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DYES, STAINS, INKS, LACQUERS, VARNISHES AND POLISHES

By

CHARLES GODFREY LELAND, M. A., etc.

AND

THOMAS BOLAS, F. C. S., F. I. C.

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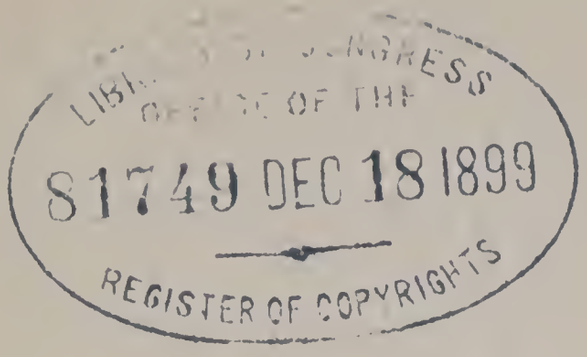

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EDITOR'S INTRODUCTION TO THE SERIES.

This series of Essays was planned by Mr. CHARLES GODFREY LELAND, M.A., F.R.L.S., founder of the Public Industrial Art School of Philadelphia, author of twenty-three books on the Minor Arts, etc., for publication in one large volume, to be called "One Hundred Minor Arts." The publishers have thought, however, that the widest publicity will be obtained by issuing them in the form of a series of small hand-books, especially in view of the author's desire to make his work accessible to students and to poor people who can hardly afford a large book.

This breaking of the work into separate sections has made it easier to add to the matter supplied by the original author, and to include many extra illustrations, designs, etc. It has provided for the introduction of a few additional treatises, such as "Soldering, Brazing, and Joining of Metals," "Dyes, Stains, Inks, Lacquers, Varnishes, and Polishes," and others which will be added from time to time, and which will be the subjects of constant reference from the other books. It also leaves the series elastic for the introduction of other kindred subjects.

The Editor is anxious to receive hints and suggestions from his readers, with a view to making the work as complete and as useful as possible. He will also be pleased to reply to queries from those correspondents who will write on one side of the paper only, and have the courtesy to enclose stamped envelope for reply. Communications should be addressed to the Editor, care of the Publishers.

List of Subjects and Authors.

(See List of Principal Contributors on Front Cover.)

Additions and alterations will be made from time to time, but this list gives an idea of the scope and catholicity of the series; and of its value as an encyclopedia of the minor arts and handicrafts.

