the pattern, then accurately divide the waiter into fifteen equal parts by stepping it round with the compasses. This will leave two divisions for the panel, and one division for the ivy leaf spray. Next cut the outside lines of the panels, using the dividers to trace the second line of the panel, by means of the outside line. Cut all these second lines, and you will have the required space in which to sketch the scroll work. To do this, draw a straight line down the centre of the panel, and sketch in truly, and afterwards trace it in with the point (Fig. 23, page 596), and outline only. Now sketch in the spray to the right, point in and outline, and proceed in like manner with the outside and inside borders. On the line down the centre of the panel cut an almost imperceptible dot or speck, so that you may know the exact centre. Now that we have got a section outlined, the next thing to be done is the taking of an impression in paper, termed a "white" or "dry" print. This is done in the same manner as the taking of an ink print, with the simple exception that we must use no ink. Use a pretty good paper, such as good white or blue unruled foolscap. Take off the paper, after you think you have got a good impression, and dry it gradually and thoroughly. The pounce bag here comes in. It is simply made by crushing fine an ounce or so of common whiting—see that it is dry—and then enclose it in a piece of well-washed linen. Now cut from the print all superfluous paper, and cut an oval-shaped hole in the top and bottom of the paper print exactly down the centre. Now draw a centre line down the remaining four panels, and rub just the least bit of candle grease on the surface of each, and also where the ivy spray is to come. The print now being ready for laying down, dust the pounce bag smartly on the print with the impression upwards, and "lay down" all the panels in turn. If the workman has been successful in dividing the waiter accurately, the pattern will fit exactly. The workman will observe that the borders are little else than outlining, thickening, and colouring, which will form excellent practice, while the scroll and leaf work will be an agreeable change. Work slowly at first, frequently pausing to see that the work is uniform. The leaves of the ivy spray may be "blacked" out with the "shading" graver, and lightly veined, and the panels blacked out with either the graver or the shader, according to the time it is desired to spend upon the work. The scroll work will not want much shading, and only judicious thickening. I hope I have made this clear to the young workman, who is supposed to know something about the treatment of ornament as far as regards the shading, etc.

In Fig. 33 will be found a sketch of a Britannia metal teapot, of a very old-fashioned shape, but which is now very fashionable. This pattern may be done either in first-class style or in a cheap and effective manner.

As the latter style will better suit the young workman, I will give a few brief directions how to proceed with the work, leaving the engraver to supply the details according to his individual taste, which the workman will do well to practice.

The chief ornament is the wide border, with arches and drooping fleur-de-lis. For the double lines of the top and bottom borders a double wriggling tool (Fig. 34) is used, this tool being made in many different widths. It consists of a flat or ordinary wriggling tool, with a groove cut straight down the centre, slightly "set off" and whetted on the back in the usual way. In addition to the ordinary graver will be required a large round-nosed tool for the "bright" leaves of the top and bottom borders; also a smaller one for the small spots; and a narrow flat tool or wriggler for the waved lines of the bottom border, and the waved line of the spray in the hollow section at the top of the teapot.

The tools being ready, rule two single lines as truly as possible, using the dividers, and the angle of the join where the hollow at the top of the teapot commences. Rule similar lines of the required width for the bottom border, using the bottom of the teapot for a guide. Now take a double wriggling tool of the proper width, and with a regular rocking motion of the wrist, push forward the tool, which will, or ought to, make a continuous dotted double line. All these double lines are done before putting aside that particular tool. Now change the tool for the narrow wriggler, and cut the waved lines on each side of the bottom border, and a rather deeper and bolder wave for the spray at the top of the teapot. Then take a wide shading graver, a No. 12, and cut away the whole of the space between the lines of the bottom border, cutting lengthways, and then it is ready to receive the bold cutting of the large round-nosed tool (Fig. 35), which will eventually take the form of "bright" leaves. To do this, after whetting the round tool, rub the tool on a piece of thick leather on which a little rouge has been sprinkled; this will make the tool cut bright. Draw a pencil line down the exact centre of the teapot, and cut the four small bright spots. Now step out with the dividers the intervals for the bright leaves, and form them with two cuts—a deep and bold cut, followed by a light one in the first to clear the cut, and also to bring it to its proper size. It will be seen that the points of the leaves in both borders extend from the centre, and are carried round the teapot as far as the spout and handle respectively. After the round tool has done its work, cut the oval form left by the round tool into shape with an ordinary graver, flanching, or cutting with the point and right or left side of the graver, using two cuts on each side of the leaf. The ornament on the spout is done in a similar way, with the exception that the leaves are graduated. The bottom border and spout being finished, I will now show how the top border is done. Take the No. 12 shader, and cut the width of the graver *only* on the inner sides of the double lines already cut. Now rule a line along the centre of the border, and with the large round tool cut the four-leaved flower in the centre; next mark out the leaves with the point, setting out the angles of the leaves accurately and at equal distances, then rough the shape of the leaves out, as in the bottom border, with the round tool, and "cut them up" in a similar manner, giving the leaves a slight curve as shown in the sketch.

The spray in the hollow section now remains to be engraved; the leaves may be wriggled with the No. 12 shader, and "cut up" in three or four cuts on each side of the leaf, giving them their proper form as the work progresses. These leaves may be lightly veined and sprigged as shown.

The arches under the top border must be stepped out, and wriggled with the narrow tool used for the waved lines. The leaves at the points of the arches may be done (wriggled) with the No. 12 shader, and cut up in the same style as the spray in the hollow. A small spot between the arches, and a large spot with smaller one beneath in bend of arch, complete pattern. The work on lid is outlined with graver and finished with shader.

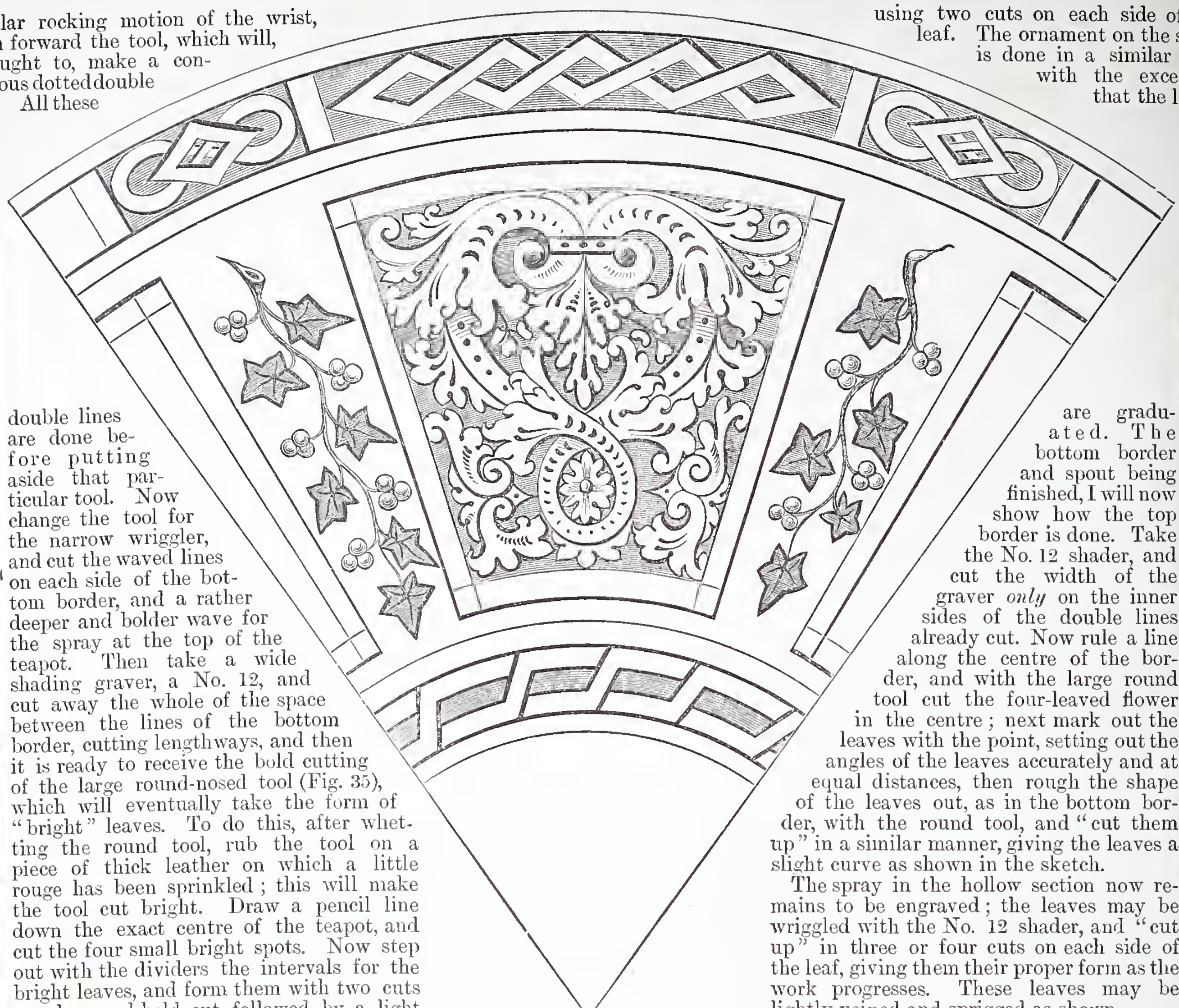


Fig. 32.—Design for 12-in. Waiter.

Fig. 34.—Belly of Double "Wriggling" Graver.

Fig. 35.—Belly of Large Round-nosed Graver.

Fig. 33.—Design for a Queen Anne Teapot.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

OCKED LETTERS—THICKNESSES—CAST SHADOWS —SHADOWING—LIGHT AND SHADE—TUSCAN AND TABLET ALPHABETS, AND HOW TO TREAT THEM.

IE laws of light and shade play a very ominent part in the more advanced stages our art, especially to the more practical anch of ornamental lettering; therefore regards importance, this subject follows ry closely upon the heels of perspective. e will leave this matter, however, until the ter part of the chapter, and first of all nsider the raising and blocking of letters, d other work which always precedes the ading proper. I had better, perhaps, fore proceeding further, explain the mean- g of one or two technical terms, so that e novice may be able to thoroughly com- ehend their meaning whenever they are entioned in this chapter.

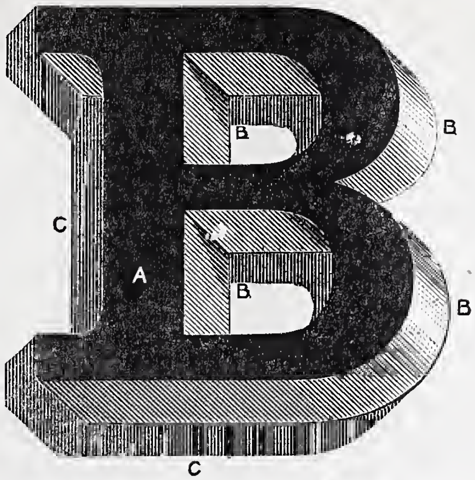


Fig. 66.—Diagram in Explanation of the Structural Formation of Letters.

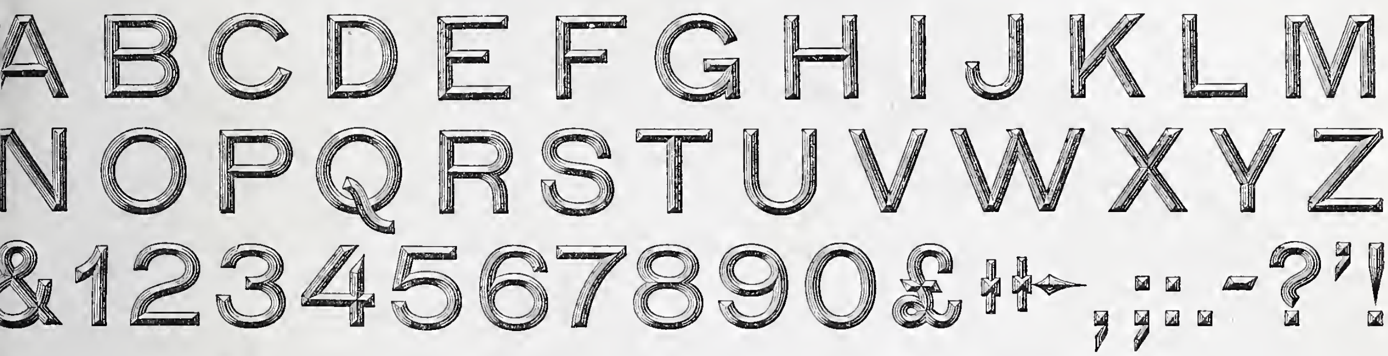
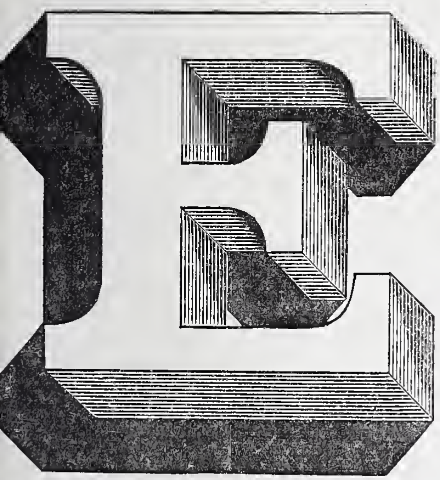


Fig. 67.—Tablet Alphabet, Capitals, Numerals, Points, etc., to Illustrate Method of Shading Letters.

A "blocked" or "raised" letter is one ich appears, or stands out in relief, such the manufactured wood letters pre- ously referred to, and which it is the rk of the sign-writer to imitate on a flat rface by skilful perspective and colouring. "double blocked" letter is one which is ocked out on both sides, or internally and



g. 69.—Letter invested with Thickness underneath and towards Light. Cast Shadow on opposite side.

ternally. The "thickness" is the o sides or edges, and the two ends a blocked letter; but of course, om whichever way such a letter is oked at, only one side and one end e visible to the eye at one time, d as letters are generally looked at om below, and commonly shaded on e right, the bottom and right sides the letters are usually those where

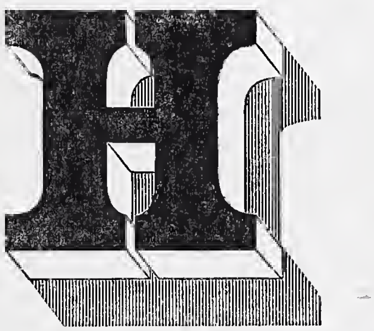


Fig. 68.—Letter with Thickness and Cast Shadow both on same side.

the thickness is given. Of course, it must be understood that we can put this thickness on either side of the letter, or at the top or bottom, but we cannot put it on both sides at once, because in a real raised letter it would be impossible for us to see both its edges at one and the same time. The same remark applies to the top and bottom edges. The "cast" shadow is the shadow which is thrown on to the background by a raised letter through the sun or strong rays of light shining upon it in an oblique direction: this shadow is of course on the opposite side to that upon which the rays of light fall. A graduated thickness is one with its colour of various tints softened into each other in order to represent more vividly the various degrees of light or the sun's rays as they fall on different portions of the thickness; these may be divided into the high light, the middle or secondary light, and the deepest shadow. A graduated thickness is often put in, however, for mere ornamental effect and showy colouring. The "face" of a letter is its front portion, which is generally painted to appear in the highest light, sunken letters excepted. The explanation of these terms will be better understood on referring to Fig. 66, where A is the face of the letter, B B the thickness or blocking, and C C the cast shadow, or, as it is termed in some parts, the back shadow.

Although no sign or inscription nowadays would be considered to possess any artistic merit unless the writing were executed in blocked letters, this system of blocking is of comparatively recent introduction: in fact, about the year 1840 it was only then just coming into vogue, but soon became immensely popular, and was considered to be a vast improvement on the "flat" lettering of the old style, and which we only now see on the commonest of work. In order to impress upon the mind of the novice the real meaning of these imitation raised letters, or, I should say, the effect or illusion they are intended to convey to the eye of the spectator, I may say that "blocking" was introduced by the sign-writing profession to imitate the raised cut-out letters in wood which I have previously spoken of, and which, no doubt, did the sign-writing profession at that date

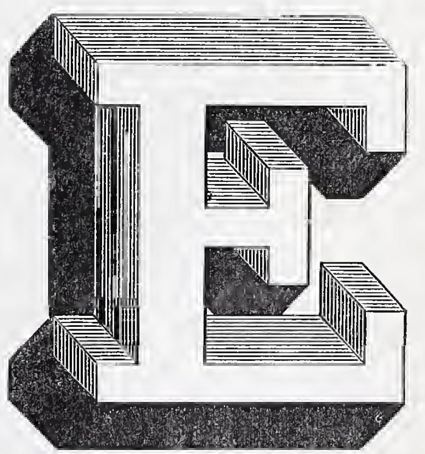


Fig. 70.—Letter with Thickness above and partly towards Light and partly against. Cast Shadow on opposite side.

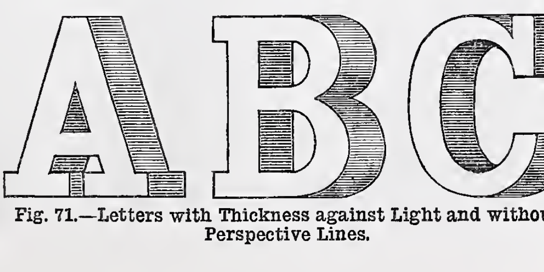


Fig. 71.—Letters with Thickness against Light and without Perspective Lines.

considerable injury by sudden and unexpected competition. A technical writer of the period indicated alludes to this subject in words which have still greater force and truth than they had formerly; he remarks: "The projecting letters, formed of wood or metal, have of late become so fashionable that the writers on shop fronts and signboards have had recourse to imitating them, and have produced letters *in such bold relief, that they look more real and much better than their wooden rivals.*" The italics are mine.

In "blocking-up," each letter must have its thickness outline in its own perspective, but the perspective must be at the same angle in each letter, say 45°, as being the angle usually adopted. For plain work, the colour of the thickness is usually darker than the ground colour, and also the colour used for the face or body of the letter, but there are plenty of exceptions even in the simple form of blocked letter, some of which are in very bad taste as regards colour. But when we go in for light and shade, then we must decide upon which side of the letter the light is to strike; if the thickness is away from the source of light, its colour will be darker in shade than both the face of the letter and the ground colour, but if it confronts the light, it will be lighter than the ground colour, but darker or of a more retiring colour than the face colour of the letter (see Figs. 68, 69, 70, and 71).

It must be remembered that writing on a shop front or on a signboard is generally looked at from below, so that it is a general rule to invest the bottom end of letters with a thickness, and not the top (Fig. 69). To see a letter with the thickness at the top and above its arms, as in Fig. 70, we must, if the letter be a real projecting one, stand above it and look down on it, but nevertheless, this lettering is often done even when it stands above the point of sight, and out of all true perspective. There is so much latitude allowed in sign-writing, that this anomaly is permitted to pass unchallenged, so that we may thereby obtain a somewhat picturesque effect. I can vouch for the example here given being perfectly correct, as it is a letter formed by one of the most successful writers this country has as yet seen. It is also permissible for one to do his thickness on straight lines instead of in perspective. In this system we have the whole of the work inside the two horizontal lines which contain the body of the letters, and there is not a single perspective line in any letter, yet they certainly have the appearance of projection, as will be seen on looking at Fig. 71. In a graduated thickness, the various tints or colours must not be blended into each other by guesswork; the principle of light and shade must be carefully thought out, and the science of optics studied before any successful result can be arrived at. In looking at some of the best specimens of sign-writing which we come across in the principal streets of some of our large towns, one cannot help being struck with the taste and ingenious talent displayed in the beautifully blended and coloured thicknesses which play such an important part in adding a positive air of grandeur to the work.

It is really wonderful how effectually we can imitate, upon a flat surface, a real raised letter of any description, or of whatever material, whether it be wood, stone, metal, or marble. To ensure success, we have only to be correct in drawing, colouring, and shading; in fact, the drawing must be true, the colouring bold and effective without being gaudy, and the shading and gradation appropriate to the whole, which gives to the subject an appearance of what it is not in reality. I can only add that the most beautiful softened thicknesses are only obtained with slow drying colours, and the judicious use of the blender. Thicknesses may, however, be of any colour, bright or otherwise, according to the scheme of colouring employed by the operator.

I must next turn to shadows; and here I may say at once that however bright in colour the body and thickness may be, if a cast shadow is added it must be quiet in tone, being, in fact, a mere glaze on the ground colour to make such colour darker where the shadow falls. It must not consist of a primary or secondary opaque colour unless the author of such work wishes to be accused of bad taste, and of being a bad colourist. The siennas, umbers, Vandyke brown, and asphaltum are good glazing colours for rendering cast shadows. Letters may be shadowed either on the same side as the thickness or on the opposite side; the latter, I think, will be the system generally adopted, and in this case the thickness receives the rays of light, and is therefore painted in a brighter colour than it otherwise would be, were it represented as in the shade. It is best, perhaps, if it is painted the same colour as that used for the face of the letter, but in a somewhat darker shade. When a thickness faces the source of light it is frequently put in with two or three gradations of tint or tone, the lightest being where the edge of the letter catches the most light, and the darkest in the underneath portions of the arms and bottom end of the letter; in fact, the bottom of a letter always gives better effect to the whole structure when it is painted in a darker shade, as this portion of a projecting letter must necessarily be in the deepest shadow. Of course, the bottom portion of all letters throws a cast shadow, and where these are inserted they follow beneath the thickness, so that the shadow always touches certain portions of such thickness, whether it is on the opposite side, or *vice versâ*. With a letter that has its cast shadow and its thickness both on one side, and against the source of light, the latter is naturally darker than the face of the letter, and the shadow is preferably of a shade not far removed from black. I have frequently alluded to the source of light in this chapter as being the guiding star upon which rests the correct colouring and shading of a letter. I suppose I need hardly say that this light can hardly be anything else than imaginary, in the mind of the writer, when carrying out work of this class; I am, of course, alluding to work in the open air, where the sun, that lights all things, good or bad, is constantly on the move. It would thus be impossible for the workman to so arrange his shadows that they may always be thrown in an opposite direction to that in which the sun is shining, or the light the brightest, because, if even correct in the morning, it would not be so in the afternoon. Most readers may say, every simpleton is aware of these simple facts, but I am writing more particularly for the younger generation, and boys are not apt, overflowing as they are with animal spirits and bumps of mischief, to give even these simple matters a thought. Once bring anything to their notice, however, and set them thinking, and clever lads will work the problem out for themselves; but I am digressing.

The best arrangement we can make, therefore, is to consult the position in which the sign is situated, notice from which direction the light is strongest during the best part of the day, and adapt the light and shade of our work so as to conform with nature, as far as it can, in a pleasing and truthful manner.

There are many specimens of the sign-writer's art to be seen abroad, which have been treated in a purely conventional manner: for instance, one may often see letters possessing a cast shadow, but without any blocking or thickness. The question arises, what is there to throw this shadow, considering that the letters appear to rest quite flat upon the surface; of course the only way out of the difficulty—if such it is—is to stretch the imagination and assume that they *do* project, and certainly by clever and tricky shading they may be given that appearance in some slight degree. After all, the sign-writer is a sort of "free lance," and even in blockless letters with a cast shadow, no very great harm is done if the work is handled judiciously.

Some styles of alphabets of the modern ornamental and mediæval design have the face of the letters shaded: this consists of sharp clear markings or linings. In some alphabets the thickness or breadth of these lines is symmetrical throughout, in others it is thickest in the middle, and graduates outwards to the top and bottom of the letter until it assumes a fine hair line. Those letters known as Tuscan are of this description, and when well done, they have a very gorgeous and rich appearance, especially if the letters are gilded. The student will find a complete Tuscan alphabet in any printer's specimen book; and to render the same more useful to him I would advise that in copying it for practice a full alphabet be enlarged to about the size of the large specimen letters given with this chapter, and they will then prove very useful for future guidance. They should be drawn on separate squares of Bristol boards, and kept in a strong home-made envelope or case, and to add to their usefulness, they may be coloured with water colour and gum in various designs, and will thus be handy for showing to customers for selection. I need hardly say this dodge applies to all alphabets, and is a good way of assuring oneself upon giving satisfaction even before commencing the work, yet, I presume, very few professional hands consult or study their customers' wishes in this way. Another alphabet is that known as the Tablet, and here the shading is all done upon the face of the letter, and to look well requires a skilled and decisive hand, besides a thorough knowledge of the art, otherwise the proper effect will not be gained. Those painted letters are supposed to represent cut-out marble or china tablets affixed to the shop facia—articles which are often seen in the reality, and common enough they look. Another style of letter very difficult to paint, and where the whole effect depends upon clever shading, is the sunken or incised letter, which is just the opposite to the Tablet.

If space permit I will try to give an alphabet of this in a later chapter, and will here only point out that the great difficulty in shading these letters is "*not to give a Tablet letter the* (*reverse*) *appearance of a sunken or incised letter, nor vice versâ.*" This is very often done, so "forewarned, forearmed," as the old proverb has it. A complete "Tablet" alphabet is given in Fig. 67, and here also should the letters be enlarged in order to learn and judge of the proper effect, and their suitability for various classes of work.

OUR GUIDE TO GOOD THINGS.

** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

19.—EATON'S "POSTABLE" FLOWER POT TRIPOD.

'HE accompanying illustration will, I think, e sufficient to show that the "Postable" Flower 'ot Tripod of Messrs. S. J. Eaton & Co., Inentors and Manufacturers of Specialities, 131, reat Titchfield Street, London, W., is a light nd pretty means of introducing plant decoraion into corners and other parts of rooms in hich it would be otherwise most difficult to get any adornment of this kind. The only thing about it to which I can take exception is its name "postable," which Messrs. Eaton & Co. have clearly invented for the occasion, as well as the speciality itself, and which is applied to it in virtue of its being made collapsible in one form, so that it can be closed up and forwarded by parcel post for 3d. or 4½d., thus rendering it an acceptable and useful present for transmission in this way, and to be readily obtained by anybody who may desire to have one if it does not appear among the stock of the fancy furniture dealer nearest to the residence of him or her who wishes to get it. As it will be readily

seen from the engraving, it consists of three bamboos arranged in the form of a tripod, with a larger triangular board inserted between them near the base, and a smaller one at the top, each board serving as a support for a flower pot or ornamental vase. Those that are sold fixed are 44 in. in height, and 15 in. wide at base; the "postable" are 41½ in. high, and 14 in. wide at base. They are sold plain at 1s. 3d. each, or 2s. 3d. per pair; enamelled in dark colours, or stained and varnished, at 2s. each, or 3s. 9d. per pair; enamelled white or in light colours at 2s. 6d. each, or 4s. 9d. per pair. I may suggest that the plain tripods would furnish a little congenial employment to ladies who are fond of "aspinalling," and who might thus bring them into accord with the prevailing tints and colours of the rooms in which they may wish to place them. Slender and pretty in appearance, the tripods are suitable for use in or out of doors, and make admirable stands for pendant and creeping plants above, and geraniums, etc., below. The stand is strong, rigid, and perfectly stable when ballasted with a heavy pot on the bottom board, and at the point where the bamboos cross each other is a ring to which a small coloured lamp or hanging vase may be suspended.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

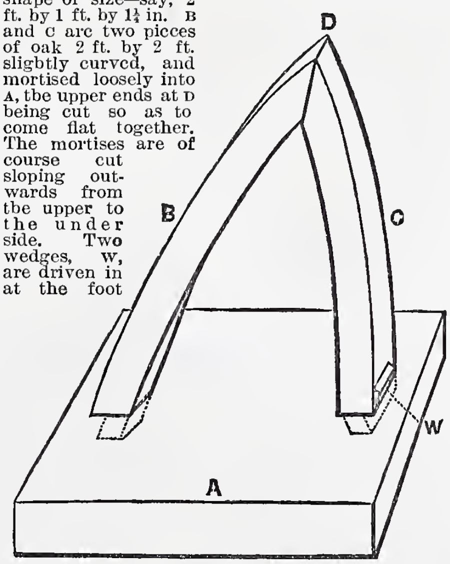
NOTICE TO CORRESPONDENTS.

**** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.

I.—LETTERS FROM CORRESPONDENTS.

Fretwork Clamp.—KILDONAN.—The contrivance here submitted is the invention of a friend of mine, a very skilful fret cutter, who in his leisure moments turns out the most beautiful work. It is so simple that any one can make it, and has the advantage of getting rid of the sawdust without any expenditure of breath, or adventitious aid of blower or other complicated arrangement. It is used, of course, by the artist who works with the ordinary bow. A is a heavy block of wood of any shape or size—say, 2 ft. by 1 ft. by 1½ in. B and C are two pieces of oak 2 ft. by 2 ft. slightly curved, and mortised loosely into A, the upper ends at D being cut so as to come flat together. The mortises are of course cut sloping outwards from the upper to the under side. Two wedges, W, are driven in at the foot



Fretwork Clamp.

of the uprights, thus increasing the gripping force of the jaws at D. Two similar wedges driven in from below serve to decrease the grip, and the tension of the jaws can thus be regulated to suit the convenience of the worker. The faces of the jaws are covered in leather, which keeps the work from slipping. If the wood is left bare it soon gets very slippery, and the work will not be held steady. The *modus operandi* is as follows:—Having drawn the design on the wood, the latter is placed between the jaws, the design towards the worker. It is held upright, and when the holes are bored the saw can also always be held upright, for the tension is sufficient to hold the wood in position. With the help of the left hand, the work can also be turned round, thus relieving the right arm of the fatigue of holding the saw at all sorts of angles. The dust falls down. The apparatus can thus be used in the house, for by spreading a newspaper below to catch the dust and pieces cut out, the cleanly housewife can look on complacently while the "guid man" cuts out some fancy article to beautify and adorn the home.

Tools.—H. J. L. J. M. (*Ealing*) writes:—"May I remark that Messrs. Melhuish, of Fetter Lane, E.C., offer facilities to purchasers of tools similar to those offered by the firm mentioned by H. C. on page 542? I have no doubt that Messrs. Buck, or any other tool makers, would give every information and instruction as to the use and capabilities of any tools supplied by them. I am not writing this from any desire to puff the wares of any one firm, but simply from a wish to let every one have his due. As I go in chiefly for chasing and repoussé work, I make the bulk of my tools myself, and am thus far independent of any firm."

Saw Hammering.—J. N. (*Sheffield*) writes in reply to T. O. (*Bootle*):—"I notice a reply from you to T. O. (*Bootle*) (see page 587), who makes an inquiry on the subject of Saw Hammering. I am junior partner in my firm, but am a practical workman. I spend a great portion of my time hammering saws, mostly circulars. I have only been a subscriber to your paper a few weeks, and I did not notice T. O's. (*Bootle*) question. If he will repeat it I shall be pleased to give him any information I can."

Boots and Shoes.—J. R. writes:—"I wish H. G. (*Bishopsgate*) would let me know through your columns how to cut out a pair of men's shoes laced, and a pair of women's laced plain for a light bottom hand-sewed; how to round the insole, the heel about 2 in. high and 2¼ in. broad for men's, and 1½ in. high and 1¾ in. broad for women's. Should there be two split lifts and one about with the lifts pegged together, or two split first? In all heels should they be slanted in heel seat what way to fit the welts, and dress up after sewn and level; how to make a broad welted boot and set up the stitch—should it be marked with a wheel; how to make a spring heel cork pump bottom, and a pair of slippers turned."

Ink for Posters.—M. D. C. (*Liverpool*) writes in reply to SMILING SMUDGER (*Manchester*) (see page 573):—"I would like to ask him how he calls oil paint ink for posters? From my point there is a vast difference between oil paints and inks. Also how is an amateur to fill up small letters with a pound brush? In reply to H. L. B. (see page 574), I would like to ask him if he ever wrote a poster of printers' ink and paraffin? as he says posters are only written with printers' ink and paraffin or benzoline. It is a nice thing to tell an amateur to use either paraffin or benzoline. Suppose a man bought enough colour to do what he wanted, and he used paraffin, I must inform H. L. B. that his colour would be useless after he had got it mixed. H. L. B., I must say, is a nice party to write an article on poster writing. I would like to ask H. L. B. if he knows how to mix colours for poster writing? If so, what would make a good chocolate or marone that will not fade on being exposed to the sun, also salmon colour, or flesh colour? Also, if he knows anything about poster writing, what would he put in printers' ink to keep it from working stickier, or leaving brush marks on his work. He says he is engaged by the Editor of WORK to write on poster writing. Well, if he is not an amateur I hope he will give us some good information, and I don't care how soon; but from my point he must be an amateur of the worst type, or he would not have mentioned paraffin to dilute printers' ink with. If A. Y. (*Ilkeston*) will send me his private address, I will give him all the information he requires on poster writing and ticket writing, although I am not a professional at ticket writing."

Book on Bookbinding.—B. R. C. (*East Finchley*) writes:—"Will you permit me to inform G. F. S. (*Nottingham*) (see G. C.'s reply to him, No. 36, page 572) that there is a thoroughly good and cheap book on bookbinding—viz., "Bookbinding for Amateurs"—by W. J. E. Crane, published by L. Upcott Gill, 170, Strand, London, price 2s. 6d. It contains full and clear instructions, with numerous helpful illustrations, on each process in the art from start to finish; together with descriptions and prices of the various tools and materials required, and the names and addresses of dealers in the same. Allow me to add that I am in no way interested in the sale of this or any other book, but write solely in the hope of giving a useful hint to a fellow reader of WORK."

Lathe Bits and Drills.—J. H. N. (*Malvern Wells*) writes:—"Seeing some forms of bits and drills for the lathe by OLLA PODRIDA, on page 321 of No. 21 of WORK, I could not resist sending you a suggestion for Fig. 7, an enlarging drill, for which I hope you will excuse me taking the liberty. The plan is, instead of having the wood on sides of drill, to cast in sand a plug of zinc, which is within the means of every one, rather larger than drill, to allow for turning down; then bisect plug down the middle, and cut down with a hack-saw; then fix on drill same way as shown in Fig. 7. The reason I propose a zinc plug is because it will wear better than wood, and not be so likely to be affected by the scrapings or chips cut by the drill."

English and American Tools.—WALSALL writes:—"I should like, through the pages of WORK, to call the attention of my fellow-readers to the price list issued by Mr. Lunt, 297, Hackney Road, London, E., which he will forward to any part of the United Kingdom on receipt of one penny stamp. I have one before me while I write this, and I can assure my fellow-workmen that it is the best list I have been able to procure, and I believe his price will compete with any other firm in the country. The list, which is illustrated, contains eighty pages of the best and most improved tools in the market, and tools suitable for almost every trade that is known. Also a large assortment of cutlery, etc. I feel sure my fellow-readers will not regret sending for Mr. Lunt's list. I myself have found tools in his list that I have wanted for several years, and could not obtain them, not knowing where to apply for them, and I have no doubt many others experience the same difficulty."

A Metal Worker's Complaint.—W. G. (*Gateshead-on-Tyne*) writes:—"In your issue of September 28th, on page 437, there is an article on Metal Spinning by F. Durrance, which I eagerly read, and looked forward for the next issue, as at the end of the article he says 'in our next we will try and have something more difficult,' but as yet I have not come across anything on the above subject."—[These papers will be continued as soon as possible. W. G. will readily understand, however, that contributors to WORK are practical men, who cannot always find leisure to turn from their work and to write. Moreover, other contributors than W. G. want their subjects considered, so that it becomes difficult to give weekly sequence to any one subject. All that can be promised is that all subjects commenced in Volume I. of WORK will be completed within that volume.]

Cuts and Bruises.—MECHANIC (*Rugby*) writes: —"Being a subscriber to your valuable paper, WORK, from its birth, and having read the correspondence from the writer in 'Means, Modes, and Methods,' and the replies, to and from, by MEDICUS and the writer (whose name does not appear), in reference to remedy for severe cuts and treatment of bruises (WORK, No. 26, page 411, and No. 35, page 555), I think, perhaps, you will not be against a few remarks thereon, having passed over twenty-six years in private and public engineering works of one sort or other, wherein I have seen, and in many cases attended upon, the injured parties. Prior to anything out of the way in 'Shop,' I would beg to say that when I was a boy of fifteen years old, my father, who was a brushmaker, had the misfortune to cut off his little finger on the left hand (about the centre of the middle joint) with the bench knife. This he picked up off the block, placed it where it came from, and walked to a chemist's shop, where it was strapped on again. This finger adhered to its old place, but it would not work with the others after. I know it had to be opened or shut by the aid of the other hand, but I could not now say which, and I have heard my father say many times that he had better have lost it at first, as it was often in the way. Still, I hope this goes to prove that parts of limbs will take root in their old places. As regards cuts and bruises I have seen many, from simple ones on the fingers to human bodies right through; and from nips from pincers, or cracks from hammers, to men hurled yards by blows from machinery. Of course neither of the latter cases would be likely to require the aids as prescribed by your writer in 'Means, Modes, and Methods,' as in such cases generally the sufferers rarely survive many hours, sometimes minutes, but for ordinary use I can assure MEDICUS that I have used gallons of turpentine for bruises, also for cuts. I never used leeches, but have seen them used; but for hammered finger or thumb nails, I have scraped and cut the middle of the nails away to release the blood underneath, which is equal to leeches sucking it out, I should suppose; and I know from experience which thumb or finger will get well first, the one cut, or the one left with the blood to rot under the nail. At sixteen years of age I had the inside flesh of my left-hand thumb torn off to the hone, from the nail end to the first bend. This was done at play. I went home, and asked my mother for a needle and white cotton, with which I put quite twenty stitches round the piece; after which I bandaged it up in old linen, and steeped the thumb end in Friar's balsam, and the thumb is as good to-day as when I was born with it; and I do not hesitate to say that good turpentine would have done the work equally as well. I have also used it in scores of cases of bruised flesh, having been ambulance man in one works over fifteen years. I am not now connected with any firm; but in addition to turpentine would recommend Friar's balsam, and a new article termed vaseline, and sold in boxes from one penny upwards. I have found the latter article very good for cuts and bruises; in fact, it heals and eases the pain like magic. I could give other cases and cures, but hope the foregoing will convince MEDICUS that he is not quite correct, and should space he allowed me at a future date I shall be pleased to give several tips upon treatment of injury to the limbs."

An Easily-Made Fret Machine.—EAST WINDOW (*Southport*) writes:—"Would W. R. S. (see page 332) explain what he means when he says that the throw of the machine will be double the distance from centre to centre of the piece marked C? What centre does he mean? and how does he arrive at the length of the piece marked C? for if it was not the proper length, I think there would be some difficulty in the working of the machine. I am sorry to trouble W. R. S., but I have never had anything to do with treadles or machines, so am ignorant of their working. I am much obliged to W. R. S. for his plain direction in the other parts of the machine, which has long been a desideratum."

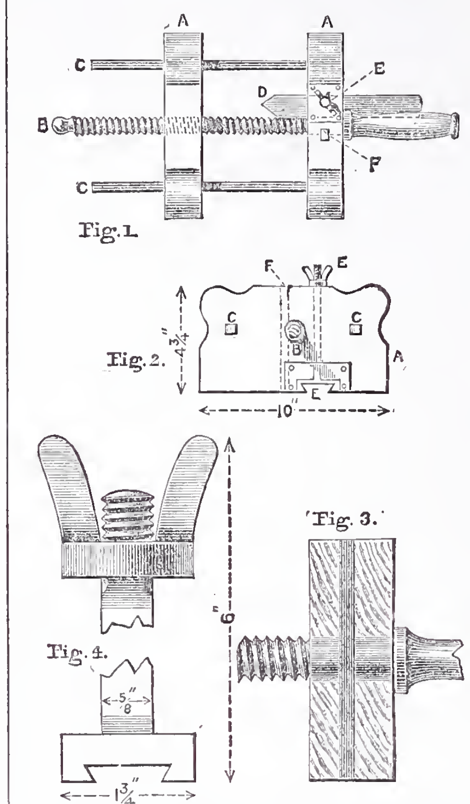
A Simple Incubator.—A. T. B. (*Walthamstow*) writes:—"Will W. L. (see page 557) kindly state what kind of lamp was used, also the degree of heat employed, and the means of ascertaining it, as no thermometer is mentioned?"

Hints to our Staff.—GNIMELF (*Dublin*) writes: —"Seeing in your issue of WORK for November 9, No. 34, a letter from W. B. (*Liverpool*) referring to writers for WORK shortening their descriptions, I beg to say that I quite agree with him. For instance, I wanted to make a camera. When I got the number it was in I was delighted, but after reading it I had quite to give up the idea of making one, as I could not understand it enough. I don't want to find fault with WORK, for I consider it the best paper I ever subscribed to, but if the writers would go into small details it would be much better. The article on Folding Stove is very vague."

A Simple Incubator.—A. R. (*Manchester*) writes:—"Will J. T. R. (see page 654) kindly answer through 'Shop' how and where does he use the lamp, and what kind? What position the drawer is, and how it opens if it has no bottom with eggs in? Has the damper to be bored through into the drawer, and what does he use for a damper?"

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Book Edge Cutting.—F. H. (*Walsall*).—There will shortly be published in these pages a series of articles on bookbinding proper, from which I hope you will learn all about "cutting edges," and not only this but everything in connection with the art. You are quite right about the plough. There is such an article, and it is used in conjunction with the press—the lying press as it is technically called. In the meantime I will give you instructions for making a plough, which I trust will be sufficiently plain. If you know anything about wood-working, I don't think it will be a very difficult task to execute. Fig. 1 shows the complete tool looking from above. Fig. 2 is a side view. The correct



Book Edge Cutting. Fig. 1.—Bookbinders' Plough looking from above. Fig. 2.—Side View. Fig. 3. —Detail of Wooden Screw, B. Fig. 4.—Enlarged View of Knife Bolt

A, A, Sides; B, Wooden screw; C, C, Square rods to act as stays; D, Steel knife; E, Knife bolt; F, Pin to keep screw in position.

sizes are given, and the letters in both figures refer to the same parts. The wood to be used should be well-seasoned beech, although for your purpose a commoner kind may be substituted, as I believe beech is difficult to procure. The two sides are made the same shape, and it is not necessary to adhere closely to the shape given in the diagram. They should be made of 1½-in. stuff, 10 in. by 4¾ in., and three holes in each—two square holes at equal distances from the ends, and a round hole in the centre; the hole in the left-hand side will require to be tapped to take the screw. The screw may be about 22 in. long, including the handle. A groove will need to be cut ¼ in. from shoulder (Fig. 3) to take a pin to keep it in its place. A square iron pin with a screw at the top, and provided with a wing nut, and a wedge-shaped piece cut out at the bottom to receive the knife, is passed up through the right-hand side (Fig. 4). On the top of the same side is an iron plate to prevent the wing nut from sinking into the wood; at the bottom also are two iron plates, against which the knife presses when the nut is tightened. The knife itself is a wedge-shaped piece of steel ground to a point at one end. To perform the operation of cutting with the plough, the book is screwed up tightly in the press, allowing the part to be cut off to be above the cheeks of the press. The plough is driven to and from the body; the screw is turned gradually until the cutting is completed. The left-hand side of the plough runs between two strips of wood screwed to the left-hand side of the press, and as the right-hand side is free to move, as the screw is turned the knife is brought over the entire edge. If you succeed in making your plough, and learn to cut books with it, you will not need to be ashamed to show your books to your friends, for edges cut with the plough are more satisfactory than those cut by the machine.—G. C.

Sanitary Inspector's Qualifications.—G. S. M. (*Hartlepool*).—The necessary information respecting qualifications, etc., for a sanitary inspector may be obtained by applying to the Secretary of the Sanitary Institute of Great Britain, 74A, Margaret Street, W.—E. S.

Making Fret Saw Machine.—JIG SAW.—I am sorry you are disappointed at this subject not having been treated yet, but everything cannot be treated at once, and there are many subjects of more general interest to the majority of readers. Let me advise you, instead of wasting the long winter nights because you have not a machine, to get one of the little fret saw frames which are worked by the hand, as you are much more likely to accomplish good work with it than with a machine of your own make under the circumstances to which you allude. Though the ambition of many fretcutters is to have a machine, I can assure you that unless it is of the best description a hand frame is better, and that for some work it is, to say the least, superior. Such thick wood cannot be cut with one as with a good machine, nor is it quite so rapid, but otherwise everything that can be done with a machine can be done with a frame. Your desire to make a machine seems to be on account of supposed saving in cost; but if you have to buy materials you would probably find that it would have been cheaper to have bought a machine. Perhaps these remarks will reconcile others who want descriptions of fret machines to absence of papers on the subject. You will find secondhand machines constantly advertised in *The Bazaar*, if you do not care to invest in a new one. It is impossible to answer your questions precisely without fuller particulars and detailed measurements of the parts you already have and intend using up.—D. A.

Watch Repairing.—PIVOT.—Your query has been sent to the proper quarter, and will doubtless soon elicit a reply. The contributor who takes charge of these special questions has been away from home on his annual holiday, and hence the reason that you are kept waiting. I have his promise that all these things shall receive immediate attention on his return. You may be sure that when an answer to a query is long in coming it is delayed for a good reason."

Matching Plane.—C. H. L.—If you will send me drawings and description of your matching plane, I shall be very pleased to look at them with the view to publish them. It would also be useful if you could let me have a look at your plane. It shall be quickly returned to you after I have examined and tested it.

Gilding and Mount Cutting.—J. A. McL. (*Glasgow*).—An article on mount cutting is in preparation. Gilding in all its branches will also be taken in hand shortly by a practical man.

Photo-Zinco Process.—PRINTER (*Edinburgh*). —The processes employed to obtain zinc relief blocks are varied, and some of them are secrets religiously kept by their proprietors. There are, however, two methods which any one is at liberty to experiment upon, if means and capabilities are agreeable, and I will briefly describe them. First, a drawing upon lithographic stone may be transferred upon a polished zinc plate, and afterwards etched by immersion in a bath of acid; secondly, a drawing or a print to be reproduced, if its detail be expressed by lines or dots, may be photographically rendered upon zinc which has been sensitised with bichromate coating (albumen or gelatine as the case may be), but the operator must use a rectilinear lens. The zinc is then treated thus:—A roller charged with litho ink is passed entirely over the surface, leaving behind a layer of ink, the thinness of which will be determined by experience only. The picture is developed by placing the plate in a vessel containing sufficient water to cover it, and while immersed gently clearing away with a dabber of cotton wool the coating which has not been affected by light. The plate is then fanned dry, and asphaltum powder is brushed over it, so as to adhere to all parts of the work; gently warming the plate, now causes the ink and asphaltum to unite. The biting away or etching in either case is managed somewhat after this fashion. The zinc plate with the subject upon it is covered with a protective agent capable of resisting the action of acid, and protecting the places where it is desirable, such as the back, edges, and large whites. The plate is then immersed in an acid—that is, a solvent of zinc, diluted, and a see-saw motion is given to the trough in which the bath is prepared. This rocking enables the acid to do its work more thoroughly than were it allowed to corrode the zinc gradually. This description is necessarily rough, but no doubt the book on "Zincography," published by Wyman, Great Queen Street, Lincoln's Inn Fields, will give information at greater length.—J. H. M.

Enlarging Camera.—MERVEILLEUX (*Peckham*).—Your sketch of the front of enlarging camera is quite correct, and shows that you have thoroughly grasped the details of construction. The inner box is movable, and slides out and in, for this reason, that the greater the size to which you enlarge the nearer must be the lens to the negative, while for small enlargements the distance has to be increased. If the box, therefore, were a fixture, as you seem to suppose, you could only enlarge to one given size, while, by moving it, you can make your picture any size up to 12½ in. by 10½ in. The lens you have will do very well for the purpose of enlarging, but you are in error in supposing it has only one "glass;" it has in reality two, which are cemented together, and so appear as one. As to your query as to the length of the baseboard, the fact that you only use quarter-plate negatives ll not affect its length, as that is regulated by the ;e of the enlargement, not the negative, so that you wish to have your pictures the full size that c camera is capable of making, the baseboard ust be kept to the size given. In No. 23 of WORK, page 360, you will find a method given for the aking of a camera bellows of a tapered form. ou should not use leather, as it is very expensive such a large size as you require; stout brown aper with black calico well glued down on each de makes a very good bellows, and possesses the ıerit of being easier to manipulate. If you decide n making a square bellows, you had better make rough box the size of the inside of the folds, and ork them over it, letting the glue dry thoroughly, nd then removing the box, which is simply to erve as a block to work upon while folding. hould you meet with any other difficulties I will e glad to smooth them away for you if in my ower, and as I reside near your locality could give ou a call, and a verbal explanation, if you comnunicate with me through the Editor.—G. LE B.

Batteries. — H. L. D. (*Heaton Norris*). — In ınswer to our querist, I am afraid he is rather ıazy about electricity and its terms. I suppose ›y what he terms penetrating power, he means the ›urrent in ampères. This depends upon the resistınce of the cells and the E.M.F. (electro-motive 'orce). A small bichromate cell such as he menions has an E.M.F. of 2·0 volts and 0·8 ohm inernal resistance, so that with 50 such cells in series ıe would have by Ohm's law:—

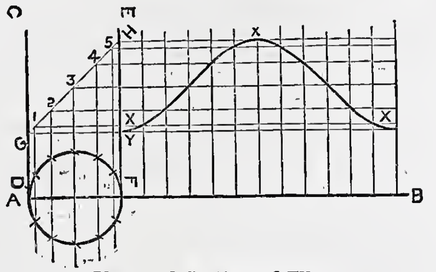
$$\frac{2{\cdot}0 \times 50}{0{\cdot}8 \times 50} = \frac{100}{40} = 2{\cdot}5 \text{ ampères}.$$

To measure this resistance he would need a resistance box and differential galvanometer, which I fancy our querist is not provided with; and another thing, even if he were, I very much question from the tone of his query whether he has the essential electrical knowledge that is required for all electrical measurements. If he has, however, the instruments, and thinks he can manage "Ohm's calculations," and likes to write again, I will advise him. Another thing that leads me to suspect our querist's knowledge of batteries lies in the fact of his using the bichromate cell for medical purposes. This is a bad thing from two points of view:—(1) That with the number of cells he has (especially in series) he is using a dangerous current, if using it on the human frame; and (2) the cell only gives a current from three to four hours, when it requires recharging. The cell that is recognised by electricians for medical purposes is the medical Leclanché. This consists of an outer cell of glass or ebonite, containing elements of a zinc plate, and a small carbon block. The zinc is wrapped round with a layer of canvas or flannel; these elements are placed in the cell, and are surrounded with a mixture of equal parts of small broken carbon and manganese. This is tightly packed in the cell, and thoroughly saturated with a strong solution of sal-ammoniac. This cell will give a current for five minutes, and then will require a little rest (to revive itself) and it is again ready for use. It is this cell that is always used for medical purposes, and so I should certainly advise our querist to change his bichromate cells for these. These cells are good for four or six months' work, and so it will clearly be noticed that it is a rather large step in advance of his now costly cells. Any further information I shall be very pleased to give.—F. W. M.

Paint for Glass Writing.—F. P. (*Bolton*).—Thanks for your letter; you may rest assured that our Editor is determined to make WORK the technical paper for all workers. "Rome wasn't built in a day!" you know. Scene painting will be, doubtless, taken in time; but it is a subject that requires some knowledge of painters' pigments and processes on the part of the student, to attain to any practical success. You are, therefore, advised to thoroughly master the papers on house painting, and these will prepare you for the other subject. We can't have "all paint" at once, you know. As to glass writing:—Mix your pigment or white lead, according to desired colour, with good copal oil varnish. Quick-drying varnish would be too brittle. Ordinary oil paint would take too long to harden right through, and there is a non-absorbent surface to consider. Carriage varnish will do. Keep your pencil free by rinsing in turps occasionally. Back your glass writing with varnish colour made in the same way, and give two thin coats in preference to one thick coat.—F. P.

Books on Photography.—AMATEUR had better purchase Burton's "Modern Photography," or T. C. Hepworth's "Photography for Amateurs" (Cassell and Co.), which will afford him all the information he will require as to the practice of the art; anything else is a matter of experience. With regard to the appliances necessary they are few, and may be thus enumerated:—Camera with dark slide, lens, tripod, developing dishes, measures, washing-pan, magnifier, and focussing cloth, dry plates, and chemicals for developing and fixing, varnish, printing frames, sensitised paper, and toning bath. As to how these are to be used, information will be obtained by carefully reading Burton's work. If AMATEUR gets into any difficulty after this, if he will communicate his trouble to WORK, I shall be pleased to help him along.—D.

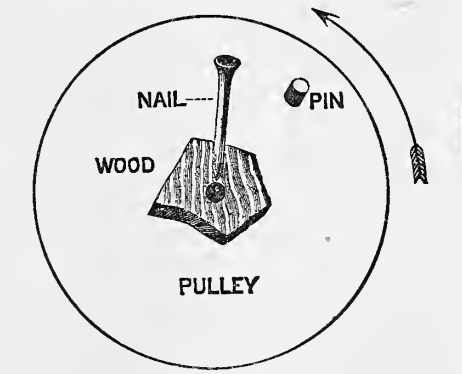
Iron Stove Pipes.—AN IMPROVER (*Arundel*).—To set out elbows in sheet iron, etc., proceed as under:—Take the piece of metal that is to form the pattern, and at the left-hand end of it describe a circle equal to the diameter of the pipe. Have the stuff long enough. Say you are cutting the pattern of a 4-in. elbow ordinary right angle or 90 degrees, cut the stuff 18 in. by 12 in. Having described the circle, draw a straight line, A B, through the centre of it. Next divide the circle into twelve parts; erect the two perpendicular lines, C D and E F, also the lines 1, 2, 3, 4, 5, cutting the divisions of the circle. Then set a bevel to half the angle required —in this case it will be 45 degrees, being half of 90 degrees—and draw the diagonal line, G H. Now along the line, A B, commencing from line, E F, set off the length required for the circumference of the pipe in twelve parts. For 4-in. pipe this will be 12⅝. Now draw twelve lines perpendicular to A B. Now



Plan and Section of Elbow.

from each point where the diagonal line, G H, cuts the lines, C, D, E, F, and 1, 2, 3, 4, 5, draw lines parallel with A B. Draw a curved line, X X X, starting from the point Y, and going from corner to corner. This gives the correct pattern; allow ⅜ in. each side for seam. Any angle can be set out like this, bearing in mind that the angle, G H F, must be half what you want the finished elbow. I hope this will be plain enough for you to understand. I think you will if you read it carefully and work it out two or three times. There are several other ways of getting these patterns, but I think this is about the best. I shall, however, have something to say about them when I arrive at that part in sheet metal work. To draw pipes in so that one length will fit the other is termed "tucking," and is done as follows:—After you have finished grooving the seam, draw the length of pipe nearly off the mandrel, and taking a thick pane hammer draw the end of the pipe in by lowering the left hand, that is holding the pipe, so that the other end is slightly raised from the tool; work right round the pipe with the hammer, taking care not to get solid blows on the tool, or you will stretch the pipe instead of making it smaller. When you have got round you will have made a kind of groove round the pipe. Now work round and round, gradually coming nearer to the edge, and working the puckers out. Strike with a kind of drawing motion, and finish off smooth with a mallet. Tin spouts, such as beer-can, tea-kettle, etc., are first turned straight, then filled with lead and bent, and the metal run out again. It is not worth your while to do them as they are so cheap, unless of course for any special job.—R. A.

Home-Made Lathe. — A READER (*Newcastle-under-Lyme*).—The wood is not driven by the bush of the cone pulley, but is simply put between the centres of the lathe. If now a screw or nail be driven into the end of the wood near the fixed headstock long enough to engage the pin mentioned in



Home-made Lathe.

your query, you will find that when the pulley is revolved it will bring the pin into contact with the nail or screw, and thus cause the wood to revolve likewise. In practice a carrier is generally employed instead of the nail or screw. In the end view annexed, when the pulley revolves as indicated by the arrow, it will bring the pin into contact with the nail, and cause the wood to revolve.—SELF-HELPER.

Microscope.—B. L. H. (*Glasgow*) has a microscope the power of which he wishes to increase, and asks how it can be done. I may say there are three ways of increasing the power: (1) By increasing the length of the power tube—this mode I should not advise; (2) by increasing the power of the eye piece — there are three powers often made and marked A, B, C; and (3) by changing the object glass. B. L. H. has a triplet which magnifies according to his measurement, 1—80, 2—100, 3—135, and he wishes to know, can the power be raised to 400 diameter? Certainly with the requisite O.G.; what that power should be it is impossible for me to say, as I do not know the magnifying power of the eye piece. What I would recommend B. L. H. to do is to send the microscope to an optician, and ask the cost. Mr. Lancaster, of Birmingham, would give him the information, I have no doubt. But before doing so, I would like to point out an important question or two. B. L. H. speaks of his instrument as a small microscope. It is for him to consider whether the other parts of the instrument than the power tube are good enough to spend much money on. Many amateurs forget that really the most important parts of a microscope are the stand and focussing arrangement; if these are all right, then higher powers can be added when one has the money. But to spend some pounds on a high power O.G. on a stand which is not perfectly steady, or where the focussing arrangement is not perfectly smooth and free from tremor, is simply a waste of money. Before I could advise any one to purchase high powers I should want to know the make of the instrument, as it seems to me that the powers attached are as high as could be used with advantage. B. L. H. asks, would an inch O.G. be suitable? Here we are on surer ground, and can answer in the affirmative. As a rule high powers are of little use to beginners, simply because they show but a small portion of an object at a time, whilst a low power, as an inch or 2 in., will take in a considerable field of view. But here, again, I cannot tell how much an inch would magnify, as that depends on the eye piece. Shall be glad to give further information, if possible, through "Shop."—O. B.

Lantern Slides.—G. B. says he has a lantern but no slides, and he wishes to know the cheapest way to procure some. By this and the statement made that he has some knowledge of photography, I presume he proposes to make his own. Beautiful and effective slides can be produced by copying—photographically—good wood engravings. As there are so many beautifully illustrated books and magazines now, there is no want of subjects. G. B. also asks where to get transfers for slides. I may say Mr. Lancaster, Optician, Birmingham, supplies the very thing. Personally, I can say nothing of them, as I have not seen them, but from what I know of Mr. L.—and I have had dealings with him many times—I am confident one would get their money's worth from him. The next and best plan of all is to paint slides. If there is a desire for the subject to be discussed, I shall, at the Editor's request, prepare a series of lessons on slide painting in oils and water.—O. B.

Bright Parts of Tricycles.—F. W. R. (*Harling*).—Coat them with some transparent enamel, of which several equally good kinds are sold for the purpose of preserving bright steel from rust.—D. A.

Twine Makers.—A. S. C. Y.—I am quite unfamiliar with the thing you ask for—viz., "a Cromer twin spinner," and I cannot find any one who knows what it is. At a venture I reply to your question. It may possibly refer to Macramé twine, of which you wish to know the name of a manufacturer. Write to Boardman Bros., Sharp Street Mills, Rochdale Road, Manchester; but if you only want a small quantity get it through some dealer in your own locality. If, instead of telling us you are "a constant reader of WORK," you had put your address, I might have been able to give you the name of some one in your own neighbourhood.—D. A.

Music Turnover.—EUGENE (*Castlejohn*).—There are several contrivances for turning over the leaves of music while playing, but I believe none of them have met with general acceptance. They are more of the nature of "fads" than of practical utility. The best forms are patented, so that you would be precluded from making and using. You may make a simple one with pieces of wire loosely hung at the top. Put a wire between the leaves you wish to turn over, the wire being sufficiently long to be caught at the lower end. With this or any other arrangement for the same purpose, you will be able to turn the music over nearly as quickly and conveniently as by the ordinary plan. To emboss headings to note paper, etc., you require a steel die, or rather, two of them, one having raised letters, etc., and the other sunk. These are fitted to a convenient press actuated by lever. The paper is put in between the dies, which are forced together, and the embossed imprint is formed. This, I think, will be intelligible to you without a sketch, and show you that the work, so far as the formation of the dies is concerned, is beyond your powers.—D. A.

Battery for Electric Light.—W. D. (*Blackfriars*).—The Bunsen battery is the strongest and most lasting for the electric light, but it gives a good deal of trouble in setting up and cleaning, and it gives off noxious nitrous fumes whilst working. If the same porous cells are charged with a solution of chromic acid instead of nitric acid, we get the next best battery, stronger at first but not so lasting in action. The whole subject of electric lighting in a small way is being dealt with in a series of articles now preparing for WORK.—G. E. B.

Electric Light for Photographic Dark Room.—F. D.—Respecting a former reply on this subject on page 445—both zinc plates and carbon plates should be of the size therein mentioned. The battery does not give off offensive fumes if charged with the solution of chromic acid. Of course, there is a certain acid odour about the apparatus, but that is not considered objectionable. Am glad you find WORK the paper you wanted.—G. E. B.

Bicycle Purchasing.—A WELL-WISHER (*Forest Hill*).—A WELL-WISHER would certainly find it cheaper to buy an ordinary bicycle finished ready for using, than to buy the parts ready for putting together. He gives no indication of the quality of the machine he wants. New ordinaries can be had from £4 10s. up to about £18. If he wants a cheap machine, and at the same time good value, he will get it from L. Deney, Berwick, from £4 10s. to £10. If he wants a tip-top, let him apply to Rudge, Singer, Bayliss and Thomas, or the Humber people, at prices from £15 to £18. There is no *best* maker; there are many of them, and to buy the parts finished of one of the best makers, fit them together, then get the machine enamelled and plated, would be costly, unsatisfactory, and altogether a mistake.—A. S.

Bending Wood Lawn-Tennis Racquets.—AMATEUR CARPENTER.—The wood used is English ash, and is boiled in a long tube or pipe for an hour and a half, when it is sufficiently pliable to be bent round a mould shaped like the inside of a racquet.—C. T. S.

Slate Mantelpiece.—OLD TIPTONIAN (*Tipton*).—The proper way, of course, is to enamel your mantelpiece, which, without proper appliances, you could not manage yourself. Failing this, you might certainly try the effect of one of the enamel paints; although it is not clear whether you simply want to touch up the mantelpiece here and there, or to go all over it.—D. A.

Music Canterbury.—A. T. F. (*Dover*).—Two novel and tasteful designs for a music canterbury or whatnot will shortly appear in WORK.

Knife Cleaner.—A. D. (*Wath-on-Dearne*).—Buff leather will be best, but almost any that is not too hard will do. Ordinary good sheet indiarubber. As for the rest of your suggestions, "Yes" will be sufficient answer. I am afraid you will find the job you contemplate is rather a difficult one.—D. A.

Worm in Furniture, etc.—P. H. C. (*Croydon*).—When once wood is attacked by parasites it is extremely difficult, if not impossible, to effect a radical cure. You may stop further ravages for a time, but sooner or later the "worms" will appear again in all probability. Benzoline is the best thing to use. Wash this freely into the infested parts. It will destroy existing worms. Of course you must not use the benzoline near a fire, as the vapour is exceedingly inflammable. To gild picture frames use the ordinary leaf gold as prepared for gilders' purposes. If an imitation will do use Dutch metal, which is got up and sold in similar form, or else a bronze powder mixed with varnish. Quite impossible to answer questions in our next issue after their receipt.—D. A.

Glaze.—F. W. R. (*Harling*).—Glaze is easily made by dissolving gum benzoin in methylated spirits. Proportions may vary, but a good general rule is to mix equal quantities—*i.e.*, half fill a bottle with the crushed benzoin, and fill up with spirit. You will require to strain the mixture before using. It is used to finish French polished wood instead of "spiriting off," to which it cannot be compared for durability of surface. By glazing, the polish or gloss is got quickly and without difficulty, but it is not to be compared with the legitimate method of finishing. It would be useless for you to apply glaze to bare wood, or over a varnished surface.—D. A.

Reviving Morocco.—F. W. R. (*Harling*).—Morocco seats may be freshened up by going over them lightly with a little thin French polish. Do not saturate the leather, and unless you are careful you will do more harm than good. Worn parts must be touched up with a little colour. White of egg is sometimes recommended as a reviver. It may be more convenient for you, but I have never used it personally.—D. A.

Stain for Light Wood.—F. W. R. (*Harling*).—Bismarck brown, mixed with warm water, makes a mahogany stain. A decoction of logwood chips will do the same. The nearest approach to a good rich mahogany, and not offensively red in colour, may be got by using a little weak walnut stain, composed of Vandyke brown, liquid ammonia and water to colour the wood, and then polishing it in the usual manner with red polish. This you can make yourself with ordinary French polish and a little Bismarck brown.—D. A.

Arms of Towns.—F. C. S. W. (*Birmingham*).—In Burke's "General Armoury" are verbal blazons of the arms of British towns and bodies corporate. The tinctures are, of course, given, so that any one who understands heraldic terms and heraldic painting will have in it all that he requires. The book may be found in most good libraries, or any bookseller will know and can get it. With any work containing coloured plates of the arms of all our towns we are not acquainted. A work of that nature, if produced with such care and exactness as to be of authority, must, from its nature, be very expensive.—M. M.

Outlines in Perspective.—R. Y. (*Norwich*).—There have been several inventions with the object of drawing correctly outlines in perspective, but we do not know of any which have been thoroughly practical and successful in working. It is beyond our province to compare the merits of one invention with another, having regard to their patent rights. If you give particulars of your invention to several firms you run the risk of having your ideas pirated, and it would be difficult for you to prove that your invention had been stolen. It is unwise to explain matters that have not received any protection. The most satisfactory way would be to search the records of the Patent Office, to ascertain if your idea has been anticipated. The Patent Office Library is open from 10 a.m. to 10 p.m., and is situated at 25, Southampton Buildings, Chancery Lane, London, W.C.—R. and C.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Adjusting a Compound Lathe Rest for Taper Turning.—IRON TURNER (*Bolton*) writes in answer to A READER (see page 382):—"I suppose A READER will have a mark on the base of his rest, to show when it is set right for parallel turning. Now, READER, take a pair of callipers, and get the diameter of the base of your rest, take half that diameter, and you have the radius. Rule—multiply one-half the taper required by the radius of the base of rest, and divide the result by the length of the taper part. Example—a piston rod end requires turning taper for crosshead to fit. Length of taper part, 8 in.; the two diameters, $2\frac{1}{2}$ and 3 in.: supposed radius of base of rest, 6 in. Now, by the above rule, one-half of taper $= \frac{1}{4} \times \frac{6}{1} = \frac{6}{4}$ and $\frac{6}{4}$ divided by $8 =$ length of taper part $= \frac{6}{4} \times \frac{1}{8} = \frac{6}{32}$ or $\frac{3}{16}$ of an inch distance to move rest. Take up this distance with a pair of compasses, place one compass leg on the mark on your rest for setting it parallel (your rest being set for parallel turning), and mark a faint line with other compass leg on the base of the rest. Move rest round until your centre mark coincides with this line, and your rest will be right for the taper you require, but remember whether by this or any other method, everything must be mathematically correct, otherwise you will not get your taper absolutely correct."

Machine for Current of Air.—J. A. P. (*Accrington*) writes:—"In looking through 'Shop,' I have noticed several replies to BELLOWS (see page 190). The fans sent have been out of shape and proportion in my mind. One with the wings bent the wrong way; and the one in No. 35, page 557, would blow very little, as the pulley on the fan is too big, and the driving wheel too small. It is made left-handed, and the hole in the pipe is not large enough. You cannot force a fan like you can bellows. It wants more play, as you will see by looking at Fig. 1. The pipe being much larger, the

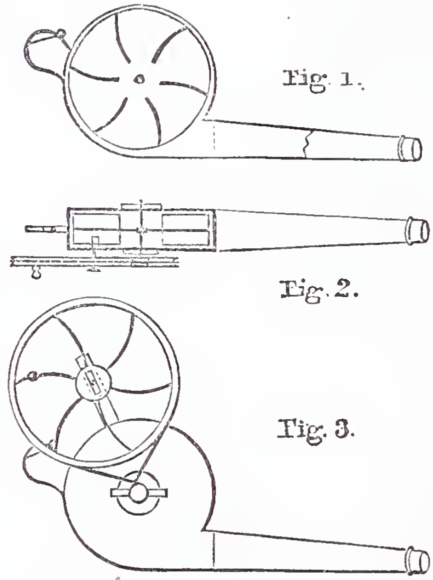


Fig. 1.

Fig. 2.

Fig. 3.

Machine for Current of Air.

spider should not run close to the case all the way round, but as marked in Fig. 1. Now as to making it. Do not use wood, as it dries in more one way than another, and I know cardboard is useless, as both have been tried many a time, and do not pay for the time in making. If they are worth making, make them well. I find tin to be best for these small fans. This is the handiest size that I know of. Fan 6 in. diameter, pipe 14 in. long, $2\frac{1}{4}$ in. square at fan, and $1\frac{1}{2}$ in. at end. Driving wheel 7 in. diameter fully on spindle, $\frac{3}{4}$ in. groove. If you have followed WORK up in soldering, and other things, BELLOWS should be able to make this."

Colouring Photographs.—S. H. C. (*Penzance*) writes in reply to EXPECTANT (see page 174):—"EXPECTANT finds difficulty of making water colour stick on the photo. If he would lick the photo over before painting, the saliva would render the surface fit to hold colour. There are preparations sold to work with, but I find the spittle best and handiest, if I may so apply the word. Gum arabic and water is a medium."

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THE attempt which one of our great English railways is making on a small scale to use petroleum as fuel is being practically made in Russia on a large scale. All the steamboats in the Caspian Seas are using naphtha residuum and oil as the fuel. In Moscow, the factories are also taking to it; and on the Volga steamboats are beginning to use it. Cheap petroleum for some purposes may check the advance in the price of coal.

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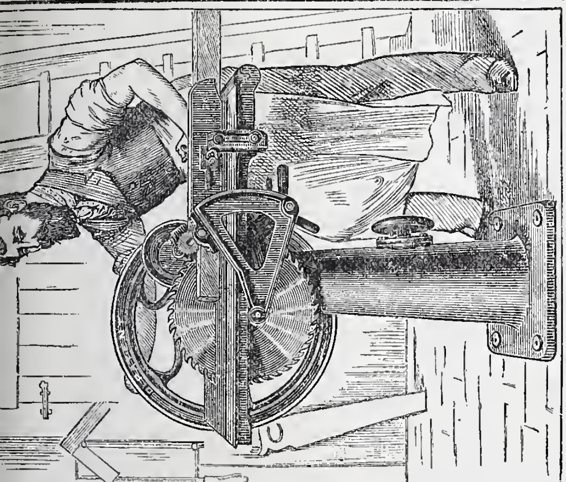

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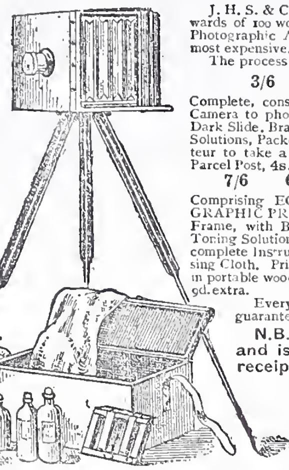

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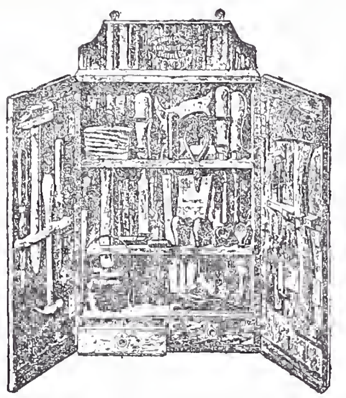

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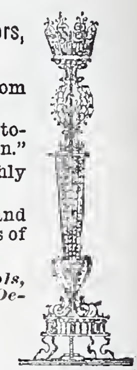

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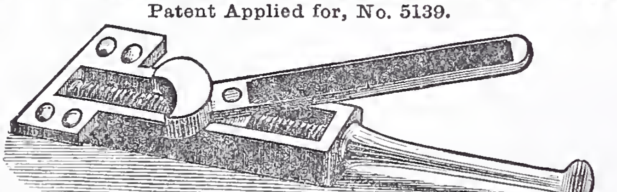

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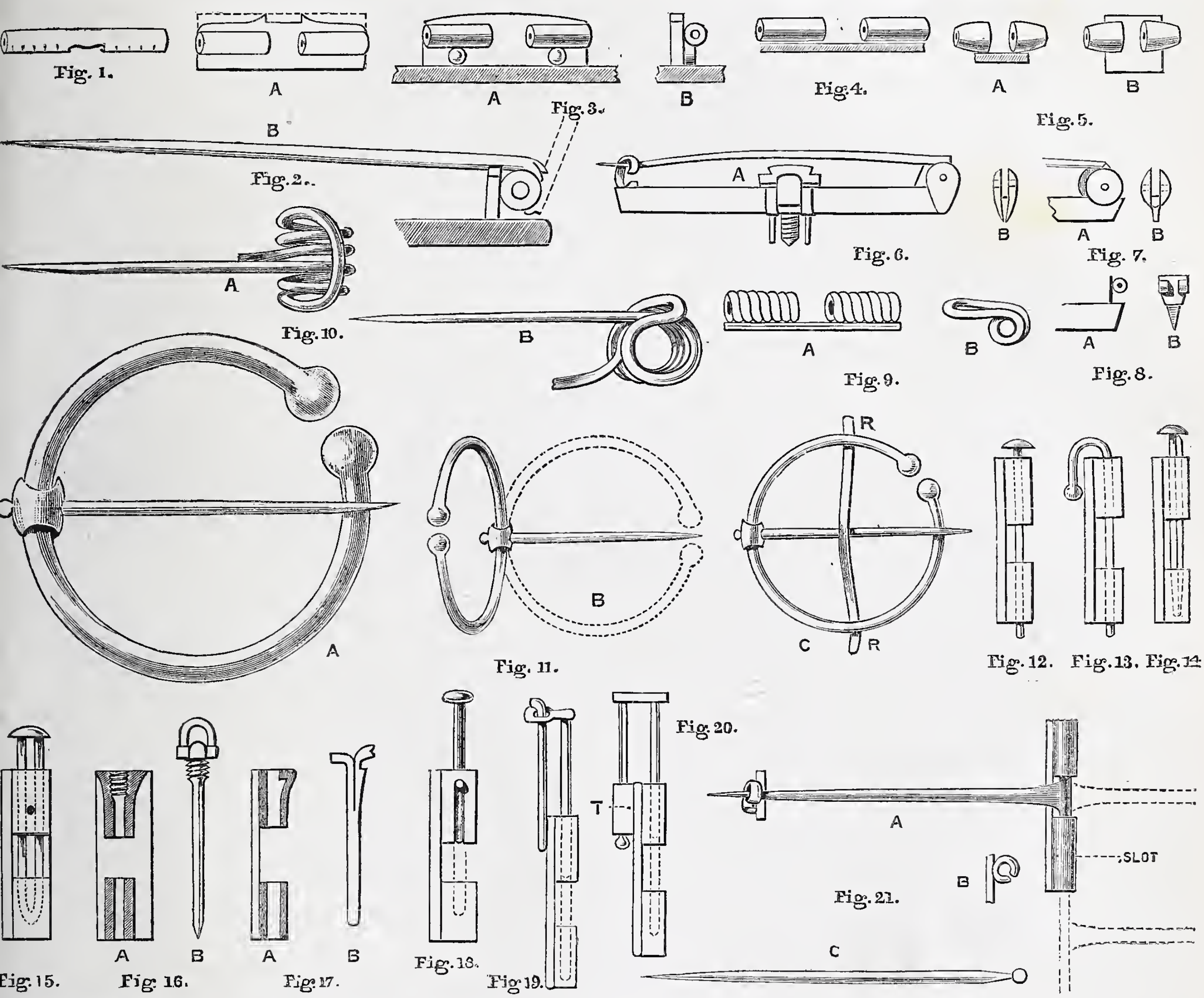
Vol. I.—No. 46.] SATURDAY, FEBRUARY 1, 1890. [Price One Penny.



BROOCH JOINTS. Fig. 1.—Piece of Joint Chenier prepared for soldering on. Fig. 2.—A, Chenier soldered on and Centre Piece cut away ready to fit Tongue; B, Height Joint should be raised; also by Dotted Lines Convenient Distance for Tongue to turn back. Fig. 3.—Method of supporting Side Knuckles by Grain of Gold; B, ditto by means of Bar. Fig. 4.—Joint without Fly-up Plate. Fig. 5.—French or Barleycorn Joint. Fig. 6.—A, Side View of Ball-Joint made from Flat Plates, a Strong Form of Narrow Joint; B, End View of same. Fig. 7.—Ditto, but made from Grain of Gold with Centre cut away; B, End View. Fig. 8.—Weak and Bad Form of Narrow Joint—A, Side View; B, End View. Fig. 9.—A, Etruscan Joint formed from Coiled and Soldered Wire; B, Another Form of ditto formed from Wire. Fig. 10.—A, Top View of Antique Brooch Joint in British Museum; B, Side View of same. Fig. 11.—A, Type of Celtic Brooch-fastening without Catch; B, Showing by Solid Lines the Position for Insertion, and by Dotted Lines the First Move towards Fastening, *i.e.*, Point between the Ends; C, Position of Tongue when fastened: the Rod, R R, indicates way Material acts in securing Brooch. Figs. 12, 13, 14.—Joint with Simple Removable Joint-Pins. Fig. 15.—Joint with Pin that allows of Partial withdrawal. Fig. 16.—A, Section of Joint to take B, a Screw Joint-Pin. Fig. 17.—A, Section of Joint to take B, a Spring Joint-Pin. Fig. 18.—Another Form of Joint where Pin can only be partly withdrawn. Fig. 19.—Another Form of Joint acting on a Guiding-Bar. Fig. 20.—Another Form of Joint acting through a Tube. Fig. 21.—General View of Removable Tongue in Position: Dotted Lines show course of Removal or Insertion; A, Shows Position of Slot: B, Side View of Open (Lower) Knuckles; C, Side View of Tongue showing how it is thinned down to pass along Slot where soldered to the Joint-Pin.

THE BROOCH: HOW TO MAKE IT.

BY H. S. GOLDSMITH.

THE JOINTS OF BROOCHES.

THE joints of brooches are so evidently the next in order to tongues of brooches, that no reasons are wanted to explain the why and the wherefore of this paper coming next.

We shall have to see that they are made strong enough for a fair amount of wear, and that they are suitable to the size of the brooch, and in keeping with the character of the ornament.

We will first take up the most common form: *viz.*, those with the fly-up plate soldered to the joint for the tongue to obtain its spring from, for which tongues such as Fig. 5, A to D, in the previous paper, are suitable. Then those without the fly-up plate, for which the tongues, E, F, and G, are used.

Finally, the form of joint where the tongue is removable at pleasure.

Before we begin this matter, I particularly wish to call attention to the possible results of an unsoldered joint. It may cause a great amount of trouble and expense if it be not noticed before the work is finished, for I know—and if you do not know now, you will later on, to your own cost, too, I hope — that to reset and to polish and colour work a second time is running a great risk of the work not finishing, besides the loss of time and the delay in the delivery of the work to the customer, all of which can be prevented by a little care and attention on the part of the workman.

Now, to make the joint of a brooch we want a piece of chenier of suitable length and thickness, from the centre of which a portion has been cut away—of less than one-third in length, and only half-way through for the present, like Fig. 1. Then tie it on a plate of fair thickness, Fig. 2 A and B (I should say certainly not less than size 8; Shakespeare Guage 10 or 12 would be better), and solder it with the joining or soldering seam in actual contact with the plate, in order to get it firmly and soundly soldered: I mean so soldered that it cannot come open any more. The next thing to do is to remove the other half of the centre piece, and to fit the tongue in between these two knuckles or side pieces of the joint, and let it be fitted properly. If you want a pattern for your fitting, look at the hinge of the nearest door, and you will probably find that great affair fitted better than many tongues are, particularly in job work. Now, as our work is of a much finer and more delicate kind than that of a hinge maker, I trust that you will do your jointing as it should be done; it only wants a little care and practice—but it wants them both to turn out a properly made joint.

The other way of making a joint, by soldering each knuckle on separately, is rarely used for single brooches, and as that method more properly belongs to the joints of lockets and boxes, we will deal with that when we come to those particular articles.

We have now to solder the joint on to the brooch. But how? Some jewellers have the chenier fitting close down on to the brooch and soldered to it; but I prefer slightly raising it, as Fig. 2 A and B, Fig. 3 A and B, in order to let the tongue come back rather more than a right angle, which we cannot do without weakening the tongue, if the chenier be soldered close to the back of the brooch. Fig. 2 gives about the proportion of height required, and the dotted lines show the distance or angle to which the tongue should be able to move. If you raise the joint as advised, and you have made your fly-up plate too weak, you will have to support the side knuckles with grains, like Fig. 3 A, or a bar, like Fig. 3 B; but you ought not to require either.

You will, of course, file up the fly-up plate—something like Fig. 2 A or Fig. 3 A will do, or any other shape that you may prefer, providing that it is not liable to catch in lace that a lady might wish to wear with it.

We will suppose that the joint is soldered in its place (I will tell you about the place later on, when I summarise the first three papers on tongues, joints, and catches), and the tongue fitted. Now we will regulate the hole with a joint-brooch, and from the proper end, if you please. I don't suppose half the trade have thought about there being a proper end to put a joint-pin in—well, there is; and it is from the top end, and this is why—if it works loose, then it will work upwards, and may be noticed and replaced, while if it works loose after being inserted at the lower knuckle first, it will naturally work downwards and drop out; then the brooch will fall away, and either get damaged or lost. I can tell you that it is but a week ago that my firm gained a most valuable customer through this very defect on another firm's part, by which a diamond brooch was nearly lost.

The joint-pin itself should be of hard wire (metal or gold-wire I mean, not hard steel); it should taper gradually, if at all, and be finished with a smooth file; it should bind on the two outside knuckles so as not to rotate when the tongue moves; it should also be tight enough to keep the tongue perfectly steady, and on no account to let it wobble up and down, and from side to side anyhow; in short, it should *fit*.

We may as well finish with the joint-pin here, although in practice it is the last thing we have to do before the work is sent home.

I have been taught that a joint-pin, if properly made and fitted, should stay in its place by itself, and it undoubtedly should in most cases; but with brooches I slightly rivet the ends of the joint-pin over—it gives so much extra security, and when carefully done, neither the brooch nor joint is touched or damaged. Mind, this riveting is in addition to a properly fitted joint-pin, and is not to be used in place of one fitted anyhow.

If the joint is not to have a fly-up plate, as Fig. 4 and Fig. 5 A, we prepare the chenier in the same way as before—that is, with part cut away from the centre—and proceed to solder it on the back of the brooch, or on a plate like Fig. 4 and Fig. 5 A; then we cut the remaining half of centre away as before, and fit the tongue. The tongues for this class of joint have to be made like Fig. 5, E, F, and G, in the previous paper, in order to obtain the requisite spring, which in the previous case we got from the fly-up plate.

The diagrams, Figs. 5, 6, 7, 8 and 9, give a few different forms of these classes; there is the Barleycorn, Fig. 5 A and B, made from thick chenier, and is filed into the shape it has. It is mostly used on French jewellery.

The ball-joint, Fig. 6 and Fig. 7, is the form usually found in the fittings for diamond work. It is either made from two pieces of thick gold, like Fig. 6 A and B, or else a grain of gold is melted, and the centre is cut out on Fig. 7 A and B, to take the tongue—which in these cases is formed with a flat plate instead of chenier — and the whole is drilled through together to take the joint-pin. Either way, we get an improvement on Fig. 8 A and B, with its weak knuckles; but Fig. 6 is decidedly the better of the two, inasmuch as each knuckle can be well and securely soldered to the side of the brooch mount.

Fig. 9 A is a joint whose chenier is made out of a coil of rings soldered together; it is sometimes called Etruscan.

It is undoubtedly one of the best, if not the very best, we can have—there is no danger of a soldering seam opening here, for the excellent reason that there is none to open. This is even stronger than the chenier without a soldering seam that has been introduced into the trade, for that might split if there were a flaw in the gold, while all the flaws would have shown themselves in drawing down the wire, and have caused it to break where they were, long before we had reduced our wire to the small size required for this work.

Fig. 9 B is another form of joint, used in the modern Etruscan or Roman gold work; it is made from one piece of wire, as I think the diagram clearly shows. One tongue for this is Fig 5 K, in the paper that precedes this. Generally a piece of tube takes the place of the joint-pin, and it is chamfered or burred over, so there is no fear of that dropping the tongue out. It is also worth noting as one of the narrow and strong class of joints.

The coiled wire that takes the place of a joint in a safety-pin brooch is much the same in all of them, except that we get three turns instead of two occasionally. You will see, by referring to Fig. 10 A and B, and Fig. 6 in the paper on Catches (both Fig. 6 and Fig. 10 being drawings of ancient brooches now in the British Museum), that this method of doing away with a joint is not in any way a new idea. Fig. 10 particularly has a very clever way of obtaining the spring, with the minimum risk of breaking the tongue short off, which sometimes happens to the safety-pin brooches, now so much worn. In this case, and in the type of brooch indicated by Fig. 11, no attempt is made to hide the means of fastening, as we always do, nowadays: in fact, the aim of these ancient jewellers undoubtedly was to turn a necessary part of the construction into an ornament, which is, I am told, the artistic way—and it can hardly be disputed, either—in these two cases, at any rate.

Do my young readers know how Fig. 11 is fastened? for it has no catch, as we generally understand the word, and the joint into which the tongue is soldered travels easily round the rim from end to end. What prevents it falling out? you may reasonably ask. The answer is the shawl, or whatever it fastens. That looks like a bull—and as this type of brooch chiefly comes from Ireland, a bull is surely admissible here, if at all—but it is a fact, nevertheless. First we will put the tongue through the shawl, etc., Fig. 11 B; then place the point between the ends shown by dotted lines, and bring it on to the top or front of the rim, like Fig. 11 A and C, and slide it round a little way, or a long way, just as you like, and that is all. We shall find that the shawl, etc., is acting in the way shown in the diagram, Fig. 11 C, by the rod, R R; and it is a good secure hold too, but it is only suitable for large brooches that have to fasten shawls and plaids, or such-like heavy woollen articles.

We will now have a few words on joints that allow of the temporary removal of the tongue, for this is often required in valuable ornaments that have to do duty for several articles, forming either brooch, pendant, or locket, bracelet-centre, hair-pin, etc., at the pleasure of the owner. Of course, joints and catches are made to remove altogether; however, at this early stage of my papers I do not think I will go into details, but will do so when I come to the fittings for diamond work, about which there will be plenty to say, and to illustrate.

In the meantime here are a few methods of getting rid of the sharp tongue, for no lady in evening dress could wear an ornament as a pendant, and have the point continually scratching her. And if the point were covered up by a protective catch, after the manner of Italian mounts for Mosaic work, there still remains all the brooch fittings to prevent the pendant or locket resting steadily and close to the figure; besides, as it is not wanted it is best away, so take your choice of doing it from what follows, or evolve something yourself which will be better practice for you, only using these as hints.

The simplest way of all is by making the joint-pin to take in and out; so just solder a top on like Fig. 12 or Fig. 13, and do not forget all these easily-fitting pins are to be inserted from the *top* end of the joint.

Fig. 14 is a split joint-pin, made out of two half-round pieces of wire soldered together at the two ends; this can be made to spring apart just a little, and so give some sort of a hold.

Fig. 15 is much the same, but it has a peg inserted and soldered to the knuckle; this allows of only the partial withdrawal of the joint-pin, and prevents its loss. It is a way much used to fasten Indian bracelets, for which it is much more suitable, as the size chenier required would look clumsy on a brooch; but as it can be used sometimes, I give it here.

Fig. 16 A has the top knuckle enlarged, and a plate or ring soldered in to take a screw. The joint-pin, Fig. 16 B, is made like the sketch, and generally with a fall-down handle, but that will have to be governed by circumstances; it has got to be unscrewed by the fingers, so take whatever means you best can to facilitate that.

Fig. 17 A and B is a spring in place of a screw, and there are doubtless many other ways that an ingenious workman will devise to obtain a desired result; and speaking for myself, there is nothing I like better than some good tough proposition in jewellery mechanics to work out.

These entirely withdrawing and removable joint-pins are always getting mislaid or lost, so I will follow on with one or two methods of retaining the joint-pin in its place.

Fig. 18 has a slot cut in the top knuckle, in which a peg can work up and down, and to the peg the joint-pin is soldered; it should not be made to withdraw further than to allow of the tongue's removal.

Fig. 19 has the joint-pin soldered to a cap, and the cap is pierced and fitted to run on a parallel guiding-bar, or else with the bar soldered parallel to the joint-pin and working through a tube (T), Fig. 20, soldered underneath the joint or behind, or wherever is most suitable for your particular job.

In the paper on Catches, which will follow this, you will find particulars of a fall-down catch that should be used with these removable tongues. Fig. 7 is its number.

Thus far only the withdrawal of the joint-pin to allow of the removal of the tongue has been considered, and for that purpose all has been worked from the top knuckle, so that if by accident or wear the joint-pin becomes loose, it will not drop down and disengage the tongue. Now, our next example, Fig. 21, is one in which the bottom knuckle plays a part, and for the same reason: namely, that it is the more secure of the two for the purpose.

This bottom knuckle has a slot cut right through it in the position indicated in Fig. 21 B.

The joint-pin is here soldered *to* the tongue, which is flattened and broadened out (Fig. 21 A and C); it is placed in position sliding along the slot, as indicated by the dotted lines; then when the tongue arrives in between the knuckles, it is turned down towards the catch in the usual way.

This is the one I mostly use, as it makes a neater joint, and reduces the number of pieces that have to be made and fitted, but it has two very important parts that want watching: first, the soldered connection of the joint-pin and tongue, which must be sound, and yet leave the round joint-pin quite clear where it joins the tongue, Fig. 21 C; the second point is the slot, which must be just wide enough to allow the joint-pin to come out sideways. I have enlarged all the diagrams on purpose to make things clear, and I hope I have succeeded.

This brings me to a finish of this paper; and before entirely closing it, I should like to say that all I have written here are what I have made or have seen, so there is nothing theoretical about them; but I must warn anybody that tries their hand at the more difficult ones, that patience, care, and skill will be required to carry them out properly, and even then it seems that it is not every man who is able to make them.

They should be taken in hand with a thorough intention to do the very best, and if done with a little thought, I do not fear the result.

As all of them depend on exactness of fitting, it is evidently of no use rushing at them in a careless, anyhow sort of way—slogging may do at cricket, but it won't do at jewellery. And if we aspire to be in the front rank of our trade, we must do all our work conscientiously, and I had almost written devotedly.

This capability of taking infinite pains, which somebody says is the sign of genius, will at the end give the requisite skill if intelligent practice is added; please notice that I have not written practice only, but practice and intelligence added, for practice (I mean making many things of the same sort) never will *alone* make a good workman. To become that depends to a very great extent indeed—in fact, almost entirely—on the man himself, and I hope that such a one may find a little now and then in these papers to help him on his upward road.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

MIXING OIL PAINTS AND COMPOUNDING TINTS AND SHADES OF COLOURS FOR PRACTICAL USE—SECOND AND THIRD COATS.

LET us now give a glance around the room before I make up the paint, and get some idea of what is required. We notice that, beyond the discoloration of the white plaster cornice, there is little evidence of oil paint on its surface, so that the oil has all been absorbed into it. The walls, however, having been well trowelled and finished, show some signs of the glossy paint on the surface, hence the suction is entirely stopped in those places, and, probably, nearly so all over. Under these circumstances, the previous kind of paint, but with a little more lead in it, is required for the second coat for the cornice, but, for the walls, I make it up considerably rounder, or thicker, and use, instead of all oil, two parts of linseed to one of turps.

Before straining this, I add sufficient Venetian red in oil to give my paint a decided pink cast, which not only enables us to see that nothing is missed, but also exerts an agreeable influence of colour upon the succeeding coats.

My second coat to cornice and walls being now manipulated as before, I return to the woodwork. Having lightly papered it down, I dust it, and stop the nail-holes in the panel mouldings, etc., with putty made from white lead stiffened up with best, or gilders', whiting. After stopping woodwork, it is advisable to let it stand a day, to enable the putty to harden on the surface; the second coat of paint can then be applied without affecting it, and should be of similar proportions to that last spread on walls, but in this case I use the paint without any stainer. We have now two coats upon all our work, the absorption in cornice, wall, and woodwork being thereby effectually stopped. Before, however, we consider the finishing *colour* of our paint work, we must turn our attention to the ceiling. This is now coated with a preparation of size and whiting, with the object of stopping some of the suction of its surface; and, having again become thoroughly dry, I finish my ceiling-light with three coats of white paint, and the flat, or bed, with a coat of faint pink distemper—a lesson on which process I postpone until the present one is completed.

At this point it is now necessary that you, my reader, as the supposed patron as well as learner, and I, the practical worker and adviser, should consult together as to the finish and appearance of our temporary job. May be you have received instructions from the partner of your joys and sorrows (who, probably, paints upon banjoes, tambourines, drain-pipes, etc., for the embellishment of your drawing-room, and is a member of the "Blankport Amateur Sketching Society") that such and such a "fashionable" shade of "electric" blue or peacock green will give the most artistic effect; or, perhaps, you have some striking colour-notion of your own, originating from a profound study of the charming kaleidoscope of colour obtained with a pot of Mr. Aspinall's enamel. This decision, we will suppose, is eventually arrived at—that the teacher's knowledge and experience shall be responsible for the artistic as well as the practical success of the work, the "why and wherefore" of my selection of colour being explained as we proceed.

In spreading a succession of coats of oil paint, upon plaster work especially, it is not advisable to use two coats of *all oil* colour upon each other, unless for the purpose of stopping the absorption; when, however, that end is gained, it is necessary to use the next coat with a larger proportion of turpentine than oil. If we continue using our paint very oily, each coat hardens, so to speak, in itself; but if we interpose sharp or turps colour between two coats of oil paint, the former acts as a cement, and the three coatings become firmly bound together. In *flatting*, or dead-painting, surfaces, this same principle underlies the whole process. A last coat of oily paint, nearly identical in colour to the desired tint of flatting, is very carefully spread, and upon this *ground*, as it is technically termed, the thin coating of purely turps colour is laid before the ground becomes properly hard—which is generally the next day or next but one. Providing the ground and flatting are properly prepared and manipulated, we find this action takes place: the oil of turpentine slightly opens the surface of the linseed oil ground beneath it, so that the latter takes hold of the particles of pigment contained in the flatting, whilst the gradual evaporation of the turps leaves the surface without gloss, the pigment being held from beneath by the oil, but uncased with any upon the surface. Woodwork and walls, if properly flatted, can be washed as safely as can oily paint, but the same knowledge of its nature is as necessary to successfully clean and preserve it as it is to prepare it. It is only when wrongly manipulated that flatting will not stand fair wear and tear.

This explanation will now help you the better to follow my methods. Having determined to flat the cornice, I must previously ground it with oil paint, somewhat akin to my finishing, flatting, colour. The wall space we will leave in a medium gloss of oil paint, so that my third coat must be of sharp colour and near the tint of finishing paint. The cement skirting I shall now first coat with the paint used on walls, and then finish that and the woodwork with two more coats of good oil paint. I here remind you that this decision is made with a view to present economy and the temporary nature of the job; permanent embellishment is to come later on.

In painting a billiard-room particularly, the range of suitable colour is governed, and limited considerably, by the appearance of *the* principal article used therein, namely, the vivid green mass of the billiard-table covering and the accompanying green shades to the usual gas-lighting arrangement. If, therefore, our selection of colours is of a common sense nature, it must not clash with or in the least detract from the appearance of the billiard table. The dominant colour-tone of a room is usually furnished by the walls, and being, here, the principal surface the eye will rest upon after leaving the green table, their appearance is a most important item.

Now every definite colour has its *contrast* and *complementary*: that is, a colour directly opposite it in appearance and sentiment; but which, when placed in juxtaposition therewith, not only improves and heightens the effect of it, but combines with the former in producing the sensation of *colour harmony*. In the selection of colour, *contrast* is therefore one scheme we may choose; the *alternative* in this case is to keep our walls more in *unison* of colour with the billiard table, namely, a subdued shade of green.

The complementary colour of the bright green in question is a rich purple red, the two combined giving a very brilliant appearance. Harmony of colour and brilliancy of contrast is not the principal object in this instance, however; my aim is rather to soften down the vivid green than to enhance its brightness, which any shade, however deep, of its complementary upon the walls would do. Our best wall colour will therefore be a dull and soft-toned green, and by introducing the warm complementary colours into cornice and woodwork we shall obtain pleasing and harmonious results.

From this short gossip on theory, we turn again to our practical operations. Preparing my third coating and ground first occupies our attention. The sharp wall colour is mixed—the proportions of lead and patent drier being twelve to one respectively—with nearly three-fourths of turps to the remaining part of linseed oil. There is no occasion to measure it out exactly, but if the solids are beat up in oil into thick batter consistency, it will require turps only for thinning it for use. I put enough of the thick paint aside as will suffice for the cornice, and before thinning the remainder for my walls, I stain it to warm green with the subjoined pigments, ground in oil: Prussian blue, yellow ochre, and burnt umber. In the colour mixing you manifest much interest, and since we feel the impossibility of adequately conveying, by signs or sounds, knowledge appertaining to the sense of colour only, I gladly bring to our aid the array contained on "Aspinall's enamel" card before mentioned.

I will here strongly advise all readers of WORK who take more than a passing interest in these papers to procure, if at all possible, one of the cards alluded to. Lessons on colour, without colour examples to work with, are of little avail; but with such a collection of some hundred different hues, tints, and shades of colour before both contributor and knowledge-seeking reader, the practical and artistic value of these papers should be increased tenfold.

To return to my wall paint, I find the exact shade is not contained on Aspinall's card, but its appearance is similar to "sage green" in colour, although of a much lighter tint. To ensure, however, a good solid wall when finished, I stain this "third coating" paint several shades *darker*, since a lighter, finishing shade of any one colour will cover much better when superimposed upon a darker shade than *vice versâ*—a point it is very necessary to remember in oil painting. In mixing both this and the finishing wall paint, I first stain the white to a medium blue, then add ochre and convert it into green, and lastly, the umber to soften and neutralise, or to warm the green mixture. Previous to spreading my "sharp," that is comparatively quick-drying wall paint, I must ground the cornice, but as I intend introducing thereon some warm tints in contrast to the "sage green" walls, it is best to first mix my finishing woodwork colours.

As some relief to the mass of wall colour, I determine to paint the woodwork in dark warm shades, and which, upon reference to the colour card, I find nearly identical to the globes thereon, marked, "Arabian brown" and "Terra-cotta, No. 3." The former, which is the darker of the two, I use upon the entire door frame and window frames, the doors, with the exception of panels and mouldings around same, and the deep bottom plinth of the skirting. The panels of the woodwork, the window-sashes and top plinth of skirting, I paint with "Terra-cotta, No. 3;" and, with a view to brightening up the doors in their entirety, I shall finish the panel mouldings and one member or division of the door frame with the soft sage green wall colour. From the method I proceed upon, there can be gathered the advantage of deciding and making-up the dominant colour given by the room, namely, the warm green, at the start, so that the remaining and contrasting colours may be compared therewith, and the most harmonious effect obtained. The paint for the woodwork I make from Venetian red and burnt umber chiefly, with the addition of a little ochre, lightened up with white for the panels and Indian red. In contrasting any shade of green against a warm colour, it should be remembered that the more yellow the green contains, it must be opposed by an equally blue or purple-toned red; the true contrast of *pure red* being, *not* as has been taught by some colourists, pure green, but a decidedly *blue hue* of *green*.

Notwithstanding the principles of colour-harmony are as definite as those which give us harmony of sound, a knowledge of the exact equivalents of a colour will not guarantee the successful colour-treatment of a room or building. The scientific equations alluded to should form the foundation of our colour-studies; but the amount of success we obtain will, however, depend upon our adaptation of these definite laws to each particular circumstance and undertaking. The climate and light, the position and interior lighting of the room, the scenery from the windows, are each and all prominent factors in determining the strength and weakness of the contrasting tints which compose a harmonious colour scheme—besides the more positive reasons I have explained herein—and it is then that scientific proportions fail the decorator, and he has to rely upon his own experience and faculty as a *colourist*.

Having given this explanation, you will agree that I cannot well describe to a novice the exact arrangement of my cornice colours. You notice, however, that I treat it in three main divisions: that portion next the wall I paint with a colour similar to the woodwork panels, but with the addition of a little more white and umber. The middle recessed division, or cove, I paint with a slightly more blue-grey and lighter tint of wall colour, made by adding a very little blue and white to the latter; whilst the third and top division of mouldings I ground a lighter and more golden hue of the base part. These cornice paints—which I have prepared from the "thick white" put aside previously for the purpose, and for staining or colouring which I have principally used a little of my woodwork and wall paints—are now well strained; and, being thinned with three parts oil and one of turps, are spread according to the above arrangement. The wall space being previously papered down, and any little indentations in the plaster faced up with the hard stopping made for woodwork, is now third-coated with the "soft" sage green, used darker than the desired finish and with fully two-thirds of turps to one of oil. The third coat requires to be rather rounder, thicker, than the two previous ones; must be well spread, laid off, and worked rather expeditiously, one flank or division of the wall at a time to avoid the joints "catching," as it is termed. The cement skirting is afterwards first-coated with the same colour spread *very barely*; and, as it is a comparatively non-absorbent surface, this sharp paint forms the best "key" for the dark red, finishing paint. Its present colour is no disadvantage, since the first coat of woodwork paint will effectually hide it.

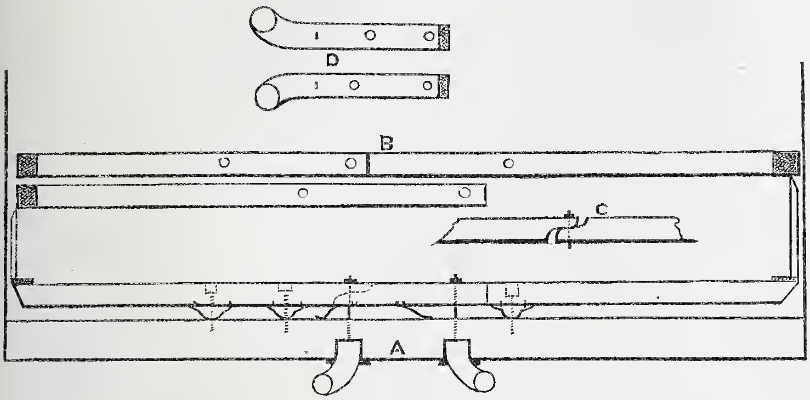
I am again obliged to break off in my subject here, but I may add that few remarks are required to bring this part of my subject to a conclusion, and that they will be chiefly directed to the treatment of the cornice and flatting, and the colouring of the skirting and woodwork.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

FINISHING OR FITTING INTERNAL MECHANISM—PEDAL ARRANGEMENT AND CELESTE PEDAL.

THE case having been completed, it is now ready to receive the internal mechanism, or labour to facilitate production. This made room for the key maker and action maker to supply the manufacturers, thus making the key maker and action maker two distinct trades. Although I am aware there are a few firms who make their actions and key-boards on the premises, these may be counted As for the piano we are making, we only need one; it will be enough for the present to describe this one. The action I have selected for this piano is what is known as the tape action, from the fact of it having a tape or bridle attached to the hammer butt. This action was patented in England as far



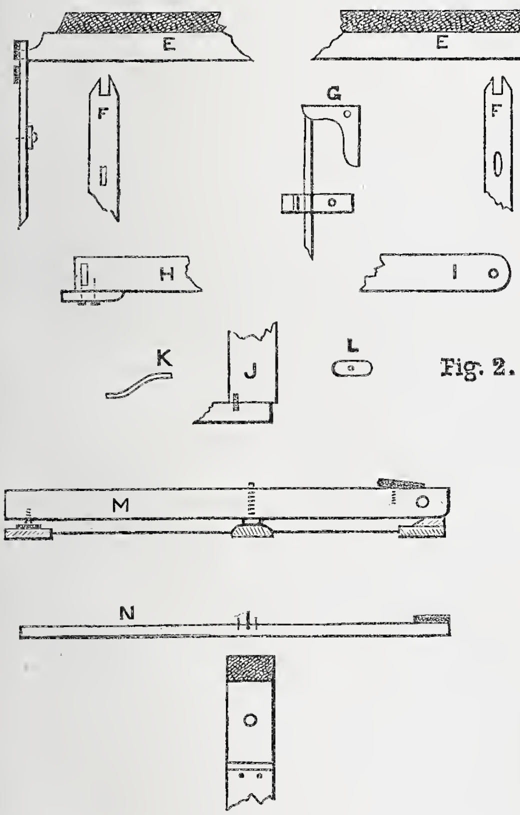
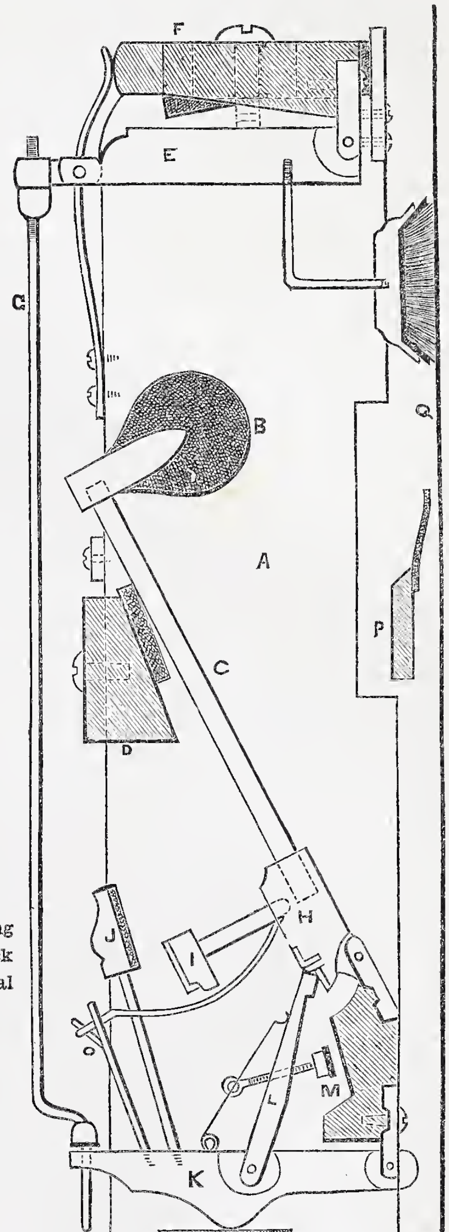


Fig. 2.

Fig. 2.—Diagram showing Arrangement of the Pedals and Rockers, and their various parts. (Scale, 1 inch to 1 foot.)



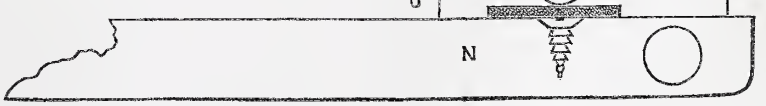


Fig. 1.

Fig. 1.—Diagram showing Section of Tape Check Action. (Half actual size.)

References to Letters in Fig. 1.—A, Standard; B, Hammer; C, Hammer Shank; D, Hammer Rest; E, Damper; F, Damper Rail; G, Damper Wire; H, Hammer Butt; I, Check Arm; J, Check; K, Lever or Crank; L, Hopper or Fly; M, Set-off on Side Rail; N, Portion of Key showing Pilot Screw; O, Bridle and Tape or Stay; P, Section of Celeste; Q, String. In Fig. 2.—A, Pedals in Position and Arrangement of Rockers; B, Plan of Rockers; C, Overlapping of Celeste Rockers; D, Plan of Pedals; E E, Plan of Celeste with Section of Sticks; F F, Plan of Pedal Sticks to support Celeste; G, Crank showing Method of Working. H, Bass End of Damper Rail; I, Treble End of Damper Rail; J, Method of fixing Standard and Standard Block; K, Spring for Front of Damper Rail; L, Wood Button to secure Action; M, Sketch of Key; N, Section of Balance Board; O, Plan of Balance Board.

action. This branch of the trade is known as the finishing. The finisher prepares the keys and action for the case, and adjusts the different parts so as to bring the whole into working order, including the pedal action. Formerly, the pianoforte manufacturers made their own small-work, or action and keyboards; but as the demand for pianos became greater, it was found necessary to make more divisions in the on the fingers. The firm of Steinway, of New York, U.S.A., boast of making every part of their pianos, having several factories and an iron foundry, but they are an exception. There are a variety of actions in the market, each having its particular claims to merit, but the maker exercises his discretion as to the one he adopts. It does not come within the scope of this paper to notice the merits or demerits of the various actions. back as 1842 by Robert Wornum, who spent a large amount of time and money in perfecting the pianoforte, but it did not find the favour in this country that it deserved, illustrating the old proverb that no man is a prophet in his own country. But the French makers soon discovered the merits of this action, which was so much used in France that it acquired the name of the French action. Latterly, however, it has found more favour in the land of its birth.

The action forms a very important part in the construction of the piano, as without it the piano would merely be a large dulcimer. The action and keyboard form the link between the performer's hands and the strings. There exists much difference of opinion as to the weight or balance of a key or note, as when the key is pressed down and the finger taken off, it is returned to its former position by a weight at the extreme end of the key, and also the weight of the action. Some prefer a light touch or fingering of the keys, while others are in favour of a heavy touch; I think, without offering a decided opinion, it would be as well to accept the happy medium. For if a touch is too heavy, it renders playing for an hour or two more the nature of work, as it makes the fingers and wrists ache; while, if too light, you cannot feel enough weight under the fingers. The reader will find in very old pianos the touch is very light, while in the modern pianos they have a decided tendency to be heavy. The action I have selected for this piano will require a weight of two-and-a-half ounces to press the key down of each note, so that the hammer strikes the string. A person playing, for instance, the popular piece of music, "The Maiden's Prayer," presses a key down 1,220 times, which is equal to raising a weight of about 82 lbs. So the reader will readily understand that if a touch is heavy, and a person plays for some hours, how tiring it must be.

I will now enumerate the different parts of the keys and action as they are known in the trades. Beginning with the keys, we have the key frame on which the keys work, comprising front rail, balance or middle rail, and back rail; in the front and balance rail are key pins, those in the balance rail penetrating the keys, while those in the front rail partly do so. On these pins cloth is placed to prevent noise, the back rail also having cloth to form a cushion for the back of the key to rest on. The keys in a seven-octave piano are eighty-five in number, being fifty white or natural keys, and thirty-five black or sharp keys. The parts of the tape action are named standards, damper rail, hammer rest, set off or slide rail, hammer, damper, lever or crank, hopper or fly, hammer butt, check arm, check, bridle or tape, escapement button, bridle stay, and damper wire. You will now require your keys and action to commence work as the finisher; the keys you may obtain from F. Edwards, 63, Southampton Street, Pentonville, N. In ordering, ask for one set of keys (ordinary scale), ivory or celluloid according to your means, as ivory would cost more, 14 in., $7\frac{1}{2}$ in. balance. The action you can procure from V. A. Hallpike 213, Mare Street, Hackney, E.; order one tape check action (ordinary scale) 10 inch strike, with hammers complete.

Your first business will be to set up your action in the cases; take the two screws out of each end of your damper rail and put it aside for the present; now take the extreme bass and treble hammers out of the packet they are in, and file the ends of the shanks until they fit the holes in the hammer butts at each end of the action. In the bottom of each standard put a dowel, and make two blocks to fit them (see diagram); these are what the action rests on, and are glued on the key bottom when it is in position. Stand your action on the blocks, and put the hammers in the bass and treble holes of your action, and when the point of the hammer touches the string, see that the shank of the hammer is $\frac{1}{4}$ of an inch out of the upright or leaning back, both ends the same. Now keep the front edges of the standards upright or square, and mark the front of your standard blocks, and keep it in this position temporarily. You leave this for the present; put your keyboard on your bench; take the extreme treble and bass keys off the frame; take the treble one, and holding it $\frac{1}{16}$th of an inch from the front of the lock board, rub it under the treble note, and it having black lead on the bottom, makes a line on the top of your key; serve the bass end in the same way, and you have a line on each key. Put them in their places on the frame, and get a straight-edge and make a pencil line across the whole of the keys at the two marks, then take a centre-punch, and make a mark in the centre of each key on the line; in these punch marks holes are bored for $\frac{5}{8}$-in. No. 10 screws, and countersunk so that the head is level with the key: these are called pilot screws; put these in. Now make a pencil line across the keys $\frac{3}{4}$ of an inch behind the screws; now take the keys off the frame, and the next operation will be to load them. There are two methods of loading them: you can either bore the holes in the keys, and melt the lead in a ladle and pour into the hole while holding the key on a flat-iron with the handle in your bench screw, or you can buy the leads moulded ready to put in the holes and make tight with a hammer; you will require them $\frac{1}{2}$ an inch in diameter, one or two for each key, according to your balancing.

You now make a balance board: this is a piece of wood 3 in. wide, and the length of the key; mark one end for the back, then cut a kerf with your saw in the centre of the wood, and put a piece of thin brass or veneer in the kerf, allowing it to stand above a $\frac{1}{4}$ of an inch. Now bore two holes (for a wire nail with the head off, to fit in) $\frac{1}{8}$ and $\frac{1}{4}$ inches in the front of the kerf; have one of your moulded leads ready; put your wire in the $\frac{1}{8}$-in. hole, so that it stands above the level of the veneer an inch; put the centre hole of your key on, beginning at the bass end, then slide your lead towards the back of the key until it weighs it down. Now make a mark on your key at the place where the lead is, taking care that it does not come on the pilot screws: serve as many keys as there are dampers in this way; then you change your nail into the $\frac{1}{4}$-in. hole and weigh the remainder of the keys. In the treble the keys are a little heavier, to compensate for the weight of the dampers in the bass; you bore centre-bit holes in the keys right through the sides at the marks you made in balancing, and fill them up with lead; see that the lead does not move in the holes, to prevent rattling noises; as you hammer them in you can try if they are tight by pressing with the thumb.

You now want a strip of cloth $1\frac{1}{4}$ in. wide, and the length of the set of keys; let the cloth be of firm texture, such as box cloth or black cloth: this is glued on to the keys at the line behind the pilot screws, so that the cloth covers the screws; you only glue behind the screw, leaving the front of the cloth over the screws loose, as you may have to regulate these screws. After gluing, cut the keys apart with a knife; you will now require some baize or felt to put on your key frame—felt such as that used for putting under carpets will answer your purpose; put the two extreme end keys on the frame, and mark with a pencil the frame where it extends outside the keys; also see that the frame is level with the back of the keys: if it is not, plane it down, also cut the ends off the frame at the marks you made. You must now cut two strips of your baize or felt, one piece 1 in. wide, and the other $1\frac{1}{2}$ in. wide, and the length of the key frame: these strips of baize are to form a cushion for the back of the key to rest on, and are placed on the back rail of the key frame, directly under the pilot screw; you gauge a line and make a groove with your rabbet plane about a $\frac{1}{4}$ of an inch wide, holding the rabbet plane at an angle so that it makes the groove deep enough for your $1\frac{1}{2}$-in. piece of baize to lay in; the 1-in. piece is simply glued at its front edge and laid on the frame, and the $1\frac{1}{2}$-in. is glued in the groove and lays over it. You will now want on the centre pins of your key frame small pieces of cloth the same kind that you used for the top of the keys. In the trade, it is usual to punch these out with punches for the purpose; as the reader will not be provided with these, he must cut a strip of cloth the width and length of the balance rail, and stretch it across the top of the pins, then rub a file along the top of the pins, and it will make a hole for each pin; then press the cloth down level on the rail. For the front rail you will require two strips of felt: cut these the width of your rail, and make holes in the same way; the keys are now ready to be eased on the frame. For this you will require two small files, one round and the other square; if you cannot get the size you require at the tool shop in your locality, you may obtain them from G. Buck, Tottenham Court Road, W.C.; by rubbing a piece of thin paper over the round and square hole, you would be able to send the size; you use the round file first, easing the round hole so that the key drops easy on the pins, but do not make it loose. Now use the square file for the top hole, and ease so that it fits; serve the front holes in the same way: of course you ease every key on the frame. Now put the set of keys as they are on the frame into the case; the extreme bass and treble hammers are put in the butt at each end of the action, and while the lever is resting on the key you plane down your blocks that are under the standards until the point of the hammer is 2 in. from the string at each end: this is technically termed the blow, as it is the distance the hammer has to strike or give the blow to the string. When you have got the blow the right distance, you move one of your hammers, placing it in several butts, to see that your hammers will strike each note squarely, and the shanks upright; you must move the action either to the right or left until you have got it right. Now mark the place where the blocks or standard feet are, and these must be glued down on the key bottom; put a screw through when the glue is dry, then take your keys out, and unhook the tapes or bridles off the stays: this you can easily do by using a pair of pliers; notice how they come off, as you will have to hook them on later. Now lay your hammers out on a clean board: you will find they are numbered on the side of each one; then take your extreme treble hammer and cut a piece off the end of the shank, until the point of the hammer strikes the string close under the bridge pin: this gives you the length to cut the hammer shanks. You will need a block to cut these, so that from the top of the wood of the hammer to the end of the shank they are all the same length; you can make this block by rabbeting the edge of a piece of wood 8 in. long, and making a saw kerf across at the place you want to cut them. Having cut your hammers to the length required, you file the ends of the shanks so that they fit the butts; do not make them loose; begin at the treble, and take each one in rotation according to the numbers. While doing this you will have to lean the case back, as the hammers will have a tendency to fall forward.