Introduction: Design and Drawing. C. G. Leland. *Ready Nov. 30.*

Wood Carving. C. G. Leland. *Ready Dec. 7.*

Picture Frames: Making and Decorating. Leland and Bolas. *Ready Dec. 14.*

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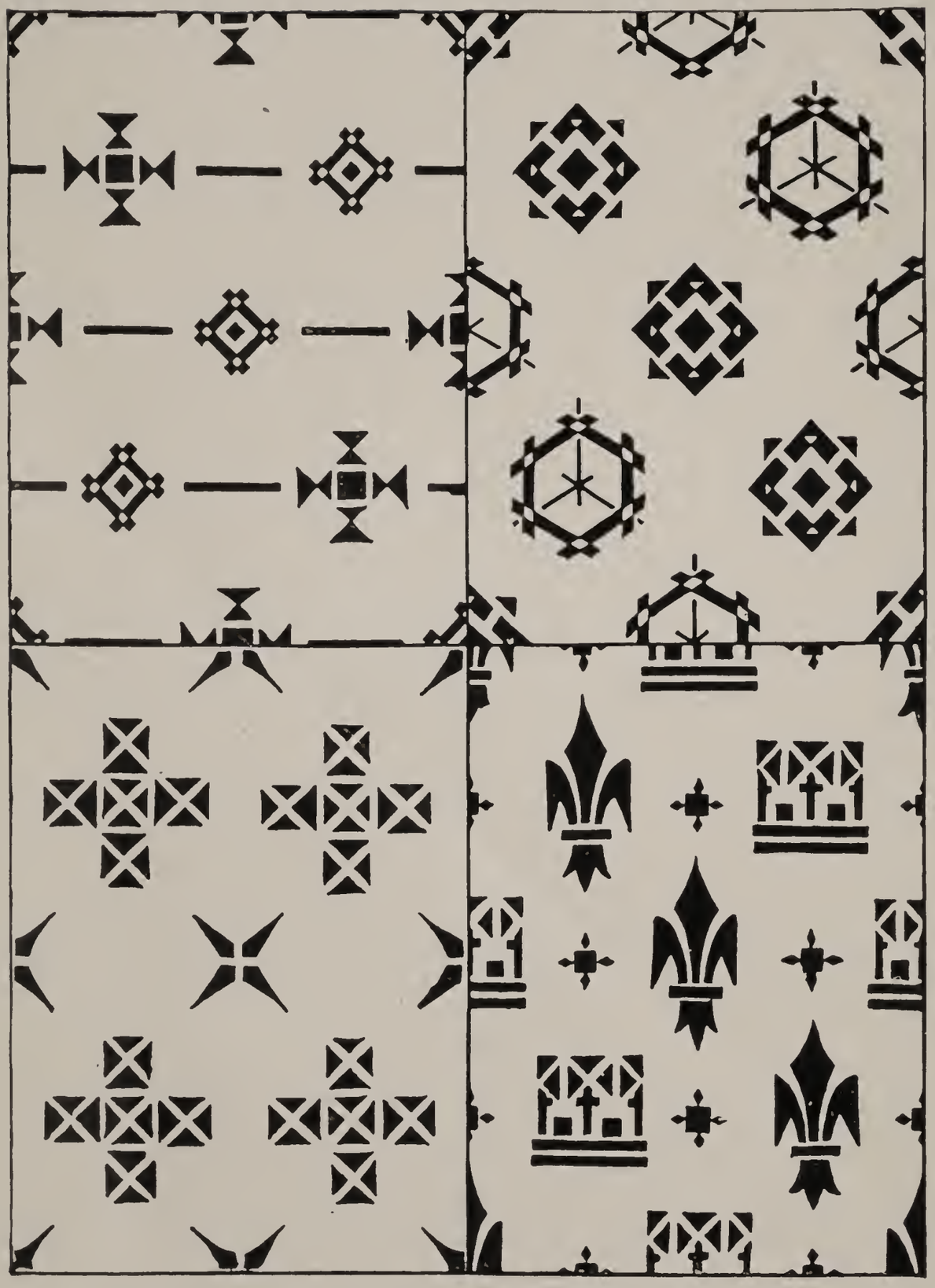
Soldering, Brazing, and the Joining of Metals. Thomas Bolas.

Bent Iron Work. Leland and Bolas.

Drill Work on Metal. Nail and Scale Work. C. G. Leland.

Etching on Metals: Niello and Inlaying. Leland and Bolas.



Four designs for mordant or discharge printing.

[In these and most of the other designs great variation is obtainable by the rearrangement of the simple stamps.

DYES, STAINS, INKS, LACQUERS, VARNISHES, AND POLISHES:

HOW TO MAKE AND USE THEM.

By T. BOLAS, F.C.S., F.I.C.

PART I.—INKS AND STAINS.

RUE INK, in the old-world sense of the term, was a stain which penetrated, or burned itself into, the papyrus or the parchment, hence we get the name ink (encaustum, inchiostro, ink). The king of inks in the old days was the purple liquid of the murex, none but royal personages being allowed to write with it. Another true or penetrating ink of the old days was the black liquid of the cuttle-fish. The purple liquid of the murex is now of no commercial or industrial interest, as only about one drop is obtained from each shell-fish, but the black liquid of the cuttle-fish is used in manufacturing the sepia paint of the water-color artist.

Water Stains and True or "Encaustic" Writing Inks differ by the fact that an ink for ordinary writing should contain about one-third ounce of gum to each pint, the object of this being to make it sufficiently viscous to flow but slowly from the pen and to hinder a too rapid lateral spread on the paper. The water stain is generally best without the addition of gum, but in the case of very soft wood, the gum is often an advantage as lessening the tendency to soak in, while if the same water stain is to be used on the flat of the grain, and on the end-grain of a wooden article, that used on the end-grain should ordinarily have a little gum with it. As regards the application of stains to wood, see another section (page 11).

In the following formulæ an amount of gum will generally be indicated which will convert the water stain into an ink suitable for the average writing-paper of the present day. For hard papers and pens with many irregularities for inkholding, less gum will serve (or even in extreme cases none whatever may be required), while the use of soft papers and very plain pens necessitates a larger proportion of gum.

No. 1. *Ordinary Nutgall and Iron Ink.*— One formula for this is sufficient, the following, due to Professor Brande, being highly satisfactory: Sound Aleppo gallnuts, crushed but not powdered, 6½ ounces; soft water, 6 pints; heat to the boiling point, and add 3¼ ounces of ferrous sulphate (green vitriol) and 3¼ ounces of gum arabic. When cold, put the whole in a bottle and shake occasionally. It will be ready for use in a few weeks if strained off from the dregs (for straining device see page 13). All the materials may be placed together in a bottle and allowed to digest without the application of heat. For modern papers the gum may be reduced to 2 ounces; or if the ink is for use with stylographic pens, to 1½ ounces.

Preservatives for the above and for other inks.

Inks containing organic matter require the addition of an antiseptic (unless some constituent of the ink acts as such). Five drops of true creosote, or 15 drops of phenol (carbolic acid) to the pint of ink will prove satisfactory. One-fourth or an ounce of cloves, crushed and allowed to macerate with the materials of the

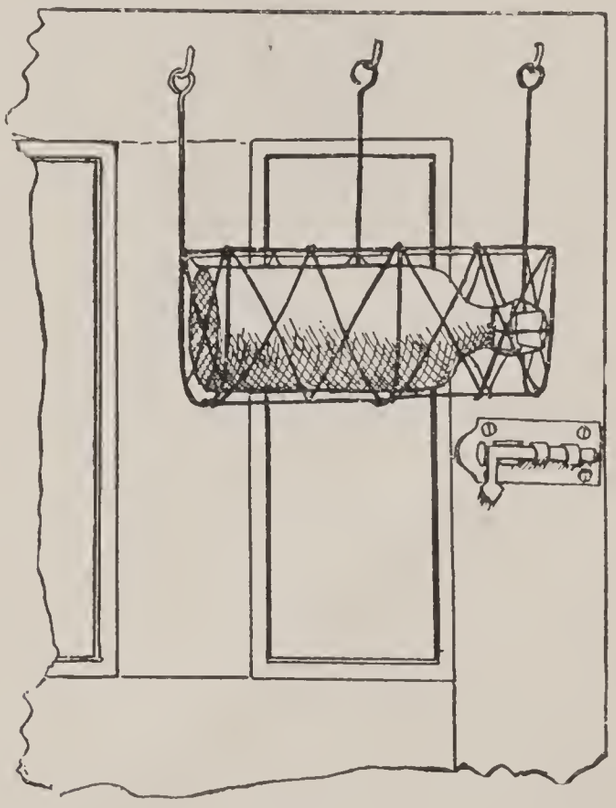


FIG. 1.

inks, is also satisfactory. If smell is objected to, 20 to 30 grains of salicylic acid may be added to each pint.

A Macerating Device.— In making ordinary black ink, and in some other cases in which vegetable products are concerned, the materials are placed in a bottle, which should be frequently shaken.

A convenient way of doing this is to lay the bottle in a kind of cradle attached to a door which is in frequent use. Generally speaking, the cradle is best placed high up near the opening edge of the door, and as against breakage by slamming a thick lining of flannel is useful. Fig. 1 sufficiently illustrates the nature of the device, which, by-the-by, is also useful in varnish-making.