After fitting them all in, take two small straight-edges about 8 in. long; begin at the treble, and place one on the top of the hammers and the other under the check arms, and see that the tops of the hammers and check arms are straight; if they are not so, file a little off the end of the shanks until they are. You now proceed to glue in the hammers: have your glue hot and of medium thickness, use a small stick to glue with, put a small portion on the shank, place in the first butt at the treble and turn the hammer round two or three times while it is in the butt: this forces the air out, and assists to set the glue. Now place the hammer up to the strings, and see that it strikes the note square; glue about a dozen in this way, then press one straight-edge under the check arms and the other on the top of the hammers, and see that they are straight; then draw the hammers back, and let them lean on your straight-edge about 2 in. from the strings: this is the distance of your blow. While they are in this position regulate the spaces so that they look even to the eye; serve the hammers right through the set in this way; now screw your hammer rest on with two screws. To find the place for this, lean the treble and bass hammer back, holding the hammer rest under them until the point of the hammer is 2 in. from the string: this will be the place for it to be fixed. When the hammers are all laying back on the rest, just look over them and see that they are to your satisfaction; when your hammers are dry, place all the tapes or bridles as before; now put your keys in the case, and take out the keys where the frame passes over the cross rails of the key bottom; then move your key frame to the right or left, until each key is under the lever of each note. Now mark the front, middle, and back rails of the frame for holes to be bored for screws to go into the rails of the key bottom. Having bored these holes, put your key frame in position, leaving a space of $\frac{1}{16}$th of an inch between the front of the keys and the lock front; screw down to your key bottom. At each side of the standards, blocks are fitted to fill up the space between them and the ends of the case: these are 1 in. in thickness, and are made of hard wood; the bass one has a piece cut out for a pedal stick to work through, the hole being lined with cloth; the pedal stick is tapered from an inch at the bottom to $\frac{1}{2}$ an inch square at the top. In a line with the front of the standard a $\frac{3}{16}$-in. slot is cut out of the blocks for a button to fit in which secures the action in its place; the position of these blocks on the ends of the case is 1 in. above the top of the hammer rest; put a screw through these into the ends, also glue them; now scratch a line under them on each standard and put a small dowel in, allowing it to stand out $\frac{1}{2}$ an inch: these press under the blocks and prevent the action from moving upwards; then screw one button on each standard to fit in the slots before mentioned: these you can make of beechwood $\frac{3}{16}$ths of an inch thick, 2 in. long, and $\frac{7}{8}$ in. wide round both ends and bore hole in centre for $\frac{1}{2}$-in. screw.

Having secured the action, you will probably find that your hammers do not lie evenly on the rest: some may be a shade high, while others may be low; by taking hold of the rest in the centre and pulling it forward, you will find some of the hammers follow the rest: these are low; take out the key and turn the pilot screw up a little until they remain stationary; if any stand a little above the rest, take the key out, put it on your bench, and give the cloth over the pilot screw a sharp blow with a hammer. The hammers being in line on the rest, the next operation will be to make the touch: that is, the depth the key presses down. Take two pieces of wood $\frac{5}{16}$ths of an inch thick, 2 in. long, and $\frac{7}{8}$ths of an inch wide; on the back of these is screwed a piece of lead sufficient to press the key down; these are named touch weights; one is placed on the front of a treble key, and the other is placed on a bass key, then a light straight-edge is placed from one touch weight to the other; if the keys are too high, and your straight-edge does not touch the weights, then your touch is too deep; you must alter this by placing a piece of cardboard under the front rail of your key frame; if your straight-edge rests on the touch weights and the keys do not touch it, then your touch is shallow: this can be altered by putting a piece of card-board or thick paper under the middle rail of the key frame at the places where it is screwed; get it as nearly right as possible to the straight-edge in this manner, then you must take a shaving off the bottom of the high keys, while a piece of paper must be put on the centre pins to raise the low ones; those keys that are out of square may be made square by tapping the centre pin either right or left, as required; the spaces of fronts of the keys are now made equal by a key spacer: this is a forked piece of steel which moves the key pin to one side or the other; you can do it with pliers, but do not scratch the pins.

Having spaced the fronts, now space the sharps, and by tapping the centre pin of the sharp, space it between the two naturals on the balance rail; the backs of the keys are spaced by striking the key on the side with a hammer on a flat iron the way you wish it to move; strike on that side. Now you will have to fit the damper rail when the dampers are on the strings; the largest damper is for the extreme bass note. Let the rail hang over the standards $\frac{1}{2}$ an inch each end; at the treble end a hole is bored through for a screw to go in the top of the standard, while at the bass end a slot is bored out for a round-headed screw to go through freely so that it does not touch the sides; on the front of the damper rail at the bass end a piece of wood 4 in. long is screwed and glued on, and extends beyond the damper rail to within $\frac{1}{8}$th of an inch of the end of the case; behind this projection, a crank (which is screwed on the end of the case) works; it presses the damper rail forward, while a spring screwed on the front of the standard presses it back, the screw at the treble end acting as a centre, and the bass one keeping it in position; the bottoms of the dampers should be $\frac{1}{2}$ an inch above the hammers when they touch the string; if they are too high, you must cut a piece off the tops of the standards until they are right, then screw the damper rail on, and screw a stop on the back of the standard to prevent the damper rail going back too far, placing a piece of felt between to act as a buffer; there must be a space of $\frac{3}{8}$ths of an inch between the top of the damper and rail. You must now take a pair of long-nosed pliers, and put the damper heads on the string, bending the wire to right or left as needed, and keeping the tops of dampers and heads in a straight line; then put the damper wires in, screw the top button down until there is $\frac{1}{8}$th of an inch space or play between the damper and lever when the wire is in, put them in, and then cut off the tops level with the damper with a pair of pliers.

You now proceed to pedal the piano; to do this, you must put the piano on its back on two trestles, so that you can get at the bottom of it; make two pedals of beechwood 16 in. long, and the shape they are in the sketch, $\frac{3}{4}$ of an inch thick; mark 4 in. from the front, and put two pins in temporarily; this is the distance they stand out in front of the plinth; from these pins bore a hole in the right or loud pedal, $2\frac{1}{4}$ in., and bore a hole in the left or soft pedal, $3\frac{5}{8}$ in., for the pedal bolt to pass through: these are made of stout wire with a nut to screw on the top; also bore a hole in each $1\frac{1}{2}$ in. from the back for a stout screw to go through; glue a piece of felt on the bottom of each to prevent noise. You now mark the centre of the plinth, and $2\frac{1}{4}$ in. each side of this mark you place the pedals, that will leave a space of $4\frac{1}{2}$ in. between the pedals; cut pieces out of the plinth for the pedals to fit in, cut up to the bottom board of the case, leaving space for a piece of felt to go round the hole; this felt is glued in the holes and tacked under the plinth; now let the pedals rest on the pins, and put them in their respective holes, and mark through the holes you made for the bolts; at these marks bore two $\frac{3}{4}$-in. holes through the bottom board; now put your pedals in their place and put a stout screw in the bottom of each. Next get out the rockers: these you can make of deal $1\frac{1}{4}$ in. square, and one piece will be 2 ft. long, and two pieces 2 ft. 6 in. long; on the 2 ft. 6 in. rockers a small block is glued at the bottom 10 in. from the end, while the 2 ft. rocker has a block 8 in. from the end; take one of the 2 ft. 6 in. rockers, and put it on the bottom board, extending 1 in. over the hole of the right pedal, the block being 10 in. from the pedal, then mark through the hole, and bore a hole at this mark for the pedal bolt to go through, the other end of the rocker being cut so that it is a $\frac{1}{4}$ of an inch from the bass end of the case; the rocker is bored with an $\frac{1}{2}$-in. centre-bit half-way through over the block; then bore the remainder with a spoon bit for a 2-in. screw; from the hole at the bottom round the block over, and put a pedal spring on so that the point of it comes near the bolt hole; now clean this nicely with glass paper, rub some soap on the block and spring, put your bolt through the pedal from the bottom and through the rocker, put your screw in through the block, and then pull your pedal and see that it works free, without noise; you do the same with the back rockers, except that they overlap each other, and the pedal bolt penetrates both; the short rocker is at the bass end and the long rocker at the treble; rub plenty of soap where there is friction. By referring to diagrams you will see how these are arranged; the soft pedal in this piano is what is known as the celeste: this is a strip of felt or flannel on a slip of wood, so that when the pedal is depressed the two ends of the slip rise simultaneously, and interpose the flannel between the hammers and strings, and so softens the tone; the loud pedal moves the crank, which gives the damper rail a forward movement, taking the dampers away from strings, and allowing free vibration, and so making the tone louder. By referring to diagram, you will see that the two sticks which hold the celeste have slots in them; also a piece cut out of the top for the celeste slip to ride in; screws penetrate the slots into each end of the case to keep the celeste in position, so that it is near but does not jar on the strings; fit it so that the top edge of the flannel is ½ in. below the strike line when the pedal is at rest. You now make a crank as per sketch, of beech ½ in. thick: this is screwed on the end of the case above the damper rail at the bass end, the front of the crank being over the pedal stick, the back being behind projection of damper rail.

MEANS, MODES, AND METHODS.

Stone-cleaving Tool for Small Specimens.

To the lapidary, the geologist, and the amateur mineralogist, a handy tool to cleave with more exactness and less waste than by the hammer has been much wanted. Some specimens that have to be opened are so valuable extrinsically, from their rarity, that the small cost of this tool would repay the owner at once using. Its value may be judged when jade has to be cloven so as to produce two surfaces without fracturing any but the part to be divided; and such rare stones as chrysolite, aurite, pectolite, fluorite, coral, etc., to be opened in a direction for special results.

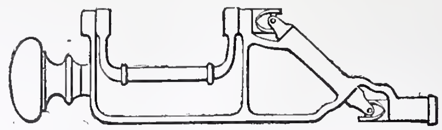
Such a tool was in use by one of the most scientific geologists in France, with the largest display of valuable minerals and fossils collected at the French Exposition—Mr. W. Foote, of Rue Desaix, Paris. It is an American invention of Mr. F. A. Clanfield, Dover, N.J., United States, for whom Mr. Foote is agent in France.

The illustration needs little description. It is nearly all cast steel, somewhat like the bed of a lathe, with two poppet-heads, each with a chisel in a socket-hole, with cross drift-holes, to enable the chisels to be driven out at any time. The head, A, is recessed into a slotted mortise in the bed-top, forming a movable joint, turning on the fulcrum-pin, B, by the purchase obtained by the screw, C. The shifting-head, E, has a tongue a third of the width of the bed-top, which is recessed into a long slot, F, shown by the dotted line. This is to take any side-rack. The movable "bridle," G, is the main stay to resist direct strain in cleaving stone. It consists of ½-inch square steel bond, fitting quite round outside of bed and poppet-head, secured only by the pressure in action, drawing it into angle-notches on the under-side of the bed. It requires no bench. A table serves to rest it on, as the resistance in cleaving is self-contained.

The force required for the hardest agates or gems is often less than for softer stones of the same bulk; but, so powerful is the leverage, that a lady can use it with ease. It is about 2 ft. long by 10 in. high.—J. C. K.

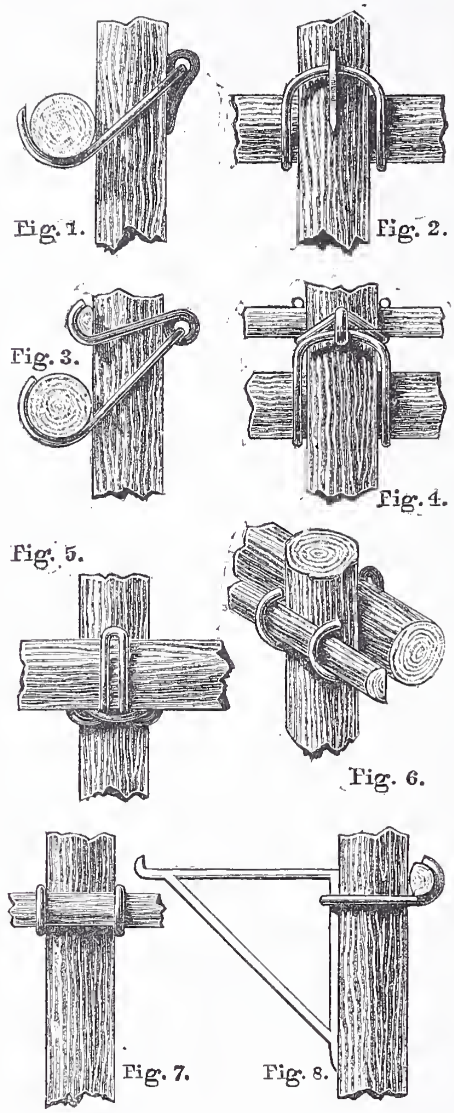
Science in Scaffolding.—Steel Ties.

To erect the scaffold from which a structure is reared is a skilful piece of handiwork. Recent improvements of elevated "stages," from which a building can be erected without the network of scaffolding, is a real scientific advance in building operations, but it is mostly restricted to very lofty buildings, so that scaffolding of the ordinary form will still be used for dwellings and factories of small altitude.



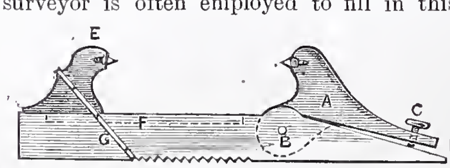
Brace for Boring in Angles.

Sometimes the new building falls to pieces "before there is time to get the paper on to hold it up," remarked a man on a jerry building that threatened to collapse when one of the doors slammed. The law is lenient to such malefactor builders, or it would not be attempted if the penalty was penal servitude for such delinquents. There



Scientific Scaffold Ties.

seems a hiatus in building science existing between the architect and the builder. One often is biassed by rules, the other often ignorant of the simplest laws of mechanics, and helpless to fulfil the main practical purposes of his trade—make a sound building as a comfortable dwelling-house. Any one who has been "clerk of the works" on any large building must have observed this. A surveyor is often employed to fill in this



Stone-Cleaving Tool for Small Specimens.

hiatus, and often very efficiently links architectural and building sciences.

The scaffold has to be got together often by the humblest craftsmen in the building trades, often with the most inadequate materials, the pole-bearers and putlogs being old and decayed, especially the ropes. To aid the builders, any plan which combines safety and economy would be welcomed. A Swiss invention for that purpose is now shown by the accompanying illustrations. T. G. Grossman, of Seefeld, Zurich, is the patentee. He substitutes steel for cord in securing putlogs to poles. It was shown at the Paris Exposition, and every opportunity of examining the scaffolding was given to those interested in such matters. The structure shown had all the firmness of a permanent building when heavily loaded to test its strength.

Fig. 1 shows the "dog-eye," with two "clutch-points" driven into the scaffold-pole, upholding a cross-pole. Fig. 2 is another view of the same. Fig. 3 is a scaffold iron with an extra double hook above the pole-hook for wedging the hook that holds the putlog tight. Fig. 4 is another view of the same. Figs. 5 and 6 show other forms. Figs. 7 and 8, the scaffold-iron used to hold an iron bracket wedged tight to the pole.

A practical builder would see at once the merits and disadvantages of the invention, and also see that the merits predominated for economy and security. He already practically employs a somewhat similar means in his "baulk-dogs," which require to stand exceptionally great strains. Such men are never slow to appreciate anything which is a practical and commercial economy in their trade. The way the scaffold was taken apart by two men was conclusive in the gain of time over using ropes to tie the poles together, and then wedging the tying tight, in scaffold-building.—J. C. K.

Brace for Boring in Angles.

All workmen, as well as amateurs, know how tedious it is drilling holes in the interior angles of furniture or buildings. The ordinary brace cannot be used for it. The geared brace, however small the mechanism, cannot drill one quite at the bottom of an angle and perfectly parallel to one of the sides.

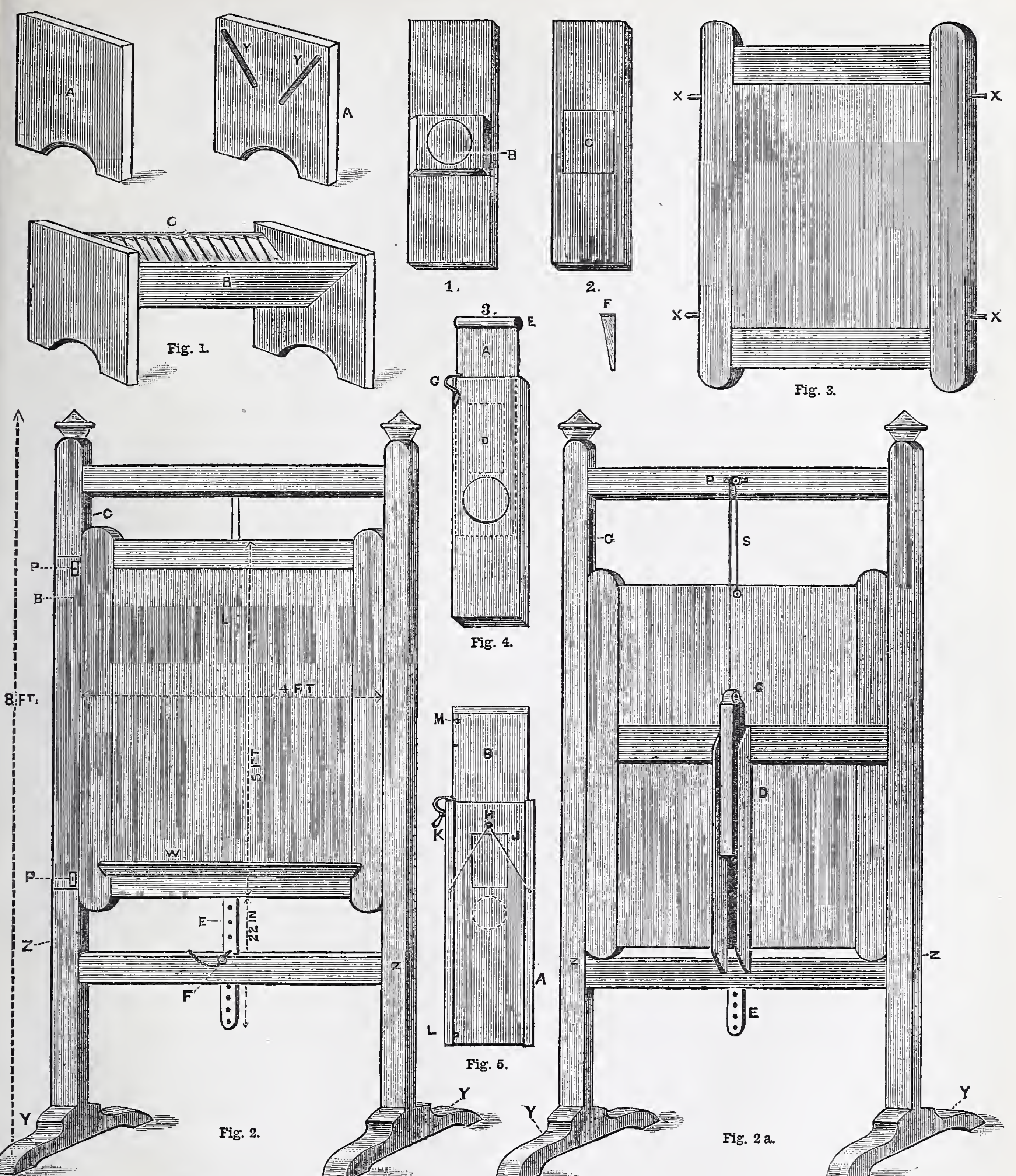
A brace, similar to sketch, was shown at the Paris Exhibition, and seems to us to overcome this difficulty very well indeed. It is really a simple brace with the bit in a separate shaft, out of centre with the handle, but connected therewith by a double hook's joint.—H. B. P.

SOME MORE PHOTOGRAPHIC APPLIANCES.

BY AN OLD HAND.

Draining Rack for Plates—Copying Easel—Instantaneous Shutters.

The Draining Rack for Plates is a very convenient, and almost, so to say, necessary adjunct to the photographer's material. It is made of two kinds, rigid and folding. Since the introduction of gelatine plates, development of negatives is usually carried on at home. The *raison d'être* for the folding form is gone; the only advantage of this kind was portability. To make a rigid one, cut out two pieces of ¾-in. pine or any other wood—it is immaterial—7 in. by 5 in. (Fig. 1). In each make two grooves, Y Y, 3 in. long and a ¼ in. deep, at right



ig. 1.—Drying Rack—A A, Ends of Rack; Y Y, Mortises for Supports for Grooving; B, Support for Grooving; C, Grooving. Fig. 2.—Front of Easel—Z Z, Pillars; L, Board; G, Groove; E, Iron Rack; F, Pin; Y Y, Solid Feet; B, Door; P P, Bolts. Fig. 2 A.—Back of Easel—G, Groove; Z Z, Uprights; Y Y, Feet; C, Weight; D, Case to guide Weight; E, Rack; P, Pulley; S, Cord. Fig. 3.—Board of Easel—X X X X, Pins. Fig. 4.—Drop Shutter—1, Back of Case; 2, Front of Case; 3, Shutter in Position; A, Ebonite Shutter; D, Opening in Shutter; E, Wedge Stop; F, Ditto; G, Catch. Fig. 5.—Modified Drop Shutter, working with Elastic Band—A, Case with Grooves; B, Ebonite Shutter; H, Pin; J, Elastic Band; K, Catch; L, Spring Catch; M, Aperture to remove Spring Catch.

ngles to each other, as in diagram. Pre-are two lengths of wood 3 in. wide and $\frac{3}{8}$ in. hick, as long as may be deemed convenient -12 in. is a good length. Nail and glue hem firmly into the grooves to form a kind f bottomless triangle, and on the inside ace of each attach some V grooving, made of either wood or zinc. The ordinary *straight* grooving of a plate box is sometimes used, but not to be recommended, as the edges of the grooves are likely to tear the film of negatives set in them to drain. The shape of the V avoids this fault. Care must be taken that the grooves are directly opposite each other. They are best fastened to their supporting sides by small screws, any projecting end carefully filed off. A coat of shellac varnish will complete it.

The Copying Easel.—In all studios where much copying is carried on some contrivance is requisite to support the picture, drawing, or whatever it may be, at a true right angle to the plate. The following easel (Fig. 2), although somewhat cumbersome, answers the purpose well. It will be seen to consist of two strong uprights on feet, framed together at the top and at a short distance from the floor, also centrally, a board working in grooves between them, kept in place by a rack and pin, and balanced by a heavy weight suspended in the rear. The difference in this from the ordinary artist's easel is that, instead of open framework, it consists practically of a large drawing board, on which can be pinned or fastened the drawings to be copied, an advantage that will be appreciated by those who have much of this class of work to do. To construct it, cut out two uprights, Z Z, 8 ft. long by $2\frac{1}{2}$ in. thick. The upper end of each may be somewhat ornamental, and the lower fixed into solid feet, Y Y. On the inside of one upright cut a groove 6 ft. long, G, and hollow the other out sufficiently deep to correspond with the opposite groove; and make up the outside with a hinged door, bolted top and bottom (Fig. 2 A), which, when closed, forms a groove for the projecting pins of the central board (Fig. 3, X X X X) to work in. To the centre of the bottom of the board fix an iron bar perforated with holes, half an inch apart, E, which passes through the lower connecting bar of the supporting frame, strengthened with an iron plate, and is retained at any height by the pin, F, being passed through and resting on the frame. On the lower face of the board is fixed a ledge, W, for the purpose of supporting framed pictures that would be too heavy to be supported by pins driven into the board, the usual way for light works. The diagrams will explain the construction in detail.

Instantaneous Shutters are, of all photographic appliances, perhaps, most varied in character, and may be numbered by the hundred, every maker having some pet design of his own that may embody some improvement on those that have been already constructed. The object in all cases is to give a brief exposure to the plate, always expressed in fractions of a second, in contradistinction to time exposures, which are generally understood to be from one second upwards. Some shutters claim to be under the control of the operator for any space of time, their speed being regulated by tension springs, and marked by a pointer on a scale. As to their accuracy for high speeds, it is somewhat doubtful. One of the first contrivances for instantaneous work, and which even now is not to be despised, is the drop shutter (Fig. 4), which we propose to describe. It essentially consists of a perforated screen, A, falling before the lens, the exposure taking place during the time the opening passes before the lens in the act of falling, the weight of the shutter being its only motive power. This speed may, however, be accelerated by the tension of an elastic band. This kind of shutter has several modifications, to work behind the lens, and through the lens mount itself in the position usually occupied by the diaphragms. The conditions essential for the satisfactory working of all shutters that are used in front of the lens, and attached to it, are, firstly, freedom from vibration during its action, and the absolute obscuration of light from the lens at other times. They should also be of as light weight as it is possible to make them, as they are generally used on small light cameras and lenses, that the additional weight of shutter on the lens hood tends to render less steady. Any shake produced at the *end* of the journey of the shutter is of no consequence, the exposure having been effected; but the *slightest* vibration during the time it is in transition is fatal to a sharp image. Such vibration is very difficult, if not impossible, to detect, except in the unsatisfactory result. A rough and ready method is by holding the lens in the hand whilst releasing the shutters, and noticing if there is any tremor during the movement. A very trifling jar may thus be detected. We will proceed to construct one. In the first place, the size of the lens for which it is to be made must be known, the diameter of the lens mount deciding the proportions of the shutter. A lens most frequently used for $8\frac{1}{2}$ by $6\frac{1}{2}$ pictures is the Rapid Rectilinear, the diameter of the lens hood being $2\frac{1}{4}$ in. We will take this as our guide. Plane and smooth some $\frac{1}{4}$-in. mahogany, or other light, close-grained wood, and make two pieces, $3\frac{1}{2}$ in. wide and 8 in. long. Glue a strip of wood $\frac{3}{8}$ in. thick and 3 in. wide across the centre of one of the pieces (Fig. 4 B), and when dry, cut an opening sufficiently large when lined round with a bit of cloth or velvet to fit the lens hood exactly and firmly; in the middle of the other, cut an opening $2\frac{3}{4}$ in. square, C. Blacken one side of each with black varnish or Stephens's ebony stain. The stain is, perhaps, the best. A strip of wood rather more than $\frac{1}{8}$ in. square is glued down each side to separate the pieces, and all glued and screwed together. We now have a shallow case, open at both ends (Fig. 4), with apertures in the centre of each, and facing each other. In a piece of ebonite preferably, although wood will do, $\frac{1}{8}$ in. thick and 14 in. long, the width of the inside of the case, make an oblong opening, D, 4 in. long and $2\frac{1}{4}$ in. wide, so that it will pass through the case with little or no friction. A strip of wood, E, is attached to the upper end to act as a stop, preventing the slide from passing through the case after the exposure has been made. In order to prevent any rebound, the strip at the top is made wedge-shaped, as Fig. 4, F. This completes the wooden portion of the shutter, and it may be actuated by hand, but it is better to fix a catch, G, on the side engaging with small saw-cuts in the edge of the shutter. In order to ascertain the proper position for these cuts, pull out the shutter until the lower part entirely covers the opening of the lens, holding it up to the light to make certain that none can pass; then make a saw-cut in it just above the top of the casing. Push down the shutter until the opening is fully disclosed, and make another cut. A simple pivoted catch (Fig. 4 G) is now fixed to the side of the case, the end of which will just engage the saw-cuts, and retain the shutter in either position with the lens disclosed for focussing or obscured ready for exposure. A slight pressure with the finger now on the catch will liberate it and the shutter will fall, the wedge-shaped stop, F, preventing any rebound. The favourite method of working all instantaneous shutters is by the pneumatic release, which is simply an indiarubber tube with an air-tight hollow ball at one end and an expanding tube at the other. Pressure applied to the ball expands the tube at the other end pressing against the catch, and so setting it in motion. The time of exposure of course depends on the rapidity of the fall and the length of the opening. With a shutter as described, about the twentieth part of a second is occupied; this may be decreased by slightly sloping the shutter, so that more friction is caused, or the speed increased by attaching an indiarubber band whose elasticity will give impetus to the fall. This is a very useful shutter, and free from vibration, and much good work has been done by it. Instantaneous shutters for very high speeds are altogether more elaborate affairs, and are made by the judicious combination of wheels, levers, and powerful springs. A modification of the drop shutter is constructed by substituting a groove, as in Fig 5, for one side of the casing. A small knob, H, is screwed into the shutter; an indiarubber band, J, passes over it, being fastened at each end to the sides of the case; the shutters being drawn out, the band is stretched, and, on being liberated, drives the shutter along the groove. A small spring catch is fixed to the lower edge of the slide that falls into a slot at the end of the journey, thus preventing any rebound. This shutter is used horizontally, and the speed entirely regulated by the strength of the elastic band.

The roller blind shutter is, as its name indicates, made on the principle of ordinary spring roller blinds, and may either be used behind the lens or before the plate, working either from right to left or from top to bottom. The blind itself is made of opaque material, with an opening cut across the centre of about half an inch in width and of the length of the plate, or diameter of the lens, according to the position it is intended to occupy in the camera.

Another very good form is the double drop shutter, designed by Mr. A. Cowan, and intended to work behind the lens, and is practically part of the camera front, working quite independently of the lens. This is constructed of two separate sliding pieces, one above the other. On applying the release, the lower part falls, disclosing the lens; and, on removing the pressure on the indiarubber ball, is rapidly followed by the other, which covers it again. It is not a very rapid working shutter, but sufficiently so for most purposes. Very free from vibration, the fact of its being attached to the camera instead of the lens is greatly in its favour, as any lens can be used, irrespective of size. The convenience of this form has made it a favourite with many leading photographers. Time exposures can be readily given with it, the exposure continuing so long as pressure is applied to the ball; remove the pressure, and the lens is at once closed.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

120.—Patent Wire Thread Fret Saw.

I have replied more than once to correspondents in "Shop" that when I was in a position to state positively that the Patent Wire Thread Fret Saw was fairly on the market I would give the sizes in which it is made, and the prices current. I am now well able to do this, for I have received specimens from different quarters. A correspondent who gives no name sends two saws, and says, "The two saws enclosed are the finest, 00, and a thicker one, No. 5; they are made in sizes between. My correspondent signs himself "Bradley." Mr. Herbert Bolton, dealer in Fretwork Materials and Designs, 59, Burmantofts Street, Leeds, writes: "Herewith I beg to submit to your notice sample of the Patent Wire Thread Fret Saw that has been so much inquired for in 'Shop' for some time past. Will you mention in 'Our Guide to Good Things' that these are 7d. per dozen post free, or 6s. per gross? The sizes are from 0 to 5 inclusive." They are also kept on sale by the old-established firm of Messrs. Moseley & Son, 323, High Holborn, London, W.C., who wrote to me a short time since to say that they aro now prepared to supply them. These saws aro so constructed that the teeth project on all sides, and as the teeth run in a spiral from end to end it appears that the saw teeth are first cut in the ordinary way, and the blade is then twisted in order to give it its new form. The advantages claimed are: (1) That it will cut in any direction, so that it is unnecessary to turn the work; (2) that it never sticks fast but constantly frees itself; (3) that it is stronger than any other saw; (4) that it retains its cutting powers longer; and (5) that it cuts more rapidly than any other saw. Further it is said that the performance of this ingenious invention is most surprising in the way of cutting, and that the peculiar make renders it entirely free from all the faults peculiar to the ordinary fret saw, and capable of doing work that cannot be accomplished by the latter. A considerable saving of time is said to be effected by its use and its practice. Although its cost is somewhat higher it is found to be more economical than the straight fret saw, because a greater amount of work, on the average, can be done with each individual blade. Readers will find from their own experience, on making trial of them, whether this be so or not. For myself, I regret to say that I have not yet been able to find time or opportunity for testing them.

121.—"The Amateur."

I trust that amateurs who stand in need of more patterns for fret-cutting, wood-carving, and ornamental woodworking generally than can be given in Work will not forget the monthly magazine entitled "The Amateur," a serial publication of continental origin and production, published in this country by Mr. Henry Zilles, 24 and 26, Wilson Street, Finsbury, London, E.C. The third volume is commenced with the January part, and as the year is yet young a favourable opportunity for beginning presents itself to intending subscribers. In the December part, completing Vol. II., some excellent patterns were given for chip carving, or "notch cut work," as the Germans call it, a kind of surface ornamentation, with small carving tools, which is easily done, and is beginning to find much favour among ladies.

122.—Walker's Turning Patterns.

Mr. F. J. Walker, 41, St. Helen's Street, Ipswich, sends me a sheet of patterns for turning, comprising knobs, finials, spindles, pillars, etc., well proportioned and excellently drawn, and writes: — "Herewith I beg to hand you advance sheet of a set of turning patterns which I am preparing for publication. The set will consist of 50 distinct patterns in 5 sheets of 10 each. They will all be the same size, and equally well drawn as the enclosed, the only difference being that those for sale will be printed by the ferro-prussiate process direct from the tracings. I would beg to call your attention to the fact that these patterns are not stencilled copies of common mouldings, but originally and accurately drawn. I shall issue the first 100 sets to the readers of Work at 1s. per set, after which the price will be 2s." Let me warn my readers that there are only 99 sets to be had at the low figure named, as I have taken advantage of priority of knowledge, and secured set No. 1 by lodging the required coin of the realm with Mr. Walker. It is the best testimony I can give with regard to the excellence of his patterns from my point of view, judging from tracing of Sheet 1. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Angles for Hoppers.—J. G. W. (*Glasgow*) writes:—"On page 414, No. 26, B. A. B. gives a sketch of how to get the angle of boards for hopper, which is quite clear. Instructions are still wanting how to find the angle for butt joints when the top and bottom edges of the hopper are square to the faces

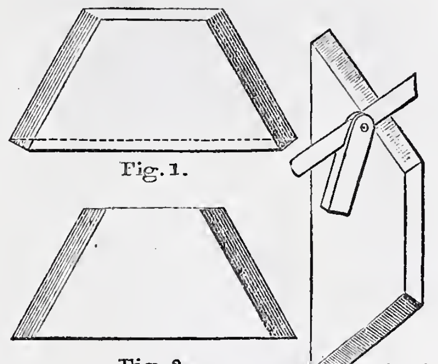
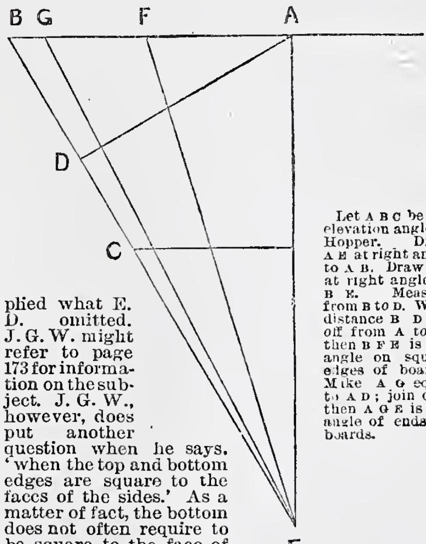


Fig. 1. Fig. 2 Fig. 3.

Angles for Hoppers.

of the sides, as in Fig. 1, not as in Fig. 2—that is to draw down the angle for the butt joints, and set a bevel to it, and apply to the butt edge, as in Fig. 3. I think this is the point which most of us can't get over. If you possibly can make this clear, I think the mystery will be solved."

"In answer to J. G. W. (*Glasgow*), may I be permitted to say that my reply, which he understands, was only supplementary to that written by E. D., and printed on page 173, June 1. I therefore only supplied what E. D. omitted. J. G. W. might refer to page 173 for information on the subject. J. G. W., however, does put another question when he says, 'when the top and bottom edges are square to the faces of the sides.' As a matter of fact, the bottom does not often require to be square to the face of sides. I will try to make it plain. He (J. G. W.) will also notice I give another but equally correct plan for getting angle of ends of boards. Scarcely any books give any help on this subject.—B. A. B."



Let A B C be the elevation angle of Hopper. Draw A E at right angle to A B. Draw A D at right angle to B E. Measure from B to D. With distance B D lay off from A to F, then B F E is the angle on square edges of boards. Make A G equal to A D; join G E, then A G E is the angle of ends of boards.

Angles for Hoppers.

Registration of Printers.—W. I. W. (*Banchory, N.B.*) writes:—"H. E. C. (*Wednesbury*) writes in 'Shop' (see page 509) about registration of printers. Being a printer in a small way I intended to follow his advice, and have myself registered with the Clerk of the Peace as stated. I applied to the Clerk for County of Kincardine, but he is not aware of on what conditions a printer may carry on his business, and if they have to be registered, he says, it is not with him. How does H. E. C. account for this?"

Taking out a Patent.—Loco (*Finsbury Park*) writes:—"As one greatly interested in Work from its commencement, I was glad to see an article on the above subject (see page 545), as I believe many would-be inventors are kept from availing themselves of the protection afforded by law, through their ignorance of the mode of obtaining a patent. To such as these your correspondent C. C. C. has afforded some valuable hints, while at the same time he seems to have fallen into the same error as, I might say, the majority of those for whom his article is intended—that is, that as soon as provisional protection is obtained the inventor is safe, or, to quote his own words, 'as safe (meanwhile) as if the patent had actually been granted.' Now, although provisional protection secures us against subsequent applicants, and also secures to us the right to publish and use the invention without prejudice to the patent to be obtained, it does not secure to us the full rights of a patentee—that is to say, the right to prevent others from making and using the invention to their own profit. For instance, suppose our imaginary friend, the inventor of the wheelbarrow, after getting provisional protection for his invention, forthwith starts to make and sell the same. A second individual or imitator (of which there are many), seeing that the invention is only provisionally protected, also starts to make and sell similar wheelbarrows. Then the original inventor has no remedy whatever, as he cannot sue the imitator for any act of infringement committed before the patent is actually granted. Any profits that the imitator may have gained are therefore legally his own. I do not see exactly why your correspondent should prefer to describe everything so fully by the aid of drawings, as when the complete specification comes to be filed he will then have to adhere pretty much to the description given in the provisional specification, as the examiners are sure to object to anything being inserted in the complete specification which was not indicated in the provisional specification. Your correspondent C. C. C. would have done better to have left out the claim which he makes at the end of his specification, as no such claim is necessary in a provisional specification. Where a complete patent is taken out in the first instance in addition to the two forms marked C, a form marked A or A¹, bearing a £1 stamp, as in the case of provisional protection, is also required. It will thus be seen that the forms for the complete patent will cost £4, the same as when a complete is filed after a provisional."—[With regard to Loco's comments on what has been said *à propos* of provisional protection, I must still be allowed to retain my former opinion. I know that the words of the official circular are that "Provisional protection entitles an applicant to use and publish his invention without prejudice to his patent rights, but does not protect him from the consequences of infringement," and that this would seem to credit it with a very limited value only. But it appears to me that the common opinion drawn from experience may givo a more truo appreciation of it. A rival maker may, as Loco suggests, make and sell a similar article. But he cannot well do so without its coming to the ears of the inventor, who thereupon completes his patent, and stops the sale, with probably a result of loss rather than gain to the pirate. Or, a second inventor may, in the interim, obtain protection for a similar invention. Such a caso has occurred within my own knowledge; but the first applicant having the right to complete first, did so, and the second inventor had simply to withdraw. Only a negligent inventor will, as it appears to me, be otherwise than virtually safe. As regards a claim in the provisional specification, it is immaterial; additional claims can be added in the complete specification. It is rather a matter for individual judgment. As to Loco's objections to the free use of drawings, let me say that an inventor ought to be able to adhere pretty much to his drawings; but he can, if he pleases, add others in his complete specification. I have added a converse method in one case, and no objection was made to it by the examiner. Loco will, I think, see therefore that his objection is of no great moment, whilst the following special advantage may be instanced. If he bears in mind that "pictures are the books of the illiterate," he will see how much better the working man understands the specification when it is read over to him, if it is freely explained by drawings. In most cases where a working man has come to me, he has first made a model, and the parts of this he recognises in the drawings at a glance, and is able to detect any little omission should there be any. I imagine also that explanation by drawings must save thought and time to the officials at the Patent Office.—C. C. C.]

Simple Incubator.—J. E. L. (*South Lambeth*) writes:—"In reference to B. F. (*Liverpool*) (see page 557), I beg to ask if he will kindly give us more explanation respecting the simple incubator, with garden pots, which he shows in his diagram, marked D, D. Do they both join together, or is there a passage through, and what is the supposed amount of heat from the lamp to produce satisfactory results? Has the box a door to it or is it left open?"

II.—Questions Answered by Editor and Staff.

A Baby's Crib.—Clydeside.—I do not think the construction of a baby's crib should be beyond your power. Of course, knowing nothing of your skill in joinery, or the size of the baby, which is a variable term—one has known babies of seventy-five—it is hard to give exact details or measurements. Speaking roughly, I should think a plan about 4 ft. by 2 ft. 6 in. would allow room for growth. I should take four upright posts, at the usual height from the floor, and mortise in cross pieces; or, if this be too technical, use thicker wood and simply screw each piece. A top rail at the usual height might be added, with a railing of either straight or turned wood to keep the precious contents from early nocturnal expeditions. The floor, so to speak, of the bed could be made of sacking nailed to the four pieces of the frame. If space permits, it may be possible to give a working drawing of such a thing, which would no doubt meet the wants of many. But for the sake of household peace, remember the old rhyme, and see that whatever may be made is strong, else down may come baby, crib, and all, and this member of the staff of Work become accessory, however innocently, to baby slaughter. Knowing the peculiarly destructive power of the young Briton, I should suggest cast iron or wrought steel as the best material, did not I fear the flippancy of the advice, no less than its impracticability, would be condemned. Seriously, no work could be more deserving of honest praise than such as you purpose, for the love of a strong man for his child is perhaps the most sacred thing of this life, and if the above remarks seem too jocular, I pray you pardon them, for I know no nobler instinct than this fatherly care for childhood.—J. G.-W.

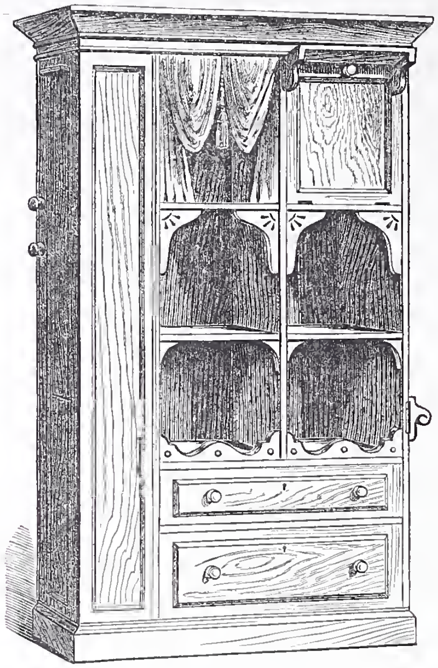
Organ Engine.—A Well-wisher (*Chichester*).—The Otto Silent Gas Engines are made from half horse-power upwards, and are adapted for organ blowing. If your single manual organ is not a large one, I should think the half horse-power engine would be sufficient for your purpose. I am unable to give you any information as to the price of the engine, but if you communicate with the vendors, they will no doubt be pleased to furnish you with full particulars. I believe the engines consume about 23 feet of gas per hour per indicated horse-power.—M. W.

Binding Single Plates. — Clydeside. — That "Bookbinding Made Easy" proved intelligible to you is somewhat of a relief to its author, for a dear friend who told him the sort of truth dear friends are apt to indulge me with, said he tried in vain to understand it. The great obstacle to binding single pages is that, try how you will, the book will not open flat, unless you paste each couple together with a strip of paper folded at the back, and thus make them, to all intents and purposes, ordinary folio sheets. If this course is not adopted, and it is a tedious and delicate task, the only other way I know is to lay all the pages in a pile with their edges exactly true, then taking a finely pointed bodkin or bradawl, bore a series of holes some quarter inch from the left-hand margin, and stitch them firmly with coarse thread or fine twine. So far it is plain sailing, but immediately the difficulty arises how best to fix them in a cover, and although I have tried a dozen makeshifts, I must own I never succeeded in doing so with a stiff cover, and now always fold a piece of limp cardboard, scored to fold with a sharp clean angle, just over the whole lot of prints, and bore the holes through it, stitching it with the pages themselves. If a piece of linen or buckram is pasted over the back to keep the stitching firm and safe, the book is well preserved, but it does not lie open as a book should. On the whole I should recommend, if the book is one likely to be used for reference, or still more if wanted for purposes of copying the plates—supposing them to be designs of some sort — that Clydeside should boldly face the trouble of affixing strips of paper to the backs and treat them as if they were ordinary pages.—J. G.-W.

The Mail Cart. — G. F. (*Nottingham*). — An article has been written on the mail cart with drawings of same, and appeared in Work, No. 30. There are three different designs, each possessing a novelty in the make. Since the article was written I have thought over a plan whereby a lifting hood might be made to fit the cart to protect the children from sun or rain.—W. P.

Ladies' Work Box, etc. — S. H. D. (*Newtown, Mont.*). — Every endeavour will be made as successive numbers appear to meet the desire of subscribers for small things, as well as large. In due time the wishes of yourself and your six friends shall be fully met, but it is not possible, as you must know from everyday experience, to do everything at once. Something, and indeed many things, must be kept waiting.

Combined Bed Suite.—J. H. H. (*Oldham*).—I venture to submit rough sketch of combined bed suite with less work in it than that published. I do not think it advisable to take away any more wood, if it is intended to make it a large job as per sketches. If a smaller article is required the bottom part might be taken away bodily, and the top part rest on four stout legs, the whole panel of the door falling down as flap, and being hinged to the bottom door stile. Concerning the thickness of wood I had more than one reason for giving it as $\frac{1}{2}$ in. Firstly, it will be apparent that if it is made as in No. 26 of Work, and the wood is even $\frac{1}{8}$ in. thicker throughout, it will increase the weight of job to nearly a quarter as much again. Secondly, this extra wood means extra expense. Thirdly, if made in comparatively thin wood, as there are so many boards connecting with each other, it will have a sufficiently firm and solid appearance. In the sketch, however, $\frac{1}{2}$-in. wood would scarcely be the thing, as there is so much space to counteract the effect of the wood. I should say have the sides and the long door $\frac{7}{8}$ in. thick, and the centre upright board and the horizontal ones $\frac{3}{4}$ in. thick. The glass door might be $\frac{5}{8}$ in., and the drawer fronts $\frac{1}{2}$ in. You will see that I show two knobs on the



Combined Bed Suite.

long door stile. One is to fasten the flap, the other the whole door. So far as I can recollect, I believe I showed this in my original drawing. Whether or no I cannot positively say, but if I did the engraver must have left it out, probably considering it was a mistake, or else concluding that one knob would fasten the flap to the stiles, and the door to the job. This latter could be done, but then the flap would always be loose, unless the door were shut. In the present sketch I have shown the glass door rests at the top, to come within the thicknesses of the two sideboards, and not on them as in Work No. 26. If the centre shelf is placed at the proper distance it will form a support for these rests, to keep the glass at the angle.—J. S.

Punching Dies. — R. G. (*Denham*). — Punches and dies are hardened by heating to a low red, and plunging in water. You ask for a few hints on hardening and tempering in general. This is almost entirely a matter of practice, but the following are of the nature of fundamental principles:—(1) Hardening almost invariably precedes tempering; the reason being that it is easier to lower a body to a definite grade of temperature than to raise it to that grade. (2) Since all articles are liable to warp in hardening, various practices are necessary to lessen this tendency, as heating articles in boxes to render the temperature equable, plunging vertically into the hardening mixture, cooling between plates when the articles are thin, and using lukewarm and oily or medicated mixtures. (3) The less often steel is passed through the fire the better, and overheating should be scrupulously avoided. A clear fire should be used, and charcoal is better than coal. (4) The scale should be ground off before heating, and the oxide produced by the fire rubbed off with a stone, and then with waste to render the changing colours visible. (5) Small objects are better heated on a hot bar of iron than in the fire, as the colours are then more readily observed, and the temperature under better regulation. The shank of the tool is often used as a reservoir of heat for the cutting point, communicating its heat thereto until the right colour is obtained for quenching.—J.

Siemens' Drum Armature.—Puzzled (*Burnley*).—The machine you saw was probably one of Siemens and Halske's continuous current dynamos. In these machines the ends of the armature coils do not each terminate in two segments of the commutator as in the form known as the Siemens H armature. In the machine you describe there are 12 coils on the armature, and 48 bars on the commutator. The ends of each coil, therefore, branch out to four different bars arranged on opposite sides of the commutator. Each coil of this armature is made to cut the lines of magnetic force four times during one revolution of the armature, and this gives a certain continuity and regularity to the current. If you care to go into the subject further, you will find a full description of these machines, illustrated by diagrams, on pages 299 to 302, part 5, of "Electricity in the Service of Man," now being published by Messrs. Cassell & Co., Limited, at 6d. each part. I can highly recommend this book to all students of electricity.—G. E. B.

Violin Bow-hairing.—Jeune Écolier.—I am preparing a paper, with illustrations, on the above subject, which will appear as soon as space permits. Organ and harmonium building will be thoroughly treated in Work.—B.

Violin Strings.—Sheffield Blade.—I cannot obtain the information you desire, but surely if you pay the price you will have no difficulty in getting the strings you require. Try Tarr, of Orchard Street, in your own town.—B.

Flux for Solder.—Blowpipe wants to know what is the flux used by silversmiths for silver solder, and how to prepare and use it. It is borax, and the necessary conditions of successful soldering are perfect cleanliness and freedom from grease and all other impurities in everything used in connection therewith. The solder and the work to be soldered must be scraped clean, and the borax slate and pencil must be washed clean. Generally borax—lump borax, not powdered—is rubbed up with water until it is as thick as cream, or until it stands in ridges. The article it is rubbed up on is a piece of clean slate, 4 to 6 inches in diameter, and to roughen it it is sometimes scored across with the edge of a file. Make plenty while you are about it for the job in hand, and apply it to the work with a borax pencil (camel-hair brush), taking particular care to get all the surfaces that the solder is to run over covered with it. The next thing to do is to prime your work with solder, and for silver it would most probably be small pieces called "pallions" that we should use, and they would be picked up by the borax pencil and laid along the soldering seam. All you now have to do is to gently heat it to drive off the moisture, and then, if these "pallions" have not moved away, you can apply the full heat and make the solder run. Another way, after boraxing the soldering seam, is to have a narrow strip of solder and apply it to the work at about the time you think it will run, and as it runs you move it along until you get to the end of your soldering seam. Should there be too little borax on your work, you can pass a piece of the lump borax along it, and it will hold if the work is hot. This is in place of leaving the work to get cool previous to applying more with the pencil. The strip of solder spoken of above must be held in pliers or something of that sort. Borax is sometimes burnt and powdered before mixing with water, but that is only for cases where it is of great importance that the solder does not move. I hope this answers you. If it does not, then please write again.—H. S. G.

Fern Case and Fountain.—D. M. (*Larbert, N.B.*). — I presume you mean that you want a fountain for the inside of fern case. If so, you had better not have one of the self-acting kind, as it is hardly likely that your case—not having been designed for that purpose—would be suitable. An article appears in No. 31 which contains details of a very simple plan of fountain, which you can easily adapt to your requirements.—C. M. W.

Chiming Clock. — H. E. B. (*Liverpool*).—It is not possible to deal with this subject at present.

Home-Made Lathe.—H. E. B. (*Liverpool*).—Instructions for making lathes of a simple character are given in the papers entitled "Lathes for Everybody."

Advertisement Pages.—J. G.—I am obliged to you for the correction, which I have forwarded to the writer of the paper. I am glad to know that you find Work helpful. There is no necessity, I think, for me to repeat what I have already said so often about the pages that contain advertisements.

Building Society.—Plumber.—It is altogether beyond my province to say anything with respect to existing building societies. I may add, however, that I am unacquainted with the one about which you write. You have the rules, I presume, and can ascertain from them if you can withdraw the money that you have already paid in.

Glass Staining and Lead Light Work. — Plumber.—It is not possible to commence a series of papers on these subjects in Volume I.

Painting Carriage.—W. M. (*Islington*).—You have omitted naming your carriage in your query. The two prettiest colours I know of to go in combination with silvered work are lemon yellow and black—the body panels and under-carriage painted yellow picked out and fine lined black, or picked out lilac and fine lined black. The monogram, if any, to be in the following colours, blue, red, black, green, and brown. If we have the body and under-carriage black, we pick out with a shading yellow graduating from a tan brown at the top to a chrome yellow at the bottom. Get a tube colour of chrome yellow, raw sienna, and burnt sienna; the last two must be mixed with white or yellow and gold size. Instead of placing the colours upon each other we can place them in close proximity to each other, taking care that the yellow is quite dry, or the colours will run into each other. Get your strongest fine liner you have and line, leaving a space of $\frac{3}{8}$ inch between. When dry get your raw sienna mixed with white, and line two lines within this space, these lines just touching the chrome lines. There will be a space left; this we fill up with tan colour made of burnt sienna and white mixed.

This has a very stylish appearance when finished. This lining looks well upon a dark brown. The monogram should be in silver or gold shaded, the body fine lined yellow. The following would also look well, which I will give for the benefit of other readers :—Rich blue body panels, fine lined yellow. Under-carriage yellow, picked out black or blue, fine lined black. Green body panels, fine lined vermilion. Under-carriage vermilion, picked out black. Rich olive green body panels, fine lined lake-glazed vermilion. Under-carriage lake, picked out black, fine lined vermilion. Brown body panels and under-carriage in any shade, fine lined with white, orange or tan, picked out black. The mouldings of the body in all cases painted black. I shall be pleased to supply you with further information.—W. P.

Hand-Railing and Staircasing.—Brutus.—I will endeavour to meet your wishes on this point as soon as I can. I have some drawings from the workman of whom I spoke in the early numbers of Work, but they are unaccompanied by descriptions, and he is now far away from London at work on a long job in the country. I must try to find someone else to write on the subject, but whoever may undertake it must not run in the old grooves. Readers seem to think that there is no trouble whatever to get good writers on special subjects. If they had had my experience, they would find it by no means as easy as they imagine, and would not wonder at the delays that frequently occur.—Ed.

Brass Ball Making.—E. J. B. (*Blakenhall*).—By all means send me the article referred to on "Brass Ball Making" on approval.

Tinning Cast Iron Diameters. — Tinner (*Hull*).—Your testimony as to the value and utility of Work is very gratifying. We are always pleased to hear that our efforts are appreciated by those for whom we write—viz., those who are willing to learn and anxious to improve their knowledge, not only of their own trades but of anything useful. To tin cast iron articles, they must first be pickled in a bath of mixed acid—hydrochloric acid 2 parts, sulphuric acid 1 part, water 7 parts. The stronger the pickle is made the quicker the articles will be ready. Heating the pickle also will cause it to act quicker. I used to use a large wooden tank lined with lead, and a steam pipe led to it from the boiler that drove the engine. When the things are sufficiently clean, rinse, and dip in a bath of "killed spirits" in which some lumps of sal-ammoniac have been dissolved. Pour this into the tinning bath, on which keep plenty of sal-ammoniac in a melting state. When tinned, take out and wipe or shake off the superfluous tin as required by the circumstances of the article. Cast iron is not so easy to tin as wrought iron, and some samples of iron are very difficult to tin at all. With regard to your second query—for a scale of circumferences for diameters of 1 in. to 24 in. I will tell you how to get the circumference of anything if the diameter is known. The rule is to multiply the diameter by 3·14569; thus an article 1 in. in diameter $1 \times 3{\cdot}14569 = 3{\cdot}14569$. If this is too difficult for you to calculate for the sizes you require, here is a very simple plan, which gives results quite accurate enough for any ordinary work. Divide the diameter into 7 parts, and take 22 of these parts for the circumference; thus, supposing a piece of pipe 7 in. across, $\frac{1}{7}$ of this is 1 in. multiplied by $22 = 22$ in. When the diameter runs into odd measurements, it is perhaps best to work it out with a pair of dividers instead of an arithmetical calculation, as you would have to go into decimals to get accuracy. If you want these sizes for stove pipe and similar work, you must add sufficient to allow for the seaming, or if riveted for the lap.—L. L.

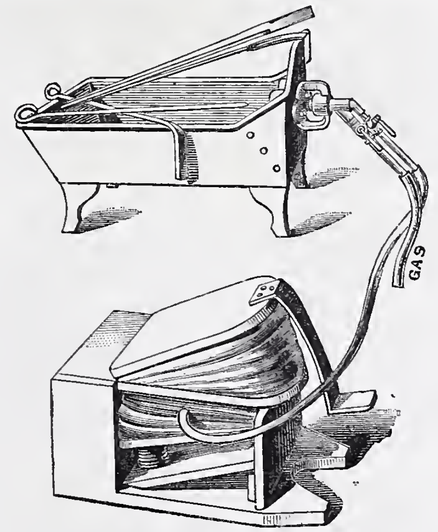
Duties of Telegraph Linesman. — W. W. (*Cupar*).—I do not know of a book detailing the duties of a telegraph linesman, and how to perform them. If any of our telegraphist friends know of such a book, will they kindly oblige us and W. W. by giving us the title, price, publisher's name, etc.?—G. E. B.

House Painting.—X. Y. Z. (*Liverpool*).—The following is a suitable book on house painting :—"House Painting," by Davidson, 5s., published by Lockwood & Co., Stationers' Hall Court, London.—F. J. C.

Drills.—C. E. (*Greenwich*).—Yes, you must soften the steel to form the drill, by heating it to a low red heat, and allowing it to cool gradually in air. When the drill is formed, and you want to temper it, proceed thus :—Heat it to a low red, and plunge the tip only in water. Withdraw it, and brighten the portion just immersed by rubbing a bit of soft stone upon it, and brush it quickly with a bit of waste. Now watch the changing colours imparted to the hardened point by the heat still remaining in the unhardened shank. When the point becomes of a plum colour, or dark purple, immerse it vertically in water until quite cold. I cannot see the reason of the method given in *Scientific American*, but turpentine is often used to assist the action of a drill through very hard substances.—J.

Sign-Writing Charges.—R. C. (*Chertsey*).—I am sorry to say I am unable to give R. C. any direct particulars as to the prices charged by sign-writers. Prices vary in almost all parts of the country, being highest in London, and other large towns; poor workmen also take work at a lower figure than their more skilled brethren would deign to accept, and the result of keen competition often leads to a lot of "cutting" in prices. R. C. may possibly, however, find this and other useful information in the following handbooks, which are published annually. Before purchasing these, though, I would advise him to write to the publishers, and ask if they contain prices of sign-writer's work. I know they contain prices of painters' and paperhangers' work, but am not sure as to sign-writing. (1) Lockwood's "Builders' and Contractors' Price Book for 1889" (3s. 6d.). (2) "Quantities and Measurements in Bricklayers', Masons', Plasterers', Plumbers,' Painters', Paperhangers', Gilders', Smiths', and Carpenters' Work" (1s. 6d.), Crosby Lockwood & Co., 7, Stationers' Hall Court, E.C. (3) Spon's "Builders' Price Book" (3s. 6d.), E. & F. Spon, 125, Strand, London. Perhaps, however, some reader of Work would kindly give a price list for sign-writers based on London wages.—H. L. B. N.B. I will endeavour to include a price list in my articles if possible.

Coke Forge.—Young Apprentice (*Kettering*).—I send you a sketch which will show you what you want: it is Fletcher's gas forge. You will see that a foot blower is necessary to work it; a bladder, as you suggest, would be of no use whatever, so don't waste valuable time experimenting with that. A fan would, perhaps, answer; but there is not the force and power in a fan that you would get from a foot blower, and these are recommended by the makers. The forge shown in sketch is a very useful article in a workshop for small odd forgings, doing



Coke Forge.

up lathe tools, etc. It is perfectly clean, no trouble in lighting, and is always ready for use. Starting all cold a slide rest tool can be repaired in about two minutes. The way to use it is as follows :—Fill the hearth with small coke, light the gas at the blowpipe, and use the blower. In a minute turn the gas out, and then turn on again, a very small quantity, not enough to burn at the blowpipe jet, but sufficient to visibly brighten the fire. When the heat is obtained the forge may be worked without the gas, but a little gas doubles the power. The gas must not burn at the blowpipe jet, except for the first minute. The parts may be had separately. Blower only, No. 590, £1 15s.; blowpipe, 10s. 6d.; hearth, 15s.; so what you do not succeed in making you will know the price of, and where to get it.—R. A.

Tin and Tinware.—No Name.—In speaking of tin as a metal, we do not mean the tin used for making up tinware. This is not tin at all, though it is often so named, but simply iron plates coated with tin. The pure metal tin is sold in blocks varying in weight from about 18 to 28 lb. This is called block or ingot tin. It is also sold in bundles of long strips; this is the kind termed grain tin. It is supposed to be better than the block tin, but I cannot say that I have noticed any difference; it is a convenient form for users of small quantities. Tin in the block or ingot gives a clear ringing sound like a bell when struck, and in strips can easily be recognised by a peculiar crackling sound when bent. Both tin and solders can be bought of any good ironmonger or coppersmith, value about 1s. per lb. retail. To melt, place it in an iron ladle or plumbers' metal pot; melt over a forge or kitchen fire, using a little resin as a flux.—L. L.

Electro-Gilding.—G. F. (*Birmingham*).—I hope shortly to be able to thoroughly deal with the subject of electro-gilding in an article in which I will endeavour to provide for your wants. The best solution for a novice or an amateur is one made up by the battery process, in which pure gold is dissolved in a solution of cyanide of potassium by the current from a strong battery.—G. E. B.

Model Yacht.—White (*Shipley*).—I know of no book, inexpensive or otherwise, which deals with the class of model which you are building. A model merchant sailing vessel, for which you require instructions in rigging, is seldom made by the ordinary model yachtsman, it being almost an impossibility to sail such a model on anything like a definite course. If (as I presume it is) your model is only ornamental, and not intended for sailing, your best course will be to notice and copy the arrangement of the rigging of any specimen of naval architecture you may happen to see, and then to find a good picture or engraving of the type of vessel you wish to make a model of. You will find some excellent cuts of all classes of vessels in the numbers of *The Illustrated London News*, particularly in the old numbers of that paper, and you will then get a very good idea of what your model should be. As to the actual rigging, there is very little required beyond care and plenty of patience, and as you do not specify whether your model is a brig or a full-rigged ship or what not, I cannot without fuller particulars give you definite instructions as to the proportions of the masts, spars, etc., for which, if you require them, you must write again giving the necessary information. I may say, however, that the masts and spars should be of straight-grained yellow pine, the sails of fine calico, edged with cord, and the cordage, shrouds, etc., of the best water cord, or fishing line, of various thicknesses.—G. J. E.

Printing Book. — Saraband (*Bridgwater*). — Printing is so universal a term, and embraces so many kindred arts, that I regret you did not define the particular kind of printing—*i.e*, letterpress, lithographic, copperplate, photographic, or process printing. The books on these arts are legion. You may, however, select from the following in the meantime, and address the editor again giving minute particulars, if my selection does not give you the precise information he requires: "Printing Machines and Machine Printing," 5s., Frederick J. F. Wilson; "Grammar of Lithography," 5s., W. D. Richmond; "Colour and Colour Printing as applied to Lithography," 5s., W. D. Richmond; "Zincography," 2s. 6d., Josef Bock.—J. W. H.

Tempering Tools – Long Chisels. — T. O. (*Liverpool*).—I answered this writer at your request fully, and sent it to you promptly with another question at the same time, I think. Briefly, he careful in forging to draw the steel regularly, not to smash the grain on one side, and work it unevenly. Steel-workers know there is science in the method of striking. It is explained in "Sword Making" in Work. Also in letting it cool in the ashes after forging. Heating in a "muffle" is essential. Use an oil bath—that is, two inches of linseed or other oil floating on the top of the water. Put the chisel straight down through the oil into the water. Do not move it sideways at all, but draw it straight up out of the oil and water bath.—J. C. K.

Jet Warehouse.—G. H. (*Hetton-le-Hole*).—G. H. will be able to get all the jet he wants from the Whitby Jet Association, 17, Hatton Garden, London, E.C. It will be advisable to clearly specify the purpose it is wanted for, as I am given to understand that there are some six or seven different sorts.—H. S. G.

Egyptian Articles.—H. C. T. (*Newcastle-on-Tyne*) and T. E. P. (*Cambridge*) will find Cavendish House, Cheltenham, a depôt for Egyptian goods.—C. H. O.

Book on Violin Making.—C. D. A. (*Glasgow*).—A good book is "Violin Making," by Allen, 10s. 6d., published by Ward, Lock & Co.—F. J. C.

Sign Writing.—A New Subscriber (*Hackney*).—Papers on this subject have appeared in Nos. 1, 2, 4, 11, 13, 17, 19, 23, 30, 34, 39, 43, and 44 of Work.

Spiral Spring.—Basil.—I should advise you not to attempt to make the springs; it is work requiring special knowledge and training, and you will find it cheaper and more satisfactory to buy them. The size you mention should be made of steel.—F. C.

Casting and Moulding.—A. W. A. (*Aylestone*). The subject of clay modelling will be noticed in turn in a series to be commenced by-and-by on foundry work.—J.

Moulding Papier-Mâché.—H. C. C. (*Hornsey*) will find that his first letter was duly answered. Some little time must necessarily elapse before the reply to any query can appear in "Shop."—S. W.

Ticket-Writers' Ink. — R. H. — Ticket-writing ink is called japan ink, and may be obtained at any large stationer's cheaper than it can be made at home—viz., 6d. per bottle. The following formula, however, is simple :—Evaporate some of the water from the best black writing ink in a moderately heated oven, then add liquid gum arabic to replace the water lost in evaporation. This will dry with a gloss.—H. L. B.

Fret Saw.—H. B. (*Manningham*). — Without having full particulars of the stand you wish to utilise it is impossible to give such directions as would be of the slightest use to you. Even with them I am afraid you would find "the game not worth the candle," for fret machines are to be bought so cheaply that, by the time you had made the necessary alterations and additions, the expenditure would probably be more than if you had bought a machine. You may often pick up a second-hand one by advertising at a very low figure. An umbrella stand will be described in an illustrated article in due course. Directions for cleaning up wood for polishing will also be given. I think you will find that you may learn much from every page of Work. As you say, the remarks on planing and planes are very interesting, but what is more to the purpose they are thoroughly practical and intelligible.—D. A.

TABLE GIVING PROPORTIONS OF WHITWORTH SCREWS AND NUTS, WITH CHANGE WHEELS TO CUT THE SAME.

Diameter of Thread.	Threads per inch.	Wheels required for lead screw of ½-in. pitch.				Diameter at bottom of thread.	Sectional area at bottom of thread.	Hexagon nuts.	
		Mandrel.	Driven.	Driver.	Lead Screw.			Across flats.	Across angles.
$\frac{1}{16}$ = ·0625	80	20	100	30	120				
$\frac{3}{32}$ = ·09375	60	20	100	40	120				
$\frac{1}{8}$ = ·125	40	20	100	60	120			·338	
$\frac{5}{32}$ = ·15625	32	20	80	60	120				
$\frac{3}{16}$ = ·1875	24	20	Any intermediate idle wheel.		120	·136	·015	·418	·517
$\frac{7}{32}$ = ·21875	24	20			120				
$\frac{1}{4}$ = ·25	20	20			100	·186	·027	·525	·606
$\frac{5}{16}$ = ·3125	18	20			90	·241	·046	·6014	·694
$\frac{3}{8}$ = ·375	16	20			80	·295	·068	·7094	·819
$\frac{7}{16}$ = ·4375	14	20			70	·347	·094	·8204	·947
$\frac{1}{2}$ = ·5	12	20			60	·394	·121	·9191	1·016
$\frac{9}{16}$ = ·5625	11	20			55	·456	·163	1·011	1·167
$\frac{5}{8}$ = ·625	11	20			55	·509	·203	1·101	1·277
$\frac{11}{16}$ = ·6875	10	20			50	·571	·256	1·2011	1·3869
$\frac{3}{4}$ = ·75	10	20			50	·622	·304	1·3012	1·502
$\frac{13}{16}$ = ·8125	9	20			45	·684	·376	1·39	1·605
$\frac{7}{8}$ = ·875	9	20			45	·733	·422	1·4788	1·707
$\frac{15}{16}$ = ·9375	8	20			40	·795	·496	1·5594	1·8
1 = 1·	8	20			40	·84	·554	1·6701	1·928
$1\frac{1}{8}$ = 1·125	7	20			35	·942	·694	1·8605	2·148
$1\frac{1}{4}$ = 1·25	7	20			35	1·667	·894	2·0483	2·365
$1\frac{3}{8}$ = 1·375	6	20			30	1·161	1·06	2·2146	2·557
$1\frac{1}{2}$ = 1·5	6	20			30	1·287	1·3	2·4134	2·786
$1\frac{5}{8}$ = 1·625	5	20			25	1·369	1·472	2·5763	2·974
$1\frac{3}{4}$ = 1·75	5	20			25	1·494	1·753	2·7578	3·184
$1\frac{7}{8}$ = 1·875	$4\frac{1}{2}$	40			45	1·59	1·985	3·0183	3·485
2 = 2·	$4\frac{1}{2}$	40			45	1·716	2·31	3·1191	3·636

Change Wheels.—F. W. H.—You describe the wheels of the two lathes you use, with the intention of asking "two questions," but you conclude without asking any question at all. As I am not a thought reader I can only guess what you may want to know. Here, then, is a list of useful pitches taken from a table of Whitworth bolts, and including gas threads:—40, 32, 28, 24, 20, 18, 13, 14, 12, 11, 10, 9, 8, 7, 6, 5, $4\frac{1}{2}$ threads per inch; 28 is "brass gas," 14 and 11 "iron gas." Probably you will want no others than these. Now for your first lathe, which has a screw of 2 threads, and 13 wheels of 16, 20, 22, 32, 36, 40, 40, 44, 48, 56, 64, 72, 80. Put the 16 wheel on the mandrel, and try each of the larger wheels on the screw, thus:—$\frac{16}{80}=\frac{1}{5}$, but as the lead screw has a pitch of $\frac{1}{2}$ we get by this arrangement a pitch of $\frac{1}{10}$, or ten threads per inch. This is the finest pitch the wheels will cut when arranged in single train. Trying other wheels on the screw we get—$\frac{16}{72\times2}=9$ threads, $\frac{16}{64\times2}=8$ threads, $\frac{16}{56\times2}=7$ threads, $\frac{16}{48\times2}=6$ threads. You see why the numbers 80, 72, 64, 56, 48 were chosen; the 16 becomes 8 when divided by the 2-pitch screw, and the numbers of the wheels are multiples of 8, so that they give 10, 9, 8, 7, 6 threads exactly, as required by the Whitworth rates. Continuing our investigation, $\frac{16}{44\times2}$ gives $5\frac{1}{2}$, $\frac{16}{40\times2}$ gives 5, $\frac{16}{36\times2}$ gives $4\frac{1}{2}$, and $\frac{16}{32\times2}$ gives 4 threads per inch. We need go no further in that direction, but only notice that the number of teeth in this part of the series rises by 4 instead of by 8, enabling us to get $5\frac{1}{2}$ and $4\frac{1}{2}$ threads per inch. However, thus far we have all the required rates from $4\frac{1}{2}$ to 10, and the remainder we must seek for by means of the compound train. Having already obtained 10, 9, 8, 7, 6, 5, $4\frac{1}{2}$ threads as before explained, it will be understood that if we put on the intermediate stud a pair of wheels which are as 1 to 2, say the 22 and 44, or 32 and 64, we can reduce the speed of the lead screw by one-half, and so multiply by 2 the pitch of the screw we shall cut. Now multiplying 6, 7, 8, 9, and 10 by 2 gives us 12, 14, 16, 18, 20 threads; by putting on intermediate wheels of 3 to 1, we might get 24 threads from 8; and by intermediate wheels of 4 to 1, from 7, 8, 10, we get 28, 32, 40 threads. The 16 and 48 wheels are the only ones which are as 1 to 3, therefore, as we have only one 16 wheel we must put for 16 and 64 to give 8, 20 and 80, so as to leave the 16 and 48 wheels free for the intermediate stud; 16 and 64 bear the same relation to each other as do 20 and 80. In placing the pair on the intermediate stud we must, of course, put them on so as to reduce the motion, the larger going on first to be driven from the mandrel, and the smaller next to drive the wheel on the screw. Looking over our list of pitches, we shall see we have obtained them all but 11 threads, quite an important one, since it is not only the rate of Whitworth bolts of $\frac{9}{16}$ in. and $\frac{5}{8}$ in., but it is also the rate used on iron pipes of 1-in. bore and over. Now we obtained $5\frac{1}{2}$, and, though that rate is not in the table, by doubling it we shall obtain the wished-for 11. Your second lathe has also the $\frac{1}{2}$-pitch lead screw, but it has, apparently, the usual set of 22 wheels rising by 5 from 20 to 120; you say, however, that the 35 wheel is "fixed" on the mandrel; I don't think so, but if it is, I would have it off somehow, if it had to be turned off, and put instead the 20 wheel, which is most often wanted with a 2-threaded screw.—F. A. M.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Safety Cages.—T. J. (*Dudley*) writes in reply to E. J. J. (*Notting Hill*) (see page 590):—"I shall be pleased to put before E. J. J. a new safety apparatus for mine and other cages, which for simplicity and certainty of action I claim to be the very best yet introduced."

Ink Bottles.—J. W. W. (*Hanley*) writes in reply to INQUIRER (see page 526):—"No doubt you can get the article you require if in store by applying to Calvert & Lovatt, Langley Mills, Nottingham."

Birdcage Fronts.—J. G. (*Nottingham*) writes:—"I beg to say if J. S. (*Coatbridge*) (see page 587) will communicate with me I will make him what fronts he wants, or I will put him in the best way to proceed in making them himself if agreed."

Tarring Fence.—W. D. (*Newcastle-on-Tyne*) writes in reply to C. M. (*Hornsey Park Road*) (see page 654):—"Coal tar is as good as any for this purpose. It should be mixed with pitch, boiled, and applied hot. It will dry hard and very glossy. If mixed with mineral naphtha it will soak into the wood and dry a dull black. The tar washing off by the rain may have been caused by the fencing being wet when it was applied."

Tarring Fence.—W. E. H. (*Bognor, Sussex*) writes in answer to C. M. (*Hornsey Park Road*) (see No. 41 of WORK) *re* tarring fence:—"He will find that to follow the plan adopted here by the fishermen in tarring their boats will be the best. They obtain the tar from the gas-house here, and add a pint of turpentine to the gallon of tar or more if required to make it thin enough. Then choose a warm sunny day, the wood being perfectly dry, and lay it on with an ordinary tar brush. Some add naphtha instead of turps on account of cheapness, but turps is best to add as it lasts longest. Once a year will be found sufficient for a fence. If new work, give two coats of tar, one week to elapse between each coat."

Tarring Fence.—FAL writes in reply to C. M. (*Hornsey Park Road*) (No 41, page 654):—"Black varnish, which is specially prepared for outdoor work, is much better for C. M.'s purpose than tar. Messrs. Bayliss, Jones, and Bayliss, Wolverhampton, make a very good quality at 1s. 6d. per gallon. Brushes, 1s. each. There are numerous other makers."

Wheels.—WHEELER writes in reply to R. B. (*Largoward*):—"In answer to your inquiry where you can buy machine-dressed materials for wheels, if you will write to any of the three makers named below you will receive a price list or a quotation for any requirements. The following names have been selected from a number of dealers in the same articles: William Cary, Red Bank, Manchester; James Chapman, 181, Chapel Street, Salford, Manchester; Joseph Owen & Sons, 21, Grosvenor Street, Manchester, and 67, St. Anne Street, Liverpool. You will be able to get what you want, even to the ready-made wheels ready for hooping and bushing, at Cary's."

Electric Motor.—B. F. (*Birkenhead*) writes in reply to J. C. (*Shipton, Yorks*):—"There is one of these working often in Avonberg's window, Manchester Street, Liverpool, driving the way you want. I have seen and bought the wheel of life with pictures for 6d. I have seen in Archer's, optician, Lord Street, electric motor with driving wheel on for 2s. 6d."

Trade Note.

ONE hundred and four societies reported to the request of the Board of Trade for returns, and these represented a total membership of 373,904, which Mr. Burnett considers are more than one-half the trade unionists of the whole kingdom.

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

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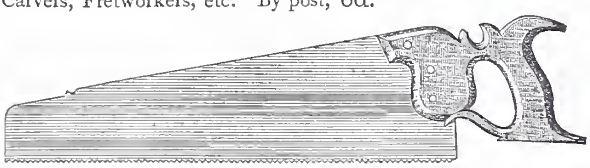

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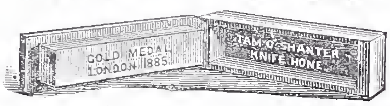

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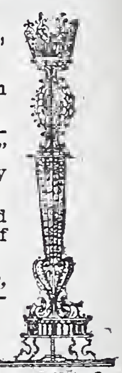

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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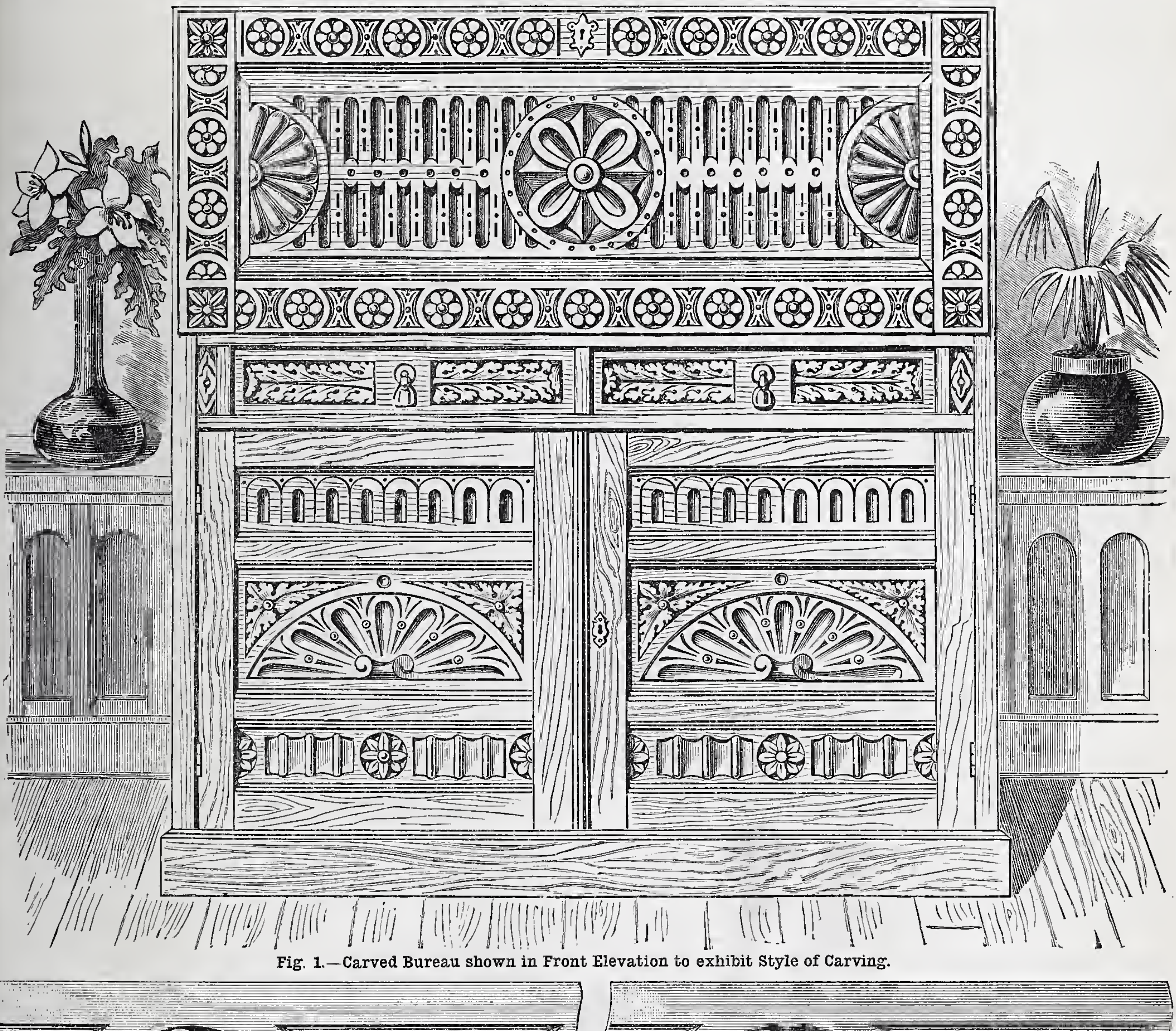


Fig. 1.—Carved Bureau shown in Front Elevation to exhibit Style of Carving.

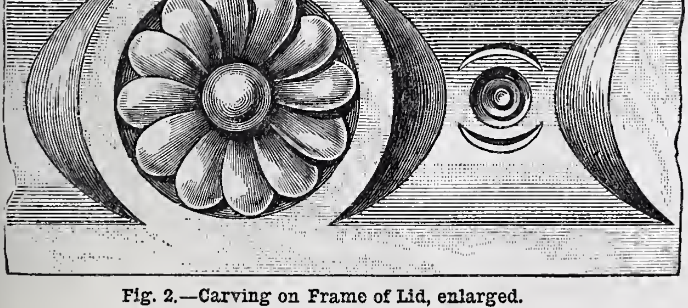


Fig. 2.—Carving on Frame of Lid, enlarged.

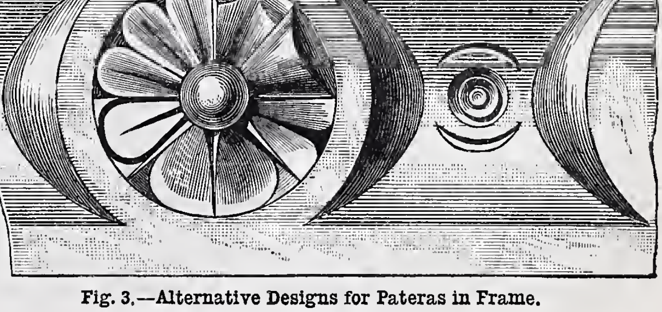


Fig. 3.—Alternative Designs for Pateras in Frame.

A CARVED BUREAU.

BY D. ADAMSON.

We have in previous papers considered the old bureau and a bureau in "Gothic" style. The next style of bureau which demands our attention is one which prevailed more or less during the latter part of the sixteenth and the greater part of the succeeding century. It must not, however, be supposed that art as applied to woodwork was at a standstill, and that no variety in style is discernible during this period; for there are differences in ornamental detail by which the Elizabethan or late Tudor style is distinguishable from the succeeding Jacobean. These comparatively trifling differences, however, need not be dilated on, for the prevailing characteristic of domestic woodwork decoration throughout them is much the same. If we examine any of the numerous specimens which have survived, we find the predominant feature to be bold, effective carving with little, if any, attempt at rendering natural forms. The designs are strictly conventional where foliage is represented, and simple geometrical forms are largely used. We thus see that the motives

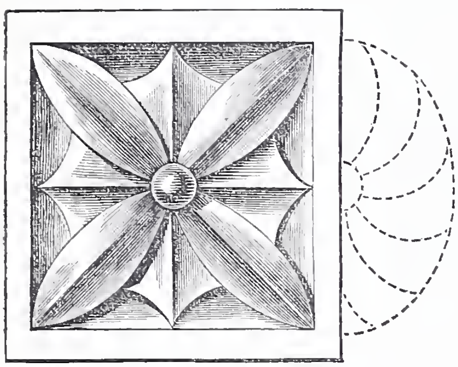


Fig. 4.—Pattern at Corners of Frame, enlarged.

which inspired the designers are in accordance with correct principles. There is no endeavour merely to imitate natural objects, and one has only to look at a piece of work of the period referred to to recognise the good general effect which was produced by the simplest means. Much of the work was crude in execution, but there was a boldness in its conception, an absence of all finnicking over-elaboration, which renders it so attractive not merely to students of woodwork but to the most casual observer. Please do not, however, suppose that this is intended to mean that it should be merely copied nowadays. Far from that, as the only result would be deterioration of the worker's powers. If we want to make a facsimile of some old work well and good, then copy from it; but if the intention is to make a given piece of furniture in a given style, all we have to do—so far as the design is concerned—is to seize some of its leading features, or, to use an expressive term, the feeling of the style, and embody the details in any article, whether of cabinet making or otherwise, which may best fulfil its intended purpose. It must be understood that the accompanying illustrations by no means exhaust the varieties of ornament which are to be found in Elizabethan woodwork. To do so would be impossible within a moderate space, and all that can be managed within the limit of these papers is little more than an indication of what may be done in the way of ornamenting woodwork by carving in what may be described as the English version of the Renaissance. We find a similar style prevalent throughout Europe, not identical in detail, each country giving a rendering of its own,

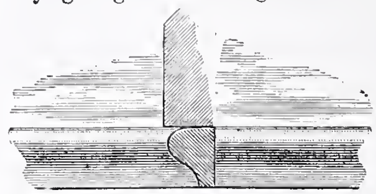


Fig. 5.—Moulding exhibiting Section.

but all emanating and expanding from the Renaissance originated in Italy.

So much for theory; now let us see how it is to be applied to the bureau. To begin with, for the encouragement of those who are not skilful carvers, it may be said that carving tools as now understood are not absolutely necessary. In the designs to be given there is nothing that may not be managed with ordinary carpenters' chisels and gouges. If carvers' tools are available, well and good, the work may more easily be performed, but certainly none of the more modern forms—the bent tools and others which carvers use nowadays—will be required. There is no undercutting, while all the work is bold and free. Those carvers—or should they not be described as carpenters, who used their chisels as freely for decoration as for construction?—of the days of good Queen Bess understood how to produce effect by the simplest means. Take the front of an old chest or cabinet, with its wealth of cutting as the old craftsman would probably have called it, how elaborate it seems, with perhaps scarcely an inch of its surface undecorated by carving, yet analysed it will be seen that there is in truth little that could not be attempted by the veriest tyro. Bold effective lines without much depth, which it requires only a slight acquaintance with the art of carving to discern, may be cut and shaped with the most rudimentary tools. But let not the beginner fall into the mistake of supposing that the breadth and general good effect can be produced by purposely leaving the work in a rough state. He is apt to do so, but let him instead give the highest finish he can to his work, taking care at the same time not to destroy the vigour and robustness which characterised the mediæval craftsman. Let the work be bold, but not necessarily rough. The former quality stamps its character with merit; the latter depreciates it. A bad, or, not to put it so strongly, an inferior design executed with vigour is preferable to one of superior merits weakly carried out. To combine robustness of work with proper finish is not so easy as it might at first appear, and as those who have attempted it well know. Still, this should be the aim of any wishing to excel in good carved work such as is under consideration. The illustration of the bureau shows a considerable quantity of carving, but it may be as well to state that there is no necessity for carrying out the design in its entirety. It will be noticed that a departure from the original construction is shown, two doors having taken the place of the three long drawers. This alteration is partly made as a suggestion that a cupboard may take the place of these, and partly because the carving of three drawers, or rather their fronts, might become monotonous.

This leads me to say that those who prefer to have the drawers may, if they do not wish to dispense with them, fit them inside the doors. Further, if they do not care for doors, it is not necessary that each drawer front should be of exactly the same pattern. The details of each rosette or patera, for example, may be varied, but this suggestion will be more of service to those who are fairly acquainted with the principles of design than to beginners, in whose hands there is a danger of the result being too patchy to be pleasing.

Well, now let us refer to the illustration, Fig. 1, which gives a general idea of the carved bureau, much of the detail being necessarily left out, or at most merely indicated. By the way, the front only is drawn in elevation, but there will be no difficulty in recognising the various parts. Let us take the lid first. This may be either made with the panel flush as in the original bureau, or sunk as suggested, when dealing with the Gothic design. As the panel is rather a large surface to carve, it may have a bevelled edge with advantage to those

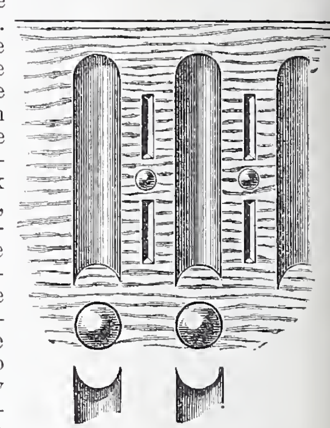


Fig. 6.—Carving on Panel.

who do not wish to bestow too much labour on it. Of course, the bevelling, which may be an inch or so wide, considerably reduces the surface to be carved, so that the effect of a panel covered with carved ornamentation may be produced without so much actual work. The framing around the panel may be either left plain or be carved as shown. To convey as far as possible the pattern, which, of course, must be drawn of a suitable size on the wood itself, illustrations on an enlarged scale are given, which, it is hoped, will make the ideas sufficiently clear to enable those who are not conversant with actual carvings of the kind represented to reproduce them. Fig. 4 shows the pattern at the four corners of the frame, and Fig. 2 the remainder. In case the cutting of so many pateras exactly the same may be monotonous, suggestions for varying them, while keeping them in harmony with each other and the rest of the work, are given in Fig. 3. The frame may also be left uncarved, like the door frames, if preferred, and, it is almost needless to add, these may be carved in a similar manner. It will be noticed that the long rails, those at the top and bottom, are moulded on the inner edges. To be in character with the style of

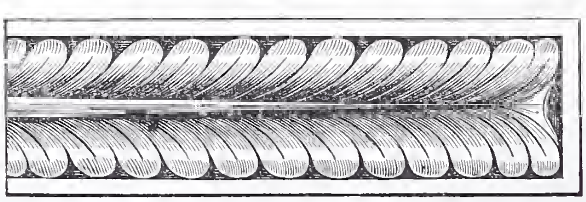


Fig. 7.—Carving on Drawers.

decoration, these mouldings should, strictly speaking, be worked on the solid, *i.e.*, instead of gluing them to the framing, they should be cut on the framing. This, however, may be rather more trouble than the amateur artisan would be disposed to take, and with care a very serviceable job may be made with mouldings stuck on. A suitable moulding is shown in section in Fig. 5, which also gives a portion of the flat frame. The carving on the panel itself is represented by Fig. 6, while that on the drawer fronts is shown by Fig. 7. The door panels are carried out much as the other carving, and no minute description can, therefore, be necessary. Each door, it will be seen, has three panels; the middle one being the principal, with fluted carving arranged in circular form, instead of being straight as on the lid. As the flutes converge towards a centre, they, of necessity, assume a tapering form. The top and bottom panels are simply flutes similar to those on the lid, but shown of a simpler form, with the addition of pateras on the bottom panel. The door framing should be fastened with the ordinary mortised and tenoned joints, the two intermediate rails being tenoned into the stiles. If the lower part is to have drawers behind the doors, it will be better to hinge these on, instead of within the ends,* as shown in Fig. 1. To do so, of course, the end pieces must be cut away to the thickness of the door framing, and the doors themselves be correspondingly wider. By hingeing the doors on the ends, it will be seen that the drawers can be the full length of the inside of the cupboard part; but if they are hinged within, the ends must be lined up, or thickened, that the drawers may work clear of the doors.

Much more might be written about the bureau in this old English style, which, undoubtedly, is a most interesting one, but space forbids. I may, however, say that many, if not most, of the old chests which one meets with, not to mention other articles of carved oak furniture, principally chairs and tables, are often rich in suggestions to the designer.

With this let us pass on, merely observing that the style known as "Queen Anne" was evolved from the one just considered, with which, for all practical purposes, it may be said to be almost identical, except that it indicates a closer adherence to classic forms, and, consequently, greater simplicity prevails in it. In the furniture of the Queen Anne period there is also much that shows Dutch ideas to have been largely borrowed; but as at present rendered in modern furniture, the term "Queen Anne style" is remarkably comprehensive, and, at its best, is founded on architectural details of the period which gives its name to it. For various reasons a "Queen Anne" bureau need not be given now, but it may be said that the style prevailed during the reigns of William of Orange, whence much of its Dutch character, and Queen Anne, to whom its name has been given, till well on into the eighteenth century, when domestic furniture, as we now understand it, assumed an importance it had not hitherto occupied. At the commencement of the second half of the eighteenth century the style known as Chippendale was all the fashion, and it may be interesting to note that, for the first time in the history of English furniture, this is distinguished by a name of its own apart from architectural nomenclature.

* See article on Hinges, etc., in No. 7.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

MIXING OIL PAINTS AND COMPOUNDING TINTS AND SHADES OF COLOURS FOR PRACTICAL USE (*continued*)—FOURTH COAT.

THE cornice is now ready for flatting, and the walls for the fourth and last coat of oil paint. I break up lead and paste driers with former proportions of solids, but all turpentine, into batter consistency. I then divide it into the amount required for the three divisions of cornice, stain them a few degrees lighter than the respective oil-ground colours, using the blue, red, ochre, and umber pigments for staining, then strain and thin with more turps for use. The nature of the flatting process I have already explained: but you must attentively notice that I must now take each colour right along each flank; first, the light terra-cotta next to ceiling; then the green-grey (recessed) portion; and lastly, the bottom division of warm colour. Were I to bring all three colours along at once, the joints would invariably appear shiny, the effect of which, at intervals of every five or six feet, would be most disagreeable, and would spoil the repose of the entire cornice.

Flatting requires to be *very* expeditiously manipulated, and the brush must not touch it a second time after leaving it and it once commences to set, which is within a few minutes. When a large mass of wall is flatted, the colour must be spread entirely over it at once; so that, single-handed, I do not attempt more than the cornice in this lesson. If any small portions of a large space are missed in the flatting, the wall is spoiled, not so much by the colour of the part missed, but by the bright oily gloss of the ground. Notice that I use the flatting much thinner than the oil paint—almost like milk—taking special care to coat all recessed as well as prominent portions, so that it all dries as dead and solid as the pink distempered ceiling.

All danger of splashing now being over, I give the walls a final rub down with No. 1½ glass-paper, and finish them with my lighter tint of sage green, prepared as before, but with two-thirds oil to one of turps, which dries with a good medium gloss, and gives me plenty of time to spread it and lay it off.

Ceiling, cornice, and walls are now finished and dry, so that the skirting and woodwork alone remain. My colour for the latter is already made, but requires the addition of terebine (which is preferable to white driers in compounding this paint), in proportions of one of terebine to twelve or fourteen of pigment. I thin sufficient of this with two parts turps to one of oil; then, having already carefully rubbed down and faced up the work (taking special care not to rub the previous coats off the sharp edges of the mouldings), I coat it on the system previously explained. The light, panel paint is first spread, covering mouldings also this time; and then the brushes are well worked into the dark, "Arabian brown" colour, and the remainder is painted, skirting included. On the following day we find our third coat quite hard, so I finish it right off with the remainder of our thick mixed paint, but made to working consistency with reversed quantities of liquids (namely, two-thirds linseed oil to one of turps), leaving until the next day the picking in of panel mouldings with the sage green wall-colour.

Let us now look around, and gather up the lessons this room should have taught you. There are the *proportions* of solids and liquids that go to compound both *oil*, *sharp*, and *flatting* paints for walls and woodwork. You have also a good notion of the *system* of working or manipulating them, as well as the methods of *thought* required i deciding colours, from which latter you have gathered that successful colour-results are *not* the outcome of a sort of inspiration—"taste" it is usually termed. Beyond this, you understand the *necessity* for clean and careful working, dusting the work, and well straining the paint, and thereby saving much time and glass-paper, on new wood particularly. As to the colour scheme of your billiard-room, perhaps its present appearance, after your being used to the rich variety (?) of black-and-umber drabs the builder has favoured you with, strikes you as being rather "loud." But wait, my friend, until the table is fixed in the room, with its pure green cloth, when our wall-colour will assume a warmer and much more sombre tone, making a fine background for a few good oil paintings in gilded frames; whilst the dark warm shades of the woodwork will correspond effectively with the mahogany framework of the table, and will suit equally well with any other articles of furniture usual to a billiard-room.

I promised in the opening lines of this lesson to deal generally with mixing colours for oil-painting, and to this end I will devote the remaining space allotted to my paper.

In these days of cheap paperhangings and materials it is the usual method for a client to choose a wall-paper, and then desire the woodwork to be painted to match—that is to say, in tints corresponding with the paper. In these cases, and for bedrooms especially, the painter will get good results by making the bulk of the woodwork a deeper shade of the predominant colour of paper. For instance, if the pattern is in soft green shades upon a cream ground, I should paint the panels cream, the remainder soft green to match the walls, and, as we should probably get a few touches of pink amongst the pattern, I should pick in the mouldings with a lighter tint of similar colour. Unless the paper is dark in appearance, it is generally advisable to put darker shades on the doors, etc. When such is the case, however, fairly light colours will suit a dark paper the best. The object in view is to make the doors and structural features of the room to stand out distinctly, but yet harmoniously, from the walls.

For practical house painters, the pigments I have previously described are the best, cheapest, and easiest to manage. Let me here point out the meaning of a few colour-terms, which are seldom properly understood even by operative house painters—namely, *tints*, *shades*, and *hues*. I take a little vermilion, for instance (which, you know, is a bright, rich, and rather costly red pigment), and to this add a little white lead. The resultant mixture forms a *tint* of vermilion—call it "coral," "blush rose," or any other fanciful name you please. If I further lighten the colour by adding white, it still remains a *tint*. Suppose, however, if, instead of adding white to the vermilion, I substitute a black pigment, the result is a darker mixture we should call a *shade*. By the term *hue* we understand what is predominant in a colour, such as a *blue hue* of green—that is, nearer the blue than the yellow, both of which it is made from. "The *roseate hues* of early morn" is a sentence that fully explains the word. It will, therefore, be understood that to speak of a colour as being a few *shades lighter*, or of a *darker tint* of colour, is altogether incorrect, and is certainly more than a matter of passing mention.

Before the painter can properly and confidently mix colours, he must be familiar and "carry in his eye" (so to term it) the appearance of all his pigments, so that when a colour has to be matched he can at once analyse it and judge what are the best pigments to use for it, subject to the other considerations of cost and permanence I have treated upon.

Suppose we try a few examples. I want to make a very bright and pure *tint* of red. Vermilion is my brightest red pigment, and this will, therefore, give me tints far purer than the cheap Venetian red. So also with blue tints: ultramarine gives the purest blue, and chromes the brightest yellow. The same method is used in mixed or compounded tints: we work with the brightest blue and yellow to obtain bright greens, although none such can approach to *emerald green* in this respect. All the useful variety of cream, buff, fawn, drab, stone-colour, ivory white, and terra-cotta colours, and so on *ad infinitum*, can easily be made from white lead and the yellow and red pigments of Venetian red and ochre, with burnt umber to tone or soften them down, and, occasionally, chrome and vermilion for the brightest kinds. Black with white gives us *grey*, neutral tints, and, with the further addition of blue, green, or red, we obtain all that class of cool *greys* known as French grey, silver-grey, green-grey, and so on, according to the dominant tint of colour displayed to us, and all of which a careful student of my papers should now be readily able to mix, providing his own vision is colour-perfect.

In my next paper the subject of distemper, or *tempera*, painting will be practically explained, this elementary series of papers being completed with a chapter on painters' tools and brushes.

SMITHS' WORK.

BY J. H.

About Grilles, Gates, and Screens.

A GRILLE is an open grating or lattice-work in metal, and is used as a protection to a tomb, relic, or shrine. In the Middle Ages a great deal of labour was expended on these works of art, so that they exist in very great diversity of form, and possess very often a great ornate development. A screen may be regarded as an assemblage of several grilles arranged in panellings; or it may be composed chiefly of foliage, with little or no duplication of parts. I cannot give an illustration of an entire grille or screen, but will only note in brief some of the details of their construction.

The illustrations here given (for some of which I am indebted to Wyatt's "Metal Work") represent some of the details of the construction of a screen from the Church of Santa Croce, in Florence. It is the most elaborate and perfect specimen of smiths' work in Italy. It was erected in 1371 by the Runuccini family, in honour of the Virgin. An examination of these figures will give a tolerably clear idea of the methods of union adopted. These methods of union are not apparent in front view; they must be looked for behind. The use of solid bars is well illustrated in each of these sectional figures. All the fastenings of bars and mouldings are not clearly seen, but the hinder views of portions of the gate clearly indicate the use of rivets. Thus the circles (A, Fig. 10) forming the panels are plain bars of iron, to which the mouldings are riveted (see section Fig. 11, A). The quatrefoils, B (seen in section Fig. 11, B), appear to form part and parcel of the circles, or they may possibly be attached by welding; but there are no rivets apparent. It would be possible, by slitting the bar forming the circle, to bend round strips to form the quatrefoils; or alternately the quatrefoils might be prepared, each separately, and welded at the cusps, C, or prepared as a whole and welded to the circles. Short scarfed joints might be made, or butt-welds, the metal, perhaps, being upset a little for the making of a good joint, and the superfluous metal filed off afterwards. The cusps, C (Fig. 10), are apparently welded on to the points of the quatrefoils.

The circles of the panels are united to each other and to the standards and transoms (Fig. 10) by means of dogs, D, which must evidently be riveted into holes countersunk on the front face. There is no attempt to conceal these fastenings at the back—all are visible; but in the front the points of junction are all hidden by little rosettes or star-like bosses (Fig. 12, A), prepared separately, and apparently welded or dabbed on. Thus the necessary method of union is made an occasion for the introduction of ornament. In this respect the panels would lack the rigidity of a cast-iron structure. But the screen does not depend for rigidity upon the panels, but upon the framework. The bars of which the structure is composed form an overlapping and crossing series, one bar binding others, and all riveted together in detail.

Some idea of this crossing of bars and mouldings may be gained from Fig. 11, C, which represents the building up of one of the vertical standards. Note also in the hinder view of a portion of the arch of the gateway (Fig. 13), which belongs to the screen of Santa Croce, how the various parts are bound securely with rivets and "fish-plates" (if we may use the term), while a stiff bar riveted right across ties the sides together, and affords a rigid backing for the mouldings.

We note also how the aim was to simplify the details of construction as far as possible consistently with the strength and beauty of the design. In no case is a moulding formed on a main bar where it can be formed equally well on a smaller supplementary bar. Not only in the larger sections, but also in the very smallest, such as those forming the tracery of the gate (a portion of the back of which is seen in Fig. 13), the mouldings are formed on bars distinct from those which constitute the skeleton, or light backing, or framework itself. This is the more noticeable as in all the tracery-work the mouldings have to be bent to such curvatures as would make them precisely concentric with their plates, so that the same margin of edge would show all around when the moulding and plain bar were bent and riveted together.

Thus in Fig. 12, B shows the section of the moulding of the portion A in Fig. 13, and Fig. 12, C, the section of the portion B in Fig. 13. To us, with our rolling-mills ready to turn out almost any sections to order, this method of bending mouldings and their bars distinct would appear a sad waste of time and labour. All the more reason why we should honour the men whose skill conquered the difficulties of hand work, and produced such beautiful examples of simple handicraft.

A beautiful example of a bit of work which must have occupied a vast deal of time is seen in the ribbon of the twisted shafts of the gates. A portion of one of these shafts is seen in Fig. 14. This twisting is prepared as a moulding, seen in section, Fig. 12, D. The centre piece of the shafts is a round bar, and the mouldings being bent around this, and meeting square edge to square edge, give the twisting whose effect is so beautiful. How many times one of these bars must have gone into the fire, how very many minute settings must have been required before the precise amount of twist was obtained, all kinks removed, and the ribbon-like moulding made not only to fit closely around the central bar, but also against the contiguous ribbons, three of which were required to complete the twisting, like a triple-threaded screw!

The more closely we look into these works, the more we see to admire. They are like great paintings: the more prolonged the study, the more vividly do their beauties impress themselves upon our mind.

It must have been a most tedious operation to build up an elaborate piece of work like the screen and gate, bits of which are seen in Figs. 10—14. Drawings, templets, swages, dies, must have been made, and every bit of iron must have been wrought upon the anvil, and between swages to its proper section, before any of the more artistic work was done. Probably some of these repetition tasks may have been allotted to subordinate and younger workmen. Though much of the beauty of some of these structures is largely due to their light appearance, yet a closer study reveals the fact that constructive strength has not been sacrificed. In some details we seem to meet with unnecessary mass. Many mouldings that we should stamp out of sheet-iron are formed in solid bars. And this, it must be remembered, was the practice at periods when iron was very precious, and every bit used was smelted with wood charcoal.

A curious illustration of the value of iron appears in a French book, written by one Mathurin Jousse, bearing date 1627, in which he advises the aspirant to begin to forge things in lead, so as not to waste coal and iron in his first attempts. By the way, I cannot see wherein the wisdom of this advice consists, or how the bending of lead can in any way aid in acquiring the knowlenge of how to bend iron. But in the Middle Ages iron was very dear, and was sold in bars of about four pounds weight each. Steel was about four times dearer than iron—in England at least, and probably also abroad. These bars were usually purchased at the great fairs; and on the farms the bailiff kept them in stock, and served out the quantity required by the local smith to fashion what was needed. It was owing to the great cost of iron that cart wheels were frequently cut out of a solid trunk of a tree and unprotected with iron, and that oaken pegs were substituted for those of iron in the rude harrows of that period. Spain was the principal source of foreign iron. Because of its cost it was chiefly reserved for ecclesiastical service, and for arms and armour.

There must necessarily have been many months of labour expended on such tasks as these screens and gates before any considerable show of erection was made.

Long time must have elapsed ere the conception of the artist began to grow into shape. Impatient these artists must have been sometimes to see the realisation of their ideas; but they were, nevertheless, severely careful not to let "raw haste" become "half-sister to delay." Every portion was carefully secured, each minute detail finished, as though that alone were the object of their care; and strength as well as beauty were regarded.

Identical methods were not followed in works of the same class. In some grilles the quatrefoils were made in bar-iron, bent and riveted together, as in that of Santa Croce just noticed. But in others a simple method was followed. Thus a grille in the railings which enclose the monuments of the Scaligers at Verona is made of sheet-iron. The quatrefoils are cut out of the sheets and riveted to each other. This was a cheap method, and lacks the strength of those made of twisted bars. The effect is, nevertheless, very pleasing. An excellent example of the method of building up with solid bars is shown in Fig. 15. This represents a portion of the framework of a grille of fourteenth-century date in the Chapel of the Palazzo Publico, Siena. The section (Fig. 15) is seen to be composed of five plates symmetrically arranged. In two the edges are notched for ornament.

There are some comparatively recent screens made by one

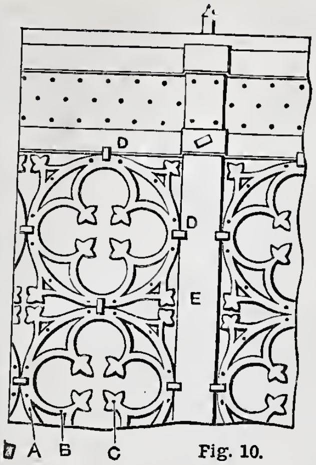


Fig. 10.

Fig. 13.

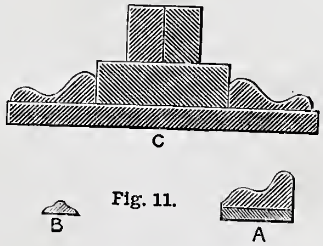


Fig. 11.

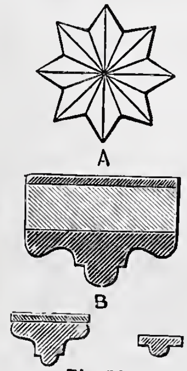


Fig. 12.

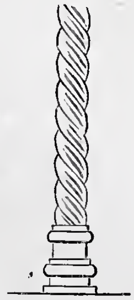


Fig. 14.

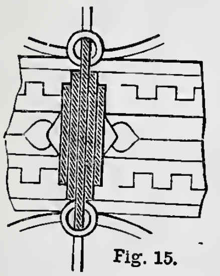


Fig. 15.

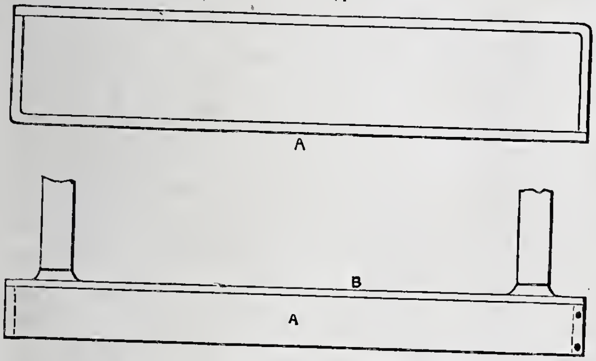


Fig. 16.

Fig. 20.

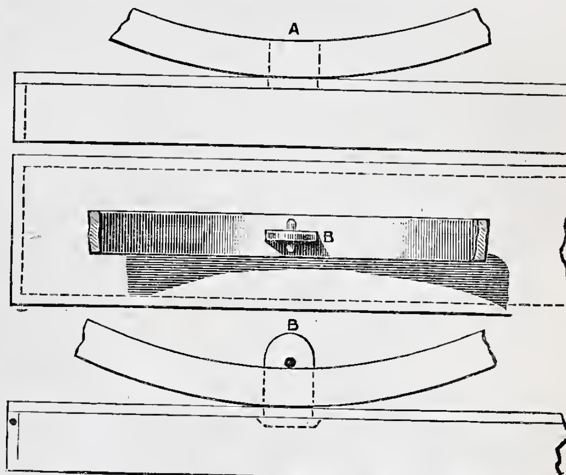


Fig. 17.

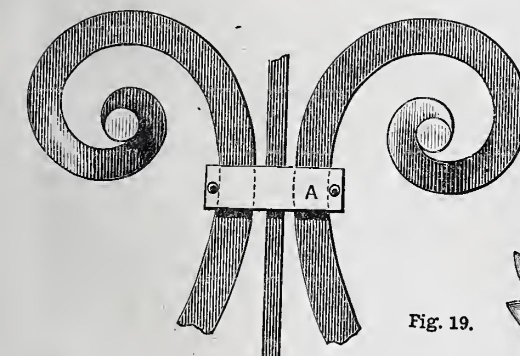
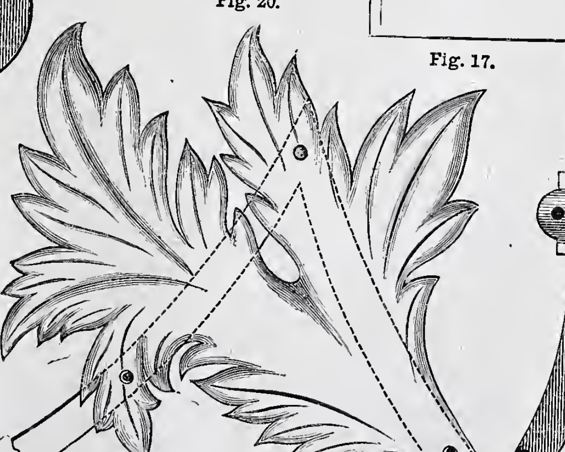


Fig. 19.



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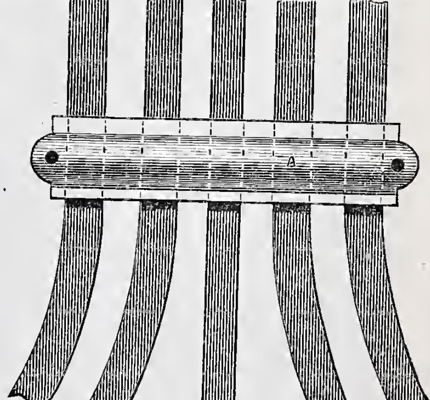
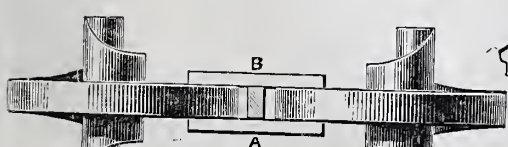


Fig. 18.



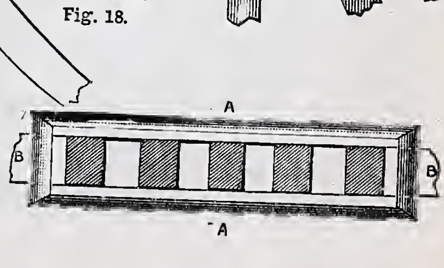


Fig. 10.—Quatrefoils of Screen, from the Church of Santa Croce at Florence, seen from the back. Fig. 11.—Details of Fig. 10. Fig. 12.—Sundry Details. Fig. 13.—Portions of Head of Gateway in Screen of Church of Santa Croce. Fig. 14.—Portion of Shaft of Gateway of Screen. Fig. 15.—Framework of Grille in Section. Figs. 16-21.—Various Details of Screens by Huntingdon Shaw.

Huntingdon Shaw, a blacksmith of Nottingham, about 1695, for dividing the gardens of Hampton Court Palace from the Home Park, which are now in South Kensington Museum. Their appearance is more attractive when viewed from a distance than when examined closely. There is a vast deal of work put into them; yet for excellence of finish they cannot compare with some of the mediæval screens. This is largely due to the action of the weather upon them, and to general neglect. The wealth of foliage with which they are covered is marvellous. From these screens I have taken a few illustrations, showing the method of union of parts, and with these I must conclude this article.

The heavy-looking horizontal bases, measuring about four inches square, are really made of comparatively light plates, bent round and riveted at opposite corners (Fig. 16, A). Upon these rest other plates, B, supporting the pillars, between which scroll-work is carried. Some of the larger scroll-work is united to the bases in the manner seen in Fig. 17. A broad thin tongue, or tenon, B, passes from the base through the scroll-bar, and is secured with a pin. In some cases the tenon only is used (Fig. 17, A), without the pin. Where a number of bars are running parallel for a little way previous to diverging into scrolls, they are united with a band or loop (Fig. 18, A). The loop, being large, is then made of four pieces, each of nearly semicircular section, and riveted at the four corners. Fig. 19 shows the union of three pieces with a riveted loop, A, B, and also the spreading outwards of the terminations of the scrolls. Fig. 20 shows leaves partly encircling the bars, and united thereto with rivets; and Fig. 21 shows broadly-expanded leaves spreading over the bars and riveted thereto, and fluted as *repoussé* work.

WHY MY GAS-ENGINE WON'T GO.

BY F. A. M.

Lubrication of Gas-Engines.

Is any one ambitious to make a gas-engine? Castings may be bought, and the work is not very difficult to one who understands and can make a steam-engine. The gas-engine, however, is not so well understood as the steam-engine, and many who have undertaken to make one have failed to get it to work, and have had to sell it as "partly fitted." I have made a model gas-engine, 1½ in. diameter, by 4 in. stroke, and it goes pretty well. I had to look up the subject, and found some difficulty in getting the information required, especially certain practical directions, simple enough when you know them, yet not contained in any book with which I am acquainted.

My first intention was to write a paper on "How to Make a One-man-power Gas-engine;" but I find the cylinder of this is rather large, and the crank shaft too large to be turned upon a 5-in. lathe; and, altogether, the amateur would probably have to get a good deal of the work done for him. Having applied to the maker of my engine for leave to publish working drawings, I could not obtain it; instead, therefore, of describing the construction of any particular gas-engine, I intend to try to give a few practical hints such as I found the want of myself, which may, perhaps, be useful, not only to those who have made gas-engines and cannot get them to work, but to those who have bought a gas-engine and find it "so uncertain."

Beginning at the beginning, I will deal only with the *non-compression*, or simplest form of engines; their action is briefly this: the fly-wheel must be turned by hand to draw the piston partly up the cylinder; the exhaustion underneath the piston opens valves over the air and gas inlets and sucks in both air and gas; besides the valve on the gas inlet, there is also a cock, which enables the quantity of gas to be regulated till it becomes about one-tenth of that of the air. Having thus drawn in the explosive mixture by raising the piston about two-fifths of the stroke, the piston, continuing to move, uncovers a hole made through the side of the cylinder, called the ignition orifice; from this moment the piston draws in at three places instead of two. Now, the ignition orifice is covered by a little hanging flap valve which opens inwards, and against the outside of this orifice there plays a constant flame. The moment, therefore, the piston passes the ignition, the suction of the piston opens the little hanging flap and draws in flame; the flame ignites the mixture of gas and air in the cylinder, which instantly becomes full of blue fire, the heat of which expands, momentarily, the contents of the cylinder and throws up the piston. All that remains of the cycle of operations to complete the revolution is, that as the crank turns the upper dead-centre and begins to come down, a valve must open to allow the burnt gases in the cylinder to escape; this is simply managed by an eccentric and slide valve.