No. 2. *Runge's Chrome Logwood Black Ink or Stain.*— As an ink for ordinary use this is not to be recommended, as it is subject to decomposition when kept for a long time, but as a cheap and permanent black stain it is useful. Extract of logwood ½ an ounce is dissolved in 20 fluid ounces of boiling water, when 60 grains of crystallized carbonate of sodium (washing soda) is dissolved in the liquid ; now strain off (see page 13) and stir in 15 grains of neutral (yellow) chromate of potassium dissolved in 4 ounces of water. An addition of gum may be made if required. If good extract of logwood can not be obtained, ¼ pound of logwood chips may be boiled in about 2½ pints of water for a few minutes ; when cold, the decoction, which should measure about 2¾ pints, should be poured off and strained ; 60 grains of crystallized sodium carbonate (washing soda) should be added ; and 15 grains of neutral (or yellow) chromate of potassium dissolved in ¼ ounce of water, is added slowly with constant stirring ; gum may be added if necessary (see pages 2 and 3).

No. 3. *Logwood Copying Ink* (*Black*).— Inks of this class should be made with alcoholic extract of logwood, which is now an article of commerce. The following keeps fairly well : One ounce of alcoholic extract of logwood ; water, 8 fluid ounces ; when dissolved, grind in ¼ ounce crystallized carbonate of sodium (washing soda) ; strain and stir in the following, adding but little at a time : Water, 1 fluid ounce ; gum arabic, ¼ ounce ; neutral (or

should dry after each application. The number of applications is regulated by the intensity of color required. It is best to begin with the iron solution and finish with the galls. Any scum or deposit should be wiped off while the article is wet. The full color requires time to develop, and the work will be a little cleaner as regards scum if two ounces of common vinegar is added to each pint of the iron solution. On soft woods this process, if patiently carried through, gives the best of blacks, but for hardwood the following is sometimes to be preferred :

No. 8. *Sulphuric-Acid Reaction* (*Black*), as stain for wood, or as sympathetic ink.— One fluid ounce of strong sulphuric acid is mixed with 16 fluid ounces of water; but those not accustomed to handling of corrosive liquids should obtain this mixture from a pharmacist. Indeed, those merely practicing household arts should avoid this stain altogether, as if even the dilute acid comes in contact with textiles it will cause them ultimately to fall to pieces. If wood is uniformly wetted with the above-mentioned dilute sulphuric acid and then held before a clear fire so as to dry off the water, the acid as it concentrates will char the wood on the surface and give an intense and absolutely permanent black. A second and even third treatment may be necessary, and in the end the article should be rinsed to remove traces of acid. To make a sympathetic ink, the above weak acid should be diluted with its own bulk of water, and 30 grains of white sugar must be added to each fluid ounce of the liquid. Writing with this (quill pen or glass pen) on white paper is invisible, but becomes black if the sheet is held before a clear fire until the acid is sufficiently concentrated. The paper is always more or less weakened where the acid has acted.

No. 9. *Catechu* (*Brown*) *Ink or Stain.*— A simple solution of

yellow) chromate of potassium, 5 grains. This is not an ideal ink to write with, as it clogs the pen in partially drying, but it copies well.

No. 4. *Ferrous Ink (Black).*— Sometimes called "alizarine" ink. This is an iron and nutgall ink, in which the iron is mainly in the ferrous state; consequently the ink is almost colorless, but the writing soon becomes black by the absorption of oxygen from the air. Inks of this class flow readily from the pen, and they are ordinarily somewhat tinted so that the writing shall be sufficiently visible before the true black appears.

To the ingredients of No. 1, when in the bottle, add ½ ounce carmine of indigo, 3 ounces of glacial acetic acid, and ½ ounce of fine iron wire. Cork tightly, and macerate with frequent agitation, as directed in the case of No. 1.

No. 5. *Iron Copying Ink (Black).*— No. 4 is made of double strength, and 1 ounce of soft brown sugar is added to each 10 ounces of the finished ink.

No. 6. *Nigrosine Ink (Black), Noncopying and Copying.*—The coal-tar color sold as nigrosine dissolves in water and gives an excellent ink which appears to be at least as permanent as the iron inks. *Simple Stain:* nigrosine 1 ounce, water 35 ounces; shake in a bottle until dissolved. *Writing Ink:* add 2 ounces of gum. *Copying Ink:* make a further addition of 3½ ounces of soft brown sugar.

No. 7. *Ink Stain (Black) by Alternate Application.*— This is specially suitable for producing an intense black on wood. Treat the article as explained on page 9, but alternately with a solution of protosulphate of iron (green vitriol), 1¼ ounces to the pint, and with a decoction of galls made by simmering 2½ ounces of well-crushed galls in a pint of water for half an hour. The article

catechu in water, about 40 grains to the ounce. Boiling is sometimes necessary, but when used as ink no gum is required.

No. 10. *Carmine (Red) Ink or Stain.*— Among the bright or scarlet reds this is perhaps the most beautiful, but it is not very permanent as against long exposure to light. Carmine 20 grains, strong liquid ammonia ½ ounce; shake together in a bottle, and when dissolved make up to 2 ounces with water. As an ink, add 30 grains of gum.

No. 11. *Madder (Red) Ink or Stain.*—This has a more purple tint than No. 10, but is permanent against light. Artificial alizarine 40 grains, or 10 per cent alizarine "paste" 400 grains; put in a bottle and make up to 3 fluid ounces. Add ½ ounce of strong liquid ammonia, and agitate until solution is complete (solution will be instantaneous if the "paste" is used, but may be slow if the dry alizarine is employed), then add a solution of 10 grains of alum dissolved in ½ ounce of water. If as an ink, add about 10 grains of gum to the ounce. The keeping of the alizarine and alumina in solution depends on the use of a considerable excess of ammonia, and this excess must not be allowed to escape by leaving the ink-bottle uncorked. For true dyeing with alizarine, see page 15.

No. 12. *The Old-Fashioned Brazil Wood (Red) Ink or Stain.*— This has a peculiar and characteristic brilliancy. Brazil-wood chips 4 ounces, alum ½ ounce, water 25 fluid ounces; simmer for half an hour in an enameled saucepan; add 2 ounces glacial acetic acid; when cold, strain. As ink, 20 grains of gum to the ounce.

No. 13. *Eosine (Red) Inks or Stains.*— Most red inks now sold are obtained by adding soluble eosine-red to water, a strength of ten grains to the ounce being about the average; gum and preservative as may be required.

No. 14. *Yellow Stains or Inks.*—One and one-half to 2 ounces of turmeric boiled in 20 ounces of water gives a cheap yellow stain, but a much finer color, tending to orange, is obtained with about one-sixth the quantity of saffron; gum and preservatives as required. Martius' yellow and the soluble aniline yellows dissolved in water give cheap and, in some respects, convenient yellow stains.

No. 15. *Sap Green Stain or Ink.*— The soft extract of buckthorn berries, sold as sap green, is dissolved in water, 40 grains being used for each ounce of water. This makes a convenient ink, no gum being required, and it is also a good stain for the softer woods.

No. 16. *Copper Green Stain or Ink.*— Acetate of copper 2 ounces, cream of tartar ½ ounce, glacial acetic acid ½ ounce; macerate in the shaking-bottle until nearly the whole is dissolved; especially useful as a stain for hardwoods and ivory.

No. 17. *Aniline Green Stains and Inks.*— Made with commercial soluble colors; see Nos. 13 and 14.

No. 18. *Blue Stains and Inks.*— Three ounces of sulphate of indigo with a gallon of water will be sufficiently colored to serve as a stain or ink, but in the latter case gum and preservative will be required. This indigo stain is quite permanent against light, but cheaper and less permanent blue stains may be made with the commercial aniline colors.

No. 19. *Cudbear Violet Stain or Ink.*— Cudbear 1 ounce, carbonate of potassium 1½ ounces, hot water 20 ounces. Mix. When to be used as ink, add ½ ounce of gum and 1 ounce of alcohol.

Designs for mordant or discharge printing.

HOW TO USE WATER STAINS.