For the sake of my younger readers, I may say that gas alone will not explode any more than pure air will; if you could strike a match inside a gasometer, it would simply go out! If you could introduce a jet of air into the gasometer, and light it, the air would burn in the gas, just as we now see gas burning in a jet in our rooms. What we call "burning," is simply the rapid combination under heat of anything with oxygen; thus the flame appears, and the burning takes place where gas and air meet and heat is applied. Air contains oxygen. Now, there are two ways of burning gas. One is to mix together the gas and air gradually, applying heat all the while; this is what takes place when you turn on the gas tap and apply a match to the burner; the gas mixes with the air of the room, the application of the lighted match supplies the heat sufficient to cause the rapid combination we call burning, and afterwards the combination is effected by the heat of the flame itself. The other way is to mix the air and gas in the proper proportion and then apply the heat by a light; this causes the combination to take place all over the mixture at once; it is just what occurs when a tap has been left on at night, or an escape has occurred, and the gas has gradually mixed with the air in a room; in the morning, the servant comes in with a candle and—you know the result, there is a fearful explosion. Now, what has taken place? Simply this: the room was full of air and gas ready mixed—the flame of the candle lighted the whole mixture at once; it became full of flame, and increased in a moment by reason of the heat to three or four times its former volume; no wonder if the window was blown out! The room was converted for the moment into the cylinder of a gas-engine, whilst the window or door was the piston. Now, in the gas-engine, we produce a gas accident on purpose every revolution; the explosion gives one strong, but almost momentary, impulse; it occurs about the middle of the up stroke, driving the piston to the top of the cylinder, the connecting rod acting something like the leg of a man who should give the crank a good strong kick just at mid-stroke; this will show why the cylinder of a simple or non-compression gas-engine requires to be so much larger than that of a steam-engine of equal power.

It is only when combined in certain proportions that gas and air will explode. About six of air to one of gas is the richest mixture that will give an explosion; if more gas than this is getting in, the engine will not work, and you can find it out by putting a lighted match to the exhaust while turning the wheel; if you can light the exhaust, the engine is getting too much gas. About ten or twelve of gas to one of air is the weakest mixture that will give an explosion when uncompressed, but the explosions of a weak mixture are less powerful than those of a stronger mixture, so that when a governor is applied, it can, by cutting off some of the gas, weaken the explosion, or by cutting off more, stop the explosion entirely for one revolution or two, so as to bring down the speed to normal rate.

Speaking of my own experience with the model gas-engine, many seemed to think it impossible to get so small an engine to work at all, and it appears to be admitted that it is more difficult to make a little one go than one of one-man-power. However, after a few minutes spent in regulating the gas tap to give the correct proportion of gas, my little model went off at the first trial. After running with the cylinder quite dry for ten minutes or so, I tried oiling the piston, and then my troubles began. Nevertheless, I am glad of this now, for it was the means of teaching me many things I should not have known if all had gone well from the beginning.

This leads naturally to the first reason why the gas-engine may fail to go. It will not go long if the piston is oiled. The reason for this is very simple: the heat in the cylinder at the time of the explosion is considerable, quite enough to carbonise the oil, so that instead of a lubricant you have a black sticky deposit; you put more oil and the piston is free for a few strokes, when, alas! the same thing occurs and you have a thicker coat of gum to deal with. The only way to deal with it is to draw the piston and clean both cylinder and piston with paraffin. Instead of oiling the piston make a paste of paraffin and black lead, and apply this with a paint brush to the inside of the cylinder; the heat will quickly evaporate the paraffin, and the black lead will lubricate the cylinder.

Now comes the second hint. On coming back the next day to make further experiments with the gas-engine, it was found to be set perfectly fast; the wheel could not be turned, and both the piston and slide valve proved to be firmly fixed. This was caused by rust; there was nothing for it but to soak in some paraffin to dissolve the rust, disconnect the parts, and continue rapping on the piston and valve, adding more paraffin, till the parts were again free. This accident can be very easily prevented by putting a very little oil, *after the engine has done working*, to both piston and slide valve, and then turning the engine round three or four times, just to spread the oil upon the rubbing surfaces; it is well to wait a little while, to allow the cylinder to cool somewhat, before adding the oil.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

PRISMATIC LETTERS — ORNAMENTAL LETTERING — CHURCH TEXT — ILLUMINATED CAPITALS — MEDIÆVAL ALPHABETS — SCROLLS — PULPIT PANELS—ZINC.

THE last chapter concluded with a reference to the sunk or incised form of letter, but it was merely mentioned there in its plain style only, *i.e.*, as a square sunk letter. I had forgotten to say that in these letters the "depth" is here the same, or the equivalent of the "thickness" in raised letters, but in addition to this, there are the shadows and reflections which must have careful "putting in" to obtain the desired effect. I should also add that the light is best made to fall on the side visible to the spectator, which will, of course, be in the highest light and the opposite in shadow. As the letters are also often viewed from below, the revealed parts at top and bottom should also be in shadow, and also because the light principally strikes down from above.

Prismatic letters are another class of the incised series, but are of a more elaborate nature, and, consequently, harder to produce successfully. The great aim of the writer is, or should be, to deceive the sense of vision, and as this is easily done, he is but a poor workman at his chosen art if he fails. This deception of the eye is the one great principle which underlies the sign-writer's art, and it entirely depends upon its successful or unsuccessful handling whether the art workman becomes *facile princeps* at his craft or otherwise. It should be the sign-writer's greatest endeavour to secure this faculty, which, with adroitness, decisive will, and skill, is the making of any man in this walk of the minor arts.

I now leave the plain alphabet with which we have hitherto concerned ourselves, and turn my attention to ornamental and ancient letters, church text, etc.

The letters which form the various styles of plain alphabets comprise the groundwork for most of the ornamental and other alphabets, and if the student has fully mastered the earlier series of letters, he should by this time be ready to approach with success the more difficult combinations which a first-class sign-writer is called upon to produce. Mr. Callingham thus discourses respecting this item :—"It is here that the genius of the painter is most severely tested. In order to execute the comparatively simple forms of the Roman, sans-seriff, and Egyptian alphabets satisfactorily, great neatness and finish are demanded. The angles should be clean and true, the various vertical and horizontal lines straight, the parallel lines regular, and the curves well poised. A considerable amount of dexterity is necessary to attain perfection in these particulars, and it can only be acquired by much practice. But, beyond this, when the learner comes to the more difficult accomplishment of ornamental writing, he must familiarise himself with the general principles of design ; for obviously a good painter will not always rest content with copying the productions of others, however much they may have in them that is worthy of imitation." What valuable information and advice is this, and how it stamps the man as one who has his work thoroughly within his grasp and knowing also by what means it is to be—and has been by himself—obtained.

The great point to aim at in ornamental lettering is originality, and in this matter the field is practically boundless, there being really no limit to the forms which may be given to the alphabetic characters. At the outset, however, it is necessary to guard the beginner against an extravagant use of ornament. As a general rule, it should be simple rather than complex. And whatever style of embellishment be decided upon, care should be taken that it does not detract from the legibility of the lettering ; for, if it have this tendency, the result can scarcely be deemed satisfactory, as it must be borne in mind that the writing has to serve a practical purpose, to which in the great majority of cases the decorative accessories are subordinate.

The style of the lettering, too, must in all cases be in harmony, and upon this matter Sir Matthew Digby Wyatt, who took such an active part in the decorative work of the great Exhibition of 1851, remarks with special reference to form and period, that "there are few faults more common in modern work or more offensive to the educated eye, than the association of styles of lettering and styles of ornamentation warring with each other in the properties of both time and form."

When the pupil has become an adept in the plain styles of lettering, he will find it anything but hard to strike out a fresh departure and introduce fresh and graceful lines into these letters, ornament their faces, etc., and thus beautify them by several degrees. He may get many suggestions in this way from a type-founder's specimen book, and it is from these that the writer has always worked out and adapted any ornamental alphabets he may have required. I must point out, however, that it is only a slight proportion of printers' type designs that are suitable for sign-writing purposes, and these are mostly to be found in the ornamental founts. The specimen books mentioned only contain a few letters, generally a couple or so of complete words, and for those who are so backward in self-reliance as to need every letter of the alphabet, I must recommend the books sold for the special purpose. I have heard that the books of alphabets by Delamotte, and published by Crosby Lockwood & Co., are very useful, but strange to say, I have never seen them, much as I should like to; still, they ought to be in every sign-writer's library, so here they are :—1, "Mediæval Alphabets and Initials"; 2, "Examples of Modern Alphabets"; and 3, "The Book of Ornamental Alphabets." Messrs. Brodie and Middleton have also several books of a similar kind, from one shilling upwards, but these also I have never seen, so cannot recommend them nor condemn them. The alphabets given in the last chapter are specimens of ornamental letters, but there is another and even more comprehensive style, which is known simply by the name of "Ornamented." Other varieties are known as Open Ornamented, Open Tuscan, Classic, Runic, Rustic, French, and Italian, and the alphabets incidental to every century; but enough have been mentioned to illustrate the wideness of the field of selection and the scope for a suitable display in every direction. I have found it impossible to give as many alphabets as I could wish, but those which I have given I have distributed throughout my series of papers as far as I have found it practicable to do so, knowing as I do their great utility to the aspirant for sign-writing honours.

I have purposely left church text out of the above list, because it requires separate treatment at my hands, and I will now endeavour to compress as much useful information as I can into the small space left at my disposal. We all know the vast amount of work which is done in this direction within the walls of our churches, and I believe it is work of the highest remunerative description. Much of it I know borders on what is a separate department of art, *i.e.*, the art of illuminating, but I presume a good sign-writer can and does take up certain classes of this work, and if he does not, one may well ask, Why not? His previous training should eminently fit him for such work with very little extra study and preparation, and he may surely rely upon self-help and self-tuition as far as it is needed. I can only say that if the young sign-writer takes up this branch of decorative art, it will be the means of considerably augmenting his income, and it is for this reason I am urging him to give it his most intelligent consideration.

For inscriptive texts in churches, etc., the use of illuminated capitals (see Fig. 74, G) and mediæval lettering (see alphabet, Figs. 72, 73) is now much in vogue. For ordinary purposes on plain painted walls, Scripture texts should be painted on the walls in two colours only, the capitals being red, red and black, or blue, and the small letters either red, blue, or black.

Of course, the colouring may be done in such suitable tints as would stand out best against the ground colour on the wall, but as stone colour is generally employed when a wall is painted, which is seldom, the plain colours look the most substantial and the best. I may say that walls are seldom painted; when they are, they are frequently treated in the polychromatic style of decoration, which is so noticeable a feature in many of the college chapels at Oxford and Cambridge. Here the lettering, of course, is more showy in order to be in keeping with the rest of the decoration. In employing the mediæval alphabets, it is necessary to make use of the various old style space ornaments and accessories (Fig. 74), such as quatrefoils, dots single and in clusters, stars, etc.

We frequently see in church texts each word divided with these ornaments or stops, which is, of course, a violation of punctuation, but as this was the method adopted by the olden time illuminators, it is still slavishly followed by modern members of the craft.

In this class of lettering, great care has to be taken not to mix the letters of one alphabet with another in the same inscription, or even in the same word, which is very apt to occur where the student has been practising with a great many alphabets of all dates and countries. To avoid this, he should always carry his specimen books —some of which should be of home manufacture—for ready reference.

I must warn the student against employing any alphabets antecedent to the twelfth century, as these are not intelligible to the majority of modern readers. Celtic and Anglo-Saxon characters the writer may have in his book, but only as curiosities and not for everyday use. He may, perhaps, require them when lettering some archæological object, and that is about all.

The great point to consider in church lettering is what alphabets to employ which shall be both readable and appropriate to the scheme of decoration in hand. Mr. W. Sutherland remarks that "Our ecclesiastical decorators are too much in the habit of stultifying themselves by using these unreadable letters simply because the same letters were used in certain manuscripts

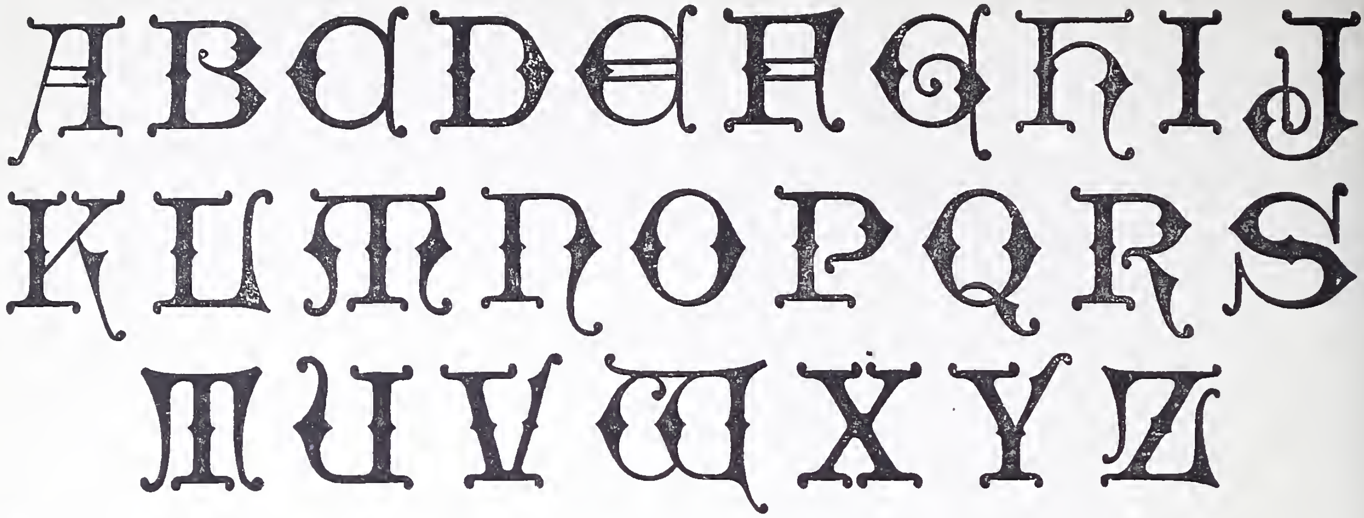


Fig. 72.—Mediæval or Church Alphabet: Capitals.

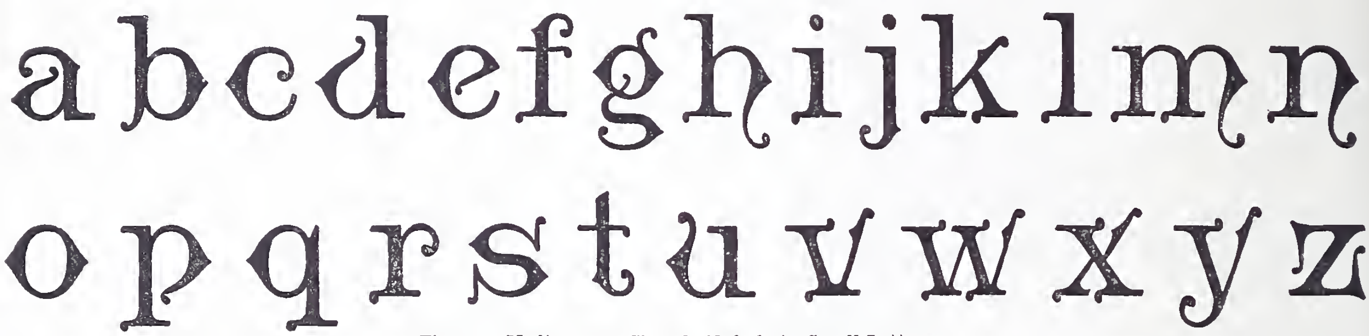


Fig. 73.—Mediæval or Church Alphabet: Small Letters.

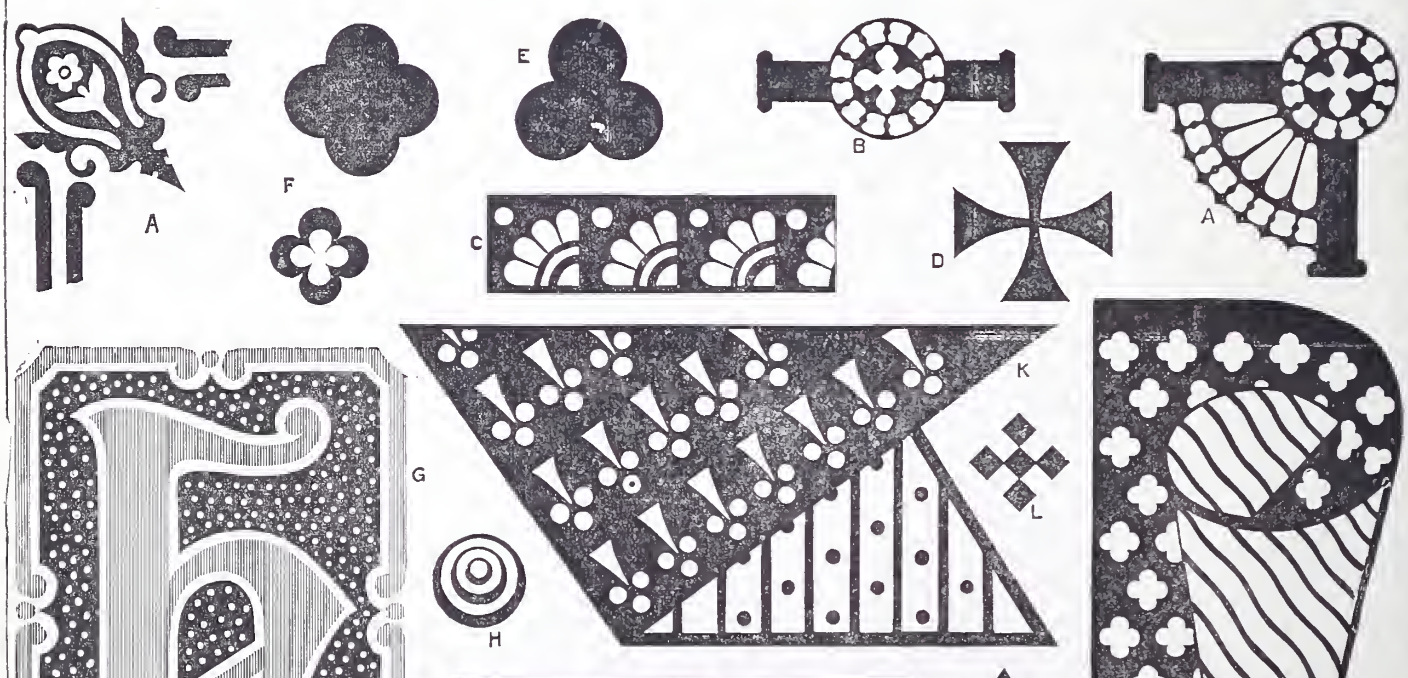


Fig. 74.—Ornamental Lettering and Ornaments for Church Work—A, Corners; B, Centre; C, Border; D, Maltese Cross; E, Trefoil; F, Quatrefoils; G, Initial Letter; H, Circles; K, Ribbon End; L, Diamond Cluster; M, Cross; N, Star (in Heraldry a Mullet); O, Tablet End; P, Scroll End.

and certain churches at a certain period, and they consider any departure from this plan as a move in the wrong direction, forgetting, or, if not forgetting, ignoring the fact that at the time these letters were used in our churches the mass of the people were ignorant of reading and writing, and that it was only the learned, who were few and far between, who could read or interpret these inscriptions." In these days, when all can read and write, we want inscriptions that are decipherable by all, and this these obsolete alphabets are certainly not.

As much text lettering is frequently done upon zinc in the shape of scrolls, pulpit panels, etc., I append a receipt for the preparation of the zinc previous to painting.

To prepare zinc for painting upon.—In sixty-four parts of water, dissolve one part of chloride of copper, one of nitrate of copper, and one of sal-ammoniac, and add one part of commercial hydrochloric acid; brush the zinc over with this mixture, which gives it a deep black; leave it to dry for twenty-four hours, when any oil colour will firmly adhere to it and withstand both heat and damp. I am sorry that space will not enable me to give examples of these scrolls and panels for church decoration.

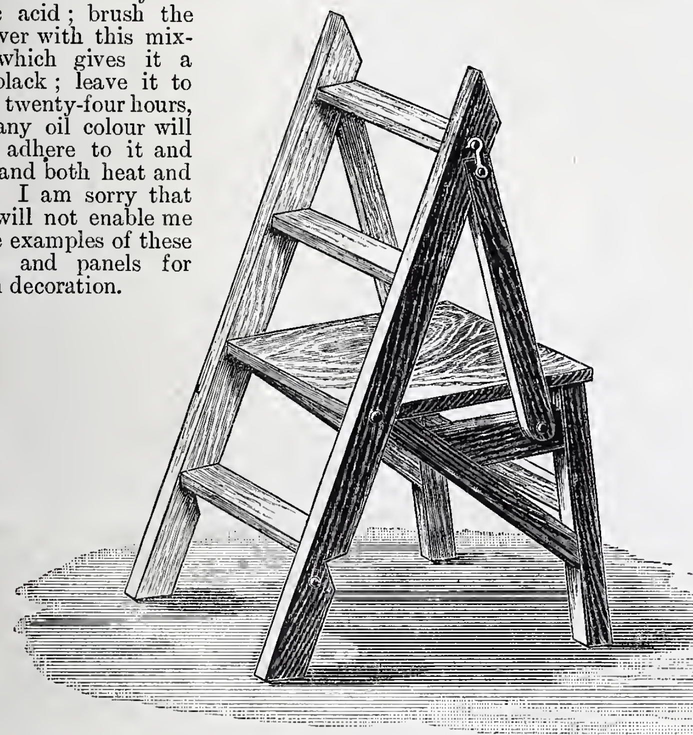


Fig. 1.—Step-Chair in Position for Use as Steps.

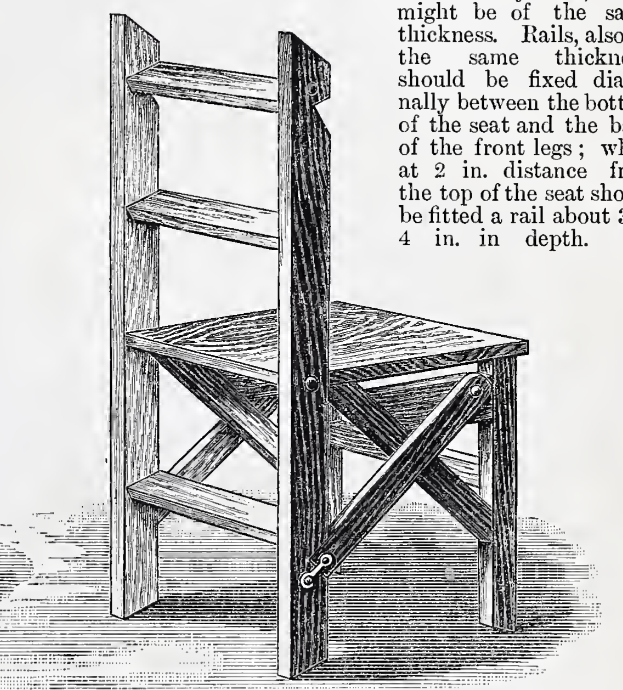


Fig. 2.—Step-Chair in Position for Use as Chair.

A STEP-CHAIR.

BY J. SCOTT.

EVERYONE knows what a step-chair is. It is a combined chair and pair of steps. For the library, such an article is of very great use, although much cannot be said in praise of its appearance, as the demands to be attended to in designing an article of this kind are such as prevent the introduction of curves; without which, beauty or prettiness can scarcely be obtained.

It is very often difficult to fathom whence a designer obtains his original ideas; they sometimes seem to spring from nothing whatever. In most of what are called original designs, nowadays, some feature or another is traceable to previous designs; and designing may now be said to consist of combining to advantage the improvements and most pleasing features that have developed from other men's minds, when there was a freer field for their imagination.

Whoever was the original designer of the ordinary step-chair—which is about the only one at present in the market—he could scarcely have had any suggestions from articles previously made, and the present result must have been one of those freaks of the mind that are frequently experienced by those who give up much of their time to designing.

My drawing shows a step-chair which, although I can claim a certain amount of originality for it, is merely a suggestion from that at present in the market. It has, however, a few advantages over its elder brother, and these are: that it requires hardly so much time, labour, and material to be spent upon it; and, although it may not be quite so compact and solid-looking an article as its relative, if made well, and in sound wood, it ought to be quite firm and substantial enough for its purpose. If any amateur reader intends to make one after this pattern, I should strongly advise him to go to some well-known and reliable wood-yard for his material, as, otherwise, some may be palmed off upon him which would be utterly worthless. I should, indeed, feel very sorry if I were to hear that one of our numerous friends had suddenly collapsed with the chair, while he was on the top of it reaching down some interesting book. I am afraid such a calamity would upset his desire for book information for some time, and also bring upon my head some undeserved accusations.

But it is not to be denied that great disappointment sometimes follows the purchase of what is apparently good sound wood. Not long ago I was watching a professional friend working up the back-foot of a chair with his spokeshave, when he suddenly came upon a very great defect, which was previously hidden from view. Of course, such things cannot be helped at times; but the chances of buying bad stuff are greatly lessened by going direct to a well-known firm.

In the article here shown, besides having good wood, it is a very essential thing to have thick and strong iron, steel, or brass pegs, to act as pivots upon which the back and side rails revolve.

Now for the sizes.

The length of each back-foot is 38 in., the width 3 in., the thickness 1 in. The bottom of each will have to be cut on the cant, so as to afford a firmer support for the job when used as steps; and for appearance' sake, the top as well might be so cut. The seat will be 18 in. from back to front, and 15 in. wide. It would be best, perhaps, if it were thicker at the back part than the front; say $1\frac{1}{2}$ in., and the front 1 in. It will then allow a sufficiently strong and stout peg to be driven into it. The front legs will be $1\frac{1}{2}$ in. square in thickness, and the sides of them must come flush with the sides of the seat; otherwise, the movable rail will not be able to work. It will not be necessary, however, to have them quite flush with the front of the seat. These two legs should be connected by a rail, which might be of the same thickness. Rails, also of the same thickness, should be fixed diagonally between the bottom of the seat and the back of the front legs; while at 2 in. distance from the top of the seat should be fitted a rail about 3 or 4 in. in depth. My reason for having this last-mentioned rail so deep is on account of the weight that will be brought to bear upon it. It will no doubt be seen that I show the pivot more towards the top than the centre or bottom, where it will be firmer.

Between the two back feet we have three steps, the seat forming the fourth. These steps should each be 15 in. long, and about 4 in. wide, by $\frac{3}{4}$ in. thick. They should be so fixed as to be in an horizontal position when the article is used as a pair of steps. Stout iron pegs should pass through the back feet, and penetrate the seat for a few inches; these are the pivots upon which the back feet work.

We now come to the movable side rails. These must be 16 in. long, $1\frac{3}{4}$ in. wide, and 1 in. thick. They work upon pivots which pass through them into the side piece, as I have shown in the drawings. Two notches must be cut in each back-foot, to admit the end of one of these rails. It will be best if the cutting of these notches be left until all the rails, etc., are cut out; their exact position can then be the better ascertained. A hook should be fastened, to work loosely, to the end of each of these rails; and an eye or nail fixed above the top notch, and one below the bottom. The steps will have a firmer support, perhaps, if the bottoms of the front legs are slightly canted inwards.

Allowance must be made in my measurements for joining, which will require a great deal of attention; as, unless well joined, it will soon become shaky.

Such a chair as I have just described is not a very comfortable one to sit in; but comparative ease can be obtained by using a cushion. This cushion should be made long enough to cover the back and seat together; and one end should be fastened to the top of the back feet, while the other is secured to the front of the seat, so that it hangs something like a hammock, only, of course, fitting more closely to the form of the chair. If this is done, it will be found that the cushion will in no way prevent the chair from working, as it will only be necessary to pull the middle of it up from the seat and back. Here, then, is another advantage, as a cushion cannot be so well adapted to an ordinary step-chair.

Thus I conclude my remarks of the step-chair; not "a thing of beauty, and a joy for ever," but a thing of ugliness, and of use for—not ever, but a long while.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

Mounting in Cells — Semi-Opaque Objects.

Mounting transparent and semi-opaque objects in cells is the only subject which now remains for consideration. Cells, as we already know, are used for the purpose of preventing the object from being subjected to pressure, and so crushed out of shape; but, as in the case of dry mounts, so with transparent objects—it is especially essential that the cell chosen should be of the right thickness. This is even more important in the latter than in the former case, because if the mounting medium used is a fluid, the object is exceedingly apt to slide about in the cell if the cell is in the slightest degree too deep.

The choice of materials for the cell walls is also more limited, as it is always necessary to make the cell wall of a material which is not porous; if it is, the medium will, of course, leak through it.

Books on the microscope recommend, in many cases, "built up" cells—that is to say, cells built up of slips of glass cemented together on the slide, but for practical purposes these are never required, so we will not refer to them further. I have always found the ordinary vulcanite or glass rings amply sufficient for any ordinary purpose, and if I have found it necessary at any time to use an exceptionally large cell for any particular purpose, I have cut one out of a piece of good sheet indiarubber and cemented it to the slide.

For cementing the cell to the slide, marine glue is, perhaps, one of the best cements to use, and in order to make the cell walls quite impervious, they should be coated with a thin layer of gold size after the cell is fixed on to the slide. The coating should extend just over the outer and inner edges of the glue.

Marine glue is, however, at times, somewhat difficult to work with, and I have found very useful the cements sold for sticking glass together (compounded mostly of isinglass and acetic acid).

The media used for mounting in cells are the same as before: viz., Canada balsam, gum dammar, glycerine jelly, Farrant, glycerine, and dilute glycerine; but it is particularly necessary in using Canada balsam to dry the balsam very thoroughly before dissolving in chloroform. Again, in using balsam, it won't do to use cells fastened on with marine glue, because the chloroform will act on the gold size and glue and spoil the mount. Cells fastened on with isinglass cement should be used with this medium, and after placing the object in position, it should be covered with a watch-glass and put aside, to allow the chloroform to evaporate, then more balsam should be added until the cell is quite full of hard balsam, when the cover glass may be applied in the manner described hereafter. Balsam labours under a great disadvantage, in so far that it is difficult to get it sufficiently hard and dry before applying the cover glass, and the result is that, after the cell is nicely varnished and put aside as finished, some fine morning you will find that the cover glass has cracked across or collapsed in the middle, which mishap has been

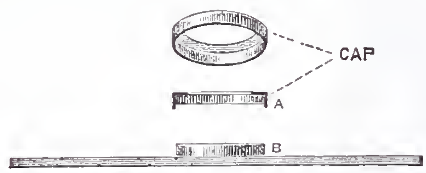


Fig. 4.—Cap for securing Cell.
A, Metal cap (in section), fitting exactly over cell wall, B.

brought about by the contraction, through further drying, of the Canada balsam.

Many of the fresh-water algæ, such as *Batrachospermum*, whose beauty is much impaired by pressure, look exceedingly well when mounted in a cell in glycerine jelly. They should be prepared by soaking in strong glycerine for a day or two previous to mounting, and as, in some cases, objects of this class are too fragile to stand even the slight amount of heat required to melt the jelly, they require to be mounted in glycerine alone, with a trace of carbolic acid, or even dilute glycerine, consisting of about equal parts of distilled water, pure glycerine, and a few drops of pure carbolic acid. It is here that the great difficulty comes in.

Glycerine, as we know, easily mixes with water, and therefore readily unites with most animal and vegetable secretions, but, for this very reason, has the disadvantage of interfering very materially with the effectual sealing up of a cell, because neither glycerine nor water will unite with anything of the nature of turpentine; consequently, if there is the slightest trace of glycerine or water in the top of the cell wall when you come to ring the slide with gold size, the gold size will not adhere at that point, and the result, sooner or later, will be a leak, which is undesirable. On the other hand, it is impossible to use a spirit varnish, because the spirit would run in at once.

The following very ingenious method of getting over the difficulty has been devised, I think, by Mr. Enoch :—

A small metal cap (see Fig. 4) is made to fit exactly over the top of the cell, and when the cover glass is in position, and as much of the medium as possible wiped away, particularly from the top and edges of the cover glass, a layer of gold size is applied to the edges of the same and the top of the cell wall, and then the little cap is placed over all. This holds the cover firmly in position, and the slide is placed on the turn-table, and a good layer of cement applied to the outside of the whole. If this is carefully done, and good gold size and indiarubber cements applied alternately, an exceedingly strong and neat cell is the result, and there need be no fear of breakage. As I have said before, the great thing is to see that all trace of glycerine or water is removed before applying the varnish.

Now concerning preparation and manipulation:

From the very nature of the case, objects suitable for mounting in cells cannot require much preparation. They must be altogether or almost transparent, to begin with, or, at any rate, quite capable of being easily rendered transparent by the ordinary methods of maceration in water, caustic potash, or soda.

Vegetable preparations will not, of course, stand much of this treatment; nor do they require it. Soaking in glycerine before mounting is usually sufficient, but preparations of insects, or portions of them, require careful and discriminating treatment.

Some of the very dark Coleoptera with hard carapaces require soaking, or even boiling, in strong potash or soda before being fit for mounting; others, again, with softer coverings, require only soaking. For some insects, again, the re-agents referred to are too strong, and pure carbolic acid must be used, and for others even this is too strong, and the carbolic acid has to be diluted with glycerine. This last method is the one used for preparing specimens of insects in their natural form and colour without pressure, and by it some very beautiful results may be obtained—the object being, after preparation, mounted in dilute glycerine.

It is often extremely difficult to get the object (say, the head of a bee or wasp) firmly fixed in the cell so that it will not move about, and this, no matter how careful we have been in selecting a cell of the right thickness. This defect may be remedied by taking a piece of glass tube and drawing it out to a thread. Now take a piece of this thread just the breadth of the inside of the cell, and stick it right through the object from side to side. If the ends of the glass thread are now placed against the inside of the cell walls, the object will be securely fixed in position, and a source of annoyance removed. The glass thread, when immersed in the medium, is not in the slightest degree unsightly, nor is it in the way.

It is far more necessary to be careful to exclude air-bubbles in mounting in cells than when mounting in the ordinary way, because they cannot be squeezed out. Hence, after filling the cell with the mounting medium, its interior should always be carefully examined, and if any air-bubbles are found adhering to the bottom or sides, they should be removed with the point of a needle. Again, as to filling the cell. There should be just enough medium in it to form a slightly convex surface when the object is immersed, and the object should be allowed to remain in the medium for a few minutes before applying the cover glass, in order to allow any air-bubbles that may be attached to it to rise to the surface. These should then be removed, and then the mount may be completed as follows:—

Take a clean cover glass—warmed, if the medium is Canada balsam—and, allowing the right-hand edge to rest gently on the p of the cell wall at the left-hand side, ish it gently forward until it touches the edium. If there is the right quantity of edium in the cell, the cover glass will now itself go into position by the force of pillary attraction, and all that is necessary rther is to squeeze out superfluous medium y gently pressing the top; clean it away, pply the varnish, then the cap, and after rther varnishing and drying, the mount is omplete. It is only necessary to add that a all microscopic work cleanliness and neatess are great desiderata.

OUR GUIDE TO GOOD THINGS.

** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

23.—Griffin's "Ideal" Combination Paper Knife, Eraser, and Envelope Opener.

Mr. Griffin, 5, Wisteria Terrace, Chapel Road, Stamford Hill, London, N., has sent me a very nice-looking and useful article which takes the form of a penknife, but whose handle is so cleverly contrived and fashioned that it will act also as a paper knife and an envelope opener. It is known as Griffin's "Ideal" Combination Paper Knife, Eraser, and Envelope Opener, and is sold at 2s. Its shape and make may be gathered from the illustrations given, Fig. 1 showing a back view and Fig. 2 a side view of the knife. Its length from end to end is 4 in., and its greatest width ⅝ in. The handle is made of a solid piece of ivory wedge-shaped in form, being sawn through from the top, which is rather more than $\frac{5}{16}$ in. thick, for 2¾ in. of its length to admit of the introduction of the blade and spring. The length of the handle admits of its being shaped at the thin end, as shown in Fig. 2, the form thus given to it being convenient for opening the envelopes of letters by inserting the point under the fold on one side, and pushing it along the top, which is

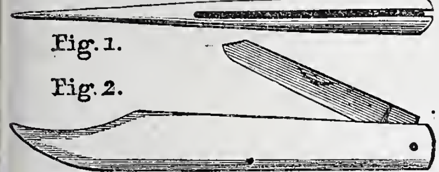


Fig. 1.—"Ideal" Paper Knife: Back View. Fig. 2.—Side View.

ripped open by the pressure of the wedge-shaped point. The blade is wide and stiff, and of a shape well adapted for erasing or scratching out. The handle of the knife is marked with a trade mark of peculiar form, consisting of a diamond surrounding a square on which is marked the word "Ideal," a black diamond being placed in each corner of the square, two sides of each of the small diamonds being coincident to a certain extent with the sides of the large diamond, the ground of which is white. This trade mark is the distinguishing feature of Mr. Griffin's inventions, all of which are therefore known as "Ideal" articles. Among them I may be permitted to mention the "Ideal" Patent Adjustable Perpetual Calendar, the "Ideal" Date Table, now preparing for publication, the "Ideal" Revolving Box Cover, and the "Ideal" Parallel Ruler. I have an early copy of the "Ideal" Date Table before me, a table showing the day of the week on which each month commences, and also giving a complete calendar for any month from A.D. 1797 to 1955. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

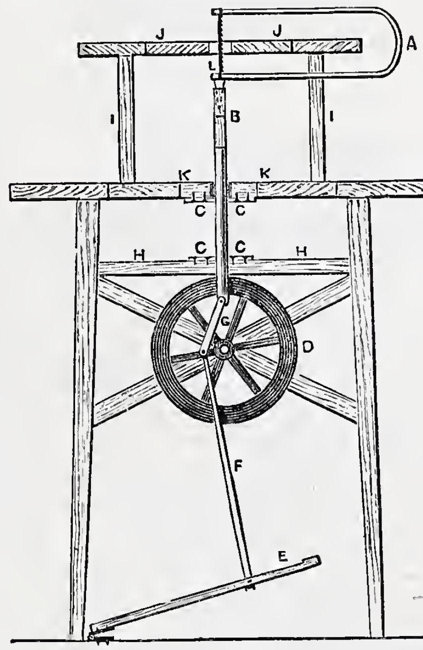
NOTICE TO CORRESPONDENTS.

** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

An Easily-made Fret Machine. — F. D. (*Luton*) writes:—"In No. 21 of Work, on page 332, I noticed an easily-made fret machine (?), which claimed certain recommendations to the amateur—namely, a vertical stroke, easily constructed, and could be made for a few shillings. According to the design, they were all false claims, at least, in my opinion, and I should guess that from the letters which have recently appeared in 'Shop,' asking an explanation, I am not the only one of that mind. However that may be, I am glad it appeared, as I had long wanted a fret machine, and it



An Easily-made Fret Machine.

gave me an idea which I now propose to give in my turn to the readers of your paper. My easily-made fret machine has, I believe, a just claim to the above recommendations, as the illustration will show. First a table or bench is made, and it will be best to make it of such dimensions that it will be at once a bench and saw combined. The sawing apparatus will of course be at the end of the bench. The cross pieces which support the wheel will next be fixed, and then the shelf, H, which if run the entire length of the bench will serve as a shelf and bearing for the rod, B, at the same time. The shelf, H, and top of the bench, K, have each an iron plate fixed to them with a hole bored to let the rod, B, work in. The table, J, is next made, and fixed by means of four pieces of wood about 2 inches square to the top of the bench, so that it is quite firm. It has a hole about an inch in diameter bored in it to allow the saw to work in. The wheel is then fixed in such a way that it can revolve freely without rocking. Next the crank, F, is fixed. Suppose the saw is 5 in. long, and the thickness of the table, J, ¾ in., the screw of the top of the crank, F, must be 2 in. from the centre of the wheel. That will give 4 in. throw, and if the table, J, is ¾ in. thick, a quarter of an inch will be allowed between the top of the table and the under side of the top part of the saw frame. The crank, F, is not fixed direct to the rod, B, but is connected with it by a smaller crank, G. This apparatus gives a perfectly vertical stroke, and I believe is altogether what I claim for it—namely, a good machine at a moderate price. The rod, B, is a brass tube, and is flattened, drilled, and tapped to receive the screw which connects the crank, G, to it. The upper end is filled with a piece of wood to hold the end of the saw frame."

Cheap Hearth for Smithing.—Worker Bee (*Hertford*) writes:—"I would like to say a word of congratulation to A. H. (*Wolverhampton*) for the excellent hearth he has given us on page 556, and to point out to him, as well as A. S. (*Liverpool*), that his blast will be far more effective if the pipe marked 'A, Fig. 7,' is made slightly tapering all the way from the mouth of the fan to the nozzle of the tue-iron. I knew a chap who rigged up a nice little forge, but could not get it to go until he had made this alteration."

Band Saws Breaking. — Worker Bee (*Hertford*) writes:—"A. R.'s (*Scorrier Saw Mills*) remarks always attract my attention, because he not only knows what he writes about, but also, like myself, is a 'Cousin Jacker.' All the reasons he gives for band saws breaking are good and, I fear, too true, but in my experience the most fruitful cause of breakages is when the wood from various causes (such as the plank being warped or hollow, as it frequently is) does not lay 'dead' on the table at the exact spot where the saw passes through it. The plank vibrates or 'chatters,' as we term it in the mill, more or less, and the probability is the saw snaps before it has cut sufficiently far to allow the plank to lay flat on the table again. I was about to say a few words on polishing cutlery, and one or two other matters, but must refrain, or I shall be dubbed a *multum-in-parvo* critic."

Model Yachts, etc. — Nautical (*Waterford*) writes:—"As Oxygen surmises, articles in designing and building model yachts that will sail well will interest others besides him, and will, I think, extend the circulation among the younger members of the fraternity. Model yachting is not such child's play as it may seem, and is a healthy as well as pleasant pastime—a consideration to some who are engaged in workshops, etc., during a long day. I hope to see designs and hints for building or making a good racing model soon, and wish you every success with your magazine."

Cabinet for Fretwork.—F. P. (*Bath*) writes:—"I was forcibly struck with the beauty of Mr. Gleeson-White's design for a cabinet in fretwork in your first issue of Work, and determined, sooner or later, to attempt its construction, but as no hint was given as to the thickness of the wood to be used for the purpose, I decided to wait awhile, hoping that some brother amateur would lay before you the result of his labour so that I might glean some information for my guidance. In a subsequent number (6) T. F. seems to have undertaken it, but failed to produce the desired effect, owing to his having employed too thick a wood. Having some very old dark oak panelling by me, I had them planed down to ⅛ of an inch thick, and then commenced cutting out the pattern carefully traced from Mr. Gleeson-White's design. On the completion of the pieces for two cupboard and four drawer fronts, I procured some mahogany ⅛ in. thick for backing, and, adopting Mr. White's suggestion, gave each piece of mahogany three coats of white enamel paint, laying my work on the last coat whilst wet, and then subjected the several pieces to pressure until the paint was dry and hard. This was continued for three days, and on removal from the press the fretwork was found to be firmly embedded in the paint, and in a solid condition for cleaning up and polishing. I should have acted wisely had I followed your advice and have used thinner wood (say $\frac{1}{16}$), but notwithstanding my self-will, the cabinet is much admired as a fair substitute for marquetry. I must add that the body of the cabinet was constructed of mahogany, ebonised, by a skilled cabinet maker, and now forms a goodly ornament in my wife's drawing-room. Thanks to Work."

Fret Saw.—A. J. A. (*Malvern*) writes:—"I notice that A. A. (*Coventry*) (see page 636) whilst finding fault with methods of fitting up saws for fret cutting contributed by Artist in Wood and W. R. S., has in his own sketch for fret saw totally omitted to give any idea as to how he obtains the necessary motion without a fly wheel. I presume this was an oversight."

Tuition in Carpentry.—R. A. P. (*South Kensington*) writes recommending in strong terms the classes held by Mr. S. Robertson, 11, Augustus Road, Goldhawk Road, Shepherd's Bush, London, W.

American Organ and Harmonium Building, Book on.—J. B. (*Ashton-under-Lyne*) writes:—"In Vol. I, page 673, G. N. says he does not know of any book on the above subject. May I inform G. N. and the readers of Work that much information may be gathered from two books published by Metzler & Co., 42, Great Marlborough Street, London, W.—'The Alexandre Harmonium: Its Mechanism, Stops, Tuning, Regulating, etc.,' clearly explained, with drawings and plates of various instruments; and 'The American Organ: Directions for Tuning and Regulating Mason's and Hamlin's Organs,' preceded by a description of their mechanism, stops, etc.; also *Musical Times*, No. 421, Vol. 19. I, like many more of your readers, am waiting for the long-promised papers on American organ manufacture. Hoping your readers will help each other when opportunity presents itself is the wish of Musical. Please say if back numbers can be had. I am about two numbers short since Work started."—[Yes, all the back numbers are obtainable through your bookseller or Messrs. Cassell & Company, Limited, London, E.C.]

Cork Heels, etc.—T. R. (*Ripon*) writes:—"If H. G. (*Bishopsgate*) (see page 526) would tell me how many irons are used in finishing the shanks of boots and shoes, such as waist, fore part, etc., and whether the shank irons do for men's and women's alike, I should be obliged. The description of the "Wurtemburg" is what I wanted, but should like to know if the screw nails are driven in slant outwards or inwards, and how to make the breast level with the sole? Should there be a piece of leather under the heel of the insole or across the balls? This part in particular I hope will not be looked over. Please say also in a heel of a boot or shoe 2 in. high and 1¾ in. broad at top piece how may split and lifts be sloped in; if the pegs or rivets should be slanted in the same way—the split lift from the edge of seat for men's light boots or shoes bandsewn on wooden lasts; how to dress a pair of welts, and how to make a close-welted boot, and broad, and medium?"

Band Saws.—A. R. (*Scorrier*) writes:—"In my remarks on band saw machines and band saws in No. 35 of WORK (see page 556) I said the top wheel should rise and fall freely. This will allow for the expansion and contraction of saw. I might add that I have worked saws ⅜ in., ¾ in., and 1 in. wide with 5 and even 6 brazes in them, and they seldom break in the braze, and with as many as 4 and 5 flaws half-way across the saw by punching a small hole at the end of flaw. I was rather amused with some remarks on band saw brazing on page 621. I never heard of a stone or brick wall being used for brazing band saws on before. I should judge it to be a very clumsy way to braze a band saw. It may be all right."

Clocks in Fretwork Cases.—A. B. C. (*Christchurch*) writes:—"On page 606, column i, line 11, word 'left' should be 'right.'"

A Word in Season.—J. W. H. (*London, S.E.*) writes to querists in "Shop":—"(1) Do not ask us for information, vaguely expecting to be taught a trade or process by a few magic lines. It stands to reason that the short allowance of space at our disposal cannot be made a finger-post to any royal road to learning. (2) Don't be discouraged by failure in attempting anything well begun! Give us the fullest detailed account you can of any difficulties you may encounter; give us a fair chance of coming to a logical conclusion as to the causes of failure by stating your case fully, and you will have no cause of complaint in our answers, but if you only tell us half the circumstances, how can you expect to be more than half counselled? (3) Write at full length; we must be brief in reply. (4) If you ask more than one question at a time, pray use a separate piece of paper for each query."

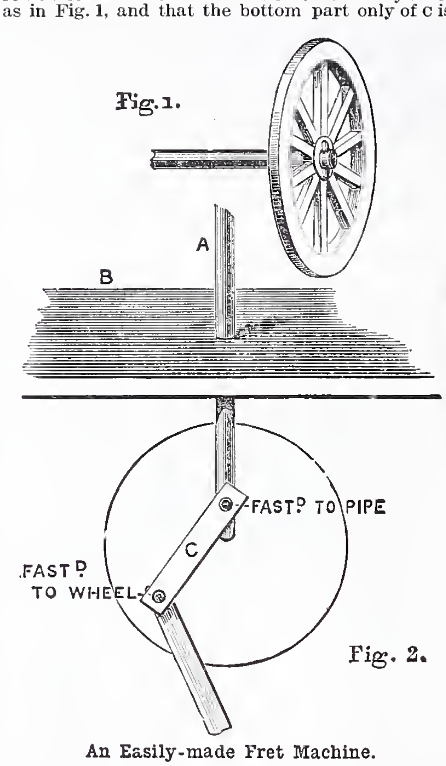
II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Staining Floor.—DECORATOR.—The floor of the room you refer to having been painted, you cannot treat it as if the boards were still in the natural state. Your questions are rather involved, but as far as I understand you want to know how to polish the existing painted surface, or how you can get the paint off in order that you may stain, and the answer to your letter is given accordingly. It certainly would be hardly worth while for you to take the trouble of "polishing," if by this is meant French polishing the floor. A sufficient brilliancy may be got with far less trouble and expense by varnishing it in the usual way, which, as a decorator, you are, no doubt, practically acquainted with. Of course, if the paint is much disfigured by wear there is no reason why you should not repaint, in which case there is no necessity for removing the present coat. This, I think, would be a far better way than staining, for before this can be done you must remove the paint, which you will probably find a very tedious and troublesome operation. It seems almost unnecessary to remind a decorator that the paint may either be burnt or washed off with one or other of the many well-known preparations, and that the paint on the skirting board is very apt to be injured. Without knowing all the circumstances of the case, I am inclined to think that if the floor is to be stained it will be advisable to have it planed over. So much, however, depends on its condition that I cannot do better than advise you to use your own judgment, for you will readily see that an amount of trouble, which might well be bestowed on a fine oak or pitch pine floor, would be thrown away on one of the ordinary kind. Finally, neither I nor any one else can tell you how to "stain with the paint on," as it can't be done.—D. A.

Dry Battery for Electric Lights.—ASCA (*Newcastle-on-Tyne*).—I do not know of any dry battery giving an E.M.F. of 4 volts from two cells in series. The silver chloride battery has an E.M.F. of 1·02 volts per cell, or each pair of elements, so that you would require four cells and four pairs of elements to give you the needed E.M.F. from this battery. This is the nearest I know of likely to suit you, as it is quite free from liquid, and very light and compact if made up with ebonite cells. The elements of the battery are:—Negative, a silver plate coated with silver chloride paste kept in position by blotting-paper pad; positive, a zinc plate enveloped in blotting paper, moistened with a solution of zinc chloride. The zinc plates may be 4 in. by 2 in. by ⅛ in., and the silver plates may be of silver foil, having the same surface area. Connect three of the pairs together by soldering strips of copper to their tops; this will leave one zinc plate to form one pole of the battery, and one silver plate to form the other pole. The cells should only be large enough to admit the plates with their folds of blotting paper, so that the intervening paper may be pressed between the zinc and silver plates in each cell.—G. E. B.

Coppering Blackleaded Moulds.—COPPERED PLUMBAGO (*Malton*).—Knight's process of coppering blackleaded moulds previous to placing them in the electrotype solution is as follows:—First, blacklead the mould in the usual way. Then wash off superfluous plumbago with a jet of water. Next flood the face of the mould with a concentrated solution of sulphate of copper. Over this sift some very fine iron filings through a very fine sieve, or dust the mould with finely-sifted iron filings from a kind of pepper-box. Brush the face of the mould with a soft brush, and wash off excess copper and iron with a rose jet. By this means finely-divided copper is precipitated by chemical action on the blackleaded surface of the mould, with the result that a superior conducting surface is presented to the electrotyping solution. I do not know where you are likely to get the "impalbably fine iron filings" ready to use. They are easily got by sifting ordinary iron filings through a very fine sieve, or rubbing them through a fine wire mesh.—G. E. B.

Fret Machine.—C. J. D. (*Glasgow*).—You say that you made a model of this, but could not get the pipe to move up or down. I think that the fault is that you have not got the pipe exactly over the centre of the wheel (if you turn to page 332 you will see that I specially mentioned this), or else the bearings are not bored straight. You must please remember that the wheel runs on an ordinary axle, as in Fig. 1, and that the bottom part only of C is



An Easily-made Fret Machine.

fastened to the wheel, and the top part to the pipe, as in Fig. 2. You also say that you wish me to give you a correct drawing of the machine. The illustration on page 332 is perfectly correct, and is the same as the machine I have here, which I shall be pleased to show you if at any time you are in London. I might add that your letter is not a very complimentary one, as it seems that because you are not able to make the machine you think that the best thing to do is to abuse it.—W. R. S.

Replating Brass Caps.—R. C. (*Wood Green*).—Strip all the old silver from the brass caps by boiling them in sulphuric acid, and adding, whilst the acid is hot, a few crystals of saltpetre. The acid should be heated in a porcelain crucible, or glazed carthenware pipkin. Add the saltpetre until all the silver has dissolved off, then take the caps out of the acid with a pair of brass or copper tongs, and throw them into clean water. After this, brush off all loose silver with a wire brush, scour the caps with bath brick in water, well wash them, and quick them in a nitrate of mercury solution ready for silver-plating in the bath. I must ask you to be good enough to look up other replies to correspondents relating to electro-plating for further information respecting how to make up and work the silver-plating solution. I hope to take up the subjects soon in a series of articles, and then you will be able to learn all about it. Dynamos, motors, and other "electrical hobbies" will receive attention in due course, and you will then, I hope, be abundantly satisfied.—G. E. B.

Oxford Picture.—F. M.—In answer to yours, a small circular saw is used for cutting rebate in Oxford frames, fixed in bench sufficient to cut depth in wood desired. A cutting gauge is used sometimes, but is very hard work. Spokeshave is used for chamfers and chisel. You can buy the wood ready rebated, and can neatly fill the ends in. If carefully done, it is as good as cutting out of solid. Almost any moulding can be treated in this way, black and gold, etc.—G. R.

Charging Batteries for Electric Lighting.—J. T. (*Walham Green*).—Charge your battery with a solution of chromic acid, made by dissolving 3 oz. of chromic acid in 1 pint of water, acidulated with 3 oz. of sulphuric acid. With this solution your three-celled battery will give a current of 1½ ampères at a pressure of 6 volts for some four or five hours with one charge of solution. If you select a 6 volt 2½ c.p. lamp, this current will light it up nicely during that time.—G. E. B.

Leaf and Flower Printing.—LEAFLET.—Impression of leaves, etc., can be taken on wax or cast in plaster of Paris, but the process is too long to describe here. I shall, however, be happy to contribute an article on the subject if of sufficient interest, as this was a favourite hobby of mine in my younger days. LEAFLET may also try the blue printing process recently described in WORK, as it is often used for the purpose of copying leaves and plants.—H. L. B.

Mounts and Cardboard for Ticket Writers.—TICKET.—Write to Messrs. Surflen & Clarke, 3, Bucknall Street, New Oxford Street, W.C., and ask for their price list, which will be sent post free.—H. L. B.

Transfer to Metal Plate, etc.—F. J. L. (*Bristol*).—I know nothing about the process of the first query. The only ink that can be used on zinc to withstand the action of acid is of a greasy nature, such as that used by lithographers, which can be ground up thinly and used with a pen on stone, transfer paper, etc. The drawing would have to be transferred to the zinc from the transfer paper, unless drawn on the metal with a fine brush. The pen would scratch the zinc. See a manual on lithography.—F. M.

Clock Cleaners.—W. E. S. (*London, E.C.*).—Take off cylinder cock, and with a pinion gauge measure from jewel hole to middle of curb pins. Select a hairspring the same size. take hold of outer end of the spring, pass the cylinder bottom end up through the centre of it, and let it hang by the notch. Then measure as near as you can the distance the cylinder and balance draws the spring down. If about a length and a half of the cylinder it may possibly do (if you have the old spring you can get near the right strength by comparing the old and new). Now take the collet off the cylinder, and take the pin out that fixes the inner end of spring to collet. See if the collet will go inside with a little room to spare. If not, break out coil till it will go, then bend a small portion of the inner coil straight so that it will make a half-circle. Then pass the straight piece in the hole of collet and pin it in tight. See that the spring and collet are quite flat, replace the collet on balance or cylinder, lay the cock on the bench on its back, put cylinder cock pivot in the hole, pass the outer end of spring through the stud in the cock, and pin it in. See that the spring is free everywhere, and that the watch is in beat, set going, and note time. If it gains, you must go all over the work and put a weaker spring; if it loses, try breaking off a turn or half-turn first of the outer end; re-pin and try, but if after taking off one or at most two turns and it still loses time, why you must put a stronger spring, but unless you have a good selection of good springs, I should advise you to send or take to any watch tool shop, the cost of springing and timing being only about two shillings.—A. B. C.

Book on Heating.—MECHANIC (*Lewisham*).—Hood's "Warming and Ventilating," Spon & Co., 12s. 6d., is a good book.—F. J. C.

Book on Cooper's Work.—Δημᾶς.—A suitable work is "The Cooper," price 1s., in Houlston's Industrial Library.—F. J. C.

Moulding Indiarubber.—C. P. C. (*New Kent Road*).—This substance, which is the dried sap of the *Hevea Guianensis*, etc., cannot be moulded whilst in the pure state, although the sap as it runs from the tree may be used to coat the external surface of any article selected as a mould, which, indeed, is the method adopted in the collection of the gum in its crude commercial form of "bottle rubber," but such a process is evidently of extremely limited application, and has no commercial value. Moulded articles of so-called indiarubber are formed of an intimate admixture of indiarubber and sulphur with various adulterants, the mixture being pressed into hollow moulds of suitable shape, and simultaneously subjected to a temperature varying according to the amount of sulphur contained in the raw mixture, and the degree of hardness required in the finished article. The heat not only softens the compound, and so enables it to conform to the exact outline of the mould, but also effects the vulcanisation of the rubber by chemically uniting the sulphur therewith, the result being a more or less elastic object capable of retaining permanently the form of the mould in which it was vulcanised. The pressure is needed to counteract the expansion which would otherwise be caused by the liberation of sulphurous gas, the result of such expansion being rubber of a spongy texture similar to that sometimes used for cleaning gloves. The adulterant is added to give "body" to the mass, and to reduce cost at the same time. It may consist of any inert substance capable of resisting the heat employed in the vulcanising process. Unvulcanised sheet rubber of various qualities and thickness may be obtained

. almost any shop for the sale of rubber goods.—
ui Vive.

Cracks in Oven.—J. D. (*Hanley*).—Try one of e following cements. You will find them all ood for the purpose you require:—(1) Flour of ilphur ½ oz., sal-ammoniac ½ oz., finely sifted iron orings 20 oz. Mix to a stiff paste, and apply im- ediately to the crack. (2) Five parts of fire-clay ell dried and powdered, 3 parts of fine iron orings or filings, 1 part peroxide of manganese, part of salt, and ½ part of borax. Mix these ioroughly, and make a paste with the necessary ater, mixing well. The parts cemented with this iixture should be heated gradually. This will stand red heat. (3) Dried and powdered fire-clay ¾ lb., on filings ½ lb. Make into a paste with boiled nseed oil. If you could get to drill a hole or two ı your oven, and put on a plate with a few small ındcr bolts, with some portion of one of the above amed cements, that would make the best job of .—R. A.

Rifle.—Derry.—I am inclined to think it is not) much because your rifle is not often used as ecause it is badly and carelessly kept when not in se that it "gets a sort of rusty, etc." Keep it ean, well oiled, and in a dry place, and you will ot find it rust either inside or outside. There is no ay by which you could "blue" the barrel satis- ıctorily without risk of injuring it, unless you are ccustomed to the work. It is done by heat. I uite agree with you that Work is a splendid paper or instruction, and I am only sorry that I cannot nswer your question more definitely. Thank you or your good wishes.—D. A.

Upholstery.—S. M. (*Battersea*).—Your hope will ot be misplaced, as we shall not print your letter, 'hich has been written under an imperfect appre- iation of facts, and reminds one of the old tale of ie peaceably inclined Hibernian who trailed his oat on the ground for some one to tread on. Your erception of the contents of a former corrspon- ent's letter is wonderful, the only point on which ou are wrong being that he did not ask for in- ormation on the subject to which you allude, and, f course, this slight error disposes of the utility of ıe major portion of your remarks. We do not ee how you can have taken up the idea that we ıink drapery cutting is woman's work, for the entence on which you found your assumption egins thus:—"With the exception of planning, tc., draperies, the actual making up is done mostly y women." As one who is very much in the up- olstery trade, I cannot find in this anything to ıdicate that women are engaged in cutting. An pholsterer was replied to, and knowing his question e would understand the answer. You, not know- ıg his question, have misinterpreted the answer.)f course I am glad to have your opinion as to what ·ould be useful to readers, but I am not convinced hat the cutting of draperies would be a subject of ufficient interest to warrant much space being evoted to it. Here and there a reader might find benefit, and you may be sure the matter will re- eive all the attention it deserves, if there should e anything like a general wish for papers on up- olstery drapery. Perhaps those who agree with ou that these should be given will write saying so, or the desire of all concerned is to make Work s generally useful as possible to all classes and rafts. It is news to me that cutting is not taught a trade except for an extra premium and in ex- eptional cases. Of course you know that in aany shops, especially in London, drapery is not ttempted, and that the men are only stuffers, a vord which you have possibly heard rhymes with 'duffers." You will usually find that cutting lraperies is not specially taught, but is acquired, if may express it so, gradually. The foreman takes n interest in the smartest boys who show some ptitude, and they by degrees become conversant vith the "fine art" of the upholsterer's work. There are several old books dealing with draperies, out I do not think you would find any of them of nuch use. If you are inclined to study them you vill find many in the South Kensington Library. t is very likely that before long an article on lrapery, with an illustration, will be given in Vork, whose pages, I quite agree with you, will ıot be degraded by it. Your remark that "one ;ood design," accompanied by full directions how o cut out same, "would be sufficient for all pur- ıoses," simply amazes me. How can directions for estooning a chair, for example, teach you or any ıne else how to drape a window or a bedhead? No, ny friend, you will find that each article, each lesign, must be specially studied with due regard o material, quantity, colour, cost, etc., and that it s absolutely impossible to formulate a few rules vhich shall be applicable and sufficient under all ircumstances. A namesake of yours was at one ime, perhaps is still, foreman in one of the largest ıpholstery shops in London. Ask him, or any other ıpholsterer, if he can kindly tell you of any one lesign and instructions which will enable any ıne to master the art of cutting and arranging lraperies, for if you can get to know, and will send ıs word, you will confer a benefit on all young up- ıolsterers, for whose benefit the directions—with our permission—will be printed in full.—D. A.

Etching with Nitric Acid.—Spot (*Lancashire*). —In answer to Spot, the first thing you should do is o see that your metal is quite clean, then heat it sufficiently to melt a composition of asphaltum and Burgundy pitch, called etching ground; or of as- ohaltum, gum mastic, and resin. This should be olaced on very thinly, and allowed to cool, when it will be found to be of a hard consistence, and ready to receive the subject to be etched, which is drawn on transparent paper with a blacklead pencil, and then laid face downwards on the etching ground, and pressed or rubbed with such force that the im- pression is left on the ground when the paper is removed. Next apply your tool over the lines, care- fully removing the ground, at the same time press- ing sufficiently hard to scratch the surface of the metal. A wall of wax is now placed round the margin of the plate, and some aquafortis poured in the inclosure. Let this stand for about an hour while it bites in, then wash the plate with water, and let dry.—S.

Counter Case. — W. P. (*Liverpool*). — As an amateur you will not find the construction of a show or counter case an easy matter, and all that can be done is to indicate the course you should pursue, or, rather, the course I should advise you to take, for possibly an expert show-case maker, especially if lightness of appearance were a *sine quâ non*, would go about the work in a somewhat different manner. I think you will succeed better by not making the framework too light, and I sup- pose you want something serviceable. I fancy you are under the impression that the wooden framing, or what you call the beading, is added to the glass. If so, let me put you right. The skeleton case, or framework, is made up first, and the glass fitted into it. Regard the case as so many frames, which are to be glazed much the same as a window would be, and you will understand what is wanted. Now, to give you a few hints about making the case. The bottom board you will not need to be told about, but you may as well get it out first, as it

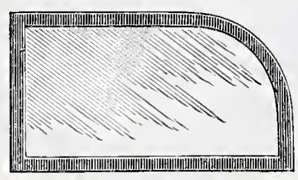


Fig. 1.

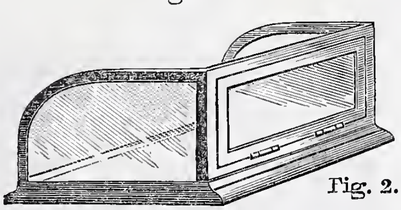


Fig. 2.

A Counter Case.

will guide you when making the rest. For the framing into which the glass is to be fitted, use ¾-in. square stuff. Make two frames for the ends as Fig. 1, and a similar one, only rectangular, for the back. Within this latter, fit another to serve for the door. Hinge this to the lower portion of the back frame. Fasten the back frame and ends together with glue, if necessary running a bead to break the joint, and using a few screws. Fasten the entire framing to the bottom board by the same means, the screws being driven through from below. The framing must be rabbeted to receive the glass, which can be kept in place either with putty or small beading. Along the front fasten a rabbeted piece for the bottom of the glass to rest on. See that you get the glass bent, so that it lies within the rabbet without straining; in other words, it must be a perfect fit or it is sure to break, and I daresay you know that a bent piece of glass is some- what expensive. Anything you have not under- stood of the construction I suggest, will, I think, be sufficiently intelligible from Fig. 2.—D. A.

Boring Holes in Glass. — H. M. (*Slevoye*).— Holes may be bored in glass with a steel drill lubricated with turpentine and camphor. I cer- tainly should not advise you to attempt to mend your own spectacles, for you will probably break the glass.—D. D.

Small Portable Electric Lamp.—Ammeter (*Woking*).—A small lamp to go in a kind of lantern surmounting a small box battery would just suit your purpose. I do not know the "Miner's Lamp made by the Mining and General Electric Lamp Company, Limited, Crown Works, Guildford Street, Lambeth," but shall be glad to see one, and will report upon it for the benefit of readers if the com- pany will send a sample to me to be tested. Until I have seen it I cannot recommend it to you. In answer to your second query, I may say that Mr. S. R. Bottone, Carshalton, will make you a small box battery (of the kind supplied to myself), and this, together with lamp and fittings, will cost about £1. The salt to charge it with can be supplied by the same gentleman, and the charge will cost about 1s. 6d. This will give a 5 c.p. light for three consecu- tive hours, or the light can be used at intervals as you suggest, as the battery is easily thrown in and out of action by a simple mechanical device. I shall hope to illustrate and describe this battery in my articles on "Model Electric Lights."—G. E. B.

Recharging Leclanché Battery.—G. H. W. (*Barnsley*).—You are right in thinking that a piece of gas retort scurf, sawn to the shape of a carbon plate, will do to form the negative element in a Leclanché cell. But I think you have gone wrong from this point. This carbon plate must not be packed in the porous cell with the little bits of carbon sawn off from the plate. This is not the stuff it was charged with, however much it may appear like it. The cell was charged with lumps of manganese peroxide mixed with little bits of carbon in equal quantity, and you must pack the carbon plate in the porous cell with this mixture, or your battery will not work. The manganese looks very much like carbon to the unpractised eye, hence you and your friend were deceived by ap- pearances. Again, it will be useless to recharge the old porous cell, for its pores are, most likely, clogged with zinc salts. You must get a new porous cell. The old carbon plate might be used again. Read what I have said about the Leclanché battery on page 419, No. 27, Vol. I. of Work, and this will help you.—G. E. B.

Fountain.—H. G. H. (*Lower Tooting*).—A paper on this subject was given in No. 31.

Wrought Iron Columns. — A Constant Reader (*Wolverhampton*). — For angle, tee, and channel iron columns, and for columns built up of these sections by themselves or in connection with plates, you may use the following rule:—Divide the square of the length by the square of the least width; divide the quotient by 900. Add the fraction so found to 1, and by the sum divide 19; the result will be the breaking weight per square inch of hori- zontal sectional area. Example—Require the strength of a tee iron strut, 5 feet long, 6 inches wide, and 4 inches deep; the least width is the 4 inches, $4^2=16$, 5 feet $=60$, and $60^2=3{,}600$, $3{,}600\div16=225$, $225\div900=\frac{1}{4}$, $19\div1\frac{1}{4}=15\frac{1}{5}$ tons per sectional square inches. The sectional area of the tee iron, if $\frac{1}{2}$ in. thick, will be $(6+3\frac{1}{2})\times\frac{1}{2}=4\frac{3}{4}$ square inches, and, therefore, its breaking strength $15\frac{1}{5}\times4\frac{3}{4}=72\frac{1}{5}$ tons. The strut should not be loaded with more than one-fourth or one-fifth the breaking weight. The same rule will apply to English rolled joists, but those of Belgian make are so unreliable we should not care to give a rule for them.—F. C.

Polishing Table Top. — Nil Desperandum (*Tamworth*).—Perhaps it would be more correct to say that your table top shows the inequalities of surface than that it acquires an uneven surface while being "bodied up." Are you sure that you have made it quite level before beginning to polish? It must not be forgotten that inequalities which might be passed over while the wood is in the white may show up when it is polished. If this is not the cause of the defect you notice, it must be owing to the polish being unevenly applied. The result of this is that the shellac, or body of the polish, is thicker in some places than others. If this be so, you have probably used your rubber too wet. In any case whatever be the cause, you must clean all the polish off again. You can easily do so either with a scraper or glasspaper used in the ordinary way with a cork block. I do not think you need trouble your head about the stuff you saw used. From what you say I imagine it was pumice powder, which might do well enough in experienced hands, though I certainly should prefer glasspaper. I am afraid the polishers you saw troubled in the way you are could not have been very skilful, or they would not have worked up an uneven surface. Possibly they used the substance merely to dull down, but anyway you will find the remedy sug- gested is effectual.—D. A.

Electric Accumulator.—C. D. (*Hull*). — Long before this appears in print you will have read my reply to D. S. (*Holloway*) (see page 477) on this subject, and will therefore know how to prepare your accumulator plates. You have done quite right so far in cutting the plates to the proper size. As the 1 c.p. lamp may have a voltage of 3 or of 8, I cannot say how many cells you will need, but you will have enough in the 6 at your disposal. You may reckon on getting an E.M.F. of 2 volts from each pair of plates in each cell whatever their size. The larger cell will not in itself give sufficiently high E.M.F., however many plates you may have in it, as the whole plate surface would only represent one pair. You may employ the 2-quart Bunsen cells connected in series to charge the accumulators, one cell at a time. When the liquid in the accumulator cells gives off bubbles of gas and appears to boil, the charging is com- plete. Although I have thus replied to your ques- tions respecting the accumulator you wish to make, I do not advise its use in lighting a buttonhole lamp. See reply to Asca (*Newcastle*), page 718.—G. E. B.

Battery to Fire a Charge of Powder.—W. G. (*Weybridge*).—I cannot see how a charge of powder could be fired by current from such a small battery without using a coil. With a coil it could be easily made to fire an Abel or a Statham fuse. If you wish to fire the charge with the battery current only, make up four cells, charge them with a solution of chromic acid or bichromate of potash, connect the four cells in series, and use a fuse made in the following manner:—Twist the ends of two cotton-covered No. 18 or 20 copper wires together, separate the extreme ends and uncover them. Connect the two ends by a very short piece of extremely thin iron wire twisted around the copper and soldered thereto. Insert this into the powder in the tube of the fuse. The tube may be of any- thing capable of holding powder, such as a quill, a hollow elder, hemlock, parsley, or hogweed stem, or a bit of metal tube stoppered at both ends with a cork or a tube of paper. A tuft of gun cotton around the iron wire will increase the firing quality of the fuse. The battery must be made so that the zincs may be lifted out of the solution when not wanted, or they will be eaten away by the acid.—G. E. B.

Miniature Electric Lamp.—VENUS (*Norwich*).—Four Fuller cells, with an E.M.F. of 1·6 volts per cell, will, if arranged in series, furnish current enough to light up a 2½ c.p. 6 volt lamp for the short time needed to see the time by a watch in the early morning. Have the lamp suspended over and close to the watch-stand on a table by the side of the bed, rather than on the wall at the head of the bed. Connection may be made between battery and lamp through a flexible cord carrying two No. 18 wires, and the push may be attached to the lamp support if you have this heavy as it should be.—G. E. B.

Ornamental Rock Work.—G. G. (*Gateshead*).—I am pleased to learn that you find WORK interesting and helpful. With regard to the ornamentation of house front, you will see in a reply to ROCKERY in present number a plan which cannot fail to be successful. A friend of mine a few years ago had a blank wall in a conservatory which he desired (as you do) to make more pleasing to the eye. I suggested and had carried out the method suggested to ROCKERY, and the result was very much admired, and very easy of execution. You see you cannot go wrong. The very clumsiness of one who does the work really improves its rustic and rugged appearance. With regard to your centre beds, I would suggest the formation of raised beds formed by "rock-working," and border of galvanised iron netting, say, 6 in. deep, as described in No. 20, filling up with earth, and repeat in a lesser irregular circle, thus forming a terrace for the plants, and a bold piece for the centre, made hollow, so as to be used for growing. You might also at the bottom of your wall, say, 2 ft. from wall at its widest part, erect a wire border of about 20 in. high, as irregular and bold as you can, using very large pieces of coke for the purpose, leaving here and there crevices for plants. Fill up with mould, and you will have a substantial piece of work.—C. M. W.

Rockery.—(*Clapham Common*).—You can make use of your wall for growing ferns, etc., with excellent effect as follows:—Decide upon the number of pockets of various sizes you intend to have, and hang them to the wall in irregular positions on strong French nails, then at distances of about 6 in. over all the remaining surface of the wall insert some French nails (not less than 3 in. long) into the mortar of wall. Have ready some pieces of cemented coke, as described, and lay a piece on each nail, using a little cement on each. Now mix up a quantity of Portland cement and very coarse sand—about 4 parts sand to 1 of cement—with water sufficient to make it a creamy consistency; thoroughly wet the surface of the wall, and fill up by dashing on the cement, so as to cover every inch of the brickwork. Lay on a little thicker where the coke and pockets project, and see that these are well secured with cement. The result of the foregoing will be that your wall will present an irregular and, to my mind, a very pretty rustic appearance. With regard to the fountain, I cannot advise you without further particulars. Where and at what height is the water supply, height of wall, etc.? Let me know these, and I will do my best to help you.—C. M. W.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Boot Bottoms.—SILLAW (*Rochdale*) writes:—"Will any reader kindly say how to fasten boot bottoms on when making a new pair? This information will suit me any time this winter. I am a clerk, but can mend boots, bind papers, etc., through your good work, WORK."

Furniture Cream Bottles.—T. B. (*Rochdale*) asks for the name of a firm who will supply him with these.

Terra-Cotta Stove.—NAGA (*Margherita, Assam, India*) writes:—"Having the facility for burning one, could any reader let me have through 'Shop' a sketch with detailed instructions for making a terra-cotta stove for bungalow? Not to have any iron in construction."

Watertight Boots.—RUTHENPHARL (*Saltburn-by-the-Sea*) writes:—"Can any of your readers suggest any means by which ordinary boots can be made watertight?"

Gold to Gild and Bronze Iron.—J. G. G. (*Glasgow*) will be glad of any information as to where to buy and how to use this.

Re-waxing Meerschaum.—A. H. (*Sydenham*) writes:—"I shall be much obliged if any reader will inform me as to the best method for re-waxing a meerschaum pipe."

Mandoline.—J. N. (*Tooting*) writes:—"I want to know how the body of a mandoline is made. I should be grateful for any information on the subject."

Exhaust Fan or Ventilator.—D. B. S. (*Ferns*) writes:—"Would any reader be kind enough to describe a simple way of drawing off dust from a grinding shop, 50 ft. by 24 ft., with loft overhead 8 ft. high from ground. There are a number of grindstones and emery wheels at work, and the dust from them is very unwholesome."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Building Railway Carriages.—F. C. (*Leytonstone*) in reply to R. C. C. (*Plaistow*) writes:—"There is a book published by Spon called the 'Car Builder's Dictionary.' The price is 12s. 6d. It is an American work, and is a dictionary of the terms used by American and English railway carriage builders. It gives no information respecting the process of manufacture. The engravings in it are excellent, but are principally of American stock. I do not think there is another book published in England on the subject."

Banjo without Brackets.—D. K. (*Gateshead-on-Tyne*) writes:—"In No. 37 of WORK, page 589, ALPHA (*Birkenhead*) asks information about banjo without brackets. I take opportunity of sending a very rough sketch, which I hope you will be able to understand. It is composed of two wood rims with wood screws, cup head for screwdriver, and small washers under the heads

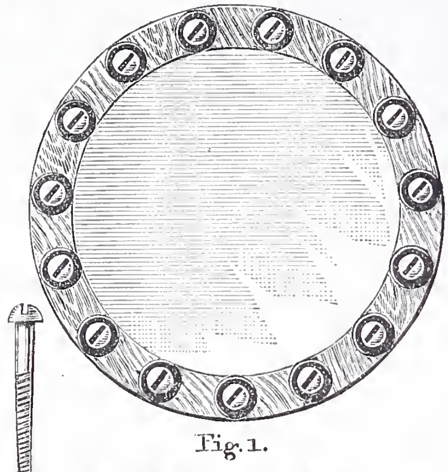


Fig. 1.

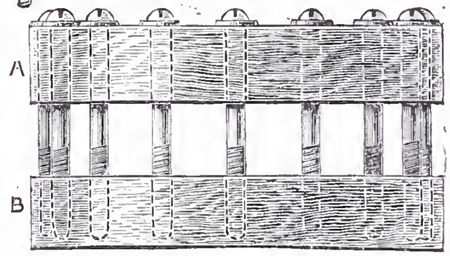


Fig. 2.

Banjo without Brackets.

of screws. Fig. 1 is the top rim over the top of the banjo skin showing the screw heads and washers. Fig 2 (A) is top rim showing screws, etc. Fig. 2 (B) is bottom rim into which the wood screws are screwed, and this rim is screwed on to the middle of the banjo drum from the inside, so that there are no screws seen outside. This is a very good and simple way, and I hope it will suit."

Pitch of Roofs.—W. D. (*Newcastle-on-Tyne*) writes in reply to C. M. (*Hornsey Park Road*) (see page 654):—"There is no definite rule for the pitch of roofs for greenhouse or shed, or in point of fact for any building at all, as a glance at the surrounding housetops will readily prove. However, a good roof for ordinary purposes would be to make the height one-third of the span."

Flux.—S. W. H. (*Aintree, near Liverpool*) writes to G. H. S. (see page 670):—"At a carriage factory in America with which I was connected they experienced a similar difficulty in finding a suitable flux for welding steel buggy axles. Ultimately marble dust (which may be obtained from any marble mason) was found more suitable than either borax or sand."

Dulcimer.—R. F. (*Norwich*) writes in reply to J. McF. (*Edinburgh*) (see page 636):—"I may say that I know of no reliable tutor for the dulcimer. There is one published by a London firm, but I hesitate to recommend it, as the scale shown is incorrect, being diatonic instead of chromatic—that is to say, there are no semitones corresponding to the black keys of the piano, so that it is impossible to play in more than one or two keys, and the tunes must be free from 'accidentals' sharp or flat, as no provision is made for them; and again, the method of beating there given is distinctly wrong. J. McF. will find a correct scale in No. 41 of WORK, page 645, and if he has access to a piano, and will tune his instrument to correspond with the notes, as shown in the diagram, he will find it fairly easy to master a few tunes in a short time. If he finds any further difficulty, I shall have pleasure in helping him in any way."

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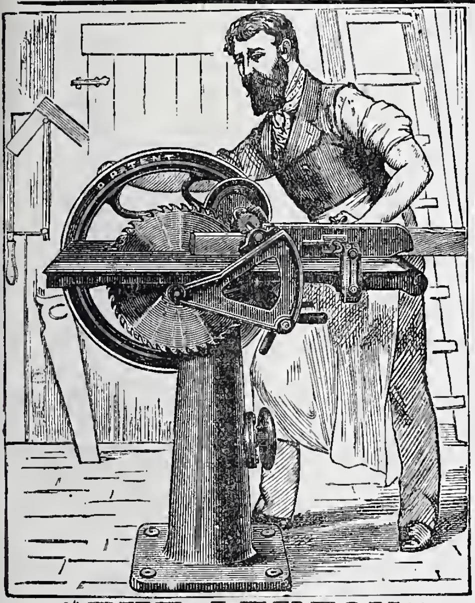

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

Vol. I.—No. 48.] SATURDAY, FEBRUARY 15, 1890. [Price One Penny.

ENGRAVING ON METAL.

BY NORMAN MACLEAN.

Work on Silver and German Silver.

It is presumed that the workman on taking up this class of work will have been prepared, by previous practice on the commoner classes of work, to give due effect to the designs he may have to engrave on the better class of work known as hollow ware engraving. The methods of sharpening or whetting the gravers are modified according to the class of work on which the engraver is engaged, as for instance—a cake or card basket, round or oval, has usually a considerable depth, therefore an outlining graver must be "set off" very considerably, and the facility of cutting *towards the right hand* will, in this and other cases, enable an expert workman to engrave an article in about one-half the time that would be taken by another. Therefore, I strongly recommend the workman to practise the cutting from left to right, whether it is absolutely required or otherwise. (See Fig. 1, page 520.) Letters A and B represent a line cut towards the left hand, and which is the natural tendency. The line represented by the letters C and D is to be cut—not as a continuation of the circle, but from the left towards the right hand, commencing at C and finishing at D. There is little to say to the workman as to the way in which he should cut his work, as by this time his work will have developed an individuality quite his own, which may be a good style or a bad one. If it is the latter, he must take every opportunity of comparing his work with that of other engravers, and noting his own shortcomings. I will, however, give the workman a few hints. Remember that you will get a better price and more credit on best work, and, therefore, you can afford to spend more time in proportion than you would if engaged on common work. If the design is a repetition in sections, take great pains in dividing the sections, using the dividers freely. Get your prints on truly, and the shields exactly upright, for nothing looks worse than a shield all awry. Point in the pattern exactly as it is intended to be cut. I am speaking of the outline, and where parallel lines occur rule the second line by the first after outlining. In veining a scroll or leaf, study your pattern, and see that all radiating lines glide imperceptibly into the main vein. In cross shading and blacking out ground, see that no "whites" are left in either, and that the

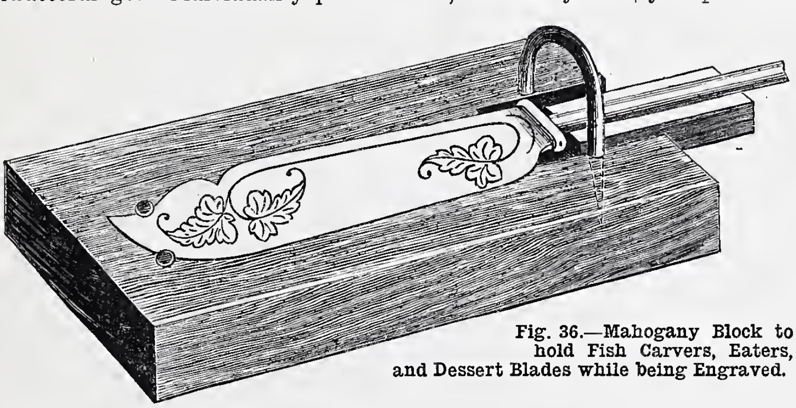


Fig. 36.—Mahogany Block to hold Fish Carvers, Eaters, and Dessert Blades while being Engraved.

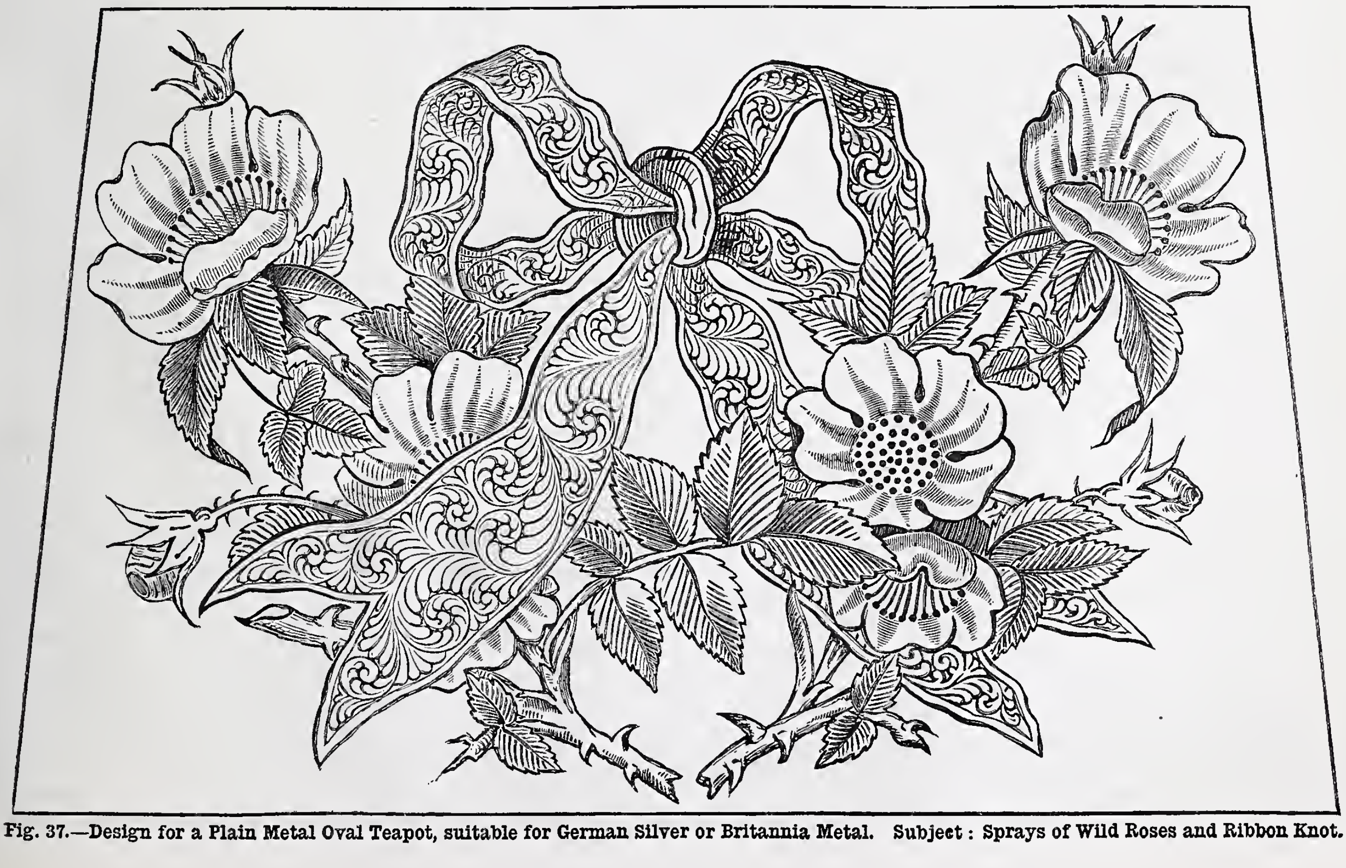


Fig. 37.—Design for a Plain Metal Oval Teapot, suitable for German Silver or Britannia Metal. Subject: Sprays of Wild Roses and Ribbon Knot.

shading is graduated artistically. I may here explain that "whites" appear when the surface of the metal is *not* entirely cut away by the consecutive strokes of the graver. When you have finished your work, give it a nice appearance by dusting it over with the pounce bag and polishing the surface, and removing the dirt from the cuts with a piece of bottle indiarubber. Do not use the vulcanised rubber, as the sulphur used in its manufacture will cause the article cleaned with it to turn black. I have said nothing about the prices of work, because so much difference in price prevails on account of the keen competition for work when there was little work to be done. Now that trade is improving all round, I have no doubt better prices will be paid.

The engraving of fish carvers, fish eaters, and general small work of an ornamental character, is practised by the engraver of small work, and who seldom or never attempts any other description of work. On this account he is much quicker than an engraver who is most used to larger work, who cannot as readily change his hand. But it must not be supposed that there are no engravers who cannot acquit themselves creditably as "all round hands." I admit they are few and far between. In engraving small work, much of it is done without the extra work of pointing in or tracing the pattern from the print. The work is cut from the print, which may be a black one or a white dry one, according as the engraver has been used to either. I prefer the white print for its cleanliness, and also for its lasting properties. A white print only requires renewing occasionally, whereas a black one will only lay down from a dozen to eighteen impressions. A block (Fig. 36) is sometimes used to hold fish carvers, eaters, and dessert blades, which facilitates the engraving of these knives. Other articles are held as best they may be in the left hand, and a few awkward articles are mounted on a cement block.

The workman in this line of business is generally assisted by an apprentice who prepares the work for his master, such as "laying down" the patterns, tracing such parts as are deemed necessary, and, as he advances in the art, cutting such parts as he is capable, leaving the whole to be finished by the workman, who will correct any little error as he finishes the work. The apprentice also runs the errands, thus giving him a little rest from his work, and enabling the master to work the whole of the working hours.

I give in Fig. 37, as promised in a previous paper, a design in the floral style for a plain oval teapot, a rather popular shape on account of its showing off all work to advantage; the lid is flat and "let in," and thus forms a smooth surface to work upon. This pattern is all line work, and as the sketch is for a five-gill teapot it can be traced and waxed down on a teapot of that size, but for any smaller size will require to be redrawn. I propose to leave this design to be dealt with according to the taste of the engraver, only remarking that the ornament on the lid should correspond with that of the body of the teapot.

ENGRAVING ON JEWELLERY.

The operation of engraving jewellery is altogether different to any that I have before described, and since the silver jewellery has had its day, I am at a loss to know to what branch of the profession the immense numbers of engravers of jewellery have turned their attention. But to those workmen who wish to learn something of the way in which it is done, I will attempt a description of the process, commencing with the bench, which is known by the name of "a three-holed bench," and which is also used by the makers of jewellery.

This bench is generally made of stout wood, such as elm; has three semicircular pieces cut out, with arm-rests in between, the object of which is to enable three workmen to work at one window. In the centre of the bench is an upright gas-bracket, an equal distance from each workman, who also has a small gas burner at his right hand, for the purpose of warming the cement on the chucks on which he mounts the articles to be engraved.

Each engraver has suspended just beneath where his work rests a leather apron, to catch all the gold and silver chips from the graver, which become a valuable perquisite. Instead of the ordinary sandbag of the ornamental engraver, the jewellery engraver uses one with a round hole left in the centre of sufficient size to receive a "bullet." This bullet is really a small round cannon ball with a screwed nose fixed firmly in, and on which the little boxwood chucks are quickly screwed. These chucks are round, about 2 in. by 1 in., and carry a female screw of $\frac{5}{8}$ diameter and eight threads to the inch. By means of the hollow pad and bullet, the engraver is enabled to quickly turn the work in any direction and at any angle which may be required during the progress of the work. This class of engraver generally works in sets of three, to facilitate the execution of the work. One engraver will outline, another will "fill in," while a third will shade and finish. A boy is usually kept to run errands and "stick on" and "take off" work from the small chucks. The tools used are the ordinary graver, the shading tool, a small spotting or round-nosed tool, narrow wrigglers and double wrigglers, with a tracing point, burnisher, and hare's foot for sweeping up chips.

A fine oilstone is necessary for this work, as it is nothing if not bright; and in addition to the ordinary oilstone, a stone known as a "black stone" amongst the engravers and engine-turners of Clerkenwell is used for finally polishing the graver before cutting the work. The use of this stone produces a cut on gold and silver of great brilliancy.

I am not geologist enough to tell the nature of this stone; its colour is black, very hard, and very scarce. I have often used it myself, but never had a piece to call my own, and the many inquiries as to its scientific name have left me as wise as before. I have ventured to think that it is iron in some form or other. If I am right, perhaps some of our geological readers will give us the proper name of the stone or metal. The use of the black stone, as I shall continue to call it, is very simple. The graver is sharpened in the usual way, and the black stone is drawn lightly along the cutting edges, which has the effect of removing the slight burr left by the action of the graver on the stone, and thus brightening the cut without taking away any of the sharpness of the graver.

HERALDIC ENGRAVING.

The successful practice of this fine art branch of engraving depends not only on the ability of the engraver to outline and shade well, but also upon the facility with which he can enlarge or reduce the coat of arms, crest, monogram, or cypher to the size suitable to the work in hand. In addition, a study of heraldry is advised. If an old crest book can be purchased in which the arms and crests have been printed by the copper-plate process, such a work will give a capital idea of the shading of crest work, etc. A book of monograms will assist the engraver; there are two or three published, all equally good, which can be seen and compared before purchase at almost any free library.

A book of plain and ornamental capital letters, and an occasional glance at Field and Tuers' "Specimens of Printing," will keep the engraver up to the most modern style of letterings. In addition to his work on metal, the heraldic engraver must be prepared to work on ivory and pearl. The practice of a crest engraver involves more work than that which appears upon the engraved article. We will suppose that the engraver has been invited by a manufacturer to compete for the engraving of the outfit of an ocean-going liner, which consists of many thousands of articles, and of all sizes, from a mustard spoon to a hot-water meat dish of thirty inches at its transverse axis. These all have to be engraved with the name of the vessel and the arms and name of the company who own the liner. In the first place, the engraver has to prepare a finished sketch of the work, which is submitted to the company for approval. This is returned, with the usual alterations and final directions as to how the work is to be done, through the manufacturer who has the work in hand. The engraver having secured the order, will now proceed to draw on a piece of German silver, similar to a practice plate, a series of twelve or more sizes, side by side, each size of the subject to be engraved being an exact counterpart of the other. The object of cutting the sizes on a plate is two-fold; in the first place, the sizes for the different articles can be better calculated, and more easily drawn; and secondly, the plate itself furnishes the black prints required for the work on the various articles. In course of time part of the original order is repeated, in order to meet the inevitable losses; the plate again is made use of, thus securing a perfect match with the original work. Crest work is done with a lozenge graver, whose angles are more acute than a square graver. Lozenge gravers are also used for making the flat tools for block letters, the main shanks of Old English, and other letters.

These flat tools are whetted at the usual angles, and flattened on the sharp angle by rubbing on the stone to the required width. A few narrow shading gravers are kept on hand, for blacking out the cheaper forms of lettering, etc. For these I recommend C and D fineness of threads, and Nos. 1, 2, 3, 4, 5, and 6 widths of both C and D.

In sketching in inscriptions due prominence should be given to "Presented," the name of the "recipient," "date," etc. But as these particulars—in fact, as the inscriptions—are generally "set out" for the engraver, he has nothing to do but copy it letter for letter, supplying ornamental capitals and lettering such as his own good taste will suggest. If the article is large, such as a tray, give prominence to the crest or coat of arms, so that it may be seen and recognised at a glance, balancing the whole in an harmonious style. If, on the other hand, the article is a small one, legibility is the first consideration. Engraving crests on pearl and ivory will require considerable determination and practice on the part of the engraver to overcome the natural difficulty of cutting against the grain of the ivory, and also the peculiar nature of pearl as opposed to that of metal. Otherwise, the work is finished exactly in the same manner as the same subject would be in metal, supposing the subject to be a crest. But with lettering the work has to be cut sufficiently deep to receive the necessary "blacking" to make the engraving prominent on the white substances. This black mixture is made of the very best black sealing wax dissolved in spirits of wine, which must be kept in a tightly stoppered bottle. The mixture when ready for use must "run" freely. To "black" the pearl and ivory already engraved, take a fine camel-hair or sable pencil and carefully fill all cuts with the black mixture, taking care that the ink, as I may call it, is confined to the part engraved. The articles are left for a time—say a whole night—for the ink to thoroughly dry, when the superabundance of ink on the surface of the ivory or pearl is removed by means of a "dolly" in a small lathe. The "dolly" is composed of a number of pieces of linen secured by clamps to the mandrel. This is revolved at great speed in the lathe, which causes the limp linen to take an upright position in the lathe, and the friction is increased by the application of finely powdered whiting, which soon removes the ink from the surface.

In conclusion, there are many articles which might have been engraved which it would have been impossible to describe in this paper. At some future time, however, I shall be glad to direct attention to a few articles which I myself have made and engraved for home use.

A STRAIN CHECK AND EXCESS LOAD ALARM INDICATOR.

BY JOHN CHARLES KING.

THERE is a correlation between moral and physical science in the warnings of one and the index limits of the other to prevent evil. For one, the simple word "Don't" has its counterpart in the other in a check-stop. The intelligent heedfulness of man to either would spare a world of suffering, not only for ourselves and others, but for the animals that serve us so faithfully with their willing toil.

Any invention that, by its simplicity of action, serves as a check-stop to undue strain on machinery or animal draught, and indicates excess, seems to articulate the word "Don't" to our understanding.

"A Stress Alarm and Excess Load Indicator," applicable to hauling machinery, running-gear, and harness of draught-horses, has been patented by the inventor, a Mr. Snellgrove, and is made by W. & T. Avery, of Birmingham and London. Being, for harness, as small as a trace buckle, it is not unsightly; and, for machinery up to fifty tons' pull, only slightly larger in proportion, and in no way interfering with the action of the chains, ropes, or traces. It seems to be the one thing so long sought for by mechanicians and horsemen to aid their judgment, and aid them also in the most important part of their undertakings, where strains from excess loads, sudden jamming, or hitches would strain the machinery or hauling gear unnoticed, and weaken it so that it might afterwards yield to moderate strain unexpectedly from a previous unrecorded strain.

This simple invention has not the word "Don't" on its front, but a dial with indicating hands, showing what maximum strain has been applied; and, for excess beyond the fixed limit, an alarm is sounded, and a red danger-disc covers the dial face till the load is taken quite off. So simple an invention hardly needs illustration. Perhaps its application to harness and carriage draught will be best explained by a diagram showing the defective attempts to arrive at the same result in one point only.

Horsemen who drive seek to avert the sudden strain on the shoulders of horses by putting a swivel-bar to the draught of a gig and dogcart, which means a central pull to the vehicle, whereas the retarding action of the wheels by the road is two and a half feet each side of this centre, forming a corresponding leverage against the horse's draught, which, in ruts, or in turning,

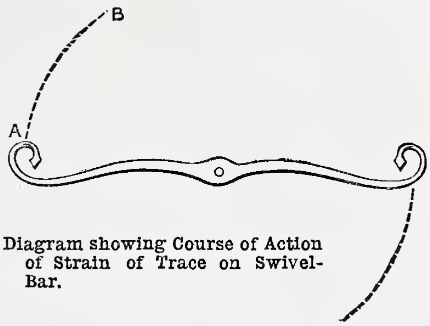


Diagram showing Course of Action of Strain of Trace on Swivel-Bar.

throws the strain on the shafts by the side pressure of the horse against them, which means straining the legs of the horse needlessly by side-pack action. The swivel-bar is a danger also. Should a trace come off or break, the other trace snatches the swivel-bar hook round into the leg of the horse, wounding it, and perhaps causing it to bolt, often with serious or fatal results to the riders in the vehicle. The dotted line A to B shows this action.

This invention serves at once to relieve the shoulders of the horse from concussion by wheel-jerking, and to tell of any wrong by the alarm indicating it, as a "fired" axle or strained wheel-fixing, which would be marked at once by the dial showing excess strain, or the little boss on the trace sounding the alarm; or, for teams, the pull of the free or lagging horses is indicated.

For heavy weights, the fifty ton indicator is tested up to a hundred tons, to allow for sudden enormous strains, and the alarm by fulminating charges of intense loudness of report automatically fed for the fall of the striker.

This invention does not appear to have been forward enough to be exhibited at the Berlin Exhibition of May last for the Prevention of Accidents; but it was shown at the French Universal Exposition, and attracted well-merited notice.

GESSO WORK APPLIED TO THE DECORATION OF ROOMS AND FURNITURE.

BY E. C.

IN the present paper I propose to consider gesso work as a means for the decoration of rooms and furniture.

In selecting the design for a frieze, and also in arranging the scheme of colour, much must necessarily depend upon the interior—upon its size, height, and aspect, and upon its present decorations if they are to remain unaltered. According to the height of a room the frieze may be two or three feet in depth; in low-ceiled rooms one foot will be sufficient. For myself, I prefer, whenever possible, a rather deep frieze of bold design. For the purpose a soft, shadowy grey-blue background is charming; on this the flowers may be done in terra-cotta tints and the leaves and stems gilded; the stamens of the flowers also gilded. In this case the background and blossoms would be done in oils and the leaves in the gold which is sold with the metallic colours. A chaste effect could be obtained by tinting the design in cream and shades of brown only, then laying in a background of bronzy gold. This would make an artistic frieze with blue and cream brocade wall hangings, or with oak panellings. A rich scheme of colour may be desired to suit surrounding decorations. Under such circumstances I should suggest that the lilies should be of tawny orange tints shaded with coppery red; the foliage in greeny-blue tints, with the under part of the leaves of a silvery-blue shade, and the background gilded. The lilies should be outlined with copper red. Many other schemes of colour could be suggested for Fig. 1 of our illustrations, but I have said enough to show that it is easy to paint a frieze to suit any and every room decoration imaginable.

The design I give for the ornamentation of an occasional table top will be sure to prove effective if well executed. It would be charming if carried out in varied tints on a metallic green ground: gold and silver foliage, and flowers and buds of terra-cotta tints with brownish stems. Or the background might be of walnut wood, untouched; the chrysanthemums and buds painted pale yellow, and the foliage in shades of green and silvery grey green. If the table is square, run two circular lines round the design, and add four separate corner decorations. The gesso is laid flat, and is here merely as a foundation for the painting; it would be contrary to the canons of true art that a table top should be decorated with a design in high relief. If liked, the decoration could be carried out entirely in silver and gold on the green lacquer ground. An accomplished worker will find he can secure beautiful effects by laying on a coat of silver, say on a rose, and then tinting the petals with oil colours used very thinly. Pale yellow or blush roses are lovely when treated in this manner. It requires some practice to do it well, but no art work can be successfully learnt without perseverance. A quiet but pleasing harmony might be arranged by painting the chrysanthemums white and the foliage in cream and fawn tints just thrown up with deeper brown in the veining of the leaves: the background to be the wood—walnut or rosewood—left plain. I am fond of these sober decorations myself.

Now we come to Fig. 3, a pretty little cabinet door with two gesso work panels. This design may be modelled slightly. To my mind it does not allow of high relief, although such would be perfectly legitimate on cabinet doors. Here a rich Oriental colouring would be admirable; such as a deep metallic blue ground, copper red and gold for the design with touches of green here and there. This would look well for the door of a black enamelled wood cabinet; the handles should be of silver and the hinges of silver of openwork pattern, such as are general on the lac cabinets sent to us in such quantities from the East.

A second plan is to lay the gesso on, and,

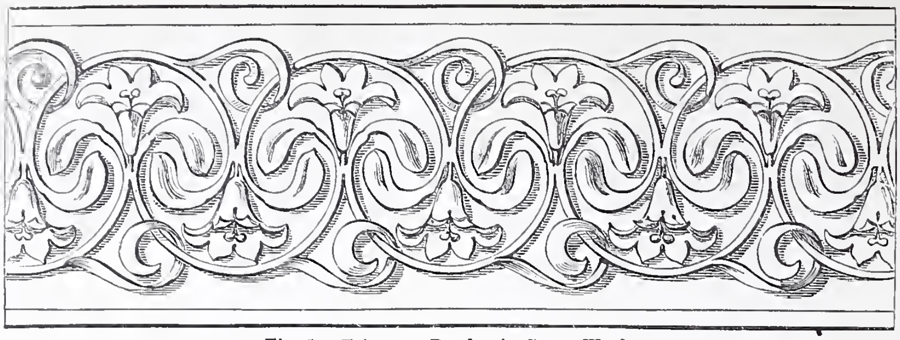


Fig. 1.—Frieze or Border in Gesso Work.

after modelling it, to tint it the same colour as the wood, when it resembles wood carving; I do not greatly recommend this style, because it is a mere imitation of carving, still it is, of course, far easier, not half or a quarter so much practice being required to accomplish a good piece of gesso work as to execute a carved wood panel. A turquoise-blue enamelled cabinet, the design carried out in ivory tints on a gold background, would be very attractive. It might well be accompanied by a settee decorated with gesso work. I give (in Fig. 4) a sketch of the back of such a settee ornamented with foliage in gesso and upholstered with self-coloured *frise* velvet or brocade. Pale gold coloured material (or chestnut shade) would accord well with the ivory and gold gesso work. It would not be at all difficult to enrich a whole suite of furniture in this way and so double its value. Furniture ornamented with garlands of roses and bows after the French style is extremely fashionable at present; this is merely painted, but I cannot doubt that any one who could execute gesso decorations well would have a fine chance of doing a good business with some of the larger furnishing and decorating firms. But they would need to be done in a masterly style, because rival workers soon appear wherever money is to be made; and to keep up with, or distance, such successfully, needs continuous attention and care. New and suitable designs would have to be constantly produced, and the work would have to be rapidly executed, for orders taken must be sent in up to time. Those who are only working for their own pleasure and can set about their self-imposed tasks leisurely will find it a pleasant occupation to decorate a room entirely with gesso work. If they do not wish to go to much expense, they could have a *stained* walnut or oak dado, and ornament the panels with gesso designs done in ivory tint with shading of leaves and flowers in warm brown. The background could be of stained wood; panels of door and shutters of the same; a self-coloured grey blue or terra-cotta wall-paper (or painted wall) with frieze in gesso carried out in soft terra cotta and gold and blue of a greyish tone. An effective interior could be arranged in the same way, but the panels should be grounded with gold; and copper red and silvery blue—toning to greeny blue—might be introduced in the design. Each panel would be decorated on a table or easel, and when all are finished would be inserted in the dado and door, so there is no fatigue in stooping down or sitting on steps to do the work. No end of lovely possibilities present themselves to my mind's eye as I write. I should like to see a dainty boudoir decorated somewhat in this manner. White enamelled wood dado with gesso panels bearing conventional designs in turquoise and ivory tints on an incised gold background. Turquoise satin panelled walls with flat white enamelled wood pilasters (decorated with designs corresponding with those in the dado); these forming the framework of the satin panels. In the centre of each of the satin panels, a figure after the style of Mrs. Wylie's "Dawn" exhibited in the Arts and Crafts Exhibition last autumn—a figure floating in mid air with the sun rising beneath her feet from behind golden-tipped clouds, her soft fleecy draperies fluttering in the gentle breezes. The figure executed in white with reflected sunrise tints, which also fleck the snowy cloudlets. A rich frieze of gold, turquoise and rosy tints, and a white panelled ceiling. I should enjoy describing the furniture and draperies of this ideal lady's sanctum, but I fear being called to account for running miles away from my subject.

Fig. 2.—Table Top in Gesso Work. Chrysanthemum conventionally treated: Design produced in very Low Relief.

There are many other modes and means of rendering gesso work subservient to the decorations of rooms and furniture with good effect, but I have said enough here to show its capabilities for this purpose.

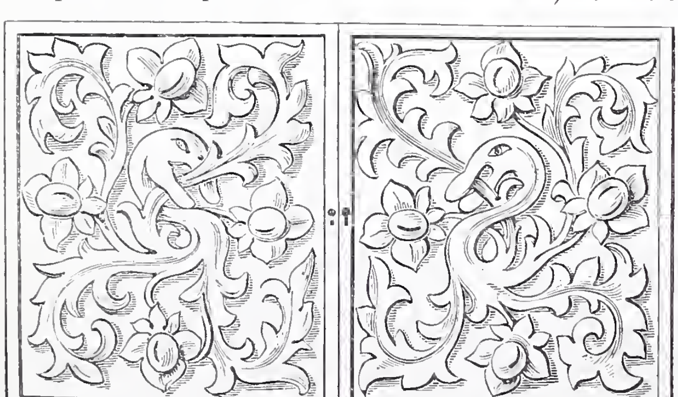


Fig. 3.—Design in Gesso Work for a Pair of Doors for Cabinet.

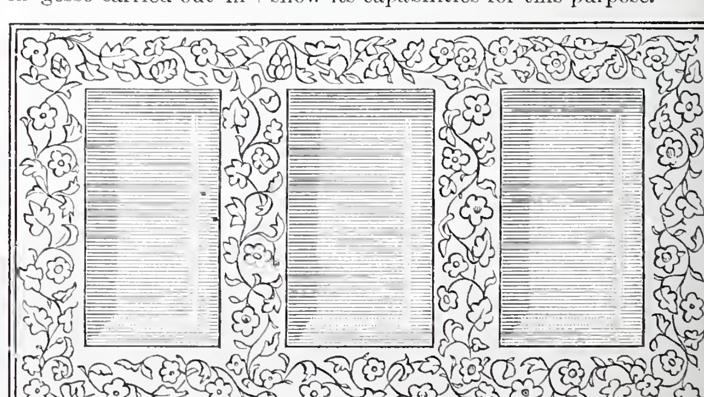


Fig. 4.—Design for Back of Settee, decorated with Gesso Work.

HOME-MADE SQUARES AND CALLIPERS.

BY J. H.

SQUARES.

THE square has much in common with the straight-edge and the surface plate. Like these, a square is made accurately without any reference to an original standard, and to a certain extent the same methods of construction apply to each. Squares are of two forms—the try square (Fig. 3) and the set square (Fig. 2). Each form is made both in wood and in metal, and in almost all possible dimensions.

A square is essentially two straight-edges set at right angles with each other. To test these relations, it is necessary to set the stock or base against an edge known to be straight, and to mark a line along the edge of the blade, or perpendicular. Then, if on reversing the direction in which the stock or base lies, the edge of the blade or perpendicular still coincides with the scribed line, the square is true. If there is any departure from absolute coincidence, half the amount of that departure is the extent to which the square is inaccurate.

To make a square in wood or metal, the first thing is to rough out and straighten the material of the stock and of the blade, and afterwards to work both edges of each perfectly straight, according to the directions given in reference to the making of straight-edges (see p. 500), and then to secure these together firmly and permanently. In the case of wooden squares, thin broad tenons are cut on the blade and fitted neatly into corresponding mortises cut in the stock. Half an inch or more of timber should be left at the end of the end mortise, to be dressed off after the blade or tongue is glued in place. This precaution prevents the splitting out of the end grain by the cutting of the mortise and gluing in of the tenons. While the glue is yet moist the square should be tested, and the blade adjusted thus :—

Select an edge of a drawing or joint board known to be true, and having a clean smooth surface. Lay the stock of the square against that edge, allowing the blade to lie flat upon the surface, and scribe a fine line upon the board exactly along each edge of the blade. Now reverse the direction of the stock (Fig. 1) to the position shown by the dotted lines, and note the coincidence, or otherwise, of the edge of the blade with the lines just scribed. While the glue is yet moist, some very slight adjustment of the blade can be made, so that no subsequent adjustments with the plane need be necessary. Each edge will be thus tried in turn.

A steel square is differently made. There are no tenons, but the blade is fitted into a saw kerf cut down into the end of the stock, and when fitted is secured with rivets. The slit is cut with a hack saw, and the blade must therefore be selected, or filed down, to the same thickness as the hack saw, to make a tight fit in the stock. If it is a slack fit it is not likely to remain true for any length of time, as the rivets, though holding the blade in place, are not sufficient to prevent slight disturbance or dislocation of the parts by accidental shocks or falls.

Some slight adjustment of the blade in the stock is possible at the time of making, by following the same method as that employed for a wooden square. The stock should, however, be laid against the edge of a metal marking-off table, or surface plate. First one rivet hole should be drilled, and one rivet inserted to hold the blade pretty firmly; then the blade may be tested and adjusted, and the second rivet hole drilled and the rivet inserted. If the square is small two rivets will be sufficient; if large, three, or even four, will be used. But after two rivets are inserted, no further adjustment of the blade is possible, except that of filing it in a tentative fashion, a necessary practice always when a square, by long service, has become worn more in one locality than another. When filing thus, or in the case of a wooden square, planing, the stock is held against a true edge as already described, and lines marked along the edge of the blade. The linear accuracy will be tested by means of a straight-edge, or by the turning over of the edge of the blade against a line just marked from that edge.

Set squares made in wood or in metal are tested either with a try square, known to be true, or by laying them against the edge of a plate to which a straight-edge is held for the base of the square to lie against. They are then reversed, still being held against the true edge.

Instead of cutting the hypotenuse of a square into some fanciful curve, it is always preferable to give it a definite angle in frequent use, as 45°, or 30° and 60°. A set square may also be utilised as a protractor, by marking out the quadrant into degrees.

Set squares made in wood are apt to warp when of large size. When over 5 in. or 6 in. in length, therefore, they should be grooved and tongued together (Fig. 2). They will then remain true for an indefinite time. The

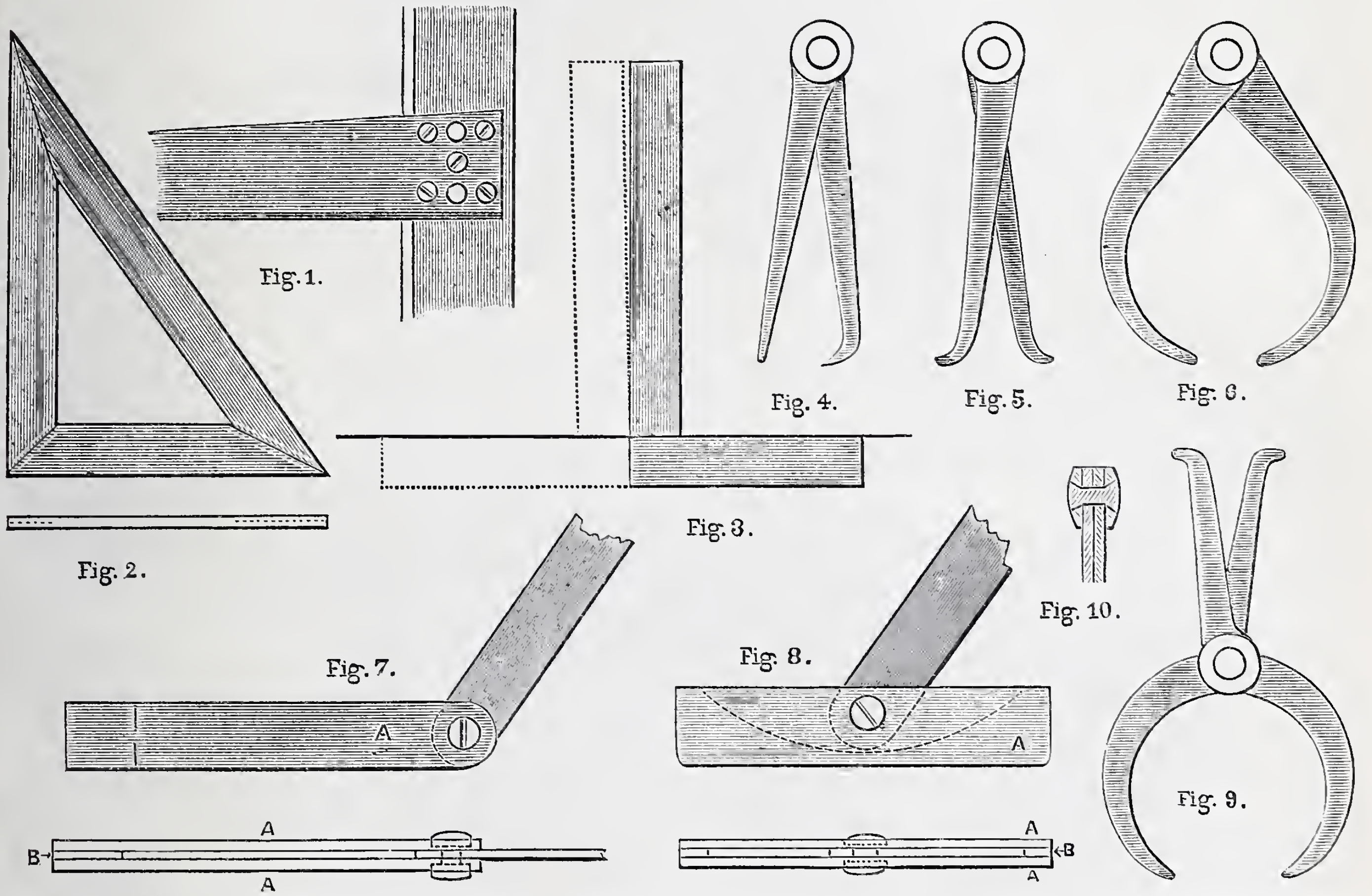


Fig. 1.—T Square. Fig. 2.—Set Square. Fig. 3.—Try Square. Fig. 4.—Compass Callipers. Fig. 5.—Internal Callipers. Fig. 6.—External Callipers. Figs. 7 and 8.—Bevels. Fig. 9.—Combination Callipers. Fig. 10.—Section through Rivet.

central portion may be left quite open, or a thin panelling fitted in by tongueing.