If a highly colored water stain is applied to an article of soft wood, there is considerable risk of unequal and patchy coloring if the stain is applied to the dry wood with a brush, as absorption is then very rapid. Three courses are open for obtaining uniform coloring. 1. To apply the stain a little at a time with a sponge

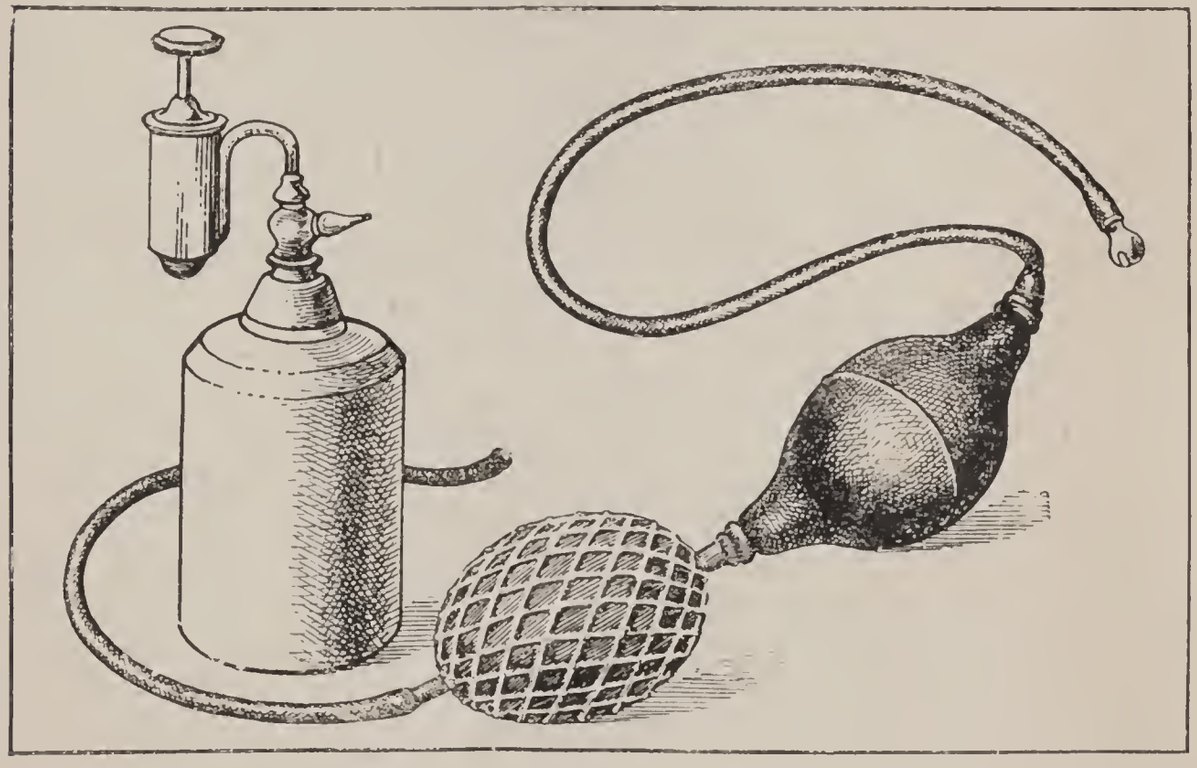


FIG. 2.

which is only slightly charged with the stain; this being perhaps the most convenient when completely unobstructed access can be had to all parts, as. for example, in staining the outside of a plain box. 2. The stain is applied by spraying, this method being especially useful in the case of intricate work. A spray-producer suitable for the present purpose can be obtained from any dealer in

toilet requisites, and one should be selected with quite a fine spray. A mechanical blower of some kind should be used with the spray producer, as, if the mouth is used, it is not easy to watch the effect. The bottle shown on page 9 has a small metal compression-pump attached and is a very convenient form, as the bottle can be held in one hand while a single finger works the pump, the other hand being free to move or adjust the work. Another, but less convenient, air-compressor is the india-rubber bellows, also shown on the same illustration. 3. The stain is applied by free brushing ; almost mopping. When a piece of woodwork is very complex this is often the best way, but a preliminary moistening by spraying or otherwise is sometimes desirable to control unequal action. When the stain is freely brushed on, the work should be held over a tray or dish. Speaking generally, articles of woodwork are less damaged by a thorough wetting than by a partial wetting, and if a free circulation of air is provided for, water dries off very quickly ; obviously staining should be done before any metal articles or textiles are attached to the wood. On page 2 will be found a note as to the use of gum, and especially as to its use in preventing a too free absorption of stain by the end-grain of the wood.