Large T squares and bevels are used in workshops for marking out work upon the drawing boards. They are usually made either of mahogany or oak. As the long thin blades are liable to spring, they should be cut out and roughly planed over several months before being finished. Sometimes ebony edges are used. If so, these should be glued on in the rough. The blades of long squares, say those of over 2 ft. in length, are made tapered for purposes of rigidity. One edge only then can be used. The blades are screwed upon the face of the stocks and prevented from dislocation by the insertion of a couple of dowels (Fig. 1). Squares such as these are expensive, yet they can be made very well by a careful workman.

Two useful shop bevels are shown in Figs. 7 and 8. In the case shown in Fig. 8, the stock is formed of two pieces, A A, between which is glued a thickness piece, B, a mere trifle thicker than the blade, and cut to allow the end of the blade to clear when in any position. The three pieces are well glued together and the end of the blade inserted between. The bit hole bored for the screw must be of the exact diameter; if larger, the end of the bevel will slop on the screw.

The other bevel (Fig. 7) is of a rougher type but very servicable in the shop. It consists of two sides, A A, united at one end by the distance piece, B, and receiving the end of the blade at the other, which is pivoted on its screw. If the stock is wide, its side well secured to the distance piece, B, and the screw fitted well into the sides of the stock and the blade, the bevel will be strong and firm.

Callipers.

These tools appear simple enough, and easy to construct and use, yet there are nevertheless some points about them which a workman learns by experience, but which have to be explained to an apprentice. These points are, that the legs should be tolerably free from elasticity, and therefore broad near the joints in proportion to size, thence tapering down towards the ends, that the pins should be large and close-fitting to prevent slop, that the points be slightly spreading, and that callipers should never be forced over the work whose diameter they have to measure, but be simply brought into bare and just perceptible contact therewith.

Is it worth one's while to make callipers? Yes, for more than one reason. A careful apprentice can make better callipers than he can buy, because stiffer and better fitted; and as he wants several pairs, and the material costs a mere trifle, or nothing, there is a saving in doing so. As a matter of fact, all apprentices do make squares, callipers, and scribing blocks, because they like to do so, and are proud of them ever afterwards, and because they afford good practice in their particular handicraft.

Four pairs of callipers are shown: Fig. 6 external, Fig. 5 internal, Fig. 4 compass, and Fig. 9 combination callipers. Only, or chiefly, in the matter of outline do these differ, and therefore a description of the method of making the first will suffice for all.

The blades of callipers can be drawn down from any bit of steel and bent, or they may be cut from steel sheet, the outlines being marked thereon, and centre popped, the severance being effected either by means of a cold chisel, or by the drilling of contiguous holes. This will have the effect of curving and twisting the legs out of shape, and they will accordingly have then to be levelled by means of a hammer upon a plate of metal. After this will follow the filing of the flat faces smooth, the legs being steadied with nails driven at intervals along their edges into a piece of board, as in the filing of the flat faces of straight-edges. Afterwards the outlines will be finished with files and emery cloth, and the legs are ready to be pivoted.

The holes will be drilled, and the rivets and the washers turned and drilled in the lathe. The rivets must fit closely into the holes in both legs and washers (Fig. 10), as there must be no slop in the mutual fitting of these. The rivetting over will be done with the cross pane of a small hammer. Then the semicircular ends of the legs will be filed round flush with the edge of the washer, and the battered ends of the rivets smoothed over with the file and emery cloth.

Observe with regard to the slight spreading of the points that they are thereby less liable to get diagonally across the work than if they are not thus spread. This very slight spreading out becomes to the delicate touch of a careful workman a sufficient indication of the square embracing of the work by the calliper legs. For some special purposes the points are spread to the extent of ¼ in. or more, but not so for common use.

A CHAT WITH FRENCH POLISHERS.

BY "LIFE-BOAT."

French polishing and spirit varnishing, or both in combination, is an art whereby our household furniture and thousands of other things are covered with a lac solution, the object being to give them a polished mirror-like surface By it the beauty and figure of the various woods are brought out and shown to the best advantage. If we paint them, the figure and beauty of the wood are hid, the article is given a lifeless look, and to a great extent the cabinet-maker's skill has been so much labour in vain. If we leave it alone, we have the appearance of an unfinished, unsaleable article, on which dust and finger-marks will soon accumulate, giving to the same a dirty, loathsome appearance, unless we, like Hollanders, content ourselves with making our household goods strong, massive, and plain, on which the good housewife might use the scrubbing-brush with impunity.

A good polisher who knows his business can stain and match the various pieces of sappy or common woods which, unfortunately, sometimes find a place in our furniture to match its surroundings. The amateur carpenter of to-day, who is having such capital lessons in our pages from the able pens and designs of David Adamson, Alexander Martin, J. W. Gleeson-White, and other able writers, may not be possessed of the needful cash wherewith to buy solid mahogany or walnut, nor yet be an expert at laying on veneers; he may find it to his advantage to do as others have done before him—use the mahogany or walnut at the front, deal or pine for the sides, back, or inside fittings of his cupboard, cabinet, or other article he may be making. To him, a knowledge of how to stain his inferior wood in such a way as to match his best woods may be useful.

True, there are some persons who lay claim to good taste who strongly object to staining, on the ground that things are not what they seem; but as these pages are printed for the British workman—amateur or professional—and they have been educated up to the use of finished articles, stained or not stained, I repeat, a knowledge of how to stain and match various woods cannot but be useful. It is not for me now to tell you how best this can be done—the Editor has kindly promised that this shall be done by other and, I trust, more able pens than mine; suffice for the time that I chat with you on other interesting phrases. To return: The gold incisions to be seen on much of the furniture of to-day gives to the articles thus treated a richer and more artistic appearance. Even these I have seen improved upon by staining inside of two gold lines—say, ½ in. apart—in imitation of some darker or black wood, thus giving an appearance of inlay; and by suitable stencils, designs, and colours, many articles can be made to look more artistic. Note the chests of drawers, wardrobes, etc., of pitch-pine and light bedroom furniture generally. Most of the decoration of these is done by the aid of stencils.

The polisher of to-day is called upon to do many ticklish jobs. It is not enough for him to be able to put a clear bright polish on anything that may be brought to him. He must, if he would hold his own, be able to match the various coloured woods, giving to the whole an appearance of carefully-selected and joined veneers. Here a knowledge of how to use chemicals, stains, and dyed polishes must be brought into play. Some parts must be made darker, dark parts may have to be made lighter, oak may have to be treated so as to present an appearance of age.

Here I cannot refrain from quoting portions of a lecture given in Dublin, some time ago, by Mr. T. R. Scott, whose able pen puts the subject so well before us:—"It requires some considerable skill and manipulation to turn out a genuine antique 120 years old inside six weeks. To get real good polishing is simply impossible. Of course, others as well as myself have to content ourselves with the best we can get for the want of better; but there is no reason why a better state of things should not be achieved. In my experience, I have come across very few polishers who know anything of chemistry. When I have spoken to them of this, I have seen a bland smile stealing over their countenances at the bare thought of their being chemists. But a knowledge of chemistry, as applied to the preparation of polishing materials, is a desirable advantage to the possessor. They ought to know all about the raw materials, where they come from, whether they are mineral or vegetable substances, how the colours are prepared and extracted for the market, and how these stains, dyes, or polishes are made. In this particular branch our French neighbours are ahead of us; indeed it is, and has been, the admiration of us Britishers to see the beautiful ebonistic work of Paris; and why our polishers should not be able to produce as good work as our Continental neighbours I cannot tell."

The unvarnished and unpainted oak fittings of stables have been noticed to change from their light colour to a rich brown. Observant minds have traced this result to ammoniacal fumes. Acting on this principle, many oak articles are given an appearance of age, or enriched in colour, by shutting them up for a time in a cupboard or air-tight box, on the bottom of which has been placed an open dish of liquid ammonia. Failing the acquisition of a suitable cupboard in which to do this, chemistry again comes to our aid, and tells us we can get a like result by wiping over with a solution of bichromate of potash, common soda, or even lime-water. Not alone is this useful for oak, but, by careful management, common bay wood or plain mahogany can, by the aid of these and dyed polishes, be made to look equal in colour, etc., to Spanish mahogany.

The coloured stringings, or inlays, found round ladies' work-boxes or on writing-desks, with their many-coloured woods, are not all real. No: the polisher and chemistry have been called upon to play their respective parts; and I have seen musical-boxes, etc., with imitation pearl inlays and stringing, which has been simply bird's-eye maple dyed green, verdigris and vinegar being mostly used for this. And yet, again, it is possible some of you may be able (as is now often done) to paint flowers, birds, etc., on the panels of doors; or, failing one's ability to do this, it is possible to get transfers that look exceedingly well when polished over or one may even cut out birds, flowers, and such-like from thin paper, and fasten them to the work with thin polish or varnish, giving them, when dry, a coat of white hard varnish, which can be polished, first taking the precaution of sizing the pictures with isinglass.

And here let me advise the embryo polisher, when getting his polishes, gums, etc., to get the best. They are far more satisfactory in the end. There is less waste, they work easier, and give far the best results.

One could but wish most heartily for a return of the good old times of polishing, when the work was done with small rubbers and small circular motion; when "patent fillers" and piece-work at low prices were almost unknown. I ofttimes meet with work now that was done at least twenty years, and some over fifty years, ago, which will put much to shame that has been done by my fellow-countrymen and women and Continental brethren only six months. Especially is this the case of some German goods, which, even in this short time, is covered all over with a greasy, sticky substance and cracked fretful surface, which, in nine cases out of ten, has been brought about by the use of patent filling and adulterated spirits and gums, or a too lavish use of oil. I do not mean to say our Continental friends are alone in this—far from it. I have seen work which has left the polisher's hands only a few weeks running with oil—or, as a master polisher remarked to me, "It's running after the fellows as put it on as fast as it can go." I have seen other work all blister up directly the sun shone on it, from the simple reason that resin had played a too conspicuous part in the preparation of the polish and varnish used.

Do not, for one moment, think that I mean to suggest that good polishing cannot be got for love or money. Give a good polisher a reasonable price for his labour, and then, if he is honest and true to himself, he will give a resultant polish that will bear future inspection.

On the point of brilliancy and transparent polish, *some* of our Continental brethren gain the day. They dispense with the use of fillers, using their polish very thin, and fine pumice pounced on in lieu of these; and, as they work longer—or, more correctly, more hours for a day's work—and receive less wages, they give us a polish we can but admire and envy.

This, then, in conclusion, is the cardinal point I wish to impress on your minds: If you wish to turn out work that shall bear future inspection, use the best of materials, have a clean, warm work-room, be sparing in the use of oil, and unsparing with your patience and labour.

WHY MY GAS-ENGINE WON'T GO.

BY F. A. M.

IGNITION OF GAS-ENGINES—IGNITION VALVE—FLAP VALVE—AIR INLET VALVE—SLIDE VALVE—ACTION OF SLIDE VALVE—CASTINGS: WHERE TO GET THEM—PRESSURE OF GAS ON GAS-ENGINES—HOW TO TEST PRESSURE—OTTO GAS-ENGINE.

It is usually through failure of the ignition that small gas-engines will not go. At Fig. 1 is a drawing of the arrangement for the ignition of the model gas-engine, which has succeeded very well. C is the section of the side of the cylinder, and P is the piston. On the side of the cylinder is cast a round boss, through which is bored a ½-in. hole, so placed that the piston, as it rises, will uncover the hole before reaching the middle of its stroke (see Fig. 1). Into this hole is fitted a kind of gland of brass, the shoulder of which is ground to fit against the boss, and held in close contact by two screws. The gland piece, G, contains the ignition orifice $\frac{3}{16}$ to ¼ in. in diameter, and over the inside of the hole hangs a light steel disc as thick as a threepenny piece; this is the ignition valve, V. The inner surface of G is cut slanting, because the object is to make it easy for the flame to get in, and also because there is no doubt of the closing of so light a door by the force of the explosion; the valve then is hung loosely upon a tiny screw, in such a way that it can open a passage underneath it at least ⅛ in. wide, but not so wide as to touch the piston. In working, it slams to with some force, enough to slightly bruise the surface of G. These two surfaces must, of course, be carefully filed flat, and slightly ground, to make a good fit. Although the valve shuts so quickly, it is not quick enough to prevent a sudden puff getting out, and meeting the igniting flame, I, which is instantly extinguished. To provide for this, the relighting jet, R, is placed underneath, out of reach of the explosion; it strikes across the path of the horizontal igniting jet, and relights it before the eye can see it has been put out. It is possible that if the flame, R, were brought close to the face of G, the flame, I, might not be required; but the ignition is a ticklish thing, and requires every advantage. The flame, I, requires to play pretty strongly against the outside of G, in such a way that no air, but only flame, can be drawn in; if air were drawn in, it would dilute the explosive mixture round the valve inside, and prevent any explosion. Finding that the shutting of the room door would often produce a draught sufficient to deflect the flame, I, and prevent explosion, the sheath, S, was added; this is simply a bit of sheet brass, doubled round to form a cylinder, and sprung on to G; this cylinder has a hole cut through it for the jet, R. The drawing sent with the castings of the model gas-engine showed the ignition orifice ⅛ in. in diameter, but, suspecting this was too small, I held a plate, having in it holes of different sizes, over a gas flame, when I found the flame would not pass through a hole ⅛ in. in diameter. It is no wonder gas-engines will not work if the ignition orifice is too small. The flame would pass easily through a ¼-in. hole, and less easily through a hole $\frac{3}{16}$ in. in diameter. However small then a gas-engine may be, the ignition orifice must not be less than $\frac{3}{16}$ in. in diameter, and it need never be larger than ¼ in., however large the engine may be. The little tap at B is obtainable at the gas-fitters', and is called a "pipe light." The piece, X, is a kind of "cross" made of a bit of brass rod; it screws into the foundation of the cylinder.

This engine is so small I did not find any gas-bag was needed on the pipe which supplies the cylinder, but as the lights, I and R, were supplied from the same source, and close to the intake valve, they used to bob up and down at every stroke when the lights in the room were quite steady. I found a small gas-bag 3 in. in diameter, on the pipe supplying X, sufficient to stop that mischief.

One other caution is needed with regard to the ignition valve. The slightest amount of oil, paraffin, or even of moisture, which may get under the ignition valve, is sufficient to stick it down, and, of course, stop the engine. In first lighting up, the engine being cold and the flame playing upon G, some drops of moisture may appear, and the valve, V, may be bedewed; that would be quite sufficient to overcome the very small suction in the cylinder; the valve, V, being open to begin with, the engine will give one stroke, the valve will slam to, and the moisture will prevent its lifting again. Insert a bit of wire into the hole of G, and feel the valve whether it is slightly adhering to the face; if it be only moisture, the ignition flame will dry it up before long; if the paste with which the cylinder was lubricated was applied too abundantly, some of that may have got under the valve; in that case it would be better to unfix the screws and take out G, with the valve attached, to wipe it clean.

These particulars will show why it is some fail to get their gas-engines to work, and why they are considered uncertain in action.

The flap valve over the gas inlet needs no further remark than that it is like the ignition valve: it prevents the force of the explosion from driving the burnt gas up the gas inlet; this valve is sometimes made of indiarubber, but as it is almost constantly surrounded by gas, this is not a good plan, since gas perishes the rubber. It does not so much injure the gas-bag, still it is well, on stopping work, to press out any remaining gas from it with the hand.

The air inlet valve may be simply a circle of holes covered with a disc of indiarubber: sheet indiarubber for making it can be got from the ironmonger.

The slide valve is different from that of a steam-engine in two respects; and, as my object is chiefly to describe those points of which those who understand the steam-engine may be supposed to be ignorant, I give in Fig. 2 a sketch of a slide valve suitable for a gas-engine. It is, as will be seen, a piston valve; it has the advantage of being balanced, that is, it is not affected by the pressure of the gases which it guides and distributes; they cannot, by their pressure, however great, force it up to the face on which it works; neither does the pressure of the gases tend to move it endways, or to retard its movement. In Fig. 2, C is the cylinder of the gas-engine; D D is a casting containing the piston valve, S; P is the port or opening to the cylinder; A is the air inlet; and *g*, where the dotted circle appears, is the gas inlet; *e* is the exhaust port in the valve leading to the exhaust orifice, E, into which the exhaust pipe is screwed. The second point of difference with the engine slide valve is that the gas-engine piston valve is arranged for a single-acting engine. It appears in Fig. 2 as in the middle of its stroke. If the dotted circle represents the path of the eccentric, then *a* will be the position of the eccentric, corresponding to the position of the valve: the piston being at the bottom of the cylinder ready to begin the "up" stroke; turning the wheel raises the piston and moves the valve to the right, the eccentric going towards *b*; as soon as the valve moves, the small part, *p*, comes opposite A, *g*, and P, and makes a clear passage for the air and gas to be drawn into the cylinder; just before the eccentric reaches *b*, the explosion should take place, the piston valve being fully open; the flap valve in the gas inlet, and the indiarubber valve in the air inlet, immediately close, as also does the ignition valve, and confine the pressure within the cylinder. While the piston is being driven up to the top of its stroke, the piston valve is closing, and is not shut until the eccentric reaches the point *c*, half round the circle. The valve is now again in its first position, but, as the piston begins to descend, the eccentric moves on towards *d*, and the edge of port *e* opens P to the exhaust, to allow the cylinderful of burnt gas to escape; port *e* remains open during the down stroke, as port *p* does during the up stroke. Placing the piston valve under the cylinder is convenient, though it involves mitre gear and a side shaft; the plan is, I believe, part of the patent of Mr. J. F. Barker (late Dorrington), from whom I obtained the castings of my model gas-engine; it is not at all necessary to have the piston valve in that position; it may be placed parallel with the cylinder, and then the eccentric can drive it direct as in the steam-engine.

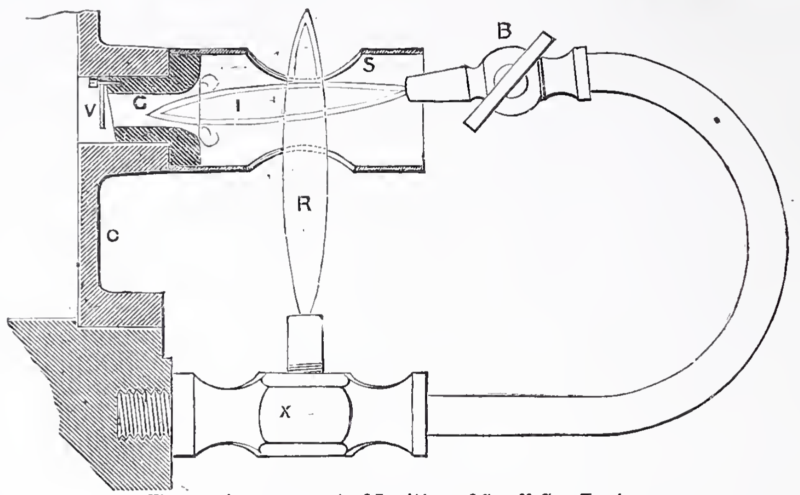


Fig. 1.—Arrangement of Ignition of Small Gas-Engine.

I found Mr. Barker's castings were very soft and easy to work, being perfectly free from hard scale; his address is 15, Dryden Street, Plymouth Grove, Manchester. He supplies castings of a half-man, one-man, two-men power, and other sizes of gas-engines. Were I going to make a one-man power engine, I should get the castings from F. Knoeferl, 100, Bolsover Street, Portland Place, W.; he offers them planed, and cylinder, fly-wheel, and crank, turned, for £5.

The model gas-engine, with cylinder 1½ in. in diameter and 4-in. stroke, can hardly be said to have any power; it might be strong enough to drive a light-running sewing-machine, but the least irregularity in working would cause it to stop; it would drive a fan or a tiny pump. The half-man engine has a 3-in. cylinder. I have not seen it at work; it should drive a sewing-machine, fret saw, overhead motion, etc. The one-man engine will drive a lathe as well as a man at least. These little engines are certainly unpleasant companions in a room or workshop; they smell and they thump. Still, a good stone foundation will lessen the noise, and a chimney over the ignition flame, or, better still, over the whole engine, will carry off the smell. I have not yet tried a governor, but I believe it improves the working of a small gas-engine very much.

I must now mention another possible cause of failure: it has nothing to do with the engine this time, but it caused me more perplexity than anything else. There were times when the engine seemed all right, yet it would not go. I have left it "till to-morrow," but, on the morrow, it would go off perfectly. At last, I discovered that when the gas was lighted in the house the engine would cease to work; this gave the clue: our gas main is rather too small, and when we light up, the pressure falls, and the ignition jet does not impinge with sufficient force upon the ignition orifice.

The pressure of gas can very easily be tested with a bit of bent glass pipe. Get a piece from the chemist, of a size that you can fit on to it your rubber tube; it may be bent like a U, with legs five inches long or more; pour a little water into the bend so as to fill half way up the legs, and fix the pipe upright on a board with wire or against the wall; the water will now stand level in the two legs, and you can mark its position on the board; now fit the indiarubber tube from the gas on to the top of one of the legs, leaving the other open to the air; when the gas is turned on, it will press down the water in one leg and force it up in the other; the difference of height measured vertically, in tenths of an inch, shows the pressure of the gas in height of water. In my own case, the gas is supplied at the works at a pressure of $\frac{15}{10}$ths, or 1½ in. of water, and this pressure is increased by its ascent from the works to this house to $\frac{24}{10}$ths.; but, in the evening, when the gas lights are turned on, the pressure falls to $\frac{17}{10}$ths.

The disagreeables connected with gas-engines, as mentioned above, do not refer to "compression" engines. The little "Otto" is a most beautiful little thing, working merrily away without more noise than a steam-engine, and practically free from smell; it is, naturally, more expensive than the simpler engines, and covered by several patents, besides being far more difficult of construction.

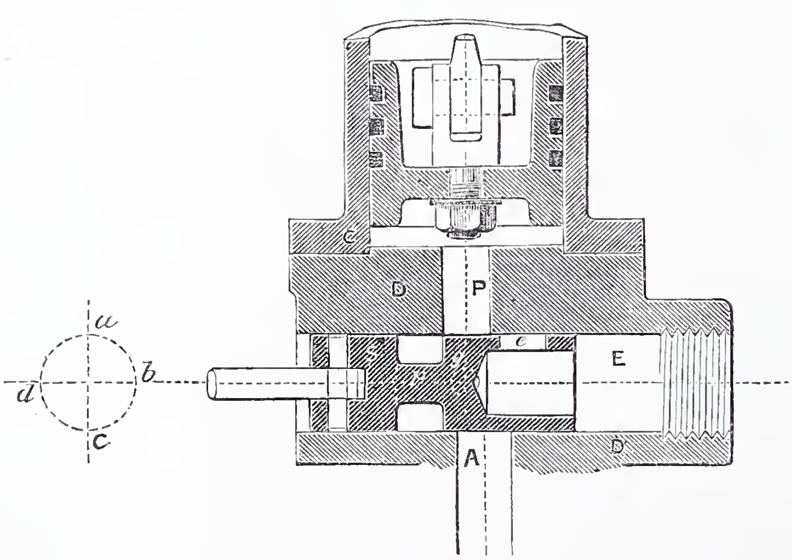


Fig. 2.—Sectional Diagram showing Action of Gas-Engine Slide Valve.

OUR PRIZE BOOKCASES.

II.—A Revolving Bookcase.

For which the Second Prize was awarded.

In a leading article which appeared a short while since in the *Times*, it was remarked "that the multiplication of good and cheap books, such as the masterpieces collected in 'Cassell's National Library,' has had a most powerful effect on the reading of multitudes of workmen, who now show an even greater interest in the problems of literature than in the problems of science." That such an effect has been produced by the publication of this library is a matter for general satisfaction.

It is, perhaps, well known that, at the end of last year, the number of the volumes of this particular series reached two hundred and eight. For those who are ignorant of the sizes, etc., of the books, I may refer them to the announcement of the prize competition in most numbers of WORK from No. 16 to No. 23 inclusive.

The bookcase here shown is designed especially to form a repository for the two hundred and eight volumes, and will form both a handy and appropriate article. It will stand with equal effect in the middle of a room, against a wall, in a corner, or, what is better still, in a bay window. In either case, the whole of the books can be turned round, so that a person sitting at it has no need to rise from his seat to obtain a volume

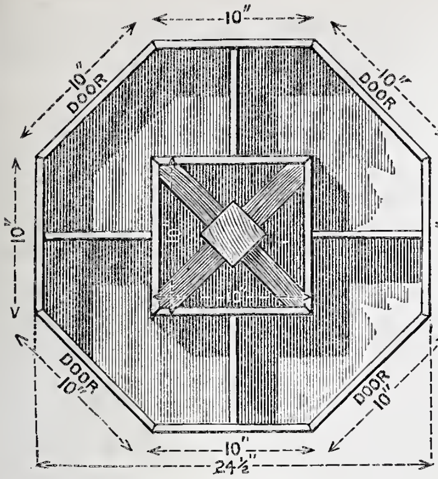


Fig. 3.

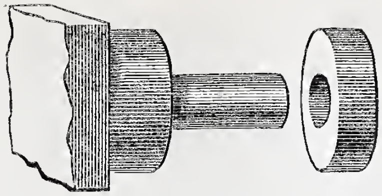


Fig. 6.

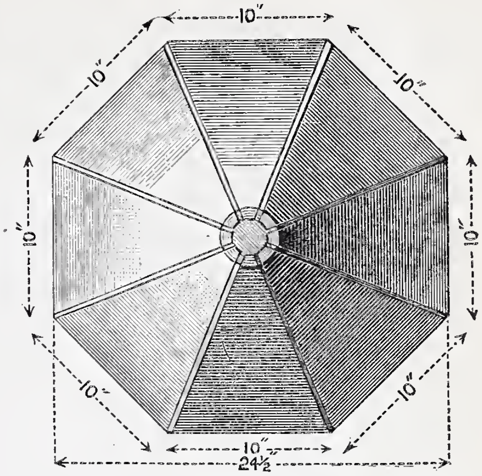


Fig. 4.

which may then be on the other side of the case. I have shown it with castors as well, for moving the whole article from place to place; but, personally, I should not fit it with them, as, when the top part is being moved round, the bottom part will thus become unsteady.

A few hints as to wood, etc., may be acceptable, although it is really a matter of individual choice. In considering the material with which it is preferable to build up any particular article of furniture, the effect to be produced by light and shade should always be studied. Where there is much shaping, and the article is of an open character, dark wood is the best; but, where there are flat sides—as in the present design—and the job has a square appearance, light wood produces the best lights and shadows. Now, I think that if the present design were built up in oak, satin-wood, or some other

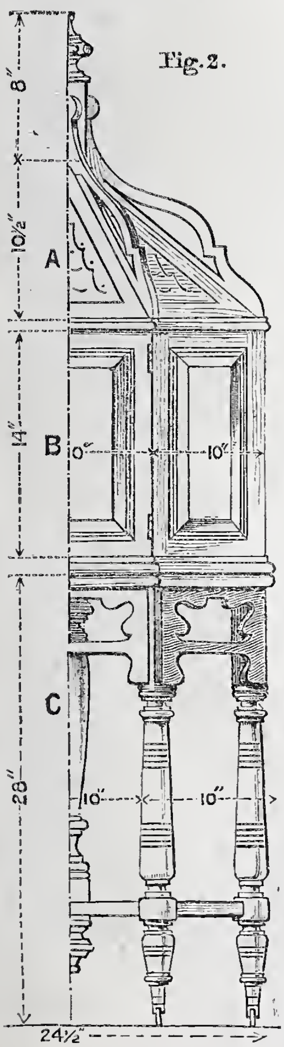


Fig. 2.

Fig. 1.

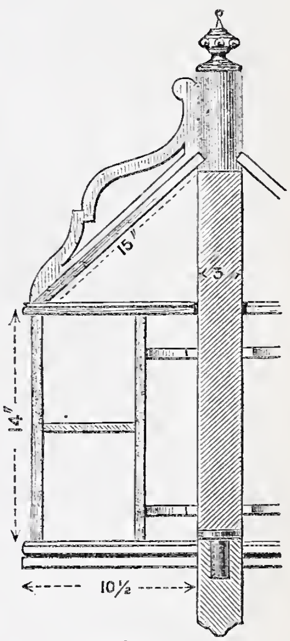


Fig. 5.

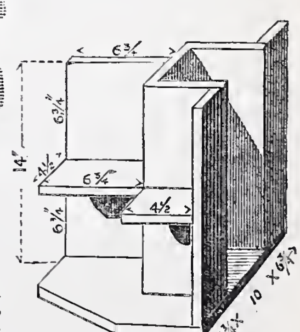


Fig. 7.

Fig. 1.—Perspective View of Prize Revolving Bookshelves. Fig. 2.—Front Elevation (half). Fig. 3.—Plan of Bottom at B. Fig. 4.—Plan of Canopy Top without Brackets. Fig. 5.—Sections of A and B, Fig. 2. Fig. 6.—Mode of cutting Centre Column to allow of A and B revolving on C. Fig. 7.—Perspective View of Inside without Doors or Panels. Figs. 2, 3, 4, 5, 7, 1-in. scale; Fig. 6, 3-in. scale.

good and light wood, with rosewood or mahogany top brackets, pillars, and door and other mouldings, a very effective artiele should result from the combination; for it must be remembered that, if the doors are glazed with clear glass, the deep shadows inside them will contrast with the lighter shadows on the outside, and the colour of the books will add a warmth to the cooling effects of the light wood. I trust I shall be forgiven if these few remarks are similar to any I have said or shall say; but, in a design of this kind, although strength and accommodation must be considered first, the appearance of the finished article must not be forgotten. Of course, the inside could be made of stained deal.

There are nine pillars supporting the top part, and, as the job is comparatively small, they will come rather close together; but this will add to the effect, and although not entirely necessary for the purpose of strength, I should not advise a less number to be used.

The sizes of this bookcase are: Extreme height, 5 ft. 1$\frac{1}{2}$ in.; extreme width, a little more than 2 ft. Taking the top, bottom, and middle boards first, it will be necessary to cut each as an octagon, each side of which shall be about 10$\frac{1}{4}$ in. long. These boards might be $\frac{3}{4}$ in. thick, but, if they are not quite so thick, they will answer the purpose just as well. As good a method as any to obtain the octagon will be to have a board 25 in. square, and draw two lines upon it so that they cross one another in the middle of the boaid, and the ends of them are in the middle of each side; then measure off 5$\frac{1}{8}$ in. each side of the point where the lines meet the edges of the board, and draw a line across each corner, so that it meets the points indicated after the above measurements are marked out.

The inside carcass should next be fitted up. Four boards, each 14 in. long and 10 in. wide, are fixed as shown in Fig. 7. To these, one on each side, and connected perpendicularly, are four other boards, each 14 in. long and 6$\frac{3}{4}$ in. wide. In each angle formed by these boards, and at an equal distance from top and bottom, are small shelves, four in number, each 6$\frac{3}{4}$ in. long and 4$\frac{1}{2}$ in. wide. All the inside boards might be $\frac{1}{2}$ in. thick.

Through the centre of the top, bottom, and middle boards must be a hole 2 in. or 3 in. in diameter, according to the stoutness the centre column is desired to be. The eentre turned column enters a square column which runs up the inside of the space formed by the four middle carcass boards (see Fig. 5), and which has another pillar joined to it at the top, which pillar is the one that can be seen in Fig. 1, to which the top brackets are joined. The square centre column is kept firm by means of eight pieces, of which one end of each is joined to the angles formed by the four middle boards. Four of these last-named pieces are fitted a few inches from the top of the space, the other four being fitted at a similar distance from the bottom. The turned centre column is cut right through just above where it penetrates the bottom and middle boards, an iron or wooden pin being driven into the top part of it, and fitting loosely into the bottom part, which has been prepared to receive it (Fig. 5) This is the means by which it revolves, and, if all parts are properly fitted and strongly joined together, it should be sufficient for the purpose; but I will give particulars of a method to facilitate a freer movement: Four or six thin long rollers of either wood or metal might be fitted under the middle board by means of a pivot passing through each of them, the ends of it being turned up and fastened to the middle board. The pivots through these rollers must fit neither too tightly nor too loosely, as, in case of their doing so, they will be an impediment rather than an assistance. If these rollers cause much of an opening between the bottom and middle boards, add a deeper moulding round one of them, or else fasten some fine fretwork to one of them.

It will be found that the canopy top will necessitate much labour, and, if it is desired that less labour should be spent upon it, have the top quite flat, with the brackets coming right in contact with the centre column. This will give room for any ornaments to be stood upon it, but I should say, *have the canopy*, as its appearance will compensate for the extra labour, and also the loss of the display of any ornaments. For this canopy eight boards are required; each should be 15 in. long and 9$\frac{1}{2}$ in. wide at one end, tapering down to a point at the other end. Eight brackets, each 15 in. long, are also required. The eanopy boards and these brackets can be connected by numerous methods. If, after the boards are joined, the outside sloping edges are planed down a little, the under parts of the brackets can be glued to these edges. Another method is to eut the bottoms of the brackets, so that in section they come to a point, and then to cant the edges of the boards inwards, thus forming, when the boards are put together, a triangular groove, into which the bottoms of the brackets fit.

The top centre column will be about 20 in. extreme length, and, of course, the backs of the brackets can fit it in a similar manner to that adopted in fitting them to the canopy boards.

The pillars now claim our attention. I should certainly advise having them not too stout. I think that, if they are turned from 1$\frac{1}{4}$ in. or 1$\frac{1}{2}$ in. wood, they will be quite strong enough. The length of them will be 27 in. In fitting them to the bottom board, do not have any side of the blocks come full with the edges of the bottom board, but have a corner of each block pointing to a corner of the board, while each side of the block runs at an equal distance from the corresponding sides of the octagon. Shaped pieces fitted between these pillars will look much better than spindles. The outside pillars are joined to the middle column by means of eight rails, each about 1 in. deep and $\frac{3}{4}$ in. thiek.

The doors and fixed sides come next. There is no need to have any pilasters to run the doors on. The fixed sides and the doors are all the same size, so that it is only necessary to describe one door. This will be 14 in. long and 10 in. wide. The stiles should not be more than 1$\frac{1}{4}$ in. wide. All the side edges of the doors and fixed parts will have to be canted a little to allow one to fit properly against another to obtain the form of the octagon. Clear glass might adorn all doors, ete., or only the doors, while the fixed sides are fitted with inlaid or carved panels. I should eertainly say, do not have the doors fitted with either silvered glass or wooden panels, as a lot of the effects of light and shadow will, in that case, be lost, in addition to the heavy appearance it would thus present.

In the above I have given only the bare measurements, and allowance must be made according to the various methods adopted in putting the parts together.

A moulding should either be worked round the edges of the top, bottom, and middle boards, or else one should be glued round them. Along the front of each shelf place some embossed or painted leather.

It will, without doubt, be noticed that, when each of the four doors is opened, four shelves of books, with thirteen volumes in each row, will be exposed; and that the corner space between these answers the purpose of a shelf where one volume can be placed while reference is being made to another.

Fig. 1 is not drawn to scale. All other diagrams, excepting Fig. 6 (which is to 3 in. scale) are drawn to 1 in. scale — that is, 1 in. represents 1 ft.

I trust that enough has now been said concerning this case for the volumes resulting from—as the *Athenæum* says—"*the greatest publishing feat of the last quarter of a century.*"

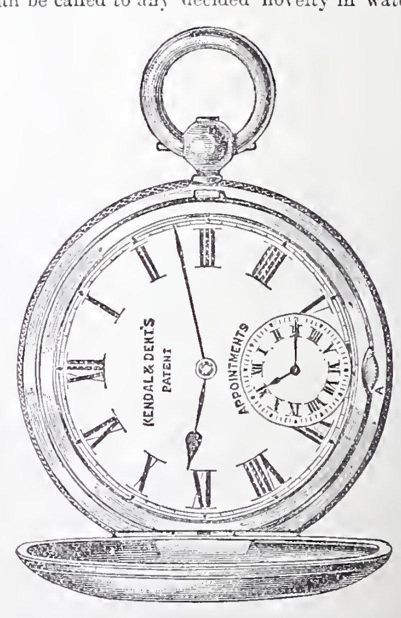
It is one of the most gratifying signs of the times to find that a firm with such a deservedly high reputation as that of Cassell & Company have brought our great authors within reach of all classes of the people by issuing these threepenny volumes. Every well-wisher to the spread of education will hope to see the NATIONAL LIBRARY receive a welcome far in excess of the utmost anticipations of the enterprising publishers. What a boon would be the perusal of these volumes alone to any working man! Here we have two hundred books which constitute in themselves a liberal education in English literature.

OUR GUIDE TO GOOD THINGS.

. *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

124. — KENDAL AND DENT'S "APPOINTMENT REMINDER" WATCH.

IT is not often that the attention of the public can be called to any decided novelty in watches



Kendal and Dent's "Appointment Reminder" Watch.

which can be readily understood and appreciated by any one who may happen to see it. By this I mean any addition to, or alteration or improvement in, the external parts of a watch, such as the case, glass, dial-plate, etc., for it is manifest that any change in the parts of the internal mechanism can only commend itself, or otherwise as the case may be, to experts in the art of watchmaking, or those who thoroughly comprehend the construction of a watch. Thus the improvement in the dial-plate of a watch, recently patented and introduced by Messrs. Kendal and Dent, Watchmakers and Jewellers, 106, Cheapside, London, E.C., is a novel feature, the utility of which every one can recognise, and whose practical value may be determined at a glance by any one who has been accustomed to carry a watch. It is shown in the accompanying illustration, and consists in the substitution for the old seconds dial another miniature dial corresponding to the larger dial of the watch itself, and furnished in a similar manner with hour hand and minute hand. Its purpose is indicated by the word "Appointments" above, from which it may be gathered at once that the small dial is to be used to fix the time of any important appointment that the wearer of the watch may have made, and is anxious to keep with the utmost punctuality, by putting the hands to the dial to the time in question in the manner that time is usually indicated by the hands of a watch or clock. It will be naturally asked, how is this effected? If the reader will look at the rim of the watch in the illustration, he will see just below the small dial the projecting segment of a small milled wheel, A. By turning this wheel, the hour and minute hands will be set in motion at the relative speed common to each, and may be kept moving in proper progression until the time fixed for the appointment be denoted. Messrs. Kendal and Dent shall speak for themselves with regard to the utility of their invention. They say, truly enough, that the new dial "occupies the position of the old and useless seconds dial." It is scarcely right, I think, to set down our old friend, the seconds dial, as useless. I can only say myself that I have found it of use at times in measuring speeds, etc., but I am bound to add that I am inclined to believe I should have found the new "appointment reminder" dial of greater use, because it would have been more frequently called into requisition. They continue: "How many of us, after referring to a time-table in the morning, and mentally repeating the exact time a train starts which we have to catch later in the day, have had a feeling of uncertainty as to whether it was, say, five minutes to one or five minutes past one? But possessed of this 'reminder,' we can now calmly set it to the time of departure, and there it will remain for instant reference, and every time the watch is looked at it acts as a reminder. As a train catcher it is really more valuable than the timekeeper itself. Again, to record the duration of a speech, or of a race, a railway journey, or of any process of distillation, cooking, or the like, when the interval of time is pre-arranged, the 'reminder' is at the commencement set so far in advance of the time as the operation should occupy, it will at once denote where the hands of the watch should be when it is concluded. Or, if at the beginning of any similar event of unknown duration the 'reminder' is set to true time, the period that has elapsed is denoted by the difference between the 'reminder' and the hands of the timekeeper."

Messrs. Kendal and Dent, as a matter of course, wish every one to buy a "reminder" watch, but although they may be had in silver from 42s., and in gold cases from £6, many, including myself, would like to be able to buy a "reminder" to be worn as a pendant to the watches we have. Could not Messrs. Kendal and Dent do something in this way, and thus extend their base of operation against the pockets of the purchasing public? The "reminder" pendant could be worked in the same way as the manufacturers have adopted in the case of the watch, and would have the merit of being far more useful and appropriate than the majority of pendants or "charms," as they are sometimes called, or even the spade guinea often worn as such. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

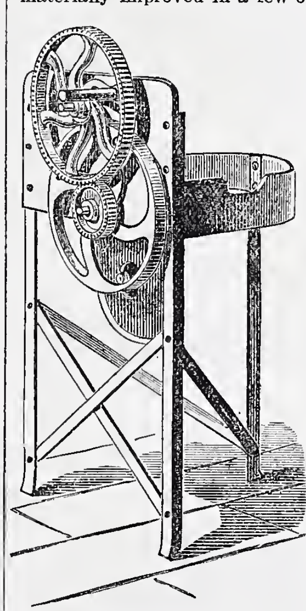
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

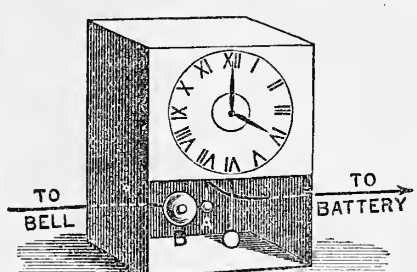
I.—Letters from Correspondents.

Cheap Hearth for Smithing.—J. M. (*Manchester*) writes:—"Your correspondent A. H. (see page 556) gives a fairly good description of a portable forge, which, however, I think can be materially improved in a few of its details:—The plates should be ⅛ in. thick, but anything thinner than 16 B.W.G. would be flimsy. The legs would be sufficiently firm and strong if made ½ in. or even ⅝ in. diameter; but for a fan the discharge pipe is far too small, as shown in sketch. For the further information of A. S. (*Liverpool*), I have seen portable fan forges made by Messrs. R. Clarke & Co., Moira Iron Works, Rochdale Road, Manchester (of which I enclose a sketch), at a cost of £3 5s. complete, and at which I have seen 1¼ in. square bar iron welded in a few minutes; the fans are of the Sebiele type, and can be easily turned by a very small boy. No doubt this firm would supply the fans, gearing, or other parts separately to any of your readers who might desire to build their own."



Cheap Hearth for Smithing.

Electric Time Alarum.—N. H. B. (*Ardwick*) writes:—"As a reader of your valuable paper from its start, I wish to congratulate you on the success of the paper hitherto, and the admirable way in which it has been managed. Having a slight knowledge of electricity, I thought I would venture, with the assistance of a friend, to fit up an



Electric Time Alarum.

electric time alarum. The clock was an ordinary alarum one with metal dial. We made the connections as shown in figure. One wire was attached to the bell and the other to the hammer. The alarum was 'set' in the usual manner, but not wound up. When the hour to which the alarum was put is reached, the hammer hits the bell and keeps in contact for about an hour, when it flies back. I send you this slight description, hoping it will help some fellow amateur. The bell must not be connected with the works or hammer."

Canoe Planks.—W. E. H. (*Bognor*) writes:—"I noticed in Work advice given about the planks of a canoe, and steaming them where the bends are. Now to have strips of mahogany 4 in. wide and straight would be absurd for either a canoe or boat planks, as every plank from garboard strake to gunwale strake is a different shape, and must be cut to shape or they will not work in, and no amount of steaming will induce them to either. I have built fishing and pleasure boats, and rarely want to steam the planks after the first one, and not always that, unless it be a boat with a long floor. I shall be pleased to answer questions that I may see on boat work. Do your readers know anything about the North Sea coble? There is no such boat here on this coast, and I want to introduce it, as I feel it will be a boon to the fishermen here on account of their light draught of water. Our boats here draw so much water, and the water is so shallow, that the boats ground so soon."—[Please send a paper describing the coble on approval.—Ed.]

Zinc Photo Etching.—O. G. B. J. (*Dover*) writes:—"Seeing some answers in 'Shop' from persons who understand zinc etching, I thought they might help me in a little trouble I have in that kind of work. Some time ago I purchased some photographic bitumen rendered sensitive from a maker who can be relied upon. I followed the directions sent in dissolving it in benzole, but when the plate had been coated and exposed to sunlight for a time, far exceeding the directions given, on placing it in turps the bitumen all washed away except a very little, but I could not get anything like a perfect image. If you could help me by any hints I should be very much pleased."

Combined Music Stand.—J. S. (*London, N.*) writes:—"I would like to make a remark or two about the scale mentioned in my article on Combined Music Stand (see page 552). Some readers may probably get confused, unless I explain. In dealing with feet, when we say a thing is drawn to ¼ in. scale, that means a ¼ in. represents a foot. When our measurements are small and we speak of inches, and say ¼ in. scale, that means ¼ in. to every inch. So that ¼ in. scale, seeing that I speak of inches, is quite correct; so also is 3 in. scale, and ¼ in. scale, although it might probably have been better had I kept to one proportionate scale."

Fret Machine.—Fair Play (*London, E.C.*) writes:—"There is not the slightest doubt that A. A. (*Coventry*) (see page 636) does not understand W. R. S.'s design for fret machine, so he must say that it will not work. Having made one according to W. R. S.'s design, and which I find to work well, I must say that it is rather good of him to condemn it, and then to give an illustration of one which he considers superior. I would like to know how he gets his motion to the crank, E, as he has no fly wheel, so when the treadle is at its lowest there it must remain, as there is nothing to counteract its weight, or, as I said before, to give the motion. I should now like to thank W. R. S. for the design of his machine, and would like to see A. A.'s answer to the above."

Work's Museum of Models.—J. Brox writes:—"I would suggest that all who have ideas and are capable of carrying them out should present you with a model, if possible, so that in time Work would be possessed of a small and growing museum of models, to be seen on some small payment at the gate, the proceeds to be used for Work and its museum. I shall be happy to start it by sending a model of the chair described in the paper enclosed, should you deem it worth a place in Work."—[I have much pleasure in accepting both your paper and your proposal as above. I trust that all inventors, makers, patentees, etc., who are readers of Work will follow in your footsteps, now that you have set them a good and praiseworthy example in going over the hedge first.—Ed.]

Levelling Oilstones.—C. A. B. (*London, E.*) gives many thanks to W. H. D. (*Birmingham*) for the way he has adopted in levelling oilstones (see page 636). It is far better than the old-fashioned way, rough flat stone and silver sand. My stone, which I have got nice and flat with emery cloth tacked on a piece of board, was ½ in. deep in the middle, and in fact in a very bad state, and in a very short time I could see a difference in the stone."

Etching.—C. A. B. (*London, E.*) writes:—"I shall feel very much obliged to W. J. P. (*Tunbridge Wells*) if he will furnish me with a little idea how to do etching, and the tools that may be required. Thin brass is the material I should require to etch. I am not in a good position at present, and it would be very useful in my business."—[Some papers on etching will appear shortly.—Ed.]

II.—Questions Answered by Editor and Staff.

Evening Classes for Electrotyping.—W. T. (*Hackney*).—Write to the Hon. Secretaries, City and Guilds of London Institute, Gresham College, London, E.C., and enclose stamped envelope for reply. They will probably direct you to an evening class on the subject you name.—G. E. B.

Electric Bell.—V. J. W. (*Ireland*).—From the fact that your bell has been working satisfactorily for two years with the current from a 2-cell battery, you may infer that the cause of the present failure is due to some fault in the battery itself. As the black japan on the heads of the carbon blocks is chipped off, and the lead heads have the appearance of plaster, it is evident that the ammonia fumes have undermined the lead caps, and destroyed their connection with the carbon. In a word or two, they are worn out, and must be replaced. It will pay you better to get newly charged porous cells than to recharge the old ones, or attempt to reeap the carbons. A little dust or corrosion on the contact parts of bell or pushes might cause fitful working, but the probable cause is in the battery. I do not suspect adulteration in the sal-ammoniac. Thirty feet is not too far from bell to push. This is proved by the past record of your bell, for it would not have worked satisfactorily for two years if the distance had been too great.—G. E. B.

Nickel Plating. — SIMPLEX (*Stamford*). — A small dynamo worked by foot power might be used by a working jeweller to furnish current for gilding and silvering small trinkets, but would be a cause of drudgery if employed to deposit nickel upon parts of bicycles, or to silver-plate large articles. Nickel is deposited from its solutions at the rate of about 16¾ grains per hour for each ampère of current, and it will take from 1 to 1½ hours to get a fairly good coat of metal. It will not be necessary to leave the articles in the bath for a long time if you have power at hand to force the nickel on fast, and only want to put on a flimsy coat of this metal, but such coats would be useless on bicycles, which, of all things, should have a tough, durable coating, put on slowly. You will gain nothing by making up a train of wheels to lift a heavy weight for the purpose of working machinery in its descent. You would require a weight of 5,555 lbs., falling at the rate of 1 foot in 1 minute, to develop the power of one man, estimating this to be ⅛ of a horse-power. If this power has to be applied through a train of wheels to get up speed in the machine, you will have to calculate the friction of the wheels together with that of the machine, and, after estimating the power needed to overcome this friction, deduct the sum from the power obtainable from the falling weight. Then please understand that it will take more power to raise the weight than you will get out of it whilst falling. A dynamo for plating purposes cannot be made to run light, since it must have a large output of current, and this absorbs energy. A series wound machine would be almost useless; it should be either compound or shunt wound. I do not know of a book that will instruct you how to make a plating dynamo. Goods to be nickel-plated must be well polished before being plated, and the coat must be polished afterwards. This may be done by hand, but it is best done with a machine. I should advise you to get Mr. Watt's book on "Electro-deposition," and study what he says about the deposition of nickel, as I have not time or space at my command to give you the necessary instructions here.—G. E. B.

Re-enamelling Clock Dials.—PENDULE.—Try the "Chez-lui" white bath enamel. I am afraid you will not be able to undertake this work in the usual way, as it requires a rather costly outfit, and the work requires to be stoved. You can get all you require from some of the Clerkenwell houses if you make a little inquiry. I can also give you directions for resilvering and regilding dials—easier operations. Do you know that Messrs. Willing, 12 and 13, Clerkenwell Green, E.C., the advertising agents, now sell patent enamelled figures for cementing on watch and clock dials? They are very good; write them for sample and prices.—H. L. B.

Modelling in Clay.—H. T. N. (*Malmesbury*).—Papers on this subject will shortly appear in WORK. The staining and shading of the inlaid portions in marquetry are two distinct operations. The former is done before the pieces are cut, the latter afterwards, whether the veneer is in the natural colour or stained. Shading is done either by engraving lines or by darkening with hot sand. This is the usual plan in such inlays as you describe, and the process may be thus briefly described. A pan or dish containing sand is heated over a fire or by other convenient means, till the sand is sufficiently hot to darken the veneer. The piece to be shaded is then pushed edge downwards into the sand, the gradations being arrived at by judicious manipulation. The process is a tedious one, but a certain amount of success is not difficult to attain even by a novice. Great care must be taken that the sand is not hot enough to burn or char the wood, and the best results are got on light veneers such as box.—D. A.

Camber in Girders.—H. H. W.—The camber is obtained by making the top flange longer than the bottom; in the lattice girder the distance from joint to joint is made longer in the top than the bottom flange, and in plate webbed girders each web plate is wider at the top than the bottom, and the rivet-pitch should be less in the bottom flange than the top, so as to suit the joints. The amount of difference of length depends upon the camber, the length of the top flange being to that of the bottom flange as the radius of the bottom flange plus the depth of girder is to the radius of the bottom flange simply. The rule for determining the radius of the bottom flange in feet: Divide three times the square of the length in feet, by twice the rise in the centre in inches, and add one twenty-fourth of the rise. This matter is thoroughly explained in an article on "Wrought Iron and Steel Girder Work," No. 12, page 186, which we advise our correspondent to read.—F. C.

Steel Colour on Brasswork. — BRONZE — To produce a bluish or steel-grey bronze on brass fittings for fishing rods, pour about half a pint of water into a gallipot; to this add 1 drachm of hyposulphate of soda, and 3 drachms of sulphate of copper. Place the gallipot with its contents in an old saucepan, and surround it with about 3 inches of water; apply heat until the ingredients are dissolved, when (as you do not specify the desired tint, whether blue or grey) it will be well to introduce a slip of brass as a test. Should it prove too dark, add more sulphate of copper, or if the opposite is the case, then more hyposulphate of soda will produce a deeper tint. When satisfied on this score, and still keeping the mixture heated, immerse the articles to be stained, which, of course, must have been thoroughly cleansed by dipping in dilute nitric acid, from this into clean water, and then dried in sawdust. After staining, heat the articles as hot as the hand can bear, and lacquer with pale clear lacquer. A steel-grey colour may also be produced on brass by immersion in a weak boiling solution of arsenic chloride, but this requires cautious handling as arsenious acid gas is evolved, which is a very powerful poison; it is therefore not advisable to attempt the experiment except in a stink closet, where all probability of inhaling the fumes could be avoided. The first mentioned method I have tried and proved.—T. R.

Magnetising Telephone Bars. — T. A. L. (*Reading*).—You ask for the simplest way of magnetising bars of steel for telephone purposes. Well, if you can get access to a dynamo, the simplest plan will be to draw the bars carefully across the pole piece, taking care to draw the bar always in the same direction. By doing so ten or twelve times the bars should be sufficiently magnetised for your purpose. Failing the dynamo, if you have a horseshoe magnet (the larger the better), you can use it for magnetising your bars. Proceed in this manner:—Lay one of your bars upon the table, and bring the horse-shoe magnet over it with the north or marked end nearest the bar, and draw the magnet slowly from left to right. Do this patiently

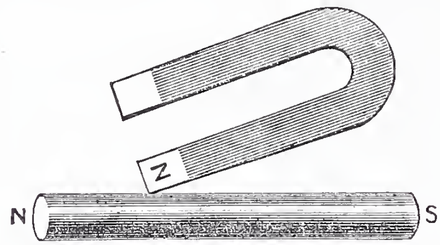


Fig. 1.

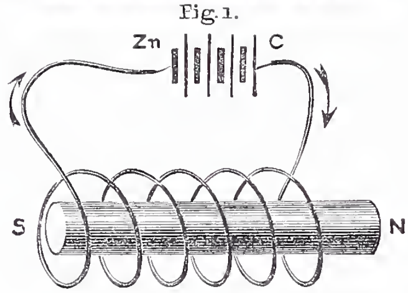


Fig. 2.

Magnetising Telephone Bars. Fig. 1.—Magnetising a Bar of Steel with a Horse-shoe Magnet. Fig. 2.—Magnetising by Means of the Electric Current.

for about twenty times, always commencing and leaving at the same ends. Turn the bar longitudinally during the process, and when bringing back the magnet for the next stroke raise the hand well above the table. The other bar is magnetised in the same manner. Fig. 1 shows the process, and gives also the names of the poles. You may turn your magnet and draw the south end across the bar, but you will require to turn the bar also. This will, however, be of no advantage, so rather than get mixed up keep to the method described. It may seem strange that by rubbing a piece of steel with one pole of a magnet you convert it into a magnet with two poles. Such is indeed the case. We cannot get a magnet with one pole; if there is south magnetism at one end of the bar there will be north magnetism at the other end. You will notice in Fig. 1 that the end of the bar where the rubbing stops is marked S or south. I cannot take up space in giving the reason of this. I merely draw your attention to the fact. In magnetism the law stands, "Like poles repel, unlike poles attract" —*i.e.*, a north pole repels a north but attracts a south, and a south pole repels a south but attracts a north. This by the way. Here is another method of magnetising your bars. Make a coil of No. 24 wire, using several hundred yards about the length of your bar, and pass a current from a battery or dynamo, giving about 2 ampères through it while your bar lies inside the coil. If you can arrange a make and brake like a Morse key in the circuit, and keep tapping now and again, it will be an improvement. If you look at Fig. 2 you will see the way to wind your coil and the method of joining up the battery so as to get the poles where you want them. I might give you other methods, but I hope you will succeed in getting your magnets the required strength by one or other of these methods. If you were not so far away from me I would do them for you with pleasure. As for the cost of magnetising such bars, I do not think any one could make a charge for it with the apparatus already at hand. A few minutes is all that is required for the process. Messrs. King, Mendham & Co., Western Electrical Works, Bristol, sell round bar magnets 5 in. by ⅜ in. (which is your size) at 10d. each. Write again and let me know how you succeed.—W. D.

Cycle Work: How to Braze.—CYCLE BRAZER. —You require, first of all, a small forge, or a blowpipe. The materials used in brazing are spelter and borax. The joints to be brazed must be well fitted and filed clean. Mix some of the borax with water into a thick paste, heat the joint to be brazed over a clear charcoal fire, sufficiently to make the wet borax fizzle when it is put on, and it will penetrate into all parts of the joint. If the part to be brazed is a solid fitted into a tube, put some borax inside the tube, allowing it to saturate the joint. Now put in some spelter, allowing it to rest on the solid in the tube; bend a piece of soft brass wire round the joint on the outside, and place on the fire if a fire is used. The fire should be clear and without smoke, and the blast kept up with a fan blower. Place a piece of wood over the joint on the fire; the heat from the burning wood will fall on the upper side of the joint. When the metal begins to get a good yellow heat the wire will disappear. Throw on a little dry borax over the joint and remove carefully from the fire. With a piece of iron clean off any cinder or scale on the still red hot metal, and lay aside to cool. If it is cooled in water the steel tube will become hard and brittle. Many joints may be made with spelter only, but in the case of tubes it does not lie well on the outside, hence the use of wire. All joints are brazed by running liquid brass into them, and the borax acts as a flux or penetrator.

Tempering Taps.—CYCLE BRAZER.—Heat the tap in a fire or gas flame to a dull red, and plunge into cold water. This will make it too hard. To bring it back, brighten one side on a bit of sandstone, and heat it in the middle through a gas flame. If you watch the brightened side you will see a yellow tinge travel slowly to the point, then cool in oil. It requires some experience to do it always with success.

Three-Inch Screw-Cutting Lathe.—F. W. (*Hitchin*).—To give you all the dimensions you ask it would be necessary to make complete working drawings, as it would not be easy to find details of a complete lathe on such a small scale. I most strongly advise you to make your lathe 3½ in. centres, because that is a size these lathes are often made, and for this you can easily buy a set of castings—say, from the Britannia Company, who will supply them with all machine work done. You can, of course, sit to work at it, if you use a high stool, and that is better than having the standards lowered, because then you can stand where you wish. If you follow my advice you will get all the main dimensions from the castings; you may, however, get the proportions and much useful information from the numbers of the *English Mechanic* mentioned in my reply to J. A. (*Preston*). —F. A. M.

Removing Varnish from Painting on Zinc.—J. M. G. (*Leeds*).—Your picture could be cleaned by any process which can be successfully applied to an oil painting on canvas, but more care will be necessary in handling and manipulation, since the colour would be more liable to peel and cake off from zinc than from the former. As you have, apparently, a picture of some value, it would be the wisest plan to hand it over to an experienced cleaner and restorer of paintings. If you are, however, determined to try the task yourself, the following may help you. The varnish which you wish to remove is a preparation of oil and resin, and can be removed, with more or less success according to the care and experience of the manipulator, by two methods—friction, or by dissolving the varnish with oil (mis-named spirits) of turpentine. In No. 26, p. 414, H. G. (*Liverpool*) gives a very reliable and commendable treatment for cleaning an oil painting, which will repay your turning up. This, however, may not be so suitable for your purpose of removing old oil varnish, which is of a much tougher nature than mastic (spirit) varnish. Try this:—Procure raw potatoes, and grate into some cold water until of the consistency of cream, then purchase at the chemist, if no large colourman's store is convenient, a little finely levigated pumice-stone. Mix well together, and then with a penny piece of sponge rub carefully and patiently. If the painting itself is carefully laid, or rather lays, evenly upon the zinc, this friction should safely remove the bulk of the old varnish. You might then try an equal mixture of methylated spirit and raw linseed oil; use with cotton wool, and carefully watch for the least sign of colour. Turpentine alone applied with cotton wool would dissolve the old varnish, but would require a very careful hand to use it. Friction of the hand alone will sometimes remove mastic varnish, but I am afraid it would only polish the face of your picture. In using the pumice mixture, this would require well rinsing off with sponge and cold water; then dry with a soft cloth. Messrs. Brodie & Middleton, Long Acre, are sole agents for a mixture called "Anadeiktine," by means of which they claim that any intelligent person can clean any valuable painting. You can get a sample bottle for a shilling, and it would pay you to try it, I think.—H. P.

Design for Safety Bicycle.—W. G. (*Bolton, N.B.*)—Yes, the probability is that your contrivance would be practicable, for so far as can be gathered from your rough sketch, it is on much the same principle as that of the "Facile" and "Xtra-ordinary," which were introduced some years ago. If, however, you know that yours embodies improvements on these, in my opinion the best thing you can do is to submit the design to some good manufacturer, and see whether he will take it up. If patentable—which you will understand I do not think it is—you should, of course, protect it before submitting it to any one whom you cannot thoroughly rely on. I am sorry to have to throw cold water on your plan, especially as you are an invalid, and no one would be more pleased than I to learn that through the indistinctness of your sketch I am mistaken in supposing it to be a revival of an old form.—D. A.

Circular Saw Bench.—C. W. T. (*Leicester*).—I am sorry to say I have read your letter over several times without being able to get your meaning as clearly as would be necessary before I could help you, but from what I can make out I have no hesitation in saying that you could not cut anything like the thickness you name. Without more knowledge than you have of the fitting up of such a machine you will do better to leave it alone; or, if you are determined to make a circular saw table, try one according to the directions already given in Work. I think your intention is to use hand power only, in which case I do not see the object of the two large wooden wheels. It is possible you contemplate availing yourself of steam power, but in this case you would hardly have asked the questions you do. Without going into calculations, for which there is no reliable basis to start from, the probable cost cannot be estimated. With regard to sharpening saws, your inquiry will be sufficiently answered by saying that the practice varies, some sharpening from one, others from both sides. Each method has its advocates.—D. A.

Lathe: Fitting Fast Headstock.—J. A. (*Preston*).—The proportions shown in your tracing are good, except the inside cone in the mandrel nose, which looks too steep. Set your slide rest over 2¾ degrees, to turn out that hole; and if the hole be ⅝ in. at the mouth, it will be about ⅜ in. diameter, at 1½ in. deep, not ¼ in. as you have it. You will find all the details you require, given for a 4-in. lathe, in Nos. 1,117, 1,121, 1,123, 1,125, and 1,128, of the *English Mechanic*. You can easily reduce in proportion.—F. A. M.

Index to Work.—F. R. (*Sutton Coldfield*).—When Volume I. is complete, an index to its contents will be issued.

Dovetailing.—F. R. (*Sutton Coldfield*).—Papers on this subject are in preparation, as I have said more than once already. Articles cannot be written and printed directly they are asked for.

Safety Bicycle Making.—J. T. H. (*Neath*).—As far as I am aware, no book has yet appeared on the subject of safety bicycle making.

Bicycle Wheels, Where to Buy.—J. T. H. (*Neath*).—You can buy bicycle wheels 30 inches high of any maker of bicycles. If the precise size is not in stock, a pair will be made for you.

Coloured Glass Windows.—Jay Bee.—Papers on this subject will appear in Work, but when I cannot say. All particulars relative to tools and materials and their cost will be given in them.

Fret Machine and Lathe to Sewing Machine Stand.—An Amateur.—It is quite impossible in the limited space of "Shop" to give directions which would occupy several pages, and then only be useful to readers who might happen to want to use up a stand exactly the same as the one you have. As you reside in Clerkenwell, why not keep your eyes open and hunt about the iron shops which abound in that neighbourhood? You would, probably, be able to pick up a second-hand lathe, etc., or such parts as would enable you to complete one at far less cost than you could make. The stand might do for a fairly serviceable fret saw, but the lathe would only be capable of doing very small work, and I cannot recommend you to waste your energy over it. You will, no doubt, agree with me that when cost is the main consideration in inducing one to make anything, that it is foolish policy to go to as much or even more expense for materials, not to mention labour, than would be involved in the purchase of an appliance of a more reliable and satisfactory kind.—D. A.

Re-magnetising Bar Magnets.—V. R. (*Liverpool*).—(1) If a steel magnet is made red hot, it becomes demagnetised, however it may be afterwards cooled. (2) Steel bars for magnets should be made as hard as fire and water can make them—viz., by beating the steel and cooling in water in the usual way for hardening steel. (3) Any number of Bunsen cells from 1 to 6 may be used in the process of magnetisation. (4) The cells must be arranged in series if you use a long coil of fine wire, or in parallel if you employ a short coil of thick wire. (5) Any gauge of wire may be used, but it must be of copper, and insulated with silk or with cotton. If for use with a large battery, with the cells coupled in parallel, use from 3 to 5 or 7 layers of No. 16 or 18 wire. (6) It will take nearly 24 yards of No. 16 cotton-covered copper wire to envelop one of your bar magnets with 3 layers of wire, and this will weigh 1 lb. It will take over 45 yards of No. 18 cotton-covered copper wire to envelop one of your bar magnets with 5 layers of wire, and this will weigh over 1 lb. You will only need to magnetise one bar at a time. (7) Begin winding at the end marked N, and wind from right to left. This will give the required polarity to the magnet if the current is made to traverse the coil in this direction. (8) The wires should go to within half an inch of each end. (9) The end of the coil should be at the opposite end from the starting point. (10) The position of the bar need not coincide with the magnetic meridian of the earth whilst being magnetised. (11) When coupling up the coil to the battery, connect the carbon element with the commencing end of the coil. (12) It should only take a few minutes to fully saturate the bars, but the process can be hastened and the effect intensified by lightly tapping the bars, or interrupting the current by drawing the connecting wires over a file during the time. (13) Bar magnets may be made of any size and length you may desire. (14) Old files may be used, but they should be first forged to proper shape, smoothed, and hardened. (15) Very large magnets will require more layers of wire or a stronger current to properly magnetise them. Are you satisfied with the replies to your fifteen questions?—G. E. B.

Bicycle Cone.—G. S. (*Liverpool Road, N.*).—It would be hard to say what is the matter and how to cure it without having seen the bicycle head. Your correspondent speaks of a cone. Does he mean the cone pin that screws down from top of head, and on which the backbone swivels? This pin usually has a jam nut to screw down hard on the head after the pin is adjusted. If his has no jam nut, let him have one put on by a repairer, or blacksmith, or mechanic. As to a bent or buckled wheel, it would be better and cheaper to put it into the hands of a repairer.—A. S.

Watch and Clock Tools.—Would-be Watch Cleaner (*Slaugham*).—The broken jewel hole is quite sufficient to stop it. Take the watch to pieces, and send plate, scape wheel bar, and scape wheel to Grimshaw & Co., 35, Goswell Road, Clerkenwell, or J. Hunt, 21, Ironmonger Street, St. Luke's. They will put a new jewel for a shilling or two, and from either you can get any and every watch and clock tools you may require.—A. B. C.

Something To Do.—Pleasure and Profit (*London, W.*)—Your question is a puzzler to answer. You might take up any of the subjects which are treated of in Work, and having now told you of something to be done I want to give you a bit of "straight" talk. Does it not strike you that you are the best judge of what you can do in your spare time? Though your letter shows you to have proper ambition and a desire not to waste time, I cannot know your capacity, amount of spare time, and fifty other matters which it would be necessary for any one to be acquainted with before he could advise you in such a manner as to be helpful to you. Your question about work that will be pleasant must also be dismissed in the same way, for "pleasant" work depends altogether on a man's taste. For example, mine leads me to prefer working in wood to working in iron, but plenty of our readers like the latter, and do not care for the former. As for profit, it may almost be said that any work is profitable, though perhaps not from a monetary point of view. Whether you can make it so must depend entirely on your own energy. As you are still a youngster, if you have mechanical abilities, why not learn some handicraft as a means of livelihood? Anyway, if you will write and let me know what you have done in the way of work, possibly I might be able to suggest something to your taste. Remember, however, that unless you show skill which, for one so young, will be quite exceptional, you are hardly likely to be able to earn money yet awhile by making things on your own account, as you will have to compete against older and more experienced workers.—D. D.

Finishing Fretwork.—F. S. B. (*Guernsey*).—The best method of finishing fretwork is to French polish the wood before cutting, and afterwards just to touch up with the rubber. Another way, and almost as good, perhaps giving better results with an amateur, is simply to body up before cutting—*i.e.*, do all the polishing except spiriting off. When the fret is cut, instead of spiriting finish with glaze. This is made with equal quantities (more or less) of gum benzoin and methylated spirits. Allow the mixture to stand till the gum is dissolved, then strain to remove impurities. It is applied by rubbing or wiping on with a soft rubber. You are quite correct in supposing glaze gives a finish superior in appearance to varnish. Varnishing, however, is easier and quicker in application. Perhaps your fretwork is dull because the varnish has sunk, and if so, give the work another coating. You don't say what kind of varnish you have used, but you may easily make a good spirit varnish by dissolving resin in French polish or methylated spirits. French polish, you know, is nothing but a thin varnish of spirits and shellac. Resin, or more shellac, added makes the mixture thicker, and you have what is commonly known as "varnish." Au revoir, m'sieur.—D. D.

Drawing-Room Chair Repairs.—Phosphor (*Plaistow*).—The chairs have not gone wrong "through being very straight-backed," but through being badly made. You will seldom find the joints at back work loose in a really good chair. Without seeing them or knowing more about yours than I do, it is impossible to tell you the best way to repair them. You might manage to fix in angle blocks between the back feet and side rails of seat, but this would be a very unworkmanlike way of doing. The only really effective way is to rejoint, but if your chairs are stuffed, I can hardly advise you to attempt the job yourself. It is not one for an amateur, as the upholstery must be partly undone if not altogether ripped off, and you will find it a difficult matter to replace it. The screws you mention might have answered. If you bored holes for them I cannot understand how they broke before you could get them in. If you like to run the risk of spoiling the back feet of the chairs altogether you might bore through them into the framing, and insert a glued peg which must fit tightly.—D. A.

Patent in Boxes.—H. H. T. (*Barnsley*).—Pray do not regard any question coming within our scope as a liberty, for it is not regarded as such. The services of both Editor and staff are freely at the disposal of readers of Work in helping to remove the little difficulties which crop up or, as in your case, by giving advice to the best of their ability and judgment. You and other intending patentees may also rest assured that you may with perfect safety, using your own words, trust to our good faith in not divulging schemes which are naturally communicated in confidence. As a general principle it is not wise to communicate particulars of anything which is intended to be patented before provisional protection, at least, is secured, and they are not invited; but when they are sent the trust is not violated, and it is a gratifying proof of the esteem in which Work is held that so many inventors apply to it. As for your own idea I may say that it seems feasible, though there are one or two points in the construction which I do not see can very well be managed. It is, of course, impossible for me to write so openly as I would wish about these, for fear of giving any one else a clue to the construction you suggest, but if you will "read between the lines" I think you will understand. First the "boring." How are you going to manage that? or, as I don't want to be inquisitive, let me rather say that this appears as if it would be sometimes impracticable. I don't think you need go to the trouble of clenching. If you do not see how this is to be avoided, I may be able to give you a wrinkle. Before spending any money on patenting your idea, you will, of course, see that it has not been forestalled, and you should also consider whether it is likely to be commercially a success. For instance, if the cost of making a box by your method is more than by the one you allude to, without preponderating advantages you could not reasonably expect to profit by your invention. Yours may be a novelty, but unless it is also an improvement on existing methods of construction in someway, novelty alone is not sufficient to make it pay. It is from a disregard of these plain business considerations that so many abortive patents are taken out. I don't want to throw cold water on your hopes, and it would undoubtedly seem more pleasant, and possibly more in accordance with your own views, to tell you that your plan is everything that could be desired, sure to be a success, and all that kind of thing, but it is only right as you ask for "opinion and advice" to put the business aspect before you as fairly as I can. I sincerely wish you success, and shall be pleased to hear of your progress.—D. D.

Clock Design in Keen's Cement.—C. R. H. (*Kilburn*).—It will be impossible to promise a paper on this subject at any very early date.

Varnishing Picture Frames.—A. L. D. S. (*Leicester*).—Before revarnishing your maple frames you must be sure they are quite clean and free from grease. I should advise cleaning them with a piece of flannel or sponge, and warm water with dry soap dissolved in it, afterwards rinsing with cold; don't let them get too wet, however. If they are very dirty try Brooke's Monkey Brand Soap, which combines the effects of soap and friction. The best varnish, I think, would be brown hard spirit varnish, applied with a camel-hair brush, such as polishers use. Copal varnish, applied with an ordinary hog's-hair brush, would do, but the former is preferable by reason of quick drying and hardening qualities, and looks more like polish. As to staining, unless all the old varnish were removed, this must be done in oil or varnish stain. A spirit and shellac mixture is sold in 6d. bottles called "Varnish Stain," or some fancy name. It is merely spirit varnish stained to match walnut, rosewood, oak, etc. This would probably suit as well as anything for you. The *Furniture Gazette* is the only one of two mentioned that I can get knowledge of. It is 4d. monthly. Order through newsagent or W. H. Smith's bookstall.—F. P.

Books on Graining and Coach Painting.—R. C. (*Chertsey*).—Coach painting is quite a distinct trade, and although I have known coach painters to turn house painters with some success, it is not often that a house painter changes over. It requires a thorough practical knowledge of the particular preparation and materials used to get up the body of a carriage, or so forth, in first-class style, and the time so necessarily expended wouldn't do in house painting, or at least on anything but the finest "hand-polishing" work. Otherwise, any painter who understands his business could paint a cart or cab in a serviceable and passable manner. I am not acquainted with any "manual" teaching purely coach painting, and do not think such exists. Respecting your second paragraph, you will find all you want in the articles now running on painting, graining, marbling, and general decorating. Cultivate patience and persistent application, or in your general desire—which is otherwise a very commendable one—to master every branch you may get but a smattering of them all. There are several works on such matters published, but no single one, I believe, treats the plain, the imitative, and also the advanced decorative branches of house painting. This the articles in WORK will make a point of doing, therefore work on at writing, and take the others as they come, and save your cash.—F. P.

Ink Drying. — LITHO (*Burnley*).—At first, in reply to our correspondent, we were about to reply very curtly that we had never had any such experience similar to his, for we always used good inks and paid a fair price for them, instead of purchasing low-priced inks, deluding ourselves into the belief that they were cheaper. As if an ink manufacturer could afford to supply an under-priced article of the same value as the best-priced article, or in other words give something away. Without seeing a sample of the bronze blue ink our correspondent refers to, we can only conjecture that it is made of inferior materials, such as varnish adulterated with resin, instead of consisting solely of boiled linseed oil, or acid added in excess to throw up the bronziness, or perhaps only half ground, and too much driers added to conceal it. Our correspondent does not say what rollers he used, whether varnished rollers or black rollers—viz., rollers baving the "nap" properly "up." We have, however, taken counsel with several of the best litho printers we know, and our opinion as above is confirmed. One recommends adding a little Russian tallow to the ink, another says a little palm oil is a good thing to "feed the job," and prevent its being pulled off the stone. We think, therefore, that our correspondent should well wash his rollers with "turps" or "terebine," and then, if "nap" rollers, well scrape them so as to bring them up, and then with clean linen rag wipe them with "methylated spirits of wine." The stone should be put on to a band press, be washed out, rubbed up well to feed it, rolled up with the hand roller in black, pounced and well etched, and again washed out, and put into full ink with the press roller by hand in bronze blue. Add to each pound of ink in the duct, a piece of palm oil the size of a haricot bean, and a piece of tallow of the size of a hazel nut. Rub well in on a slab with a muller, and add enough really good "middle" litho varnish to suit the fineness or boldness of the job. There is yet another possible cause of the trouble—namely, the paper. Paper is now so much adulterated with china clay or kaolin (silicate of alumina), especially cheap foreign kinds, that it actually falls out on to the stone in going round the cylinder, and there mixes with the water, which weakens the job on the stone, soaks into the rollers, and forms into a nasty paste, utterly subversive of good printing. In conclusion, our correspondent should learn that a just retribution will surely fall on all who are illogical enough to suppose that, by buying rubbishy materials because they are low-priced, they can take work in to do below the market value.—J. W. H.

Fretwork Designs. — H. B. (*Leeds*). — The American designs you name would most probably be obtainable of Messrs. Harger Bros., Settle. Or if they had not got them they would be able, no doubt, to indicate their whereabouts to you.—E. B. S.

Bronzing Goods. — MAC (*Wandsworth*).—Glad to hear that you were successful with the silvering solution. With respect to the urn that you wish to make look like new, I fear that will be beyond your power. If it is simply dirty, procure at an ironmonger's some urn powder, a speciality for cleaning urns; this will clean it and make it look well if the bronze has not worn off, but if it has I should not meddle farther with it, but send it to be done properly.—R. A.

Blowpipe for Soldering.—W. H. (*Birmingham*).—The blowpipe you mention can be had from Rhodes & Sons, Wakefield. It is slightly different in form to the sketch, Fig. 11 (see page 501), as it has no wood handle, and the price, I believe, is 4s. 6d. or 5s. It is just the thing for the work you specify, and for smaller pipes, but not larger.—R. A.

Brass Labels.—J. N. (*Sunderland*). — Messrs. Rhodes & Son, Grove Iron Works, Wakefield, supply the labels you ask about, and also dies for making them. Prices as under:—

No.	Size.	Die.	Labels per 1,000.	Labels per Gross.
	in.	s. d.	s.	s. d.
1	$1 \times \frac{3}{4}$	13 6	20	3 9
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3	$1\frac{1}{2} \times 1$	16 0	26	4 3

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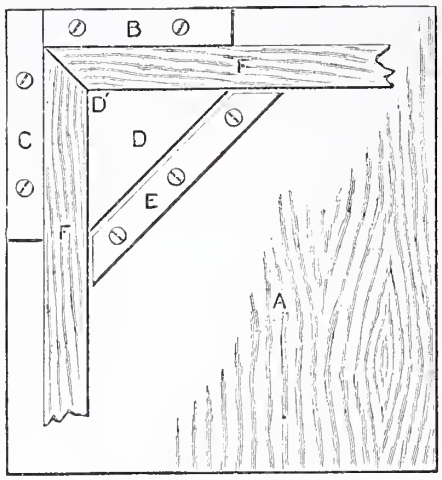
IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Patent. —LOCO (*Finsbury Park*) writes in sequence to PATENTEE (see page 574):—"I should like to show that the remarks made by MINERVA (see page 446) were quite right. In the 'Patentee's Manual,' by Johnson, published by Longmans, Green & Co., which is one of the best authorities on Patent Law, the author, in speaking of provisional protection, on page 109, says:—'This protection, however, gives the applicant no right against the public. He is only protected against the consequences of his own publication in case of his employing workmen, making experiments, or exercising the invention—that is to say, he will not thereby prejudice the patent afterwards granted to him. He must not forget, however, that as he cannot take any legal proceedings for infringements committed before the publication of the complete specification (Sect. 13), his proceedings even under protection should be conducted with due caution.'"

Wood Mitre Cramp.—H. J. L. J. M. (*Ealing*) writes:—"Perhaps this may suit J. H. (*Blackburn*) (see page 605). A very good way to join up mitres is to take a stout board, A, and after planing it quite true screw on two pieces, B, C, of hard wood (such as solid oak moulding), lined on one surface and one edge, in such a way that they form a perfectly true right angle. Then prepare a triangular piece (with one angle a right angle) of similarly hard wood, and a slip similar in size to B or C, with two or three holes bored through it. When the pieces are cut and ready for gluing up, glue them and place them (F, F) in position on the board A. Next put D in its place, so that the right-angled corner, D, may press well into the mitre joint.



Wood Mitre Cramp.

Then screw down the strip E, leaving room to insert a few thin wedges, with which D may be forced more tightly into F, F if required. In the case of larger mouldings E might be fitted with two large sash screws, the points of which could unhinge on the hypotenuse of the triangle-shaped piece, D; a small stud of metal, such as a screw, being first fixed into D where the sash screw points would exert their pressure. This idea of mine answers very well for gluing up frames, and was thought out long before a somewhat similar but more expensive one in iron was introduced into use. As the apparatus can be made of any size as required and so very inexpensively, I have not given any measurements or dimensions. For the making of small picture frames a board might be made with all the four corners similarly fitted, and thus the four mitres of the frame could be glued at the same time."

Cab Drawings. — G. W. writes in reply to W. M. C. (see page 631):—"Working drawings of Forder, Showful, or four-wheel cabs, regulation sizes (London), and all details, may be had on application to me, Spring Road, Bournemouth."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A. C. (*Leeds*); J. KENNEDY; H. D. (*Blairgowrie*); J. C. (*Cork*); WINDMILL; J. D. N. (*Glasgow*); TIM BOBBIN; SALE MOOR; J. M. (*Nottingham*); J. S. A. (*Manchester*); E. B. (*South Shields*); Dr. H. (*Ireland*); J. P. (*Byker-on-Tyne*); J. R. (*Truro*); P. P. (*Withington*); ELECTRIC NIGHT; A. R. (*Saltaire*); J. R.; SPAH; W. M. (*Hairwain*); OXON; TANCRED; THETA; CLOCK; F. N. M. (*Keighley*); A. H. (*Ashton-under-Lyne*); SPOKES; HEXHAM; P. W. (*Bradford*); VAN BUILDER; J. T. R. (*Newcastle*); WORKER BEE; V. R. (*Liverpool*); G. J. P. (*Manchester*); B. F. E. (*Carlisle*); AMATEUR; STAUNCH; G. H. G. (*Bishopsgate*); J. R. (*Spilsby*); A. P. (*Hoxton*); MANDOLIN (*E.C.*); G. D. (*Sheffield*); E. D. (*Clapham*); GLACIER; W. S. (*Upper Clapton*); A. G. (*Leicester*); F. J. S. S. (*Birmingham*); A. H. (*Manchester*); POO BAH; W. W. (*Dublin*); A. W. (*Manchester*); GALVANUM; C. W. B. (*Plymouth*); H. A. B. (*Tunbridge*); H. B. (*Kettering*); CLOCK; T. R. (*Belford*); H. E. A. (*Hackney, E.*); W. H. P. (*Loughboro'*); J. L. (*Wandsworth*); W. F. H. (*Dartford*); J. A. (*Liverpool*); CLERICUS; M. H. (*Bristol*); U. G. (*Hitchin*); B. E. C. (*Stepney*); C. B. (*Highbury*); B. W. (*Bridport*); J. W. Y. (*Loughboro' Junction*); NEMO; A. C. (*Grimsby*); BIRKENHEAD; M. S. (*Gateshead*); J. S. (*Coseboe*); F. W. (*Doncaster*); A LOVER OF "WORK"; CHIP; PERPLEXED ONE (*S.E.*); THREE LEGS; R. S. S. (*Trevil*); YOUNG GRAINER; E. H. P. (*Manchester*); H. H. (*Sidcup*); R. A. S. (*Staines*); QUEEN ANNE SIDEBOARD; W. B. (*Inchimann*); DRAPER; J. McG. (*Salford*); HOMO; D. S. (*Auchenheath*); W. R. H. (*Leeds*); R. W. S. (*Godalming*); A. E. B. (*Cromer*); J. P. (*Belfast*); W. G. (*Exeter*); A. M. L. (*Nottingham*); A. S. G. (*Hull*); V. B. (*Smethwick*); TO-PO; ARTISAN; PATRAS; GRAINER; J. F. K. (*Doncaster*); G. H. R. (*Saltley*); J. W. W. (*Hull*); V. R. (*Liverpool*); YOUNG BRASSFINISHER; P. W. F. (*Falmouth*); W. S. T. (*Edinburgh*); NEMO; P. P. C. (*Dudley*); F. W. T. (*Ipswich*); W. B. (*Leith*).

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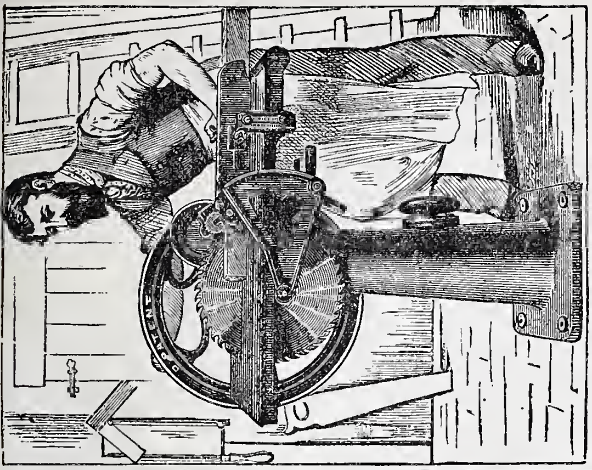

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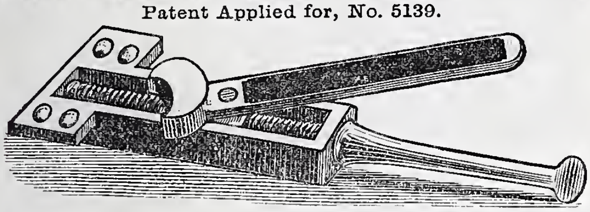

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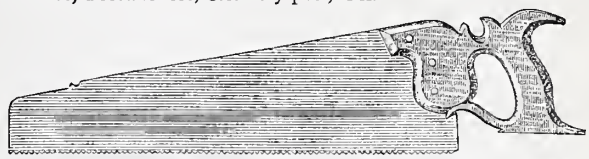

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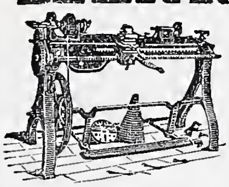

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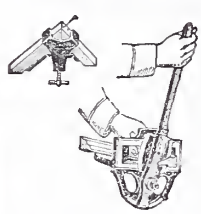

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WORK

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THE DARK ROOM AND ITS EQUIPMENT.

BY AN OLD HAND.

The Arrangement of the Dark Room or Laboratory—Print-washing—Accessories.

The "dark room," as it is generally called, is somewhat of a misnomer, the word "laboratory" being much preferable, for the amount of light admitted to this so-called dark room may be sufficient to enable the operator to see comfortably over the whole place and yet be perfectly safe; that is, not affecting the sensitive surfaces with which he has to deal, unless they are very unnecessarily exposed to its influence. It may be borne in mind that *no light* is absolutely safe for an unlimited period. Sensitive plates and papers should never be exposed to it more than is absolutely necessary; this matter has been already referred to in treating of lanterns. The conditions required for constructing a "dark" room are, first of all: convenience in size and design, good ventilation, and thorough protection from any white or actinic light when desired. The photographic dark room bears the same relation to the studio and the rest of the premises as the kitchen does to the ordinary dwelling house; or rather the dark room is to the photographer as kitchen to the cook. It is true all sorts of holes and corners have been used as "dark rooms," but are makeshifts at best; good work may be done in them, and frequently is, on the same principle that a good workman will make good work under almost any disadvantages, but this is no argument in favour of the makeshift. Where opportunity offers, no trouble should be spared to make this portion of the photographer's premises as perfect and convenient as possible.

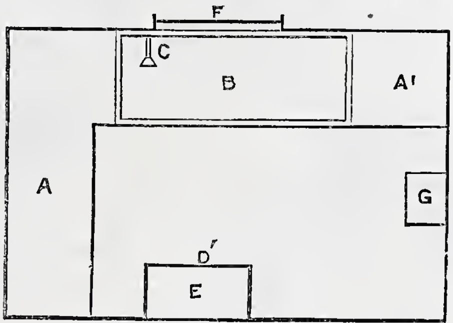


Fig. 1.

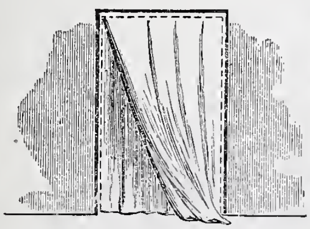


Fig. 2.

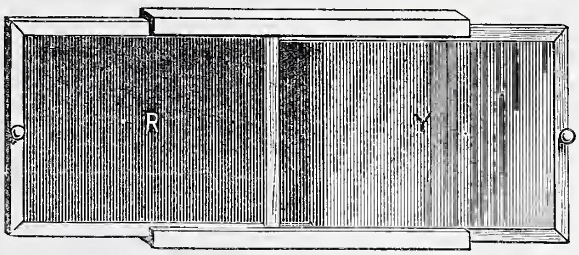


Fig. 3.

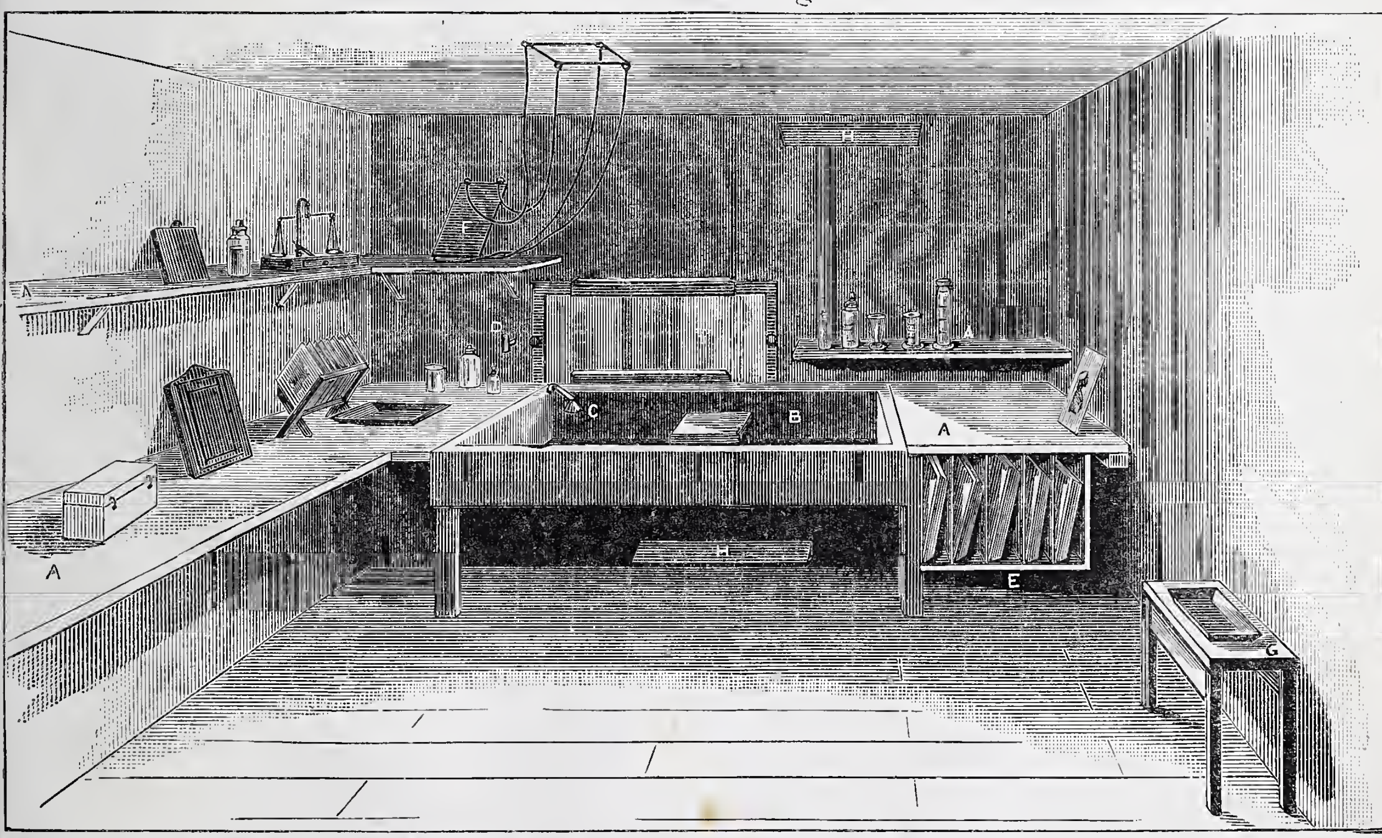


Fig. 1.—Plan of Dark Room—A, A′, Shelves; B, Sink; C, Water Tap; D, D′, Doors; E, Lobby; F, Window; G, Small Table. Fig. 2.—Curtains over Doors. Fig. 3.—Sliding Sashes in Coloured Glass. Fig. 4.—Interior of Dark Room—A, A, A, A, Shelves; B, Sink; C, Water Tap; D, Gas Tap; E, Shelf with Partitions for Dishes; F, Oscillating Table; G, Small Table for Hypo. Dish; H, H, Trapped Ventilators.

The area of such a workroom should be sufficiently large to contain two persons at the same time, with plenty of elbow room. This I consider the smallest space that can be fairly designated as convenient; but if the size is that of an ordinary sitting-room, so much the better. The larger the place the more healthful and pleasant it is to work in.

Let us suppose we have a space at command of about 8 ft. by 6 ft., which we will now proceed to fit up. The ground plan (Fig. 1) shows the disposition of the window, door, sink, and shelves. The door must either be doubled, or covered with double curtains, impervious to light. The doors, D and D′, being double, should have a short lobby, E, between them, that may either project into the dark room, or, if there is sufficient space, extend outwardly, a hinged rod connecting the two, preventing both doors being opened at the same time. The edges of the door should be made to fit into a deep felt-lined rebate, so that when closed they are absolutely light tight. If a single door is used, one opaque curtain is fastened securely along the top and down the side, the other being also fastened along the top and down the opposite side, taking care they are sufficiently voluminous to permit easy passage between them (as in Fig. 2); these curtains take the place of the outer door. B is a lead-lined wooden sink, 4 ft. long, and 2 ft. wide, and 9 in. deep; A, A′ are shelves, A being 3 ft. wide and the whole width of the room, A′ being the width of the sink, grooved and sloping gradually to it, so that any fluid may drain into the sink, filling in the space between the sink and wall. F is the window, consisting of a grooved frame that is glazed with white glass, and in which other frames filled with orange or ruby glass, or other non-actinic material, can be slipped at will (Fig. 3). The light is preferably a gas jet *outside* the room, regulated by a tap on the inside. Of course daylight *may* be used; but, owing to its fluctuating character, is not to be recommended; C is the water tap with rose, from which the water flows on its being pulled forward. A narrow shelf is fixed against the wall over the sink, for any measures, bottles, etc., that may be required. Another shelf at a distance of 2 ft. above the lower one is convenient, and a roller towel hung behind the door. Brown or yellow varnished paper should cover the walls and ceiling, as less likely to retain dust and dirt, and can be readily cleaned with a damp cloth. In Fig. 4, the general appearance of such a room is given. Placed in the sink are one or more small movable platforms, on which to place dishes and bring them under the tap at will; to the right, below the sink, is a shelf divided into cells for the purpose of storing developing dishes and trays. In front of the window and screwed to the ceiling are four eyes, from which an oscillating table is suspended, such as described in a previous chapter, and which in the diagram is represented placed out of the way on a shelf. The door should be provided with the means of securing it on the inside. The fewer the bottles, jars, or other articles (than those required for daily use) stored in the dark room the better. There should be a place for everything required, and everything in its place, so that even in total darkness they can be found at once. This methodical arrangement is of much more importance now, in these days of plates and papers of such exalted sensitiveness, than when only wet collodion was used; in fact, when working orthochromatic plates only the merest glimmer of deep ruby light is permissible, and very little of that, if we expect to produce bright, clear negatives. With regard to temperature of the room, it should never be below 60° Fahr., or above 70° Fahr. The hyposulphite fixing bath is best placed on a stand separate (Fig. 4) from any of the shelves or sink, and let the dish or dipping bath be used for nothing else, when it has once been devoted to this purpose. Contamination with hyposulphite of soda is a fruitful source of stains and trouble; after touching it, the hands should always be rinsed and wiped before proceeding with any other operation. It is convenient if the bottles containing the accelerators or restrainers are of different shapes, for labels soon get partially or wholly obliterated. Once get accustomed to a particular shaped bottle for a solution, and there is very little probability of using the wrong one. This may be an apparently trifling matter, but the advantage of adopting it will be soon appreciated.

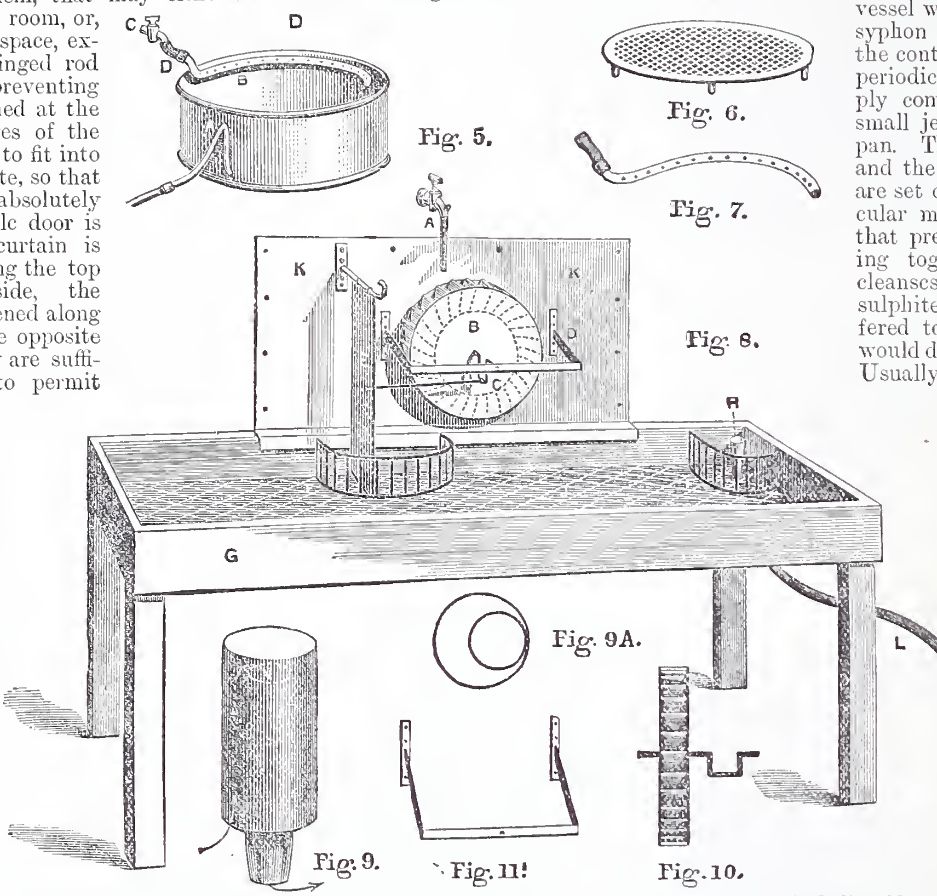


Fig. 5.—Small Washing Machine—A, Syphon; B, Jet Pipe; C, Water Supply; D, Indiarubber Connection. Fig. 6.—False Bottom of Perforated Zinc. Fig. 7.—Brass Perforated Jet Pipe. Fig. 8.—Large Washing Machine—A, Water Supply; B, Water Wheel; C, Crank; D, Support; E, Paddle; F, F, Cage; G, Tank; H, Water Plug; J, False Bottom of Perforated Zinc; K, K, Zinc Sheet to protect Wall from Water; L, Wash Pipe. Fig. 9.—Waste Plug. Fig. 9 A.—Diagram showing how Plugs are Soldered together. Fig. 10.—Water Wheel and Crank. Fig. 11.—Iron Frame to support Axle of Wheel.

Print-washing.—One of the most important processes in the preparation of silver prints is that by which they are freed from the hyposulphite compounds formed during the fixing; very many kinds of washing tanks have been devised for this purpose. We will select two: one of which is suitable for small quantities of prints, and the other for larger numbers. Fig. 5 represents one of the smaller kind, and consists of a circular vessel with a false bottom and syphon attached, in order that the contaminated water may be periodically drawn off, the supply coming from a series of small jets near the top of the pan. The force of the supply and the angle at which the jets are set cause a continuous circular movement in the water, that prevents the prints sticking together, and thoroughly cleanses them from those hyposulphite compounds that, suffered to remain in the prints, would destroy their permanency. Usually this washing pan is made of zinc, but glazed earthenware is frequently substituted, and answers the purpose thoroughly well. The pan being provided, proceed to drill a hole about an inch from the bottom, into which fasten a bent syphon tube A, the bend being about 2 in. from the top of the pan; compo gas-piping answers every purpose. If the pan is made of zinc, soldering is the method used to make the attachment; but if earthenware, a cork ring is most easily adapted; various methods will suggest themselves; the idea is to have a syphon outside the pan, to draw off the water from below the false bottom (Fig. 6). This drainer is made of a perforated zinc disc supported on three short legs, just above the outflow of the syphon; the reason for having the syphon outside is, that any roughness or projection inside interferes with the movement of the prints, and is apt to make them clot together and escape that thorough cleansing so essential to permanency. The supply pipe (Fig. 7) is the next consideration. This is best made of $\frac{1}{2}$-in. brass tubing, bent to follow the curvature of the pan for about a third of the circumference; one end is stopped up, the other connected by indiarubber tubing to the water supply. At a distance of about $\frac{1}{2}$ an inch apart, fine holes are drilled in a line along the lower inner side of the tube. When the water is turned on, it issues through these small holes with considerable force, striking the water in the pan at a sharp angle, so that it and the prints are driven round and round during the time the water is allowed to flow; as soon as it rises above the bend in the syphon, the pan begins to empty, and continues to do so until the discharge is completed, when it again fills. This is automatically repeated during the time the water is flowing into it. The rapidity of the process depends on the size of the syphon and force of the water supply. It does not require to be very rapid; a syphon of ⅜ tube is quite large enough, the supply of water being regulated accordingly.

An arrangement for large numbers, or large prints, is shown in Fig. 8; it consists of a slate trough, 8 ft. long by 3 ft. wide, and 8 in. deep, with a false bottom of perforated zinc, made in sections for convenience of removal for cleansing. A syphon plug (Fig. 9) is adjusted in one corner. This plug is made of a short tube, one end of which fits into an aperture in the bottom of the trough, the upper end being about an inch and a half below the upper edge. This is surrounded by a case open at both ends, the upper end being an inch or so above the plug, and the lower half an inch above the bottom of the trough; when in position they are fastened together by solder. It will be seen by this contrivance that the impure water from the bottom of the tank is carried off, whilst the supply of fresh comes in at the top, thus setting up a continuous and thorough circulation. The method of keeping the prints from sticking together is by gently agitating the water by means of a paddle attached to a small water wheel (Fig. 10); a brass wire cage prevents the prints getting torn by contact with the paddle. In this arrangement no syphon is used, the quantity of water being considerable, and being steadily renewed the whole of the time is considered equivalent. If it is thought desirable to heat the water, hot-water pipes can be arranged below the false bottom. I may here mention that in all apparatus in which zinc is likely to come in contact with the silver print, the prints should be washed face upwards, for however well the zinc may be varnished or protected at first, the coating very soon partially wears off; but by keeping the *face* of the prints from lying in contact with the unprotected metal, no harm will happen.

Accessories.—Under this head is comprised almost everything that is used for pictorial effect in conjunction with the figure; it will be therefore out of the question to enumerate them. We will therefore in a great measure limit our remarks to a few of those things it is better to avoid. We will at once say, that anything that has an unreal appearance in the picture is bad, and that a theatrically made-up look is the bane of portraiture; both faults are so easily avoided, that it only proclaims the uncultivated taste of the photographer if he indulges in them. The inconsistent mixture of wild mountainous or other landscape scenery with fashionable upholstering and carpeted foreground is most absurd. The bizarre and extraordinary designs of studio furniture, such as are never seen in an ordinary household, are other objectionable points in the matter of accessories. The only deviation from the usual every-day style of furniture is, that it should not be polished; let it be chosen for chaste, elegant, or solid design, and the seats of the chairs not provided with springs, but merely firmly stuffed. The rest may be left to the good taste of the user; baskets, fans, and good artificial flowers will be found useful. Ferns and palms in vases are very effective. Curtains of rich material and Japanese screens are frequently admirable aids to composition. Having thus given a passing mention of a few of the most generally useful accessories, it may be left to the individual to select such things as will be most in accordance with his or her taste, and in harmony with the subject that has to be photographed.

THE BROOCH: HOW TO MAKE IT.

BY H. S. GOLDSMITH.

Catches of Brooches.

I think I said that a brooch tongue was but a piece of wire soldered on to a piece of tube, and with very few exceptions this is the case. Now that we are dealing with catches, they can be just as easily defined as some kind of hook, so shaped that it will retain the tongue in its position, and yet allow of its withdrawal easily.

You will see by glancing at the diagrams that the forms vary considerably; but throughout the lot the principle that is defined above is there. They are all hooks of one kind or another.

Now, undoubtedly, the main thing is that we obtain some piece of metal bent round in the form of a hook; and if our business did not (and rightly) lay claim to being an artistic one, I should be the last to desire anything more than mere utility. Neither should I bother about giving a good shape to this or anything else; but the whole *raison d'être* of our productions is that they shall give pleasure as ornaments, and to do that all the details should be carried out in the best way we know of, artistic as well as mechanical, even down to the catch, which is seen by nobody but the wearer.

To begin, as usual, with the simplest and most general forms, such as Fig. 1, A and B, we notice that the shape is a nice C scroll, or rather should be, of the shape of diagrams. But if you will take notice of the next dozen brooches you see, I feel pretty sure that four or five out of the dozen will be rather like the carelessly made ugly thing sketched in Fig. 1, D.

Perhaps it will not be wasted time if we consider the way to make them properly. It is but the same old story of beginning at the beginning: thus it is the *ends* of the wire or whatever you are using that have to be turned first—and it is the very end I mean that has to be bent; ⅛ of an inch from the end will not do unless you are going to be content with a wretched article like Fig. 1, D. When the ends are properly curved it is easy enough to get the other part into shape.

This ordinary catch is really so simple that I feel almost inclined to apologise for the foregoing; but it is these details that help so much in the style or character of the work—hence all this writing.

There is just a word more: and that is, don't get it too high. There is no actual need for the curls to be wider apart than just to let the tongue pass easily in and out. You will see what I mean by Fig. 1, C, where I have drawn the tongue in section in several places.

Also note that both ends are thinned down, both to improve the shape, and at the top end to facilitate the tongue's entry and exit.

The next sort I have sketched are examples of spring catches. They really ought to be called safety catches; but the custom of the trade decrees that "safety" is the word to be used when "protecting" catches are what is actually meant.

In Fig. 2, A and B, you see there is a spring acting against the lower part of the top curl of the catch, which is prolonged as much as possible, in order not to let the tongue drop down below it, and also to give an unmistakable lead when it is desired to unfasten the brooch.

Of these two, the first one (Fig. 2, A) is most decidedly the better, for this reason, viz., that the spring is a separate piece of gold, therefore you can make it of any quality you think best, and you can hammer it as much as ever you like; while if it is soldered like Fig. 2, B, there is the chance of breaking it off, besides the greater difficulty of getting it hard enough to act as a spring.

This separate spring in Fig. 2, A, is fixed in its place by a pin or screw passing through it; or you might pewter-solder it in its place.

Just a word or two about pewter-solder. Now I daresay in the course of these papers that I shall occasionally speak of its employment; but you must understand that it is not to be used as a rule for ordinary work—not even for repairs if it is possible to avoid it. It is a bad sign when it is always, or even often, used.

In this case, if sparingly, neatly, and cleanly employed, it is all right. But if not, then it but proves the rule against its use; and the fellow that slobbers his work all over with "soft tommy" as a regular thing, had better go and be a tinker at once, then perhaps he will have enough of pewter-soldering.

I think that I may say without exaggeration that, as a rule, double the quantity of pewter-solder is used more than is actually required to do the work it is wanted to do. But enough for the present on that matter. I daresay that I shall have to return to it later on.

Safety catches—that is, catches that protect the point of the tongue—are made as you see from the diagrams, Fig. 3, A, B, C, D, E, F, G, and Fig. 4, A, B, C, from both flat metal and from wire.

Every one is a means of guarding the point of the tongue, and so are Fig. 5, A, B, C, D. In Fig. 3, F′, is given the shape plate out of which Fig. 3, F, is made.

Fig. 3, E, F, and Fig. 4, B, are used for narrow bar brooches, and to show their width you will please refer to the next illustration for each, namely, Fig. 3, E′, F′, and Fig. 4, B′. Fig. 6 is shown as a type of ancient Etruscan work. There are a few in the British Museum of these fibulæ; and in my outline drawing, you may perhaps notice that the protective catch is very much there. As a rule these are beautifully ornamented with fine wire and small grains of gold; but sufficient for our present purpose is shown in the diagram.

Safety-pin brooches, as they are called, are now, and have been for some time, very fashionable. You will find but one in its entirety (Fig. 5, A), for it is of no use taking up space by drawing the joint ends to each when they are all alike—except that some make them with three instead of the usual two turns.

Fig. 5, A′, is the side view of the catch of Fig. 5, A. It is the neatest of all, and is mostly used in the best houses here in London—at least, I think it is.

Fig. 5, B, C, D, are simply different ways of forming them.

The last one (Fig. 5, E) is put in as a horrible example of how not to do it; and I should not have thought of introducing such a scarecrow but that I came across it as I was drafting this paper; and it had on its front a diamond beetle worth, I should say, about £15. Why, the one with the five turns (Fig. 5, c) is infinitely better, and that is one of the same pattern as they use in hospitals, etc., for it is the safety-pin (*i.e.* the non-scratching pin) of surgical practice that gives the name to this class of ornament, and may account for the double-barrel name—pin and brooch—that it bears.

Fig. 7, A and B, is the most usual way of arranging a fall-down catch. The catch is simply soldered on to a joint in such a manner that it can move about the quarter of a circle—that is, from its proper upright position to one where it lays down close to the back of the brooch. To prevent the catch falling *outwards* a stop is formed, either by the catch itself (Fig. 7, A) or by soldering a grain of gold to the side of the joint, which does quite as well. The method shown, however, keeps the work more compact, for the grain of gold would only be used when the catch is soldered on top of the joint. This is the catch I should use with any of the removable tongues I spoke about in my paper on Joints.

Fig. 8 is a slide arrangement, to catch the end of the tongue. It is shown open, with the tongue in position, while the dotted lines indicate its position when closed.

This is but one of the different forms that have been introduced from time to time, and the only one I have seen with a date, which is registered June 19th, 1848, and has the initial punch of G. U. as well. My Birmingham readers, and I daresay many in London as well, will recognise it as that of George Unite & Sons, a well-known firm of silversmiths.

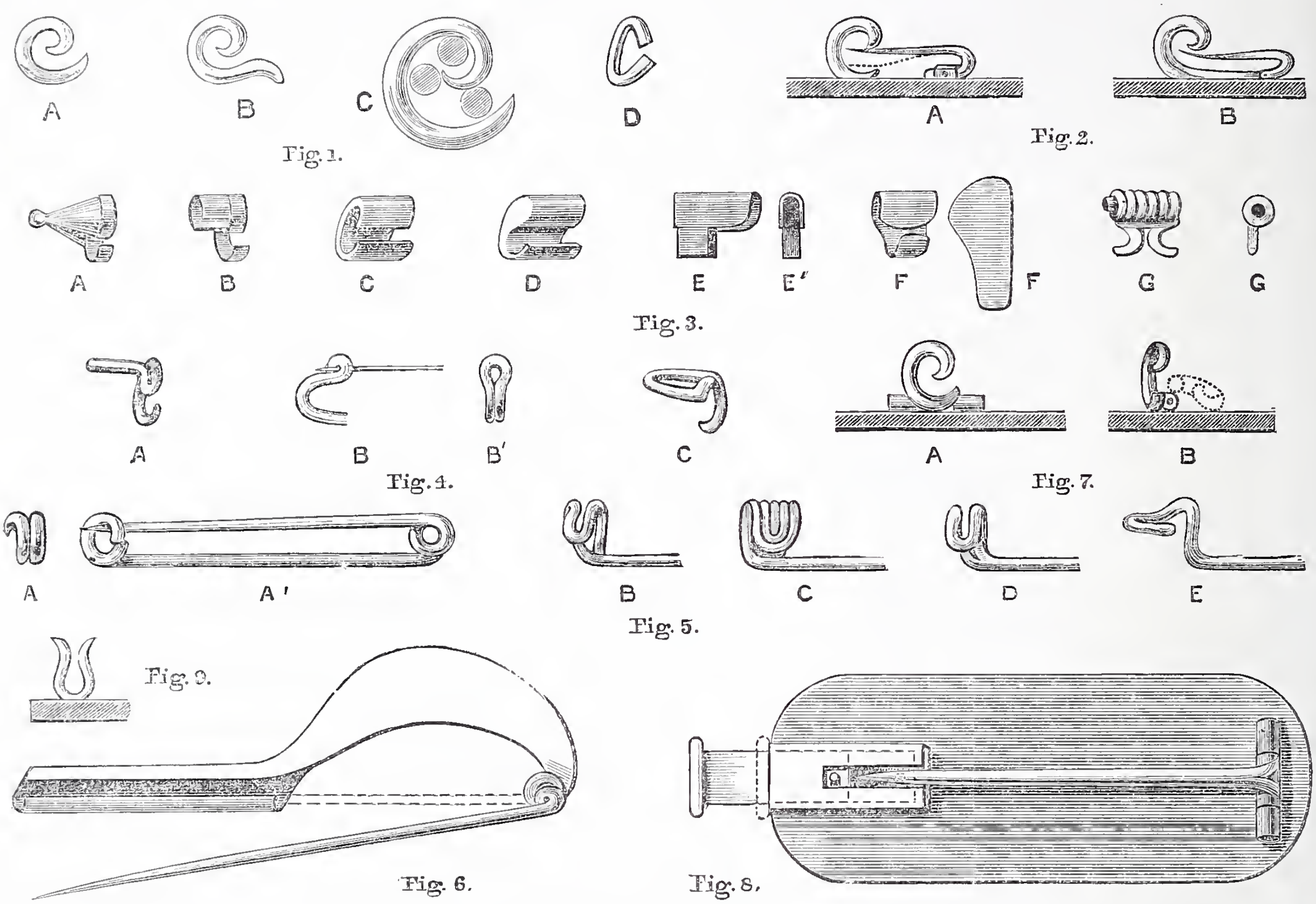
Several others have been made, some with a spring attached to the movable piece, but none seem to have obtained much favour; at least, one meets them but rarely, and then it is to find that they have been patented or registered. What is the reason of this scarcity? Is it the excessive royalty demanded, or the difficulty of finding the maker? or the fact that the simple scroll catch does not get out of order? Be the reason what it may, the fact remains that none of these strange arrangements have "caught on," as the Americans say.

Fig. 9, the lyre shape, is a clip catch that one can occasionally use to fasten scarf-brooches and ear-ring hooks. I know scarf-brooches are old-fashioned, but some customers will have their work done that way. And to steady the brooch, this shape catch is easier to adjust than the C shape, but does not hold so well, of course.

You see how it works. The two horns or ends act as springs to some slight degree, and retain the wire—clipped in between them—steady, but hardly secure.

The next paper to this will be on the positions that joints, tongues, and catches are to be placed, and in other papers which I trust will appear at some future time, I hope to take up some other of the numerous details of our business.

But with the article next to come, which will be a paper on brooch mounts, my instructions on brooch making will be complete. It will be noticed that my papers on this subject have been arranged in a systematic manner, so as to embrace the various details, and to touch on each and all in the order in which the workman would naturally have his attention drawn to them when engaged in the manufacture of this article. Thus the method employed in making the tongues of brooches was first dealt with, then the joints of brooches, and thirdly, in the present paper, the catches, a piece of curled metal on the under part of the brooch, used as a means of holding and retaining the tongue after it has been passed through the material to be fastened together by the brooch.



BROOCH CATCHES. Fig. 1.—A and B, Correct Shapes of Catches; C, Tongue in Section in several places; D, Bad Shape of Catch too often made. Fig. 2.—A and B, Forms of Catches with Spring to keep Tongue in place. Fig. 3.—A, B, C, D, E, F, Shapes of Safety Catches or Catches that protect Point of Tongue. Fig. 4.—A, B, C, Other Forms of Safety Catches made from Wire; B′, End View of B. Fig. 5.—A, B, C, D, Forms of Catches used in Safety-Pin Brooches; E, Ugly and Bad Shape of same. Fig. 6.—Type of Ancient Etruscan Brooch, showing exceptional Length of Catch. Fig. 7.—Fall-Down or Hinged Catch—A, View from Outside of Brooch; B, End View, with Dotted Lines showing Position when folded down and not in use. Fig. 8.—Patent Catch shown, the Dotted Lines giving its Position when closed. Fig. 9.—Lyre Shape or Clip Catch.

A CARVED BUREAU.

BY D. ADAMSON.

Chippendale's Frets and Ornaments.

Although Chippendale furniture is often spoken a good deal of, confusion exists as to what it really is, so perhaps it will be well to devote a short space to a few remarks about it. First and foremost, Chippendale was a prominent cabinet maker who flourished about the middle of last century. His business lay among the aristocracy, hence, along with his appointment as Court cabinet maker, it may be assumed that he was able to command good prices, which is sufficient to account for the careful finish which characterises all his work. As, however, he only followed—or, perhaps, to a certain extent led—the then prevailing fashions, much, indeed most, of the furniture which is said to be "Chippendale" is, undoubtedly, not of his construction—*i.e.*, it did not emanate from his shop. It may be quite correct to say that a piece of furniture is Chippendale *style*, but quite the reverse to say that it is "genuine Chippendale." The latter can only be truly said of furniture made under his superintendence; the former may be said of all that bears the character of his designs, whether by himself or not. As he published various editions of a well-known book of furniture designs, it is not surprising that we find many of them reproduced by cabinet makers contemporary with him, but there were also others who issued books of designs about the same time, some of them anterior to his. These being the same in their leading features, it cannot be claimed that Chippendale originated the style which goes by his name, but it may fairly be conceded that he produced many new designs in what, as a business man, he knew would meet the taste of the times. That his work was good is not to be gainsaid, so good, indeed, that we are apt to lose sight of the fact that his style—or the style of the times in which he lived — was not altogether commendable. He hardly descended to the fantastic vagaries of some of his contemporaries, and there is a certain refinement about his lines which almost disarms criticism of the style. Let any one compare the designs in his book with those published by Johnson, another artist of the same period, and the restraint of Chippendale will at once be apparent, however florid his work may appear when contrasted with other styles. It should be said that Chippendale's later work is not so meritorious as his earlier productions, which are free from many of the extravagances found in these. It almost seems as if, after having, no doubt, personally prepared his earlier designs, he left this part of the work to others not possessed of the same skill. Be this as it may, few will be found to dispute the fact that his style deteriorated as it advanced, and that few, except his simplest—and best—are desirable as models for reproduction, especially by amateur craftsmen.

As these remarks may not be in accordance with the notions of those who—generally without much, not to say without any, knowledge of the subject—"swear by" Chippendale, let me point out the singular mixture of styles, "Gothic," Chinese, rococo, etc., which he combined often in the same article of furniture. At the very least, it cannot be said that this conglomeration is in accordance with present taste; so that to make a bureau which shall be "Chippendale," and at the same time such as could be regarded with pleasure, we must confine ourselves to a simple mode of treatment. We find this ready to hand in the fretwork of which Chippendale made such free use. Much of it was avowedly derived from Chinese sources, but in addition we find that other ideas were engrafted along with them, so that there is no reason for confining the frets to those which are distinctively Chinese. To ornament a bureau in the manner indicated the frets should be cut out of thin wood—veneers will do very well—and glued on to the fronts of the drawers, etc. It must be understood that the veneers should be saw cut, not knife cut, as these are altogether too thin. If the three lower drawers are made of the same size, the frets for them may be cut together, as, the material being thin, it will be almost as easy to saw through the three thicknesses as through one; in fact, the risk of breakage while sawing will be considerably reduced. If, however, only one thickness is to be sawn at a time it will be necessary to protect it by cutting along with it a thicker piece of wood. As this is merely required to prevent the veneer being broken by the saw catching, a piece of pine will do very well. The fretwork may either cover the whole of the drawer fronts, or be limited to strips glued on round the edges, if a simple decoration is all that is required. In the latter case the labour is considerably diminished, as all the strips being of the same width, as many as convenient may be cut at a time. To hold them together while being sawn they should be fastened by small wire nails driven through the waste wood. The pattern, of course, must be on the top veneer before nailing together, in order that the nails may be only in the waste wood, *i.e.*, in the pieces to be cut out. Needle points may be used instead of small nails, but they are open to the objection that there is a risk of the veneers springing apart. This is not the case if nails are used, as these can be driven right through, and the projecting points hammered over to form a kind of rivet. This method is far preferable to the one sometimes adopted by amateurs of fastening the wood together by dabs of glue here and there. This may be done, but there is the difficulty of getting the glue only between the waste and preventing any of it getting between the parts which form the finished fret. It will be found to promote easy working of the saw if a piece of greased paper is fastened in between the veneers, as the grease forms a continual lubricant as the saw proceeds. Tallow is about the best medium, as being tolerably hard it is not absorbed by the wood. The paper used should be soft and not too thin — an old newspaper answers very well. As the paper is cut at the same time as the wood, on separating the layers of this it will be found that the papers are identical, so that they may be used as patterns for any repetitions of the fret which may be required. This may frequently save the trouble of drawing a pattern a second time, and the outlines are clearer than those reproduced by heelball rubbings. Owing to the difficulty that may be experienced in gluing the greased paper, template, or pattern on to the wood, it will be advisable, when duplicates for this purpose are wanted, to let one of the pieces of paper between the frets be ungreased and fairly thick. After the frets are completed, it is only necessary to glue them to the drawer fronts; but some care will be required to do this neatly and prevent glue exuding beyond them. It will be almost impossible to avoid this entirely, but any which makes its appearance should be carefully scraped away while it is still soft, for if allowed to get hard the difficulty of removing it and the risk of injuring the wood will be much increased. The glue should be applied thinly and evenly. If of the ordinary kind it should be freshly made, but for work of this sort Le Page's carriage glue, now obtainable at most dealers in tools, possesses many advantages. The fret must be well pressed down to ensure perfect contact and adhesion to the wood under it, any tendency to rise being overcome by weights left on till the glue is set. Should it be found on removing the pressure after the glue has hardened that any parts have failed to adhere properly, they may be laid

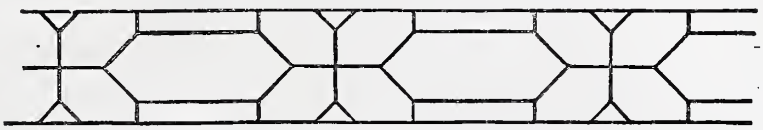


Fig. 8.

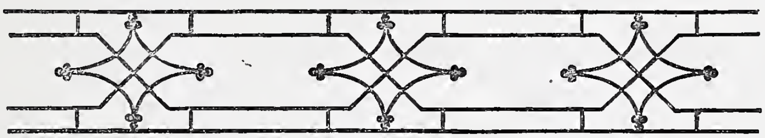


Fig. 9.

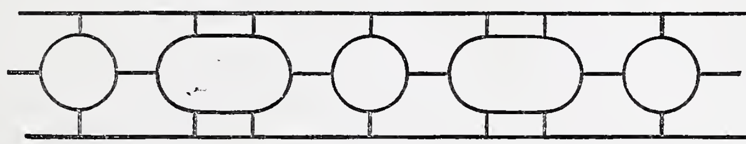


Fig. 10.

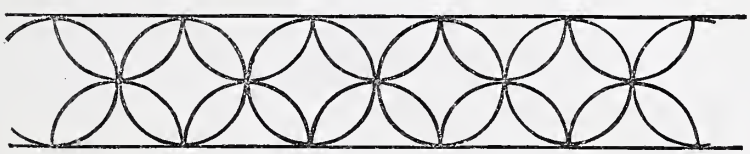
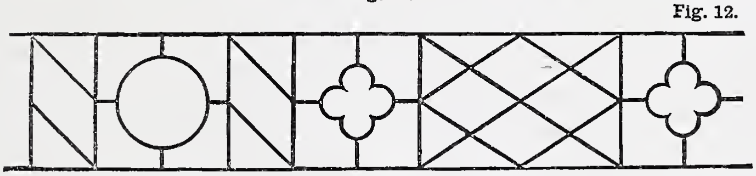


Fig. 11.

Fig. 12.



Figs. 8-12.—Examples of Chippendale Frets.

by the application of a warmed flat iron. This should be previously made hot enough to melt but not to burn the glue. Any defects of this kind ought to be rectified before the polishing is done, as the heat would damage the polish. It should also be said that there must be sufficient moisture remaining in the glue to permit the heat to soften it; therefore, blisters should be laid as soon as possible.

Now a word about the polishing of such applied fret and the ground on which it is fixed. It will be found that this requires much care to prevent the polish spoiling instead of improving the effect, the difficulties consisting in the almost impossibility of getting uniform brightness on the sunk portions, and the liability of any excess of polish in the rubber to congeal in the open corners of the fret. The best way to overcome these difficulties is to let the ground be dull, merely finishing it by oiling, and then giving the subsequent polish with a firm hard rubber to the surface only of the fret. This will then appear bright on a dull ground. A still better method, though involving more labour, is to polish the veneers before fretting them—when, after they are laid, it will only be necessary to oil over the groundwork, and to touch up the surface of the frets. Any oil getting on while finishing the groundwork will not hurt the polish, though it will be necessary to wash off any "sweating" which may, and probably will, appear in course of time. If the fret is only applied as bordering, it is hardly necessary to say that the remainder of the work should be polished thoroughly, either dull or bright, and not merely oiled. To those who are at all conversant with Chippendale's style, mahogany will at once suggest itself as being the most appropriate wood, though there is no practical reason why the work should not be executed in any other; for example, much furniture ostensibly reproduced, wholly or in part, from his designs, has of late years been finished black or ebonised. With the faces of the frets polished bright, and the remainder either dull or dead, the effect is rich, and there is the further advantage that choice, finely-figured wood is not required. However, if the work is to be of mahogany finished in its own colour, this should be darkened if the deep tint of old mahogany is wanted. It may be effected either by fuming with ammonia or washing a liquid stain in, but as the former does not raise the grain it is to be preferred.

The accompanying illustrations (Figs. 8 to 12) of frets are all suitable for Chippendale furniture, and as they are purposely selected for the facility with which they can be drawn enlarged to suit the work, it is to be hoped even those unskilled in drawing will be able to make use of them, for being of a geometrical construction they can easily be set out by means of ruler and compasses. It must be understood that these frets by no means exhaust the Chippendale style, but they are such as any amateur can easily cut, and they are, therefore, more suitable than those of more complicated arrangement. They may easily be cut in sections and neatly joined together when laying them, but it may be useful to know that any length can be cut with the ordinary fret-saw frame if this has adjustable clamps, so that the saw can be adjusted to work in different directions. The same may be managed, irrespective of the length under the arm, with many of the fret machines which have a perpendicular action, as, for example, the newer machines of the Britannia Company. The Chippendale style, which, as here exemplified, is given in its least objectionable features, seems soon to have outrun its popularity, and before closing the remarks anent it, an extract from a writer may be quoted, showing that even when it was all the rage it did not meet with universal approval by those who were unbiassed by fashion. Thus wrote an architect contemporary with Chippendale, mentioning his style:—"An unmeaning scrawl of C's inverted and hooped together. . . . . . It is called the French, and let them have all the praise of it. The Gothic shafts and Chinese bells are not beyond it nor below it in poorness of imagination." It will, of course, be understood that as we are not giving a full analysis of Chippendale, the features so strongly condemned are not included in the directions how to make a Chippendale bureau.

After the vagaries of the Chippendale style had exhausted themselves, it is not surprising that a strong reaction set in against the absurdly devised ornamentation which he affected, and it is with almost a feeling of relief that one turns to the simpler designs of Heppelwhite, the next in order of the trio of cabinet makers whose names are landmarks in the history of English furniture. As in the formation of the Chippendale style we may easily discover the influence of an architect (Chambers), so in the Heppelwhite may we trace the inspiration to the classical feeling which pervaded the works of later architects, among whom the brothers R. & J. Adam stand prominently forward. There is a refinement about Heppelwhite's lines, with a simplicity for which we look in vain among the productions of those cabinet makers immediately preceding him, but as applied to our bureau there is little that is sufficiently distinctive to warrant any lengthened description, without, indeed, so far complicating the work that it would be practically useless for the amateur artisan to attempt it. It may, however, be said that mahogany still remained the characteristic wood for good domestic furniture, and that the ornamental details of carving and inlay show a strong classical tendency, with great neatness of execution. The keynote of Heppelwhite's style may perhaps best be explained by an extract from his book, which we may well imagine was written just one hundred years ago, as it was published in 1789. His words run thus: "To unite elegance with utility, and blend the useful with the agreeable." As Heppelwhite worked in the style of the Bros. Adam, who, in addition to their purely architectural work, have left us some specimens of their smaller work in the shape of furniture, it is not incorrect to regard them as being identical. True, there are distinguishing features between the two, but it would be almost beside our purpose to consider them, and, as in the case of Chippendale, though for different reasons, an exemplification of Heppelwhite's style in an easy form is all that is required. As already stated, it does not in the case of plain carcase work offer any very marked characteristic, a certain severe simplicity being all that is required. In fact, if we make the bureau as originally described, but in fine dark mahogany with a little inlaid stringing, taking, let us say, the form of the Grecian key pattern, it may be said that the style is "Heppelwhite."

With this we may take leave of this great cabinet maker, whose works, though not perhaps like Chippendale's, "familiar in our mouths like household words," are yet deserving of consideration as marking very emphatically the return to a purer style. We may deny ourselves the further examination of Heppelwhite's style with less regret when we remember that the last and, perhaps, the greatest cabinet maker, as an artist of the eighteenth century, designed on much the same principles, developing the style of Heppelwhite (or Adams) with a grace and purity of line peculiarly his own. The maker referred to—Sheraton—published his first book of designs in 1793-4, and though ostensibly an educational work on drawing for cabinet makers, it contains representations of furniture in his best styles, for in his later works, published in 1803 and 1804, we find that there is an extraordinary deterioration, a fact of which Sheraton seems himself to have been conscious. Those who wish to reproduce his work will therefore do well to note this, as all is not gold that glitters, neither is all good that's Sheraton's. We find that he made free use of choice veneers and inlays. Many, I am aware, object to veneering, but when conscientiously employed there can surely be sound reason for regarding it as a legitimate means of decoration. Sheraton certainly did not think its use incompatible with either beauty of design or sound work, but exception must be taken to some of his arrangements, and the modern designer will do well to avoid copying them. I refer particularly to grain of the veneer running across instead of along the piece on which it is stuck. For example: in a drawer front the grain should run from end to end, horizontally, not from top to bottom, perpendicularly. Much more is this the natural way of arranging veneers on the frames of doors, yet it is often seen—happily not now so much as formerly—just reversed. Now, though Sheraton erred in this respect, it must not be supposed that he was the only one who adopted this construction; but, whenever found, it can only be regarded as faulty, unless, indeed, in the case of stringings or bandings introduced for purely decorative purposes, and should not be copied. If we wish to see how Sheraton's style may be adapted to modern requirements in the light of increased attention and knowledge to the principles of design, we cannot do better than study the modern inlaid furniture which is to be seen in every good cabinet maker's. This, popularly but erroneously regarded as Chippendale, is, in fact, the modern rendering of the principles which guided Sheraton, without, it is to be hoped, his faulty work, such as has been alluded to above. We find that Sheraton's furniture depends for its effectiveness not so much on carving, at least, where flat surfaces are concerned, as on coloured inlays, bandings of various woods, such as tulip wood, and contrasts between different kinds of woods. Rosewood and satinwood seem to have been a fashionable combination, the surface of the latter being often ornamented by decorative paintings of a delicate character, in the form of festoons, wreaths, garlands, ribbons, etc. Inlaid panels of a very similar character to those so often seen nowadays in rosewood furniture were also largely employed, so that the artificer who desires to work in Sheraton style will find plenty of scope for his talents and mechanical skill.

SMITHS' WORK.

BY J. H.

ARMOUR.

THERE was plenty of work for the armourer smiths in the Middle Ages. It would be interesting to trace the development of the arms and armour of that long period. Though few authentic specimens of ancient armour remain, we have history in tapestry, stone, and brass, by which we are able to rehabilitate the old knights. There was, first, the mailed shirt or hauberk, a woven fabric covered with chain mail, consisting of numerous rings in close contiguity. By-and-by the custom arose of covering the more vulnerable parts of the body more effectually with plates of iron, and this finally developed into the massive panoply of armour of the ages of chivalry—armour so weighty that a knight unhorsed was helpless and at the mercy of the meanest foot-soldier. The helm also protected the head itself against the battle-axe and mace, but afforded little or no security against the stunning effect of the blows dealt by those weapons.

The hauberk, or coat of mail, underwent various modifications. At one time it had a coif or hood, which might be drawn over the head, and over this the helm was worn. Below it was lengthened, and divided to cover the lower limbs. The sleeves were lengthened to cover the wrists. Gauntlets or gloves of leather, and leggings (*chausses*) and coverings for the feet, also covered with mail formed of small plates or rings, came into use. Then, when these were found insufficient for protection, arose the practice of protecting the more vulnerable portions of the body with plates of iron fixed by straps and buckles over the mail. These were at first fitted to the elbows, knees, and shoulders, and afterwards to the arms, thighs, and legs, first on the outer parts only, but afterwards clasped completely round the limbs.

The advantages and disadvantages of light and heavy armour were apparent in the Crusades. In the first Crusade the heavily-armed knights of the West coming into collision with the light-armed Saracen cavalry clothed only in chain or ring mail, bore down all before their solid phalanx. But, afterwards, the Saracens gained the advantages due to their lighter equipment under a Syrian sun. Lightly clad, they swept round the comparatively inert masses of their opponents, and attacked them on all flanks, watching their opportunities to beat down the long serried lances, and so bring their light swords into play. And thus they more than made up, by their swiftness and bravery, for the advantages gained by the heavy panoply of armour worn by the knights of the West.

By the close of the fifteenth century armour had about reached its highest stage of completeness, as far as multiplication of parts is concerned; though, in the matter of elaboration and ornament, a great deal yet remained to be done. At the close of this century a knightly suit of armour covered the whole body *cap-à-pie*—breast, back, shoulders, arms, legs, feet and hands, head and neck; and each separate piece had its distinctive name.

With the invention of guns and cannon the disuse of armour commenced. But, in the period of its decadence, there prevailed the utmost elaboration of detail and beauty of art workmanship. As its value in actual combat declined, so the richness of its ornamentation increased, and the work of the smith merged into that of the jeweller. To this period belong most of the suits of armour still in existence, and they are well worthy of careful study as specimens of handicraft of the highest kind.

Then the armour gradually fell into disuse before the spread of firearms. First the protection of the lower limbs was abandoned, the cuirass remaining to protect the vital parts of the body. Even this was presently felt to be a useless and intolerable burden, so that it was only with the utmost difficulty that kings and princes could enforce its use.

The armourers of Milan supplied the nobles of Europe with the choicest productions of their art. Suits of plate armour of steel were covered all over with elegant arabesques beaten up and then chased. Sometimes damascene work in gold and silver was added to the beaten arabesque work. Sometimes, again, the work was fluted, and polished like a mirror.

A study of the examples in the Tower, and in numerous other collections at home and abroad, will inspire us with regard for those who, with rude tools, could execute such intricate and difficult tasks as are involved in the formation of armour.

Our surviving specimens of armour are not so old as was formerly supposed. It is doubtful if any authentic specimens of the Norman period remain unaltered. Very little of the Plantagenet period remains. Nearly, if not quite, all of the armour in existence dates from a period subsequent to the introduction of firearms, when armour had become less valued for purposes of defence than for ornament, when it was used for jousting or military show rather than for actual warfare. The armour, therefore, which we can actually study affords, though of comparatively recent date, excellent examples of periods in which the art had reached its highest stages of development, in which perfection of workmanship was combined with the highest ornamentation.

In our great national collection of armour in the Tower, the development of the later period can be profitably studied. Beginning at the left hand as we enter the armoury room in the White Tower, we have the earlier specimens, consisting of mixed chain and plate armours. The making of this chain armour must have been a very tedious process, particularly when we remember that the wire itself had to be beaten out by hand. The rings are, in most instances, welded together. Some are of round wire, and others of flat section, with the appearance of having been stamped out of sheet iron. The dimensions of the rings of which the armour is composed vary considerably. For the most part they average from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. diameter. In exceptional cases they are as large as $\frac{5}{8}$ in., or as small as $\frac{1}{4}$ in. They are, in some cases, lapped and thinned out, and apparently welded; others appear as though lapped and riveted, each with a minute rivet. In some examples rings punched from flat iron, and rings made of round wire with abutting joints, alternate in rows. Gradually the use of plate armour began to supplement the chain mail, and this transition period is well illustrated. At last we have the warriors armed *cap-à-pie* with plate.

The earlier plate armour was plain, that of later date is variously ornamented. At the first the pieces were ribbed or fluted with a succession of contiguous flutes, the effect being very pretty. Then engraving and damascening were resorted to, and finally attained a very high pitch of perfection. A suit of armour belonging to Henry VIII. in the Tower, presented to that monarch by Maximilian, is foliated and engraved all over with human figures illustrative of passages in the lives and martyrdom of St. George and St. Barbara, with the badges of roses and pomegranates, and the letters "H" and "K," for Henry and Katharine of Arragon. This suit was formerly covered with silver. The horse is also in complete armour. There is another suit of Henry VIII. beautifully damascened—that is, wire of brass, gold, or other material, is beaten into narrow grooves punched in the plate, and so worked all over into patterns more or less elaborate. The appearance of these suits of armour in joust and tournament must have been truly magnificent. But the minute details of workmanship are no less noteworthy.

Some of these suits of armour were very heavy. There is one of Henry VIII. weighing ninety-two pounds; another of Charles Brandon, Duke of Suffolk, bearing date 1520, of one hundred pounds weight. And these are built up of thin plates and minute rivets. The plates are bent to the difficult forms required to permit of the free play of the joints and various parts of the body, and then, besides, they are frequently fluted and covered with inworked or inlaid ornament. There is never a bruise to be seen—never any flat, or angular, or waved portions; but the curves are as perfect as though stamped between dies. Probably the hammering of the broad surfaces was done with wooden mallets, the work being laid on a bed of pitch or similar yielding substance.

The accoutrements are as elaborately finished as the armour itself. Spurs and bits are engraved similarly to the armour. Helmets, gorgets, casques, and morions are artistically finished. Pikes, maces, and roundels are also excellently made, and covered with engravings.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

EXPANDED LETTERS—ELONGATED, CONDENSED, AND COMPRESSED LETTERS—HAIR-LINE ITALIC—HOW TO SET OUT, LETTER, AND FINISH A SIGN—SPACING, ETC.—PAINTING ROYAL ARMS, ETC.

HAVING digested as thoroughly as space will permit the subjects of ornamental and church lettering and other matter appertaining thereto, I have now only to draw attention to one or two other much-used forms of letters before finally quitting the subject.

I refer here principally to letters that have to be somewhat distorted in shape to suit the exigences of space, which in some cases is too much, and in others too little. Let us first take the case of having to write a rather short name over a shop-front or on a long narrow board or surface. In this example the ordinary-shaped letter could not be made to fit or look well, and we therefore have to expand it, so that it may not only fill out the long space better, but also be sufficiently decreased in height to come within the compass of the width of the board and allow for shading, etc.

We do not in reality decrease the height of the letter, but use a letter small enough for the purpose, and widen this to such an extent as not to look positively ugly, and which would be the proper width of a much higher letter in its normal form. When, therefore, it is desired to fill out an extra long line with expanded letters, the expansion must be proportionate throughout, so that the work may have a symmetrical appearance.

This expansion can be executed with mathematical precision according to the following method:—

We will suppose that we have to put some letters on a signboard 6 ft. long by 1 ft. 6 in. wide, but that the ordinary letter, properly spaced, would only extend to 3 ft. 3 in., and that we therefore require to expand the letters so as to make them up to 5 ft. We must now refer to the diagram which is given in Fig. 81, and drawn to a scale of one inch to the foot, roughly. The length of the normal letters, 3 ft. 3 in., is from A to B, and we have to spread them out 1 ft. 9 in. without increasing the height. We first rule two parallel lines at any convenient distance below, and 1 ft. apart and 6 ft. long, *i.e.*, from C to D. We now draw a diagonal line, A to D. Then draw slanting lines parallel with each other from the bottoms of the top row of letters to the diagonal line, and from there vertical lines to the line C D. If we now proceed to draw in the bottom letters according to these lines, the result will be as shown in the diagram. Letters can be extended as much as possible by this method by simply increasing the slant of the diagonal line, and they may also be condensed

Fig. 75.—Alphabet of Expanded Letters.

by drawing the diagonal line within a shorter compass—as, for example, from A to E. To use this problem in actual practice, the student may either work it out, as I have done here, in a scale drawing, or draw the letters full size on two lengths of lining paper tacked to a wall or floor, and the outline of the extended letters prepared for pouncing the design upon the signboard. An alphabet of expanded letters will be seen in Fig. 75, and some Expanded Ionic in Fig. 80.

Elongated letters are just the reverse to the former series, and are principally used in circumstances where the surface to be lettered is very short in length, but of an unusual height. I do not know that I can give any practical advice concerning them, but a reference to Fig. 79 will illustrate form and probable usefulness.

There are also condensed letters, such as the letters H, E, R (Fig. 78), and compressed letters, as T (Fig. 82), which all come in useful on certain occasions. Other useful alphabets are the italic and hair-line italic, a full complement of the last-named being shown in Figs. 76, 77.

Having now finished my remarks respecting the various styles of letters and the method of forming them with truth and graceful outline, I will now describe how to put them to practical use in "setting out" and lettering a sign. Taking it for granted, therefore, that the signboard is quite ready to work upon, we make a start by damping the whole surface with a wet chamois leather. This simple process must always be gone through, otherwise the colours will "ciss," and no end of trouble will be the result. This "cissing," as it is called, refers to the colours running off the ground colour and leaving a ragged edge instead of a sharp clear outline. This can only be rectified by the workman going over the same outline repeatedly, with the natural result of deteriorating the quality of the work when complete. Even this, however, will not always cure the evil. If the student finds his colours "ciss" after damping his board, he should give it another rub over with the leather, and should that fail to improve matters he must conclude that he has too much oil in his colour, and may be it is also too thick. He should, therefore, thin it with a little turpentine. I have always found that the addition of a little turpentine will at once prevent the colour from "cissing," and it, of course, makes the colour flow easier from the brush.

The size and character of the letters being determined upon, we strike the necessary lines to contain them, and proceed to set out the writing with the prepared pipeclay mentioned in a previous chapter.

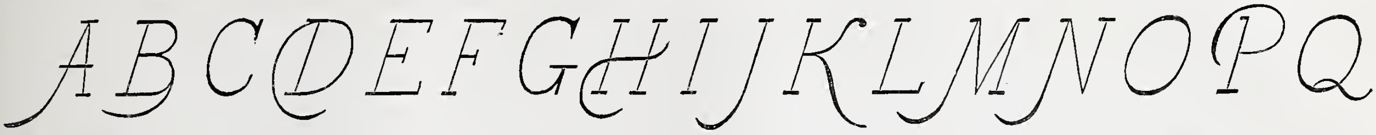
Much depends upon this setting out and spacing of the letters, as it may mar or make the success of the young workman's effort; for no matter how well shaped the letters may be, if they are badly set out the whole work will look clumsy and inartistic.

In the first place, we must mark the whole of the letters out in a very light and sketchy manner, taking pains to make them fill up the board as evenly as possible. If when finished they do not "come in" properly, we must wipe out the chalk marks with the damp leather and try again. Great care must be taken not to press the pipeclay upon the ground surface, otherwise it will leave unremovable markings. With practice the young writer will soon be able to set out his letters with the utmost exactitude. But there is another matter to be considered, and that is the spacing of the letters themselves, one from another, as it were. In printed matter the letters are all spaced the same distance apart; not so, however, in sign-writing. The letters A, J, K, O, Q, P, V, and W, Y, if not some others, require to be placed closer to their neighbours on either side than the rest of the letters, for the simple reason that they are not of the same width throughout, and therefore leave a much greater space between letter and letter. A reference to any large printed matter, or to the alphabets given with these chapters, which are, no doubt, evenly spaced by the compositors, will prove the force of these remarks, and point out to the novice how to avoid the appearance of uneven spacing, which, strange to say, truthfully-spaced letters always give. The name, or whatever the matter may be, must be exactly in the centre of the board, with an equal space or margin at each end.

Nothing displays the want of skill in a workman quicker than the careless arrangement of a name in large letters, and which leaves a wider margin at one end of the board than the other, yet it is frequently seen, through indifferent spacing.

We will, however, take it that at last the letters are properly spaced and marked out, so we must next turn to our colours and pencil, and prepare for outlining them in colour. Having got the pencil into working order by dipping it in a little "turps" and wiping out any excess with a piece of rag, we spread sufficient colour upon the palette with the palette knife, and thin it out to a proper working consistency. I cannot give any exact guide as to the best working consistency of any colour. It should, however, be somewhat thicker than good rich cream. If too thick, it will not flow freely from the brush, and will probably "ciss;" if too thin, it will not only not cover sufficiently, but will very likely run and spoil the work. It must be absolutely perfection; a little variation either way will put everything out of order, and the workman out of temper.

The letters should be outlined boldly with a pencil well charged with colour, and which should not leave the surface till the outline is complete from top to bottom.



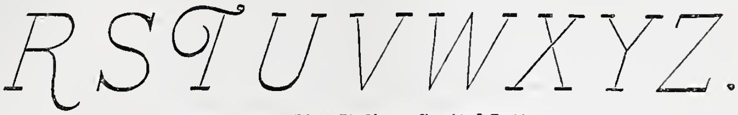


Fig. 76.—Hair-Line Italics: Capital Letters.

Fig. 77.—Hair-Line Italics: Small Letters.

Most amateurs and beginners make their outlines in a series of short strokes, and frequently stop in the middle of a line to recharge the pencil with colour, which renders the letters of a shaky aspect, and betrays the nervous, unpractised hand. Of course, in very large letters, the pencil will not hold sufficient colour to enable the operator to work from top to bottom without a break; but, as such letters are generally at a good height, distance softens off any imperfect or ragged outlines. If the student takes care to refill his brush with colour before starting on every fresh line he will generally find it hold out to the end. He must remember that the larger the letter, the larger the brush and its holding capacities, and so there need be no excuse for short, uneven strokes in any moderately-sized work. It is, I admit, more difficult at first to make a line in one continuous stroke than in two or three, but if the beginner once gives way to the latter method, faulty and unworkmanlike as it is, he will have great difficulty in shaking himself free from it in after life. The hand must not rest on the sign; if it be an unsteady one, the wrist may rest on the mahl stick, or upon the wrist of the left hand; but never touch the sign, or it will be cramped and hindered in its free movement. In curved letters this is especially so, as nothing is so necessary for their correct formation as a bold, free, and pliable hand. For the sake of practice, the student should make all his outlines of the same thickness throughout, as he will find this somewhat hard to accomplish at the onset. When the outlining is complete, the letters are filled in with a short thick brush (Figs. 44 and 44a, page 357), and then leave all to dry. On the succeeding day, the thicknesses (if any) are added and the shadows "put in," and, after undergoing any little extra touching up, we may consider our job finished and ready for varnishing. If the work is surrounded with a plain or fancy border, corners, and other ornaments, they are naturally proceeded with along with the letters, and the whole completed together.

One last word as a caution: Always use the point of the pencil in outlining, and you will get a straight even line; but, use it on its side, and it bulges or shrinks in with the varying pressure of the hand, and a waved, or "in and out," line is the natural consequence.

In italic and script lettering, the greatest care must be taken to keep the letters all of the same slope or slant, and, for this purpose, the workman had better make himself a few set squares, which may be used as guides. The slant in italic letters should not be so great as that used in ordinary script or writing characters, hence at least two set squares would be necessary. In script writing the capitals should be just double the height of the ordinary or lower-case letters. It seems now to be fashionable to use script writing for indicating milliners' and such-like businesses, for which it seems very appropriate, especially gold letters on a black ground. It should always be the endeavour of the sign-writer to make the style of his letters appropriate to the trade they indicate as far as he finds it practicable to do so. Some businesses allow of much more showy colouring than others, as I have already pointed out in a previous chapter.

In varnishing the completed work, it is best to give it three thin coats, well worked, than two thick ones, allowing each to dry thoroughly hard before applying the next. By doing this, the workman may do much to prevent the sun from cracking the varnish and blistering the paint.

Messrs. Wilkinson, Heywood & Clark make a splendid varnish specially for the use of sign-writers, and the name of this firm is, I think, a sufficient guarantee of good quality combined with a moderate price.

I will now describe the method of painting a few of those common objects, or ornaments as some prefer to call them, which the writer is so often called upon to execute as a part of a tradesman's sign or of an inscription on a trade cart. We also frequently

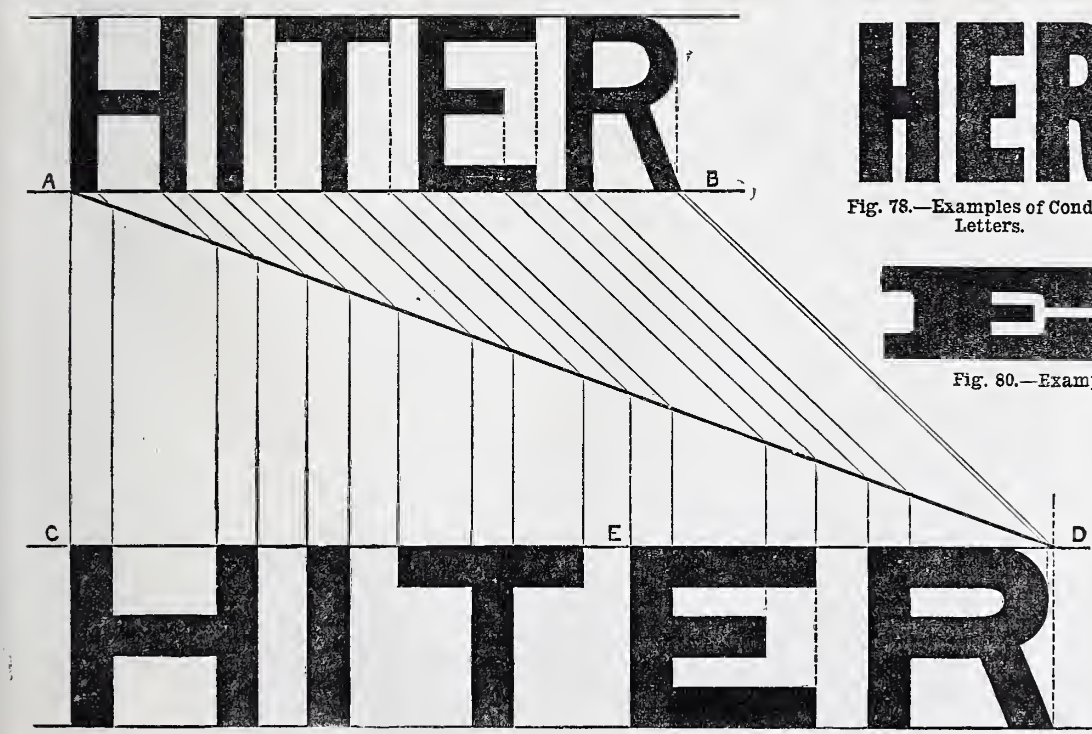


Fig. 81.—Diagram exhibiting Method of Expanding Letters correctly.

Fig. 78.—Examples of Condensed Letters.

Fig. 79.—Examples of Elongated Letters.

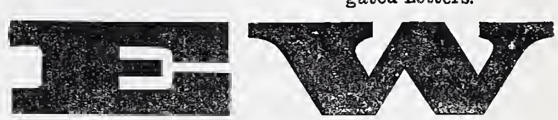


Fig. 80.—Examples of Expanded Ionic Letters.

Fig. 82.—Example of Compressed Letter.

see the best work surrounded with a plain or an ornamental border which cannot very well be dispensed with, even if the writer is accustomed only to the simplest of work. Starting, then, with Royalty and the Royal tradesman—happy and favoured beings—I will first take in hand Her Majesty's Coat of Arms, which, I need hardly say, is always executed in gold and certain regulation heraldic colours. Now, I am honest enough to say that I know very little about heraldry, and also that I have never painted the Royal Arms in my life, for the simple reason that I have never had occasion to do so; nevertheless, if I had, I am one of those sort of fellows who "would be bound to do it." I am, however, going to rely on the undisputed authority of Mr. Wm. Sutherland in regard to the Royal Arms, and in doing this I know my readers and I are in safe hands.

The Royal Arms of England, with which are combined those of Scotland and Ireland, consist of a shield surrounded by the ribbon of the Most Noble Order of the Garter. The shield is surmounted by a royal crown, upon which is a lion, also crowned. The shield is divided into four equal parts—the first and third quarters are blazoned with the arms of England proper, viz.: three golden lions on a red or vermilion ground. The second (Scottish) quarter of the shield is a red lion rampant, that is, standing on its hind legs, pawing the air with its fore legs, surrounded by a tressure, that is two lines a little way apart, having small *fleur de lis* at each corner, and on the sides. This tressure is red also, the ground being gold. The fourth quarter of the shield is occupied by a gold harp on a blue ground, being the Irish national emblem. Round the shield is placed a blue ribbon with gold edges, upon which is displayed the motto of the Order of the Garter, *Honi soit qui mal y pense*. Each side of the shield is supported by a lion and a unicorn; the lion to the left, as we look at the shield, and the unicorn to the right. The unicorn has a gilt horn springing from out of his forehead; round his neck is a collar of gold, to which a gold chain is fastened, overlapping his body, and secured below. The lion is painted proper, that is in natural colours; the unicorn is white with gold hoofs, and the tip or tuft of hair at the end of his tail is also gilt. Underneath the shield are scroll ornaments upon which the feet or claws of the animals rest, and upon which also a ribbon is hung. Upon the ribbon is the motto, *Dieu et mon droit*. This ribbon is blue, but generally of a lighter colour than the blue of the garter round the shield. The letters on both should be in gold, outlined with black. Underneath the shield and springing from the scroll ornament are conventional representations of the rose, the thistle, and the shamrock, national emblems of the three kingdoms. In painting this, or in fact any heraldic emblem, every part of the work is outlined with black, and shaded more or less. The gold is best shaded with burnt sienna, with a little burnt umber added; and the white parts, with Vandyke brown and ultramarine blue, or with blue black alone; the reds and blues with purple lake, or burnt umber and crimson lake. It must be understood that the colours of coats of arms are fixed, and therefore there can be no departure from them or we create false heraldry.

I will now describe the arms of the Prince and Princess of Wales. As Prince of Wales His Royal Highness bears the shield of his mother (as Queen of England), differenced with a silver label of three points, as the Princes of Wales, his predecessors from the time of the Black Prince (who was the first English Prince of Wales by creation), have borne the Royal Arms with the same difference. Accordingly the arms of the Prince of Wales are quarterly, first and fourth England; second, Scotland; and third, Ireland; the label being in chief (*i.e.*, on top part of shield), and extending across the entire width of the shield. Upon this shield that of Saxony is now charged in pretence. The arms of Saxony are *barry of ten, or, and sable, a crown of rue in bend, vert.*

His Royal Highness also bears the feather badge, the well-known cognisance of the Prince of Wales. The three ostrich feathers of the famous badge were first ensigned with a princely coronet by Edward Tudor, Prince of Wales, son of Henry VIII.; and Henry Stuart, eldest son of James I., established the arrangement of the feathers within the coronet as they have since been blazoned. A single ostrich feather having a scroll with the motto *Ich dien* (I serve), may probably have been borne, after an early usage, by the Princes of Wales.

A coloured sheet of the Royal Arms of England appears in Part CVIII. of "The Journal of Decorative Art" for December, 1889. It should prove very valuable to the sign-writer, who so frequently has to paint it on signs and trade vans.

MEANS, MODES, AND METHODS.

A Lost Colour Material Discovered.

The brilliant blue of the Egyptians and Greeks in use more than twenty centuries ago was regarded as lost to modern science and industries, as it had been out of use for many centuries. The traces of it were manifest in the ever-brilliant colours in the Pyramids, Greek tombs, Pompeii and Roman tombs, and in the frescoes from walls preserved in the Vatican.

It was sometimes called the "Egyptian Blue," and by the Romans—who never scrupled at appropriation—the "Vestorian Blue." Several chemists of note tried by analysis to ascertain its constituents—Sir Humphry Davy, amongst others—but without result.

Vitruvius, a Roman writer of about the calibre for science of our daily journalist writers, gives a description of its composition of about their stamp of writing, and worthless to workmen or scientists. In the many attempts to reproduce this colour, the experimentalists showed sad lack of comprehension by using alkalies, acids, and compounds not at all likely to have been in the laboratory of ancient pigment-makers. Had they gone to Egypt to do as the Egyptians of old had to do, they would not have found these materials within handy reach. A French chemist, M. Fouqué, took a common-sense view of the matter, and for his colour used oxide of copper; for his bases, lime and silica; and the pigment material only needed a bright red heat and patient mixing, and the long-lost blue of the ancients was revived, and will form a new commercial article of surprising cheapness, and no money wasted in patenting it.

The proportions of the ingredients are:—

Silica	63·7
Lime	14·3
Oxide of copper	21·9

The variation of the quantity of copper, of course, affecting the intensity of the colour, or its tint and shade, may be modified by oxides of other metals.

As a dye-stuff, it is as good as it is as a pigment. J. C. K.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

125.—A New and Good Self-Clipping Buckle.

I have received from Central India a specimen, with drawings, of a new—as far as I know, remembering that there is nothing new under the sun—and good—which I think nobody who sees it will deny—self-clipping buckle, with which, I must confess, I am very much taken. The sender of the article in question writes:—"I am taking the liberty of sending you a patented invention of mine in the shape of a 'self-clipping' buckle, if you would be good enough to notice it in 'Our Guide to Good Things.' I am desirous of selling the thing, and would be glad if you would mention this in your notice. You state in Work that you are willing to bring forward anything new like this, so I hope that a request such as I am making will not be thought impertinent, especially when it is considered how greatly handicapped one is in being so far from England in trying to dispose of such a thing, it being so difficult to find out from this outlandish place who exactly are the people who would invest in an article like this, besides a great amount of time being lost in carrying on correspondence. From the specimen I send you by this mail and the enclosed drawing, you will see that pulling the strap tight makes the buckle grip it, and, theoretically, the harder the pull the greater the grip. No holes are required in the strap, and a special feature is that the thinning of the strap through wear can be compensated, for which purpose the upper clipping limb is made curved. When the strap wears this limb has merely to be flattened, thus bringing the two gripping bars closer together. To loosen the buckle and free the strap the central bar has merely to be lifted with one hand, instead of having to employ both, as in the ordinary buckle. It could be made as cheaply as an ordinary buckle, and if desired wholly of wire it could be made as shown in Fig. 2 of the drawing. The buckle is well adapted for bedding straps, Gladstone-bag straps, tourniquets, leggings, ladies' and gentlemen's belts, etc."

I have now done what I have been asked to do by my correspondent, whose letter shows me that Work has made its way into Central India, and is read there by Englishmen and appreciated. "But where is Fig. 2?" some reader may say. "I don't see it here, nor do I find Fig. 1, and as Fig. 2 is mentioned, I suppose there must of necessity be a Fig. 1." True, oh, reader, but the giving of the drawings would have revealed the whole secret of the buckle, respecting which I must, for the writer's sake, preserve a fitting reticence until the invention is safe in port, if it be really a new thing. It is declared to be a patented article, but I do not know that it is patented in this country. When the time comes that the drawings may be safely published, they shall find a place in Work. Meanwhile I shall be happy to show the article itself to any well-known manufacturer of goods of this kind who might wish to enter into communication with the writer with a view to purchase his rights. Men who live at home can have help rendered to them more directly in other ways. I am in sympathy with every inventor who has a good thing to place on the market, and is seeking to make his invention profitable to himself, but much more so with those who are heavily handicapped by distance from the place where buyers and sellers most do congregate, and it is this sympathy which has prompted me in this case to step somewhat out of the beaten course, and to set up a fingerpost to what I believe to be undeniably a "good thing." The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Steel Distorting.—Worker Bee writes:—"In 'Shop,' page 476, I observe A. B. C., in reply to a query on this subject from G. H. (*St. Helens*), gives it as his opinion that the steel became distorted in tempering by being heated 'too hot or not dropped perpendicularly into the oil or water to cool it.' May I point out to G. H. that there are many other reasons why his steel became distorted in tempering besides the one given by A. B. C.? The chief and most difficult to avoid is the treatment the steel has been subjected to in forging. If it has received a greater number of blows on one side than the other, or the blows have been given with greater force on one side than the other, although the steel may be straight when dipped into the cooling bath, it is certain to become distorted during cooling in proportion to the inequality in number and force of blows given during the forging process. Not knowing the article G. H. has been making, I will suppose it is a taper steel bar. It has been forged, and now he wishes to turn it in a lathe and afterwards temper it without risk of distortion in the latter process. Let him proceed thus. Having centred it, take a rough cut from end to end in the lathe; now make it a dull red heat throughout, and plunge it into dry slaked lime or charcoal dust, and allow it to cool. When cold take another cut down it in the lathe, and repeat the heating and cooling process. Unless the bar has had extra rough usage during forging, this will usually be sufficient. It may then be finished in the lathe and tempered, and be found free from distortion, but if doubtful, I have seen it heated and cooled the third time before finishing. If the article is flat instead of round, and fitted by grinding or filing, the same process must be observed if you wish to be very accurate. The cause of distortion, you will gather from the above, is the outer surface has become of a closer texture in some places than others, and unless that surface is removed it is certain to contract greater there than elsewhere, when 'cooled' during the tempering process. Without wishing to be hypercritical to A. B. C., I venture to write this, on the principle of 'help one another' that prevails in 'Shop.'"

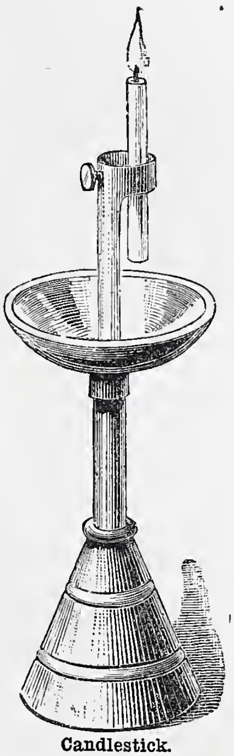
Incubator.—J. O. K. (*Aylesbury*) writes:—"Will W. L. (*Kingsland*) kindly enlighten me on a few points as to his mode of making incubator? I will put the questions. (1) What size garden pots would he allow for, say, fifty eggs? How does he regulate his heat? He must have a thermometer, considering the thickness of sand the heat must penetrate before it reaches the eggs. (2) Does he close the top of the upper pot to keep the heat in? (3) As the eggs require damping at times, how does he manage that part? (4) Would not two pails answer the same purpose, as one bottom would fit close into the other, and only one piece of tin would be required to fit, or the bottom pail might have a large hole cut so as for the heat to reach the bottom of the upper pail? I have seen the water tank used to heat by steam, but never the arrangement named by W. L."

Home-made Articles.—B. G. S. (*Dover*) writes:—"You seem to have discovered a clever mechanic at last. Have you seen these productions of H. G.'s (*Bishopsgate*) (see page 636), because I can't quite believe in them, though they are said to be made with the aid of a keyhole saw, an iron chisel, and a shoemaker's knife. Not a large tool chest required for those. Why, the dresser rails would have to be turned. What about the rails being decently round. I don't wonder he refused 20s. for it. It must have taken a month to make. And these are all his first attempts! He must indeed be a genius. Is it true? Have you seen the articles, or only his sketches? I can do them that way out of books with a little tracing paper."

Bell Metronome.—R. F. (*Norwich*) writes to Fiddler (*Glasgow*) (see page 654):—"I would say 'Go it, Fiddler, there's nothing like asking for enough when you are about it.' His very modest request is something like asking for instructions how to make a clock, and is quite outside the limits of 'Shop.' If I thought it would be of sufficient interest, I would, with the consent of the Editor, get up a paper on the subject, but as the articles in question are very little used except by music teachers, and can moreover be purchased very cheaply, I think it would be using valuable space that might be devoted to subjects more interesting to a larger class of readers."

Purchasing Timber.—A. J. H. (*Brixton, S.W.*) writes:—"I have read with surprise the remarks by A. R. (*Scorrier*) (see page 635). How long has he been in the trade not to have learnt yet that a 2-cut is always understood to be 3—1-in. boards, and a 3-cut 4—⅝-in. boards? I am quite aware that they do not measure the exact thickness, but few expect this. In fact, speaking from twenty years' experience, I do not remember more than two or three persons who required a 2-cut deal to cut 3 full 1 in. board. A. R. must be aware that every thickness in the trade is calculated to run the size less the saw cut, and that the only boards that do hold the full thickness are those cut on the 'other side'—*i.e.*, at the mills when the timber is first cut. Of course, if a customer requires a full 1-in. board, a deal can be cut for him, and leave a ⅝-in. board off. I presume A. R. must have left his thinking cap at home—that is, if, etc., when he wrote his letter. In writing the article I gave only the trade sizes and expression, so that the amateur could be on a level with the professional in asking for his timber. I may add that I have had the article quoted to me in the yard, thus showing that it has been of some use to the many readers of Work."

Candlestick.—W. W. C. (*Peterboro'*) writes:—"The enclosed drawing of the raised cup candlestick I send to the editor of Work to illustrate it in a place in any part of the paper."



Candlestick.

Misuse of Terms—Bookbinding, etc.—H. B. (*Jarrow-on-Tyne*) writes:—"I have repeatedly noticed correspondents use the word bore in relation to metal. Now I always understood that wood was bored, but that metal was drilled. Again, as a practical joiner, I must take exception to the way in which Mr. B. A. Baxter is teaching young joiners how to use the mortise chisel. In the number for December 28, page 647, Fig. 4, I think most practical joiners will bear me out that the chisel is turned the wrong way, and for this reason the chisel as there shown has a tendency to jam the core in the mortise, whereas if used the reverse way the tendency is rather to free the core than to jam it. To refer once more to the misuse of terms, in the part of the country where I served my time (Norfolk) the outer uprights in the framing of a door were always called 'mullions.' Now I find almost invariably in Work correspondents use the word 'munting'—Mr. Baxter, to wit, in the above mentioned article. Now in the only dictionary I happen to have by me at present (it's only a small one, 'tis true) I don't find the word munting, but I find mullion—a bar in a window frame. Now even that, I think, is scarcely correct. Strictly speaking, a mullion in relation to window frames is the stone or brick upright or column that divides a window opening into two. I would like to correspond with some subscriber who is interested in bookbinding with a view to mutual help. I have carved a piece of mahogany with the word 'Work.' If any subscriber who has facilities for casting small articles in brass would like to have one, I would lend him the pattern if he will cast me one. They are for lettering the back of Work when bound."

Copies of Fretwork.—F. C. (*Leytonstone*) writes:—"Perhaps the following method of making copies of fretwork designs may be useful to some of your readers. Instead of cutting one piece of wood at a time, clamp two together, and put three or four pieces of paper between them, then cut. The saw will cut the wood, and the paper as well, and as many pieces of paper as are used there will be copies of the design. A piece of thin copper or tin-foil may be used instead of the paper, and thus make a stencil plate."

Fret Machine.—Sceptic (*Brixton*) writes:—"I notice on page 636 of Work that A. A. (*Coventry*) has been kind enough to give particulars of a fret machine which he says works well. I should esteem it a favour if he would answer the following questions:—(1) When the frame is down how does he get it up again—he has no flywheel in the illustration? (2) Does it require two people to work it, because the saw frame is parallel with the treadle? (3) If you want to cut the inside of any piece of work, how is it done?"

Blowpipe and Fan.—W. G. (*Cheltenham*) writes:—"As a reader of Work, and rather an impatient one for every weekly number, I should like to ask A. S. P. what he means by a curve to a radius of twelve inches for a fan. I should esteem it a favour if he would explain it fully for me to understand, as I am making a double fan, and should like to see section of curved fan blower. I understand fully everything else."

Organ Materials.—B. F. (*Birkenhead*) writes:—"There are many inquiries by amateurs for organ pipes and parts. I once started to make one, but it cost too much. I saw one with, I think, four stops and room and holes for more not put together, the case all complete for £7. It stood about 7 ft. high, and was to be seen at Mr. Hall's, 4, Moor Place, Liverpool. He might sell the parts. My advice is, take the lot and fit it up yourself."

Belts Slipping.—B. F. (*Birkenhead*) writes in reply to J. P. A. (*Walthamstow*) (see page 524):—"I use this every day on the boiler or steam chest: Place an old tin with tallow and resin mixed together like glue; not too much tallow. Stir it up, apply hot while in motion, pour on. Put it back when done; it will always be hot and ready. You will find it stick."

Brazing Machine.—A. X. E. (*Nottingham*) writes "that the maker's name of the brazing machine referred to on page 635 is Thomas Duncan, machine maker, 305, Manchester Street, Oldham, and not Duncan and Mills, who are the patentees only."

Cigarette Maker.—C. W. B. (*Plymouth*) writes:—"I have had a cigarette tube made out of a piece of brass tubing in accordance with the sketch shown on page 670, but find it a complete failure for the purpose intended. The ends were left open to allow the stick to pass into the tube. There is evidently a defect by the open space where the tubing is hinged causing the tobacco to jam instead of passing freely through it. My idea is that a thin slip inside would obviate this defect."

A Simple Incubator.—B. F. (*Birkenhead*) writes:—"I have been busy or would have written earlier. Thanks to those who replied to my question *re* a simple incubator (see page 302). Mr. W. L. (*Kingsland*) (see page 557) says cut a piece of tin to connect the two pots together, but he does not show how far up to keep the sand from going below. Won't it burn the flannel? I thought the heat should be above the eggs, not below. The tin could go through, and a bollow tin box on top to throw down the heat. B. A. B. (*Hampstead*) (see page 573)—thanks for your reply. I had seen on dissecting an old Bourdon pressure gauge a hollow horseshoe shape which expanded, telling the steam pressure. I have a plan which I am working on that will turn the lamp off and on for the gas as required, similar to the governors of an engine. This idea I am going to sell, or get a partner and patent it. The whole affair could be made for 2s. 6d. It can be used for anything requiring steady heat, stoves, etc. Did any reader hear of such being patented? It is self-acting on the burner of lamp damper or gas. No chemicals or hollow vessels; cannot get out of order, being so simple."

II.—Questions Answered by Editor and Staff.

Colouring Brass Work.—Plumber (*Glasgow*).—I find that a beautiful violet colour is imparted to brass work by the application of chloride of antimony. Get the work perfectly bright and clean by the usual methods, either in lathe, or by dipping, etc.; heat it over gas flame or spirit lamp, so that water will steam off it but not fizz, and then apply the chloride of antimony liquor with a piece of rag or pad attached to a piece of wood; when the metal has assumed an even colour polish by rubbing with a soft cloth, perfectly clean and dry, and protect with a coat of clear lacquer. Should you prefer a darker colour use either of the following recipes:—(1) To 1 part oxide of iron, or iron filings, add 1 part arsenic, and 12 parts hydrochloric acid. Dissolve the oxide of iron or filings in the acid, then add the arsenic; strain, and bottle for use. (2) One pint of strong vinegar, 1 oz. of sal ammoniac, ¼ oz. arsenic, ½ oz. alum; dissolve in the vinegar, and bottle. These mixtures are to be applied in the same way as chloride of antimony, and, as you are doubtless aware, the ultimate shade may be varied by treating with various lacquers. In all cases the work should be polished with a dry cloth immediately the desired colour is obtained, and in the case of the two latter recipes the work should be lacquered at once, but with the chloride of antimony this is not essential. With regard to Florentine bronze, I should be glad to hear some other contributor's views upon the subject, as I am not aware of any recipe for a mixture, etc., which will impart the desired red shade, and also a metallic appearance. The only recipe I know of is the following:—The work having been finished bright and clean, is covered with a thin coating of copper. Now make a paste with Spanish brown, 12 parts, and blacklead 1 part, in hot water. Dissolve a small quantity of oxalic acid—say as much as will fit on a sixpence—to ½ lb. of other ingredients, also in hot water, and thoroughly mix the whole; thin with hot water to a workable consistence, and apply with a soft brush. When dry, polish with a medium brush. This done, the work is ready for lacquering, a pale lacquer being employed. I give you this recipe for what it is worth; to my mind it seems like directions for a coat of paint, and hope some one practically acquainted with "Flor" may give us the benefit of his experience.—Opifex.

Spence's Casting Metal.—D. O. (*Blackhill*).—The firm you refer to is not now in existence. Upon hearing from you I inquired of one of the leading London firms in this line, and they reply that they have not heard of the casting metal you ask about for years. There are various alloys which might suit you. Write again and state exactly what your requirements are, and I am sure we shall be able to obtain the information you need.—OPIFEX.

Small Castings.—E. W. (*Petersfield*).—There are several foundries in Southampton where you could get your castings made. If, however, there is anything specially difficult about them, which heavy founders do not care to tackle, and the Editor cares to furnish you with my address, I will, on the receipt of the pattern, get them cast, or advise you if there is any difficulty in the work, and how to remedy it.—J.

Browning Rifle Barrel.—PADDY BROWN (*Belfast*).—To prepare your rifle barrel for browning, all the old colouring, rust, etc., must be removed. To accomplish this rub it down well with emery cloth, and then polish with finest emery and oil until quite bright. Remove all trace of grease by rubbing with quicklime and water, rinse in warm water, and let dry. Plug the muzzle and vent with wood, and avoid handling the barrel. A good plan is to leave the piece of wood with which you plug the muzzle long enough to hold the barrel by during subsequent operations. There are various recipes for browning composition. The simplest is chloride of antimony and olive oil. Add the oil to the chloride of antimony until the mixture is of a creamy consistence; heat the barrel slightly, and apply an even coating of the mixture, and allow it to stand for twenty-four hours, when it will be covered with a fine coat of rust. This is removed with a perfectly clean and very stiff brush. Repeat these operations until the desired depth of colour is obtained. Should you wish to hasten the operation, add a little nitric acid to the browning mixture, when about ten hours will be sufficient for each application. When satisfied with the colour the barrel is washed in hot water, dried, and polished by rubbing with a very smooth piece of hard wood, when it should be varnished with pale lacquer. I need hardly add that every process of this nature requires practice, and that all operations in which chemicals are employed are liable to disappoint the worker, but if the foregoing directions are followed carefully I think I may promise you success.—OPIFEX.

Camera Fittings.—WM. McM. (*Cupar*).—A lens tube and cap can be procured from almost any lens maker. Lancaster, of Birmingham, or Taylor, of Leicester, would, I have no doubt, supply the want. The price would of course depend on the amount of finish, or if made for single or compound arrangement of lenses with or without diaphragms. If WM. McM. can work in metal, by the exercise of a little ingenuity he could construct one himself from a piece of brass tube of the right dimensions. The cap is easily made of a disk of thin wood of a suitable size, around which is glued several folds of stout paper. Cover with leather on the outside, and line the inside with black velvet. The cap should fit smoothly and evenly, but not too tight. He might possibly find something to suit him at some dealers in second-hand apparatus. The price of a whole plate lens complete (new) varies according to the maker's reputation from 30s. to £7, and for a portrait combination considerably more.—E. D.

Screen Materials.—BOB (*Sunderland*).—Paper, as you suggest, will do very well for lining the reverse side of your screen, but it should be laid on a calico, or some similar support, or it will be very liable to get torn. You may use almost any fabric instead of paper. If you want a glossy surface you might use oil baize or leather cloth. This you can also get with a dull surface more closely resembling morocco leather. Then there are cretonnes and chintzes in an almost endless variety. Cretonne lining is very good if you want a plain cover. Any of these materials are suitable, but prices vary so much that I cannot give them here. Your best plan will be to go to some good upholsterer or furnishing draper, and tell him what you want. He will quote price, when you can easily calculate the entire cost.—D. A.

Advice as to Trade.—B. R. G. (*Dorking*).—The subject on which you ask advice is, indeed, a serious one, for, as you say, it may affect your whole path in life, and I should strongly recommend you to take counsel with friends who know more of your circumstances and capabilities than I do. At the same time, as a friend who only knows as much of you as your letter tells, I may give you my own views. The most serious hindrance to your learning a trade in the ordinary way is your age, for I do not think any one would take you as an apprentice at twenty-two. You might get some employer who would be willing to take you on for a time with a premium till you had acquired sufficient knowledge to continue with him, or with another as an improver. Your taste for the carpenter's bench, and your familiarity with amateur woodwork, I am afraid, will not be of much use to you in a practical shop. Ability to work well as an amateur is a very different matter from being of the slightest use in a workshop, where a sharp lad, who had worked at the bench for a few months, would probably be of more value than the most skilful amateur. This may seem rough on amateurs, who, as a rule, have great ideas of their own skill; but I do not want to mislead you by giving you the idea that your present knowledge of joinery is likely to be of material aid to you. It may indicate that you have a natural bent for mechanical work, but otherwise it has little or no value. Amateurs are rather too apt to air their skill to the disparagement of others who have practical knowledge, so that on the whole if you want to become a joiner, I think you will do well not to lay much stress on what you can do now. Your employer will soon see what you can do. Many in similar circumstances to yourself have applied to me to be taught practically, most of them because they "have a taste for the business," or "are clever with tools," but such people, I have generally found, know too much to be taught anything. You will take these remarks in good part, I am sure, and not consider them personal further than indicating an error you should try to avoid. The terms for teaching you would have to be entirely a matter of arrangement, and probably before anything could be definitely decided you would have to go on trial for a month or so. If you are sharp and capable, you might be able to secure a small wage from the beginning almost, and if I were in your place I would regard with suspicion, or, if this is too strong an expression, examine with great care, any offer made to teach you if the premium required be a large one. Probably your services would be an equivalent for premium. I do not know what you have been brought up to, but could you not, presuming that you know something of any business, manage to get into some trade in which your knowledge might be of use? Very few men can get into precisely the trade they like, and after all, you know, a man is not always the best judge of the course of life for which he is most suited. Circumstances have to decide for most of us, and you must, to a great extent, be guided by these. I do not know that I can answer your inquiry as to wheelwright or joinery more definitely. They are both good, reliable trades, but if the choice be open to you, I am inclined to think that joinery offers the best prospects, especially if you turn your attention to the finer branches, such as cabinet making. The only way I can suggest for you to put yourself in communication with an employer is to write, or call on him. If you do not know any you might advertise, but the most reasonable way seems to try the local people first. If there is anything more I can tell you, write us again.—D. A.

Postage Stamp Gum.—E. M. (*Ashton*).—I believe dextrine is used for postage stamps, but even if not you will find it an excellent material for similar purposes. It can be obtained from chemists in the form of a powder, which readily dissolves in water. It is very strong as an adhesive, and cheaper than gum arabic, which may be used instead, if you cannot get dextrine.—D. A.

Polishing Fretwork.—A. J. M. (*Gravesend*).—You want "directions how to polish or varnish fretwork that cannot be done with a rubber," and I am sorry to say I cannot tell you, for I do not know of any fretwork which cannot be done with a rubber. Of course, if you varnish fretwork no rubber is required, as the varnish is laid on with a brush. Let us know what the peculiar kind of fretwork is which cannot be finished with a rubber, and then I may be able to help you, and tell you "what material is required to do it with."—D. A.

Varnishing Violins.—T. P. (*Birmingham*).—Violins should not be stained and subsequently varnished, but should be covered with a varnish charged with colour; a camel-hair brush is used for the purpose. Every fiddlemaker has some special "fad" for varnishing, and mine will be explained after the instructions in violin making.—B.

Small Camera.—W. J. A. (*Morley*).—A quarter-plate lens may vary in price from a few shillings to a few pounds, according to the kind and reputation of the maker; excellent lenses may often be procured at very low prices. If W. J. A. does not understand them, it would be as well to get some one experienced in the matter to select one for him. Landscape or single lenses are less expensive than double combination or portrait ones. As to the kind, the work to which they will be put must determine that. The portrait lens works more quickly than the landscape form, but does not possess so flat a field or so much depth of definition; that is to say, objects at different distances are not simultaneously depicted on the focussing screen so distinctly as with the single lens: the principal advantage of the portrait lens is rapidity. With regard to stops, a strip of blackened brass, in which an aperture has been made, and fitting into a slot cut in the lens mount between the lenses, is the most simple form of diaphragm existing. With regard to a camera, a full description of one was given in WORK about two months ago. A camera to be of any use at all must be as good for an amateur as for a professional, or *vice versâ*. One box sliding in another, telescope fashion, in order to adjust the focus, with a lens fitted at one end and a plate at the other, can be made, by one who understands what he is about, to produce good photograph negatives. The principles of negative making are complied with in this simple arrangement.—E. D.

Castings for Rivetting.—CASTING (*Camberwell*).—I could answer your question better if I knew the nature of the articles you require. The cheapest metal of course is cast iron. But unless the castings are tolerably stout and solid, they will not stand rivetting. Malleable cast iron is next best, and will stand rivetting very well, and can be recommended. Send for these to Harrison & Co., Malleable Iron Works, Lincoln. Gun metal will also stand rivetting, but is probably too costly.—J.

Knife Repairs.—H. W. H. (*Anerley*).—Knife blades may be fixed in their handles by putting some powdered resin or shellac in the holes, heating the tangs of the blades sufficiently to melt the lac, and inserting them. When cold they can be as firmly fixed as ever. Brackets and tables for painting will be described, but there is very little fancy furniture which may not be made of pine, and painted. You will find several designs suitable for your purpose in our back numbers. For instance, the two tables described in No. 1 would look well if painted.—D. A.

Photographic Changing Boxes.—TRIPOD.—The matter will receive attention. Changing boxes of the usual type are seldom used now by practical men, the double dark slides being infinitely better from all points of view, as it has been found that much more nicety in cutting the glass for the dry plates and grinding the edges is a necessity with these boxes, as the least inequality in size or roughness on the edges or corners of the plates is apt to disarrange the whole affair, and necessitate a careful examination in the dark room before the apparatus can be made to work. These, with the liability of getting the films imperfect from dust and fragments of glass detached from the plates by the friction of carriage, are such serious drawbacks, that double dark slides of light modern make are better in every respect, and weigh no more, a matter of considerable importance to the tourist, who is jealous of any extra weight unless coupled with corresponding advantages.—E. D.

Connections for Carbons.—A HUMBLE ADMIRER (*Bradford*).—My experience with bichromate batteries goes to show that lead caps cast on the ends of carbon plates make a more lasting connection than copper-electro deposited on them. Paraffin wax is worse than useless as an insulator in the presence of chromic acid. Bore a hole in each of the carbons to make a holdfast for the lead, and cast a lead head to each, in which embed a binding screw of the pattern shown at Fig. 5, page 474. As this is sketched full size, perhaps you can make it yourself. I hope shortly to show exactly by diagrams how to cast lead heads on carbons. Warm the lead caps when finished, and paint them with Brunswick black, allowing this to go well on the carbon below the head for half an inch. Connect to the copper rings above the board, if you choose, by means of copper wires attached to the binding screws.—G. E. B.

Chloride of Lime Battery.—D. D. (*Glasgow*). Why bother your head and myself with scheming out such a hodge-podge battery, when there are so many good and cheap ones already invented and proved? I cannot say how you would succeed with a battery charged with dry chloride of lime in the porous cell with the carbon, for I have never tried it, nor am I likely to do so. Neither should I cement glass plates together to form a battery cell, whilst such cells can be improvised out of any old crocks, providing they are not cracked. Try this as a cheap battery for your bell. Get three small porous pots and three meat tins. Solder a copper wire to each of the tins to form connections. Put in the porous cells, and pack them in with iron turnings from the lathe. Fit an air-tight bung to each cell, and soak it in paraffin wax if possible. Through this bore a hole to closely fit a zinc rod for the positive element. This must not touch the bottom of the cell. Charge both cells with a strong solution of caustic alkali; black potash will do for the purpose. This is not so good as the Leclanché, but it will ring a bell, and is a cheap battery.—G. E. B.

White Lead.—J. G. (*Cottingham*).—Strictly, chemically speaking, white lead is a mixture of carbonate of lead and hydrate of lead. The true oxides of lead, I am well aware, are of a considerably different appearance—for instance, litharge and minium, or, as the latter is most familiarly known, red lead. How far I am chemically justified or incorrect in terming the commodity not oxide merely—as you will notice on reference—but white oxide of lead, it may scarcely be worth while to consider here; but the late noted writer on pigments and colours, George Field, author of "Chromatics," etc., so designates the whites of lead, and I preferred to retain the support of so generally acknowledged an authority (whose works upon the subject formed my earliest lessons on pigments), when briefly explaining the nature of the substance in question, than to repeat the nomenclature of the ordinary cyclopædia. Whether Field was justified by analysis, logic, or usage of his time, I cannot answer, since we know that many oxides have no acidity, and are, therefore, to some extent, misnamed. Space will not allow me to go further into this and other apparently similar instances, but I trust my answer will satisfy you, and be some return for your courteous sentence on the matter.—LONDON DECORATOR.

Green Paint for Venetian Blinds.—G. S. (*Greenock*).—I am not directly acquainted with the methods practised by those who make and paint laths in large quantities, but I have confidence in recommending the subjoined to you. To paint laths two or three coats, and then to varnish afterwards, is a method that scarcely pays where there is competition to be considered. Most large lead and paint manufacturers now prepare enamel paints ready for use for the purposes of coating cheaply ironmongery, machines, implements, etc., and the ordinary mineral-green colour of Venetian blinds is one of the most used articles.

If you do any quantity it would best pay you to buy some of this, which is usually most satisfactory, and dries in about one hour. Give the new laths first a coat of patent knotting composition, and then finish with two coats of green enamel paint; or if a fine cut and the colour will cover in one good coat, give two of knotting and one of enamel. If you cannot get enamel conveniently, or do not require much, make it yourself, with mineral green ready ground to paste in oil, beat up with cheap, hard-drying varnish, and strain before use. Don't use size instead of knottings! For enamel paint write Pontifex & Wood, Shoe Lane, London, E.C.—F. P.

Safe Locks.—J. A. (*Hull*).—In attempting to open a safe it is always as well to try the bolt with a pick. If the bolt step of the key is worn it will not throw the bolt home, the stump will remain in the gate of the levers, and the bolt can be thrown back with a pick. But if the bolt is fully shot home it is useless trying to open it in this manner. All good safes have lever locks fitted with improvements, which absolutely prevent the possibility of their being picked, so that there is no alternative but to open them in the manner you describe. Should the lock, however, be an ordinary lever one, it could be picked with an instrument similar to that described on page 404. To show that safes nowadays cannot be opened easily, I may mention that early last year a gang of burglars spent the entire night at the Agricultural Hall, Islington, endeavouring to open one, but were obliged to take their departure early in the morning, leaving the unopened safe, and the whole of their tools—to the value of several pounds—behind them. T. W.

Repairing Locks.—W. M. (*Dover*).—Your query is rather a difficult one to answer, as there are such an enormous number of patents in door furniture. Is there no patentee's name on it? If the rose is fixed with wood screws which are visible, take them out, and possibly the knob will come off with it; this is called Pitt's patent, and is in very general use. If there appears to be no fixing for the rose, try to unscrew it, and if you succeed in doing so, you will probably see how the knob is fixed to an inner rose, some by means of a fork that secures the knob to the rose that is fixed on the door, while others revolve in a collar. If you are still unable to remove them write again, and try to give more particulars.—T. W.

Glaze for Porcelain.—W. B. (*Holloway*).—It is difficult to give a definite receipt for this purpose without knowing what kind of porcelain is to be glazed, and what special result is desired. There are many glazes—transparent, opaque, and coloured. For hard or true porcelain we believe the only glaze employed is ground felspar or Cornish stone, with sometimes gypsum added. For soft or tender porcelain the common glaze is of much the same materials as those which form crystal glass—viz., flint, alkali, and about ⅔ oxide of lead. The glaze for what is styled English porcelain (that in which there is a considerable admixture of calcined bone) is an intermediate one, felspar with about ⅙ of lead. Oxide of tin, etc., render the glaze opaque, and other metallic oxides will give it various colours. Indeed, the variations which may be made in glazes for various purposes are almost endless. The method of using them is by reducing the material to a fine powder, mixing this with water to a thinnish paste, and dipping the article to be glazed into it, which to give a uniform coating of glaze needs to be done skilfully. The parts by which the article is held need to be glazed over with a camel-hair pencil. The articles have, of course, to be fixed afterwards. —M. M.

Watch Wheels. — C. C. (*Chippenham*).—You can get any clock wheels to order or pattern from Grimshaw & Co., 35, Goswell Road, Clerkenwell, or J. Hunt, 21, Ironmonger Street, St. Luke's, or better still from J. Mayes, 55, Red Lion Street, Clerkenwell.—A. B. C.

Transfer of Lithographs. — In answer to Young Cabinet Maker, several so-called "secret" methods of transferring lithographs, drawings, woodcuts, etc., to wood are practised. Our correspondent, like most of those who ask us questions, does not give us full enough details as to the kind of process he wants to try. The word lithograph embraces so many sorts of printing that we scarcely know how to reply to the query. We can thus only deal in generalities. If the paper upon which the lithograph is printed be steeped in strong isinglass, care being taken to sponge it off the ink all over its surface with methylated spirits, it should be then dried. The surface of the wood should be then glass-papered with No. 1, and finished with No. 0, and sponged over with hot (not boiling) water, and left to dry. This will swell up the grain. Then paper first across, then with the grain, with No. 0. Repeat this, and finish by applying with a soft rag methylated spirits, which let alone till it is evaporated, and paper off again with No. 0 with the grain. Then with japan gold size let down with "turps" so that it may be laid on rapidly and flat so as to show no brush marks with a flat camel-hair brush, similar to those used for damping letter-copying books. Leave it until it is "tacky" enough for gilding, then lay the lithograph face downwards upon it, and rub it till it sticks all over, and let it stand several hours. When thoroughly set, moisten the back of the paper with very hot water (not boiling) and rub away all the paper. The ink alone, being greasy and therefore insoluble in water, will be found adhering to the gold size after all the paper is rubbed away. Give the wood either a coat of mastic varnish or French polish; with white (colourless) lac polish spirit off, and the work is finished. White of egg may be substituted for isinglass, and for light-coloured woods, such as pine or satinwood, Venice turpentine and Canada balsam, two parts of former to one of the latter, should be used instead of gold size. If "transfer lithographs," such as are sold for decorative purposes, are used, a very thin coating of gold size will suffice, and the paper when moistened through with cold water will peel off, and the transfer remain on the wood ready for a coat of varnish or French polish as before.—J. W. H.

A Complaint. — C. H. (*Bloomsbury*).— I know fully what I am talking about when I describe plane patterns. A sensible man would have pointed out the errors into which he supposed I had fallen, but my haughty critic only sneers and snarls, and does not condescend to particular facts. Therefore all I can do is to challenge him to point out my errors. If he will name particularly any example or examples whose description he deems unpractical, or inaccurate, or misleading, I will send patterns, core boxes, and castings of such particular examples to the editor of Work for his inspection and verdict. Beyond this I will not waste words.—J. H.

Steatite Burners.—H. W. L. (*Ealing*).—I am not aware of any manufactory of these in England, the English market being mainly supplied from the Continent—notably Nuremberg in Germany. The principal factory there has a representative house in London—Messrs. Falk and Stadleman, Farringdon Road, E.C.—who would undertake the making of any experimental work, however small; but, as I gather from your letter that you can use a lathe, why not make them yourself? Steatite is identical with soapstone used by tailors to mark lines for cutting out cloth, and is easily worked, and may be bored, turned, planed, and polished like a piece of wood. When in the form of a powder it is termed French chalk. There are not two sorts, as you suppose—hard and soft; in the raw state it is soft; when baked it is hard and brittle. You would require to get some of the material in the lump, and proceed exactly as though you were making a burner out of a piece of wood. When made submit it to a gradual heat (the kitchen oven will do) until it becomes a whity-brown colour, and perfectly hard. Of course in that state you can no longer manipulate its shape.—C. M. W.

Books for Laundry Men.—Fitter (*Walsall*). —In the October 5th number of Work, page 459, the names of a few books likely to be of use to laundry men are given, among which are "Stationary Engine Driving" (by Reynolds, 4s. 6d.), "The Safe Use of Steam" (6d.), and "A Treatise on Steam Boilers" (by Wilson, 6s.). I should feel very gratified if you would (through the medium of 'Shop') kindly give the price of each and where to be obtained.--[Prices have been added as requested, and all are published by Crosby Lockwood & Co., Stationers' Hall Court, London.—Ed.]

Conducting Wire.—F. S. (*Bermondsey*).—The meaning of the wire, which is shown in Fig. 1 in the article on the "Construction of the Telephone Running to Earth," is sufficiently explained in the text. But as it is sometimes difficult to understand little things I will endeavour to give you a little more explanation. To get work done of any kind by electricity we must have what is called a "circuit." Now a circuit is a conducting wire going to the work from the source of production, and returning from the work after that has been accomplished to the original source. Shortly after the invention of the telegraph it was discovered by Steinheil that the earth could be used as the return. So for convenience sake, and also to effect an economy in wire, instead of running two long wires—viz., from the battery to the work and back again—one long wire only is run connecting the battery and the work called the "line," while from each end a short wire is run to the nearest gas or water pipe, thus connecting them to the earth. Telephones made as described in the article do not require a battery in the circuit unless a microphone is also used, so the two wires either run directly to the pair of instruments, or to the earth, as shown in Fig. 2, not to a battery. You might profit by reading the article again.—W. D.

Pedestal Sideboard.—J. H. B. (*Manchester*).—The firm you refer to is Messrs. C. Gibbons & Co., 2, Avenell Road, Highbury, London, N. Their "bead router" was described in No. 17 of Work, page 267. All the back numbers of Work are in print, and can be obtained through any bookseller or newsagent. Regarding quantity of timber for the sideboard you contemplate making, I can only give you these approximately for your small sketch, though an assistance is not sufficiently defined to enable me to tell exactly. The only way you can ascertain exact quantities is to take the measurements from working drawing, but no doubt the following will be of assistance to you:—

52 feet	1 in.	stuff for	top, lining, door frames, ends, back frame, etc.
8 "	¾ "	" "	pediments, mouldings, etc.
15 "	½ "	" "	door panels, etc.
12 "	¼ "	" "	drawer bottoms, etc.
32 "	1 "	" "	pine, for shelving, bearers, etc.
46 "	½ "	" "	back.

From this quantity, allowing for a fair amount of waste, you ought to be able to make the sideboard, but, of course, a good deal will depend on the way you cut your stuff up. The quantities might also be considerably altered, and in fact everything may be summed up by saying that till the working drawing is made out you can't arrive at an exact specification. As one example of how you might considerably alter the above I may remind you that the first item, 52 feet, might principally be of ½-in. stuff. You would also save a good deal by facing the front of the back frame and veneering the sides—*i.e.*, of the back. To go into all the details which you might alter would require a few pages of Work, but I dare say enough has been said to assist you. Your sketch does not show any rail or glass framing just above the top—*verb. sap.*—D. A.

Staining and Varnishing Cabinet. — E. J. (*Leith*).—I am glad to hear you have succeeded so well in your first attempt, but it is a pity you have used such a mixture of woods if you wish to stain your cabinet walnut or mahogany colour. Owing to the different colours of the woods, you would, as a novice, experience a great difficulty in securing anything like uniformity, for you will readily understand that to get the teak and butter-nut woods to the same tint would require careful and experienced manipulation. A really expert polisher might manage, but I fear you would be disappointed with the result were you to attempt to stain as you suggest. However, if you wish to try I should advise you to stain walnut colour rather than mahogany. Go over the wood with the walnut stain of Vandyke brown ammonia and water, then when dry either polish or varnish. A far better way will be to ebonise your cabinet, as the different woods used will not be apparent, and you will have little difficulty in getting a uniform appearance. You had better buy the black stain, as it will cost you no more than to make, and there will be no difficulty in procuring it in your neighbourhood. Go over the wood with it once or twice, allowing each wash to dry before repeating. You may then varnish, using a hard varnish, which may be improved by adding some gas black. Strain through muslin. It will save varnish if you size over the surface before applying it, but whether you use size or not, if the varnish, when dry, seems to have sunk, leaving a patchy surface, give another coat of varnish. Possibly the wet stain may have caused the wood to become rougher looking than you like. If so, rub down with fine glass-paper before varnishing. When the varnish is dry you ought to have a glossy surface, not so smooth and fine as if it had been well French polished, but sufficiently good for a first attempt at cabinet making, and probably better than it would look if you had tried your first attempt at French polishing it. If you want to get the dull black surface so often seen on ebonised furniture, all you have to do is to brush it lightly, or even rub it down with a little fine emery powder. Brush in the direction of the grain. You will see the brilliancy is quickly removed. Of course the varnish must be quite dry and hard before you attempt to "dull down."—D. A.

Electric Light for Photo Dark Room.—G. E. S. (*Berkeley*). —No other apparatus beside that described on page 445 will be needed. The cost per hour will be 1½d. per cell of pint size. No. 18 wire will do to connect the lamp with the battery if the distance is not over 12 feet. If over this No. 16 will be better. Lead caps, holding binding screws, must be cast on the carbons, and binding screws fixed to the zincs for convenience in connecting up. I hope to fully illustrate and describe this battery in my articles on "Model Electric Lights."—G. E. B.

Glass for Overmantel.—J. G. W. (*Stratford*).—As you are not "connected with the trade" you cannot do better than get what glass you want from any cabinet maker of good repute. If you are ever in the neighbourhood of Shoreditch you might see what Mr. Vincent, Rivington Street, can do for you. You must make your own arrangements about price, which, as you do not give sizes of plates, I cannot even form an idea of. The rate per foot varies considerably, increasing according to superficial measurement. Read the answer to Pedagogue, who also inquires about looking glass. —D. A.

Looking Glass for Bookcase. — Pedagogue (*Aldershot*).—As you want the name of a London house supplying looking glass, I give you one, Andrew Gibson, Garden Walk, Great Eastern Street, E. C. I do not know, as he is a wholesale man, whether he will care to supply you with such a small piece as you want, and if he does you must not expect to get it at a wholesale price. So far as my own experience goes *bonâ-fide* wholesale houses do not care to be bothered with small retail orders. Your best plan is to get what you want from one of the leading cabinet makers in Aldershot. I do not think any of them do their own silvering, but they are constantly getting glass down from the wholesale houses who supply them. Of course, they get a profit, but you would not buy at the same rate that they do, so that by the time you had paid carriage on single plate, including case, and cost of this or return carriage, you would probably find that by ordering direct the expense to yourself would be much greater than if you went to a good local tradesman. The cost of mirrors varies considerably according to quality of glass and silvering, but you may reckon on yours costing 6s. or 7s. If it costs more it does not necessarily follow that you have been overcharged.—D. A.

Camera Fittings.—P. A. C. (*Hornsey*) will be able to procure camera fittings of all kinds from Henry Park, 1, Orchard Buildings, Acton Street, Kingsland Road.—E. D.

House for Watches. — SCOTY (*Leith*). — The most reliable people who are makers, not mere dealers, are Messrs. T. Russell & Sons, Church Street, Liverpool. They do an immense trade, and turn out a well-finished article, be it a silver lever or a gold chronometer.—J. S.

Repairing Verge Watch.—W. K. (*Leeds*).—You misunderstand my words. I say "for repair, see last chapter;" I ought to add at end of watch, and how to clean it. I did not say "previous chapter." You must learn to take to pieces, and clean before repairing, or it will be like trying to learn to read before mastering the alphabet. You must not clean watch plates with oil; do as I say, or when bright touch the brush in rouge, and give a few sweeps in a circular motion; by using oil you cannot expect but to have a dull appearance.—J. S.

Stain.—FRETWORK (*Oldham*). — I suppose you refer to the common fret cut and carved brackets, etc., which are made on the Continent. I do not know the particular stain used, if indeed there is a general one. Probably there, as here, different preparations are found. The colour, as you know, is walnut, and you cannot do better than use any of the ordinary walnut stains. One of the simplest and best has already been several times referred to in these columns. It consists of Vandyke brown, ammonia, and water.—D. A.

Re-staining Bookcase.—G. B. (*Leeds*).—I am not acquainted with the "Castle Brand walnut stain," but having used it on a piece of pine furniture which you now wish to stain and polish in imitation of mahogany, I should think you must clean it off before you can do so satisfactorily. A good deal, however, depends on the darkness of your present stain, for if this is only of a light walnut colour, you will probably get the effect of a dark mahogany by using a red polish over it. To get a good mahogany colour on pine furniture you cannot do better than adopt the method above given, being careful not to make the wood too dark with the walnut stain.—D. A.

Address and Moulding.—J. H.—Secretary of London Association of Foremen Engineers and Draughtsmen, W. Smith, 101, Thomas Street, South Hackney. Meetings held in Cannon Street Hotel. There is a similar society in the Yorkshire district, but I cannot give particulars. Articles such as you mention are in course of preparation.—J.

Burnisher. — W. H.—No book specially on the subject, but consult Holtzapffel's "Turning and Mechanical Manipulation," Vol. 3, page 1042.—J.

To Mount Tracings. — J. E. J. (*Middlesborough*).—Prepare a flat straining frame the size you desire your mounted tracing to occupy. Then cut some calico just large enough to cover it and to fold over the back to the extent of one inch. Damp this slightly, paste edges, and fix on strainer. When dry it will strain quite tight. The next operation requires the most care. Damp your tracing either with a sponge or by steaming it, but be careful the colours do not run. Then paste round one inch of the edges (of course at the back), then fix on the calico. The best way I find to do this is to put your damped drawing face downwards on your bench, paste edges as directed, then lay your covered strainer down on the drawing. Taking it up press round the pasted margin carefully with clean hands or linen cloth, but beware of finger marks, and in damping do not deluge, and take care that colours do not run.—F. B.

Book on Painting.—E. M. J. (*Ipswich*).—You had better advertise for a second-hand copy of the book in question.—ED.

Telephone Fittings.—CURIOUS (*Belfast*). — I am very pleased to have your letter. It shows considerable acquaintance with the subject, and I am quite delighted to be able to set you right. I hope you will succeed in getting your telephones to work properly. As you have numbered your questions, I will answer them in rotation. (1) In Fig. 4 you will observe two little articles lettered respectively A and B. A is a binding screw, which is shown at B in Fig. 1. and has no connection with Fig. 8. B is an adjusting screw, which has a neck wrongly shown screwed in the figure. This neck fits into the brass collar, Fig. 8, which is itself screwed to the top of the body of telephone. The screw fits into the S end of the magnet, and the whole is for the purpose of adjustment. The arrangement which you have described and are going to adopt will do just as well. (2) The bobbins can be made of boxwood, and the spindle part must be very thin—in fact, it is no thicker than paper. I was showing one to a friend the other evening, and I could easily squeeze it out of shape between my fingers and thumb. (3) It is not necessary to insulate each layer of wire on the bobbin with paraffin paper. The depth of the bobbins may be seen from Fig. 1. It is not necessary to have them any particular size. Make them to fit the end of the magnets, and to hold a ½ oz. of wire No. 36. (4) You can have a bell in the circuit with the telephones, but you must have a battery or a generator of some kind to work the bells. In a circuit arranged with bells you would also require a transmitter. (5) Certainly rig up your telephones with a battery, and dispense with the earth wire. This wire is the return wire, and is only connected to the earth through the means of a water or gas pipe for the sake of economy. (6) You understand the microphone perfectly. It is as you say two pieces of wood joined at right angles, and three pieces of carbon. The two end pieces are just fastened to the upright in the most convenient manner, so as to get a connection. I think Fig. 6 explains it fully. Fig. 11 shows the connections.—W. D.

Painting Magic Lantern Slides.—P. M. C. (*Finsbury Park*).—In answer to your question "Can you tell me how to paint lantern slides with water colours?" I can here only give you a few hints. The glass must be perfectly clean, and of special quality. Give the glass a very thin even coating of finest sheet gelatine dissolved in warm water. This may be done with a flat camel's-hair brush, or let gelatine form jelly, heat the glass, and rub with jelly. The colours to be used are the ordinary moist water-colour paints in pans or tubes, but in slide painting you are restricted to the use of the transparent pigments—viz., Prussian blue, indigo, gamboge, carmine, crimson lake, Italian pink, sap green, ivory black; the semi-transparent colours are sepia, burnt sienna, Vandyke brown, and burnt umber. This is not a full list, but will serve as a guide as to the choice of pigments. Lump sugar dissolved in water to form a syrup is about the best vehicle for mixing and thinning the colours. Oxgall may be used to make a refractory colour take upon the glass. Use camel's-hair brushes, except for the very finest work, when a sable pencil will suit best. Do not try to give a second wash or put in shades without giving the slide a thin even coating of collodion, applied by pouring upon the centre of the glass, letting it run all over, and then draining off at one corner into bottle. The compound colours, such as purple, violet, greens, browns, greys, etc., may, of course, be produced by combining the colours mentioned above. When the picture is finished it should receive a thin coat of best mastic varnish.—OPIFEX.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Gilding on Satin.—S. H. (*South Norwood*) (see page 637) writes:—"On white satin, etc., size spoils the look, and gold size, oils, varnishes, etc., all spread. But if you could explain how it could be done, and some people know the way, it would oblige some of your readers."

Glue.—A SUBSCRIBER asks:—"Can any reader give me the name of the maker of glue with the trade mark on—a dragon standing up against a shield?"

Book on Sheet Metal Work.—L. P. (*Deal*) wishes to know the publisher of a book on the above subject written by H. Warne.

Furniture Cream Bottles.—T. B. (*Rochdale*) repeats his question:—"Will any of our kind readers of WORK give me the name and address of any firm of glass bottle makers where I can obtain furniture cream bottles from, such as are retailed at shops when filled at one penny each?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Fairy Bells.—R. F. (*Norwich*) writes in reply to SUBSCRIBER (*Bristol*) (see page 654):—"I will send particulars of the interior of fairy bells in a short time."

Spence's Metal.—H. J. L. J. M. (*Ealing*) writes:—"In answer to J. S. B.'s (see page 541) query as to Spence's Metal, I think I am right in saying that it is a combination of sulphur and iron in the shape of fine dust or filings. The metal is used for fixing railings in their sockets (just like sulphur pure and simple) and for fitting grindstones on to their axles. The compound is much cheaper than lead, and melts at a very low temperature. I have a small grindstone that was mounted for me in this way by the friend from whom I learned the nature of the metal. Like most sulphur compounds it has a very evil smell, and it is better to melt it out of doors. At the present time I have some small pieces by me, and if J. S. B. cared to write to me through the Editor, I should be glad to send him a piece. By the way, the addition of iron to the sulphur seems merely to change the colour of the sulphur to a dark slate-coloured black, as the compound, when it cools, seems to have the same shaped crystals on its surface as pure sulphur has."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—P. E. (*Ebbw Vale*); REGULAR READER; G. H. (*Congleton*); R. H. (*Birmingham*); YOUNG ENGINEER; G. P. (*Elgin*); GAMMA; ONE INTERESTED; LANE (*Nottingham*); C. H. L. B. (*South Shields*); PAINTER; T. H. D. (*York*); R. L. (*Liverpool*); CREST; J. H. (*Crewe*); PEEPING TOM; J. B. (*Tiverton*); V. A. H. (*Hackney*); J. A. C. (*Plaistow*); H. J. A. (*Dover*); M. S. G. (*Oldham*); W. R. (*Oswestry*); SLIGHTED; A. H. F. (*Cheltenham*); AJAX; BOMBARDIER; J. H. M. (*Ashfield*); F. C. (*Stockwell*); J. B. B. (*London, S.W.*); W. H. M. (*Burgess Hill*); J. G. (*Tottenham*); J. L. W. (*Biggleswade*); W. H. B. (*West Hartlepool*); W. Y. (*Enfield Lock*); B. J. (*London, W.*); J. S. (*Birmingham*); S. B. (*Exmouth*); W. D. G. (*Lowerfold*); R. M. C. (*Gravesend*); NEW SUB.; BOATHOOK; W. A. E. (*Manchester*); A. P. (*Wigan*); G. E. D. (*Watlington*); W. N. (*London, E.*); S. S. (*Nottingham*); W. H D. (*London, N.E.*); H. J. (*Bristol*); M. S. (*London, E.C.*); J. J. D. (*Bournemouth*); H. H. (*Stapleford*); J. W. R. (*Cockermouth*); G. M. (*Berlin*); J. T. H. (*Sheffield*); T. W. (*Bradford*); CROSS; WHIT (*Shipley*); I. H. J. J. (*Birmingham*); RESTORER; A. A. (*Liverpool*); M. R. (*Burnley*); A. and N. (*Battersea*); E. R. S. (*Stroud*); M. A. G.; W. H. S. (*Nottingham*); W. S. C. (*North Shields*); D. O. W. (*Ipswich*); CORE-BOX; I. B.; NOll (*Glasgow*); ZINC-RODS; L. M. (*Roscrea*); ANXIOUS; L. B. (*Upper Sydenham, S.E.*); W. R. C. (*Falmouth*); T. W. S. (*Orkney*); WORKER BEE; A. B. C. (*London, E.C.*); C. C. B. (*Watford*); W. E. R.; T. W. A. (*East Dulwich*); A. P. (*Stockport*); M. R. (*Glasgow*); LIGHT OAK; I. H. N. (*Worcestershire*); PATIENCE; BRITANNIA COMPANY.

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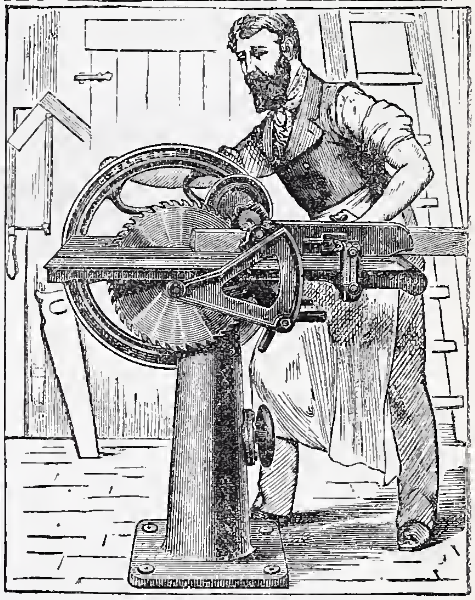

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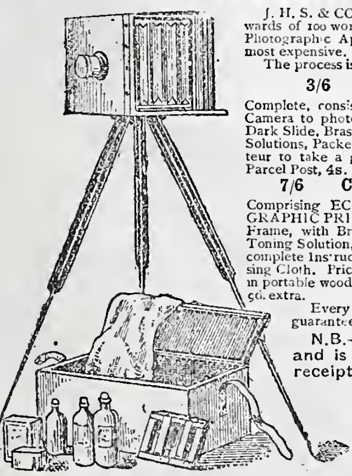

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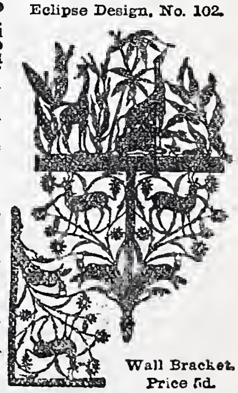

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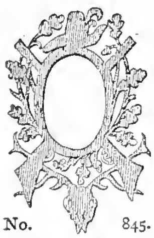

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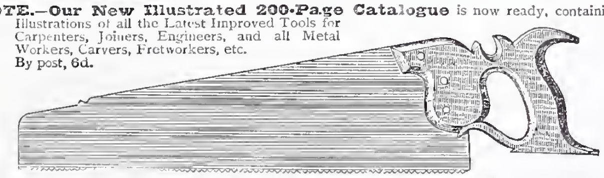

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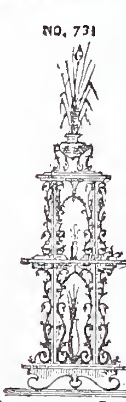

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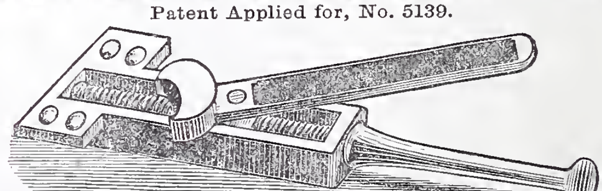

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 50.] SATURDAY, MARCH 1, 1890. [PRICE ONE PENNY.

PROPER HEIGHT FOR MECHANIC'S VICE.

BY H. B. PILKINGTON.

If men were all of the same height there would be no difficulty in regulating and determining the right height of the carpenter's bench and the mechanic's vice, for it would be easy enough in each case to arrive at a standard which would serve equally well for all. There is, however, a considerable difference in the stature of men, some being above and some below the average height, and as work at the bench and vice has to be done by the workman when standing, it is manifest that a tall man would be compelled to stoop too much when working at a bench or vice of suitable height for a short man; and a short man obliged to stand upright and raise his arms to an inconvenient height if put to work at either appliance at which a tall man could work with ease and comfort. Without doubt a great many amateurs, and, possibly, not a few intelligent and skilful professional workmen, would be puzzled to give with promptness a direct and satisfactory answer to the question: At what height from the ground should the jaws of the ordinary mechanic's vice be placed? To such as are ignorant, or perhaps in doubt, on the point, the accompanying sketches will be helpful in fixing on both mind and memory the right solution of the problem. For the sake of comparison, four have been given. In Fig. 1 the vice is too low, and the workman has to bend his knees and stoop too much over his work, and thereby loses power. In Fig. 2 the vice is too high, and this compels the workman to assume too erect a position and raise his arms too high, and in this case also power is lost. In Fig. 3 the vice is just at its right height, midway between the too low position in Fig. 1 and the too high position in Fig. 2; and the position assumed by the workman is such as enables him to bring the whole weight of the body, or nearly so, to bear on the stroke, and thereby the power exerted is at its maximum. How is the proper and most convenient height for each workman to be obtained? This is answered by Fig. 4, which shows that, to suit the workman, the top of the anvil should be just high enough to touch his elbow when he stands erect and bends his arm as drawn.

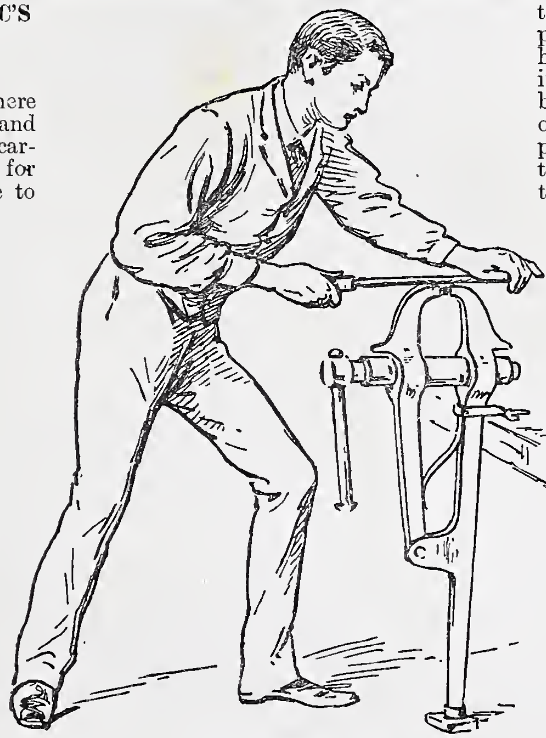


Fig. 1.—Vice too Low.

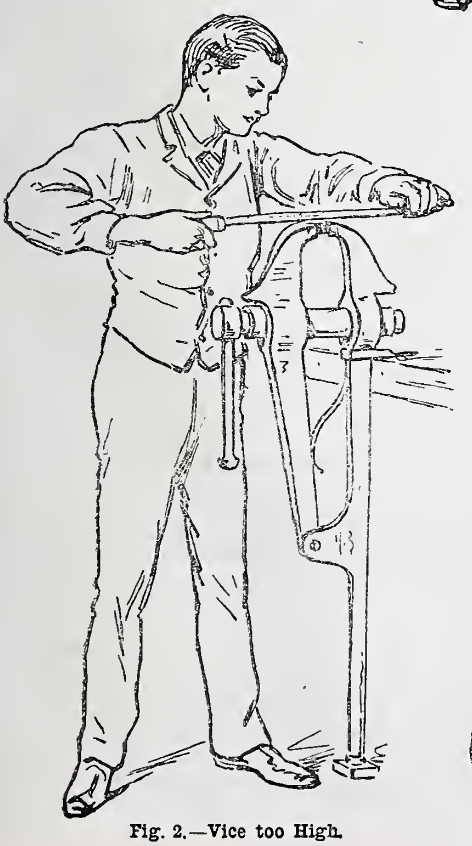


Fig. 2.—Vice too High.

Fig. 3.—Vice at Right Height.

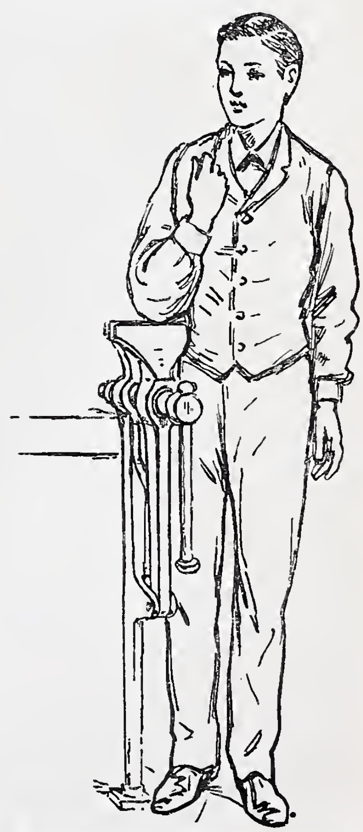


Fig. 4.—How to Determine Right Height of Vice.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

DISTEMPER OR TEMPERA PAINTING.

In writing technical papers upon house painting, and indeed upon most trades and callings, there are many words and expressions used in connection therewith that the writer always feels require but little explanation other than the words themselves convey. "Oil paint" and "varnish" for instance are examples of such. Upon the other hand it is very desirable that words of a more complex nature—notwithstanding their meaning may be very patent to most of my readers—should be accompanied, if only for the benefit of a small minority, by a practical knowledge of their proper sphere and use. "*Distemper*" is, certainly, a word of this latter kind; for although the process of *distempering* is familiar to all of us, I suppose, in its most elementary form of "whitewashing," the word has a distinct interpretation in its connection with the brightening and embellishing of our buildings.

Briefly, its Italian derivation, of *tempera*, gives at once a key to its meaning, when compared with the word "tempering," *to temper*, *to work up*, or *to mix*. Notwithstanding this mixing, or tempering, is a process common to all painting, oil and otherwise, *tempera* is the recognised name for *water painting*, that is to say, the compounding and spreading of *opaque* solids and pigments with water for the solvent, and some suitable *vehicle* introduced to bind the particles together.

At the present time, in which it is our privilege to be workers, the qualities and cheapness of distemper make it as invaluable a servant of the decorator as are oil and flatting paint. For preservative purposes, and as a covering for surfaces exposed to our humid atmosphere and weather, distemper is, however, practically useless; and although under fair conditions it will stand much "wear and tear" on walls, it is principally for situations out of reach and beyond abrasion that it is used with more advantage than oil paint. The most satisfactory purpose to which we can apply either oil paint or distemper will readily be apparent if we consider their totally distinct qualifications and nature. In the former mixture we know that whilst the linseed oil is the *solvent* it is also the *binding* factor, driers being added merely to hasten and accentuate the hardening. On the other hand, in distemper colour, the solvent, namely, water, has no such permanent action as has the oil in the former, but is entirely dispersed and carried away by evaporation.

Distemper, it therefore follows, besides being prepared from dry pigment and with water added to enable us to manipulate the former, requires a third and highly important factor which shall of itself bind the particles together and maintain this action when evaporation is complete.

Having, satisfactorily I hope, now explained the term, and also the nature of, *distemper*, we will consider separately the solids and the binding factors which are necessary to preparing it; concluding my paper with instructions for mixing and using it for general purposes.

In both oil and distemper painting there is one item, or rather substance, which ranks pre-eminently for its purpose above all other pigments. In the former process this position we know is held by the ordinary *white lead*, and other similar *carbonates* known as "Flake," "Nottingham," and "London" whites, etc., but which latter are seldom required for ordinary house painting. Mother Earth favours us even still more for *tempera* painting, providing us with an unlimited store of limestone and chalk, from which we derive the ordinary lime, *oxide of calcium*, of building processes, and a further preparation known as *carbonate of lime*.

Whiting, or *whitening* as it is sometimes termed, is the most ordinary and also the most useful form of carbonate of lime. *Paris white* and *gilders' whiting* are the best qualities of the same article, and differ from the cheap kind in fineness of substance and purity of white. *Paris white* is in far greater demand in the United States of America than in this country, where, under the term of "*Kalsomining*," the practice of whitewashing is carried to perfection. Repeated grinding and washing are resorted to in order to convert the chalk into the condition of whiting, the processes being worked to extremes when the finer qualities of the above-mentioned are required. For the practical benefit of the young learners amongst my readers, I may mention that Paris white is usually sold in a loose or powdered form, whilst gilders' whiting is commonly dried in the form of large knobs, each weighing three and four pounds, and being therefore about twice the size of the cheap knobs of "oil-shop whiting."

Whiting that has been properly washed and prepared, will easily break in the hands by pressure of the fingers, and there should also be a total absence of grit and sand. If it does not crumble up and dissolve easily, we have evidence that insufficient washing has left objectionable traces of a binding nature, common to lime.

I have gone somewhat minutely into *whiting*, and its desired condition and qualities, with good reason, however, for upon its purity much of the permanency and beauty of our *tints* of distemper will depend. Whiting which contains grit is entirely useless for gilders' work, namely, the preparation of surfaces for *water-gilding*; whilst if present to any extent in our distemper, grit will settle to the bottom of the vessel and, what is more troublesome, often carry with it the bulk of any powdered pigment used for tinting or staining purposes.

It is not my purpose herein to consider exhaustively every description of *vehicle*, ancient and modern, that has been, or can be, used for binding or cementing the particles of whiting or pigment to each other and, collectively, to the surface our distemper is applied on, but to notice the best and most convenient preparations of "to-day."

Until recent years, the ordinary glue of commerce was the only serviceable "binder," or water-vehicle, that house painters could conveniently use and obtain for making distemper. To the present day glue is still largely used in the provinces and places remote from the larger trade circles. The usual mode of preparation is to soak it in cold water over night, and then by breaking it up with the hand, or the application of heat, to convert it into a liquid or jelly form, when it is ready for adding to our whiting. The chief and only advantage of thus using and preparing glue lies in being able to stock it without detriment to its service ability. In London, Manchester, and, in fact, all large towns, glue for distemper purposes is now entirely superseded by a jelly substance of similar source and nature, termed "size."

The nature and preparation of *size* is almost identical with that of glue. The hoofs, hide-clippings, and other refuse of the tanyards is the source from which they are prepared, both being a gross kind of gelatine. The substances mentioned are purified with lime, and then the gelatinous matter extracted by gradual boiling, and the clarified condition of this extraction is the *size*. When required to be converted into glue, this liquid, after the greater portion of the water has been evaporated, cools into a very strong jelly. It is then divided into blocks which are ultimately converted into cakes of hard glue by a double process of drying by natural and artificial methods.

Clear, or *gilders'*, *size* is a simple decoction made by simmering "parchment cuttings" in a vessel—preferably with an enamelled inside—until the gelatinous "virtue" is all extracted therefrom. It is then poured off in its liquid state and strained through fine muslin, and when cool is almost colourless. Gilders—I mean those who are masters of every branch of this craft and follow it entirely as their trade—always prepare their own clear size; and as this article is one of the most important used in all water-gilding processes, knowledge of and practice in preparing it are very essential to such work. *Clear size* is also used for finishing decorative "oil gilding" in buildings, etc., hence this knowledge should be common to the decorator also.

Painters' size is usually sold by the pound weight, or in firkins containing about 28 lbs. The finest and whitest variety, used in London and district, is known as "Young's patent size," which for purity and strength is equal to anything that can be produced. *Double size* and *extra double* are the two varieties most used for distemper, the latter being the strongest; neither of these are, however, to be compared with the first-named for purity and translucency, their colour being similar to size prepared from a good quality of ordinary glue.

When required for use these jelly sizes are put into a vessel and dissolved by heat, a little water being first introduced to prevent them from burning. Size should never be made very hot, but dissolved sufficiently only to allow of its being thoroughly incorporated with the whiting or other pigment. The only disadvantage the jelly form has is its liability to putrefy and decompose during the hot weather. It is for this reason that glue is often substituted in the provinces and districts where there is no factory at hand, and where the comparatively small demand for it does not warrant the trader or house painter keeping it.

Still more recently, and in order to cope with the disadvantage above-mentioned, glue and size in a powdered form have been placed upon the market, and can usually be obtained in any district. "Cannon's Concentrated Size" was, I believe, the first in the field, but at the present time every glue and size factory makes a glue powder, size powder, or concentrated size, which is usually retailed in penny, quarter, half, and pound packets. By dissolving this powder in boiling water, according to the directions sold with it, we get a good binder for distemper work without any of the risks or trouble attending the use of glue, or the storing of size.

The best method of mixing distemper is to first put some cold water into the vessel we purpose making it in, and then put the whiting into it, breaking up the lumps at the same time, so that, without unnecessary delay, the whiting may be thoroughly dissolved. Care should be taken not to use too much water, sufficient only to cover the whiting being required. When properly "slacked" and settled down, the surplus water must be gently poured off. A careful worker will then thoroughly stir the whiting to ensure its all being properly dissolved, this being best done by the bare hand and arm, and, gently pouring in his warm size, will continue to stir and mix until the two constituents, size and whiting, become thoroughly worked together. This should now be set aside in a cool place, when it will gradually assume a white jelly form. The amount of melted size used would be about half the bulk of the soaked whiting, but should there be an excess of water in the latter, it often so dilutes the size that there is not sufficient strength contained in the whole mixture to gelatinise or set it. Some of my readers may feel that this simple pail of whitewash requires more care than was anticipated, but good work cannot be done without properly prepared material. For the very common kinds of whitewashing, on country cottage ceilings, etc., it is very often the case that the housewife brushes the surface over with whiting and water only, just as lime is used for "white liming." No solid appearance is possible with such, however, and although for ceiling work in general less proportion of size than that given above can be used, jelly distemper works far easier, presents a more solid appearance, and is manipulated with far less splashing and mess than is usual with the watery wash we often find used by others than country housewives.

Those of my readers who have studied the previous papers on oil painting, will have in their mind how far the condition of the surface to be covered affects our proportions of material in that process. The same principle underlies both oil and distemper work; and the success of the latter will greatly depend upon the preparation of the plaster work. In describing the nature and necessary manipulation of flatting paint, I have also shown that no "break" must be made in a piece of continuous work, or flank of wall, but that every surface complete in itself, like a ceiling-flat or side of a room, must be commenced and expeditiously completed without join or "miss." We must therefore ensure a uniformity of absorption, or rather non-absorption, by previously coating the plaster with a mixture, which, like the first thin coats of paint in oil painting, shall stop the unequal suction common to all such plaster-work.

For this purpose the most convenient preparation is strong jelly size diluted with about one-third of water and just sufficient whiting to colour, without practically thickening, the size. This clear-coat, or "clearcole" as it is termed, should be prepared in precisely the same manner as the finishing distemper, and when convenient the addition of a little alum is desirable. The hardening action of alum on substances of a gelatinous nature is well known, especially among those of my readers who know what a photographic dry-plate is—not a few, I am sure! The introduction of the alum is not obligatory; the strong size and whiting alone will suffice, and this should be applied warm, as soon as mixed, for when cold it would be too stiff to spread with the brush. No such precautions concerning joins and streaks are required for using clearcole, since there is not sufficient body in it to form an appreciable incrustation on the wall. The size soaks into the face of the wall, and when dry is ready for finishing upon.

When distempering or tinting, that is, with tinted distemper, a ceiling of any dimensions, it is advisable to have a scaffold to work from, consisting of a plank resting upon two pairs of steps or, preferably, trestles made for that purpose. All cracks in the plaster should, if at all bad, be first "cut out," the face of the plaster each side cut away for half an inch, and then finished to a level surface with plaster and a small trowel. A broad, thin piece of wood with a square, bevelled edge is very useful for stopping plaster walls, for many operative painters even, in trying to stop a crack or hole with a sharp steel "stopping knife," will badly scratch the surrounding face of the plaster, the evil result of which is only seen when the job is finished. Repairing should be done on new ceilings before the clearcole is applied, and with old ceilings, at the time they are "washed off"—that is, when the old, dirty distemper is removed with water and brushes.

Ceilings should always be distempered by working away *from* the light towards the door or entrance to apartment. Two men are required to do a good-sized ceiling-flat; they should start at the window end, and, keeping their work in one general line, spread the distemper from the end as far towards the centre as they can both conveniently reach. The scaffold is then brought forward and another "shift" covered, and so on until the whole is finished. The solvent we use for distemper work being water, it will readily be seen that extreme heat or draught of air, such as will evaporate the water, is to be avoided during manipulation; but so soon as a piece of work is completed, our object must be to *dry* it off as *quickly* as possible, and hence open door and window to create the draught we previously had to avoid. A properly executed piece of distempering should have a level, but not perfectly smooth, surface; should show no joins or coarse brush-markings; should have a perfectly "dead" appearance, be solid and uniform throughout, and should, finally, *not* rub off by ordinary wear, or leaning against.

In distempering walls where a good job is required—and this I aim to direct all workers to—the stopping and clearcoling must be carefully performed, and thoroughly dry before the finishing coat, in a nicely jellied condition, is spread. In covering a wall of ordinary height, two workers are necessary, one standing on the scaffold and taking from the top, half-way down, the other working beneath him. It is a good plan for the bottom man to start spreading and keep slightly ahead of his fellow, who then, in his "laying off" strokes, will nicely cover all traces of the join. Distemper neither requires nor allows one-half the manipulation that oil paint does; and, as before mentioned, its nature rather corresponds with "flatting."

The brushes made for distempering, and the proper method of using them, I shall describe in the following paper, and which will cover also, as far as possible, all the tools and brushes used by the house painter.

By far the greater proportion of plaster ceilings are finished with distemper paint. Besides the advantages of cheapness and of covering in one coat where, with oil paint, four would be required, distemper shows superiority in other respects.

In large halls, dining-rooms, and similar places where people congregate, the moisture in the atmosphere—unless the ventilation of the apartment is exceptionally perfect—will condense upon a painted surface and run down the walls. This can be easily noticed by any of us. When distemper is substituted for it in such situations, no unpleasant effect is seen, since the distemper will absorb the moisture for the time being, and ultimately give it forth again without any detriment to its colour.

This property of distemper also points out the necessity of removing all old colouring and whitewash from ceiling and walls, but which are, in some cases, coated over with size, instead of the dirty, unhealthy coating being removed with brushes and water. The size binds the dirt down, and the opacity of distemper paint allows us to do this without its showing the dirt through; nevertheless, it is a practice to be condemned by all who think of sanitation. Doubtless this labour-saving plan would be used to a more general extent but for the fact that continuous coats of distemper and size soon discover the bad worker by the surface cracking and peeling off, owing to excess of size thereon.

In all preparations of paint the purity of our tints of colours is very much dependent upon that of the body pigment used. As good whiting is far more white and brilliant than white lead, it follows that we can obtain much purer and more delicate tints in distemper work than is possible with substances more affected by the atmosphere, as are the carbonates of lead, and oils which contain yellowness. If *gilders'* or *Paris* whiting be used with *clear* or *Young's patent* size, the purity of distemper tints is so very much in advance of those of white lead paint that it is impossible to match them in colour. In desiring our paint to suit the colour of the paper of a room this fact must be borne in mind, and allowance made for it. In such cases, *exact matching* is neither necessary nor possible. Our colours should always be judged by the general or dominant effect, and not by any infinitesimal portion thereof.

Notwithstanding the natural characteristics of distemper are absence of gloss, and suitability solely for interior and unexposed situations, many attempts have been made to combine its cheapness with the permanent qualities of oil paint.

When distemper work was scarcely so ordinary a process as size and size powders and improved pigments have of late years made it, the walls of apartments were sometimes painted in *tempera*, and finished, at some expense, by polishing or "satining" with French chalk and flat brushes. Nowadays, however, it is very seldom done directly on wall surfaces, although a similar process is still used on paperhangings, termed "satin goods." As before mentioned, excess of *vehicle* in distemper, whether gum, glue, or size, causes it to crack and peel off; so that, notwithstanding an "egg-shell gloss" could be obtained were sufficient used, it would only be at the sacrifice of permanence.

Pure beeswax can be added to distemper with occasional advantage for decorating ceilings in tempera. It forms a far harder surface for painting or stencilling ornament upon, without any risk of peeling off. It can scarcely be termed washable, but may be made to stand a considerable amount of wear and cleaning. The mode of preparation is to dissolve the yellow beeswax—not the paraffin-adulterated article—in oil of turpentine by heat, to have one's whiting ready for mixing, then add strong and very hot size, and well mix together before stirring in the melted wax. I do not commend this to the novices amongst my readers; it requires the professional hand to work it successfully.

Mixtures of distemper—that is, size and

whiting—with "turps," hot linseed oil, Russian tallow, etc., are occasionally made to spread on outside work, and are successful so far as they contain the oil or grease which repels the water. For inside work a washable tempera is impossible from ordinary ingredients and without mechanical processes. There are, however, a few so-termed washable distempers in the market. The best known are J. B. Orr & Co.'s "Duresco" and Griffiths' "Acquol." The former has been much used on such large buildings as colleges and hospitals, but only for interiors. As *washable* paints they are fairly successful, but, since they are prepared from a basis other than whiting, they lack considerably the opacity we can obtain with one coat of good plain distemper.

In tinting, or colouring, distemper, the pigment used for staining, whether ground in water or in powder form, should be mixed with the whiting before the size is added. It cannot otherwise be properly worked into the whiting, and, after the size is added, the distemper should be run through a thin gauze or hair sieve. If it is strained after getting set, this will give it in a very agreeable condition for spreading—"to work like butter," it is termed.

The nature of distemper is such that, when dry, its tints are very much lighter than when mixed. This is due to the action of light upon the solvent—water—used for mixing, and the evaporation of which allows the pigment to convey an equally bright sensation as it did before being so saturated.

The pigments most suitable for staining whiting will be gathered from the opening papers of my subject, but I append a few of the most useful and ordinary:—For *warm*—that is, red—tints, Venetian and Indian reds and burnt sienna. For *buffs*, *cinnamons*, etc., the natural *ochres*, *umbers*, and *siennas* with the above reds. Lime blue and ultramarine, so-called, make blue and grey, with red added for French grey, and *blue-black* or *Paris* black where the neutral is required. Greens are seldom required bright, and mixtures of raw sienna or ochre with lime blue, indigo, or ultramarine are most reliable. All dark-colour distemper paints like purple-brown, for instance, seldom require whiting, only the pigment prepared in similar manner. All mixtures should be tested and dried on paper to allow us to judge the colour, and when this is correct, add the size.

THE BROOCH: HOW TO MAKE IT.

BY H. S. GOLDSMITH.

Brooch Mounts:

The Principles that Govern their Position, both on the Brooch and with Reference to One Another.

We have made the different mounts, and now we have to attach them to a brooch. So, if you please, we will consider if there is a proper place for them, and what relation they bear to each other.

I can simplify these considerations, inasmuch as custom decrees that all ladies must be right-handed—at least, we make brooches for them alone.

The poor ladies who are left-handed must be content with insecure fastenings, for, as far as my knowledge goes, they are never considered by us at all in this matter.

A circular brooch (Fig. 1, A) will be the type from which we can point our moral, even if it does not help to adorn a tale.

As the perpendicular lines on the front of the brooch (be they what they may, either ornament or stones) depend on the *position of the tongue*, this must be so placed that it is parallel with the true horizontal line, or, as we say, straight across the brooch, as in Figs. 1, A, and 1, B, but a little above the middle line, else the brooch will topple forward.

To get the tongue right, the joint and

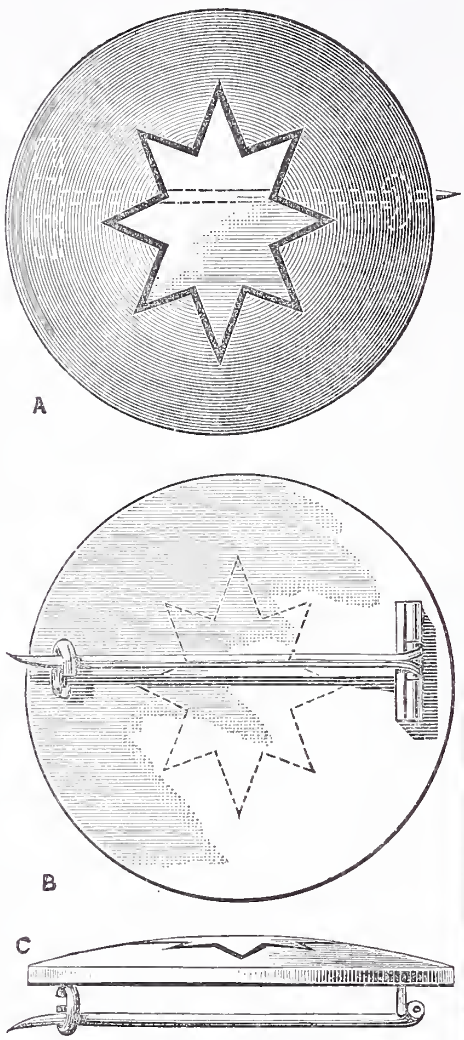


Fig. 1.—Circular Brooch.

The Star in front is to show the horizontal and perpendicular lines; correct position of tongue is shown in A, B, and C, that is, straight across and above the middle line. A, Front view, showing by dotted lines the position of the various mounts as they would appear if seen through the brooch. B, Back view, giving the positions of the mounts; note that the opening of the catch is downward. C, Top view, to show parallel position of tongue when fastened.

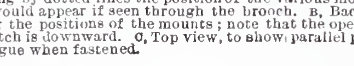


Fig. 2.—Form of Double-Pointed Tongue, to prevent tilting forward of Narrow Brooch.

catch have to be properly placed. It is not difficult to see where the centre of the joint should be—as that is in the same line as the tongue—and with the catch there is no difficulty here either, if you remember that the natural spring of the tongue will force it to rest against the highest part of the inside of top curl.

This point being fixed, you have but to solder such highest point in line with the centre of joint.

You will, I feel sure, without being told, solder the joints and catch parallel | thus | and not / thus |.

Besides obtaining the horizontal position of the tongue in reference to the front, we have to get a proper distance between it and the back of the brooch (Fig. 1, C). This distance will vary according to the size of the brooch, and to the material that it will have to fasten; for example, but little space is wanted between them when silk ties or lace is to be secured, while something like $\frac{1}{4}$ in. may be wanted for a heavy shawl brooch. You will have to judge that for yourselves, as it will probably vary with every brooch you make.

The side view of the brooch (Fig. 1, C) indicates the position that should be tried for: it is, as you see, quite parallel with the back all along.

What should the length of the tongue be? For the ordinary tongue we have it projecting a little beyond the catch, say $\frac{1}{8}$ to $\frac{1}{4}$ in., and, at the same time, bear this in mind, it *must adjust easily*, therefore don't cut it *too short*, and it should not give opportunities for the wearer to *get scratches*, therefore, *not too long*. You must find the medium; I cannot fix one for you.

You should also turn up the point a little away from the brooch, in order that it (the point) may rest against the dress, and so obtain a little protection.

The length of the tongue in a protecting or safety catch decides itself, for we should never be mad enough to let a tongue project when the catch is made expressly for its protection—should we? Of course, never! Well, perhaps, we had better say hardly ever!

The catch, you will notice, is placed with its opening *downwards*, for a very simple mechanical reason that I leave you to guess for yourselves. If you do not know what it is, just observe the way left-handed ladies put their brooches on, then you will see the insecurity of turning the catch the other way about. I expect a good proportion of us have put a catch on head over heels when we were but young at the trade, and the same thing still happens even now with apprentices, so, kind reader, you are warned: be ready to do this properly when first asked to solder a catch on.

Fig. 2 indicates a suitable way of using the double tongue, for if a narrow bar brooch has a heavy or high front, then it will look towards the ground, and show us its edge instead of its front, unless we take some such means as this to keep it up.

The artistic part of our work I am purposely refraining from making but little allusion to, at any rate, for the present; but this I should like to say, with all the authority that others' opinion and advice and my own experience give: *Learn to draw*, and, if possible, to model in wax as well. For without a knowledge of drawing it is *simply impossible* for you to do your work properly. You have not educated your eyes, and cannot appreciate, and, consequently, cannot reproduce the drawings given to you to carry out.

I could write for hours and give examples without number of the advantages this confers, but I will content myself with asking those who mean to be good workmen to study freehand drawing and geometry during their leisure hours. Go to some art school. There are evening classes held nearly everywhere now, and, at first, keep to simple outline scrolls and leaves: it will give the best results for your business.

I am so convinced of its necessity that I advise the giving up of some hobby or other for this purpose, if you can find no other time, for if you do not, then in the race to the front you will be left behind.

Drawing is of paramount necessity as a means to convey your ideas or methods, and in this I have our worthy editor's experience to go on as well as my own. And he has had the greatest opportunities of knowing the value that illustrations have as a means of making others understand.

Therefore, endeavour to obtain the power to convey your thoughts by means of the pencil—it is a pleasant task, and one that foreigners have mastered. Why cannot our countrymen do the same, and not be beaten on their own ground, as they sometimes are, through being unable to indicate their method even by the roughest of sketches, to say nothing of their more artistic way of work?

This lack of becoming acquainted with everything connected with our business or craft as far as opportunities allow us seems to be a usual thing now, for I noticed the other day that William Morris, poet and socialist as he is, said "that there were no craftsmen now except surgeons." Such a statement as that from one who, I fear, knows only too well what he is talking about, hits, and hurts too, as Mark Twain says, "until we get level again." I hope some of my readers will help us to get level by removing some of the truth of that accusation, for it is an awful condemnation as it stands, be the fault whose it may.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

POLISHING THE PIANO—THE PROCESS—FLY FINISHING.

IT is now necessary to beautify the exterior in some way. As I pointed out in the paper on "Fitting-up" that the ornamentation was decidedly a matter of taste, I think the same remark applies equally to this part. It is usual in the pianoforte trade to polish with shellac polish: this is made from shellac held in solution with methylated spirits; the lac is manufactured in several parts of India, and is produced on the branches of trees, in the form of a cellular incrustation, by an insect—the *Coccus lacca.* This incrustation is scraped off the branches by the natives, and after being washed is put into linen bags; the bags are then held before a large fire, while a native at each end twists the bag in opposite directions, and the lac exudes through the bag and drops in a trough; it is then formed into thin sheets, and afterwards broken into fragments. Polish ready made can be procured at most oil or paint shops. You begin the work by rubbing a piece of fine glass-paper over the part you intend polishing, to remove any spots of glue or foreign substance that may have adhered to it since it was cleaned up; now take some plaster of Paris, and mix into a paste with methylated spirits and a little brown umber, to make it the colour of your walnut. Rub this well over the work so that it fills up the grain of the wood, employing plenty of friction, then wipe off clean with a piece of rag; next put some raw linseed oil on a piece of wadding, and rub over the surface; do not flood it with the oil. Although the oil is necessary in the working of the polish, if too much is used it has a tendency to sweat or ooze out on the surface. Make a rubber in the following manner: take a piece of wadding and form it in the shape of a ball, with one flat side; make this in size according to the size of the work you have in hand; now put about a teaspoonful of polish on your rubber; see that it penetrates the wadding well; by pressing with the thumb it will enter the wadding better. Now put over the wadding a nice piece of soft linen rag free from holes, and twist it round, the twist occupying the hollow of the hand when using; now rub your fine glass-paper over again, and commence by going over the surface with your rubber, in all directions, up and down, then across, then forming the letter O, then the figure 8, and every way, so that you do not work your rubber too much in one direction, as this tends to make minute spots on the work, instead of being level; work on until your rubber is dry, then replenish with more polish; you will probably have to put a drop of oil on the face of your rubber—with your finger this time—so that it works free; repeat supplying your rubber with polish until the grain of the wood is quite filled up, and a smooth surface is on the work. Up to this point of the work it is called bodying up; before finishing or spiriting off, it is best to leave the work to stand a day or two; you can then proceed to finish. Instead of using polish only in your rubber, you use half polish and half spirits, and work with this until you remove some of the smears left from the bodying: this has the appearance of steam on the work; your object is to remove this. After using half and half, you make a rubber of methylated spirits only, using very lightly until you find it getting dry, then you can use more pressure, until the smear is finally removed. The fly finisher now receives the parts of the case from the polisher to put together; he has to see that all the different parts of the case are complete. I will now describe what the reader has to do at this stage: a very important and necessary work is to take a pair of bellows and blow out all small particles of dust or shavings which may have lodged behind the strings or in any other part of the piano; it is better to stand the case on its top on a clean board, and tap the bottom gently with a hammer: this makes the dust fall from under the bottom plate. Now put the trusses or brackets in their place between the key bottom and truss toes: these are secured with screws through the bottom of truss toes and top of key bottom; you then put on four castors with screws, two being on the truss toes and two on the bottom of the back. At each end of the key-board you will find there is a vacant space: this you fill with blocks 7 in. long and the width of the spaces, to stand $\frac{1}{8}$th of an inch above the key: these are called key-blocks. Now you can hinge the fall and back flap together; see that it fits in its place nicely, and try whether it locks; if it does to your satisfaction, then put the name-board on: this is screwed to the back flap from its bottom edge. Now that the name-board is in position, you will find that it will not go down into its place by reason of the sharps or black keys being too long; you cut the ends off these after marking, so that they are $\frac{1}{8}$th of an inch clear of the front of the name-board. You may have to plane a little off the bottom edge of the name-board so that it rests on the top of the key-blocks and the back flap on the cheeks; also glue a strip of red cloth or flannel along the bottom, allowing it to stand over so that it shows behind the keys; now hinge your top together, fit panels, and fasten them in. On the pedals you put bosses: these are round pieces of brass to prevent the wood being

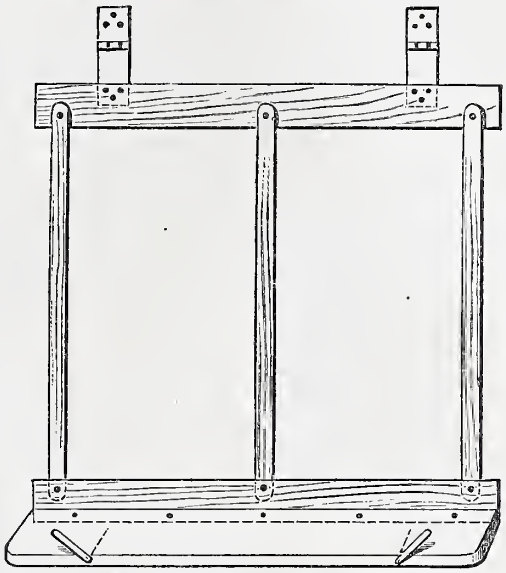


Fig. 1.—Desk to support Music. (Scale, 2 in. to 1 ft.)

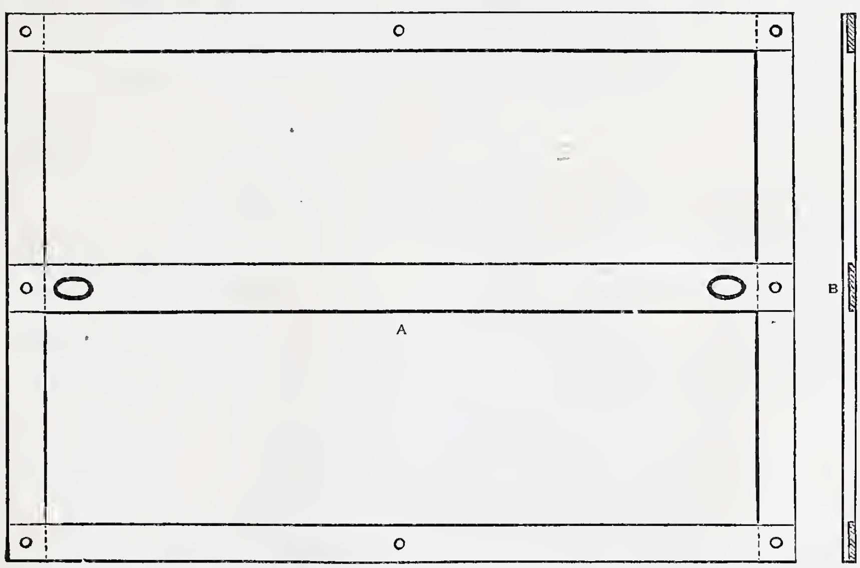


Fig. 2.—Back Frames in Plan (A) and Section (B). (Scale, 1 in. to 1 ft.)

worn by the feet; you will now require a back frame to fit in the back of the piano to be covered with lining, or any material the reader may choose: this is merely a square frame made of $\frac{3}{4}$ in. pine, with a rail crossing its centre: this is used in lifting the piano about; you level the ends down to the frame, and clean up with glass paper and colour it with brown umber and polish. Now screw your back frame in, and put in two round knobs just under the top at the back, to prevent it touching the wall. You will now require a music desk for your piano; the kind that will suit this piano is what is known as an overhanging desk; this is comprised of six pieces of walnut, $\frac{3}{8}$ths of an inch in thickness, two pieces $\frac{1}{4}$ in. wide, one piece $1\frac{1}{2}$ in. wide, and three pieces $\frac{1}{2}$ an inch wide; when complete, it closes up, and turns over the top door out of sight; you will want six desk rivets and washers, a pair of overhanging hinges, and a pair of book-holders; the two $1\frac{1}{2}$ in. pieces have three holes bored in each for the rivets to go through, and are $14\frac{1}{2}$ in. long; the $1\frac{1}{2}$ in. piece is the same length, and is screwed by its edge to one of the $1\frac{1}{4}$ in. pieces, while in the other edge is placed the book-holders; the three $\frac{1}{2}$ in. pieces are 12 in. long, and have a hole for a rivet at each end: these three are riveted, one end to the top of the desk and the other to the bottom; the overhanging hinges are screwed on the top edge of the top door (and are let in the thickness of the hinges) at one end, and the other end to the back of the top piece of the desk. Sconces or candle holders are not always used, but if you require them, these can be screwed on the panels on the door.

MEANS, MODES, AND METHODS.

How some Broken Roman Pottery was Mended.

A few months ago, some seven or eight small Etruscan vessels and vases were put into my hands for repair. They were mostly in fragments, as their discovery was due to the partial disappearance of a ploughshare in a tomb near Soriano, over which the unsuspecting ploughman was driving his team.

I have seen similar and larger specimens in museums repaired with narrow tape cemented on the outside; this, no doubt, is strong, but it certainly is unsightly. It might do on large vessels such as amphoræ, but on small ornamental vases would be quite out of place.

To rivet Roman remains would in most cases be impossible; the outlay of time and extra care would be enormous, and the risk of further increasing the number of fractures too great.

Ordinary cement and liquid glues seemed to be absorbed into the crumbling and very porous clays too readily to make a good joint, and I was rather at a loss how to go on. Then it occurred to me to try ordinary carpenters' glue. I had some by me (it is needless to repeat here how to prepare and mix it, and how the best quality is cheapest in the end), and making it rather thin, I tried the effect. First, I moistened the edges to be joined with clean warm water, and then put on the glue rather freely with a long flexible chip of bamboo (this, by the way, is my invariable substitute for a glue brush), put the broken edges in their places, and held them there with stout indiarubber rings, crossing and recrossing them wherever required. The glue, when dry, made an excellent joint; and a little trimming up of excess glue finished the job.

To further strengthen the vases, and to make good several pieces that were missing, I mixed some fresh plaster of Paris about the consistency of thick cream, and after slightly wetting the inside of one of the vases, poured the mixture inside, and turned and twisted the vase in all directions till the plaster was quite set. In this way I had built up a new vase inside the old, and the result was and is successful to this day, as the vases so repaired stand the dusting of the ordinarily careless housemaid.

One little vase of the saucer kind had a triangular piece missing from its circumference; this I was able to build up by chucking the saucer by the foot in a Whitton chuck, moulding moist plaster into the gap, and then removing the superfluous plaster with a chisel as the saucer revolved in the lathe; in this instance, the lathe reverted for once to its original form, viz., the potter's wheel.

The friends who had entrusted their pieces and fragments to my care were so delighted, that I became the proud possessor of two vases dating from B.C. 29, and this year some more vases were brought specially from Italy for me to mend.

H. J. L. J. M.

Prevention of Air-Bubbles in Graph Composition.

Those who, like myself, prefer the hektograph or chromograph, or, in fact, any of the simple graphs or gelatine processes for reproducing letters and designs, may have often been worried by the air-bubbles which will keep rising while the liquefied composition is beginning to solidify. These bubbles can easily be removed in the early stage of the solidifying process (in fact, they only rise then) by holding a heated piece of metal such as a poker or a soldering-bit near enough to the bubble till the air therein expands and bursts the bubble. I always use a gas-blowpipe flame myself, and find it very simple, and more effective than the heated metal; care, of course, must be taken in either case to avoid scorching the composition.

H. J. L. J. M.

Two Misfortunes and their Lesson.

The other day, in mending some broken articles, I had two curious experiences. An old Sèvres cup (which I had picked up for a mere trifle at a curiosity shop in the country) got cracked. After cleaning and warming the edges, I cemented them with Le Page's Liquid Glue, wiping off the superfluous glue, as I usually do, with a damp rag. However, I had inadvertently left some on the gold with which the cup is plentifully adorned, and after some hours, in cleaning off the little hard ridge of superfluous glue which had formed under pressure, I was surprised and disgusted to find the gold come away with it in a thick flake.

At the same sitting I had mended, with the same useful cement, one of those little views which are apparently phototyped permanently on some white unglazed material. I glued it carefully, wiped off the glue that oozed through the joint, and placed the view, face downwards, on a thick piece of plate-glass to keep everything level, and to enable me to see if any additional pressure were required in any particular place. All seemed well; but next day, in removing the view from its resting-place, I found that a little glue had oozed out under pressure, and had spread about one-eighth of an inch on either side of the joint; the photo, which I had fondly fancied indelibly reproduced on the porcelain or glass, was firmly stuck on the plate-glass.

In both of these cases the acid in the cement may have caused the mishap by acting on the gold in the one case and the photographic film in the other; but the moral to be learned is certainly this: In cementing any surfaces that are not perfectly plain, remove very carefully all superfluous cement with a damp rag or sponge, so that the joint will not require cleaning off when dry.—H. J. L. J. M.

A Cheap Graph.

Take 8 oz. of glycerine, 2 oz. best glue; to the glue add 8 oz. of water, and when dissolved, stir in the glycerine, pour the mixture into a zinc dish, and as soon as it sets it is ready for use. If too much glycerine is used, the paper will stick to it; if too much glue, it will not take a good impression. The remedy for this is remelting, and adding either glue or glycerine till it is right.—E. A. P.

The first volume of Work is now fast drawing to a close, and the hints and suggestions given here are the last that can be given in the numbers of which it is composed. I trust in time to come that much more will appear in "Means, Modes, and Methods" than heretofore, and that readers, who know a thing or two that they have found to be of use and benefit to themselves, will send a brief account of their experiences in makir or mending, and recipes which have fairly stood the test of trial, for insertion in this part of our Magazine. There should be no holding back under the notion that the idea or process or wrinkle to be sent is lacking in importance or is too simple to be of value. Whatever it may be, without doubt it will be useful, some day or other, to one or another of those who read Work. The only thing I stipulate for is that the information sent shall be the result of experience and not copied from a book.—Ed.

WHEEL CUTTING AND DEPTHENING.

BY FRANCIS CAMPIN, C.E.

Having in a former article ("Toothed Gearing," page 581) shown how to draw correctly the forms of the teeth of wheels and how to proportion their dimensions, I now purpose to describe how the teeth are made, and the distances of the wheel centres properly adjusted.

Wheels of moderate and large diameters are cast to form, and subsequently have the teeth cleared out; but those of small size must be cut or stamped from blanks prepared for the purpose. Stamped wheels are chiefly made in America, for the cheap clocks supplied by that country. They are necessarily far inferior to wheels formed properly by suitable machinery, and will not here receive any further consideration. The largest spur wheels have the teeth finished in a kind of planing machine, the cutting tool having its edge accommodated to the form of tooth required, but smaller ones are finished by rotary cutters and other milling appliances. Very great advances have been made during the past ten or twelve years in the improvement of milling machines and the tools used in them, and the introduction of emery wheels in some cases in which steel rotary cutters were formerly employed has been attended by advantageous results.

For clearing out the teeth of cast wheels of moderate sizes, the emery wheel has been found very effective, as the occurrence of a hard spot will not be so destructive as it would prove to a cutting edge. Rotary cutters were formerly made of the best wrought iron, and after being reduced to the required shape were "case-hardened" by being buried in powdered carbonaceous material, such as charred leather, and kept at a red heat for some hours, and then hardened by cooling in water; by this process the exterior parts—to a depth of about one eighth of an inch—were converted into steel, thus giving a hard cutting edge, supported by a tough interior body of metal. The improvements in the manufacture of steel, however, have enabled us to make these tools entirely of that metal, without having any fear of their failure through want of toughness. The cutters used in the finishing of wheels must, of course, have their peripheries made in the form of an exact counterpart to that of the teeth to be produced, and of a thickness or breadth of face equal to the distance between two teeth.

A simple form of wheel-cutting machine is shown in Figs. 1 to 4; Fig. 1 is a side elevation; Fig. 2, a plan; Fig. 3, a cross section, taken vertically through the bed of the machine along the line, X X. It shows the cutter in position to act upon the blank. Fig. 4 is an enlarged front elevation of the dividing plate. Like letters indicate the same parts in all the diagrams.

The machine is supported upon two end frames or feet, A A, upon which is securely bolted the bed, B B, which is somewhat similar to that of a lathe, but made wider in the middle to carry the cutting gear. At the left-hand end of the bed is the headstock, C, securely fixed there, with the centre line of its mandrel truly in line with that of the poppet head, D, at the right-hand end of the bed, B B. On the mandrel of the headstock, C, are carried the speed pulleys, E, and the dividing plate, Q, and on its extremity is screwed a chuck, by which one end of the bar, P P, may be securely held, the other end being supported by the poppet head centre as shown.

Upon the bed, B B, is fitted a saddle, F, which is made so that it may slide truly, and without shake, upon the front part of the bed, a lip, Y, running against the inside of the bed, and a strip, W, which fits under the front V shaped edge of the bed, holding it in position and guiding it. The surfaces of the bed upon which the saddle works must be made exceedingly true, both in respect to being true planes and to lying with their edges exactly parallel to the line of centres of the machine, so that when the saddle, F, travels along the bed, B B, its motion shall be truly parallel to the centre line of the bar, P P. The strip, W, is secured to the underside of the saddle, F, by set screws, which pass through holes which will allow of a slight adjustment, so that the strip may press evenly throughout its length upon the front of the bed.

Within the projecting part of the bed (see plan, Fig. 2) there is fitted a longitudinal screw, G, which may be turned by means of the handle, G′, made to fit on to a square on the end of the screw, G. This screw, of which the longitudinal position in relation to the bed is secured by collars at each end, works in a nut attached to the underside of the saddle, F, so that by turning the handle, G′, the saddle is caused to move along the bed of the machine in either direction, as may be desired.

Upon the saddle, F, is fitted a slide, H, so as to slide upon it in a direction at right angles to the length of the bed of the machine, the rubbing surfaces in this case being as accurately prepared and adjusted as in the case of the saddle and bed. Within the saddle, F, and in the direction of its length, is fitted a screw, I, actuated by a handle, I′; this screw works in a nut attached to the underside of the slide, H, so that it can be moved along the saddle at pleasure by turning the handle, I′, which, like G′, is removable, being fitted on to a square at the end of the screw, I. Upon H is mounted a standard, K, to afford a bearing to the upper end of a vertical spindle, of which the lower is earried in a footstep on H; on this spindle are secured a rotary cutter, L, and some grooved pulleys, M. For very light work the cutter spindle may be held entirely by the bottom end, and so the standard, K, dispensed with, thus allowing clearer access to the work. N is a blank centred upon the bar, P P, and firmly secured thereon by washers, O O, screwed tightly up. Q is a dividing plate, already referred to, as fixed upon the mandrel, and R is a stout spring, fastened to the bed of the machine, and having at its upper end a pin, Z, which fits into perforations in the dividing plate. S S is a gut band carried round one of the grooved pulleys, M, to drive rotary cutter, L, and being itself driven from some running pulley placed in such a position that the action of the band will not be affected by travel of the slide and spindle. T is a hand wheel, by turning which the centre in the poppet head is advanced or retired when placing the bar, P P, between the centres. The wheel is fixed on to the end of a screw, which works in the tube carrying the centre. When the proper adjustment is made, the tube is secured by screwing down the set screw, U. The nut, V, retains the poppet head in place upon the machine bed; this has to be loosened to set the poppet head approximately when the range of the poppet head screw is not sufficient for that purpose. The dividing plate, shown in enlarged elevation at Fig. 4, has several series of holes drilled in it to allow of wheels being cut with different numbers of teeth.

The method of operating this maehine must be described; and, in the first place, it is to be noticed that it can be used for turning the circumference and side of the blanks as well as cutting the teeth on the wheels. For this purpose, the slide, H, is removed and replaced by a tool holder, the same as that ordinarily employed on a lathe; this being adjusted, and the blank in position, the machine is driven like a lathe by a belt upon one of the pulleys at E; the blank being prepared, the slide, H, with its appurtenances, is replaced, the belt removed from E, and a gut band fitted to one of the pulleys, M. The circle of holes in the dividing plate suited to the number of teeth required in the proposed wheel is now selected, and into one of them is let fall the pin, Z, on the spring, R. This holds the blank in position, and by means of the screws, E and I, the rotary cutter is brought up to the work, and being set in motion a hollow between two teeth is cut, the cutter being travelled by the screw, G, completely across the edge of the blank, after being set by the screw, I, to cut to the proper depth. One space being thus cut, the cutter is withdrawn by working the screw, G, leaving the screw, I, alone, so that the cutter will be set right for depth for all the following spaces.

The pin, Z, is then pulled back, and the dividing plate—and with it the blank—turned until the hole corresponding to the next space comes under the pin, which is then allowed to fall into it, and another space is cut, the cutter being traversed through the blank by means of the screw, G, and this operation is repeated until all the teeth are formed.

In the adjustment of this machine, there are a few points which require especial attention, in addition to those already referred to. The spindle which carries the cutter must be exactly at right angles to the machine bed in all directions, and the centre of thickness of the cutter must be exactly the same height from the machine bed as are the centres upon which the bar, P P, turns; the cutter itself must, of course, run with absolute truth upon its spindle and entirely without shake; otherwise the teeth cannot be made of the proper form.

When it is only occasionally that wheels are required to be cut, as in amateur work, an attachment may be made to fit on to the slide rest of an ordinary lathe, being in form as shown at Fig. 5. Let A A be the top of the saddle across the lathe bed, which latter is shown in section, B being the handle of the cross-traversing screw; C and C′ represent the two parts of the slide upon the saddle arranged for angular movement, D being the handle of the screw for working the top slide, E. The tool clamps are supposed to be removed from the top slide, and the frame, F, secured to it in their place; this frame is made with bearings, G G, in front, in which is carried a vertical spindle, having at its lower extremity the rotary cutter, H, and at its upper the grooved pulley, I, over which runs a gut band, K, driven from some convenient running pulley.

When the wheels are very small, such as clock wheels, they will not be mounted between the centres on an arbor, as shown in Figs. 1 and 2; but put upon a short arbor fixed in the mandrel of the headstock, and secured thereon by a nut.

In cases where teeth are cleared out by a single cutting tool acting in a straight line, the tool as it descends must be guided by a template of the same form as the side of the tooth when finished.

Worm wheels may be cut in the lathe by first roughing out with a rotary cutter placed at the proper angle, and subsequently finishing the teeth off with a "hob," which is a fac-simile of the worm or tangent screw with which the wheel is intended to work, but which is made of steel, and hardened after having notches cut in its threads to form cutting edges by which the spaces between the teeth of the worm wheel are cleared out. The "hob" must be set to work at right angles to the axis of the worm wheel.

There are a few special wheel-cutting machines made by machine tool makers, and there are also some special machines of this class used by watch and clock makers; but for general use, the apparatus here described should be sufficient, with such modifications or additions as may make their desirability self-apparent for particular cases.

I now come to the adjustment of the wheels in gear, after the teeth have been properly formed, in regard to the distance apart of their centres. The importance of this depends upon the form of the teeth, for if they are involute, the distance of the

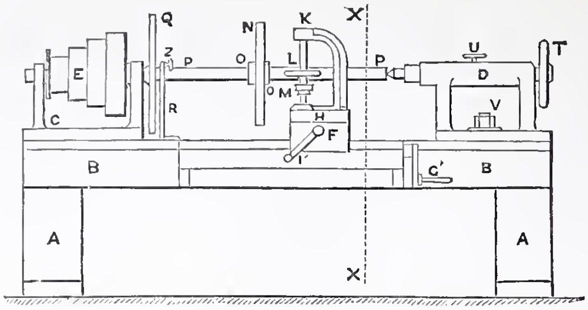


Fig. 1.—Side Elevation.

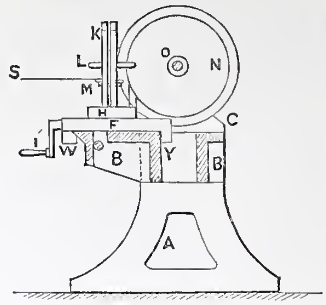


Fig. 3.—Section on X X (Fig. 1).

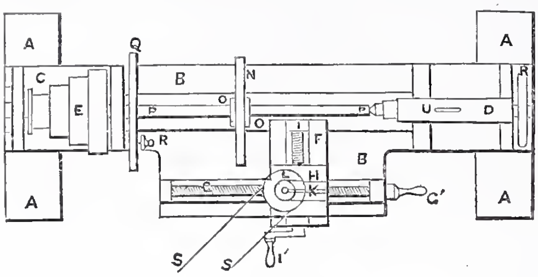


Fig. 2.—Plan.

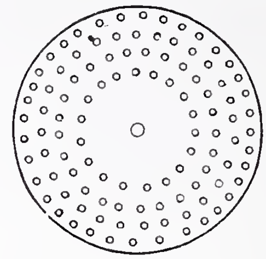


Fig. 4.—Dividing Plate.

centres need not be accurately defined; so long as they are close enough to prevent rattle, the teeth will work together accurately; but with epicycloidal teeth, the case is very different; here the face of one tooth works in contact with the flank of another—that is, the epicycloidal curve of one tooth is in contact with the hypocycloidal curve of another, and the curve of each tooth changes from epicycloidal to hypocycloidal at the pitch circle of the wheel; in order, then, that the teeth may work properly together, it is obviously imperative that their pitch circles should be just in contact; if not, the teeth will be set either too deep in gear or not deep enough.

In ordinary machinery, the sizes are such that the errors of measurement are insignificant in proportion, and the wheel centres can be marked out with practical exactitude, and the shafts upon which they are carried are also of such dimensions as to entail no necessarily perceptible error in their construction; but in the finer mechanical apparatus, such as clocks, watches, and certain mathematical and physical apparatus, the details themselves are so diminutive that a very slight actual error becomes proportionately a very serious one; therefore it is customary to determine the depth to which the teeth shall gear in such delicate machines by the sense of touch, and the centre distances are fixed by means of an instrument called a "depthening" tool. Its form is shown in Fig. 6. It consists essentially of two frames of the form shown by A A′; these frames are hinged together at the bottom, so that they can open out like a double vice. At the upper end each frame has two heads, C, C′, in which are secured centres, B B and B′ B′, by the set screws, D D′. These centres are so adjusted that they are exactly in line with each other, and the two sets parallel to each other. The inside ends are formed to support in a countersink the arbors of the wheels to be adjusted; and the outside ends are sharp points for marking off the centres, when their distance is determined, upon the plates of the machine for which the wheels are intended. The tool having been opened, the two wheels are adjusted between the centres, and the frames gradually brought together until, on turning the wheels with the fingers, they work perfectly smoothly and easily together; the sense of touch is sufficiently delicate, after some practice, to detect any roughness of action, and then the tool is adjusted until the working is satisfactory, or the operator is satisfied that the wheels do not fit, and must, therefore, be changed for others. A satisfactory result having been reached, the tool is clamped, and the centres for the wheel arbors marked off by the outer ends of the centres. The tool may be held in the table vice while in use, and the wheels are to be removed by releasing the back points before marking the centres—called pitching the wheels—on one of the parallel frames by which the wheel work is intended to be carried.

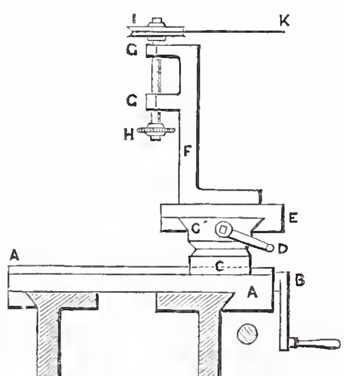


Fig. 5.—Lathe Attachment.

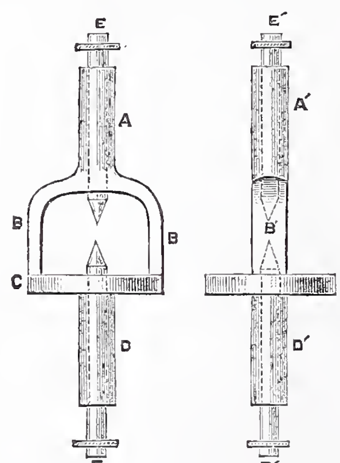


Fig. 7.—Uprighting Tool.

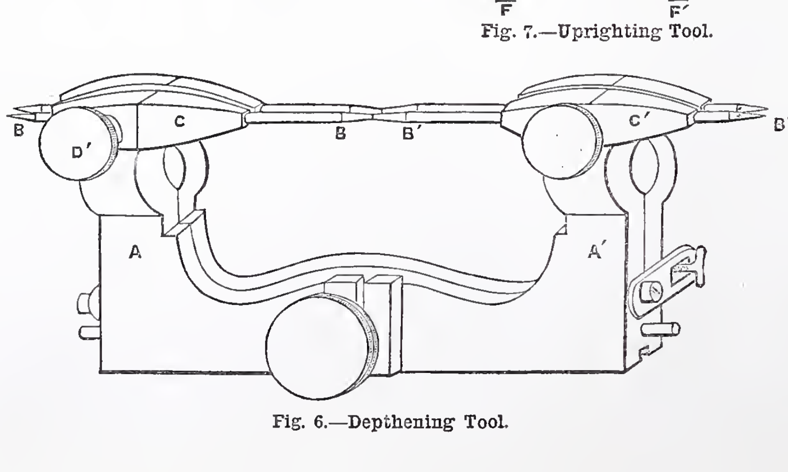


Fig. 6.—Depthening Tool.

The wheel centres having been marked upon one of the parallel plates, the holes are to be drilled to receive the ends of the arbors, and from these holes the centres are to be marked upon the companion parallel plate. It is obviously indispensable that the wheels should revolve in planes parallel to the plates, and to this end it is necessary that their axles be at right angles to the same. To ensure this, the second plate is pitched from the first by means of an "uprighting tool," shown in Fig. 7, held in the vice; E, A, etc., refer to a front, and E′, A′, etc., to a side elevation of the tool, the letters themselves indicating the same parts in both views.

The upper part, A, is an accurately bored tube, terminating in a stirrup, B B, to the bottom of which is attached a disc, C, having its upper surface perfectly true, and depending from its centre is another bored tube, D, similar to A, and in exact line with it; the centre line passing through the two tubes is at right angles to the upper surface of the disc, C. In the tubes, A and D, are fitted centres, E and F.

The pillars by which the parallel plates are held together, and which also determine their distance apart, having been truly turned, the frame is put together and laid upon the disc, C, with the pitched plate upwards, the centre, F, being, of course, drawn back into the tube, F, to commence with. The centres, E and F, are made to fit the tubes accurately, and their points are truly turned and exactly opposite each other. The frame is now moved until one of the holes is brought under the top centre, E, and there secured by pressing the point of the centre into it, while a corresponding hole is marked on the under plate by the lower centre, F, which is pushed up for that purpose; it must follow then that an arbor working in holes drilled to these marks will be exactly at right angles to the side plates of the frame. In a similar way a mark is made on the under plate corresponding to each hole in the upper one, and to these marks the holes are drilled at right angles to the plate.

Some time since a correspondent asked for instruction in wheel cutting, etc. The subject, which could not be conveniently treated in "Shop," has therefore been taken up and sufficiently explained in this paper.

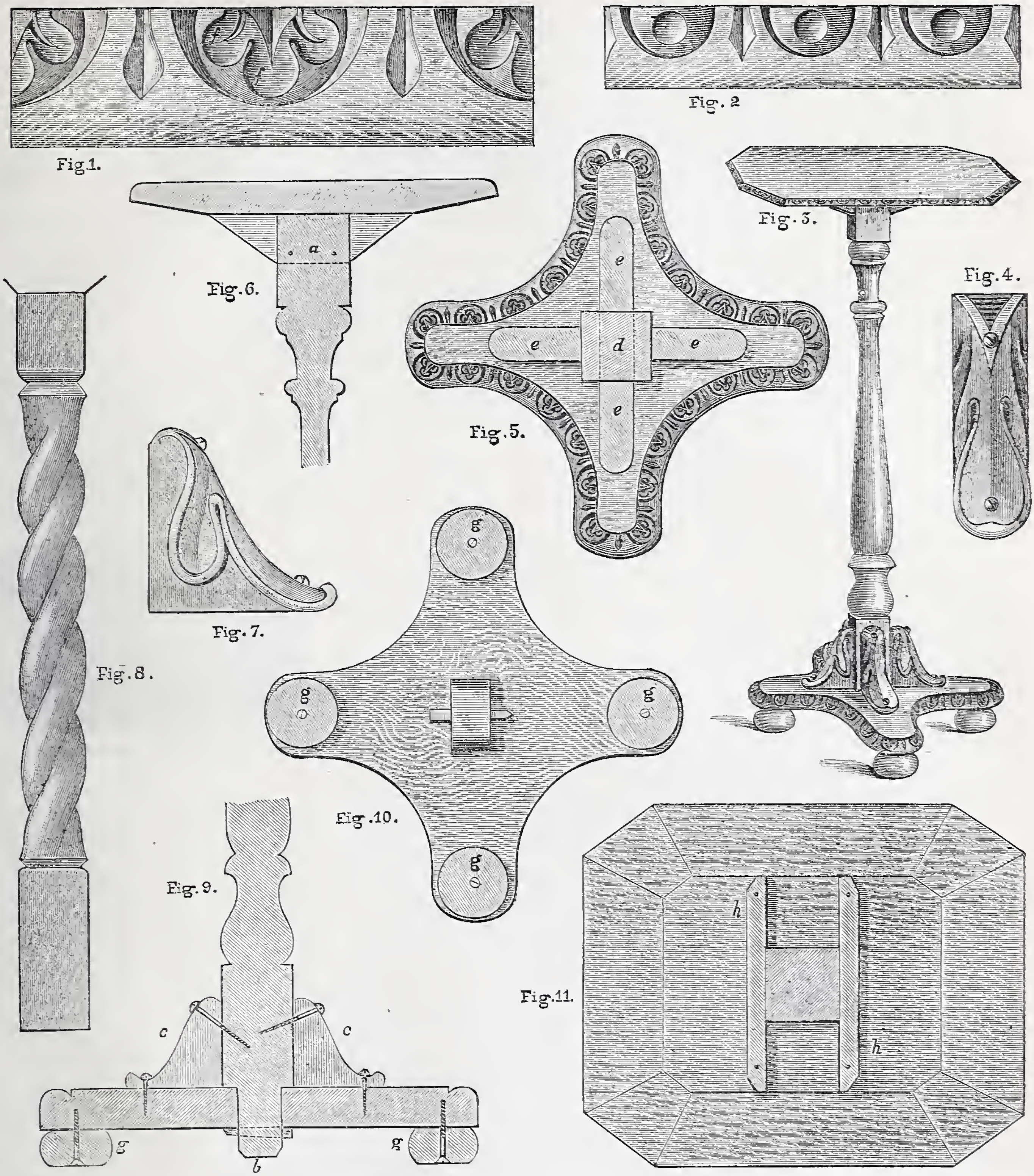


Fig. 1.—Carved Edge of Foot-Piece. Fig. 2.—Carved Edge of Top. Fig. 3.—Stand-Table : perspective view. Fig. 4.—Base-Stay : front. Fig. 5.—Foot-Piece : upper side. Fig. 6.—Section of Top. Fig. 7.—Base-Stay : side. Fig. 8.—Twist for Alternative Shaft for Table. Fig. 9.—Section of Bottom. Fig. 10.—Foot-Piece : lower side. Fig. 11.—Top of Table : under side.

A SMALL STAND-TABLE IN CARVED OAK.

BY HIRAM PRICE.

THIS small piece of furniture, of which a sketch in perspective is given in Fig. 3, will be found a handy as well as an ornamental article, and with the working drawings and practical directions about to be offered no one who can carve a little in wood will find any serious difficulty in making it. The only difficulty likely to present itself is with regard to the pillar. That shown is turned, and there are many who can handle carving tools who cannot turn ; but, to meet this difficulty, an alternative design will be given, by which the pillar can be worked without having recourse to the lathe.

The dimensions of this table are exceedingly modest ones, since it is intended for no heavier duty than that of standing beside an easy chair to hold a book occasionally, a coffee cup, or any similarly unimportant matter. It barely stands 25 in. high, and its top measures 12 in. by 10 in. only. The perspective drawing of it (Fig. 3) is not to scale ; all the remaining diagrams explaining it are on $\frac{1}{4}$ scale, except where otherwise specified.

Whether we use the turned shaft which appears in Fig. 3, or the alternative one shown in Fig. 8, the general dimensions of the pillar remain the same, excepting only that the turned work occupies more of the length by $2\frac{1}{2}$ in. than the twist.

The length of the pillar from top-piece to foot-piece is 22 in., to which is to be added the tenon, passing through foot-piece, $1\frac{3}{4}$ in., making $23\frac{3}{4}$ in. in all: its base and top are $1\frac{3}{4}$ in. square. The section of top (Fig. 6) shows at *a* how the two pieces of $\frac{1}{2}$ in. wood which serve to support the table-top are secured to the upper part of the pillar by screws.

At the base of the pillar the tenon *b* (see section of bottom, Fig. 9) passes through the foot-piece, and is secured by a peg; the hole through which this peg passes must be bored so high that, on tightening it, the shoulder of the tenon will be drawn thoroughly home. This, with glue, will make a joining as strong, solid, and immovable as it is possible to make: so that the four base-stays (*c*, *c*, Fig. 9) are rather added for effect than for the increased strength which they nevertheless give. Fig. 7 shows a side view of one of these base-stays, and Fig. 4 a front view as seen from above. The better to explain the carving upon them these stays are drawn to half size. They are cut from inch board, which will be better if somewhat gnarled in grain, as English oak often is, that there may be no danger of splitting. The various diagrams show how each is fixed by two round-headed brass screws, which are made to form a decorative feature.

The foot-piece, the upper side of which is shown in Fig. 5, and the under side in Fig. 10, is also of inch board, and will, like the last-named pieces, be best made of cross-grained stuff. It will be seen that though 12 in. across, this can be cut from a somewhat less than 10 in. board. In Fig. 5, *d* shows the square space on which the base of the pillar rests, whilst *e*, *e*, *e*, *e*, mark the positions of the four base-stays. The carved ornament running round the edge of this foot-piece is shown at full size in Fig. 1. The small hollows indicated as at *f*, *f*, in this figure, are each taken out with a single scoop of the gouge, and will give a crisper and better effect to the border if left sharp from the tool than if sand-papered down. In Fig. 10, *g*, *g*, *g*, *g*, indicate the places of the four balls on which the table stands: the same letter also marks these balls in the section, Fig. 9. They are an inch high, and two wide. If they cannot conveniently be turned, they can readily be worked, as octagons, by hand, from inch board. Each of these balls is, as shown, fixed in its place by a stout screw, the head of which will need to be well countersunk.

To give any separate diagram of the two pieces of board, screwed to the upper part of the pillar, and supporting the top, can scarcely be necessary. They are sufficiently explained at *a*, Fig. 6, and at *h*, *h*, Fig. 11. They are of $\frac{1}{2}$ in. oak, and their outer edges along their three lower sides are bevelled off: the screws which fasten them to the top are indicated.

The top is of $\frac{3}{4}$ in. stuff 12 in. by 10 in., and the corners are taken off as seen in Fig. 11, which shows its under side. At the edges it is planed down to $\frac{1}{2}$ an inch on its lower side, as appears in the section Fig. 6, which shows its narrower dimension. In Fig. 11, *h* and *h* indicate the places of the two supports mentioned above, which, it will be observed, cross the grain of the top. The screws which fix it to these supports are driven upwards, that they may not show on the upper surface. A little very simple ornament running round its edge is shown at full size in Fig. 2. This ornament, it will be found on trial, is by no means difficult to carve, and presents a highly effective appearance when finished.

Provided the person making this stand-table can turn, or can procure a turned pillar, he cannot perhaps have a shaft of form better suited to his purpose than that shown in Fig. 3. But if not, something will be needed in its place which can be made without the lathe, and as an alternative the twisted shaft, Fig. 8, is offered. A twist always looks well in oak work. In our old English (17th century) furniture it is a frequent feature, and is as artistic in effect as its successors, the screws in 19th century furniture, are the reverse. In the work of the earlier half of the 17th century we meet with single twists which frequently taper upwards, but in things made a little later than 1650 the double twist more abounds; that in the illustration is sketched from an example of (apparently) the time of Charles II.

A twist such as this may at the first glance appear a difficult thing to set about. Such, however, is not the case: it can in reality be laid out with the greatest ease and simplicity.

From a square it is no difficult matter to reduce the shaft to an octagon, and were the twist a large one, it might be well to reduce this still further, and bring it to a sixteen-sided figure; but for our present dimensions the octagon will suffice We may set out the twist upon this, and for so doing we shall need two strips of paper, each of the intended width of one fillet of the twist from hollow to hollow, and these we wind spirally round the octagonal shaft from bottom to top, giving them the desired inclination. And with regard to this inclination it should be observed that it is a mistake to attempt to get the appearance of a tight twist. The work to look well should look as if slackly twisted—that is to say, the spiral should incline to the vertical rather than to the horizontal. When we begin to wind the strips of paper they will seem to fall quite naturally, and without any trouble on our part, into their right places, and we can fix them in a temporary way with three or four drawing-pins or tacks.

One of the strips we can now remove, and having divided it in half lengthwise, we *paste* one half back where it was before, then we treat the other strip in the same manner. We now have two spirals in paper running up our shaft, and between them two bare spaces of the same width—the paper will represent the two fillets of the double twist and the bare spaces the hollows between them. This simple little operation takes some time in description, but in the actual work it is very easily and quickly done.

The twist being thus ready for working, we have to cut away the wood in the bare places, which are to be the hollows, with the gouge, to the necessary depth; making a slot with the saw up the middle of the hollow is a help to doing this, and when the hollows are worked out, we can trim off the edges of the fillets with the chisel. In finishing the hollows the half-round file is useful, and the fillets need file and sand-paper. Making a twist is a thing that any one can do if he only knows how to set about it.

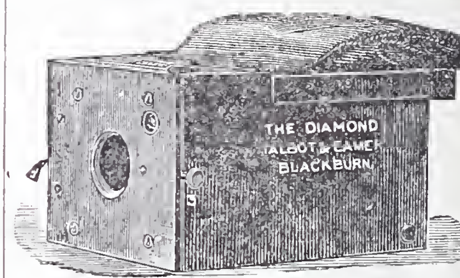
In the pillar before us, as given in Fig. 8, the square base and top are left somewhat longer than in the pillar with turned shaft. This is to prevent too great a length of twist tiring the eye by its monotony. One never sees long unbroken twists in old work.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

126.—TALBOT AND EAMER'S "DIAMOND" DETECTIVE OR HAND CAMERA.

AMONG the many cameras of all kinds that are now offered to the notice of all photographers, professional and amateur, the "Diamond" Detective or Hand Camera, figured in the accompanying illustration, appears to be one that is in every way well suited for the purpose for which it is intended. It is claimed for this camera that it is "the smallest, lightest, and cheapest efficient hand camera yet introduced," and yet is capable of taking twelve pictures, $3\frac{1}{8}$ in. by $2\frac{3}{8}$ in., on ordinary dry plates without recharging. The size of the little instrument itself is 6 in. by $3\frac{1}{2}$ in. by 3 in. It is fitted with a rapid rectilinear lens always in focus, a finder, and a shutter for time or instantaneous pictures. It is said to be entirely new in principle, form, and construction, and is thus possessed of advantages and special features



Talbot and Eamer's "Diamond" Detective or Hand Camera.

which render it particularly desirable for all who are desirous of obtaining permanent records of subjects of all kinds at a minimum of cost and trouble. In taking a picture nothing else but the camera is required, all other appliances, such as tripod, focussing cloth, etc., being entirely dispensed with, which renders it, indeed, the least burdensome of cameras to those who use it, and this will be readily understood when it is said that the instrument, which is excellently well made and most convenient in form and arrangement, weighs very little over $1\frac{1}{2}$ lbs., and is supplied complete in case and with one dozen extra rapid dry plates for 30s., additional dry plates being bought at 1s. per dozen or 6s. per half gross, carriage paid. The pictures taken are of course smaller than the ordinary carte de visite, but mount nicely on the carte de visite card. They are both sharp and crisp, and will be found to be especially suitable for lantern slides, and lend themselves readily to enlargement. The camera is always ready for use until the dozen plates with which it is stored are used, and a fresh lot required. As will be seen from the illustration, the camera itself is in the form of a box, having the lens and instantaneous shutter in the front, and the dry plates, twelve in number, at the back. By an ingenious arrangement each plate when a picture has been taken is raised from its position in front into the leather pocket at top, and is then, by the finger and thumb, raised clear of the camera, and brought to the rear of the other plates. Thus each plate is brought in turn to the front for exposure, and then transferred behind the rest. The last plate cannot be lifted out of the camera, and thus shows that the entire number has been used. It is made and sold by Messrs. Talbot and Eamer, Photographic Apparatus Makers, Blackburn. THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

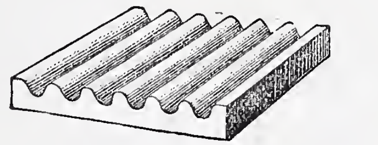
**** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Electric Time Alarum.—C. H. M. (*Wylam-on-Tyne*) writes:—"I have recently received the December number of Work, and have read the article by G. E. Bonney on an electric time alarum. Some dozen years ago I constructed an alarum which, as it differed from the one described, and had some good points of its own, I daresay, if you think fit to publish it, may interest some of your readers. My object in designing the following arrangement was to make an alarum which did not require setting, or switching off, or setting on daily, because one is quite as liable to forget to attend to the alarum before going to bed as to go to sleep again after being called up. My alarum, therefore, I made so as to ring every weekday morning, but to be silent on the Sunday, and experience of years has shown that it always answers its purpose. The proper bell to use is the kind known as 'continuous ringing'—that is, when a momentary current is passed to the bell it starts ringing till stopped by pulling a cord. This current should only be sent to the bell for a very short time, say not more than for a quarter of a minute, as you cannot stop the bell till the current from the clock ceases. This makes it necessary to depend on the minute hand of the clock for completing the circuit, as the hour hand alone would remain too long in contact. This, however, is not an objection, as it makes the connections to the clock much simpler, and such as can be made without pulling the clock to pieces. The arrangement is this: a little wheel about $\frac{5}{8}$ in. diameter is placed in the path of the hour hand, and is made with 14 teeth, because in a week the hour hand passes any particular hour 14 times. This little wheel is a pin wheel with the 14 pins standing out on one face. The pins are alternately conductors and non-conductors of electricity except where the Sunday morning one comes in. It is also a non-conductor. The hour hand in passing this little wheel acts as a 'wiper,' and carries the wheel on one pin or tooth. If the tooth is a metal one the current can pass to the hour hand while the contact lasts, but when the tooth or pin is of ivory no current passes. The contact lasts about a quarter of an hour, but the circuit is not completed till the minute hand touches a fine wire placed so as to lightly touch the tip of the hand. One advantage of this mode of passing the current is that no sparking takes place at the hour hand, because the 'make' and break take place long before and after the current passes, and the only sparking is at the point of the minute hand, and this does no harm, because the minute hand passes over this connection 168 times a week, out of which only 6 times will be when the current is passing, so that the 162 times when there are no currents are devoted to rubbing the 'contacts' clean. The alteration to the clock is very simple. Pass two insulated wires in from the back, and bring one out just above twelve o'clock, and the other out just below six o'clock. The top wire should terminate in a bare end of very fine wire (36 B. W. G.) like a hair, which may be made to stand up in the way of the point of the minute hand. This wire being so fine offers an insignificant resistance to the path of the minute hand, which merely sweeps over it on each passage. The bottom wire must be connected to the little pin wheel, which is made as follows:—Take a piece of latten brass and cut out a piece the shape of the letter Q, making the circle about $\frac{5}{8}$ in. diameter. In the centre rivet a portion of a toilet pin, leaving it standing out about $\frac{1}{16}$ in. This forms the base plate and the centre pin on which the little wheel is to revolve. Next take a piece of ivory $\frac{1}{64}$ in. thick and $\frac{5}{8}$ in. diameter, and another piece of the latten brass. Lay these together, and drill 14 holes through them near the outside edge, and one hole at the centre. Put 6 points of toilet pins through the ivory, and rivet them over in the brass. This will hold the two well together, and being spaced in alternate holes they will go nearly round the wheel. Then file up 8 little ivory pins for the rest of the holes, and fasten them in with shellac. Level all off till they stand about $\frac{1}{32}$ in. out from the ivory face. The wheel being finished place it on its pin, which stands in the middle of the base plate made in the shape of the letter Q. Spin it round and see that it runs true and very freely. Now we want to introduce a little friction to make the wheel stay where it is placed, but to give little or no work to the hour hand to move it. This is best done by a small washer of felt, say, $\frac{1}{16}$ in. diameter, which place over the centre pin together with a similar one of the latten brass, and rivet the centre pin to keep all in place. The wheel being now complete, attach the bottom wire to the tail of the Q, and fix the Q base plate to the clock face with thick shellac varnish. Being so small it does not look unsightly, any more than does the addition of a seconds hand to a clock face. It will be seen now that when the hour hand touches lightly against one of the metal pins of the little wheel the current can pass through the wire which we attached to the tail of the Q because the metal back of the wheel is touching on to the Q base plate, but that the ivory front of the wheel and the ivory pins prevent any current from passing at any other time. This arrangement is of course only for passing the current at one particular time, namely, 6 o'clock, but in most cases it is all that is required. I don't mean that 6 o'clock will do for everybody, but that one fixed hour will do in nearly all cases, and the clock can be fitted accordingly for 5, 5.30, or any time that may be required. In the few cases that I found it necessary to get up extra early or late I put the clock on fast or back slow the night before. If any one wants the arrangement made so as to be able to vary it to any extent, the little pin wheel instead of being made a fixture could be made to attach to any hour or half hour position, and the wire which is to be touched by the minute hand could be brought out at each quarter hour, and being so small would never be noticed. However, I write more for cases like my own, where the getting-up time is the same all the year round, and hope that others may find the advantage of having a bell which will ring every workday morning at their usual time of rising, and will continue to ring till they get out and pull the string to stop it, but which will leave them to sweet sleep on the Sabbath, and all without having to arrange it overnight."

P. K. P. Glass.—E. P. (*Great Yarmouth*) writes:—"Please to explain what P. K. P. glass is, as the tradesmen in this town do not know what it



Fluted Glass.

is. A. G. (*Newcastle-on-Tyne*) speaks of it (see page 619) under the heading 'Rubbing down Oilstones.' Will A. G. say if he means fluted glass?"

Book Repairing.—W. J. C. (*Birmingham*) writes:—"I learnt bookbinding from papers in a periodical. I find it most useful in repairing. I always put on a strip of smooth brown paper over the muslin. It is almost necessary to have a handy press to keep the back tight while cleaning off glue, gluing up, etc. Mine is made thus:—Two pieces of ash 3 by 3 in., about 20 in. long, are bolted through near the ends by about 12 in. bedscrews; these will hold the book well compressed. This press is more convenient if mounted in a box—say, 20 in. long inside—resting on a piece of wood at each end, so that the top of bars is level with top of box; the bedscrews will come through the front edge of box with nuts outside working against washers or plates. The box and press should be big and deep enough to drop into it, say, a volume of Work or Quiver—20 in. long by 10 in. deep, any breadth. If the loose back of the book is broken through at the hinges, it may be repaired by some fabric of similar colour inside; or, still better, fasten the two lids on as directed (see page 588), and then put on a loose back as below, covering the back and 1 in. each side with dark buckram, a very strong material, gluing the old back outside, or cover with white ticket buckram, which is not so strong, but one can write a title on it. To make the ordinary loose back which falls away when the book is opened, screw the book (with lids) back upwards in the press. Cut a piece of thin card or cartridge paper or thick note paper just to cover the back between the lids, roll this round a round ruler, so as to give it the proper curvature, then place it on the back, securing it to the lids by a bit of thin paper pasted on overlapping the lids; then cover the back with buckram, or leather, etc. Lepage's Fish Glue is a very convenient thing for the book repairer. The following paste is always ready:—Best flour, 2 oz.; water, $\frac{3}{4}$ pint; salicylic acid, 16 grains; alum, 32 grains. Break down the flour with some of the water with a paste brush, and add the rest of the water; heat it till it no longer thickens, stirring constantly; lastly, add the alum and acid, and put it into small pots—say, $\frac{1}{4}$ lb.—and tie over. I am not in love with Mr. Bonney Steyne's plan of sewing through buckram (Work No 6), but I have tried a modification of it with success—viz., cover the back of the pamphlets or sheets with a piece of white buckram overlapping 1 in. on each side; screw up the back so covered in the press, and then make four or six sew holes through the buckram and sheets; then the sheets or pamphlets can be sewn quickly and easily, making a strong book which opens very flat. I thank Mr. Bonney Steyne for some happy suggestions. I have just bound Cassell's 'Cathedrals' in Japanese gold paper with old gold Roman satin for the back.—N.B. In using Roman satin, glue the boards, not the satin."

II.—Questions Answered by Editor and Staff.

Gilding Methods.—J. S. L. (*Long Eaton*).—Several answers have recently appeared in "Shop" concerning gilding, and these you have doubtless carefully perused, as bearing upon your query. To gild with gold-leaf oak mounts and fillets, such articles being of an absorbent nature, requires some preparation. By frames in the white, I take it that you mean wooden frames, and not compo-faced ones, in which case this description will suit for all three. Stop the suction of the wood surface to be gilded either by rubbing in French polish, or by two coats of white, or brown-hard, spirit varnish. The former gives the best surface, and the smoother this is the more burnish the gold will have. Finely glass-paper down, if necessary, then apply a very bare but regular and evenly distributed coat of gilders' oil gold size. This must now stand aside out of dust until the next day, when it is dry, yet not so hard but that the wondrously thin gold leaf will stick to it. The process and object of the gold-sizing is this: to spread as thin as possible a film over the object, so that its presence is only known and justified by its holding the gold leaf. You will thus see that neither the polish or gilding should in the least prevent the grain of the mount from appearing. The manipulation of the gold leaf, if you are not used to it, will give you the most trouble. Gold leaf is sold in books of twenty-five leaves, each about 3¼ in. square; the ordinary, known as extra deep, which chiefly refers to its tone or colour, lies between paper leaves, dusted with rouge of some sort. Transfer gold is the same, but upon each leaf of gold a piece of white tissue paper is superimposed, so that the latter—the book having been subjected to pressure—when drawn out, has the gold affixed thereto. To use the first kind you require much practice, and gilder's tip, cushion, and knife, etc. The transfer, however, costing about 1s. 6d. per book, you may manage. Draw out a leaf of the tissue, and lay upon the mount, press evenly but gently with cotton wool, and it will affix itself to the size. When all is gilded gently rub with the wadding, and remove gold dust. Finish with a weak coat, and spread quickly but evenly, of clear size or with isinglass, one pennyworth thoroughly dissolved in one gill of hot water, used when cool or just warm. Prominent portions of a frame, etc., can be easily, if previously carefully gold sized, gilded by transfer, but hollows, etc., you can see would be rather awkward to get at. If you have compo frames, prepare them with paint or enamel, anything to make the surface regular and non-absorbent, then gold size and gild. The process of gilding will, in the house-decorating papers, be fully dwelt on. Space will not permit of more here. Many thanks for your letter and your pithy remarks. Let me assure you that the Editor of Work and his staff are both enthusiastic and practically minded as to the position of this paper in contemporary literature, and that the former is determined to justify, by its lasting success, his address to all workers contained in the first number. Any new modes or methods showing merit and originality upon any trade or calling, will receive a hearty welcome and a most careful consideration by the Editor of Work.—F. P.

Mixing Paints.—E. L. (*Preston*).—To mix, say, one pound of ordinary oil paint, take about 8 oz. of the colour pigment you intend using: thus, white lead for white, light greys, pinks, cream, etc., Venetian red, or vermilion, for red, and so forth, according to price and colour desired (see "Plain and Decorative House Painting" papers, pp. 450–51, etc.). Add to this 8 oz., about two more of patent paste or liquid driers; then make up to one pound with either linseed oil, or oil and turpentine, in equal parts. Remember, the more oil the more driers is advisable, but never less than 1 part driers in 8 or 10 of entire bulk. If you only want casual pounds of paint, that sold ready mixed at prices from 3½d. to 5d., according to district and maker, per lb., would be cheapest, and should do for common inside work. You would not be able to make a single pound so cheap, and some of the colours sold—bright red, for instance—you couldn't make at twice the figure. If varnished they stand a lot of wear. For cork picture frames buy varnish stain, either oak, walnut, or rosewood, stain and varnish combined, and it dries quickly. Colour for bedroom suite would depend on personal inclination; study the painting articles, or write when you have decided as to style. Frame making is in hand.—F. P.

Repairs to Verge Watch.—H. (*Brighton*).—In reply to your query, read over again the part speaking of repairs. I say "see last chapter," not "previous chapter," one gone before, but last one at end of the chapters on watches. You must know first how to take to pieces and clean before repairs. For me to begin the papers with repairs would have been folly.—J. S.

Verge Watch Cleaning.—W. G. B. (*Handcross*).—The putting in of verge staff is above the amateur's capabilities; the tools and time would be more than the cost of a pullet staff to balance; place the broken part in a small box so as to have same size inserted, and send on to Morris Cohen, watch tool, etc., maker, 132, Kirkgate, Leeds. Attach a label with above address, so that the P.O. people will only stamp on it, and not injure your new balance staff. He charges most reasonably, and I have no doubt you will be satisfied. You see you could not make one, so you might as well have it put in, costing very little more.

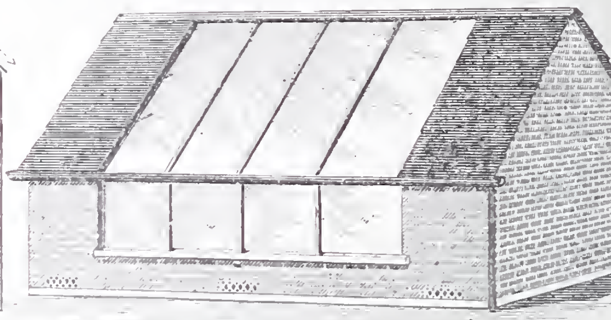
Stereotyping.—A. W. (*Paisley*) pours in a string of questions which space precludes our answering fully prefacing them with an interesting account of his experiments in stereotyping. We note, however, that A. W. either omitted a very important factor in his process, or else omitted to mention it in his account of it. We refer to what the French call "pate," or paste, consisting of flour paste, with a good proportion of plaster of Paris, and a little glue; layers of this paste harden in the drying, and render the matrix solid behind the flong and between the sheets of tissue and that of the wrapper paper. (1) As to curling, we advise A. W. to dry the matrix thoroughly whilst still on the forme and under pressure. We think this will prevent warping; and in putting the matrix into the casting box the side bars should lie on the beard, or margin, of the matrix, so that when screwed up the matrix should be held tight to the back plate, whilst the bottom bar should hold it tight transversely. The weight of metal as it is poured into the box should force the intermediate portions of the matrix back against the plate. (2) Any means of gradually drying matrixes cannot be objectionable. (3) Papers on photo-typography have been invited and received, and are under consideration. (4) To give in detail the process of producing a phototype would occupy too much space except in the article above referred to. In Wyman's Technical Series is a volume which A. W. should read, entitled "Zincography, or Process-block Making," by Josef Bock, 2s. 6d., 65, Chancery Lane. (5) We are quite unable to state whether you can claim to be the first to use blotting paper in stereotyping, but we should think not, as the papier-mâché has been thoroughly threshed out years ago. In conclusion we would point out that cuts, by which we presume wood engravings are meant, should never be stereotyped by this process, which, in the first place, is not nearly fine enough to reproduce their sharpness, and is unfitted by reason of the dampness necessary in the first stage and the subsequent heat of the second stage (which must split any wood up into numerous pieces) for the purpose. Electrotyping is now so cheap that stereotyping, either cuts or zincos, is quite out of date. Formerly they were done either by the polytype process, or with plaster matrixes. The former process consisted in first striking the block into type metal in the waxy state between fluidity and solidity which it, during cooling, attains, and as rapidly withdrawing the block before the heat has time to burn or crack it. The matrix thus made was used to strike any number, hence its name of stereotypes. It is now never resorted to, electros having quite beaten it out of the field, one valid reason being that in colour work the contraction in cooling that type metal exhibits utterly upsets all register.—J. W. H.

Ebonising Pine.—A. J. (*Glasgow*).—The greenish shade of which you complain may be owing to bad stain, or it may be (probably is) owing to a vegetable black having been used with brown polish. However, by adopting the following process you ought to be able to get a perfectly jet black surface either bright or dull. Of course, if the grain rises you must paper down. Mix some black with ordinary glue size, and apply to the wood. The mixture acts both as filling and stain. For the polishing medium use white polish and gas black mixed. Finish in the usual way with spiriting for a bright surface. To dull down use fine emery powder poured on. I am of course assuming that you are acquainted with the ordinary routine of polishers' work, so have not gone into minute particulars.—D. A.

Wooden Swing Cradle.—François (*Dulwich*).—I have the construction of a child's cot on my list of subjects, but I am afraid it cannot appear yet awhile. However, as the matter is urgent, the following hints on the construction of a swing cot may help you. The cot itself may measure about 3 ft. 3 in. by 1 ft. 8 in. by 1 ft. 3 in. deep. This is slung between two uprights by means of a couple of rods, of which one must be fastened to the foot, the other to the head end of the cot. In these days of cheap iron bedsteads you will find it much less costly to buy one ready made, and it does just occur to me that, however proud your wife might be of your swing cot, she, and perhaps you, would hardly care to trust your firstborn in it. I don't want to hint that you could not make the cot safe—safe enough, say, for the second—but the first is really such a precious little being, and in every other way superior to any previous youngster, that your wife might prefer a cot of somebody else's make. Instead of making a swing cot I think it would be safer to confine yourself to making a cradle on rockers. Some of this advice perhaps is not definitely asked for, but it is founded on experience. Somebody else for a time had an only baby, for whose use something was made by *pater*, who thought, like you, that *mater* would be pleased. She was, but baby used something else—very similar, but not *entre nous* home-made. Glad you like Work.—D. D.

Platform for Stage Purposes.—J. H. (*Liverpool*).—You cannot do better than make your platform of ordinary flooring boards. On account of the size make it either in two or in four parts. A drop scene will be much better than a screen to shut off the stage, but possibly the room may not admit of the necessary fitting. The entrances to the conservatory could easily be hidden by a judicious arrangement of curtains. If you cannot drive nails into the walls the difficulty would certainly be increased, but by a little contrivance you should be able to effect your purpose. For example, uprights could be fitted to the front corners of the stage, and a rod supported by them would do for a pair of curtains. These could be made to be drawn from the sides without trouble. Side curtains and a couple of screens would then hide the conservatory doors. I do not know if all the hints you want are now given, but I fancy from your letter that you have your "head screwed on," and will be able to see how to arrange details. Of course, it is always difficult to give precise directions for these unless one has seen the room, but if I am right in supposing the one you refer to is near Prince's Park, you will not need anything very complicated.—D. D.

Photographic Studio.—B. B. (*Holywell*).—Usually a photographic studio has to be constructed in accordance with conditions of light available, regulated by surrounding buildings, etc. The most usual form is the ridge roof studio, and this is one in which most excellent work may be made. We will presume that you have an open space with uninterrupted light. The following diagrams will give you an idea of its construction. The glazed side should face north, and the length of the room be about 30 feet, with about 20 feet to the highest point of the roof, and 15 feet wide. Six feet from each end should be brickwork, with a slated roof in which ventilators are placed, and ventilators at intervals near the ground. Access is gained by a doorway in the brick wall on the south side. Backgrounds at each end. Some photographers prefer to carry the glass roof in an uninterrupted slope to the solid low wall on the north side on account of greater facilities for fixing blinds. The lighting in both cases is identical. A series of working drawings for a studio would occupy too much space for these columns. The floor should be made as free from vibration as possible, and if erected on the ground should be on low brick pins about 6 inches above it for dryness' sake. A steep pitch to the roof tends to prevent leakage of rain and protection from hailstorms, and also improves the quality of the light. These are the principal points to be attended to in the construction.—E. D.



Photographic Studio.

Emery Wheel.—A. H. (*Manchester*).—Directions for making emery wheels at home were given in a paper in Work, August 31st, page 370, but if you require only one wheel it would hardly be worth while making it yourself, as wheels of all sizes are easily got and are not expensive. For most amateurs' work, a wooden wheel with leather rim covered with emery powder answers very well, and possesses one advantage over solid wheels, viz., that it may be renewed when worn, and also does not choke. The best wheels require to be faced up from time to time, as the pores of the material of which they are composed get stopped, and the cutting surface becomes glazed. Of course, if you require the wheels for grinding edge tools, the wooden, or buff, wheel will not suit, as it does not admit of the use of oil or water, and your only course is to purchase a wheel or make one as directed in the paper alluded to.—Opifex.

Chest of Drawers.—F. W. A. (*Forest Gate*).—To give detailed directions for making a chest of drawers would be little more than to recapitulate the instructions for making the lower part of the bureau. As you have the back numbers of Work, you will be able to refer to them. If you want to thicken up the top, read also the article on "Lining Up." I do not think you will find any difficulty, apart from that inseparable for a novice, in making a chest of drawers. In case you may not know how to fasten the top down, I may as well say that you must make what may be called an inner top which connects the ends, and screw the top down to it. As a rule, this inner top takes the form of two pieces of board, one at the front and the other at the back, widened out at each end. If this construction is not quite clear to you, it will be found more fully described in a paper which will appear shortly, giving directions for making a kitchen dresser. The tool you inquire about is a very comprehensive one, and no doubt will do all that is claimed for it, but I must say I am not altogether in favour of such things. For you as an amateur it may do well enough, but a practical workman would find the loss of time in altering from one arrangement to another too great to compensate for the undoubted saving in prime cost. I cannot speak from personal experience of the tool's durability and stability, but so far as I can form an opinion I do not think you need have any fear about them. I am glad to hear Work has been so helpful to you. I have no doubt you will find as you make progress that working in wood is not only an agreeable but very useful "hobby." You have evidently an aptitude for it, and your success ought to be an encouragement to other beginners. Apply to "Shop" for anything you want to know.—D. A.

Moulding.—Mitre (*Peckham*).—The man you saw cutting a mitre probably set it out, or, as you say, made certain lines with a pencil as follows: Down the back a line was run by the square, the wood block either on the top or bottom of the moulding. On the top another line would be marked with the aid of the bevel. This would give the direction or guide for the saw, and might be sufficient for an expert. I do not, however, wonder at your not having succeeded in making a good mitre by this means, for at best it is but an unreliable method. The man you saw do it must either have had great confidence in his skill, or not had a mitre box by him, or was not particular about getting a perfect mitre. Possibly he put the moulding in a mitre trap after he had sawn the ends in order to true them up. You will understand I do not say he was doing wrongly, for the probability is that as an expert he would know the best course to adopt in the particular instance named. It is not, however, a plan I could recommend you, nor indeed any one in a general way, to adopt. You will find it much better to use the mitre box mentioned in an early number of Work in connection with "Artistic Furniture" (overmantel), and if necessary trim up with the mitre trap. A separate paper was devoted to the construction of this. Yes, you are quite right. The great bulk of amateurs are workers in wood.—D. A.

Letter "B" in Sign Writing.—H. P. (*Plaistow, E.*).—I have not yet had an opportunity of seeing the letter "B" in No. 31 of this Journal, and even if I had, it would ill become me to speak of a fellow contributor's work in a disparaging sense. Nevertheless the specimen "B" you have submitted is correct in formation. I am glad the articles on "Sign Writing" have proved of some little use to you, and I thank you for the information *re* ticket-writer's ink, about which I have received a large number of inquiries.—H. L. B.

Books on Illuminating.—G. E. (*Liverpool*).—There are many works published on this subject. Some good ones are as follows:—(1) "A Primer of the Art of Illumination," by De La Motte (price 9s.), coloured plates; (2) "A Practical Treatise on the Art of Illumination," by Marcus Ward, Illuminator to the Queen (2s.), coloured plates; (3) "A Guide to Illuminating and Missal Painting," by W. and G. Audsley (2s. 6d.), coloured plates; (4) "A Practical Manual of Heraldry and of Heraldic Illumination," by G. J. Baigent and C. J. Russell (6s.), coloured plates; (5) "Art of Illuminating as Practised during the Middle Ages," etc., by Henry Shaw, F.S.A. A second-hand copy may be had for about 25s. from B. T. Batsford, 52, High Holborn, W.C., who has many other books second-hand on same subject; write for catalogue. John Calvert, 99, Great Jackson Street, Hulme, Manchester, will send you the first four post free at prices named above. He also issues a capital technical catalogue, price 6d. Get it by all means.—H. L. B.

Electric Lighting without Engine.—K. C. B. (*Darlington*).—Yes, electric lighting can be done without using an engine and dynamo machine. It may be done by means of batteries, but at what a cost and trouble! You do not give the height of your workshop—this must always be given in addition to the superficial dimensions—but, assuming that it is 12 ft. in height, then a room 20 ft. by 16 ft. by 12 ft. will take four 16 c.p. lamps, at a height of 8 ft. above the floor, to effectively light it. To supply current to these from a battery you will need at least 30 cells of a double fluid, chromic acid type, each having not less than 2-gallon capacity, and costing about 8s. per cell. The acids to charge each cell will cost nearly 1s., and the battery will need recharging every evening. The time taken up in charging the battery, and cleaning it, cannot be less than 4 minutes per cell, or about 2 hours each day. For further information await my article on "Model Electric Lights."—G. E. B.

Morse Telegraph Instruments. — T. E. (*London, S.E.*).—We have not yet published in Work instructions on making and working Morse telegraph instruments, but these shall receive attention when we are writing on the subject of telegraph instruments.—G. E. B.

Zinc Palettes for Sign-Writing. — J. L. (*Walworth, S.E.*).—No chemical action would take place between the colours and the zinc, but why not beg some thin pieces of mahogany from a cabinet maker, and make a palette or two with it, according to the designs shown in my articles or any colourman's catalogue? A wooden palette is much better than a zinc one, and the latter would cut the thumb and fingers I am afraid. I am glad you have made practical use of the elementary papers on "Sign-Writing," and made a blackboard and an easel from the designs; you are going the right way to work in commencing there. I will endeavour to give you some more advanced alphabets shortly. In the meantime keep repeating those already given.—H. L. B.

Wood for Cupboard. — Ambitious Height (*Cornhill*).—From what you say of the cupboard you intend making, I think you will find the following thicknesses appropriate. You must chiefly bear in mind that the stuff must not be too thin, and that anything more than is necessary is so much waste, unless indeed appearance is considered to be improved by extra thickness. If it be, you can get the same result, that is the appearance of a very massive job, by lining up the top, and putting a pilaster on the front edges of the ends. If you adopt the latter form, the doors must be hinged within the ends, and not as shown on your sketch. Taking this, however, as given 1 in. or 1¼ in. stuff for ends, top and door frames will do very well. Thickness of shelves must depend on the weight of the things to be placed on them, but 1¼ in. stuff ought to be ample. For door panels use ⅜ or ½ in. stuff, and the same for the back, muntins, if any, being proportionately thicker. The plinth may be of ⅝ in. stuff. If the cupboard is well made of good clean pine the figure you name is not excessive, but I think it is quite high enough. So much, however, depends on the quality of the workmanship, etc., that without seeing the job it is impossible for me to state its value. It might not be worth 15s., while, on the other hand, it might not be dear at 40s. Glad to hear you "are more than pleased" with Work.—D. A.

Preserving Books from Insects.—Bookworm (*Gloucestershire*).—To *destroy* insect pests, powdering the shelves, and, if necessary, the bindings and books themselves, with finely-powdered burnt alum and pepper has been recommended; the "Insect Destroying Powder," sold as such, would answer the same purpose. To *prevent* their ravages, it is held good to wipe the shelves, and even the books also (two or three times a year), with a cloth steeped in a solution of alum and afterwards dried; or with a flannel in which some white birch bark has been kept. Birch bark contains a powerful essential oil, the smell of which is highly obnoxious to insects, hence the above; hence, also, the recommendation to have some books on your shelves bound in "Russia" (Russian leather is tanned with birch bark), or to lay scraps of this leather on the shelves behind the books.—M. M.

Melting Rubber. — J. W. (*Bolton*). — Melted indiarubber — *i.e.*, indiarubber liquefied by heat alone—cannot be employed for the construction of articles, as it always remains soft and gummy. It may be used for certain purposes in solution, the solvent used being either bisulphide of carbon (which is probably the substance referred to by the querist), mineral naphtha, benzole, or caoutchoucine; but a solution of rubber is not adapted for use in any case where the sharp outline of the mould has to be preserved, owing to the enormous contraction brought about by the evaporation of the solvent. Sheet rubber (pure, not vulcanised) may, however, be greatly softened by prolonged exposure to the vapour of petroleum or benzoline in a close vessel, either with or without the aid of a moderate degree of heat, and in this state will readily conform to the form of moulds not too irregular in shape. If used in this state, pressure must be applied and maintained until the petroleum or benzoline absorbed by the rubber has been evaporated, the time needed being much lessened by using porous moulds if practicable, and placing them with the rubber inside in a current of warm dry air. But the most generally useful method is to use vulcanised rubber, the vulcanisation being effected under pressure in the mould. No precise instructions which will meet J. W.'s case can be given without a knowledge of the exact object in view, but if J. W. will supply this information, in strict confidence, through the Editor, I will endeavour to help him over his difficulty.—Qui Vive.

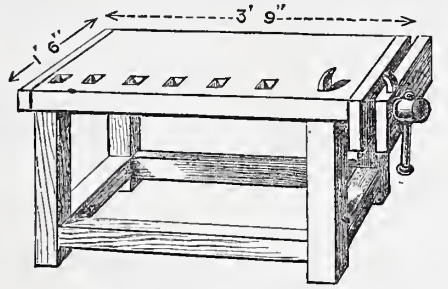
Learning Marbling, etc.—W. H. (*Newington Butts*).—The best answer to your query, "Where could I learn graining and marbling at a small cost?" I can make is to advise you to await the publication of the papers in Work upon this branch. For small cost of tuition, and with this recommendation, that also of practical usefulness, these papers will, I believe, distance any other letterpress lessons upon the subject now published. In any case you will have to devote a large amount of time and patience to it. There are, of course, various other ways open to you—for instance, a course of practical lessons from a clever marbler, costing from two to five pounds a term, or the purchase of a very good existing Dutch work on marbling, published, I think, at £2 18s. Only the litho specimens of this might be useful to you, unless you are a linguist and could interpret the Dutch articles. Hence my advice to you is to wait for lessons in Work.—F. P.

Electro and Nickel Plating.—J. S. (*Leicester*).—We have not room for the treatment of this subject in "Shop." In future numbers it will be fully dealt with. You may obtain a silver plating and nickel plating outfit for £20 from Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham. Thanks for kindly words of appreciation.—G. E. B.

Italian Fret Designs.—W. J. (*Edinburgh*).—I know of no fret designs produced in Italy. If you mean those in the Italian style, Mr. Ziller would probably be able to send you those you require.—E. B. S.

Aquarium.—C. M. (*Gloucester*).—I can offer you nothing better for outdoors than the design in No. 31. Instead of ferns, however, I should use ivy in the pots; a slow-growing, non-clinging variety to be found in most hedgerows in England would answer admirably. I find the roots run into the water from central rockwork, and require no attention whatever.—C. M. W.

Slöjd Carpentry.—J. S. (*Hampstead*). — Slöjd, pronounced *Sloyd*, is the name given to a branch of carpentry coming to us from Sweden, sometimes called Swedish carpentry; it is intended to train the eye as to form, and the hand as to uses, of tools. It is being introduced in boys' schools as a beginning or introduction to the carpenter's workshop, and also in schools for young ladies. The work mostly consists of articles made from models (which models are generally very nicely made), so that the learner has to match an object by the use of his hands and eye. The tools usually employed are certainly not



Bench for Slöjd Carpentry.

of the very best quality, or, at least, those I have seen, and this is accounted for by the very low price at which they are sold. The bench is somewhat different from the ordinary one, and is something like above design, and the work is all done from the right-hand end of the bench, similar to the German pattern bench. It is made of deal, and its cost is about eighteen shillings only. Messrs. Syer & Co., of 45, Wilson Street, Finsbury, E.C., make this bench, and supply all the tools necessary, and I should recommend any one requiring these to apply or write as above, where I feel sure they will receive every attention to their wants. I may add the knife is the tool mostly employed in this work.—T. J. S.

Iron Oil Drums.—J. H. & Co. (*Liverpool*).—Oil mill machinery is made by Messrs. Greenwood & Batley, Leeds; Manlove, Alliott & Co., Nottingham; Rose, Downs & Thompson, Hull.—J.

Gesso Work Materials.—J. N. B. (*Halifax*).—Gesso materials are to be obtained at the depôt of the Society of Artists, 53, New Bond Street, and the metallic colours for tinting the gesso work also.—E. C.

Slide Rule.—Slide Rule.—Some information on the Slide Rule, to be of any value, would have to extend into several articles. "The best engineer's rule" is, of course, that which is most comprehensive. Of these there are many, and the choice in any particular case must be made according to special requirements. There are, at least, a dozen, and those which are most expensive are the most comprehensive, and therefore the best. For workshop use a rule costing 4s. 6d. is suitable; the best will cost a pound or more.—J.

Short Distance Telephone.—G. C. (*Morpeth*).—Surely G. C. has not been reading his numbers carefully, or he would not have sent this query. The telephone was fully described in No. 23 of Work. If you will turn up that number and follow the instructions there given, you will find the instruments suitable for your purpose. If, however, you find any difficulty in making these instruments, I will be pleased to help you through "Shop."—W. D.

Indelible Ink, Indian or Chinese. — J. N. (*Bowes Park*).—You have asked a question which is very difficult to answer for many reasons. In the first place, the manufacture of the indelible Indian inks sold by Rowney and other firms are trade secrets, and there can be no doubt their receipts are the best. Again, pure Indian ink, which is really Chinese, is a most expensive article, the best costing as much as 25s. per stick, so I do not see how you are going to make half a pint of indelible ink with the real article any cheaper than you can purchase it ready for use. Please note, the best Chinese ink will never rub up when washed over with water; it is only inferior sorts and imitations that do so. Here are some receipts; whether they are indelible or not I must leave you to prove: (1) Dissolve horn strip with caustic kali root till it is melted. This brown liquid is to be boiled in an iron kettle until it is thick. Then pour on it boiling water, double its weight, and precipitate it with dissolved alum. Dry, grind, and mix it with gum-water, and pour it into a mould. A few drops of essence of musk, or of ambergris, may be added as perfume. (2) Mix finest lampblack with a solution of 100 grains of lac, with 20 grains of borax and 4 oz. of water. (3) Pure lampblack, mixed with asses' skin, glue, and scented with musk. Regarding No. 3, it is a well-known fact amongst photographers that animal glue when treated with bichromate of potash, and exposed for some time to the sunlight, is insoluble in water. Impure Indian ink (by analysis) contains such animal glue, so if a small quantity of bichromate of potash be added to it, it should prove indelible after being exposed for one hour to sunlight. I advise you to try a 6d. bottle of Stephens's ebony stain. It is now largely used in place of Indian ink. It is cheap enough for the purpose—8s. per gallon, from Henry Stephens, 191, Aldersgate Street, E.C. It is very black, and works well with pen and brush alike.—H. L. B.

A Baker's Oven.—Baker (*Blairgowrie*).—I do not see clearly how I can help you, unless you give more particulars. Correspondents would save us an endless amount of trouble and thought if they would only give full explanations. You ask for advice concerning an oven that will bake a loaf or two at a time, and give as requirements that it shall be simple, easily erected and removed. An oven constructed as bakers' ovens usually are clearly would not answer this requirement. I cannot see that you can have anything better than an ordinary cottage range with a good-sized oven, or a powerful petroleum stove. Without further information as to your intentions as to price, kind of fuel available, whether to be made by yourself, etc., I cannot advise you farther.—R. A.

Brazing.—Paul Jones (*Kentish Town*).—From the wording of your letter I suppose it is bicycle fittings that you wish to braze. This to the ordinary workman presents no difficulty. The main thing is the fitting of the parts together; the joints must fit tightly, and not only tightly but accurately, for a joint might possibly be tight and yet only bear in two or three places owing to unequal filing. It is a very true saying that there is very little difference between a fit and a "wobble." Presuming that you are able to fit the parts together "well and truly," you will, I trust, after perusing the following, make a good job of the brazing part of the process. A Fletcher's injector pattern gas blowpipe and foot-blower would be the best thing you could use for the purpose. It gives a great heat, and can be used in any position, and is clean and manageable, but if you do not possess one, and are limited to a forge, proceed as follows:—Build your fire so that you have room to manipulate your work—that is, bring it well out into the centre of the hearth by means of a pipe, if necessary; blow up a fire of charcoal or coke—I prefer coke myself—let the fire be perfectly clear and free from smoke; this is very important, for if any smoke gets round your joint it is certain to prevent the spelter running in as it ought to do; pound up some borax very fine; in a tin or some convenient article mix about two tea-spoonfuls of spelter and one of borax to a paste with water, and have some of the powdered borax ready to hand; place the article to be brazed on the fire and blow gently; when it gets a bit hot dab on some of the mixed spelter and borax with an iron spatula. It will fizz and rise up off the work, and then sink and adhere closely to it. Now blow gently, and gradually increase in force; as it gets red-hot, sprinkle a little of the powdered borax on the joint; keep blowing till you see the spelter run, then rub it with the spatula; add more spelter if necessary, and when all seems well run, give a final sprinkle of borax, cease blowing, and after a minute gently remove from the fire, and allow to cool of itself. On no account cool it with water. I advise you as an experiment before doing your tubes to try brazing two pieces of iron pipe—say, a piece of ¾ in. gas barrel into a piece of 1 in. gas barrel; it will give you practice, and show you what to do and what to avoid.—R. A.

Violoncello Case. — S. E. T. (*Glasgow*).—With the Editor's permission, I will communicate with you per post. I think I shall be able to assist you — B. [Kindly send information through me—*pro bono publico*.—Ed.]

Bazaar Ideas.—Bazaar (*Skipton*).—We might, by way of novelty, suggest "An Automatic, Infallible, Moral, and Intellectual Balance." Its professed use would be to ascertain with exactness how much of any good or bad quality might be possessed by the visitor. For instance, a lady whose "constancy" is to be tested takes her place on the scale. The attendant (who might be dressed as a necromancer) would put such weights as he thought proper on the opposite scale, and it would go down; the scales, of course, being really controlled by a confederate, either placed behind a curtain or in a large pillar through which the beam works. The fun of the thing must largely depend on the humour of the attendant; and capital could be made in such cases as that of a lady well known to think herself good-looking, who might be shown to have, by the balance, not half an ounce of beauty; or that of a man reputed to think himself clever, and yet whose record might show no more than a few grains of wit. We imagine that a little thought will show how this idea may be worked out successfully.—M. M.

Materials for Painting.—W.C. (*London, N.W.*).—The queries shall be answered seriatim:—(1) The brushes used in oil painting are chiefly hog-hair and sables. The size used must depend on the work. A flat hog-hair, ½ in. wide by ¾ in. long, is one of the most useful; very useful also is a rather smaller size in sable. For painting skies on a fair-sized scale, a somewhat larger hog-hair becomes necessary. Flat brushes are more useful than round ones, as they give greater variety of touch. The "sweetener" is properly made of badgers' hair, but, if the cost of this be a consideration, a cheaper large, flat, camel-hair will answer the purpose. (2) The mediums used and sold for mixing with the colours are various. A good and inexpensive one is gum dammer dissolved in turps. This gum may be got at any large chemist's at 1d. or 2d. per oz. Put the gum in a bottle and pour on turps to an inch above it. When dissolved, strain. Thin, if required, with more turps. (3) Prepared boards may be bought at any good artists' colourman's. (4) The paper stumps alluded to are doubtless for crayon and charcoal drawing. The large artists' colourmen, such as, say, Winsor & Newton, Rathbone Place, Oxford Street, W.C., issue illustrated and priced lists of all materials and appliances sold by them. W. C. should apply for one of their lists, which will give him much of the information of which he stands in need. A considerable discount is allowed to artists off list prices.—S. W.

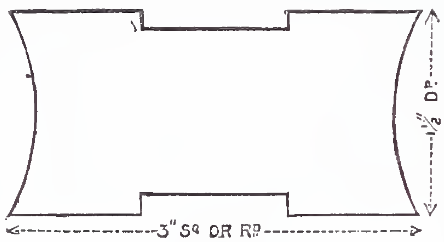
Cabinet in Fretwork.—H. H. (*Manchester*).—For a novice as you are in fretwork—although being skilled in the use of tools, you would probably succeed better than an ordinary amateur—I should not advise you to try the cabinet design issued with No. 1 for your first work, chiefly because it involves more labour than most pieces of its size, and unless absolutely well done would fail to be effective. Why not try the coffee table design in No. 30, or the little paper tray in No. 21? The design for an overmantel in No. 2 might be ornamented with some of the Japanese motives in Nos. 9 and 14. For instance, some of the storks (Figs. 3 and 4), or the other birds, might be cut in thin panels of the doors; the pattern of the paper tray on page 328 might be adapted for a cornice rail. If neither of these suggestions meet your wishes, there are two or three designs to appear shortly that will, no doubt, fully do so. For inlaying, the simplest way is, perhaps, to cut the pieces carefully out of a thin sheet of light wood, then to stain the portion from which they were cut, and replace them. Of course, the pieces themselves may be dyed various colours (with Judson's dyes) to simulate real marquetry, if you care for that effect. Another plan is to paste two thin layers of different wood together with a rather thick piece of brown paper between. Cut carefully with a fret saw, and reverse the pieces; thus if walnut and white holly be chosen, you will obtain a light pattern on a dark ground, and *vice versâ*. Bemrose's publish a book on Buhl Cutting and Inlaying; but so far as my memory serves, it was not particularly useful to me; perhaps others would find it all they wished.—E. B. S.

Gasalier Fitting.—G. S. (*Clapton*).—The first and most important thing to be done in taking down the above, is to turn off the gas at the meter, then take off the globes and triangles, next the weights, and you will then find that the outside stem with the arms, and a small inner tube attached, will draw off, or, if you are not careful, fall off. Take this down steadily, and pour out any water you may find inside. You will now notice that a single pipe remains connected at the top with a ball and socket joint; undo this joint; and all you have now to do is to unscrew the ceiling plate. If in doing the latter you notice how it is fixed to the ceiling, and how joined to the compo pipe or gas barrel above, you will have no difficulty in refixing it in any other position, and a little consideration after you have it down will at once show that the water is necessary to make the sliding joint gas tight. The only other thing of importance to do, is to be sure you pour some water in the top of the stem after you have refixed the whole before you turn on the gas. A practical gasfitter would not take the whole thing to pieces unless it was very awkward, but would unscrew it from the ball and socket joint, after removing the globes. But if you go step by step as I have described, you will understand better what you are doing. Again, let me remark, be sure not to turn on the gas before you have made the sliding joint gas tight, by pouring as much water as the stem will hold, without running over, when the gasalier is either up or down.—E. D.

Photographic Studio.—F. T. R. (*Retsbyl*).—Before the form of a studio can be decided upon, the surroundings must be taken into consideration. Good work can be done either in "lean-to" or detached glass rooms, the size and form being regulated in a great measure by the amount of money to be spent upon them, and space at disposal. The following leading conditions are generally considered imperative to good work of the usual kind:—The length of the studio should not be less than 30 ft., the width and height 12 or 14. An unobstructed north light tends to uniformity in results, on account of its freedom from direct sunshine and a generally more even illumination; a clever operator will turn out good work from a studio with any aspect. The cheapest form is the lean-to, as one side is supposed to be already built. The most convenient is the ridge-roof detached studio. It is impossible, in the space at disposal in these columns, to give full directions for building one. To sketchily describe a ridge-roof one, begin by laying down a framework the size of the area of the building, supported 12 or 18 in. above the ground on brick piers; for dryness' sake board it over with stout planks supported on battens a foot apart, and made as free from vibration as possible; on this erect the framework. Board up both ends, and about 6 feet of each side from the ends, supposing the studio to be rectangular, with a ridge roof, and one side and one half the roof may be opaque, the rest glazed; a door or doors being made on the boarded-up side, the glass is put in on the ordinary greenhouse plan, each pane overlapping the one below it; good colourless 21-oz. glass is best. The interior may be canvased and papered, and a background on roller at each end. The more steep the pitch of the roof, the less liability to leakage and accident from storms. There have already been published many designs for building glass rooms, which F. T. R. would do well to consult. A cheaply-made photographic studio is little different to a greenhouse in putting together. The fewer the sash bars and better the glass the more light. Provision must be made to ventilate it well, or unless this is properly managed the heat in summer is almost insupportable; it goes without saying that the larger the place, the more comfortable it is in this respect. F. T. R. will do well to consider the comfort of his customers in the construction almost as much as other conditions.—E. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Toughened Glass.—ONE IN A FIX (*Tunbridge*) writes:—"Would any reader give me a few practical hints upon toughened glass making, also what kind of pot and furnace is used for small work? I want to make a few articles of great strength in solid glass pressed to shapes required for experi-



Glass Mould.

menting. I believe the moulds are cast iron and made in parts. How are they fastened together to stand the pressure? What is required to make the mould leave the rough sides of glass? A sketch of parts wanted will greatly oblige, I enclose rough sketch. I want them round and square."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Rubbing down Oilstones.—BRUM (*Keighley*) writes in reply to A. G. (*Newcastle-on-Tyne*) (see

page 619):—"About the easiest way of rubbing an oilstone down is to hold it against the side of a revolving griudstone, using plenty of water."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—BOILER; W. R. S. (*Brixton*); H. A. C. (*Plaistow*); A WOOD CARVER (*London, W.*); WATERPROOF; W. E. R. (*Southgate*); C. T. (*Kent*); SEMPER PARARE; C. N. (*Yeovil*); J. W. (*Ashton-under-Lyne*); E. W. (*Sheffield*); T. E. B. (*Hants*); F. H. (*Streatham Hill*); R. D. (*Millwall*); J. H. (*Manchester*); M. G. (*Glasgow*); J. P. (*Stalybridge*); C. S. T. (*Camberwell, S.E.*); J. P. (*Reigate*); W. R. (*Nr. Bolton*); F. P. (*Brighouse*); A. S. (*Wolverhampton*); T. D. G. (*Highgate*); SUCCESS (*Wolverhampton*); ECONOMIO (*Wolverhampton*); N. M. (*Sheffield*); W. E. C. (*Wakefield*); A. F. (*Sheffield*); H. W. (*Newcastle-on-Tyne*); H. T. (*Sheffield*); NORTH-JACK; G. and Co. (*Glasgow*); J. R. H. (*Gateshead*); X. W. (*Crowle*); A. S. T. (*Bishopsgate*); S. A. R. (*South Shields*); R. P. W. (*Walkden*); D McD. (*Paisley*); C. J. D. (*Brixton*); E. J. (*Liverpool*); W. D. (*Newcastle-on-Tyne*); A. S. (*Cork*); T. L. (*Sussex*); CONSTANT READER; W. H. B.; J. F. B. (*London, E.*); A. M. (*London, W.*); M. M. (*Glasgow*); W. F. C. (*Clifton*); A. S. H. (*London, S.E.*); W. B. (*Huddersfield*); J. H. N. (*Sunderland*); F. B. (*Swanscombe*); J. J. (*Bristol*); H. W. G. (*Bucks*); F. H. (*Leith*); C. S. (*Radford*); W. H. H. (*Bradford*); E. B. (*Derby*); N. W. (*Clapham, S.W.*); E. L. R. (*Oxford*); A. A. (*Coventry*); M. BROS (*Rawal-Pindi*); D. M. W. (*Kelso*); R. M. (*Morpeth*); I. W. B. (*Southport*); G. E. S. (*Berkeley*); J. Y. (*Derby*); H. M. (*Wolverhampton*); R. J. L. (*Salisbury*); G. H. (*London, S.E.*).

Trade Note.

IT has been agreed to erect an international monument to James Watt, in Greenock, the illustrious engineer's birthplace. Subscriptions towards the project had been promised from London, and other large centres in Great Britain, America, and other parts of the world. The Greenock Philosophical Society has taken the matter in hand, along with an influential committee under the auspices of the Greenock Town Council. The form which the memorial will take has not yet been decided, but it has been suggested that it should be either a well-equipped technical school in Greenock, or a colossal tower on a prominence which would command the attention of every passing ship on the Clyde.

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WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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A JACOBEAN SIDE-TABLE WITH LOCKER.

BY MARK MALLETT.

That decorative and useful piece of furniture for constructing which drawings and instructions are now offered, is, as regards its original, of the James I. period. The type is a somewhat unusual one, for though the writer is a tolerably inquisitive student of English seventeenth-century furniture, he has met with two examples only—one in Dorset and the other in Warwickshire. The professional and amateur worker may alike find it worth the labour of reproduction.

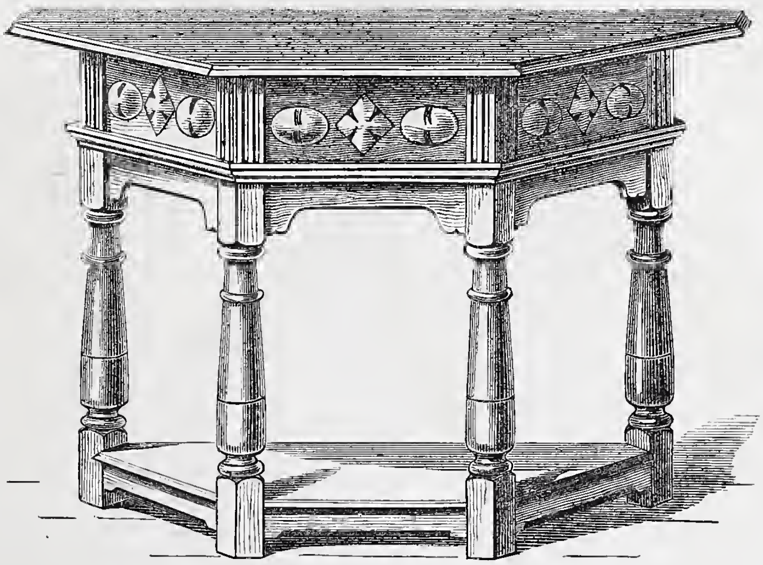


Fig. 1.—A Jacobean Side-Table.

Unlike most of the articles of that age, this table is without any carved decoration whatever, the ornament being entirely *appliqué*. As regards its construction, its peculiarity is that its top is made to open, and thus give access to a kind of locker, fitted with handy compartments of various sizes. The material of the original article is oak.

The dimensions of the table drawn are:—Height, 2 ft. 6 in.; breadth of top, 3 ft. 9 in.; projection of top, 1 ft. 6 in.; breadth of frame of table, 3 ft.; projection of frame, 1 ft. 2 in.; and depth of locker, 5 in. A general perspective view is given in Fig. 1, which is on a scale of about 1 in. to the foot. All the remaining diagrams are on a scale of $1\frac{1}{2}$ in. to the foot.

From Fig. 1 it will be seen that the supports are pillars of a pattern well known in Jacobean work. In the judgment of the writer, these pillars have merit not merely as being characteristic of the style, but also as having in their strength and solidity that kind of beauty which comes from fitness. Opinions differ, however, and some may think them too heavy; if so, lighter and more ornate turning, or even twists, may be substituted for them without any great prejudice to the general effect; and into the bases and upper parts of the pillars the framework, which is of 1-in. oak, is mortised. The frame pieces should not be less than 1 in., if the solid character of Jacobean work is to be kept; indeed, $1\frac{1}{4}$ in., when planed down, is scarcely too thick. The pillars can be cut from 2-in. plank.

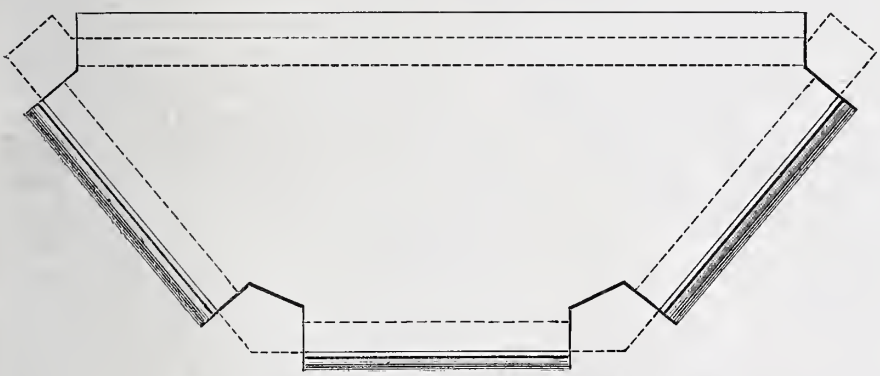


Fig. 2.—Foot-Shelf supported on Rails connected with Legs.

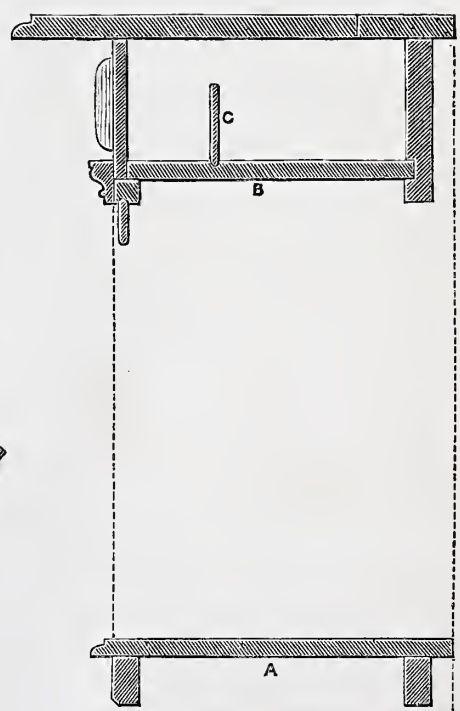


Fig. 3.—Vertical Section—A, Foot-Shelf; B, Bottom of Locker; C, Partition.

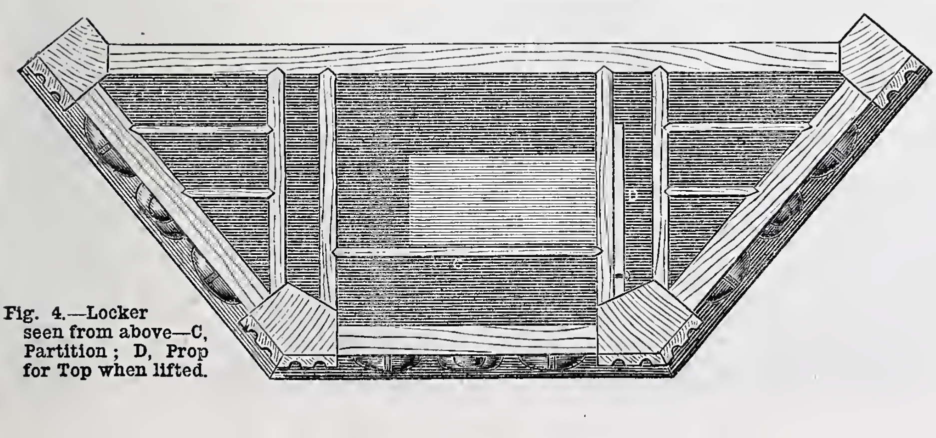


Fig. 4.—Locker seen from above—C, Partition; D, Prop for Top when lifted.

Fig. 2 shows the foot-shelf which rests on the bottom framework, beyond which it projects some $\frac{3}{4}$ of an inch. This foot-shelf is lettered A in the section Fig. 3; and the frame on which it rests is indicated by dotted lines in Fig. 2. It is of $\frac{1}{2}$-in. board, and its edges are moulded, as shown, except at the back. This foot-shelf will form no bad place for the display of artistic pottery—three vases or other articles, a taller one in the centre and lower ones at the sides, will show well upon it.

Fig. 3 is a section through the centre of the table. In it may be seen how the bottom of the locker, marked B, is supported by the framework of the upper part. But the arrangements of the locker are more completely illustrated in Fig. 4, where they may be seen as from above, before the top of the table has been fixed in place. This locker is divided by partitions into compartments of convenient size for papers or other small matters. The largest compartment is 11 in. long by 7 in. broad, and the whole locker is 5 in. deep. The more important partitions—those from back to front—are of $\frac{1}{2}$-in. board, and about $4\frac{1}{2}$ in. high; the subdivisions are of thinner stuff, and for them a height of some 3 in. is sufficient, as shown at C, Fig. 3.

At D, Fig. 4, is shown a strip of wood attached by a screw to one of the partitions. It is for the support of that part of the table-top which forms the lid of the locker, when it may be desired to prop it open. To prevent all danger of slipping, it may not be amiss to notch like a rack that part of the lid which rests upon it.

In this same diagram (Fig. 4) is to be seen something of the relative relief of the different pieces of applied ornament. These pieces are in a general way simply glued to the surface. Among the furniture makers of the seventeenth century it was rarely usual to trust the effect of their work entirely to *appliqué* decoration. They more frequently used it in combination with carving or inlaying, or both. *Appliqué* work, however, survived carving, for we find abundant, and some of the best, examples of it dating from as late as the earlier part of last century, and from a period when carving had passed out of fashion. The example before us is, as regards ornament, anything but an elaborate one. The two carbuncles on each side are, of course, turned in one and sawn through. The lozenge between them is sawn out and worked by hand. The fluted pieces at each end are also readily worked by hand; in restoring the original of the drawings, the writer had to supply one of these pieces, and found it could be quickly worked with the gouge.

In Fig. 5 we have the top, $\frac{3}{4}$ of an in. in thickness, and moulded at all its edges except the back one. Access to the locker necessitates that it should be in two pieces, of which that at the back—the fixed one—is 4 in. wide. If, however, any person making such a table should object to such a division in the lid, an alternative is open to him—he may omit the locker, and instead have a drawer on the front side. More than one drawer he could not well have; and this would, of course, involve some loss of space, and make, on the whole, a less useful article of furniture than the original, which will serve many of the purposes of a bureau.

Indeed, to the writer, the locker appears so characteristic a feature of this table, that he would not willingly sacrifice it. An ingenious combination of purposes, analogous to that shown in this table, is not unfrequent in early seventeenth-century furniture. The writer has met with joint-stools of the Jacobean period, the tops of which, by removing a secret fastening, could be made to open and disclose unexpected receptacles within. Such receptacles were, no doubt, useful in days when portable property was even less secure than in our own. Another instance with which he has met was an arm-chair, of much the same date, the back of which, when turned down on the arms, made a circular table some 3 ft. 6 in. in diameter. A chair-table like this, or one on somewhat similar lines, would not make an unattractive subject to amateur carpenters, and possibly a corner may at some time or other be found in WORK for drawings of one.

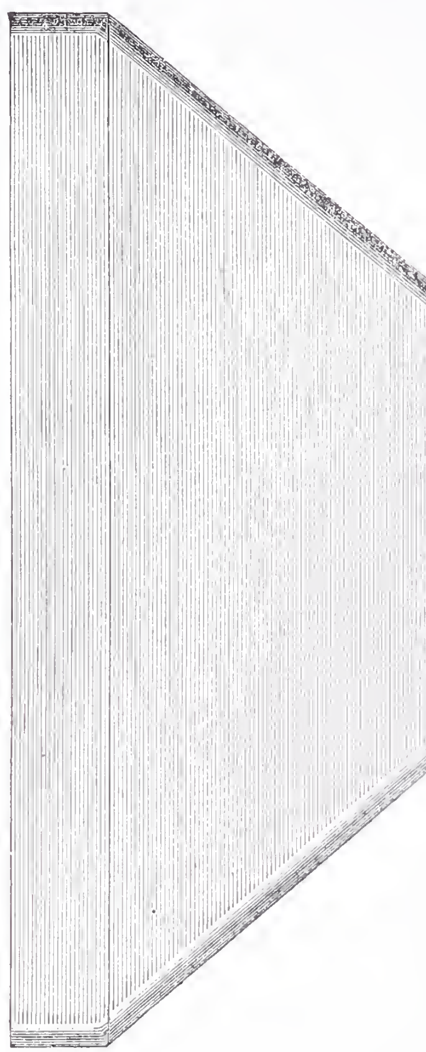


Fig. 5.—Top of Table, showing Joint for lifting Top.

The original of our Jacobean side-table is, like most of the furniture of the age in which it was made, formed wholly of oak; and oak will be the best material for any one who attempts an exact reproduction of it. A pretty table, however, on much the same general lines, but more lightly made, might be constructed in pine, and ebonised—the amateur joiner will probably prefer to work in the latter less costly and more easily wrought wood.

A suggestion may be added for the benefit of any one making such a table as this in oak and wishing it to harmonise with other oak furniture which is carved. He may gain that end with little labour by running a carved enrichment—some Jacobean variety of the "egg-and-dart"—along the moulded edges of the table-top and foot-shelf.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

REGULATING, TUNING, AND TONING—CONCLUSION.

TAKE out the keys and place them on your bench; then take a thin piece of wood about an inch wide, and wrap round it a piece of fine glass-paper, and rub over the wood of the keys, behind the ivory or sharp, cleaning one at a time; then brush the dust off them; if you see any on the key bottoms, remove it. Between the balance and front rails fit a piece of thin wood to prevent the light being seen through the spaces of the keys. Now, where the ends of the sharps were cut off, black with ink about an inch wide; also black the lower part of the sharp from this line. While the keys are out, take off your damper rail carefully, and by moving each hammer to the string, see that each hammer strikes it fair; if the shank has cast to one side or the other, as shanks do sometimes, you can alter it by warming an old file, or flat piece of steel, and hold it to the side you wish to bend over. Now you can see that the bridles or tapes of your action are properly adjusted; put one finger under the lever and raise lightly, and there ought to be $\frac{1}{16}$ of an inch play between the top of the fly and the hammer butt; if there is not, you can make it so by bending the bridle stay either backwards or forwards. Now take the action out and put the keys back in their place, and take each key separately, and see that it works free; if not, ease it with your file, but do not make it loose; if you find it a trifle loose, you can tap it gently with a hammer over the hole; this will tighten it. Having done this, put the action in its place and see if there are any pilot screws which need turning up, as in the finishing. Now look over the keys and see that they are straight to your straight-edge, then tap on the keys with your straight-edge, and those that are high will move; take a shaving off these and make the low ones level with tissue paper. The spaces of the keys must now be adjusted, then the action must be regulated or set off. I will now describe what is meant by this: if the reader will kindly look at the action, he will find that through the fly of the hopper there is a wire, with a button on the end; as the key is depressed, this button rests on the slide rail, this being on the bevel; as it rises, the fly is pushed forward from under the hammer, allowing the hammer to fall into check. This is accomplished in the following manner. As the hammer moves towards the string, the check follows it, and when the hammer falls, the check is there to receive it, holding it firmly by the check arm. Make a hook, so that you can turn the wire that has the escapement button on. Now sit down at the piano, and commence with the first note in the treble, press the key gently down, and watch the hammer; if you turn the escapement button to the left, you will find that the hammer will bump against the string; therefore it damps the tone, or, as it is called, blocking. Now turn the escapement to the right, and you will find that the hammer escapes from the string; the check allows the hammer to fall the requisite distance from the string. Allow the hammer to go up to the string within $\frac{1}{16}$ of an inch, and allow it to fall, after it has struck the string, about $\frac{3}{8}$ of an inch. Regulate the check, to catch the hammer at this distance, by bending it forward or backward. When the key has taken the hammer to the string, it ought to rest on the front baize; if it does not, the touch is a little deep, and that means loss of power; remedy this by placing a piece of brown paper under the baize. If the touch is too shallow, and the key does not carry the hammer far enough, you can strike the baize with a hammer to compress it, so that the key carries the hammer further. Regulate every note in this way. Now put your damper rail in its place, and see that it works without noise. Put your foot on the right or loud pedal and press it down, so that it removes the dampers clear off the strings; then put a small block under the front of the rocker to prevent it going down further than is necessary; glue a piece of cloth on the top; also glue the bottom to the bottom board of the case. Now serve the celeste, or left pedal, in the same way, so that when the foot is pressed on the pedal, the hammer strikes the felt or flannel; stop this with a block also.

You now proceed to tune the piano, but before you do so, you will have to make a wedge; this is made of a thin piece of wood or cane, about a ¼ of an inch wide, with a covering of leather at each end. When the reader chipped the strings, it was only necessary to chip one at a time, but now the hammer strikes two and three strings at one time, it is more convenient to damp either one or two of them in tuning. It is for this purpose that the wedge is used. The same process is adopted in the tuning as in the chipping up, only that the action being in, you will be able to hear the notes more distinctly. You sit down at the piano (and in a quiet room if possible), and put your tuning hammer on one of the pins of pitch C. Now place your wedge between the string you are not tuning and the next note; this holds the wedge in position, and damps the string or prevents it vibrating while you tune the other. The wedge is about 7 in. long, and you put it between the hammers a little further on than the note you are tuning, so that it is at an angle; this is so that the hammer of the note you are tuning does not strike the wedge; a little practice at this will soon make it easy. While the chipping up is rough tuning, until the piano has been tuned two or three times it will sound very rough. Pull the string up until it is in unison or sounds the same as your tuning fork. Now take your wedge out, and you will find it sounds out of tune. Put your tuning hammer on the other pin of the note and pull it up until it is in unison with the other string; listen attentively, and pull the string up gently, so that when the note is struck, it sounds like one note without beats. This is the way to tune the unison. Practise this well until you are proficient, then try to tune the octave; this is the same note C, an octave nearer the bass end of the piano. When the note and its octave are struck at the same time (when in tune), it sounds as if you had only struck one note. Do not turn the wrest pins back if you can possibly avoid it, as this tends to loosen the pins. If you pull a note slightly sharp, give it several sharp blows; this will make it a shade flat. If you can get access to a piano, you will be able to try the scale and octaves. If you do not know the notes on the piano, I may say that the C is the white key which comes before the two sharps, then towards the treble the notes would follow in rotation, so: C, C sharp, D, D sharp, E, F, which is the white key before the three sharps, then F sharp, G, G sharp, A, A sharp, B, C; this forms the octave. Having tuned the octave C below pitch C, move your tuning hammer to the G below, or towards the bass; damp one string of the note, then strike C and G at the same time, and pull the G up carefully and slowly, listening attentively, and although it may sound rough and discordant when you start, with a great number of beats which sound like woo, woo, woo, you will hear it gradually coming into tune, and it will sound pleasant to the ear, and without a beat. Take out the wedge and pull up the unison, then move to the D above, or towards the treble; repeat the same operation as before, and so on through the scale, a description of which was given in the paper on stringing and chipping up. The thick end of the wedge is used for the bichord notes, the thin end for the trichord. In tuning a trichord note, you would put the thin end of the wedge between the two treble strings of the note, that would allow you to tune the first string; then use the thick end to tune the middle string of the note, and draw the wedge out to tune the third string. The pianoforte has no E sharp, or B sharp, so this deficiency has to be made up by tuning

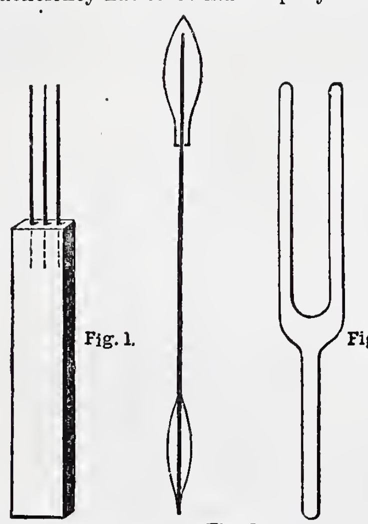


Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—Toning Needles. Fig. 2.—Tuning Wedge. Fig. 3.—Tuning Fork.

all the fifths a wave sharp, and the fourths a wave flat, towards the bass. To be able to tune perfectly requires a large amount of practice, and tuners' ears in time become sensitive to the slightest discord. No doubt the reader is well aware that there are some persons who have no tune in them, therefore it would be impossible to teach them tuning. I have known some persons during my lifetime who, when they have made an attempt to whistle, or sing a tune, have made some awful discordant noises, while they were totally ignorant of having inflicted pain on those who possessed a sensitive ear, believing they were singing or whistling in perfect tune. They say, where ignorance is bliss it is a folly to be wise, but I think in this case it would be a kindness to tell them not to sing again, and put an end to their bliss. I worked with a man at one time who had never been known for years to hum or whistle a tune; I expect some one had put an end to his bliss. I think I have said enough to give the amateur a start in tuning his piano; the rest depends on practice and perseverance.

There is one other matter that ought to be attended to now—that is the toning: this is making the inequalities of the tone more equal. I will explain to the reader what is meant by this: one note, if the felt on the hammer is too hard, may sound like a tin kettle, while another may seem much softer; to remedy this, you must prick the felt at the point of the hammer with a sharp needle, or two or three held in a piece of wood; this softens the tone. Now, in the extreme treble, it is just as well to have it sound bright, or brilliant as it is termed; this can be accomplished by passing a warm flat iron over the points of the hammers; try the heat of the iron on a piece of paper, so that you do not burn the felt.

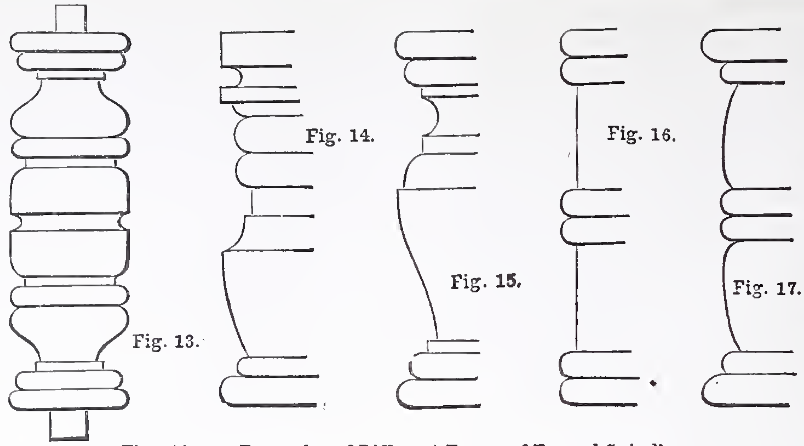
Your piano is now complete; and I hope those who do not wish to make a piano, may have found in the perusal of the papers on this subject something to interest and edify them. I am aware that a great many wrong impressions prevail with regard to the manufacture of the pianoforte, and I hope I have dispelled them. As the church organ is sometimes called the king of instruments, I would claim for the pianoforte the title of the queen of instruments. For the home, it will always be a favourite; whether for sacred, dance, or secular music, it possesses qualities which commend it to our esteem. And as the education of the people progresses, so will the manufacture of the pianoforte, as a knowledge of music is thought to be indispensable in our modern schools. To those who intend to make a piano, I hope I have made everything so simple, that they will readily understand it. Should any difficulties arise, or the reader not see his way clearly, I shall be most happy to set him right through the columns of "Shop."

A CARVED BUREAU.

BY D. ADAMSON.

SHERATON'S STYLE—EARLY ENGLISH STYLE.

To put theory into practice, let us take a drawer front—it can serve no good purpose to give an illustration showing the whole of the bureau—and see how it may be treated in a style typical of Sheraton's, merely observing that the objectionable cross-banding has been done away with. Let us then refer to Fig. 18, showing part of a drawer front, the main portion of which, by the way, we may regard as mahogany or rosewood; there is the familiar inlay, which has so often been reproduced, representing a series of flutes or beads converging to a common centre. Such pieces of inlay can easily be made by those possessing the necessary patience, but as they are somewhat tedious and by no means ornamental unless neatly put together, it may be satisfactory to know that they can be obtained through most cabinet makers who make a display of inlaid furniture. More elaborate inlays may be used if preferred, but it would take too long to describe their mode of construction here. Suffice it to say, as the process of marquetry cutting is very little understood by those who do not follow it as a profession, that full instructions have lately been published in the "Art of Fret Sawing and Marquetry Cutting." Beyond the mahogany veneer we have a stringing of a light wood, such as box. These stringings are sold at such a cheap rate, that it would be merely a waste of time for any amateur to prepare his own. Much skill is requisite to do it properly, and besides the work is purely mechanical. Next to this stringing, which is very narrow, say $\frac{1}{16}$ in. wide, we have another, a broader one of black, and beyond this a band of satin wood, or if preferred as being less costly, boxwood, between which and the outer border of mahogany the thin black and white stringing may be repeated. It will be noticed that the stringings, etc., must be mitred at the corners, but as they are very narrow no great difficulty ought to be experienced in doing this neatly. The same cannot, however, be said of laying them and the veneers, an operation which might, perhaps, deter the amateur artisan from attempting to form a Sheraton bureau unless explained to him. But as to give anything like a full explanation would be to forestall an article on veneering, which will shortly appear in these pages, the novice is referred to it.



Figs. 13-17.—Examples of Different Forms of Turned Spindles.

Early in the present century a marked decadence in the artistic features of furniture is very perceptible. We have already noticed this as evidenced in the later productions of Sheraton, whose later works may be taken as a sufficient illustration of the debased taste which during his short career had set in. It is difficult to believe that a man of his ability could possibly have fallen so much under the influence of popular fashion as to design some of his later works, which he seems to have been conscious were not so good as his earlier efforts. However, whether he originated the degraded style or merely followed the lead is beside the question. There can, however, be no doubt that for fifty—or might the time not be extended to seventy?—years from the beginning of this century, our domestic furniture was possessed of few if any artistic features which are deserving of perpetuation.

The workmanship might be good—indeed much of it was good—but any pleasure which could be experienced from this quality is lost in view of the utter want of any artistic merit both in decoration and structural design. Truly, so far as beauty or sense of ornamentation is concerned it was a desolate age, and those who pay any attention to such matters may well be thankful for the great improvement which has taken place in recent years. Perhaps the only class of men who have reason to cast a longing glance backwards to the good old times of bad or no art are manufacturers and designers of goods, such as furniture, which are influenced by artistic considerations. Anything then seems as if it served provided it were florid enough; but perhaps I am treading on the toes of some elderly readers who "can't abide them there straight things," so desist from further comment, beyond saying that though articles of furniture when perfectly plain might be worthy of regard, the same cannot be said of much that was elaborated by fanciful decoration. At any rate, there was no feature sufficient to characterise an epoch in furniture style, although here and there an enlightened designer might be found whose works cannot be indiscriminately ignored. Still, we may very well pass on to the present time.

As a result of the modern general renaissance in art, furniture soon feeling the influence became more simple in character than it had been for many years previously. Under the guidance of such men as the late Sir Charles Eastlake, the severe straight lines of the Early English style became the fashion. I must here point out Early English as popularly applied to furniture is altogether a misnomer, at least, if we regard Early English architecture as the standard, for the two present no decorative features in common. With more truth it might be called the *Old* English style, if by old we mean the woodwork of, speaking roughly, the sixteenth and seventeenth centuries. The term Early English is, however, a popular one, and as applied to furniture is so well understood, that notwithstanding writers have repeatedly called attention to its inaccuracy, it seems as though it would still remain in vogue, and it may as well be retained here.

Without going very deeply into the subject, let us then see what alterations will be needed to turn our bureau into an Early English one.

The prevailing characteristics of this style being straight lines, it will at once be perceived that in our original we have it already, with perhaps the beading round the edges of the drawer fronts omitted, and the mitred framing of the fall changed into an ordinary mortise and tenoned frame.

But probably along with severity and general plainness, scratched beads are equally associated in our minds with Early English, not to mention spindles. We all know how these were used a very few years ago. Spindles here, spindles there, and spindles everywhere. In moderation they are well enough, but really when they were brought in so very freely and indiscriminately, one began to get a little tired of them. In the bureau, fortunately, there is not the same temptation to use them in excess as with many pieces of furniture, for the only position in which they can be either ornamental or serviceable will be on top, where, in conjunction with top and bottom rails, they will form a very suitable guard to prevent papers, etc., slipping off. The guard may be either along the back alone or returned along the ends to the front. The latter will look better, but as the work is done in the same manner, the only difference being that there is a little more of it in one than the other, one description will serve for both. The illustration, Fig. 20, gives a general idea of the end of a spindled back guard, only without the return pieces. Analysing this, it will be seen to consist of an end piece into which are mortised two straight rails supporting the spindles. These will look better if placed moderately close to each other than if with a great interval between each, and two inches apart may be considered a fair distance at which to place them. In size they may be about a couple of inches long, and turned down from $\frac{3}{4}$-in. stuff, but it must be quite understood that considerable variation is permissible from these measurements. For one thing a good deal will depend on the pattern of the turning, a few suggestions for which are given in Figs. 13 to 17, the first of them being a spindle complete,

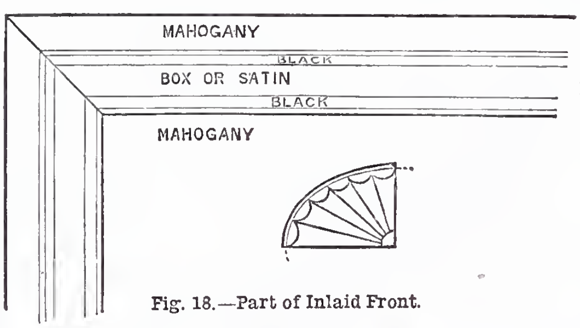


Fig. 18.—Part of Inlaid Front.

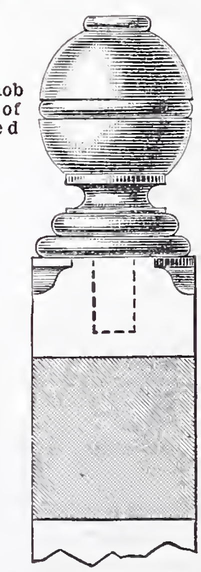


Fig. 19.—Knob at End of Spindled Guard.

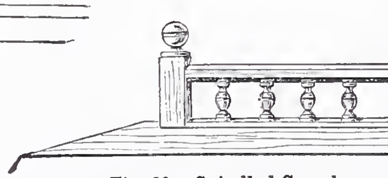


Fig. 20.—Spindled Guard.

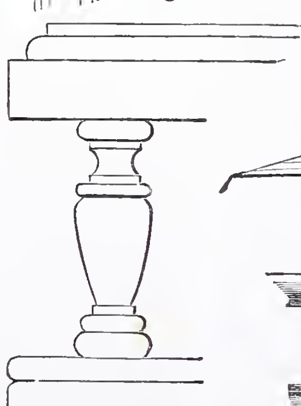
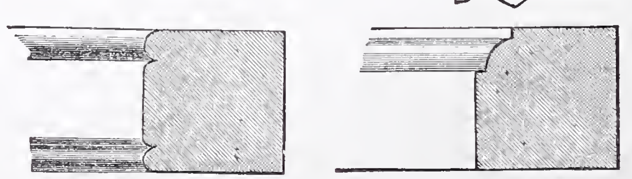


Fig. 21.—Alternative Mode of finishing Ends.


Figs. 22 and 23.—Top Rails of Spindled Guard.

and the others only showing the outline of members. From Fig. 13 it will be seen that the spindles are turned with a pin at each end, to fit into corresponding holes in the rails. As it would involve great waste of time to fit a piece of wood for each individual spindle into the lathe, the best way is to turn several on the same piece—the length, of course, of which will depend to some extent on the distance between centres, besides other considerations which the turner will well understand without them being specified. If the stick is of any considerable length, as it is only thin when turned down at the pins, a support attached to the lathe bed will be a necessity, but even without this several spindles can be turned on the same length. Great care must be taken to have all the spindles exactly the same length, so far as the show part is eoncerned. The length of the pins is of smaller consequence, as they can be cut shorter afterwards. They need not be more than $\frac{1}{4}$ in., that is on each spindle, not between two of these, though if they are not more than half this or $\frac{1}{8}$ in. they may still be used. Further directions will not be required about these spindles, and we may next turn to the rails.

Some care will be required in boring the sockets for the spindles; first, that the pins may fit them fairly tightly; and secondly, that the spindles may be perpendicular. To ensure the former, all that is necessary is to turn the pin down to suit the bit the holes are to be bored with, while to prevent any mistake in the latter, the holes may be made in both pieces at the same time. Perhaps it ought to be explained that the holes may be bored right through the bottom rail, but only sufficiently deep in the other to take the pins.

Both rails must be of the same width, which should be a little greater than the diameter of the spindles, so that they overhang these a trifle. In thickness $\frac{1}{4}$ to $\frac{3}{8}$ in. will do very well for the bottom one, but the top one will look better if it is a little stouter. It may be as much as $\frac{3}{4}$ in. thick without looking too clumsy.

Instead of leaving the edges square and plain in front, it will be better to finish them off in some way, .say by running a bead at the top or bottom, as shown in Fig. 22; or the upper edge may be moulded, and the lower left plain as suggested by Fig. 23.

It has already been said that these rails are to be attached to end pieces, which will next be described by mortise and tenon. The ends themselves are merely square pieces of wood, standing a little higher than the top rail, and at least as wide, or it will be better if they are a little wider on each face than the rail which abuts on them. The top end is turned up into a knob, and the bottom into a pin, though if preferred the knob, of which a suitable pattern is given in Fig. 19, may be turned separately with a pin which can be let into a hole bored for it in the end of the square piece, or it may be fastened with a double-ended screw. The pin or dowel at the other end of the square piece may also be let into it in a similar manner. In the bureau top holes are bored for these dowels to be placed in.

Fixing and fitting this part of the work is somewhat troublesome, but with a little patience all the spindles can be properly arranged between rails; the rails are then fixed into the end pieces, after which these are ready for fastening to the top. A little glue may be used to a spindle here and there, especially towards the middle of the rail, but if the upper one be stout it is not necessary. The mortises and tenons of course must be glued, and so must the dowels into the top. By this means the rail should be firm enough, but if any apprehensions are felt that it is not, glue may also be used to secure the bottom rail to the bureau, either along its whole length or only at intervals.

If the spindle guard is to be at each end, the mode of procedure is exactly the same, the rails being fastened to the square uprights, another of which will, of course, have to be at the front ends of each return.

As a variation it may be suggested that the finish in front might be as shown in Fig. 21, when each rail stops short without any terminal upright, and is merely rounded off at the ends to correspond with whatever beading or moulding is on the sides of the rails. By the way, the beads or mouldings should be on both sides of the return pieces, unless the bureau is to stand in a recess. The reason for this is so obvious that it will be unnecessary to explain the why and the wherefore. If, however, there be any reader who is unable to arrive at the reason without assistance, I can only say that I shall be happy to clear up the mystery for him in "Shop."

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

Gilding Materials — Gold Leaf — Half Gold Leaf—Gilders' Size—How to Gild a Sign—Cushion and Tip Method—Transfer Gold Leaf—Dutch Metal—Bronzes, etc.—Advanced Text-Book for Further Study—Conclusion.

A treatise on sign-writing could hardly be considered complete without a description of the method employed by writers for gilding letters and ornaments with gold leaf. I can only give a description of the process as it is at present used in every-day practice, throwing out, perhaps, a few useful hints here and there as the result of my own practical experience in the work. It will thus be seen that I have nothing new to tell the practical workman, and as I am, therefore, writing for the novice alone, it will be necessary to be as plain-spoken and explicit as it is possible to be in describing a somewhat difficult process.

It will first be necessary to explain the uses of the tools and materials used by the sign-writer in gilding letters, only mentioning here those that are actually used in letter work, as there is no space to treat upon gilding in general in these papers.

The most important item is a suitable surface to manipulate the gold upon, and this is to be found in the gilders' cushion (Fig. 83). This is a wooden slab about 8 in. by 5 in., covered with a soft leather, and padded between the wood and the leather. A piece of parchment is tacked round one end, and half round the two sides, as shown in the illustration. This is to prevent the gold leaf from being lifted off the cushion, as the slightest movement of the air is sufficient to carry it away. Under the cushion will be found a leather loop; through this the thumb is inserted, being held in the left hand. There is also a smaller loop for holding the palette knife when not in use.

The knife (Fig. 84) consists of a long blade in a handle, and it has a hard, smooth, but not sharp edge. It must be kept clean and bright, otherwise it will tear the leaf instead of cutting it. It is used to cut the gold to the required size and shape.

The "tip" (Fig. 85) is a thin layer of camel's hair glued between two pieces of cardboard, and is used for lifting the leaf from the cushion, and carrying and attaching it to the spot to be gilded. It is 4 in. wide, and varies in length, the most useful being 1 in., $1\frac{1}{2}$ in., and 2 in.

The gilders' mop (Fig. 86) is either flat or domed; it is used to dab the gold with, in order to make it adhere firmly to the prepared surface.

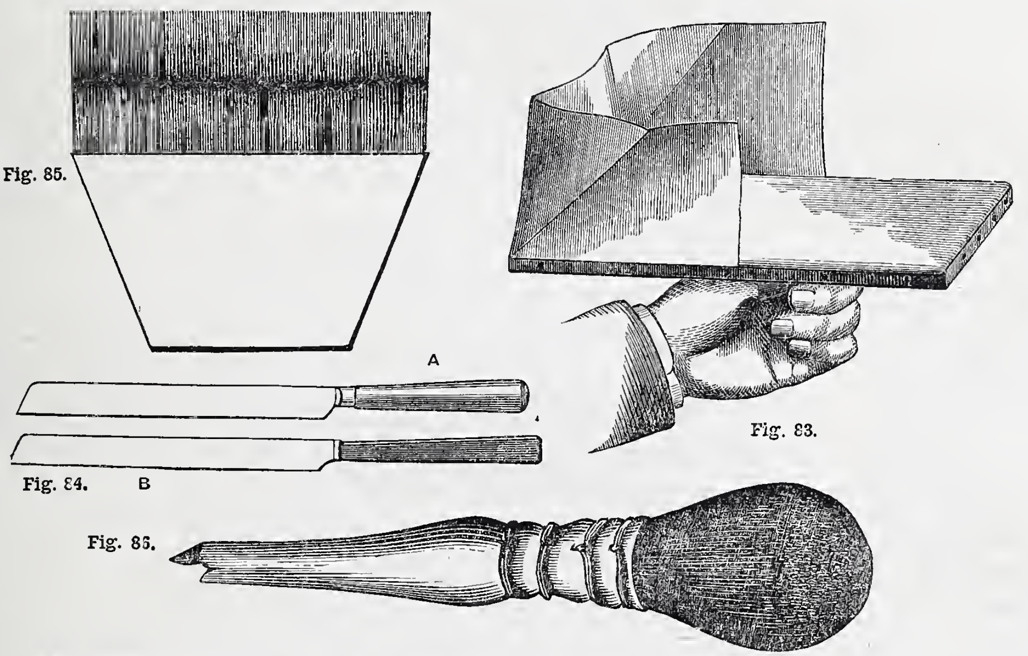


Fig. 83.—Cushion for Gold Leaf. Fig. 84.—Knives for cutting Gold Leaf—A, Knife with Balance Handle; B, Plain Knife. Fig. 85.—Gilders' Card Tip. Fig. 86.—Gilders' Mop or Dabber.

These are all the important tools that are really required, but a variety of sable, camel's-hair, hog's-hair, and "skewing" brushes will come into request in actual practice. Some powdered chalk must be tied up securely in a piece of fine muslin to make a pounce bag for dusting on the painted surface. Sponges, dusters, and other requisites should be kept specially for this work, and the whole of the tools and materials are best kept in a compact tin box.

The materials used for gilding, or for the imitation of solid gold, are—1, genuine gold leaf; 2, adulterative ditto; 3, Dutch metal; and 4, bronze powders.

In genuine gold leaf, there is always a certain amount of alloy, as pure gold is too ductile to be worked between the gold-beater's skin without it. It is sold in books of twenty-five leaves at about 1s. 4d. each, and gilders' work is measured and estimated by the "hundred" (leaves). Gold leaf must be kept in a dry place; if allowed to get damp, it will be impossible to remove it from the book without tearing it to pieces. Damp has also the power of tarnishing the leaf, and if any is discovered in this condition, it should never be used or it will spoil the work.

Gold leaf should fall freely from the book on to the cushion by a gentle breath from the operator; if it does not do so it is damp, and should, therefore, be placed in front of a fire for an hour or so to dry it. There are three shades of gold leaf sold—1, very pale; 2, medium or yellow; and 3, deep gold. No. 2 is the best for the sign-writer; it looks the best when varnished, and is the most durable if left unvarnished. It also stands the best against atmospheric influences when used on outside work, which, of course, comprises sign-writing.

Upon inquiry, I find that Messrs. Brodie and Middleton sell a "half gold" leaf at 5d. per book, which appears to be a very good article for the price charged. It is much thicker than ordinary gold leaf, and is, therefore, easier for the novice to apply, and it wears quite as long as the more expensive article. The same firm also make a special writer's gold size, which is very pale and clear, and of excellent quality.

There is now a cheap form of gold leaf upon the market known as the Venetian Ducat Gold Leaf, and sold at 7s. 6d. per thousand; it requires, I think, a special oil size and enamel, the latter being required for coating it after it has been applied to the surface to be gilded. It is then claimed to be permanent and washable, but although I have never seen a sample, I am inclined to the belief that, after all, it may be only a better sample of Dutch metal. It is made and sold by T. Pavitt and Sons, 70, Southampton Row, W.C. Dutch metal is a mixture of copper, brass, etc., and is made on the Continent. It is largely used in theatres for pantomime and burlesque scenery, hence the writer's acquaintance with it is pretty extensive. It is also used for gilding Christmas articles, and any kind of cheap and temporary work. It may be used by sign-writers and others for any temporary purpose, but soon turns black unless protected with a coat of patent knotting. Gold bronze powder may also be mixed with this, and applied to any surface, and will stand for years without tarnishing or getting discoloured.

Dutch metal is 1½d. per book at any large London colour warehouse or theatrical store. I now come to a somewhat modern article of convenience—I mean "transfer gold leaf." This is a perfect godsend to the sign-writer when working out of doors in windy weather. It is prepared as follows:—Procure a sheet of strong white tissue paper and three pennyworth of white wax, lay the paper upon a drawing board, and rub it all over—on one side only—with the wax. This must be well done, so that no small portions of the paper are missed; this can be ascertained by holding the paper sideways to the light, when the waxed surface should have a glossy and even appearance. The paper is now cut up into squares a size larger than the leaves of gold; the wax side of the paper will now have a slight amount of tackiness by which we are able to transfer the gold leaf by adhesion. The book is carefully opened, and a piece of wax paper is laid upon the gold and slightly pressed down with the hand, and this is continued right through the book until all the leaves have been provided with a sheet of waxed paper. The book should now be placed under some gentle pressure and it is ready for use. The method of using it will be described further on in this paper.

Letters for gilding are written in oil gold size, procurable at any colour shop. There is a slow and a quick size; the former is prepared by grinding up fat linseed oil and yellow ochre; for a quick gold size, a quick-drying varnish with a little oil gold size added to it to keep it tacky is a good preparation.

By regulating the quantity of oil put with the varnish, the mordant may be made to dry in three or four hours. Japanners' gold size and picture-frame-gilders' size may also be used for lettering.

Having enumerated the few necessaries required for letter gilding, I will now take the student through the process of writing and gilding a sign in simple unshaded letters on a black ground. The first thing to do is to so prepare the painted surface of the sign, that the leaf will be prevented from sticking anywhere except upon the sized portion, *i.e.*, the letters.

A sign which is to contain gilded letters which are afterwards to be varnished, is always given a coat of "flatting" as a finishing coat, and on this surface there is not much chance of the gold adhering anywhere except upon the letters themselves. If the edges are not sharp and clear, however, the sign just round the letters must be "egg-sized." But there are a great many people who will not have their gilded letters varnished over, as it takes so much off the brilliancy and richness of the gold, and in this respect I concur with such people. In such case, the sign has to be painted, varnished, and finished in every way before the letters are put on, and so we have to be careful how we work, or we shall spoil our own work and other people's too. The varnish, which should be of the best and hardest drying quality procurable, should be allowed to set quite hard; it can very well be left for a week after being applied to the sign. When hard, we commence by removing every trace of dust and sponging the board over with cold water; this will remove a certain amount of greasiness from the varnish; when dry, again dust, set out the letters in pencil, not in pipe clay, and then dust round with the pounce bag containing the powdered chalk. This need not be done to any unnecessary extent, as one frequently sees to be the case, but should be carefully applied to the spaces between the letters, and for an inch or two top and bottom of the letters. I need hardly say that this chalk is to prevent the gold from sticking anywhere but to the letters, and giving to the same a sharp, clear edge. A very slight dusting should be sufficient, and it must not obliterate the outline of the letters. Should any chalk grit get upon the letters, it must be carefully dusted off with a small brush before applying the size, which we are now to get into a workable state. The oil gold size sold in the little jars by oil and colourmen is generally too thick for use, and, therefore, requires thinning to the proper consistency. Brodie and Middleton sell it both "thick" and "ready for use." Taking as much as we require for immediate use from the jar, we thin it down with a little boiled linseed oil, and strain through a fine piece of muslin into a small jar for use. The slow-drying size is laid on one day and gilt the next, but if we require to apply the gold leaf on the same day as the size is applied, then we must use one of the quick-drying mordants already mentioned.

The method of pouncing the sign with chalk is a somewhat dirty and untidy method of working, although it is the one in general use; many of our best writers, however, use instead, egg-size, which is prepared in this way:—A nice fresh egg is pricked at both ends with a large pin, and the white of the egg only is blown into a cup; this is diluted with a little water, and the whole whisked up into a froth with a clean new sash tool. This is now applied to the sign and well worked over the entire surface, and if properly done, will prevent the stray particles of gold from sticking upon any part of the board. After the gilding is completed, the egg-size is washed off with a sponge and warm water.

Having thus prepared our sign and gold size, and marked the letters out, we take a suitable sable pencil and line and fill them in with the size, and leave it to get nearly dry. The great point now to be decided upon is, when is the size ready to take the leaf. This is somewhat difficult for the novice to decide. In the first place, if it is too moist and tacky, the gold will sink right into the size, and lose all its brilliancy, besides showing every joint and looking dirty in places. Secondly, if it has got too hard, it has lost most of its tackiness, and there is not sufficient left to cause the gold to adhere properly. The beginner generally fails from the first cause, but he is just as liable to err in the opposite direction if he allows too long an interval to elapse between brushing on the size and applying the gold leaf. The state of the atmosphere has, of course, a lot to do with the drying, and the drying qualities of the size vary in a great degree; so, as no two cases are alike as regards time of drying, a sharp eye must always be kept upon the work. I cannot give more explicit directions, beyond saying that a very slight tackiness will cause the gold to adhere, and this is all that is required.

Taking for granted that the size is now right, we proceed to apply the leaf, and as many signs are painted and lettered in the shop, we will first attempt the work indoors where no one can see our failures, or make us nervous by looking on. This is the tip and cushion process. Taking up the book of gold leaf, we open the first leaf, and breathing very gently at the edge of the leaf, and holding the book at the same time close down to the cushion, we cause the leaf to fall upon it. About four leaves are quite sufficient for the novice to take out at once, as he will be sure to waste the lot, and a few books besides, unless he has an "old hand" beside him to give him personal instruction.

Some, however, are bound to be self-taught, or not at all, so instead of paying for a tutor, they have to pay for experience, which comes to the same thing.

We now take the cutting knife, and wipe it to free it from moisture, and gauging the width of the letters, we cut the leaf into suitable sizes. A little dexterity is required in using the knife, and the quickest way to attain it is to get a practical man to show you "how it is done." We next take the "tip," and drawing it lightly through our hair, we lay it upon the leaf lengthways, and gently carry it from the cushion on to the sized letter; this operation is repeated until the whole of the letter is gilded, when we apply a slight pressure by dabbing it over—very lightly—with a piece of cotton wool, the mop, or the dabber, according to fancy. The whole of the letters are treated in this way until the job is finished. It is very seldom this method of gilding can be employed in the open air, but if it can, it is certainly best, as the gold leaf can be laid upon the size without pressure, which adds very much to its brilliancy, but when the gold is laid on from tissue paper or from the book, a certain amount of pressure must be used, and this is liable to disturb the size, and press the gold into it, and cause very uneven work.

We now come to outdoor gilding, and in this, writers of the old school simply take up a book, turn back the paper leaves, and without any cutting, place the leaf direct against the sized letter; this, I may say, is a very wasteful way of going to work, as if there is the slightest wind a great deal of the gold is wasted. The slightest movement in the air renders it very difficult to proceed in the way mentioned, and for this reason, when gilding with the tip or without it out of doors, the sign-writer is generally surrounded with a large coarse sheet to shield him from the evil effects of the wind.

The easiest of all methods in gilding is with the transfer gold leaf, the preparation of which I have already described. The work is very simple, as the leaf is now so easy to handle; this is the way to do it. Open the book at the first page, and take out the tissue square (with the metal attached) with the left hand, place it with the gilded side on to the letter, and with the right hand gently and lightly rub it with a piece of cotton wool, but only on that portion which you wish to adhere; now remove the tissue and apply what leaf there is left to another portion of the letter until all is used up.

As the tissue is transparent, it is very easy to see how much gold is used each time, so that every particle can be used up for odd corners and soon. And, moreover, there are no ragged edges with the gold flying all over the place as in the old method. Always save the tissues, as they may be used over and over again with an occasional re-waxing. As regards the application of Dutch metal, I presume that the ordinary oil size may be used as in gold leaf, but for theatrical purposes we use a preparation called madong, and this is how we make it. "Take equal parts of pitch, Venice turpentine, resin, beeswax, and Russian tallow (all to be had at the colour shop), put them into a madong pot and melt them together, but should the mixture work too stiff and thick, add more wax and tallow. The more tallow that is added, the more pleasantly it will work, but if too much is added, it will never harden sufficiently to work upon. It can be used harder in hot weather than in cold, as the heat keeps it 'tacky.'" Apply hot with a camel's-hair brush.

I need hardly say that this must not be used upon a sign-board; I give it to the sign-writer as a valuable secret recipe—secret no longer, perhaps—by which he will be able to gild letters upon canvas and other material for all temporary decorative purposes.

Writing with gold powder or bronze is hardly worth mentioning here I fancy, although I have used a great deal for room decoration, which has kept bright for years when applied by my own process. There is, however, real gold powder to be obtained, the price of which is 7s. 6d. per pennyweight, and pure silver powder at 14s. per ounce, or 1s. per drachm. Bronzes of all shades and colours run upwards from tenpence to two shillings per ounce. Bessemer's gold bronze, as used by the *Graphic* newspaper people, may be had at 4s. 6d. per pound direct from the manufacturer, and this is what I always use myself with good results.

There is a great deal more to be said and learnt upon the art of gilding letters, sign ornaments, Royal Arms, medals, etc., and all this is fully set out in Mr. Sutherland's "Art and Craft of Sign-Writing." As regards these pages, however, my readers must now rest content with what I have given them upon this interesting branch of the letter-maker's art.

I am now, through stress of space, obliged to bring these articles to a conclusion, but I have far from exhausted my subject. I would remind the student that he must not stop where I have left him, but keep going on and on, till he reaches that ambitious goal, perfection.

In conclusion, I can honestly recommend, as an advanced text-book, "The Art and Craft of Sign-Writing," by Mr. W. Sutherland, price 21s. This book measures 18 in. by 13 in., and contains twenty pages of alphabets (some in colours) and designs for sign-writers. Also coats of arms and shields, emblems for church and other decorations, with full instructions as to all methods and processes. Altogether, it is the most complete work published upon the subject with which it treats.

ELECTRIC CLOCK FITMENT.

BY H. J. L. J. MASSÉ.

After reading Mr. Bonney's article on "Electric Alarms" in a recent number of Work, I thought that some readers might perhaps be interested in another electrical clock fitment.

My drawing-room clock is an old Louis XIV. eight-day upright, with a movement made in Amsterdam nearly two hundred years ago. As a time-keeper it is practically perfect, and being in want of a striking clock on the bedroom floor, it occurred to me to fit up a single-stroke electric bell in connection with the old clock downstairs. After purchasing a single-stroke electric bell, two Leclanché batteries, a switch, and some wire, I set to work.

I did not wish any of the wires or fittings to show in the drawing-room, so I carried the wires from the back of the clock-case along the wainscoting, pushing them underneath where I could, then out into the hall up along the mouldings of the door-posts, and along the edge of the stairs, as invisibly as possible, till they reached to the electric bell, which I had fixed on the top of my bedroom door.

Of the method and the rationale of connecting the wires to the battery and the bell it is not necessary to speak, as all requisite descriptions have been given in previous articles. It will be enough to say that the circuit is only completed when the hammer of the clock rises preparatory to striking the hour. One of the insulated wires is securely fixed on to the thin metal rod which forms the handle, so to speak, of the clock hammer, and a portion of this wire (about half an inch or so) is laid bare, care being taken to so fix it that it does not touch the clock anywhere. The other end of the wire is fixed on a small bracket, at right angles to the wire on the hammer, and has likewise a small portion laid bare. When the hammer is raised to strike the hour the two bared portions of wire touch; the circuit is then completed, and the electric bell strikes upstairs.

The batteries—of which there are two, a No. 1 and a No. 2 Leclanché—are on two small brackets fixed to the back of the clock case, where they are, of course, invisible, as the clock stands across a corner of the room, though they are easily accessible

I found that a single cell Leclanché was not sufficient to do the work alone.

The switch is fixed upstairs, so that the clock may not strike upstairs during the daytime, or whenever its striking would seem to be undesirable.

At the present time I am endeavouring to find a means (electrical, of course) of pulling the cord which makes the clock repeat. This would enable me to tell the time at any hour of the night without the necessity of striking a light, or, what is worse, especially in winter, of getting up to see the time.

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

The Optical Portion—Use of the Instrument—Conclusion.

(*For Illustrations to which references are made in this Paper, see pages 424, 425.*)

Seeing that all necessary processes required in lacquering and polishing the exterior of the instrument have been frequently dealt with by other writers in the current volume, it seems superfluous to again revert to these matters here. We will, therefore, pass these by and concern ourselves with the interior, which should now have a coat of dead black paint; ivory black would be most suitable, made up thin, and sparingly applied to all surfaces except those in sliding contact.

The two pieces of patent plate glass required for the reflectors are 8 in. long, 2 in. wide, and $\frac{1}{12}$ in. thick, and previous to silvering the surfaces, all sharp edges must be removed by rubbing on a level piece of sandstone with water, all grit being afterwards cleared away by well washing and rinsing in clean water. Our next business is to make up the two solutions to be used in silvering. The first is prepared by dissolving 72 grains of nitrate of silver in $8\frac{1}{2}$ ounces of distilled water in a clean glass jar, capable of holding a pint or more. Holding the jar to the light so that you can see through the liquid, add slowly a few drops of solution of ammonia, when a precipitate will be formed; more ammonia must then be added drop by drop until the precipitate is *nearly* re-dissolved. Be very cautious in this latter particular, as if the ammonia is rashly poured into the jar the precipitate will suddenly form and as suddenly disappear. Filter, and after adding another $8\frac{1}{2}$ ounces of distilled water, label the jar—"Solution A."

The second is prepared by dissolving $15\frac{1}{2}$ grains of nitrate of silver in 17 ounces of boiling distilled water; whilst still boiling add 12 grains of Rochelle salts which have been previously dissolved in half an ounce of distilled water, the boiling being continued until the precipitate which forms becomes grey. Filter, and when cool, pour into a jar and label—"Solution B." If distilled water is difficult to procure, rain water, if caught in the country and filtered, will serve for the purpose. The boiling may be conducted in a flask on a retort stand, or in a porcelain dish covered with a glass plate, and heated on a stove. When these operations are complete, the two glass plates must be made chemically clean by rubbing them with a slip of wood dipped in strong nitric acid, the process being conducted in the open air to avoid inhaling the noxious fumes. The acid is then washed off with soft water and a solution of caustic potash applied in the same manner, after which alcohol or rectified spirits of wine is applied. Lastly, they are thoroughly washed in distilled water, and placed, whilst still wet, side by side in a clean dish, when equal quantities of the solutions A and B are poured over them and mixed by stirring with a glass rod. Six or eight ounces of each solution will be sufficient, and a meat dish will be found to be a suitable vessel for the purpose. If any suspicion is entertained as to its cleanliness, it will be well to subject it to the same searching process as described for the glass plates. At a temperature of 60° the silvering will be complete in two and a half or three hours. The glasses are then taken out, washed in distilled water, and when dry the surface may be polished with rouge, gently applied with a small pad of cotton wool. The reflectors may now be said to be in readiness for fixing in position, by applying a little cement to the backs in a few places where the glass is in contact with the slips of wood on which they rest, being careful to notice that the mirrors clear the case equally at each end, and also to refrain from applying pressure, but simply laying them on the supports at *i*, Fig. 2, and leaving them in that position for a day or so to allow the cement to harden; after which the slips at *h*, Fig. 5, may be gently screwed in their places, and the angle of the lower edges carefully adjusted by the screw at *f*, Fig. 2. A suitable cement for attaching the reflectors consists of 1 ounce of isinglass dissolved in $1\frac{1}{2}$ ounces of glacial acetic acid, the bottle containing it being placed in a little warm water when required for use.

Fig. 8. Fig. 9. Fig. 10.

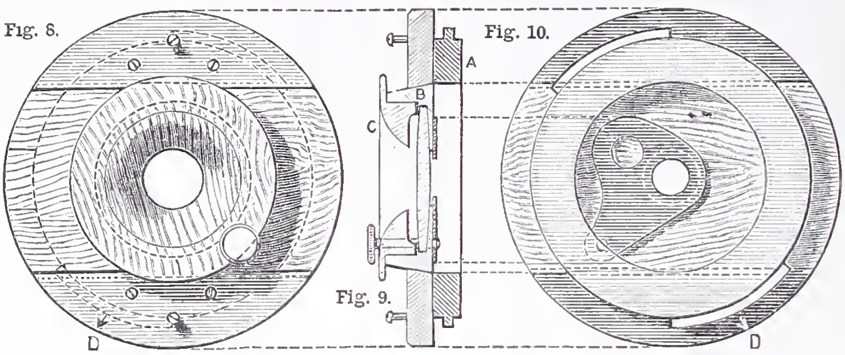


Fig. 8.—Front View of Small Eye-piece of Compound Kaleidoscope. Fig. 9.—Section of ditto, showing Lens and Method of mounting the same. Fig. 10.—Back View of ditto, showing Position of Diaphragm. (Scale of Figs. 8-17 inclusive, half size.)

Fig. 11. Fig. 12.

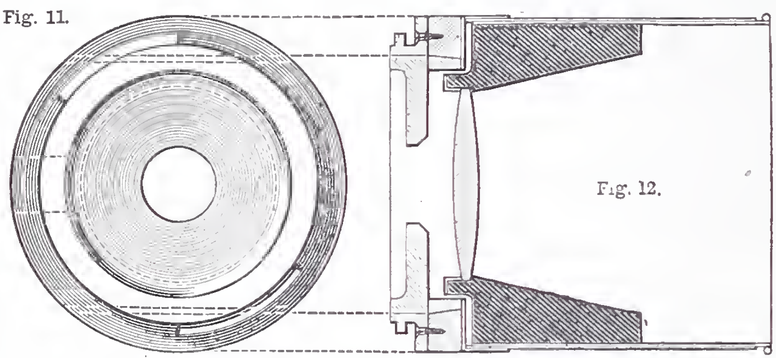


Fig. 11.—Back View of Larger Eye-piece. Fig. 12.—Section of ditto.

Fig. 13.

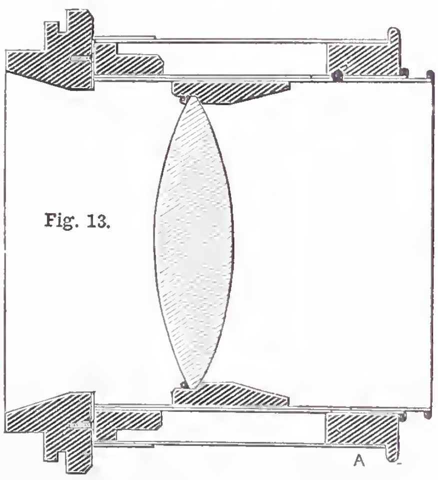


Fig. 13.—Sectional View of Objective.

Fig. 14.

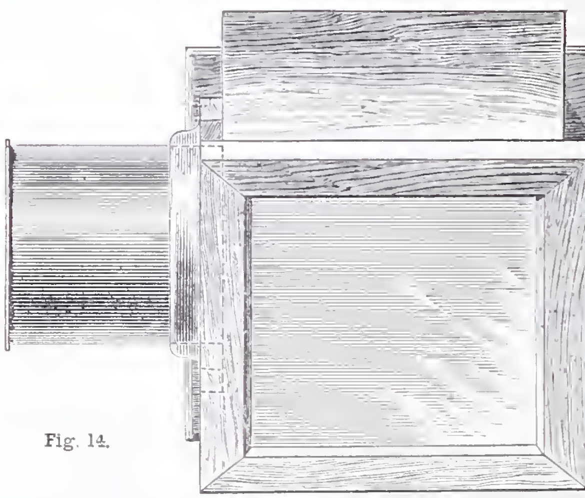


Fig. 14.—Plan of Camera Obscura for Use with Compound Kaleidoscope.

In replacing the sides of the case which have been removed to reach the interior, it would be an improvement to affix a pair of hinges and a catch to the side on the right of M, Fig. 2, to accelerate the process of cleaning the reflectors, which is effected by means of a camel-hair brush.

When satisfied that the working of the instrument is perfect, by testing it in the various movements of which it is capable, as described in the first paper, we may now bestow some attention on the construction of object-boxes. In these there is room for great diversity of form, according to the purpose for which they are intended. The object-box shown in section at z, Fig. 5, is intended for the reception of transparent objects which are attached by the cement already mentioned to the inner surface of the ground glass disc. When required for thin, loose objects, the space between the two discs is so reduced that it is impossible for one piece to slip behind another, and yet allow of perfect freedom of movement in the pieces. If it is desired to have two cells, one in front of the other, a disc of clear glass occupies the place of the ground glass disc; then a brass ring somewhat thicker than the objects in the second cell is laid in to support the disc of ground glass, and if deemed necessary, the ring of brass wire which secures the latter as shown in the section is replaced by a brass flanged ring similar in section to that which secures the lens in the eye-piece, as shown in Fig. 12. The process to be followed in making the object-boxes resembles that given in the case of the carrier, the outside being always finished first where the work in hand is so slight in character, as in this instance, for if the opposite course is adopted, on attempting to turn the outside, the work will bend and spring under the tool, and probably end by flying to pieces. To facilitate withdrawal from the carrier, they should be furnished with a round-headed brass screw at each side, in the same way as shown in the eye-piece (Figs. 8 and 9), the construction of which we will now pass on to consider. In the first place we must provide a ring, A, of particularly close-grained, hard mahogany, turned to fit smoothly in its bearing, being especially careful respecting the thickness of the tongue, so that when finished it shall be quite free from shake. To this ring is attached a dovetail slide, B, held by a piece at each side, secured across the grain by screws to the ring; the slide B carries an ordinary eye-glass which is mounted centrally, and secured by the cap, C. The opening in the slide under the lens is $\frac{1}{2}$ in. diameter, and to further close this aperture a diaphragm is provided at the back of the slide, having two holes $\frac{3}{8}$ in. and $\frac{1}{4}$ in. diameter respectively. The diaphragm is formed of a piece of thin brass, and is manipulated from the front by a small milled head, having a shoulder which bears on the slide, and the point is screwed and afterwards riveted or soldered to the diaphragm. In choosing the lens, it will be of a correct focus if print can be discerned or read clearly at a distance of 10 in. When finished, the eye-piece should have a deep mark cut on the upper edge, as shown by the crow's foot at D, Figs. 8 and 10, to indicate the exact position for entering the bayonet joint, after which a small pin or screw must be inserted in the grooves to act as a stop when the slide is exactly vertical, when it will be found that the latter requires grooving to clear the index above, and further, the ring requires cutting away somewhat to clear the diaphragm. There is yet another eye-piece to be made, as shown in Figs. 11 and 12, for projecting the picture on to a screen or camera obscura for copying. In this case the ring is heavier, and the screws which secure the guides on each side of the dovetail slide pass from the back, as seen in Fig. 12. The tubes required may be of brass, and may be procured of Messrs. Cotton & Johnson, 14, Gerrard Street, Soho, London, W., and secured to the woodwork by lugs of brass, soldered or riveted to the tubes. In the present case, however, they are formed of biscuit tins, the lid being firmly screwed to the slide while in the lathe, and perforated as shown in the diagram; the bottom is then removed with a file, and a short mandrel of wood is prepared to fit the tin tube, when the two lengths required are cut off truly at each end. The smaller tube carrying the lens is then reduced by dividing the seam with a knife, the mandrel being also reduced to take the two tubes, one within the other, after which the inner one is bound with wire at each end, and soldered afresh, the end being finished with a ring of brass wire to afford a hold of the tube in focussing, and the outer tube soldered to the lid. The lens, which is 2 in. diameter and 6 in. focus, is secured by a brass flanged ring, and mounted in a mahogany cell, turned to a tight, sliding fit within the smaller tube. The ring is then marked, and a recess cut as indicated by the dotted lines in Fig. 11, as adopted in the preceding case.

On precisely similar lines we must prepare the objective, shown in Fig. 13, but in addition, we require a larger tube and lid to form an extra draw, the difference in diameter being made up by a ring of mahogany attached to the inside of the larger tube at A, and a second ring fixed by screws to the outside of the middle tube. The lens is 3 in. diameter and 4 in. focus; it is mounted in a cell of mahogany, and held in position by a ring of brass wire. The camera obscura, shown in Figs. 14, 15, and 16, consists of a cubical box, whose interior measures 6 in. in every direction. It may be constructed of pine, and should be perfectly square. The ends are mortised into a baseboard, and shapen so that the top, which is left open, is inclined or tilted 30° from the horizontal line, the reason for this being that the picture

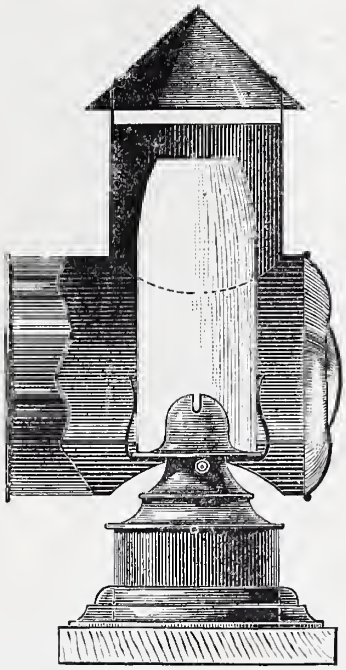
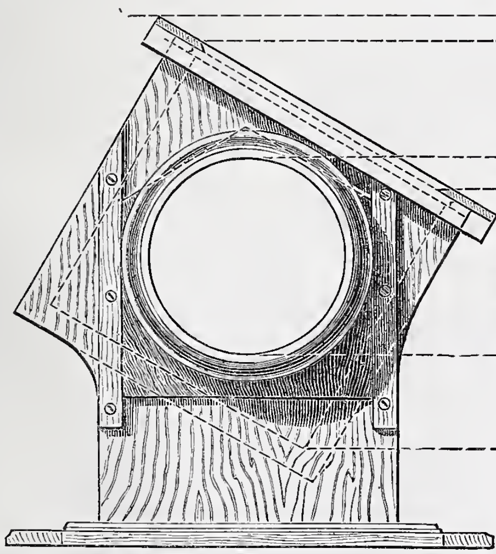


Fig. 17.—Lamp with Shade and Reflector for illuminating Objects.

may be viewed without inconvenience by the observer seated in front of it, the kaleidoscope being placed to the left. On the front is an opening covered with a slide which carries a tube projecting over the tube in the larger eye-piece, to exclude extraneous light. Previous to nailing the ends to the sides of the box, a diagonal line is drawn from one corner of each piece to the opposite, and immediately below this line a slip of wood is screwed to each side. On these slips the mirror rests, and the image is reflected upwards on to a piece of ground glass, which lays, ground face downwards, within a shallow ledge, $\frac{5}{16}$ in. wide, which runs all round the top of the box, the ledge being of the same thickness as the square of ground glass. Over this latter is a frame of mahogany rabbeted or built up as shown, which holds the tracing cloth or paper on which the picture or design has to be drawn.



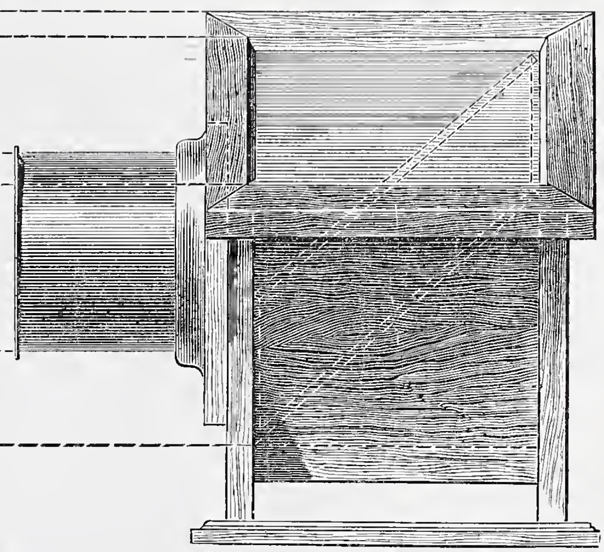


Fig. 15.—End Elevation of Camera Obscura. Fig. 16.—Front Elevation of ditto, showing Position and Angle of Mirror.

To intensify the light, and shade the eyes of the observer as much as possible, such a lamp as that shown in Fig. 17 will be found useful. It is furnished with a $\frac{3}{4}$-in. wick, and a silvered metal reflector, 5 in. diameter. The shade is of strong tin plate, and the lamp is mounted on a wood base, 6 in. wide and 8 in. long, which corresponds to the width of the kaleidoscope, so that on placing the instrument and any accessories not actually attached to the same, they may be kept central with each other on a board having slips screwed to its true face 8 in. apart, as shown in section, Fig. 15. All tubes in the optical portion should receive a coat of dead black, as advised in respect to the interior of the instrument itself.

An extremely useful addition to the object-boxes already mentioned is the oblong form. This is 10 in. or 12 in. long, and 5 in. or 6 in. deep, with a clear glass in front and one of ground glass at the back; it is placed in a slide in front of the objective, which projects the image of the objects arranged in the box, and illuminated from behind by means of the lamp.

By the exercise of a little ingenuity in the arrangement of the materials in the object-box, so that each colour harmonises with those in its immediate vicinity, and a careful adjustment of the light and focussing of the lenses, a series of patterns will be observed in the camera obscura which, by the brilliancy and the perfect harmony of their tints, will delight the eye of every beholder.

To assist the reader in the selection and combination of colours which harmonise with each other, I mention a few of the most important, viz.:—Red with green; yellow with purple; blue with orange; olive with orange; purple with citrine; russet with green; blue, red, and yellow; purple, green, and orange; olive, russet, and citrine. Space will not permit of my pursuing the subject further here, but the student is recommended to peruse the articles on this difficult subject in "Cassell's Technical Educator," by Professor Church, in which he will find it treated by a masterly hand.

The materials introduced into the object-boxes may consist of carved gems; lace; glass, either flint or crystal, plain, spun, or twisted; flowers; leaves; figures, cut out and cemented to the glass of the object-box; and when using the objective we may dispense with the object-box, and project the image at once on to the end of the reflectors, the most important thing being to have them strongly illuminated on all sides; sometimes they can be improved by cementing to mirror glass, and at others two lamps can be judiciously employed for the purpose, care being taken to exclude the direct image of the flame.

Respecting the application of the kaleidoscope to the arts, it is difficult to transfer the brilliant colours of some patterns to materials of a sober character, and therefore it appears most fitted for materials of a brighter and more reflective character, such as embroidering, and otherwise ornamenting in silk, and yet more especially in paper and glass staining and painting; and I cannot conclude these articles in a more excellent way than by quoting a passage from the writings of the talented discoverer of the kaleidoscope.

Speaking of the artist who forms windows of painted glass, he says:—"In this last profession, in particular, the application of the kaleidoscope cannot fail to indicate combinations far superior to anything that has yet been seen in this branch of art. From the uniformity of tint in the separate pieces of glass which are to be combined, the effect produced by the instrument from portions of the very same glass that is to be used for the windows may be considered as a perfect fac-simile of the window when well executed on a large scale."

THE SLIDE VALVE.

BY T. R. BLACKETT.

"Lap" and "Lead"—Eccentric Sheave.

The slide valve of a steam engine has been so often ably discussed that I have almost to apologise for writing a paper upon it. But, however, it is my intention to put the matter so plainly before my readers, that many who read this paper will know how to proceed, should they be called upon to set a slide valve.

Very few workmen, who build, and draughtsmen who design really high-class engines, are versed in the higher mathematical branches, hence my putting it in a practical light.

The parts of a steam engine move with geometrical precision with each other; thus every part must have some angular or linear relation with each other. Now such being the fact, why not do away with the time-honoured though time-taking custom of setting the slide valve before the eccentric is keyed on to the crank shaft? The proper angular relation of the eccentric to the crank is a right angle plus an angle obtained by the linear advance of "lap" and "lead."

By "lead" is meant the distance the steam-post is opened at the commencement of the piston's stroke. By "lap" is meant the distance the slide valve overlaps the opening edge of the steam-post at the end of *its* travel.

Let us take, for example, a common D slide valve (Fig. 1). We will suppose that it has $\frac{3}{4}$-in. "lap," and it is to be set with $\frac{1}{8}$-in. "lead" on each steam-post, with the travel or stroke of slide valve to be 4 in. We will now proceed to fix the eccentric, *for good*, in its proper place upon the crank shaft.

If a small shaft, we will put it on the surface plate or marking-off table, letting it rest in a pair of V-shaped bars.

The next thing to be done is to plumb the centre of the crank pin directly over the centre of the crank shaft; having done this, erect a perpendicular line from the bottom of the crank shaft, as shown in Fig. 2; next the total "lead" is $\frac{1}{4}$ in.; set the dividers to that radius, and mark off from the centre of the crank shaft *downwards* an arc cutting the perpendicular line *a* (Fig. 2).

Having done this, we take the total "lap," which is $1\frac{1}{2}$ in.; we set the dividers to that radius, and mark off downwards as before, from where the first arc cuts the perpendicular line to *b* (Fig. 2). We will now look to the stroke or travel of the slide valve itself; we find it is to be 4 in.; set the dividers to half that distance, viz., 2 in. Having done so, describe a circle from the centre of the crank shaft, which is called the travel circle. Here we take the scribing block, or, as some call it, the surface gauge; set the pointer or scriber at *b* (Fig. 2), and draw it along in a horizontal direction across the end of the shaft until it cuts the travel circle at *c* (Fig. 2). Now take a straight-edge and draw a line from the centre of the shaft, *o*, to the outside of

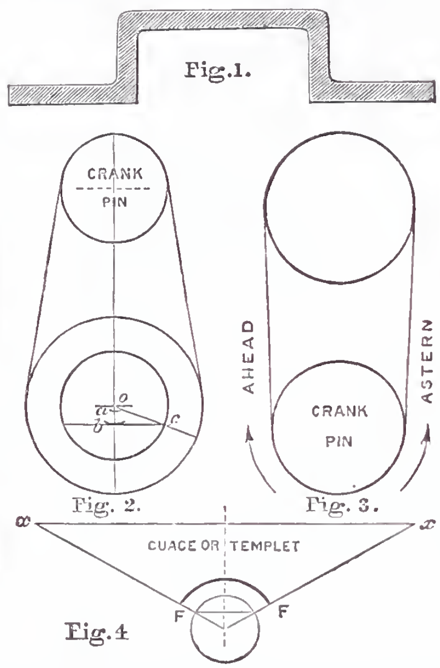


Fig. 1.—Section of D Slide. Fig. 2.—Plumbing Centre of Crank Pin over Centre of Crank Shaft, Centre Line of Eccentric. Fig. 3.—Plumbing Crank Pin for Marine Engine; Shaft to be Plumb, Pin down. Fig. 4.—Gauge or Templet; when tried upon Shaft for Marking Centre Lines, $x\ x$ to be levelled by Spirit-Level.

the shaft cutting *c*: this line produced along the shaft is the centre line of the eccentric sheave.

We have here the true geometrical relation of crank and eccentric sheave.

Although draughtsmen have for years followed this method of showing the position of the eccentric sheave upon the shaft, working mechanics have been loath to make use of the same method to fix their eccentrics, and keying them up for good.

But thanks to the advancement of education and science, we see old "rule of thumb" notions put to one side, and gigantic undertakings executed by practical mechanics on a scientific basis.

Again to our subject: the horizontal distance of the eccentric along the shaft, from centre of crank pin to the centre of the eccentric sheave, is equal to the distance from the centre of the cylinder to the centre of the slide valve spindle. I think that any one who makes himself master of the above facts, either the amateur making his model engine, or the professional workman in the workshop, who needs the instructions cannot fail to turn out an efficient engine.

In the case of a large marine engine, for example, where the crank shaft cannot be placed on a marking-off table, we have to plumb the crank pin *downwards* (Fig. 3), and make a gauge or templet (Fig. 4), constructing the same geometrical figure as described before, but showing both the ahead way and the astern way of the engines; the two lines, F F (Fig. 4), are the centres of the two eccentrics to be produced along the shaft. The thickly-marked lines are where the gauge is cut out to fit the shaft. The proper distance of the eccentric from crank pin is got the same way as the first-mentioned case.

When the eccentrics are keyed on, and the shaft is placed in position in the engine, the setting of the slide valve is now an easy matter, viz.:—Place the eccentric sheave on either of its centres, or, if you choose, put the engine on its "dead" centre; give the slide valve the required lead; our valve is now set.

These remarks are practical, and will, I think, be easily understood.

Marine slide valves are allowed more "lead" on the bottom steam-post on account of the obliquity of the connecting-rod, which I will describe fully in another paper, as well as the settling down by the wear and tear of the engines.

I have here endeavoured to set forth the vital parts of the steam engine, and should any amateur or his professional brother wish for further information, I shall be most happy to provide him with it, either through "Shop," or by post, if he will only pay the postage, as far as lies in my power. Having shown the proper place for the eccentric sheave, in my next paper, I shall consider the obliquity of the connecting-rod and its remedy; also reason of "lap" and "lead."

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

127.—Syer's Mitre Block and Saw.

It will doubtless be fresh in the memory of many of my readers that a full description of the appliance known as a mitre block, or mitre trap, was given in page 273 of this volume, and that its construction, and the mode of making one for one's own use, were clearly defined. To this paper, "A Mitre Block, and How to Make It," by David Denning, I must therefore refer all who wish for more than the necessarily brief notice I can give here in reference to the Mitre Block and Saw, which has lately been improved—I may say, perfected—following the general lines of the original appliance, and introduced by Mr. Thomas J. Syer, 45, Wilson Street, Finsbury Square, E.C., of the firm of Thomas J. Syer & Co., tool makers, etc., and dealers in all tools and appliances used in carpentry, joinery, and cabinet making, and Principal of the Finsbury Amateur School of Practical Mechanics. The mitre block is, as its name implies, a contrivance for mitreing joints, and available also as a means for squaring off the ends of pieces, such as door-rails, stiles, etc. Mr. Syer's mitre block possesses value in being exceptionally well-made, perfectly true, and admirable in action, the facility with which the movable block works, and its grip on the wood, that may be placed between it and the fixed block, being secured by the screw which is attached to it, and which is worked by an iron bar passing through the spherical termination at the outer end, as shown in the illustration given in Fig. 1. The projecting piece below the platform on which the blocks are placed supplies the means of securing the block in the jaws of the bench vice. The most attractive thing in connection with Mr. Syer's mitre block is the tenon saw that is supplied with it.

The construction of, and mode of handling adopted for, this saw will be understood from Figs. 2, 3, and 4, which show respectively the plan, the side elevation, and the end elevation of the tool. From these it will be seen that the

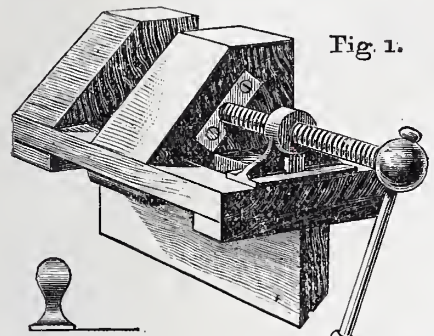


Fig. 1. Fig. 4.

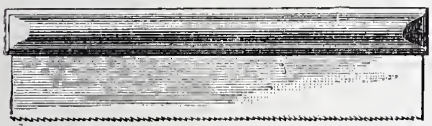


Fig. 2.

Fig. 3.

Fig. 1.—Syer's Mitre Block: perspective view. Fig. 2.—Plan of Tenon Saw, handled for Use with Mitre Block. Fig. 3.—Side Elevation of Saw. Fig. 4.—End Elevation of Saw.

saw blade is pierced with holes along the side opposite to the toothed edge, and that it is thus attached by screws to a handle extending the whole length of the side. This handle, being hollowed out on either side, can be grasped at any place along its length at the convenience of the operator, or can be worked from the end, near which is placed a hole (shown in Fig. 3) for the reception of the thumb. By this form of handle mitres can be sawn with the utmost ease, the surface of the blocks acting as a guide for the saw, which passes over them without doing any injury to them, as the heads of the screws are countersunk in the saw blade. The value of the saw lies in the fact that the blade is parallel to the guides over which it moves, and therefore makes a clean and true cut. This could not be done to the same extent, or so conveniently, with the ordinary tenon saw, as the thickness of the back would tend to throw the plane of the blade at an angle with the surface of the blocks. The price of the mitre block without the saw is 31s., or with the saw, 35s. The saw is supplied separately for 4s. 6d.

As a matter of course, the drawings of the saw given above will prove highly suggestive to many workmen, both in professional and non-professional ranks, and doubtless there will be many who will handle an old tenon saw in the manner shown above, after despoiling it of handle and back. I shall be glad to hear from any workman who may attempt the operation and prove successful in it. I can assure him he will find the saw a very useful one.

The Editor.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Wood Mitre Cramp.—J. S. A. (*Edinburgh*) writes:—"With reference to G. R.'s reply to J. C. (*Blackburn*) in No. 38, page 605, of Work, I give the following as a very simple and useful form of wood mitre cramp. Get a piece of birch or any other hard wood 1 in. square, and any convenient length, mark off with a square four pieces ¾ in. each; then make four holes through the corner (Fig. 1), saw off the four pieces, and shape them, as in

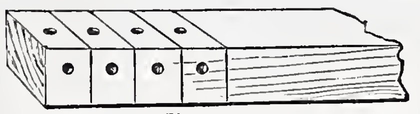


Fig. 1.

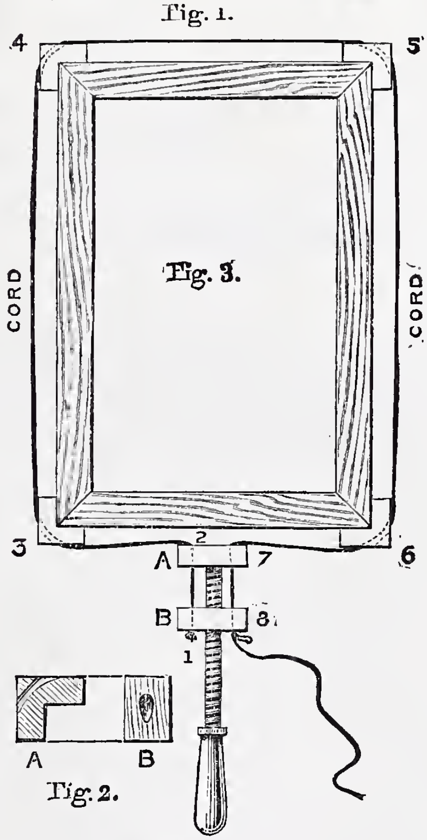


Fig. 3. Fig. 2.

Wood Mitre Cramp.

Fig. 2. Take a square piece out of the corner of each (A, Fig. 2), and shape the holes so that a cord will pass through easily (B, Fig. 2). Then you require a wooden screw, which you can get from any turner or joiner for a few pence, if you cannot make one for yourself. Fig. 3, I think, will explain itself. A is a piece of ½-in. birch 2 in. by 1½ in. In the centre there is a hole half-way through, into which the point of the screw fits, and on either side there is a hole for the cord to pass through. B is a piece of the same size which forms the nut of the screw, having two holes for the cord as in the other piece. Now get a piece of strong cord (not too thick), put a knot on one end, and pass it through the holes, beginning at 1 and finishing at 8. Glue your mitres, and lay the frame in position on a table; place one of the little blocks on each corner, keeping the screw at the side next you; then draw the cord tight, and put a running knot at 8, Fig. 3; then screw up, being careful to notice that your mitres are all fitting in properly. The frame must now be left in the cramp until the glue is dried, when it can be taken down and nailed with case."

Mail Cart Wheels.—J. J. K. (*Ireland*) writes:—"I am making a mail cart according to one of the designs in No. 30 of Work, and when I had the body made I got a pair of wheels from the Victor Cycle Co., Grimsby (as advertised in your Sale and Exchange column), for 7s., and I must say they are the best value I have ever seen, and send you the particulars for the benefit of my fellow-readers, who might be making mail carts. They are as follows: 23½ in. in diameter, rubber tires, axle, brass caps, washers, pins, etc. They set off my cart to perfection."

A Correction.—F. A. M. thanks Brum (*Keighley*) for the following:—Errata, Milnes Lathe, page 618, lines 21 and 23 from bottom, for "withdraw spring D" read "spring G"; for "arm D D" read "arm B B."

Useful Scroll Saw.—Artist in Wood writes:—"One of your correspondents says the useful scroll saw will not work; it is not likely it will work if a watch spring saw is the thing that is wanted. It is for cutting board, not thin fretwood."

Combination Bedroom Suite.—J. S. writes in reference to F. C.'s remarks (p. 684):—"Before reading your letter I had replied to T. B. R., and perhaps by this time you will have read my letter, wherein I state my objections to a drawer for basin, etc. Although 'two heads are' said to be 'better than one,' it depends upon whether they work together, or follow one another. Personally, I could not tolerate a partner, and I am afraid, if I had one, that one head would be worse—by a few punches—than the other; but I read such letters as yours in the spirit in which they are doubtless written—friendly. Concerning the suggestion of giving a summary of the total amount of wood required, very few writers do this, as space must be taken up, and any one with a small amount of arithmetical ability could manage it himself, as sizes of every part are always given. It would be almost useless to mention the cost, as Work pokes its ever-welcome nose into districts so far and wide apart that prices are bound to be different in some of them. You will have seen that I said it would cost nearly as much to make one of the robes as to purchase a complete bedroom suite. The bottom side drawer front can be either 'mocked' or panelled. Why should the latter prevent dovetailing? The framing would have the same solidity as a whole board. Front drawers certainly do show bevels, and I intended in my written article to say that if made so, a small piece of wood would have to be fastened to the front of job on to which to hinge towel-rail. Certainly the risk is always at hand of the glass door falling downwards, but just as certainly is the risk always at hand of the whole article tumbling together, if not properly and strongly made. I have remarked in an article the Editor has in hand that it is difficult to understand sometimes how designers and inventors obtain their ideas. It will perhaps surprise you to know that the main features of the article under consideration 'came to me' at about three o'clock one summer's morning, after a fruitless endeavour to court and wed sleep. This is not always the case, but I should advise no one to start on this plan. About the thicknesses it would, no doubt, have been better had I stated some parts as being thicker than others, but it was not on account of ignorance. Some time ago I sold a design (the Editor has seen a copy of it) to a manufacturer, who made several of them. It was a differently constructed affair to the present one, and was 5 ft. 6 in. wide, although answering the same purposes. I have seen one or two that he has made, and it struck me, when I 'got up' this one for Work, that thinner stuff would answer the purpose for it. However, the idea doesn't seem to be relished. In a seaside hotel, in a gentleman's office, in the green room of a theatre, etc., the slight inconvenience of not being able to wash the hands often would be counterbalanced by the convenience of washing the whole head once or twice per day, without having extra furniture for the purpose. To avoid the effect of wet, why not paint the inside of the panel (as I said paint the outside of article) in an enamel which would stand either hot or cold water? The trouble of wiping the panel must not be considered. If you leave the panel open all day, and your clothes thus exposed to dust, etc., you will be able to wash your hands oftener; if you close the panel you cannot be accommodated with washstand, but your clothes will be free from dust. In conclusion, I must thank you for your letter, and ask you to criticise any other articles of mine if you see any faults."

II.—Questions Answered by Editor and Staff.

Book on Organ Building.—E. B. (*Longton*).—"Organ Building for Amateurs," published by Ward, Lock & Co., Salisbury Square, Fleet Street, E.C., price 3s. 6d., will give you all the information you require.—M. W.

Lathe.—J. E. (*Liverpool*).—Much has already appeared in Work upon working the lathe, and from time to time further papers will appear. Any specific question on how to use the lathe will be answered in this column if you will put such.—Ed.

Protection by Patent.—A. E. S. (*London, E.C.*)—The Patent Office protections cover Great Britain and Ireland and the Isle of Man. The Government stamp upon an application for a Provisional Protection is £1. Great care should be exercised in preparing specifications, which must be written in duplicate upon the properly authorised forms, and accompanied by the stamped application form. If you merely protect a shape or design, it is probable that you may require protection under the Designs Act, and not under the Patent Act. Should you obtain Provisional Protection under the Patent Act, it stands good for nine months from the date of the application, when the complete patent must be applied for, which will remain in force for fourteen years. The protection for a design is only given for a period of five years.—R. & C.

Bronzing Fishing Tackle. — BRONZING (*Leeds*).—I am sorry you have been kept waiting, but your letter inquiring about the bronzing of fishing tackle, etc., must have miscarried. The subject has, however, been brought forward in these columns in answer to other correspondents. Chloride of antimony applied to perfectly clean and polished brasswork will produce a charming violet steel colour, which I consider most suitable for fishing reels, rod mountings, etc., but whether the makers of such articles, or the connoisseurs among the fishing community, would approve, is another matter. Try it, however, before you decide. The brass should be turned up quite bright in the lathe, or "dipped" in the usual way, then heated moderately, and the chloride of antimony liquor applied with a rag until the work is evenly coloured, when it should be polished with a perfectly dry soft cloth and lacquered with clear—*i.e.*, colourless—lacquer. —OPIFEX.

Wheel Gearing.—G. R. (*Durham*).—The data you give are altogether insufficient. To design the wheels it is necessary to know the amount of force to be transmitted in order to determine the sizes of the wheel teeth, and of the driving chains and other parts. The ratios of the diameters of wheels to get the desired increase of speed will be as under:—Assuming the wheel, of which the circumference is to run at 40 miles an hour, to be 6 feet in diameter, it will make 200 revolutions a minute nearly. There must be a pinion on the shaft geared to a wheel 5 times its diameter on the next shaft, which must carry a pinion geared to a wheel 4 times its diameter, carrying a pinion 2½ times its diameter fixed on the shaft, which is to revolve 4 times a minute. If you let me know the class of machinery, if the size of the first or last wheel is settled, and the power to be transmitted, I can give you definite information from which you can work. Four revolutions a minute is remarkably slow for any kind of machine, except, perhaps, a water wheel.—F. C.

Magnetising Steel.—FLAX SPINNER (*Longton*). —In your former letter, sent me in July last, you asked for information respecting the means to be employed in developing the greatest power in an electro-magnet. From your letter just to hand, I gather that you wanted something different altogether. Why, then, make a mystery of your real wants, and enjoin me to secrecy? There is no secret about magnetising horseshoe magnets, or remagnetising them when they have lost their magnetism. You won't get a patent for the process. Make a pair of hollow bobbins, with holes in them to fit the legs of the magnet. To develop the greatest power in the magnet, wind on these enough No. 20 cotton-covered wire to make the whole three times the diameter of the hollow core. Wind one bobbin from right to left, and the other in the contrary direction. Connect the two together when on the legs of the magnet, and send through them the strongest current at your command. The current from your 10 Walker cells in series will develop considerable power in the small steel magnets. See also replies to C. E. B. E. (*Ebbw Vale*), V. R. (*Liverpool*), and ANXIOUS (*Liverpool*). I do not forget to answer the letters of correspondents. Every letter received has my prompt and careful consideration, but my replies cannot get into print as soon as you expect them.—G. E. B.

Magnetic Exploder.—A. C.—I do not know the conditions necessary to effect the explosion of benzine vapour by means of a magnetic exploder, so cannot tell you how to make the instrument. I hope to give an illustrated description of a small magnetic dynamo in a future number of WORK, and this may possibly suit your purpose, as it will make a wire white hot, and give sparks. I cannot give you any idea here in a few words how to make the machine, so must ask you to wait until I can explain it in detail.—G. E. B.

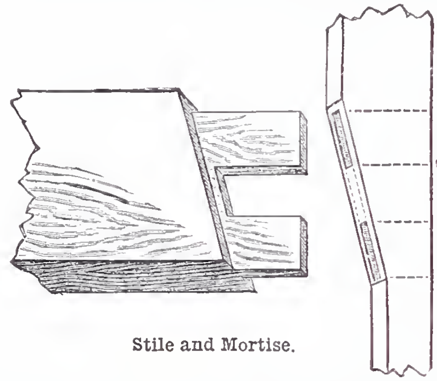
Shocking Coil.—J. B. P. (*Irthlingborough*).—Have you not heard that "everything comes to those who wait?" The coils will come by-and-by, and I hope the coil-makers are not tired of waiting. I have not forgotten them, nor my promise to them, but I wish to deal with the subject thoroughly when I set about it, so must first clear the bench of other jobs lying about on it waiting to be done. Dyer's book on "Coils" is a good, cheap book on the subject, costing only a shilling.—G. E. B.

Cleaning Engravings.—W. C. (*Somers Town*). —Put the soiled engravings in a bath of pure soft water—a flat porcelain tray or dish is the best receptacle; when thoroughly saturated, remove the pure water from the bath and add a bath of chloride of lime, which should be prepared by straining a strong solution of chloride of lime through muslin; watch the bath carefully, as the whole secret lies in *when to stop* the action of the lime: a few minutes will usually suffice, then rinse thoroughly in pure water, dry or strain.—F. B.

Repoussé Work.—J. L. R. (*Guernsey*).—All the necessary tools and materials for repoussé work may be obtained from Mr. Gawthorp, 16, Long Acre, London, and a useful little book of hints (6d.) for amateurs.—G.

Plating German Silver. — STRIPPER (*Soho*).—If your bath plates brass and copper well, and in a condition suitable for burnishing, but fails to deposit an adherent coat of silver or German silver, it shows either that you have not enough free cyanide in your solution to properly plate German silver, or you do not get each piece well coated before the other metals are put in the bath. Plate the German silver articles by themselves, and put in a small piece of cyanide just before immersing the articles in the bath. Also bring the anode a little closer to the articles at first, so as to get them quickly struck with a thin coat; then move it a little farther off whilst finishing. See to it also that the surfaces of the articles are slightly roughed in the acid pickle before being quicked in the nitrate of mercury solution, and transferred to the plating bath without loss of time, as German silver soon oxidises after it has been pickled, and the slight film of oxide would be enough to cause the deposit to strip under the burnisher.—G. E. B.

Door for Greenhouse.—W. H. (*Battersea*).—The framing of the door is made narrower at the upper part, to take away the heavy appearance which it would present if the stiles were kept the same thickness all the way up. The door stiles are first set out and mortised, then the upper part is cut down to the required width, stopping at the top of the belt rail, then bevelling off to the bottom of the belt rail. You will be unable to plane right up into the corner of the angle, and must use a chisel to finish off that part, taking particular care to keep the edge of the bevel quite square, as if it is unevenly done you will never get your joint to fit



Stile and Mortise.

closely. The ends of the belt rail are shouldered on the bevel to fit the stile. The accompanying sketch should give you an idea how to manage the work, the bevel of stile and mortise being shown, also the mode of cutting the double tenon, which you will notice is rebated at the under edge to allow for the grooving of the lower part of the framing to admit the panels. The upper edge has no rebate. The dotted lines on the stile show the position of the mortises. As you have succeeded so far with the building of the house, I hope you will not stick at the making of the door, but if you find any further difficulty I will be glad to help you out of it if I can.—G. LE B.

Porous Cell for Battery.—A. N. (*Waltham Cross*).—If you cannot get these cells in your neighbourhood, they can be sent by parcels post by Mr. Dale. See his advertisement in WORK, and write to him.—G. E. B.

Browning Gun Barrel.—W. B. (*Kent*).—For two recipes for browning a gun barrel I refer you to replies which have already been given in WORK: but, in case you might prefer a more elaborate process than that recommended to Paddy Brown, you can try the following, which is from the U. S. Ordnance Manual, as quoted in the *Scientific American* of September 21st. "Spirits of wine, 1½ oz.; tincture of iron, 1½ oz.; corrosive sublimate, 1½ oz.; sweet spirits of nitre, 1½ oz.; blue vitriol, 1 oz.; nitric acid, ¾ oz. Mix, and dissolve in one quart of warm water, and keep in a glass jar. Clean the barrel well with caustic soda water to remove grease or oil. Then clean the surface of all stains or marks with emery paper or cloth, so as to produce an even bright surface for the acid to work upon, and one without finger marks. Stop the bore and vent with wooden plugs. Then apply the mixture with a sponge or rag, and expose to the air for twenty-four hours, when the loose rust should be rubbed off with a steel scratch brush. Use the mixture and the scratch brush twice and more, if necessary, and finally wash in boiling water; dry quickly, and wipe with linseed oil, or varnish with shellac.—OPIFEX.

Coin Duplicates. — E. H. (*Plumstead*).—With reference to the first query in your letter, as to a publication which gives directions for making duplicates of medals, etc., I am sorry I cannot inform you, and hope that if any of our readers know of such a book they will let us know in these columns. I daresay that the method which I suggest is roundabout and clumsy, but I have found it answer very well, and so, hoping it may help you, give it for what it is worth. Half fill a shallow box or dish—I use a half-plate developing dish—with best plaster of Paris, in thick paste. Brush your medal over on one side with some of this paste. To guard against air-bubbles, lay the medal upon the surface of the plaster, press firmly and evenly until the medal is embedded, and the upper surface is flush with the surface of the plaster; see that the plaster touches the edge all round, and that it is not too thin and watery. Repeat these operations for as many medals as the bed will accommodate, leaving an inch at least clear round each. All this must be done as quickly as possible, as the plaster sets very rapidly; and it is better to make the experiment at first with one or two of the largest specimens. Now lay aside until the plaster is thoroughly set, and place in a moderately hot oven or before a hot fire to dry. When dry, with a sharp knife cut several angular grooves near the edge, say one on each of the sides; let these grooves be clean cut and V-shaped, and placed in such a way that they may not interfere with the medals, etc. Now dust very finely powdered blacklead over the face of the bed, and polish with a very soft brush, or rub lightly with the finger. Now mix sufficient plaster paste to fill the dish, etc.; paint over the medals as before, and pour in the plaster as quickly as possible; allow to dry thoroughly as before, and turn out carefully. The two portions of which the mould is composed may now be easily separated by gently prising at the line of juncture, when, if all has gone well, the medals, etc., may be removed—this very cautiously, so as not to crumble the edges —and we should have a perfect mould, the upper portion of which may be placed in exact position, being guided by the key grooves. The next step is to cut grooves from the edge of the medal to the edge of the mould—two for each medal, which are cut side by side, one to pour the metal through and the other as an air escape. Of course, half of each groove will be cut on each portion of the mould, and the groove for the metal should taper from the side of the mould to the edge of the medal, while the air vent need not be so tapered. Remove all particles of dust very carefully with a large camel-hair brush from the surfaces of the mould; place them together, and clamp them together. Place the mould in a hot oven, and get your metal ready. I use lead, tin, and bismuth, equal parts. Melt and well mix, and pour out into a bar; again melt, and it is ready for use. When the mould is hot—as hot as an ordinary oven will make it—hold it on edge, and very carefully pour in your metal; let stand in same position until cold. Open mould carefully, and the rest will suggest itself.—OPIFEX.

Sign-Writing. — TYRO (*Queensboro'*).—This is somewhat a pure matter of opinion, and you are quite as much right as you are wrong. It would perhaps have been better if you had added the letter "s" and made it read "Brightmans, Coal Merchants," when there could have been no doubt about the surname being in the plural number. At the same time, if a name is used to designate a firm of traders, such as in your own case, the very fact of you writing "coal merchants" conveys to the reader that there is more than one person connected with the firm, and consequently the whole is in the plural number. But, as I say, there are many to differ from me on this point, as with yourself. There are many well-known examples which you may point to in support of your contention, such as "Goy, Limited" (the word "limited" conveying the same information here as the word "merchants" in your case), or "Eastmans, American Butchers," a company which has a shop in almost every large town in the kingdom.—H. L. B.

Photographic Slides for the Magic Lantern. —JOHN BULL asks the following questions:—"How to make photographic slides for the magic lantern, and can they be made out of the plates?" Now, Mr. Editor, I do not want to develop into a growler in my old age, but will you allow me to say just a word in protest against such vague questions? It is a common fault with persons to ask questions in such a way that one is at a perfect loss to know what is wanted. I believe that the art of asking questions is one that few understand. Their want is palpable enough to themselves, but either they have not the power or are unwilling to take the trouble to place the idea—the word picture—before the mind of another. Now, I am not writing this in an unfriendly spirit, or through captiousness, but that our mates in the "Shop" may be induced to state their wants clearly, as it will save much time on the part of those who desire to help them, and very often much space in WORK—which is even of greater value. Now to refer to the question, I must presume a great deal: first, that J. B. can take a negative, etc. To take a transparency, make a wood tube, 5 ft. long and 3¼ square inside measurement. Half an inch from one end glue four very small angle pieces in the corners, so as to form a ledge for the negative to rest on, with the picture side towards the end. Now lay a wet plate on this, but separated from it by $\frac{1}{16}$ of an inch, with the prepared surface towards the negative; fasten this in its place by any mechanical means that may suggest itself. Seeing that the end is light-proof, bring it into the light, and tilt the tube towards a north light if possible. Length of exposure must be determined by experiment—say five seconds; develop in the usual way. If I have not guessed the right answer, please ask again, and state distinctly, and I will try to give the needed information. As to the second question, "Whether they can be made out of the plates," I must treat it as a conundrum, and give it up.—O. B.

Electric Breast Pin.—QUOCUNQUE JECERIS STABIT.—An electric breast pin is made up of a very small incandescent electric lamp set in an ornamental metal setting, much as a stone would be set in a scarf pin or brooch. The tiny globe of glass, the size of a large pea, is very fragile, and can only be fixed by a skilled workman trained to do such things. Connection is made with the two tiny terminal wires of the lamp, at the back of the brooch, with a small flexible two-wire cord, leading to a small battery kept in the breast pocket of the coat. The lamp itself will, probably, cost you 5s., and you can get the pins for 7s. 6d., so it would be scarcely worth your while to attempt making one yourself, for you would run the risk of breaking one or two lamps in the attempt. Respecting the battery, see replies to ASCA (*Newcastle*), VENUS (*Norwich*), and H. E. (*Leicester*). Small accumulator cells are sold for the purpose at £1 each.—G. E. B.

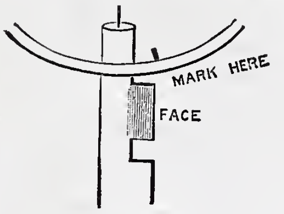
Telephone Magnets.—D. A. C. (*Aberdeen*).—I am very much pleased to find that my article on the telephone has been appreciated, and that it seems to have raised an interest in this subject among the readers of WORK. The magnets which you inquire about, and suitable for your purpose, can be had from Messrs. King, Mendham & Co., manufacturing electricians, Western Electrical Works, Bristol. The size is 5 in. by ⅜ in. (the form is round), and tho price is 10d. each; if fitted with adjusting screw 4d. each extra. I am sure you would be able to purchase such magnets in Aberdeen. If you cannot get them the exact size and make, take the nearest thereto, and make the other parts to suit. Why not make them yourself?—W. D.

Fret Saw and Lathe.—MENDICUS (*Newcastle-on-Tyne*).—As a rule combination tools and appliances are not so satisfactory as those which are simple, and I do not think you will find fret saws and lathes any exception. The combinations, however, are by no means useless, for very fair work can be done with them. The principal objection I have against them is that the lathe is of small size and power. The Goodell and Companion lathes are the best in this respect, but the sawing arrangement is not of the best. If you want a really good fret-sawing machine there is nothing to equal the Britannia Co's. No. 8. This, however, has no lathe attachment in the ordinary way, though the manufacturers will supply one when desired, and from the unusually heavy flywheel of the No. 8 you will be able to manage any turned work which could reasonably be expected from a small lathe. I should, however, strongly recommend you to have lathe and fret saw as separate articles, for though at somewhat extra cost you will secure far greater efficiency. The same company's *multum in parvo* lathe is a really practical one at a small price. Let me say that you are not altogether correct in stating that the finest class of fretwork cannot be undertaken without the aid of a machine. As a matter of fact the finest work—viz., that in connection with inlays of veneers—is done with the hand frame. A good machine is quicker and more powerful than this, but that is all.—D. A.

Medical Coil.—W. B. C.—(1) A 3-in. coil should have a core 10 in. in length by ⅜ in. in diameter, and be wound with 2 layers of silk-covered No. 16 B.W.G. copper wire, weighing about ½ lb., as a primary. The secondary may be wholly of 4 lbs. No. 32 silk-covered copper wire, or made up in 3 powers, with 1 lb. No. 32, 1½ lb. No. 34, and 1½ lb. No. 36. (2) Chromic acid is preferable to bichromate of potash, because it does not deposit crystals in the pores of the battery plates. 3 oz. of chromic acid in a pint of water, acidulated with 3 oz. of sulphuric acid. (3) Dyer's book on "Coils" will give you a tolerably general idea of their construction, but I cannot recommend a book treating specially on medical coils. This part of the subject will, however, come up for treatment in the next volume of WORK, when we deal with induction coils.—G. E. B.

Switch for Electric Time Alarum.—ONE IN NEED (*Coventry*).—I must refer you back to the illustrations, Fig. 13 and Fig. 14, on page 497. Cut out a round piece of hard wood, 4 or 5 in. in diameter, and hollow it on one side, as shown in Fig. 14. Smooth and polish the other side. This will form the base of the switch. Now make an arm of spring brass, 2 in. in length by ½ in. in width, and a thickness of about ⅛ in. Drill a hole in one end to receive the pin in which it is to be pivoted. Drill a similar hole at the other end, and rivet to that end of the arm a button of bone, hard wood, or of brass. The pivot on which the arm moves should be in the form of a small brass bolt, with a nut to tighten it on the underside of the base. Pass this through the arm, then through a small brass collar to raise it from the base, then through the base in the centre. Next cut out two thin and narrow strips of brass to the shape shown on Fig. 13, and turn up a tiny piece of each to form stops; drill holes in each to receive small brass screws, and fasten these to the board. One of these strips is connected by a small bolt, or brass screw, to one end of the line wire, as shown at Fig. 14, and this is marked ON in Fig. 13; the other strip is merely a rest for the arm when we wish to switch the bell off. The other end of the line wire is secured to the nut of the pivot bolt, as shown at Fig. 14. The arm forms the connecting link or bridge between one wire and the other, and by moving it to the right the bridge is broken and the bell switched off. The switch may be put in any part of the circuit between the bell and the clock, or between the clock and the battery, wherever convenient to you. You have only to cut the wire at the spot where you wish to fix the switch, and connect the bared and cleaned ends to the two parts of the switch—one to the arm pivot and the other to the screw of the brass stop. You may make the base square if you like, and may fix all the wires to the face of the base instead of the back; but this does not look neat, otherwise it will work equally well. Respecting the lattice arm, the pillar (Fig. 7) is screwed into its foot (Fig. 8), and the lattice arm is pivoted to the top of the pillar. As these parts are therefore in metal contact with each other, you have only to fix one of the wires to the base of the pillar by means of one of its screws.—G. E. B.

Watch Repairing.—AN AMATEUR.—Thanks for appreciating "Watch and Clock Cleaning," and your patience in waiting. To loosen cylinder, have a piece of iron—smooth—with a hole in it that will just take cylinder; now have small hammer ready and very small punch—say a stout needle, point just off, if nothing better; warm by holding over gas jet with your tweezers, then pop it into hole and tap it out all round. In refitting new cylinder, have correct depths for pivots, and be sure height of escape part is right so as scape wheel will clear it. Before taking out you should make a mark upon balance rim, for the face of cylinder scape part, as in the accompanying illustration. So in replacing you will have no trouble about the three holes you set it in beat, or the next who may clean; you understand what I mean. When cylinder is ready to fix, and a neat fit, and all is set right to receive brass collet for height, etc., place it on, and heat it over small gas flame and touch it with shellac; it will be secure enough if hot enough to penetrate, but not too hot to alter tempering. Names of all parts are with each article. Repair prices I would not like to be printed; I should upset a hornet's nest.



Balance Rim, etc.

Enlargements.—A. S. (*Sheffield*).—With the enlarging camera described in No. 13 of WORK, you can enlarge up to 12¼ in. by 10¼ in. To make pictures from ½-plate negatives to the size you want—viz., 24 in. by 19 in.—you will have to increase the size of the back and front of the camera to suit, and increase the length of the baseboard to 6 ft.; the sliding boxes that carry the lens must also be lengthened—say, about 3 in. more than the size given. The lens used in taking the negative will be the most suitable for use in the camera, and in making such large pictures you must use a small stop to preserve the sharpness of the image. Use a focussing glass, as it is difficult to tell by the eyes alone when the image on the ground glass is quite sharp; and if you cement a small circular piece of thin glass (such as is used for covering microscopical slides) to the centre of the ground glass screen with Canada balsam, you will be able to get accurate definition by focussing on it. Use pine in preference to red deal, it is much easier worked. All the details of the camera remain the same as described in No. 13, and the manner of construction will be exactly similar, with the exception of the increase in the sizes of the parts I have mentioned. I am sure you will find much pleasure in the use of the apparatus, as you will be able to produce by its aid very fine wall pictures, that is, of course, supposing that you have suitable negatives.—G. LE B.

Polishing Boxwood.—E. C. (*London, N.*).—I must repeat once more that unless inquirers will state clearly and fully what course they have adopted whenever results of polish are not satisfactory, it is quite impossible to do more than surmise what is wrong. Numerous causes might be named as the reason of your failure to get a good surface, and very likely none of them might be the correct one. Describe your process, and then I shall very likely be able to tell you how to improve. In the meantime I can only suggest that you have used your rubber too wet. If this is not so, I cannot assist you at present, owing to the very limited data to go upon. To spirit off use a clean rubber moistened with spirits instead of polish, but if you have not got a good body on it is hardly worth your wasting time in spiriting. Glaze certainly gives a common-looking finish, especially on a badly-prepared surface, but so would spirit.—D. A.

Polishing Baywood.—SALFORD LAD.—I do not know of any wood called Spanish baywood, but I am inclined to think you have misnamed it, and mean simply Honduras-mahogany or baywood. This is commonly used in your trade, the choicer Spanish mahogany being more employed where appearance has to be studied, as in furniture. If you will refer to No. 31 of WORK you will find the particulars you want are given in the middle column of page 493.—D. A.

Turkish Bath Making.—R. S. H. (*Dover*).—There is no occasion for anything elaborate. You can make a really serviceable portable Turkish bath without a mortise, tenon, or dovetail in its construction, nor are framed panels at all essential. All you have to do is to use nails instead. You probably know how an ordinary packing case would be made. Well, look upon your portable bath as a packing case, and with the knowledge you already have I hardly think you will require any directions beyond these few hints.—D. A.

Staining to Walnut.—W. G. (*Dalston*).—Having enamelled your washstand I am afraid you will not find it at all an easy matter to make a good job of it by doing as you propose—viz., staining it walnut colour. I certainly would not advise you to try this, as the result will probably not be satisfactory. If you want it walnut colour I should recommend you to paint (enamel) it. If, however, you wish to stain you must first remove the present coating. This you can do by scraping on any parts which can be got at by the scraper, and washing with strong soda and water. Why will the plane not take? After having removed the paint in whatever way may be most convenient, you must apply the stain in the usual manner, but it is more than likely that the stain will not be even. I have now told you what may be done with the best chance of success, but I cannot advise you to undertake the work. If you can give the date of former letter possibly it may be traced, but as it has not been answered, it is not at all likely it ever came to hand. You will easily understand it is hardly possible to look through the correspondence for a few months back without having an idea of date and subject.—D. A.

Upholstery in Morocco.—CAB HAMMER (*Cork*).—Whoever recommended you to use vinegar to enable you to put morocco leather on arms of couches and round frame furniture, without showing any wrinkles or creases, has either been "taking a rise out of you," or did not know anything about the matter. The backs of particularly obstinate skins are occasionally moistened slightly with water in order to make them yield, but this practice should not be adopted by any but a thoroughly skilled worker, who would hardly do it if he could effect his purpose by other means. Only skill can enable one to do as you desire, and it is utterly impossible to give instructions which can meet every case. I may, however, just indicate that judicious cutting of the skins, placing the tacks very close together, and manipulative neatness are important factors. If you have any special piece of work you are in difficulty about, and will let us know full particulars of shapes and sizes, I shall be happy to give you any assistance that may be possible. This will be of more assistance to you than pages of general directions.—D. A.

Zincography.—J. W. S. (*Sheffield*) inquires how to produce a zincotype. To enter into all the necessary details of manipulation and instructions for overcoming the difficulties likely to arise, would exceed even the ordinary length of our articles. Briefly, however, tbo process is as follows:—The subject should be drawn upon litho-transfer paper, or pulled from an engraved plate and put to stone, rolled up, washed out, brought up with a roller and again washed out, after cleaning and etching, and a transfer pulled. Then, upon a perfectly clean polished zinc plate, cut to size of job in a copperplate press, put down the transfer, and roll it up with a litho roller, and etch as if for printing from zinc. Then feed the job with an acid-resisting varnish, put the plate into a trough upon rockers, and bite it with weak nitric acid and hydrochloric acid mixed; the lines will be left in relief slightly; rinse well in pure water; dry upon a hot plate. Roll up when cool, but not cold, with a flannel roller, with a mixture of Brunswick black varnish, or other acid-resisting substance; paint sides of any lines which seem undercut by the acid. When dry again, place in the rocking trough—which must be kept moving, so that the acid washes away all oxide—using acid rather stronger, repeating the operation, drying, rolling up, etching, and rocking, until the plate is deep enough. In those parts where the lines are close together, at each drying care should be taken to paint them out as soon as they are deep enough, or the acid will eat underneath them and break them away. Then with terebine or turpentine wash off the varnish, cut out entirely all large white spaces with a fret saw, and mount upon a mahogany mount to type-height with small screws, countersunk at the edges of the zinc. There is a very useful treatise by Josef Bock, published at 2s. 6d., which fully explains the processes and gives the best formulæ. It may be had from the publishers of Wyman's Technical Series, 65, Chancery Lane, E.C., or by order of any bookseller.—J. W. H.

Mounting of Drawings.—T. A. W. (*Kilburn*).—For the proper mounting and straining of drawings, maps, engravings, etc., two things are absolutely essential—(1) good paste, and (2) cleanliness in handling; it is also advisable to practise your hand upon some small unimportant work before attacking anything large and serious. In preparing your paste, which must be free from lumps and about as thick as new milk, add a lump of alum as big as a walnut, then stir to boiling, but be careful not to allow it to burn; then squeeze through canvas. A plain wooden frame for straining is now necessary, or, if the drawing is to be framed afterwards, a permanent wooden strainer; in either case the wood should be about 2 in. wide. Obtain some plain, unbleached calico, about 4 in. longer and wider than your strainer, damp the calico with a sponge, then paste 1 in. all round, and, after laying the strainer, or frame, face down on calico, turn the pasted edges over frame; let this dry. Afterwards moisten with sponge and clean water the paper you intend to mount, sponging evenly all over, so that it is quite *damp* but *not soaking wet;* then paste about $\frac{3}{4}$ in. all round the border, take your frame with strained calico upon it, and lay it face downwards on the paper to be mounted, which it will take up; then with your hands, or a clean linen cloth, carefully press the pasted border all round, and leave to dry *slowly;* then you will find it strained as tight as a drum head, and you can either frame it in the ornamental frame you intend for it, or, after making a drawing on the strained paper, with a penknife cut it all round and release it from the strainer. Should this not be sufficiently clear, I shall be pleased to answer any further questions you may submit.—F. B.

Lathe Tackle.—J. R. (*Richmond*).—Glad to hear you have got so far. You should add the taper-screw to your set of chucks, which you can make by fixing a common joiner's screw into the centre of a small face-plate, putting it in so that it cannot turn round when the wood is screwed upon it. To turn wood you require two chisels and two gouges, say a 1-in. chisel and a $\frac{1}{2}$-in. one; a $\frac{1}{2}$-in. gouge and a $\frac{1}{4}$-in. one will do to begin with. *Don't* have a grindstone to run in the lathe; you would have to take out your work every time you want to use it, and it would splash with dirty water all your lathe and tools. I cannot recommend anything cheaper than a 20-in. stone in a wood trough, with treadle; this costs 20s. A less stone than this has not enough momentum to do without a fly-wheel.—F. A. M.

Glass Embossing and Lettering.—LETTERING (*Farnworth*).—For outlining on glass use black japan or Brunswick black. An imitation frosted ground surface is secured by coating glass with a thin layer of white paint and working a dry brush upon the surface. Black japan and deep vermilion also make good backgrounds, but, of course, a "figured gold" groundwork is the most chaste of all in appearance. Epsom salts in solution, when applied to glass, give it a natural frosted appearance when dry, but this dodge is not of a very permanent character.—H. L. B.

Book on the Lathe.—A. C. (*Oldham*).—The Britannia Company's book is to be obtained from Britannia Company, Colchester. Cash can be remitted by stamps, or postal orders, or cheque, or coin in registered letter.

Repairing Broken Pivot.—B. P. (*Birmingham*).—I am pleased to see you and others appreciate my humble efforts; all descriptions in print so far have been too scientific for amateurs: of course they do not intend to convey information to the masses. Take your pinion with the pivot broken, and in a small size gas flame, soften it, file off level, and proceed to drill in the centre; but you cannot have a centring tool, so do the best you can. In drilling, if you move ever so few turns as much around your work as possible, this will keep you in the centre, and when you are sufficiently deep enough dress up a piece of steel softened about same as pinion. When it fits tight to the drilled hole, temper it; now hard solder it. I see you know how: but the next difficulty is to turn the pivot. I see you have one. Now dress up pivot, and get correct depth; this you must be very particular about. Polish the pivot well, and I think your difficulty will vanish. But is it not much cheaper, if you call your time of any value, to have a new pinion put in? In either your first or second mentioned job, it will only cost you 2s. at Barton's, Church Street, Liverpool; or Reid's. Basnett Street, Liverpool; or Morris Cohen's, Kirkgate, Leeds, all watch tool, etc., shops. Don't act green, but as if you were in the trade. Case-harden by making a fire of leather scraps, which are most exceedingly hot, and place your steel bar with wire affixed in centre until thoroughly heated, then plunge in coldest water you can get. I think you will not have any trouble in bending after that.—J. S.

Regilding Frame.—W. L. B. (*Hucknall*).—No; vellum size will not answer your purpose; we find bronze turn colour under any circumstances; it will retain its colour the longest, however, if you get the best bronze powder, and mix well with your varnish, and apply with camel-hair brush, as gold paint. Frame makers gild in the ordinary way with a Dutch metal leaf, and then varnish; this will keep for years. The cheap German frames sold are all gilded with this leaf; some, however, are gilded with silver; the best quality ones and coloured lacquer retain their colour. I have some which I have had in my house twelve years, and they are still very good.—G. R.

Index to WORK Volume.—D. A. B. P (*Hammersmith*).—You and every reader of WORK will have an opportunity of possessing an index, as one will be published after the issue of No. 52.—F. J. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Brush Making.—T. S. (*Wellington, Salop*) asks:—"How brushmakers make the one end of Mexican fibre to represent the flag on bristle; whether it is a dye, and what it is composed of?"

Re-waxing Meerschaum.—TOBACCONIST writes:—"Will any reader of WORK explain the process of cleaning and re-waxing meerschaum pipes, as done for the trade?"

Cutting Music for American Organette.—AMATEUR MUSICIAN writes:—"I beg leave to ask (through 'Shop') of your musical correspondents for instructions how to drop in chords when cutting the notes of a tune, such as marches, waltzes, songs, etc., on the paper for an American organette. I can cut the notes, and their octaves (or unisons), but there is not melody enough without occasional 3rds, 4ths, 6ths, etc., and where to drop them in I am not able to decide. Is there a fixed rule for doing so, and if so would some kind reader be generous enough to say what it is, as I am sure many of the readers of WORK would be glad to know how to add chords in the key of C for their organette. I have a list of these chords now before me, but cannot use them in their proper places, and I care not to purchase sheets of music for the instrument when I can make them, minus the chords. I have made the instrument myself from the patented one, and, in fact, improved it, and if I could complete the dropping in of the chords it would be a real good job. But as it is patented, I must keep silent on that point."

Springs for Artificial Legs.—R. F. (*Landore*) writes:—"Will any reader kindly inform me through 'Shop' where I can obtain springs for artificial legs and steels for trusses?"

A Simple Incubator.—NEMO (*Ospizio, Malta*) writes:—"In WORK for December (see page 654) I find described a simple incubator in reply to B. F. (*Liverpool*) (see page 302). May I ask how long the incubation takes place?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Fairy Bells—R. F. writes in reply to SUBSCRIBER (*Bristol*) (see page 654):—"Bottom and sides are of $\frac{5}{8}$-in. pine. Wrest-pin blocks are of beech $1\frac{1}{4}$ in. wide by $\frac{3}{4}$ in. deep. Lower block, the front edge of which acts as bridge, is $1\frac{3}{4}$ in. wide, and shaped as shown in diagram. Under this and outside the bottom is hitch-pin block $\frac{3}{4}$ in. by 1 in.

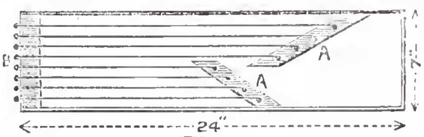


Fig. 1.

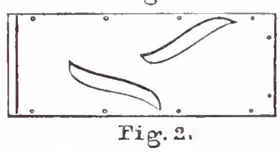


Fig. 2.

Fig. 3.

Fairy Bells.

Cover, which is made to take off, is of $\frac{1}{2}$-in. cedar or mahogany. Wrest pins are ordinary piano pins, and hitch pins are round-headed $\frac{3}{4}$-in. screws. The first four strings are of No. 11 steel wire, next two 12, last two 13. Strings must be wound round pins so as to quite clear blocks. The cover may be made to slide in and out, and is preferable this way."

A Steel Flux.—J. H. D. (*Luton*) writes in answer to G. H. S. (*Manchester*) (see page 670):—"You will find the following a good flux for welding steel: 1 part sal-ammoniac, to 10 parts borax, pounded together, and fused over the fire in an old tin until clear, when it is poured out and allowed to cool, afterwards reduced to powder, and used in the same way as any other flux would be used."

Pill Making.—CHEMICUS (*Tynemouth*) writes:—"In answer to J. C. (*Carlisle*) (see page 494) for the addresses of makers of machines: Kneading machines, Werner and Pfleiderer, 88, Upper Ground Street, Blackfriars Bridge. For piping, cutting, and finishing machinery, Mr. J. W. Pindar, 75, New Church Road, Camberwell."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—AN OLD SOLDIER; W. W. (*London, S.E.*); STANNUM; H. S. (*Tunbridge Wells*); J. R. (*Dundee*); W. W. (*Newcastle-on-Tyne*); H. C. (*Newcastle-on Tyne*); G. K.; S. R. (*Withington*); W. R. (*Fife*); W. L. D. (*London, S.W.*); BRITANNIA CO.; SKIBOO; W. C. (*Manchester*); A. J. E. (*Worthing*); M. A. T. (*Cambridge*); F. H. F. (*Kensington*); W. S. C. (*North Shields*); W. J. (*Swansea*); B. S. B. (*Warwick*); A FREEMASON; R. G. R. (*Blair Athole*); J. H. T. (*Manchester*); S. C. R. (*Derby*); E. H. (*Clerkenwell, E.C.*); J. S. S. B. (*Dublin*); W. S. A. (*Aberdeen*); F. H. (*Streatham Hill*); C. W. (*Andrie*); A WOULD-BE INVENTOR; F. A. (*London, S.W.*); J. B. (*Dunbarton*); J. T. (*Liverpool*); F. B. (*Great Horton*); A. M. (*London, N.*); H. C. S. (*Notting Hill*); C. W. (*Kensington, W.*); F. H. C. (*South Woodford, E.*); CAMERA; J. W. R. (*Camberwell, S.E.*); NOVICE; N. R. (*Plymouth*); M. N. (*Plymouth*); A. C.; W. W. (*Patterdale*); POOR STRUGGLER; IRIS (*Dublin*); B. A. B. (*Hampstead*); YOUNG TINSMITH; EXCELSIOR; SUBSCRIBER; CLIMAX FOUNDRY CO.; A READER; E. B. (*East Dulwich*); H. S. F. (*Worcester*); P. W. (*Yorks.*); P. B. (*Kent*); BICYCLE (*Weybridge*); CATGUT (*London*); A WELL WISHER; J. F. (*Elgin*); BEWILDERED ONE; W. H. D. (*Plymouth*); P. J. (*Birmingham*); J. N. (*Glasgow*); ONE OF YOUR YOUNG READERS; J. H. W. (*Walton-on-Hill*); A. B. (*Pallas Green*); C. W. B.; J. G. (*Ashton-under-Lyne*); H. C. (*Yorkshire*); E. J. P. (*Birmingham*); W. C. (*London, S.E.*); F. F. (*Birmingham*); F. B. (*London, E.C.*); A. D. (*Burnley*); E. F. B. (*Gaye*); BRASS; M. S. R. (*Barrow-in-Furness*); C. H. O. (*Stanton*); P. K. (*Birmingham*); W. J. B. (*Bermondsey*); H. J. (*London, W.C.*); J. A. (*Norwood, S.E.*); TOM JONES; A. H. C. (*Barnsbury*); MAP COLOURER; A. C. (*Stratford*); AMBITIOUS; H. G. (*Bishopsgate*); G. J. G. (*Fulham*); A. F. V. C. (*London, W.C.*)

Trade Notes and Memoranda.

THE following particulars, which have been supplied by Mr. Leader Williams, as to the mechanical appliances at present employed in the construction of the Manchester Ship Canal, will be of interest. There are no less than 96 steam navvies, including 3 German, 4 French, and 58 Ruston & Proctor's navvies. There are 166 locomotives and 5,874 wagons, whilst 213 miles of temporary railway have been laid down. There are 162 steam cranes, 127 portable and other engines, 186 steam pumps, and 40 pile engines, on various sections of the works.

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THE supply of electrical accidents in the United States is being recorded. The latest report is about a damp horse smelling a damp lamp-post, and is not so impossible as usual. In the interests of electrical progress in Great Britain, it would be well to allow a technical man to see these telegrams before they are published, for no one knows how much damage may be done to a cause by the spreading broadcast of a number of reports apparently prejudicial to its interests.—*Industries.*

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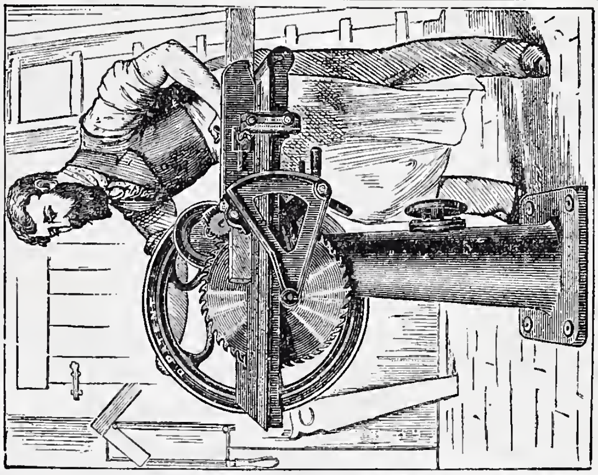

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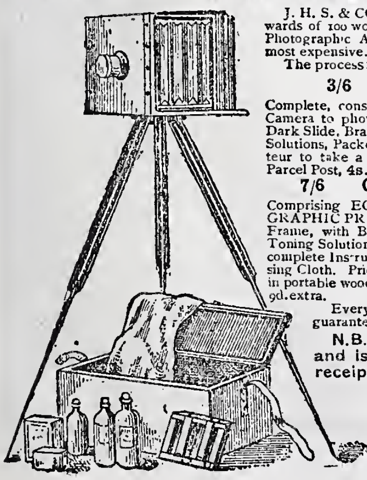

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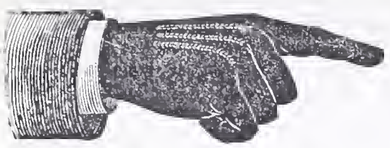

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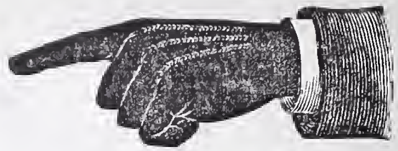

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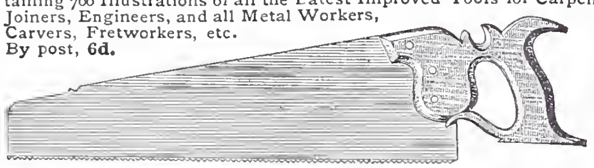

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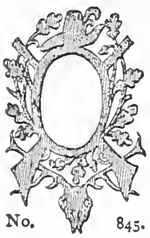

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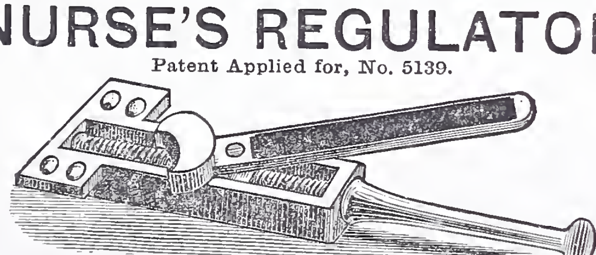

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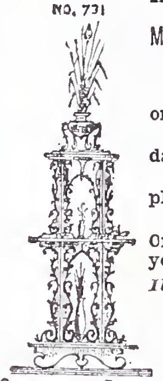

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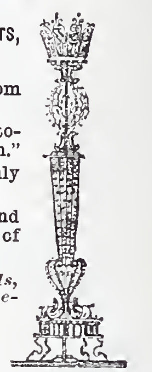

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WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

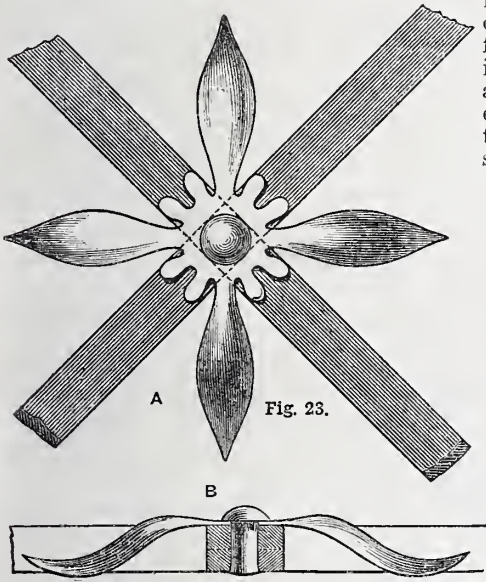
VOL. I.—NO. 52.] SATURDAY, MARCH 15, 1890. [PRICE ONE PENNY.

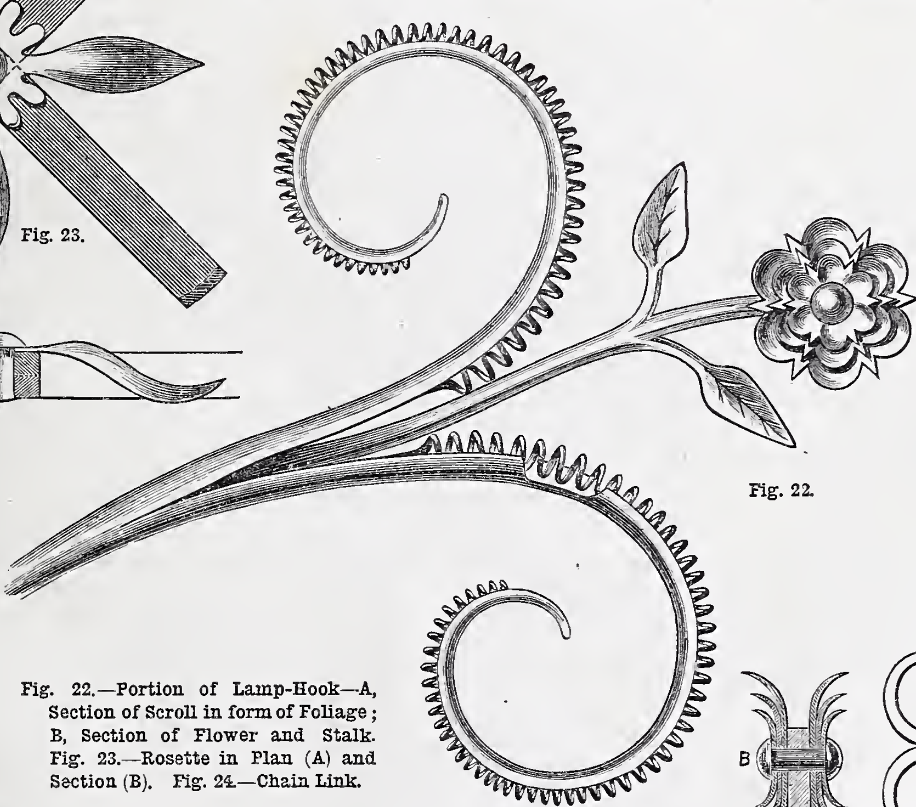
SMITHS' WORK.

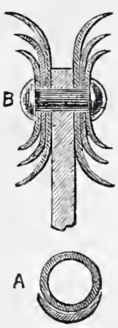
BY J. H.

ORNAMENTAL WORK OF THE MIDDLE AGES.

THERE is a large quantity of ornamental work remaining from the wreck of the Middle Ages which cannot properly be classified, but which is characterised by much redundancy of detail. Locks and keys, ecclesiastical furniture, and articles of domestic use, abound. The briefest possible notice of some of these must conclude this preliminary section on mediæval work.







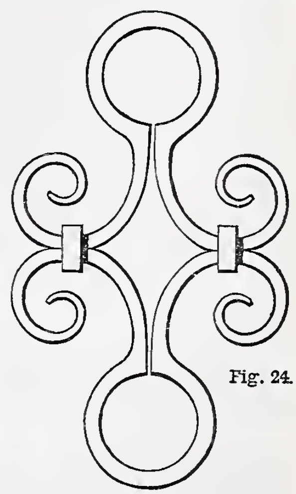


Fig. 22.—Portion of Lamp-Hook—A, Section of Scroll in form of Foliage; B, Section of Flower and Stalk. Fig. 23.—Rosette in Plan (A) and Section (B). Fig. 24.—Chain Link.

Some of the locks and keys which survive are worth careful study. The latter are for the most part filed out of the solid. Some specimens of the old French smiths, preserved in the Hôtel de Cluny, Paris, must have cost an almost incredible amount of labour. There are a good many figured in an old and very scarce book of a French smith, Mathurin Jousse, and several chapters are therein devoted to their description.

A method commonly adopted in the construction of some articles where cheapness was sought after without the sacrifice of beauty was this :—An open-work pattern was marked on sheet iron and punched out, and the edges filed square. This was laid upon another sheet, and foliations or other ornaments were marked through the interstices of No. 1 upon sheet No. 2. When No. 2 was cut out, this was laid, perhaps, upon another sheet, No. 3, which was then also marked, the operation being repeated if necessary upon several sheets in succession. These, being all perforated, were laid in relative superposition and riveted together. Sometimes beads, rosettes, or other ornaments were attached to the face. Many examples of such work occur in door-handles, locks, and escutcheons, and I may remind the reader that very pretty effects have also been produced by the twisting of bars, both of round and square section, to form door-handles and knockers.

Many of these thin-plated articles would scarcely come within the range of smiths' work. There is little difficulty in their execution, being for the most part cut or stamped without any bending ; yet there is in many cases a good deal of raised work combined therewith, semi-human and grotesque figures as well as foliage being beaten up with punch and hammer into full and perfect relief. And there is, besides, much engraved work which requires time. Nowhere, perhaps, does the contrast between mediæval and modern work appear in stronger contrast than in the relative amount of detail put into them. The quantity of work turned out in a given time, so vital a factor in our modern competitive production, scarcely appears to have affected the craftsmen of the Middle Ages. The ideal of work was of a loftier character then than it is now, and Brummagem wares are as far removed from those of Limoges and Nuremberg as the quantity turned out in the first exceeds that produced in the latter. The wares of the one fulfil the purpose of the hour, those of the other endure for centuries.

There is a coffer or deed-chest at the South Kensington Museum which is a curious example of German work. It is dated 1716. The coffer is made of iron, and is almost covered with elaborate repoussé and open scroll or foliated ornament. It is stiffened with straps, also highly ornamented, is provided with stout handles, and stands on handsome curved legs. But the most curious portion of the deed-chest is its lock, which is placed in the centre of the top of the cover. There are a large number of stout knobs studded over the cover which might be supposed to be for purposes simply of ornamentation. But there is just one knob near the lock, to the left hand, which must be turned and unscrewed in its hole before the keyhole can be exposed. Also another knob in front of the lock has to be pulled backwards to release a spring which presses against the cover of the lock. When these two operations are performed, then the cover of the lock can be lifted and turned aside, exposing the keyhole in the bottom of its little box. It is an ingenious and interesting specimen of an early burglar-proof safe.

A somewhat unique piece of work is shown in Fig. 22. It is a portion of a lamp-hook of seventeenth-century German make. This floral ornament consists of lanceolate leaves with tendrils laying in and partly enclosed by the leaves. From the axils of the leaves the flower-stem comes out, the flower containing three whorls, and it is double, back to back (B). But the noteworthy point is the beautiful manner in which the tendrils are twisted. It appears to me as though the tendrils and leaves were swaged from a divided rod, though they may certainly also have been welded at the axil. But there is no union of the two all along the course of the leaves; one simply lies within the other (A). More than this, the convolutions diminish in diameter, and the diameter of the rod also diminishes.

Rosettes are frequently employed for the purpose of covering over unsightly joints. These are generally punched from a single piece of plate and united with a central rivet terminating in a knob in front. Fig. 23 is from an Italian trellis centre of the seventeenth century, and shows a flower concealing the union formed by the crossing of $\frac{3}{8}$-in. square rods which form the panel.

There is an implement in the South Kensington Museum of French make and sixteenth-century date, used at the ceremony of cutting a first sod. It is called a pickaxe. But it is a double-ended implement. One end is shaped like a pickaxe, the other like an adze. The blade is pierced with holes and incised with two shields, one representing a similiar instrument, and the other charged with a fleur-de-lis. On the sides of the socket for the handle are masks.

A specimen of a chain link of Venetian make of the seventeenth century is shown in Fig. 24. Each link is made of two pieces curved and united with belts. There is a hook at top, then five successive links like the figure, then a large expansion of a different pattern, afterwards six more links and another expansion terminated with a bottom hook. This was probably used for the purpose of suspending a lamp.

It does not matter how commonplace were the uses of utensils, they were nevertheless wrought into beautiful forms, and decorated profusely with ornament. Stands for braziers are treated thus; hammers, carpenters' braces, pincers, nutcrackers, corkscrews, laundress's flat-irons, andirons, and many other articles commonly reputed base and vulgar, are made beautifully artistic.

Much of the art work of the Middle Ages is lost to us, having been destroyed by change, cupidity, revolution, and various political events. It may be safely averred that in the most favoured lands more has been destroyed than preserved. France has especially suffered, thousands of monuments which have been described and figured having been swept utterly away.

We cannot properly comprehend how much is involved in the mediæval smith's work, except by a broad study of the whole artistic craft of the Middle Ages. Abundant examples occur of men who were workers in gold, silver, and iron—canons of cathedrals ("artist canons," as they are termed)—men who wrought for the love of Mother Church, and remained poor at the same time that they enriched her churches and shrines with works of marvellous beauty. The smith's work was only a single branch of that art which was offered as a tribute to faith. Months and even years of loving labour were often bestowed upon a single article, and the names of very many of the artist craftsmen survive after the lapse of ages and revolutions. Need we wonder that the baser metal, iron, was wrought into such wondrous forms when we know how the same artists had wrought or cast still more delicate forms in the precious metals, or had been intimately associated with those who had fashioned the candelabra, lecterns, chalices, monstrances, reliquaries, and so forth, employed in the service of the great Church?

It is said that the church of St. Sophia at Constantinople possessed at one time no less than 6,000 gold candlesticks, two of which weighed 100 lbs. each; twenty-four copies of the Evangelists with golden covers, each weighing two quintals; and seven massive gold crosses of one quintal each.

Eloi in France, 588—659, was, like Dunstan in England, first a goldsmith, then courtier, minister, bishop, and saint. He founded two establishments for the education of artist canons, a class of men common in the cathedral establishments about the tenth century. It is related that Geoffrey de Champallement, Bishop of Auxerre, instituted three prebends in his cathedral for artist canons. One of these was to be a goldsmith, the others a painter and a stained-glass worker. Many of the monastic orders made it their boast to encourage the liberal arts. The cathedral and monastery were thus nursing mothers to the arts in a turbulent age. St. Dunstan, 925—988, who was monk, goldsmith, blacksmith, and royal minister, is an illustration of the union of craftsmanship with learning.

"Up to the middle of the sixteenth century," says Wyatt, "the artist and the workman had been one and the same, and alike honoured, hence much of the rare old excellence. After that period the artist became a patrician who designed, the workman a plebeian who executed. Hence at once arose an estrangement, which gradually widened until the artist made all his designs after some vague general model of a *beau ideal*, and the workman, having only his assistance on rare occasions, dropped into a jog-trot habit of collecting stock commonplaces, which at last degenerated into a system of mannerism and copying, taking the place of design altogether, and raising up a formidable barrier to all modern progress in the industrial arts."

A treatise on iron work, the first of its kind, was published in 1627 by one Mathurin Jousse. It treated of tools, of which he enumerates thirty varieties, and of processes in detail. He gives a description of locks, some of which he says took two years to make; the making of padlocks and of keys, the union of iron by melted brass, and of silver and brass (silver solder), the making of bellows, screws for vices, files, the tempering of steel, and much besides. There are sixty-nine chapters in all. Some of the woodcuts in this work are extremely quaint.

The ornamental section of smiths' work might well appropriate a much larger share of attention than I have been able to give to it; but forming as it does only a portion of a series having a much wider range, I now leave it to enter on at some future time the treatment of the modern practice of smiths' work. This will deal with practical work in the forge with hammer, anvil, and gauge, and with boiler making.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

House-Painters' Brushes, Knives, etc.

Throughout a varied and extensive knowledge of the house-painting trade, its employers and operatives, the writer has been much impressed by one fact in connection therewith—namely, the very limited amount of knowledge possessed by the average individual, whether master or man, as to the nature, right construction, and desired qualities of their brushes.

Without engaging ourselves with a lengthy disputation upon the political economy of the trade, a few moments' consideration will show the great disadvantage attending this lack of knowledge, as well as the cause of it also.

In no other branch of trade is it usual for the employer to supply the artisan with tools, and no custom, I believe, has been more harmful to the independence and self-respect of operative house painters as a body than this "handing over" and "receiving back" the tools with which a worker earns his daily bread every time he obtains a fresh job. Good brushes are as indispensable to the house painter as are reliable and well-tempered tools to the joiner or cabinet maker. Where, then, comes in the wisdom of such an arrangement, which, if adopted by a master worker in wood, without doubt would be considered both absurd and impracticable?

Such, however, is the case. The master-painter, or his *clerk*, or *manager*, and sometimes, but not *very* often, his practical foreman—since the latter would probably purchase good brushes, which are, naturally, *not* the cheapest—select the articles with which a season's work will be executed; and, in nine cases out of ten, they will be the *cheapest* of the "A 1," "Superfine," "Extra strong," or some such similar lying appellation the vendor or traveller pleases to term them. I do not assert this as being characteristic of the trade anywhere and everywhere; but such, undoubtedly, is the case in the provinces and small towns, where the *spreading* of paint is the most important factor of the trade's existence.

The immediate purpose of this paper, however, is not to consider the circumstance and customs attending the purchase and use of house-painters' brushes, but to describe the particular kinds with which the painter has to work, and to further afford herein some measure of advice as to price and quality for the guidance of purchasers.

The *best bristles* used in making painters' brushes are imported from Russia. The hairs of the hog and wild boar are noted for their strength and size, growing from two and three to some nine inches long. St. Petersburg, Kamschatka, and the "wilds of Siberia" contribute a large proportion of the immense quantity used for brush making annually. The quadrupeds "shed," or rub off, a goodly number of their bristles during the summer time, and these, when collected into a sufficiently large bundle, are sent by the peasantry from all parts of the country to such trade centres as those above mentioned. France and Belgium also contribute a small proportion of bristles to the market, and Germany not only sends us the hair, but a great quantity of the cheap and "rubbishy" brushes I have alluded to.

The *value* of *hogs' bristles* naturally depends upon their suitability for brush making—their length, strength, elasticity, and also colour. Not only is it so with house painters, but also with all descriptions of brushes, *white* bristles are commonly preferred; probably under the impression that adulteration therewith is less prevalent than with grey or black-haired brushes. Bristles are quoted on the market at "per cwt.," and the vast difference which may be found in the price and quality of two ordinary-looking paint brushes may be gathered from the fact that the price of genuine bristles ranges from about £10 to nearly £50 per cwt.

With the growing demands and requirements of the painting and decorative trades, the supply of the best and most serviceable bristles and brushes scarcely keeps pace; hence the industrious German trader finds a splendid market here for the showy-looking goods with which the trade is now inundated.

The *adulteration* of brushes is carried on to a vast extent, and principally by the aid of American fibre and horsehair. So well are these articles manipulated and mixed with the bristles that a thoroughly practised and practical person alone can discover them. Of the two, the horsehair is most difficult to detect by examination, since the difference between that and poor bristles is but one of a little elasticity. When there is, however, any quantity of fibre mixed with the hair the loss of "spring" in the brush is very noticeable. The appearance of the fibre is also more open to question; it is neither so smooth and finished-looking as hair; whilst the difference in burning of a vegetable fibre, which will leave a grey ash, and the peculiar smell attending the burning of hair or bristle, quickly decides for us its nature. This, however, is no test between bristle and horsehair —experience alone can decide the latter.

The *principal brush-making firms* of London, and those whom any reader of WORK (employer, operative, or amateur) can apply to with the certainty of getting genuine brushes of superior quality—providing he pays a fair market price for them—are Messrs. G. B. Kent & Co., of Great Marlborough Street, London, W. (whose goods I place before any makers for excellence); Messrs. Crowden and Garrod, of the Borough, Southwark; and Messrs. Hamilton & Co., of Greek Street, Soho, London.

In arranging the accompanying illustration of this subject, my aim has been chiefly to impress by its assistance the peculiarities of each class or make of brush upon the memory of the reader, and this without any consideration of the exact size or scale. Figs. 1 to 10 include most of the descriptions of brushes in ordinary use for painting and varnishing, and all these the earnest worker should be familiar with. The first figure will convey a fair idea of the appearance of a "good honest paint brush" in the form it is purchased in. The bristles are about 6 in. long from the binding to the point, and each brush requires tying up with string some two or three inches higher before it is used for painting with. As the brush wears down the string binding is untied, until eventually the extra "bridle" is entirely dispensed with. Fig. 2 is a similar article, but, as its name implies, made in an oval shape; and upon these lines the brush is worked. Fig. 3 represents a make of brush much used in the provinces, and in which shape quantities of cheap brushes are made. All three above mentioned are usually sold in four qualities of bristle, "Lily," "Yellow Middle," "Grey," and "Black," of which the first and whitest is the best and most expensive. The prices of each for the full size article would be about 5s. and 4s. 6d. for the first two qualities, and about 4s. for the last two, respectively. Although good hair makes a good brush in all of them, the first I believe to be the best in the hands of a thorough tradesman; and this shape is mostly used at the West End decorators' shops.

Fig. 4 shows an English paint *tool*, a small, round-handle brush, the shape of which is never altered; the small sizes are called "sash tools"—that is, for painting the small bars of a window-sash. They all require tying up shorter for using in oil paint, and the price of a good medium size tool is from 1s. to 1s. 6d. The German paint tool (Fig. 5), both for wear and quality, compares very unfavourably with the former; and although they can be bought so low as 50 per cent. less than a good English tool, they are dear at that to any worker who buys a brush to use and keep, and not to spoil. Fig. 6 represents a tool of recent date, purposely made for sash-cutting, at prices from 1s. to 1s. 6d. each; it is an assistance to quick and clean sash-painting on factory premises, etc., where there are great numbers of window-panes, but for ordinary work the string-tied sash tool will suffice. Figs. 7 and 8 are usually termed "fitches," consisting of short bristles bound in tin, with long red handles. They cost from 2d. to 2s. each, according to size, and are much used for all kinds of decorating and gilding; and nearly all workers in paint, "artistic and otherwise," find them indispensable. Fig. 9 is a somewhat similar brush, useful to gilders, scene painters, etc., as well as decorators.

Painters' Varnish Brushes are usually old and well-tried tools that have been "worn-in" with painting, and these cannot be improved upon for professional use if properly cleaned and looked after. Figs. 10, 11, and 12, represent brushes specially made for varnishing; the first, shown edgewise, it will be noticed is ground down to the shape of a partly-worn paint brush, and costs from 2s. to 4s. Fig. 11 is a shape one occasionally sees used by the operative house painter; why this shape was purchased for *his* work I suppose nobody—not even the employer who purchased it—could say; certainly not by reason of its suitability. This and Fig. 12 can only be used to advantage on the finest work, and on broad, flat surfaces; and, as before said, nothing can touch a "good old paint brush and tool" for house-painters' varnishing purposes.

Dusting Brushes are such as no clean and good work can be done without. Fig. 13 shows the best shape of brush for this purpose, at prices from 4s. to 5s. each. Somewhat similar in shape to Fig. 1, it is yet rather larger, and the bristles are much longer and spreading, so that dust and dirt can be brushed out of any crevice and corner with ease. I have seen brushes like Fig. 3, made only for painting, repeatedly used for this purpose, and when by such unfair knocking and usage the hairs come out, the maker is often blamed without reason.

Figs. 14 and 15 are more decorators' than painters' brushes. The first is used for stencilling, and the latter for running lines with the aid of a bevelled edge straight-edge. The prices of these tools, like all brushes, depend upon the size, but a useful brush of either kind can be bought for 6d.

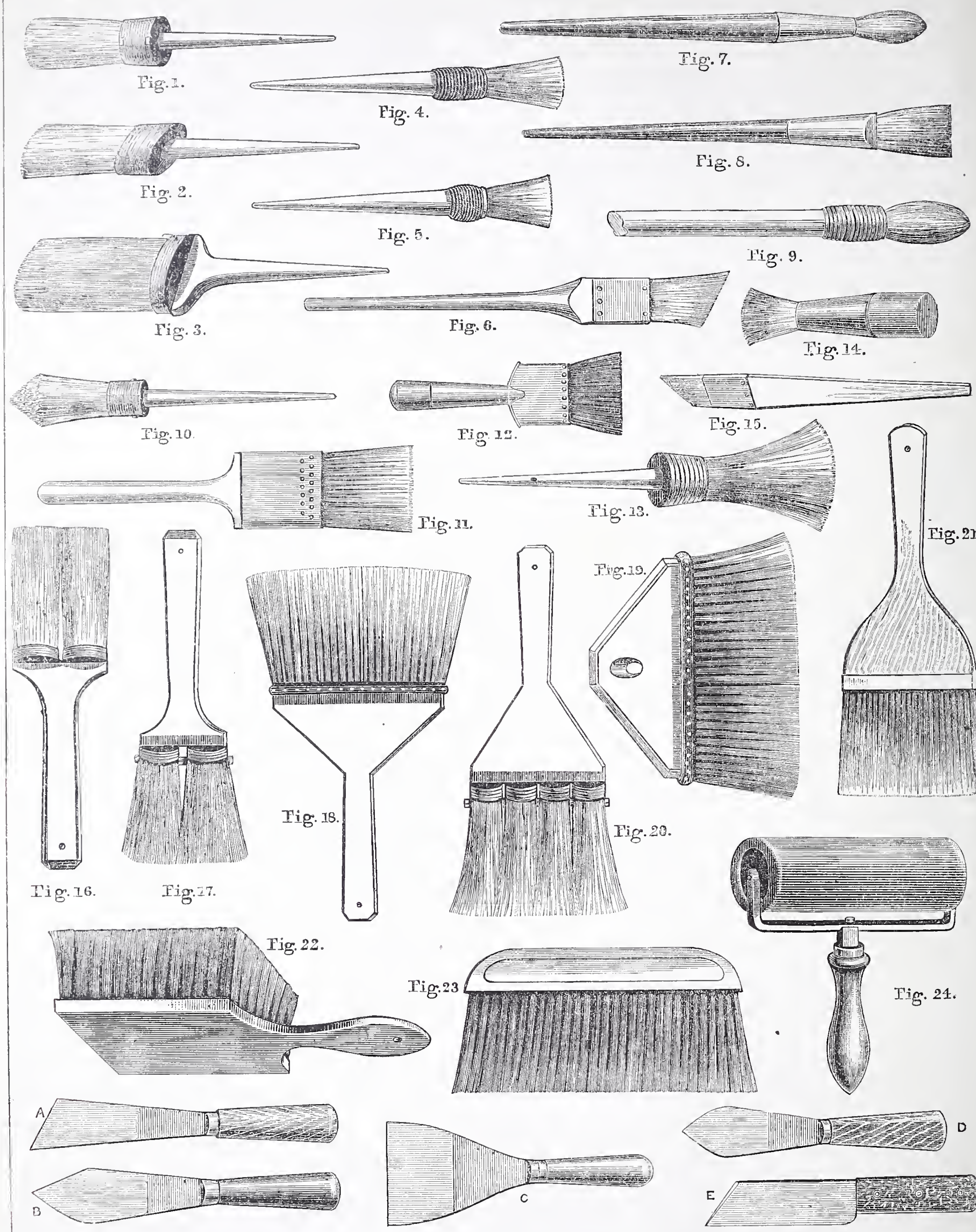
From 16 to 20 we have a variety of larger brushes specially made for distemper painting and preparation. Fig. 16 is the distemper brush for the best kind of work, and such as is used in London and the chief decorative centres. They are also known as "two-knot stock brushes." The best and finest are made with yellow and grey bristles, which are about 6 in. long, and cost from 6s. to 9s. each, according to size. They are without doubt the most suitable size and shape for spreading properly prepared "jellied" distemper. Fig. 17 represents a most useful brush, made of black hair and fibre, for washing off old distemper from ceilings and walls, the prices of which are from about 3s. to 4s. 6d. each. Fig. 18 shows the distemper brush very general in the west of England and other provincial parts, where it is commonly known as a "paddle" brush. Its broad, thin make tells plainly how little jellied distemper is understood and used in parts where the "paddle" is called for, since nothing but a wash can be spread with them. They are always made with grey or black hair, and cost from 4s. to 6s. each. Fig. 20 is a good shape and make for a practical man, but rather too heavy and clumsy for the best work; the price of this corresponds with the preceding brush. The four kinds just described are always made with handles, as shown; Fig. 19, however, corresponds closely with Fig. 18, but is made for affixing a long handle thereto.

In some parts of the country this "limer" is the principal ceiling brush used—I need scarcely add that in such quarters decorative art has not reached a very elevated position. A practised hand can get over a tremendous quantity of sizing and distemper washing with them, and they save erecting the scaffold also. They are, if of the best kind, as expensive as the "ground stock," Fig. 16. Fig. 21 represents a good pasting brush, and useful for distemper work also, costing about 4s. 6d. each.

Stipplers are the most costly of painters' brushes. Fig. 22 shows one with handle at end; they are also made with handles on the back and reversible handles. They are used for obliterating the brush markings, in "flatting" and other processes, by a beating action, executed evenly and carefully after the paint is applied and roughly distributed. They require careful attention to keep in order, and should, directly after use, be washed with plenty of soap and warm water, without wetting the "stock" or wood. When all the paint is removed, rinse in cold water, and accelerate the drying by beating on a dry cloth or wash-leather. The price of a stippler 8 in. × 6 in. is about 13s.; 9 in. × 7 in., 17s.; and a small size, 6 in. × 4 in., would cost 7s. or 8s.

Paperhangers', or *Papering, Brushes* are shown at Fig. 23; these are made for fixing new paper to walls, just as a cloth is used by the novice or amateur. The shape of the back is somewhat similar to a spoke-brush —long and thin, so that the hand can grasp it comfortably. Paperhangers use such a brush for the bulk of their work; but for "satin" goods and very delicate papers the roller (Fig. 24) is substituted for the brush, and with which the paper is rolled into close contact with the wall. When newly purchased it is usual to cover a roller neatly with a couple of thicknesses of flannel.

Of the *knives* most used by the house painter, I have shown five. A represents a *chisel knife*, or it may be termed a *stopping knife* with chisel point. B shows the most useful shape of *stopping knife*, with which holes and indentations of woodwork, etc., are filled with putty. C is the "chisel knife" proper, but as often termed the *broad knife*; this is used for stripping and scraping old walls, filling up woodwork, stopping plaster walls, etc., and is a very useful tool. D and



HOUSE-PAINTERS' BRUSHES AND KNIVES.

Fig. 1.—Ground Paint Brush. Fig. 2.—Oval Ditto. Fig. 3.—Copper Bound Ditto. Fig. 4.—Sash Tool (English). Fig. 5.—Ditto (German). Fig. 6.—Sash-Cutting Tool. Fig. 7.—Round Hog-hair Fitch or Tool in Tin. Fig. 8.—Flat Ditto. Fig. 9.—Round French Tool. Fig. 10.—Oval Bevelled Varnish Brush. Fig. 11.—Flat Ditto in Tin. Fig. 12.—Fitch Hair Ditto. Fig. 13.—Dusting Brush. Fig. 14.—Stencil Tool. Fig. 15.—Lining Fitch. Fig. 16.—Ground Distemper Brush. Fig. 17.—Washing-off Brush. Fig. 18.—Nailed Stock. Fig. 19.—Limer. Fig. 20.—Scotch Stock. Fig. 21.—Pasting Brush. Fig. 22.—Stippler. Fig. 23.—Paperhanger's Brush. Fig. 24.—Paperhanger's Roller.

E are more properly *glaziers' knives* than house painters'; the first is the *putty knife*, indispensable for glazing sashes, and the latter, the *hacking knife*, for hammering out the old hard putty previous to reglazing. All these, with the exception of C, cost from 9d. to 1s. each; the broad knife is worth from 2s. to 3s.

Brushes are by far the most important of the painters' tools, and I have given my chief attention to them in this paper. Space does not permit of my introducing herein a number of other articles used in the trade; but where possible they will be illustrated in each lesson as they are required for practical purposes described in such. The present article closes the first and elementary part of this subject. In Vol. II. the imitation of woods, marbles, etc., will be practically taken in hand, accompanied with illustrations of tools and processes—so far as such, in "black and white," can assist the student.

A CARVED BUREAU.

BY D. ADAMSON.

Drawers, Mouldings, etc., in Early English Style—Conclusion.

We have still to consider the stamping of the Early English character, if one may call it so, on the drawer fronts, etc. This will be managed by beads and mouldings, or by one without the other. Let us take beading first. As no doubt every one is aware, this effective and easy way of breaking a plain flat surface is managed with a scratch or router, the blade of which is simply worked backwards and forwards on the wood till the bead is formed. A simple form of this tool and its use having been recently the subject of an article in these pages, it will be unnecessary to dilate on it here.

Two rows of beadings will be enough for each drawer front, on which they are to be scratched horizontally, only right across, at a distance of about an inch from the top and bottom. A row composed of three plain beads, as shown in Fig. 24, will be very suitable, but there is no reason why the beading should be so uniform if any other pattern be preferred. For instance, any of those illustrated in the article above referred to will do equally well.

In addition to the drawer fronts, the bearers may be scratched in a similar manner, and not necessarily with the same beads. A bead on each edge rounding off the angle, and a hollow between, as in Fig 25, will look very well, and the same may be said of the "sunk moulding," shown by Fig. 26. In both these instances it will look better to set the front back, or within the bearers a little, as suggested in the illustrations.

It will also occur to the reader that the front edges of the ends may be finished off in a similar manner to the bearers. With the outer edges no difficulty can occur, but there may be some hesitation about the others, so it will be seen at once that the moulding or bead cannot be run through the joints of the ends and bearers. They might be worked through, but the effect would be very unpleasant, and I do not think the method would be approved of by any one accustomed to good cabinet making. The better plan, if these edges are to be moulded, will be either to stop the bead before it reaches the bearer, or work it up to a mitre with that on the drawer bearers. In either case, the bead or moulding will have to be finished off at the end with carving or other cutting tools, as the scratch will neither work a clean stop nor yet effect the mitre.

The front of the fall may also be treated with scratches on the framing, the beads terminating with the ends of the frame pieces, *i.e.*, they will not be run across cross grain, but be stopped at the joints. Of course if the framing is mitred, the beads will be formed also to a mitred angle, but, as has been said, a mitred framing is hardly in consonance with Early English. If the panel of the fall is sunk within the framing, it, too, may have two or three rows of beading scratched along it; and the same may be said even if it is flush, though I almost hesitate to recommend beading in this case. Beads may also be run from top to bottom on the ends of the bureau, though, for my own part, I should prefer them plain; but if they should be preferred, try to utilise them by concealing any join that may have been necessary. This can easily be managed by arranging the cutter so that the line of the joint is just between two beads. Three or four sets of beads at regular intervals between will be quite enough for each end.

Now for mouldings. The only parts of the work to which these can be applied successfully are to the edges of the drawer fronts, and round the inner edge of the fall framing. Many suitable patterns of mouldings may be found, from the simple one shown in Fig. 5 (page 738), to the more elaborate outline given in Figs. 27 and 28. It will not do to have the mouldings too large and heavy-looking, but as so much depends on personal ideas of excess in this direction, nothing definite can be said beyond that I consider the sizes shown in the last-named illustrations suitable. It must not, however, be taken that for all mouldings, whatever their outline, these sizes are best. It would, for instance, look clumsy were the moulding in Fig. 5 to be enlarged to it, and, of course, no one would think of using an architrave moulding for drawer fronts, such as those under consideration. With these remarks the size of mouldings may safely be left to the reader's discretion.

Whatever the pattern, they are to be neatly mitred at the angles and attached to the fronts of the drawers flush with their edges, making, as it were, a kind of projecting moulded frame on the surface of each front. Any beading that may be required on the fronts must be done before the mouldings are stuck on. Glue alone ought to hold them securely, but a few brads or wire nails, driven in where they will be least perceptible, may be used as well. The nails should be well sunk, and

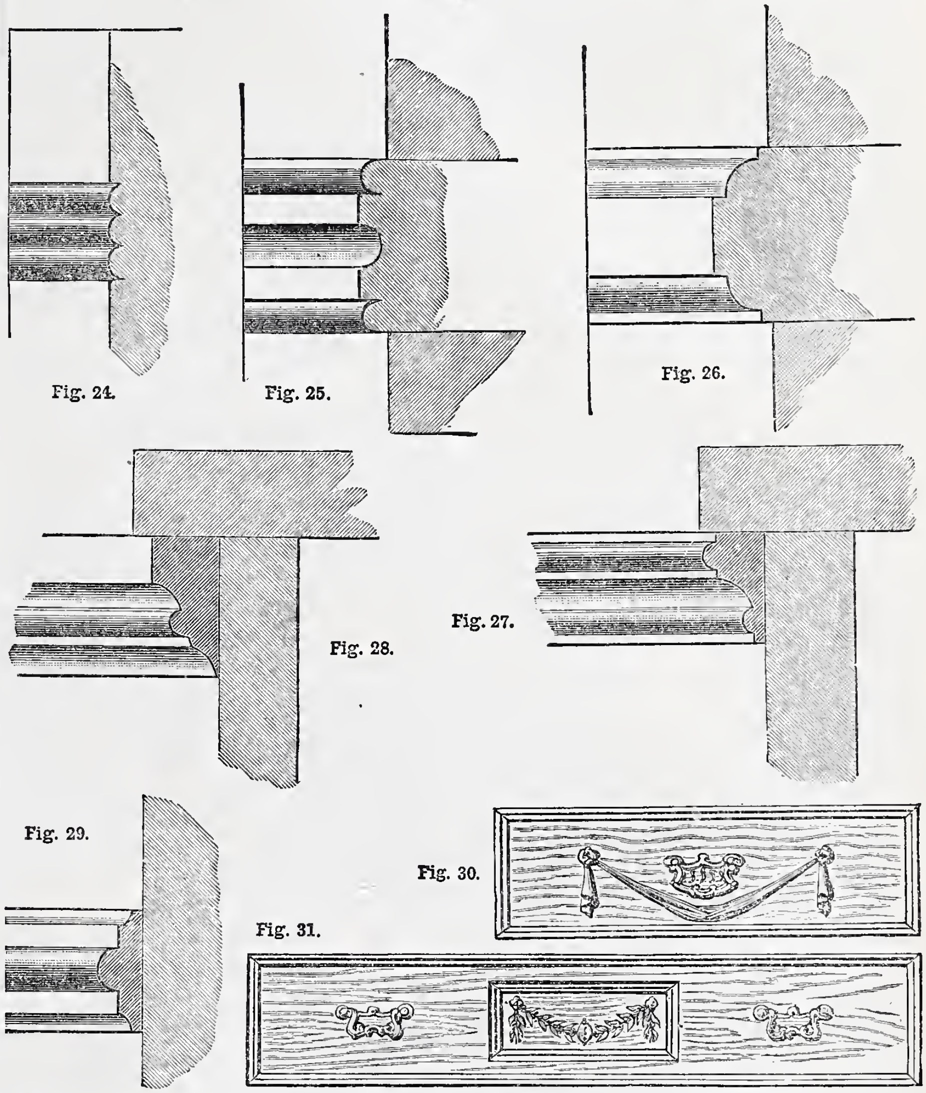


Fig. 24.—Beads on Drawer Front. Fig. 25.—Beaded Drawer Bearer. Fig. 26.—Alternative Bearer. Figs. 27, 28.—Moulding on Drawer Fronts. Fig. 29.—Moulding for Fall. Figs. 30, 31.—Drawer Fronts.

the holes filled in with stopping. As these will only be small, probably a little shellac melted into them will do very well. Figs. 27 and 28 show that the drawer fronts are set back, so that the mouldings, when the drawers are closed, do not project beyond the bearers, but are rather within them.

If the fall panel be sunk, the same mouldings may be placed round it on the edges of the frame, the corners being mitred. With a flush panel the mouldings must be modified, so that they can be stuck on to hide the joint. A suitable moulding for the purpose is shown in Fig. 29. I must frankly say that I do not like this alternative, and it will be far better, if mouldings are to be employed, to have a sunk panel.

Possibly it may be wondered whether no carving is admissible. If so, it may be said that, as a rule, it is not found on ordinary Early English furniture, but at the same time there is no valid reasou why the bureau should not be adorned with it if the maker wishes. As regards the scope of consideration of Early English design, it is, however, unnecessary to do more than say that carving, when resorted to, is usually unimportant. It may, however, not be out of place to say that as the source whence the Early English of modern furniture sprung is clearly the Tudor and allied styles, that carving inspired by them can scarcely be considered out of character. Carving is uot necessary, but it may be added as perhaps the clearest way of expressing the matter, that I think the majority of us would be rather inclined to class a bureau nominally in the Early English style with such carving as oue generally sees as a "Queen Anne." This will be the next to be considered, but before doing so attention may be called to the rich effects which may be got by a judicious use of the beads and mouldings alone.

Something should also be said about the plinth. That in Fig. 1 (page 600) would be more appropriate, and would do very well with a plainly beaded bureau, but a suitable moulding along the edge, instead of a bevel, would be better still, especially if mouldings are used on other parts.

It is possible that some readers may object to stuck-on mouldings. Many of our leading writers on, and critics of, modern furniture do, and not without a certain show of reason sometimes. Their arguments are mostly based on theory, and were it my intention to show how furniture might be got up in the most costly manner, without considering whether it would practically be any better either in appearance or usefulness for the superfluous expenditure, nothing would have been said about mouldings, or, rather, the directions would have been for them to be worked out of the solid. As it is, my wish is to help novices to construct good every-day pieces of furniture without any unnecessary labour, and to take full advantage of methods of construction which practical experience shows to be satisfactory. Those, of course, who fancy any process of either decoration or construction which I have advocated is wrong may leave them alone, and substitute others if they prefer to. I do not profess to teach those who are satisfied that they know all about everything connected with woodwork, for most of them cannot learn much—not even that there may be more than one way of doing anything. If possible, the style known as Queen Anne is even more vague than the Early English when furniture is referred to. It is almost impossible to define any lines of demarkation between the two which shall convey, without an exhaustive treatise on them, a clear idea. In very distinctive designs, of course one can do so; but the two styles are so merged into each other that it is not easy to say positively of many details that they belong exclusively to one or other. Thus in the mouldings mentioned when treating of the Early English bureau, we have met the Queen Anne style half-way, for many would feel disposed to classify a piece of furniture on which they occur as Queen Anne. Nevertheless, we may get some characteristic bits which may very well entitle even a plain piece of furniture like our bureau to be called a specimen of the modern version of Queen Anne furniture.

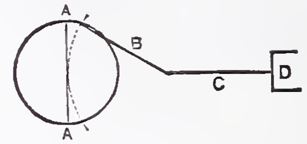
Let the mouldings be retained, even the beads if you will, but add a few carvings in the form of semi-conventionalised foliage, flowers, etc. I cannot commend the heavy swags of fruit and garlands of flowers which one often sees used, as they seem to be dangerously bordering on the strange devices which were in vogue immediately before the present Renaissance; there is, however, no reason why, in a modified form, such things should not be used. For instance, a little conventional drapery or a festoon may be carved on the drawer fronts, as suggested by the accompanying illustrations, Figs. 30 and 31. These will be quite enough to guide the carver, but it must be remembered that they by no means indicate the extent to which Queen Anne details may be applied when the construction will allow of anything more elaborate. It would be a comparatively simple matter to design a bureau with a very considerable amount of Queen Anne detail, but to do so it would be necessary to depart from the object of these instructions, which, it will be remembered, is to show how the original plain bureau, without altering its general shape or construction, may, in some measure, be invested with the features of various styles. I trust this has now been done in a way that may be suggestive to the novice either in making or designing, and, accordingly, take leave of this part of the subject, reserving any further remarks which may be considered advisable till a future opportunity, when perhaps sundry points, such as internal fittings of the upper part, secret drawers, slope for writing on, etc., may receive the attention they deserve.

THE SLIDE VALVE.

BY T. R. BLACKETT.

OBLIQUITY OF CONNECTING ROD, ETC. ETC.

IN order that the slide valve will do its duty in a proper manner—viz., to admit, cut off, and exhaust the steam at the required part of the stroke—we must have a connecting rod of sufficient length to give a proper balanced action to the engine. In explanation of the above, I may briefly state that while the piston only moves through a distance equal to twice the stroke in oue revolution, the crank-pin describes a circle exactly 3·1416 × by the stroke. Here is the proper relation between piston and crank. In the case of an ordinary horizontal engine, we have a connecting rod, one end of which takes the cross-head and the other the crank-pin, thus at every forward and backward stroke of the piston it changes the linear motion to a circular one. It will be seen by examining Fig. 5, where we have a very short connecting rod (exaggerated to point out the matter clearly), that while the piston is at *its* half stroke, the crank has not yet reached *its* half stroke or half centre. Now drop the connecting rod to the bottom half-centre, and we see that it crosses the centre of circle described by the crank-pin, as shown by the dotted lines in the figure. To overcome this obliquity of the connecting rod, it is necessary that it must be as long as possible—about two and a half times the length of the stroke. I have designed, during the last fifteen years, a good number of horizontal engines, and have giveu from $2\frac{1}{2}$ to 2·6 times the length of stroke for



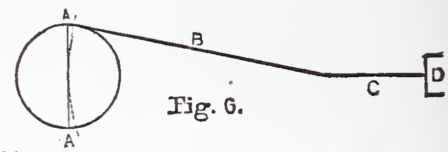


Fig. 5.—Diagram showing disadvantages of Short Connecting Rod. Fig. 6.—Diagram showing advantages of Long Connecting Rod—A A, Half Centre; B, Connecting Rod; C, Piston Rod; D, Piston.

connecting rods, and find, from actual practice, that that length answers well. If such a rod is made in proportion to the strain it has to bear, it will be found that there is no fear of buckling or bending, which some makers affirm against long connecting rods.

Fig. 6 represents by centre lines connecting rod of proper length, with an arc, shown by dotted lines through the centre of circle described by the crank-pin.

By giving a slide valve "lead," we give it not only to the steam port alone, but to the exhaust port also; in other words, it causes the exhaust port to close sooner than if we had given the steam side no "lead" at all. Hence we see "lead" is intended to give a "cushion" to the piston at the end of its stroke. If there was no cushion we would be sensible of the fact by a series of raps or blows at each end of the piston stroke, which, in the case of a high-speed engine, would be most unpleasant. In very large engines whose number of revolutions do not exceed forty per minute, I have seen the slide valves set with "lead" equal to the thickness of a piece of note-paper.

I would advise any one who intends to make himself master of the slide valve to construct a wooden model with crank and eccentric sheave, slide valve and rod, also a slot for a piece of wood to represent the piston in the cylinder. He will then be able to see more clearly than if he had only to depend on his memory. Similar models are used by "demonstrators" in our principal engineering schools.

Should any reader wish for further information regarding a wooden model, I could give it in "Shop." My reason for not giving it here is that every one who intends to master the slide valve will be able to rig up a rough model good enough for his purpose.

Now, with regard to "lap," it is put on the slide in order that we may work steam expansively. For instance, we wish to cut off steam at half-stroke, with our boiler pressure at 30 lbs. per square inch. Now, having cut off at half-stroke, we have the cylinder half full of steam at a pressure of 30 lbs. per square inch; thus it stands to reasou that when the piston has reached the end of its stroke, the steam in the cylinder will have expanded to twice its volume, but diminished to half its pressure—viz., 15 lbs. per square inch. This is called the expansive working of steam. I have given the above as a sample case. We might have an engine where we wished to cut off at one-quarter of the stroke with a higher boiler pressure. But with regard to "lap," in designing our slide valve there is a good rule, which, I am sorry to say, I cannot give in a simple form, so that our highly skilled, but not highly mathematical, workman could understand at a glance. It is this:—

From the length of the piston stroke subtract that part of the stroke at which it is intended to cut off steam; divide the remainder by the piston stroke, and extract the cube root of the quotient, which multiply by half the stroke of valve, and from the product take half the "lead." The answer will be the exact "lap" required. This may appear a complicated rule, but it is none the less accurate and mechanical.

SIGN-BOARDS.

BEING HINTS ON THEIR CONSTRUCTION FROM A CARPENTER'S POINT OF VIEW.

BY B. A. BAXTER.

In all woodwork, or, indeed, in all work, it is of great benefit and value to observe and remember any apparently small details in treatment of material by those who have experience.

We can scarcely go into a timber yard without observing that the ends of the choicest logs and stacks of boards are covered with some paint or composition to prevent gain or loss of moisture taking place at the end of the plank. The merchant wishes his wood to dry, but he prefers that it shall dry as equally as possible. The structure of wood is very much like an assemblage of tubes bound together, and the timber merchant knows that it is better that the ends of the tubes shall be sealed up, and that the drying shall take place on the larger surfaces.

For the same reason he keeps his choice timbers out of the direct rays of the sun. Rapid and partial drying means unequal and violent contraction, and this leads to cracks and shakes in the wood.

Apply this to sign-boards, and we may generalise that end grain should be exposed as little as possible, and that, where it can be, it is to be painted as effectually as circumstances allow.

If an experienced carpenter were asked to describe a cheap and yet a serviceable sign-board, I think he would say, "Have a frame made the size required, dovetailed at the corners, having a thickness at least equal to the proposed board or greater, and about three times its thickness for the breadth of framing, say panel of 1-in. stuff; make a dovetailed frame of $3\frac{1}{2}$ in. by 1 in., or $1\frac{1}{4}$ in. Let the ledges which cross the board be mortised and tenoned into the frame as in Fig. 1. In order to avoid weakening the frame, these mortises should be near the centre of its width, and the shoulder behind the ledge (what is generally called a 'bare-faced tenon'); let the board itself be fitted easily into the frame, and screwed from the back through holes in the ledges, all the holes except those in the centre being elongated to allow for a trifling movement."

The end grain of the board having been painted well before fixing, a moulding can now be fitted in the angle formed by the face of the board and the inner edge of the frame, and fixed to the frame and not to the board. This plan will ensure a durable and an economical construction.

As to the kind of wood, I can only suggest mahogany or pine. I could not recommend pitch pine, because, though very durable, it is generally so full of turpentine that it spoils the paint if exposed to strong sunshine. In all cases, avoid sap in pine.

In these days of gigantic advertisements, some mention of the covered notice and sign-boards is necessary. A prepared canvas for the purpose is to be had, and is made in very large sizes by the floorcloth manufacturers, which stands well—if only the frame has enough muntings to prevent the canvas vibrating like a sail under the influence of the wind.

Frames for these signs should be made of yellow deal from $3\frac{1}{2}$ in. to $4\frac{1}{2}$ in. wide, and $1\frac{1}{2}$ in. to 2 in. thick, mortised and tenoned together like a door without panels, painted well before canvas is put on, and moulding applied to edge, either rebated or a piece screwed on to edge of frame, forming square of moulding.

The heart side of a sign-board panel is the best for the face side, but the workman always will do the reverse if unnoticed, as the outside is easier to clean off. Particularly should this be observed when, as in some signs, there is a prepared canvas glued upon the wood like a veneer. This is an excellent plan for curved signs.

Frames for glass signs may be made like Fig. 2, but with a moulding like Fig. 3.

There should be a soft cloth or felt behind a glass fascia upon the wooden back to prevent injury to the painting and gilding, which is, of course, at the back, and special care should always be taken to prevent the entrance of rain.

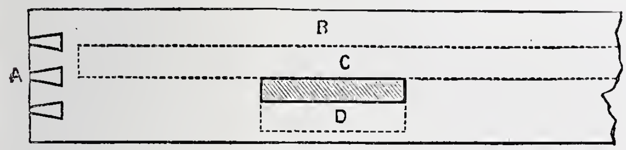


Fig. 1.

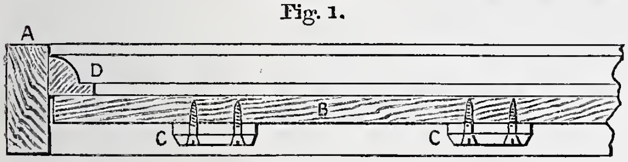


Fig. 2.

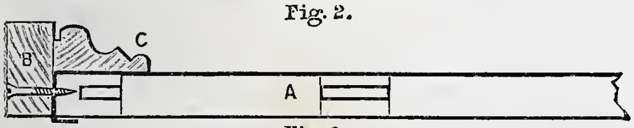


Fig. 3.

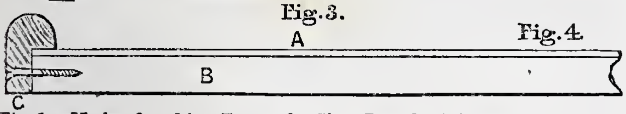


Fig. 4.

Fig. 1.—Mode of making Frame for Sign-Board—A, Dovetailed Frame; B, Space within Frame for Moulding; C, Board; D, Ledge. Fig. 2.—Section of Sign-Board—A, Frame; B, Board or Panel; C, Ledge; D, Ovolo Moulding fixed to Frame. Fig. 3.—Covered Sign-Board—A, Frame of Styles, Rails, and numerous Muntings; B, Capping screwed to Frame; C, Large Panel Moulding fixed to Capping. Fig. 4.—Glazed Sign-Board—A, Plate Glass; B, Frame; C, Moulding fitted to Frame.

GESSO WORK.

BY E. C.

THE DECORATION OF PICTURE FRAMES.

THE illustrations in this, the concluding, paper on gesso work are intended to supply designs for the decorator of picture frames. Never was there such a demand for medium-sized and small frames as at the present time. Fancy frames are required for etchings, autotypes, and photos innumerable; and it seems almost impossible that there should be too great a variety of these. The plain white enamelled frames and those of brocade and of satin have had a long run, and gesso decorated frames may well now become popular. If any of the readers of WORK wish to make a profit on such articles they will need to attain great facility in producing decorations at rapid speed. Amateurs are proverbially slow workers; they are more given to perfecting details and finicking over "finish" than to attending to effects, which after all is the main point in decorative arts. Now, the outlines should be kept true and sharp, but the modelling of the foliage will not need the same amount of care and labour bestowed on it as a figure on a panel. It can be quickly done either with or without the aid of cotton wool.

A word on the subject of "relief" to amateurs. I find that the least experienced amongst them often fall into the error of supposing that high relief is effective. To a certain extent it is, but we must bear in mind the purpose of our decorations. There is no true art in subordinating the picture or photo, which should be the centre of interest, to the ornamentation of the frame; therefore the design should be kept in rather low relief, and the colouring should be quiet in tone. The latter is more important if the photo is coloured; for etchings, too, I like subdued colouring in the frame, but for plain photos a bright frame is far from objectionable.

I will take Fig. 2 of the illustrations first for consideration, and suggest several ways in which it might be treated. I should choose that the frame should have rims slightly raised at both edges, so that the part to be decorated may appear sunk. It should be of walnut, rosewood or dark oak, or of some light wood stained to resemble one of these. Now for the design. Raise it a little above the wood surface by applying two or three coats of gesso; model the gesso with a brush, especially noting the tips of the leaves that turn over. Enrich it with gold lacquer only; for instance, the stem connecting the foliage that runs through the whole design could be touched with gold lacquer on both sides, leaving the most raised part white. Then the back parts of the leaves that turn over can be lacquered, and if veins of leaves are introduced they should be raised and the sunk portion on each side lacquered. A second mode of working would be as follows. Coat the design with gesso, keeping it quite flat. Cover the whole of it with gold lacquer, and silver the stems entirely and tips of leaves that turn over. This makes a lovely decoration with rosewood background. Again, instead of the background being of wood it could be coated with gesso and then lacquered green, or blue, or copper red. The rims in this case ought to be gilded. Yet another plan would be to carry out the gesso decoration entirely in blue and gold, and to silver the background. The design silvered, and just relieved with metallic blue, on a rosewood background would be admirable.

I should feel inclined to treat Fig. 4 somewhat differently. If this design were done in plain gesso it would look a trifle heavy on a dark wood background, so I should introduce several colours and get a rich harmonious effect. First gesso the ground all over; on this raise the design and model it. Then tint the flowers and buds red, accentuating the folds of the buds, and giving roundness to the petals by adding touches of gold. Colour the leaves a soft bluish green and throw up the veins with gold. Lastly, gild the background. This will prove a handsome frame decoration well suited for a good-sized photo or etching.

Whiteframes are much admired now for etchings. I do not mean alone the enamelled ones, but those of more uncommon style that are patronised by artists. I remember last season seeing an etching of a ship at anchor. It was a slight, sketchy production, no attempt having been made at elaboration; a few lines suggested the sea, but the effect was excellent. This was framed with a broad oak band painted white, and at one corner was a raised gilt anchor. The wood was not planed, but showed notches and cuts beneath the paint. The whole, viewed at a short distance, assumed a soft silvery-grey tone that was very charming. Now, I consider that Fig. 4 would answer well for such a frame. Say the whole ground is gessoed and left untouched with colour. The gesso is of a pleasing ivory-white tint, and the surface is smooth and appears polished. Raise all the design in gesso, but the buds and flowers may be in rather higher relief than the bordering leaves. Outline the design with gold lacquer, vein the leaves and mark out the petals with the same. Thus a chaste white and gold decoration will be obtained that will not clash with the most delicate etching.

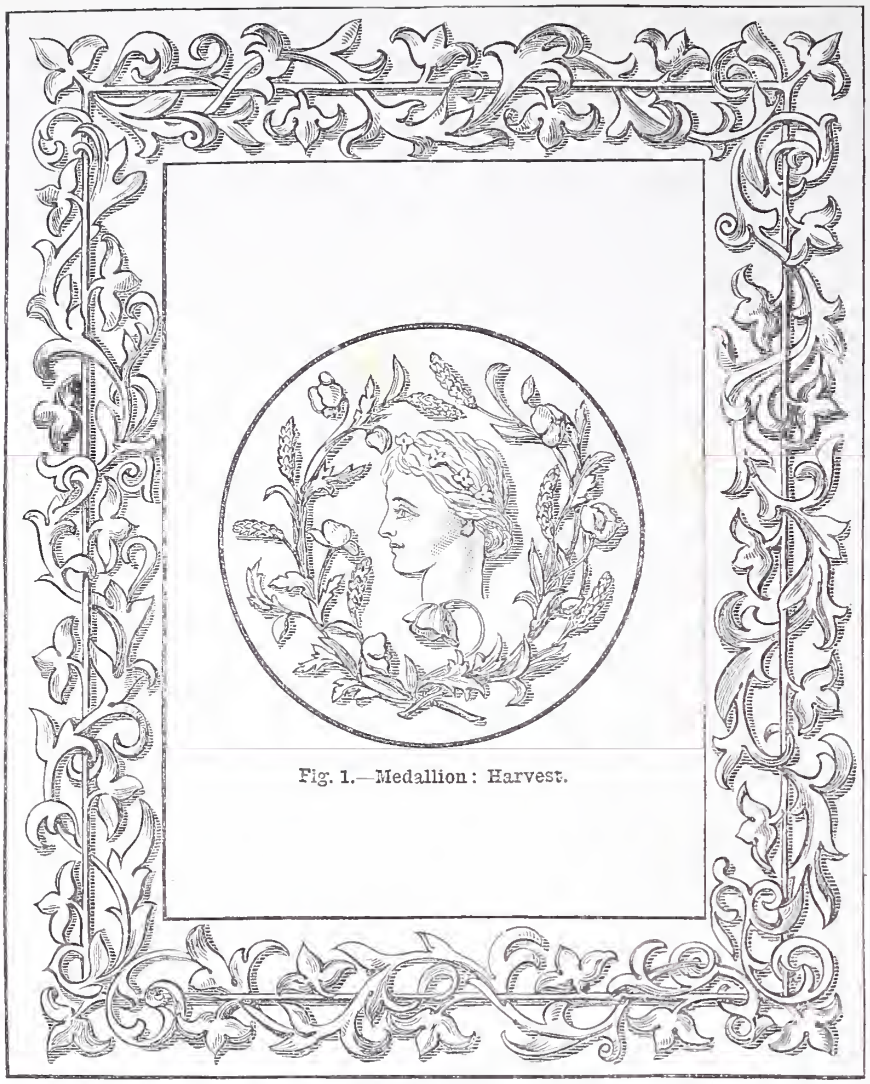


Fig. 1.—Medallion: Harvest.

Fig. 2.—Photograph Frame in Gesso Work on Flat Surface.

I would have no rims to this frame, and the etching should have a simple mount of white cardboard. Instead of the gold lacquer, brown oil colour could be suitably employed on a frame intended for a sepia drawing. A good mezzotint would be admirably set off by the white and gold frame.

The dragons shown in Fig. 3 will bear to be in higher relief than the conventional floral designs we have so far been considering. They should be well modelled and then coloured according to the worker's fancy. Here we have great scope for showing our skill in colouring. Rich, brilliant effects may be created with metallic colours, and such a design as this allows of uncommon harmonies. The ground should be of gesso, coated, let us say, with copper red, sprinkled with gold powder after the Japanese lacquer style. The dragons might be of gesso touched up with gold, the latter being used more strongly in the tails, on which strokes of gold may be closely laid, and the ears, eyes, mouth, and all outlines may be given with gold lacquer. Green and silver, or blue and silver, might be substituted for the red and gold. Or the dragons might be done with metallic blue, shaded into gold, in which case the background would be silvered.

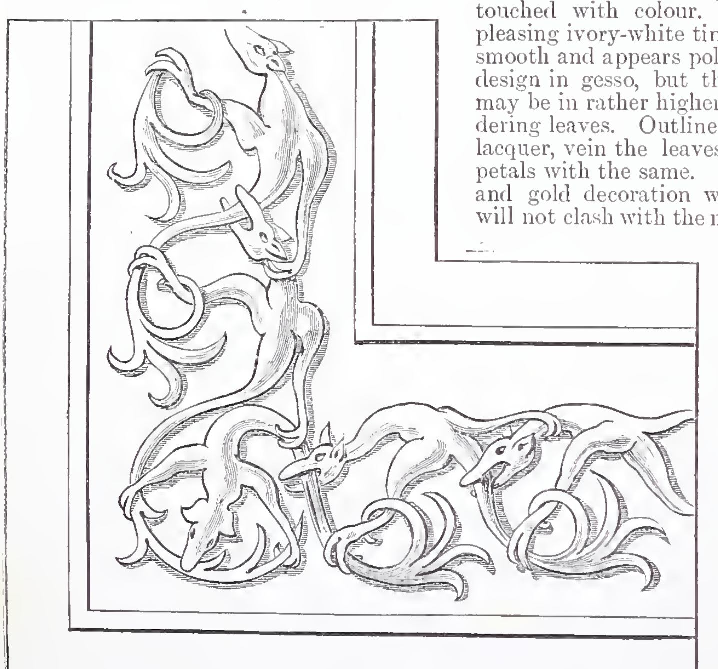


Fig. 3.—Corner for Picture Frame.

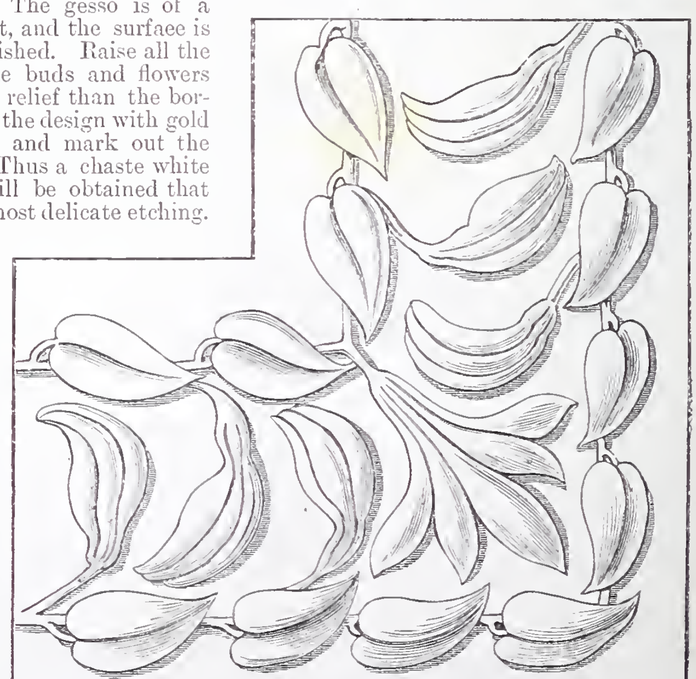


Fig. 4.—Corner for Picture Frame.

The background of floral designs may occasionally be enriched by short strokes in gold being laid on with the brush, so as to form a series of broken lines. These lines should be repeated every eighth of an inch or so. On panels, the intervening spaces between the lines gradually increase until the distance between the upper ones measures an inch or more. Sometimes the lines become more broken and cease altogether, to be resumed at a long interval towards the top of the panel or the frame. The medallion (Fig. 1) may well be coloured in a more naturalistic manner than the frame decorations; still, we must not overlook the fact even here that effect is the main end to be kept in view. The head is to be modelled in gesso, the shadows given in brown only, and the hair to be slightly marked out in tresses with brown, the wreath of marguerites to be touched with gold; this will make it appear like a sculptured head. Some might prefer to tint the face with oil colours and to colour the hair auburn; then the flowers wreathed around the head should be white. All this is just a matter of fancy. The background I suggest is blue, gradually merging into gold at the top. The garland of flowers should be done in metallic colours—scarlet for the poppies, gold for the wheat-ears, and green for the poppy leaves and stems. The blue of the background should also be metallic, oil colours being reserved for the head.

I am convinced that all who study the art long enough to become proficients will be delighted with the result of their work, and they will not consider that the time spent over it has been in any way lost.

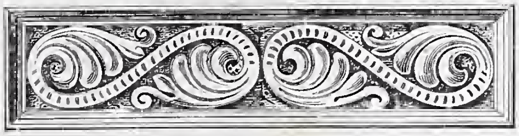


Fig. 1.—Carved Drawer Front.

Fig. 2.

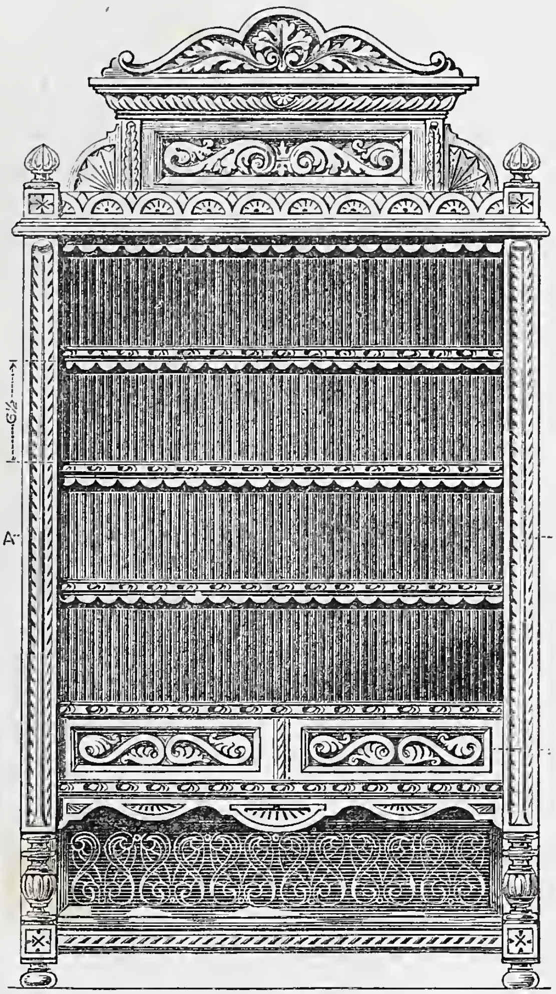


Fig. 3.

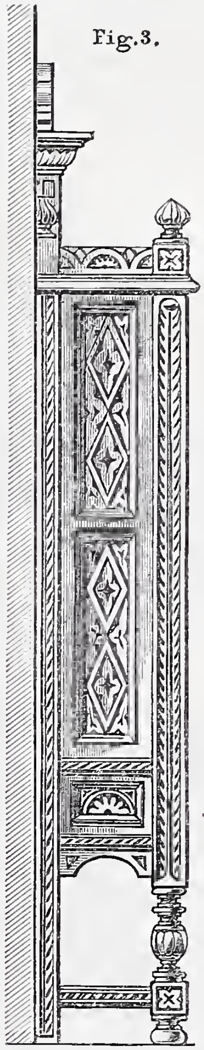


Fig. 4.

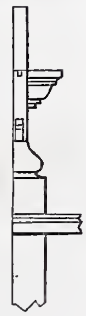


Fig. 6.

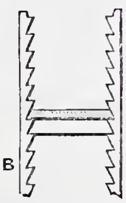


Fig. 5.

Fig. 2.—Front Elevation of Prize Bookshelves. Fig. 3.—Side Elevation. Fig. 4.—Details of Upper Part. Fig. 5.—Details of Pilaster at Foot. Fig. 6.—Rack for Shelves. (Scale, 1 in. to 1 ft.)

Fig. 7.—Plan of Top.

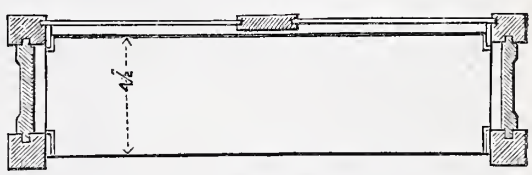


Fig. 8.—Section of Shelves on line, A B, in Fig. 2.

OUR PRIZE BOOKCASES.

III.—A Bookcase in Carved Work.

(For which the Third Prize of Half-a-Guinea was awarded.)

The bookcase, of which illustrations are given herewith, was the last of the three that were chosen as being most worthy of the prizes offered in the recent prize competition for the fitting and appropriate receptacles for the 208 volumes that form the series of best books by the best authors known as Cassell's National Library. These bookcases, it may be said, were chosen on the one part for their fitness for the purpose for which they were designed, and on the other as being types of different modes of treatment, each good in itself, but offering a striking contrast to those with which it was brought into juxtaposition.

With regard to material, the bookcase now under consideration is to be made in fumigated oak of a rich colour, the darkened hue in imitation of old oak being obtained, in one way, by exposing the wood to the fumes of ammonia, exposure in a stable where there are many horses being sufficient to produce the desired result. The lower part, as shown in Fig. 2, is fitted with two small drawers, the front of which is shown on a larger scale in Fig. 1, the front elevation and end elevation being exhibited in Figs. 2 and 3. These drawers will be found useful for pens, pencils, paper, and other small articles. The top shelf may be utilised for the display of bric-à-brac and the lower one for pottery.

The carving is to be boldly executed and the ground stamped. The details given in Figs. 4, 5, and 6, the plan of the top shown in Fig. 7, and the section of shelves on the line, A B, in Fig. 2, exhibited in Fig. 3, will explain themselves, and there is no occasion to do more than suggest a few sizes for some of the parts, as for example: uprights, $1\frac{3}{4}$ in. square; panels, $\frac{3}{4}$ in. thick; stiles, $\frac{5}{8}$ in.; shelves, $\frac{5}{8}$ in. thick, and carved on the edge as shown in Fig. 2. For making the drawers, the reader cannot do better than refer to the instructions given on this subject in "Lessons from an Old Bureau," and reference may also be made to page 233 of this volume for the method of making a bookcase.

The double rack work shown in Fig. 6, for taking supports for the ends of the shelves, might be dispensed with, the books being all of one size; but if the reader prefers to have movable shelves, he should look at page 233 of this volume, to which reference has just been made, and in which the method of making this arrangement is fully explained. The necessity of making a working drawing to scale, of a larger size than that of 1 in. to 1 ft. adopted for the illustrations here given, with the exception of Fig. 1, cannot be too strongly insisted on; and the carved work for the drawer fronts as shown in Fig. 1, the top and bottom of the bookcase, the edges of the shelves, the sides of the uprights, the pillars at the bottom, the finials at the top of the uprights, as shown in Fig. 1, and the panels at the exterior of the sides, as exhibited in Fig. 2, should all be carefully worked out full size before the workman commences the work of ornamentation with the carving tools. The scallops under the top and three shelves in Fig. 1 are intended to represent leather, attached to the under part of the shelf to prevent in some measure the access of dust to the top of the volumes.

WAX POLISHING.

BY DAVID DENNING.

THE difficulties attached to French polishing any piece of wood, of whatever kind, are sometimes so apparently insurmountable to those who have not been properly instructed in the art that many a novice, after his first attempt at polishing, is almost inclined not to risk injuring whatever he may have made by polishing it. Such a feeling is excusable. He sees the thing in the white—as an unpolished article is technically called—nicely finished and clean. He knows well enough that if he could only polish it satisfactorily its appearance would be considerably enhanced, but remembering that his intended improvement may result in an unpleasant-looking surface, he reluctantly gets someone else to do this part of the work. Of course, in trade circles the polishing, as a matter of fact, is done by a polisher, but in small shops, and especially by amateurs, the desire is to do all the operations oneself.

Now, though no method of finishing more enhances the beauty of most furniture woods than French polishing when well done, there are processes which, though not capable of being brought to such perfection, are much simpler. Among these is the subject of the present article, viz., "Wax Polishing." This mode of finishing is so remarkably easy, both as regards materials and manipulation, that it is hardly an exaggeration to say that the unskilled novice can manage as well as the most expert. It therefore seems a suitable process for the first of a series of articles in which the more difficult operations will be duly explained.

Perhaps something should be said about the kinds of timber which are suitable for wax polishing, or "waxing," as it is often called. I have used the word suitable, but it may be said that, beyond custom and fashion, there is no reason why any wood should not be treated in this way. That to which it is generally, or it may almost be said solely, confined is oak, especially after this has been darkened by fumigation with ammonia—a subject which will be more fully gone into in an article on staining. The appearance of oak so finished will be familiar to most readers who have paid any attention to furniture. The finish is comparatively dull, but there is an attractiveness about it which the more highly finished French polish does not possess for all eyes.

For old oak furniture—whether by this is meant genuine or imitation antique—no finish is superior to wax, though, as is well known, varnish is often used.

While mentioning varnish, it may be as well to explain that wax polish, though it may not give the same amount of gloss, is, if I may so express it, clearer and finer looking. Varnish clogs the wood, and is apt, to use a very expressive trade term, to give a "treacly" look to any piece of furniture finished with it.

Mahogany, though seldom wax polished now, may very appropriately be finished by this means, and it may be questioned whether, for many purposes, it is not superior to the dulled French polish so often seen.

As is very well known, the top of a dining-table is very apt to be rendered unsightly from hot plates or dishes injuring the polished surfaces. The heat burns or blisters the hardened shellac of the French polish, so that any method of finish which is not so liable to disfigurement is preferable; and one of these we find in wax polish. It ought *en passant* to be said that dining-table tops are usually (unless French polished) simply oil polished. This, however, is more tedious than waxing, which is, at least, as suitable for the purpose, and the readiness with which any accidental injury can be repaired renders it particularly useful.

Wood stained black, or the so-called ebonised finish, may also have wax polishing substituted for French. The result is certainly a closer approximation to the appearance of real ebony than when the work is ebonised in the usual way. Special attention will be devoted to the polishing of fretwork articles later on, but it will not be out of place here to say that by means of wax they may easily be made to look better than so many of them do when unskilfully French polished.

It has been said that any wood may be wax polished, but at the same time a rough classification may be made—one which, though not strictly accurate, will enable those in doubt to decide for themselves whether wax will be an improvement. I do not know whether it is a rule strictly observed—in fact, it may be said there is no rule on the subject—but there can be no question that wax answers best on the more coarsely grained woods, such as oak, ash, etc., and that pine and other light woods of close texture can hardly be considered to be improved by it—unless, indeed, they have been previously stained. As the reader will now have a fair idea of the capabilities, advantages, and disadvantages of wax polish, the making and application may next receive attention.

Probably there is no material used by the polisher, and prepared by him for his own use, in which a greater variety of proportions is used. One man likes the polish thin, so thin as to be merely a liquid; another prefers it to be in the form of a paste. As such great latitude is allowable, the novice may wonder whether certain proportions are not better than others, or whether some polishers are not using the stuff to disadvantage.

It may, however, be said that so far as actual finish—*i.e.*, gloss—is concerned, it matters little what the proportions of the ingredients are. These, it may as well be stated, are in the simplest mixture merely wax and turpentine. Others, such as resin, Venice turpentine, etc., are occasionally added, but provided the wax be of good quality, they are quite unnecessary, if not prejudicial. Resin, when used, is added with the intention of hardening the surface, and in some instances it may be beneficial, but only experience can teach when it will be. The learner may be quite certain that if he cannot get a good result from wax and turps alone, the fault does not lie in the absence of resin. Venice turpentine, though mentioned as an ingredient in some of the old receipts, is by no means an indispensable ingredient, and it may fairly be questioned whether it is of any use whatever. It rather savours of quackery, or the mystery with which some of the masters of arts and crafts appear in former times to have endeavoured to conceal their actual mode of working. I have known Venice turpentine to be employed in making wax polish, so that those who would like to try it may experiment on their own account, remembering that a very small quantity is recommended.

To prevent any misconception then, let it be clearly stated that wax and turpentine alone are all the materials necessary to make a good wax polishing paste, and that when anything else enters into the composition the mixture is one of a fancy character. This is not the place to discuss the qualities of beeswax which are offered for sale, and it must be left to the polisher's own decision what kind he gets. Some advocate the use of fine white wax, and possibly a slightly better finish may sometimes be got with it than with the ordinary yellow wax. This, however, is generally used, and the only occasions when I would suggest that it might not be so good as the lighter colour are when extreme purity of tone is required for a white wood. A perfectly white wood is, however, so seldom wax polished that, for all practical purposes, at present it may be considered non-existent.

It will readily be understood that the way in which the wax polishing mixture is prepared depends a good deal on the proportions of the materials. For a thin liquid—or should I not say a liquid polish?—it is sufficient to shred the wax finely, and then pour the turpentine over it, leaving the two till they are incorporated. The turpentine will, however, only dissolve the wax slowly, and a much more expeditious method is to melt the wax by heat, and then, before it has time to solidify, the turpentiue is poured into it. Naturally, when melting wax, caution is necessary, and on no accouut should the turpentine be poured into the wax while it is still on the fire. With ordinary care, there is, however, no danger, and I only suggest the possibility of a mishap for the benefit of those who might otherwise overlook the inflammable character of turpentine vapour. As I have so far purposely abstained from naming definite proportions in the desire not to hamper novices, it may be as well to say that if they find the mixture either too thick or too thin for their tastes, they may easily alter the consistency.

If it is desired to thin a mass, which is, say, as stiff as butter, a very moderate amount of heat will reduce it to liquid form, as the turpentine already in it facilitates the change. More turpentine is, of course, added while the wax is in the liquid state. On the other hand, it may be necessary to stiffen the mixture, and in this case some more wax should be melted separately, and the original polish added to it. The heat of the freshly melted wax will probably be sufficient to cause all the materials to amalgamate. It should, however, be noted that the wax in any case should be thoroughly melted before the turpentine is added, as a lumpy mixture is neither pleasant to work with nor yet conducive to good finish. When exposed to the air, the natural tendency of a wax polishing mixture is to stiffen, on account of the evaporation of the turpentine. A considerable time must, however, elapse before there is any appreciable alteration, and the fact that a change does go on, however slowly, is just alluded to, to remind polishers that if they have any considerable quantity of the mixture standing over, they must not expect it to retain its original condition unless kept in a closed vessel.

Now, just a hint for those who think that the more ingredients a mixture contains the better it must be, and accordingly are not satisfied unless there is a certain amount of resin in their wax polishing paste. Resin does not melt so quickly as wax, therefore let it be melted or partially melted, first adding the wax gradually, and, as the cookery books say, "constantly stirring." Whether resin be used or not, the mixture should not be applied till it is cold.

Although, as has been said, the consistency of wax polish varies considerably, it would hardly be fair to leave the novice in a state of perplexity about the comparative merits of different degrees of stiffness or fluidity.

Perhaps the best way to explain matters so that an intelligent conception of the polisher's aim may be arrived at, will be to suppose a piece of pure wax—that is, wax without any admixture of turpentine—is taken by way of experiment, and rubbed on a piece of smooth flat wood. A certain amount of the wax adheres to the surface, which, when friction is applied, becomes glossy or polished. The labour, however, is considerable, and however well dry wax may do on a flat surface, a very short experience will show that when mouldings or carvings are to be treated the difficulties in the way of satisfactory application are considerable. Well, the remedy is obvious: the wax must be softened that it may be got into all parts of the work. Melted wax, therefore, might do, but even in putting it on to the wood it becomes cold, and consequently reverts to its original stiffness. This necessitates the scraping or tedious removal of superfluous wax, for it cannot be too emphatically impressed on the novice that so long as wax is present on the surface in visible quantities, polish or gloss cannot be got. We have then to get the wax to a fair working consistency by means of some suitable solvent, which turpentine has been found to be. It is cleanly, inexpensive, and evaporates sufficiently quickly, besides mixing well with the wax. We can now see why some polishers prefer what others might think an excess of turpentine. If a stiff paste is used, the wax is apt to be deposited in excessive quantity in places, necessitating a considerable amount of rubbing to remove it. On the other hand, a fluid polish spreads the wax much more evenly, but no gloss can be obtained till the turpentine has either evaporated or been absorbed by the wood. Unless the polish has been "slopped on" over the work, this does not take long, so that, on the whole, a thin mixture may be considered preferable to a very stiff one. Enough has been said to enable any one to determine for himself whether to use a thick or a thin paste, but there are always a few who think—and very likely rightly—that as safety does not lie in extremes, but in the middle course, they would like to have some idea what this is in wax polish. Possibly here, again, opinions would be found to differ, but I should say that a paste of about the same consistency as butter in hot weather might be regarded as a medium. Of course, those who use a wax polish mixture which could be poured would consider this stiff, while others who add very little turpentine, or who believe in resin, would consider it thin. After all, it does not much matter whether a thick mixture or a thin one be used, the result depending more on the manipulation of the material than on the material itself; and how this is to be applied may next be considered.

In the application of wax polish we find almost as great a diversity of opinion, or rather variety in practice, as in proportion of ingredients. The great thing is to have the wax—the turpentine, it must be remembered, is merely the vehicle for conveying this—evenly and thinly distributed, and so long as this is done, it is of small consequence how it is managed. Some say use a piece of rag, while others prefer a stiff brush to rub the wax in with, and both get equally good results. After the wax has been rubbed in, the polish is obtained by friction; or to parody a well-known advertisement, the more you scrub, scrub, scrub, the more you rub, rub, rub, the brighter the polish will be. In this final friction it is essential that the cloth or brush used be perfectly dry, as if it is at all damp, no polished surface can be produced. In any case, the brush or cloth used to rub the wax into the wood should not be employed to give the finishing touches. These are best done with a perfectly clean rubber, and if I may venture to lay down rules when the process admits of so much diversity in procedure, I would use, say, three sets of cloths or rubbers. With the first the mixture is to be rubbed on the wood, with the second it is to be rubbed off till a fair amount of polish is got, while with the third the rubbing should be continued till the surface is as bright as it can be got. Very likely some might prefer to be told exactly what material the rags should be of, how long they should rub, and a whole host of minor details, but though these instructions may seem vague, I wish to make the various processes connected with polishing as clear as possible and to give them divested of all the needless minutiæ which are popularly regarded as inseparable from the polisher's art.

There are enough difficulties in the way of practising it successfully without adding to them by insisting on fixed modes of procedure, and so hampering the intelligence of the worker, who will scarcely need to be told that without common sense no directions, however precise, would assist him to any great extent. So far as has been deemed necessary, directions which should enable any one to wax polish wood successfully have been given, and this paper may very fitly be brought to a close by stating that hard dry rubbing, with plentiful use of "elbow grease," are at least as important as the wax and turpentine. Though more simple than the French polishing process, that with wax is more laborious. For the purposes of these hints on waxing, the Latin quotation, *labor vincit omnia*, may be freely—very freely indeed—translated into the vernacular as "labour brings the polish up."

OUR GUIDE TO GOOD THINGS.

⁂ Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.

128.—Erfurth's Patent Scaffold Holder.

In page 728 of this volume an interesting account of some ingenious steel ties for the connection of scaffolding was given by Mr. John Charles King, under the title of "Science in Scaffolding." This induced Mr. J. Charles Schroeder, 49, Ferntower Road, Highbury New Park, London, N., to send me a prospectus and working model, on a small scale, of Erfurth's Patent Scaffold Holder, a simple and apparently secure means of fixing cross-poles to uprights without having recourse to ropes. Mr. Schroeder writes:—"I would beg to draw your attention to a patent scaffold holder for which I am agent in the United Kingdom, and which I venture to think is of greater safety and efficiency than the contrivances shown in your issue of this date (No. 46, Feb. 1, 1890). I beg to enclose a circular giving diagrams and full particulars of this holder. The same is already in extensive use in various parts of the Continent, and has met with universal approval. A number of these patent holders are about to be practically tested during the coming season by a well-known firm of builders and contractors in London." Mr. Schroeder further informed me that the patentee is M. Erfurth, in Teuchern (Saxony), and that the holder is patented in England under No. 1389 (1888). It is asserted that weakness and complication in construction have been the chief causes of failure of those hitherto brought into the market, but that this patent holder is superior to them all, being of iron and wrought in one piece, and consisting of a saddle arm, clamp, and counter-arm—represented in Fig. 2 by the letters *c*, *a*, *b* respectively—each provided with a spur, or point, which are forced into the scaffold-pole and cross-piece under pressure of the cross-piece and the weight thrown on it, and which are indicated in the diagram by the arrows at the letters *a*, *b*, *c*. The holder is fixed to the standard or upright pole by pushing it on sideways at the desired height and turning it with a jerk, the saddle arms pointing in an upward direction. This can be done with one hand in a few seconds. It is not requisite to drive in the spurs with a hammer, as the holder fixes itself automatically. When the cross-poles are placed on the projecting saddle arms, their weight presses the holder against the standard in such a manner that the spurs enter the wood and prevent the holder from slipping, thus affording the greatest security. The simplicity of the invention does away with the necessity of repairs and renewal of parts, which are said to form the great objection to other holders. It is claimed that the saving in time and cost of erecting scaffoldings when the holder is used is considerable, compared with the cost when holders with screws, wedges, and chains, etc., are employed. Although the initial cost of this holder is more than that of ropes, yet, owing to the short time which ropes last, and their liability to be lost or destroyed, the saving in the end is great; and when the time and consequent expense necessary to the employment of ropes are taken into account, the amount saved by the use of this holder is very large. The strength and durability of these holders are such that they will last for many years, and, owing to their capability of being packed in a small space, their transport is easy and inexpensive. They can be used with safety on a pole much smaller in diameter than the holder, and, moreover, it does not hinder the standards and cross-poles being joined when necessary. It is made in three sizes, namely, No. 1, 7⅞ in. internal diameter, sold at 4s. 4d. each; No. 2, 6⅜ in., at 3s. 9d.; and No. 3, 4¾ in., at 3s. 3d. each. The advantages claimed, as stated above, are certainly considerable, and the holders themselves deserve thorough and careful testing.

The Editor.

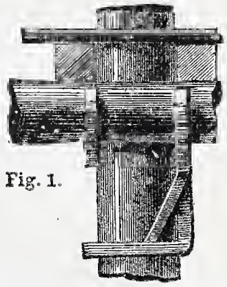


Fig. 1.

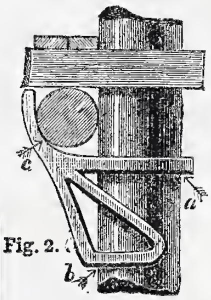


Fig. 2.

Fig. 1.—Front View of Erfurth's Patent Scaffold Holder in elevation.
Fig. 2.—Side View, showing Position of Spurs.
Fig. 3.—Another Front View of Scaffold Holder in perspective, showing Clamp on left side.

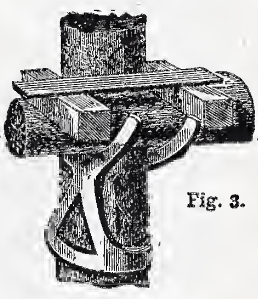


Fig. 3.

NOTICE TO OUR READERS.

With the next number of WORK (*No.* 53) *will be issued,* FREE OF CHARGE, *a large* SHEET OF DESIGNS IN WOOD CARVING (*size* 30 *in.* × 20 *in.*), *consisting of Twenty artistic and elaborate designs for various articles of Furniture in the Elizabethan, Italian, Old Dutch, North German, French 15th Century, and Modern styles. The various designs represent Chairs, Mantelpieces, Cabinets, Chests, Cornices, Pateras, Panels, Borders, &c.*

An Index to the First Yearly Vol. of WORK has been prepared, and can be obtained by order from all booksellers, price 1d. It is included in the last Monthly Part of the volume (Part 12).

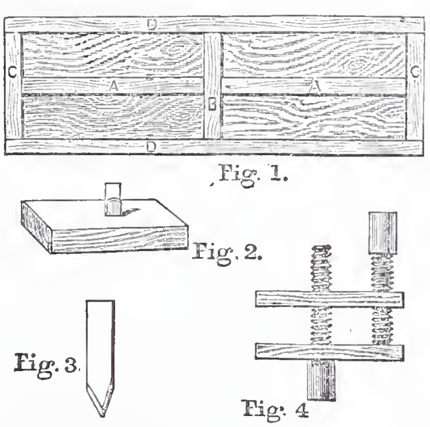
SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTERS FROM CORRESPONDENTS.

Steel Castings. — STEEL MOULDER writes:—"The reply to J. T. (*Newport*) (see page 701) is somewhat misleading, because it is not so very exclusive. Nor is the making of them so difficult. If J. T. wishes to produce small castings from a few pounds weight up to 1 hundredweight, he can entirely dispense with ganister and ground crucibles, and also with the costly process of drying the moulds, and instead of the moulds being more refractory, for such size as the above indicated it is just the opposite, because the moulds should be only just firmly rammed, and as little moisture as possible used. But for heavy castings your reply is about correct. This is my practical experience of all kinds of steel castings, extending for a period of twenty years in some of the principal firms of this country, and if J. T. would like to write personally to me, or through the columns of 'Shop,' saying what kind of castings he requires, I will gladly try to help him as to the best way to produce them, and if he is a moulder he will not find it so difficult as it appears."

Wardrobe.—ARTIST IN WOOD writes:—"Fig. 1 is wardrobe end veneered so as to show rosewood panels and ash framework; also how the veneers may be put on in least possible time and best of joints made. Lay the panels first, then with the cutting gauge and straight-edge cut out the groove, A, to receive ash veneer. Lay in this veneer, then with cutting gauge and straight-edge cut out groove B, and cut off ends of panel veneers at C. Then lay ash veneers, B and C. Now cut off sides of panels and end of rails, then lay the stile veneer, D. Cut

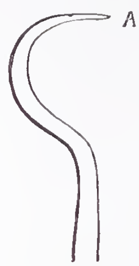


Veneering Wardrobe.

out all veneers with the cutting gauge and straight-edge. Do not use a plane except in fitting in veneers, A and B. Fig. 2 is the cutting gauge made of wood, with wedge to fix the steel cutter. Fig. 3 is cutter of cutting gauge filed to a point from one side only. It is made from a bit of thin steel. A bit of bow-saw blade will make one. Fix the straight-edge on the work with hand screws (Fig. 4). Wardrobe ends are not often veneered. I send this sketch to show your readers a proper way of doing all such-like work."

Painting Blackboards.—J. M. P. & Co. (*Nottingham*) write:—"We must take exception to J. F. K.'s description (see page 701) of the 'best' way of painting blackboards for the following reasons:—(1) The board will not preserve its 'dead' appearance after being used, but will become glossy. (2) The method he describes is as old as the art of making blackboards, and therefore should not be described as the 'best.' We are the inventors and makers of a composition for painting blackboards which will retain their 'dead' surface for years—indeed, until worn out—and we should be glad to send samples to any of your correspondents who may apply to us."

Hook-Turning Tools. — C. C. E. (*Lincoln*) writes:—"If our friend, F. A. M., had ever *worked* with hook tools, he would never have repeated, for the benefit (?) of TYRO (*Liverpool*), one of the very few mistakes to be found in Holtzapffel, Vol. IV. More than twenty years ago I procured Holtzapffel's tools, but as neither I nor any one else could use them I journeyed to Kingscliffe, to find that the tools were useless from two causes: first, the hooks were recurved as in Holtzapffel's book instead of being made like diagram, the point at A being prominent rather than curved back. Second, the stems are square instead of round. Hook tools, when properly made, are easily used, and will cut rapidly even into African black wood, but the rest must be *below* the lathe axis about 1 in. (not *above* it, as directed) and about 1 in. from face of work. Bore a hole, say, ¾ in. to nearly full depth to be excavated, and begin at edge of hole with a light cut, the edge of hook being almost horizontal. A little practice will give confidence as to price of tools. W. Green & Sons, turners, West Street, Kingscliffe, Northamptonshire, will supply small 'hooks' at 1s. 6d. each; large, 2s.; square 'hooks,' small, 2s.; and large, 2s. 6d.; long handles, 6d. each. A very efficient tool, doing partly the work of a 'hook' and 'square hook' combined, has recently been devised, but it is so much more difficult to use that amateurs had better let it alone."

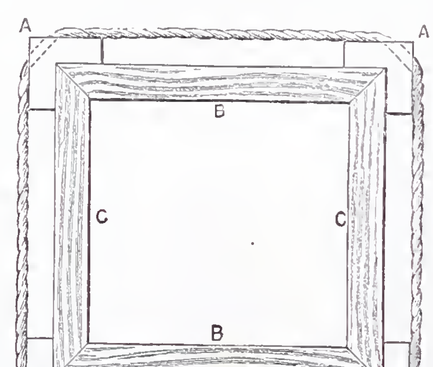


Turning Tool.

Sharpening Plane Iron.—DUMMY writes:—"I should advise R. H. (see page 651), and those who are inclined to follow his example, to forget an amateur's dodge and learn to sharpen a plane iron as it ought to be done, and not use a makeshift, slovenly dodge. In the first place, R. H. will find when the iron gets worn down he cannot continue to sharpen in the manner described. 2. He is wearing away the back part of his plane; and 3rd, he is not getting a true cutting edge. You will see by placing the plane in the position mentioned you get a bevel something like diagram, very stunted, and the iron would require grinding much oftener than it ought to do. To sharpen the iron, take it in the right hand, let the top of the iron rest against the thick part of the hand, the thumb round the edge, the two forefingers straight down the iron, the remaining two fingers round the other edge of the iron, holding quite firm. Put the iron on the stone, the bevel fitting the stone; now place the fingers of the left hand upon the iron, so as to give weight to it; proceed to sharpen; in doing so move the arms and not the wrists: the wrists must be held quite stiff, or you will roll the iron (as we call it). If your stone is in proper order, you will get a straight, smooth edge on the iron. Try it. If you endeavour to do as I say, common sense will soon show you your faults."

Plane Iron.

Mitre Cramp.—J. A. (*Wandsworth*) writes:—"Seeing in page 605 of WORK a query concerning the means of holding mitre joints, I send the following apparatus, which, though so extremely simple, is very efficient, and has a further merit with many that it costs scarcely anything. The



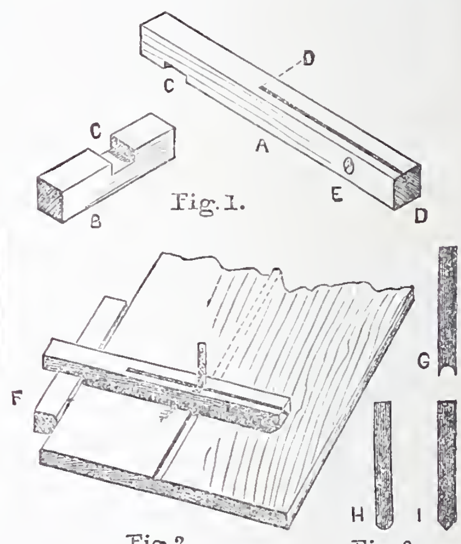
Mitre Cramp Apparatus.

sketch almost explains itself. The only things required are some wood (beech or oak) and some stout cord. Four pieces, A, A, A, A, are sawn out to the shape shown. If the inner angle is not a true right angle after being sawn, it must be made so by being pared with a chisel. Having made the opposite pieces, B, B, and A, A, the same length, and at the proper mitre angle, place them in position for gluing. Then tie the cord so that it will pass loosely round them, after which glue and tighten up the cord by means of the rod B. Before making the joints very tight, see if any of them overlap. If so, press them level with each other, and then tighten up fully."

Sign-Writing Charges. — B. J. (*London, W.*) writes:—"I send you prices of sign-writing about the West end of London:—Plain colour per inch, ½d.; sunken letters in three colours, per inch, 1½d.; each additional shade per inch, ½d., if properly executed. Gold, 4 inches and under, 1½d.; ditto, 8 inches and under, 1¾d.; ditto, 12 inches and under, 2d. Mouldings ½ inch to ¾, per foot, 3d. To the trade at one-third less than the above."

Saw Hammering.—R. H. (*Bolton*) writes:—"I notice, while perusing WORK (see page 715), that J. N. (*Sheffield*) is willing to instruct any one that is in need of information on circular saw hammering; if he will be so kind, I have a 33-in. circular saw, that is dished or concaved about $\frac{3}{16}$ of an inch, and through that cause it bears hard on the packing. I have sent it to the saw repairer's twice, and he asked me if I used pegs, and I said 'No,' but I use cotton banding lapped round a piece of pine stick, as most sawyers do. I am a practical sawyer, and I think all the pegs in the world would not make a dished saw run and cut true boards. He has hammered the saw, but still it is as bad as ever after it has run a short time in the bench; the same saw has worked for years, and done well."

A Useful Tool.—F. C. (*Leytonstone, E.*) writes:—"I send sketch of a very useful tool. It is not a novelty, and is by no means new, but it may be easily made by an amateur, and perhaps save a lot of trouble and expense, and, I believe, is not generally known. It may be made as follows.—Procure two pieces of hard wood, say 1¼ in. square—ash will do very well for the purpose—one piece, A, Fig. 1, 8 in. long, the other, B, 4 in. long. In A run a saw



A Useful Tool.

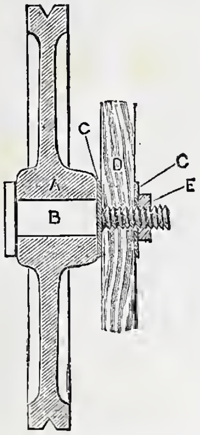
cut, D; this is to hold the cutter; notch them together as shown at C. E is an ordinary wood screw. Fig. 2 shows the finished tool, and the method of using it to work a bead in the middle of a board. The cutter is held in its place by tightening the screw, E. In Fig. 3, three forms of cutter are shown—G works a bead, H a flute, and I a V joint. They are easily made out of an old plane iron or a broken chisel. In using it is necessary to keep the knee, F, Fig. 2, tight against the work."

Dulcimers.—W. Y. (*Enfield Lock*) writes:—"On page 254, under the heading of Sounding Board for Dulcimer, W. S. M. (*Leeds*), in reply to DULCIMER, gives him some advice with regard to this instrument. W. S. M. is evidently a maker of dulcimers, and as I am about to buy one, should like to correspond with him."

Change Wheels.—F. A. M. sends the following errata *re* Change Wheels (page 734), line 9, "28 is brass gas;" also in line 8, for 28 read 26. Line 23 from bottom, omit "therefore," and put a full stop instead, beginning new sentence, As we have."

Wheels.—W. P. (*Withington*) writes:—"I have been waiting for G. W. (*Bournemouth*) to answer R. B.'s (*Largoward*) query in 'Shop' with regard to the address of firms where he might procure ready-dressed timber for wheel making. As no reply has been forthcoming, I append a few more names out of a number than those which I gave in No. 46, page 734, in 'Shop,' as being situated in Manchester, and which would be inconvenient for those living down south; anything in the wheeling line can be procured from Messrs. C. and B. Gadson, 11, Bushfield Street, London, E.; or Messrs. Thomas Whittingham & Wilkin, 135 and 136, Long Acre, London, W.C."

Parts of a Lathe.—S. G. D. (*Stroud Green*) writes:—"In the issue of WORK for December 14th I see an inquiry arising from a communication I sent you some time ago, and which you did me the honour to publish. Under the heading of 'Parts of a Lathe,' in 'Shop,' page 619, P. C. (*Bedfordshire*) seeks for further information about my temporary lathe attachment (I call it 'temporary' because by its aid I contemplate constructing a more elaborate and perfect accessory to the carpenter's bench). The wheel, A, is of cast iron, and its axle, B, is a bolt which is fixed to the bench, D, and secured by the nut, E, C C being washers; the accompanying sketch will make it clear. When I fitted up this attachment I had little time to spare, so put the wheel in the position that gave me least trouble to prepare the place for it. It would be a great improvement if the wheel was placed as near to the ground as possible, so that it comes well under the headstock of the lathe instead of behind it, and almost on a level with it, as is the case in the original arrangement shown in 'Shop,' page 508. By bringing it below the level of the top of the bench the necessity of removing it if the bench is required, say, for planing, is obviated. I should prefer brass or gun-metal bearings for the mandrel. The plummer blocks used for mine are simply of cast iron, and I am hound to say answer very well. Before making any article I generally plan it out on paper, and make careful drawings of the different parts to scale. I attribute a great deal of my success in mechanical work to this habit of drawing; it trains the eye, and is of immense value in teaching to measure and fit accurately. A moment's reflection will prove this; if an attempt is made to draw the parts of which an article is made, they must be carefully thought out, and what is carefully thought out at the beginning of the work has a better chance of being perfect at the finish than it would if done without such a system."—[Send in sketch and description of your lathe when ready if you would like it to appear in "Shop."]



Lathe Attachment.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

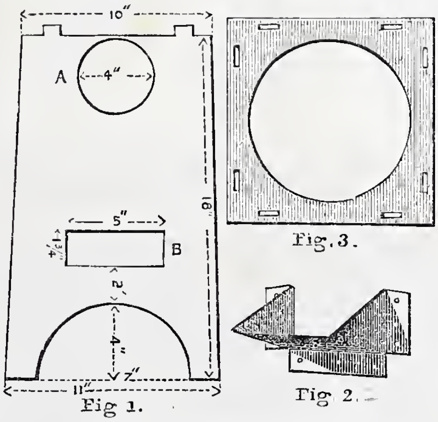
Schanschieff's Battery.—M. F. — The positive element of a Schanschieff's cell is a zinc plate, the negative element is a carbon plate; both immersed in a solution of mercury in a single cell. The E.M.F. is 1·56 volts, and the internal resistance ranges from 0·05 to 0·75 ohm per cell.—G. E. B.

Accumulator and Shocking Coil.—J. A. (*Shaftesbury Park*).—Respecting small accumulator, kindly see reply to D. SCOTT (*Holloway*) in WORK for October 12th. This will tell you how to make the plates. As you do not tell me the voltage and candle power of your lamp, I cannot say how many cells will he required, nor the size of the plates. The cells, to be light, should he of ebonite or vulcanite, and I think you would not be able to make these. Please look up my previous replies to correspondents, respecting Batteries for small Electric Lamps. Also read the articles which will shortly appear on Model Electric Lights. Respecting the shocking coil, one end of the primary wire—that is, the large wire wound around the iron core in the centre of the coil—goes to the foot of the spring of the contact breaker, and is clipped under it by one of the screws. From the foot of the pillar carrying the contact pin, a short thick wire goes to one of the binding screws on the base of the coil, and this is connected to the battery. The other end of the primary wire is connected to the other binding screw, and this to the other pole of the battery when you wish to set the coil in action. The finest wire is from the secondary coil, and this goes to separate binding screws.—G. E. B.

Gassner Battery.—G. W. (*Colchester*).—The Gassner battery is a patented article, therefore it is illegal to make and use it without the consent of the patentee. I do not know the proportions of its contents, so cannot advise you how to charge the battery. Why not make up a Leclanché battery for your bell?—G. E. B.

Electric Time Alarum.—AMATEUR (*Battersea*).—Kindly turn to replies on this subject given to ONE IN NEED (*Coventry*) and IRON TURNER (*Bolton*).—These will give you full information on how to connect the wires. What you suppose to be a lead rod is really a zinc rod, and furnishes the power in a Leclanché battery.—G. E. B.

Sheet Iron Stove.—DUTCHMAN (*Bristol*).—I do not remember ever seeing a plumber's stove made of sheet iron. It seems to me that it would wear out too quickly with the heat that it would get if in use constantly. I have made sheet iron firepots for my own and other people's use, for burning charcoal, but where coal or coke is the fuel I prefer cast iron stoves. There are some good stoves made specially for the purpose you require. Messrs. Rhodes & Sons, tool makers, Wakefield, supply a good strong one at 27s. 6d., and Messrs. Fletcher and Co., Warrington, make one in which gas is the heating power, the price of which is 15s. I can confidently recommend either of them, hut as it is probable that you may be already aware of this, and still wish to make one yourself, I will endeavour to help you all I can. You must make it out of stout plate, say, 16 in. gauge; use charcoal iron, or the mild steel which is fast superseding charcoal iron; its better quality will repay you for the slightly higher cost over common iron; cut out two pieces as shown in Fig. 1. In one piece cut out the circular hole, A, 4 in. diameter, or a little less, letting the edge of the hole he ¾ in. away from the edge at the top. This is for the back of the stove. The other piece will, of course, not have the circular hole, A, but cut in that the oblong hole, B, 5 in. by 1¾ in. The tenon pieces at the top are to rivet on the top with; instead of these, if preferred, you could rivet angle pieces ¾ in. by ¼ in., and drill and tap them, and screw the top on with stove screws. Punch a row of holes ($\frac{3}{16}$ in. or ¼ in.) down each side, about 1¼ in. apart, and ⅜ in. from the edge of the plate; mark down each side a line 1 in. from the edges, fix in a pair of clams in a vice, and hend at right angles. Now cut two pieces same shape and depth as Fig. 1, but 2 in. less in width, as they have not to he bent; these are the sides, and the front and back pieces have to he riveted to them, marking the holes from the pieces just punched. Next turn four angle pieces of ¾ in. by ¼ in., and rivet two on each side to support the hottom—the bottom should come an inch below the hole, B. Next make the apron piece, Fig. 2, and rivet it on the front of the body, to support the irons, etc. Then make a short piece of 4 in. pipe, and throw off a flange on it, and rivet on the hack, for the smoke pipe to fix on; cut out the top ½ in. larger all round than the body, and in it cut a hole 6½ in. or 7 in. diameter; carefully make the holes for the tenon pieces, and after placing the grating for the hottom in its place, rivet on the top by means of the tenons, unless you decide to use the angle pieces and stove screw, which, I think, is the best way if you have the tools, as the top could he easily removed if wanted. The next thing is the cover. I should, for this, turn a ring of ½ in.



Sheet Iron Stove Pieces.

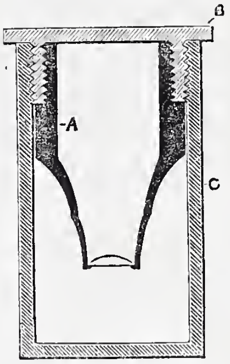
square iron that would just fit in the hole in the top, and rivet it to a round plate cut a little larger than the hole; rivet an eye or something to lift the cover for putting on fuel, and the stove will be complete, and although not perhaps so satisfactory as a proper cast iron one, I think it will answer your purpose. The dimensions I have given you can vary to suit your own convenience, and hope you will succeed in making it.—R. A.

Chemical Action in Gassner Battery.—H. H. L. (*Chester*).—I am not myself certain respecting the reaction which takes place in a Gassner battery when the circuit is closed. The constituents are (I am informed):—$Zn + Zn\ Cl + Ca\ SO_4 + Zn\ O + H_2\ O + C$, but I do not know in what proportions they are present, as I have not analysed the contents of a Gassner cell. Zinc chloride is a far more deliquescent salt than ammonium chloride, hence its superiority in a so-called dry battery, since it absorbs and retains the moisture necessary to keep the battery in working order.—G. E. B.

Switch for Bell.—IRON TURNER (*Bolton*).—As your question respecting the construction of the switch and its connections is fully answered in my reply to ONE IN NEED (*Coventry*), I must respectfully refer you to that reply. The switch could be used as you suggest instead of an ordinary push to keep a bell ringing for a long time. All letters received by me receive prompt attention, and are registered, so cannot he forgotten. But there is such a crowd waiting at the printing office! All cannot be served at once, and each are admitted in turn.—G. E. B.

Book on Masts.—J. W. (*Plymouth*).—The following book may answer your purpose:—"Masting, Mast-making, and Rigging of Ships," by Ripping, 2s. 6d., Lockwood & Co.—F. J. C.

Microscope Object-Glasses.—OLD SCOTCH AMATEUR writes a very encouraging letter to the effect that, from the drawings and description given in WORK, he has made a microscope, and that it is a very handsome instrument. He calls himself an old smith, and says that during the last six months he has made a lathe, and that with the aid of this he has made his microscope. Such a letter as the OLD SCOTCH AMATEUR writes is encouraging, not only for those who desire to work, but also to those who, from time to time, endeavour to assist them to do so. In reply to his questions in reference to the cell for object-glass, I will say that each object-glass is fitted into its own cell; so that if he has, say, a 2-in., 1-in., and ½-in. power, they must be mounted in separate cells to fit into K, Fig. 1, No. 22. I would suggest to O. S. A. that he make a brass hox to receive each of the cells; thus, procure a piece of hrass tubing, of a size that when an internal thread is cut in it, it will allow the cell to screw into it. Cut off ½ in. in the lathe, and to the end that has not the thread solder a stout piece of brass, a little larger than the ring. Place it on a chuck and turn down the disc, and finish hy milling the edge. On the outside of the ring cut another thread: this is to screw like a lid into a box. Take 2 in. of tubing, of a size to take the lid when a thread is chased on it. The other end is closed with a disc. When the object-glass is not in use, screw it into the lid and the lid into the hox. It will thus be safe against dust and bad usage. The above sketch will make this matter quite clear. A is the cell of object-glass screwed into B; C is the cover of hox. The sketch is not drawn to scale.—O.B.



Object-Glass.

P.S.—Will O. S. A. explain what he means by a "small pair of chops, which he finds the handiest tool helonging to the lathe?" Personally, I should be glad to know; perhaps others, also, would be henefited by the information.

Coil with Three Powers.—ELECTRIC LUBRICATOR (*Manchester*).—As you know how to make induction coils, I can soon tell you how to arrange the three powers. When winding on the secondary, wind on enough for the first power, then bring the finish end of this out to a stud on the hase board. To this same stud connect the starting end of the second power, wind it on the coil, and bring its finish end out to another stud on the base board. Start from this stud to wind on the wire for the third power, and carry its finish end to a third stud. These studs may be separate binding posts, or simply large round-headed brass studs, arranged in part of the radius of a circle within reach of the arm of a switch. Connect the handles of the shocking coil to the binding post at the commencement of the first power and to the pivot pillar of the switch arm. When the arm rests on the stud of the first power, the shock will be mild, when it is moved to the second stud the shock will be medium, and when moved to the third stud it will be strong, because then the effects of the whole three powers will he combined in one. A sketch will not be needed, and we cannot spare space for unnecessary engravings.—G. E. B.

Electrical Lantern.—A. O. A. (*Plaistow*).—I am now writing a series of articles on Model Electric Lights. When these appear you will see that it is impracticahle to do as you suggest. The generator itself for an electric lamp could not he put "in a hand lantern to he carried about," whilst the sloppy, dirty battery, would, in any size or weight, be an intolerable nuisance. The light from such small electric lamps would be useless in a lantern, as it would not be equal to that of a rushlight.—G. E. B.

Circular Louvre Lights.—DIDO (*Buckland*).—I fail to glean from your short note what it is you exactly require. Are the louvres to be glass, wood, or glazed? Do you wish them to he movable? Are they to be circular on plan or elevation? What purpose are they for? Have you any particular stipulations in the way of construction, etc.? If you will send a sketch (no matter how rough) with approximate sizes, you will prevent me giving a description which might be a very long way from meeting your requirements.—E. D.

Battery for Alarums.—J. C. (*Coatbridge*).—You should have had three cells at least, arranged in series, to work six alarums through 100 feet of wire. You do not say how long it is since you set up the first cell, but it is clear to me that the cause of failure lies in the resistance offered by the first partly worn-out cell. When you added another cell, you supplied enough pushing power to overcome the resistance of the first cell, but now this second cell has lost its youthful vigour, and adds its resistance or dead weight to the circuit. I advise you to discard both old cells, and set up three new ones, to make a creditable job. You do not say what kind or size of wire you have used inside. If No. 18 or 20 copper wire properly insulated with double cotton covering and properly stapled, it will do. The underground wires should have been run through a gas pipe, or else covered with tarred tape to protect the gutta-percha covering. Always provide more than enough battery power, as this is the truest economy. I shall be pleased to advise you at any time.—G. E. B.

Photographing on Wood.—WOOD ENGRAVER (*Birmingham*).—I would point out that the description you give of the process is evidently far from correct, nor have I any idea as to what is intended, unless it be the dusting-on process. It, however, appears to me that the method is a more lengthy one than that described in my article on photographing on wood, which you consider would take up too much time to be of financial value. If WOOD ENGRAVER wants a cheap process, he cannot do better than coat his blocks over with salts of iron as used for blue printing (already described in WORK) and for copying plans, etc. The block, after being exposed under the negative, is sponged with water, and a blue picture appears. I remember my father making all the illustrations for "Science at Home," of which he was the author, by this means.—W. E. W.

Model Slot Machine.—CLAUDIAN (*Nottingham*).—(1) You require no power to drive the machine, the weight of the penny does all the driving that is necessary, unless your machine is to do some kind of work of which you do not inform me. In the chocolate and similar machines, the dropping of the coin releases a catch, and the weight of the material above does the rest of the work. If you will send particulars of the purpose to which you propose to apply the machine, I will give you full information as to its construction. (2) In French polishing you do not need to soak the surface to be polished; let it be made perfectly smooth with the finest glass-paper, then dust off with a linen duster, and leave the work in a room where no dust will settle on it. Then brush it over with a weak solution of white shellac in spirits of wine, being careful that no damp strikes it. When dry pass over a linen pad moistened with pure olive oil; then polish with French polish on a pad of linen over chamois leather, working only about one square inch at a time, and finish off with a fine silk rubber. Some of the old-fashioned French polishers used the ball of the thumb to finish.—F. C.

Plate Shelf. — SIGNALMAN (*Bebington*). — An article describing the construction of plate shelves is in the Editor's hands, and is awaiting its turn for publication. Your former question was received and answered in due course, but it is quite impossible for replies to appear immediately they are written, for all must take their turn. You may be sure that all inquirers are answered as soon as practicable. Pray do not think you are "too young a subscriber" to receive attention, for we want to encourage all workers, whether young or old. Pleased to hear of your increasing interest in WORK.—D. A.

Harp, Design for.—AMATEUR.—This cannot be treated in "Shop." The harp proper is far too complicated an instrument to be dealt with in a brief paragraph. Perhaps some reader will describe, and give a sketch of, a Welsh harp.

Model for Papier-Mâché.—H. G. N. (*Islington*) requires an egg-shaped core, 3 ft. in length, on which to paste papier-mâché. Models for pasting used in the trade are commonly of American ash, but any wood which will stand well will answer the purpose. H. G. N. can either make his core, or have it made, by gluing pieces of wood roughly to the shape and then using the lathe; or, more easily and cheaply, he can turn it from a solid block of beech-wood. The objection to this would be its weight; but it might be made in two or three pieces, turned hollow, and then glued together. The turners of wooden bowls at Berkhampstead and Chesham would readily make him a core in this way. They make their beech-wood stand by boiling it.—S. W.

Tin Pattern Covers. — G. B. (*Manchester*).—Personally I do not know the articles you speak of as bevel wheel guards, and cannot find them in any book. Could you give fuller descriptions of them, with dimensions and a sketch showing them both flat and made up? I might then be able to tell you the best way to get the patterns.—R. A.

Self-acting Blowpipes, etc. — W. F. (*Woolwich*).—The lamp, Fig. 14, is sold by Rhodes & Sons, Wakefield, and, writing from memory, the price is, I believe, 10s. 6d. The Paquelin lamp is 12s. There is no book that gives the prices for doing such jobs as you speak of, and it would hardly be right for me to lay down a standard of prices in WORK; but if you let the Editor have your address, I will write you out a list of prices for a number of simple jobs, what I consider a fair price, and forward it to you, with the Editor's permission.—R. A.

Working Models.—J. H. P. (*Dewsbury*).—I do not know of any catalogue of working models being issued.—F. C.

Audiophone.—DAKER (*Camberwell*).—This instrument is a very simple affair, and is, I believe, the invention of an American called Rhodes, who is, or was, himself deaf. About seven or eight years ago it was introduced to this country through the agency of a Glasgow merchant (whose address unfortunately I am not able to give). The American audiophone consists of a thin elastic sheet or plate of vulcanite, provided with a handle about the size and shape of a Japanese or palm leaf fan. To the upper edge a series of strings is fastened, and these are brought down to the handle, where they are held by a small clamp. These strings bend the plate into a semi-circular form. When the instrument is thus strained into shape it is pressed tightly against the upper front teeth by the deaf person, who holds the instrument in its position by the handle, the rounded side of course being turned outwards. The sounds received upon it cause it to vibrate after the manner of the face of a violin, or the sounding-board of a piano, and these vibrations are thus conveyed through the teeth and bones of the skull to the auditory nerves. Fig. 1 shows the instrument in section, and the method of holding it against the teeth. Fig. 2 is an inside view. The strings are shown unstrained, and the position of the strings are not of importance, provided they give the proper degree of curvature to the plate. So much for the American instrument. It was very costly, owing to the material of which it was made. After its invention it was greatly experimented upon, with a view to find out some material to substitute for the costly vulcanite—sheet metal, wood veneer, cardboard, even paper, all of which produced most wonderful results, some of them producing results far superior to the original material. Indeed, anything of a vibrating nature, providing the form of it has sufficient surface

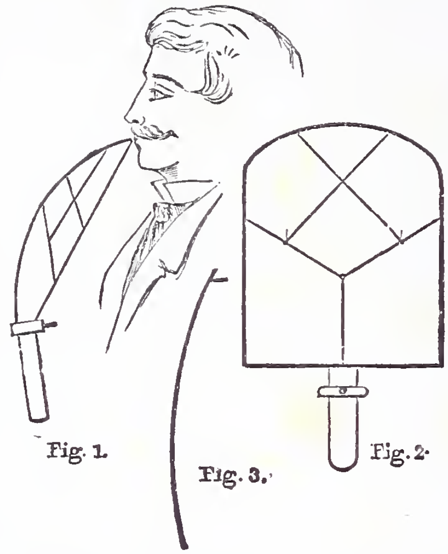


Fig. 1.—The Audiophone: section. Fig. 2.—Inside View. Fig. 3.—Fletcher's Audiophone in Section.

exposed to the source of sound, seems to answer the purpose. This I have found out by actual experiment. I will not occupy space here by giving details of the various contrivances I have made use of. Although the experiments always seemed satisfactory to myself (being possessed of a normal sense of hearing), they might not seem quite so much so to a partly-deaf person. I cannot do better, however, than describe the audiophone made by Thos. Fletcher, of Warrington. It consists of a piece of birch-wood veneer cut oval 12 in. by $8\frac{1}{2}$ in. bent like Fig. 3. The bending is accomplished by steaming it and tacking it down upon a curved board, and keeping it in this position until it is perfectly set. It should then be varnished with shellac varnish, to which a little ivory black has been added, or it may be decorated to suit the fancy of the person who uses it. This being very light it can be held between the teeth without any effort. If the querist makes this, which will cost only a few pence, he will find it to answer much better than the American instrument already described, and he will, therefore, not require the address of the Audiophone Company, which I am sorry I cannot give.—W. D.

Bent Iron Designs. — TIM BOBBIN. — Try B. Bradley, 180, Fulham Road, West Brompton. You can get iron there, and probably designs; if not the latter, I will, with Editor's permission, send an article, with illustrated designs, to WORK.—J.

Iron Strips.—J. P. S. (*Hertford*). — You will probably get these of B. Bradley, 180, Fulham Road, West Brompton.

Wooden Printing Press.—FAUST (*Liverpool*).—I have in my hands a paper on the mode of making a wooden printing press, which will appear shortly.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—DOUBT (*Glasgow*); E. W. (*Hurstpierpont*); R. T. (*Edinburgh*); F. H. H. (*Wednesbury*); S. B. (*Exmouth*); T. B. (*Sunderland*); M R. (*Burnley*); CLERICUS SECUNDUS; A. R. (*Scorrier Saw Mills*); J. K. (*Nottingham*); J. W. H. (*Holywood*); KEYNSHAM; W. K. (*New Wortley*); W. B. (*Glasgow*); R. W. (*Newcastle*); G. L. (*Liverpool*); F. T. B. (*Slade*); C. H. (*Bloomsbury*); NO NAME (*Reading*); STICKPHASTE; A. F. (*Hamilton*); A. F. (*Bath*); F. N. K.; W. J. (*Belfast*); R. O. B. (*Edinburgh*); G. F. H. (*South Lambeth*); FAIR PLAY; W. P. (*Blackburn*); G. S. (*Fulham*); C. H. C. (*Cheltenham*); A. J. B. (*Peckham*); LITTLE SCOT; T. B. (*Swanley*); J. S. W. (*Glasgow*); CINQUE PORT; A. H. (*Arlington Square*); A. H. W. (*Newcastle-on-Tyne*); D. W. T. (*Sydenham, S.E.*); A. H. (*London, N.W.*); H. M. B. (*Wakefield*); H. S. (*Clapham Junction*); R. W. B. (*Poplar*); ONE IN THE DARK; J. H. (*Heaton*); ALIQUANDO; T. K. (*Glasgow*); J. C. (*Newcastle-on-Tyne*); J. H. S. (*Wigan*); and H. G. (*Liverpool*).

Trade Notes and Memoranda.

ROBERT H. SMITH, Professor of Mechanics in Mason College, Birmingham, England, has made a series of mechanical tests relative to the durability, friction, and temperature of bearings made of magnolia anti-friction metal when running in bearings on journals of different diameters and lengths. In all, between three and four thousand tests were made, in which the temperature of the bearings and the friction were actually determined. In his conclusion he states the metal to be superior either to Babbit or gun-metal for bearings. The results of the experiments show that the temperature of the bearing and friction was less, and durability of the material considerably greater, than the other materials tried.

FOR the cementing of iron railing tops, iron gratings to stoves, etc., the following mixture is recommended—in fact, with such effect has it been used as to resist the blows of a sledge hammer. This mixture is composed of equal parts of sulphur and white lead, with about one-sixth proportion of borax, the three being incorporated together so as to form one homogeneous mass. When the application is to be made of this composition it is wet with strong sulphuric acid, and a thin layer of it is placed between the two pieces of iron, these being at once pressed together. The *Scientific American* says, "In five days it will be perfectly dry, all traces of the cement having vanished, and the work having every appearance of welding."

WORK.

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