Ivory, like other hard materials of a similar character, is stained by soaking.

Preparation of the Stained Wood for Finishing.— The fiber will always be more or less brought up by staining, and level work may be finished off when quite dry with the finest glass paper, and details may be treated by suitable slips of wood to which fine glass-paper is glued. Brick-dust and pumice powder applied with a stiff brush are also useful in finishing woodwork. For a plain oil finish no filling in is required, and in rubbing in the first dose of oil many persons would add a little fine pumice (see page 22). When the

work is to be varnished it is usual to size the wood at this stage, for which purpose it is sized with glue so thin as to set very slowly ; this having been well brushed into all interstices, all excess is wiped off with a soft cloth. When once more dry a final smoothing may be given with the finest pumice powder and a stiff brush. It is now ready for varnishing, and instructions for this will be found on page 18.

SPIRITUOUS STAINS FOR WOOD.

Although water stains such as those above described are on the whole to be preferred for wood, there are a few cases in which a staining material dissolved in alcohol or oil of turpentine is desirable ; as, for example, if the tint of a finely figured wood like pitch pine, bird's-eye maple, oak or beech is to be darkened. In such cases the surface transparency of the wood is better maintained by the use of spirituous stains, and especially if oil of turpentine is the solvent. The various qualities of bitumen, dissolved in oil of turpentine, will give nearly all the shades required for this class of work, but for somewhat brighter effects tinctures of turmeric or dragon's-blood in alcohol may be used. The above preparations may be conveniently made in the macerating bottle, and when the turpentine or spirit is sufficiently colored the bottle should be allowed to stand upright for an hour or so, when the upper portion is poured off into a paper filter through which it will run quite clear.

Filtering.— To get the finer tinctures, stains and lacquers into the brightest and clearest condition the paper filter is almost indispensable. We therefore give the following description of its arrangement and use.

In Fig. 3, A is a glass funnel standing in the neck of a bottle, B ; but to prevent the locking in of the air a short piece of string is placed as shown between the bottle and the funnel. The filtering material is soft unsized paper ; either the white blotting paper sold at the stationers' stores or a somewhat similar paper made and

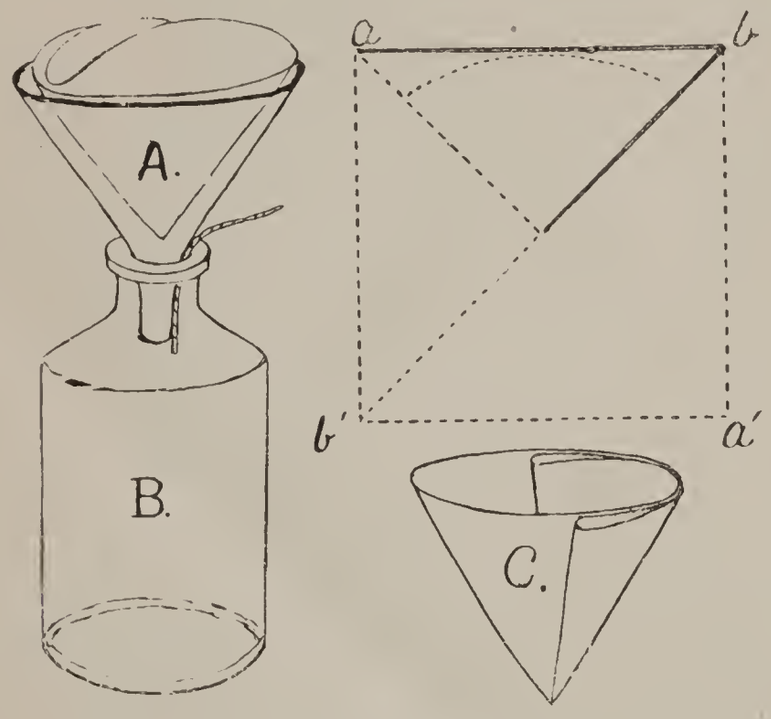
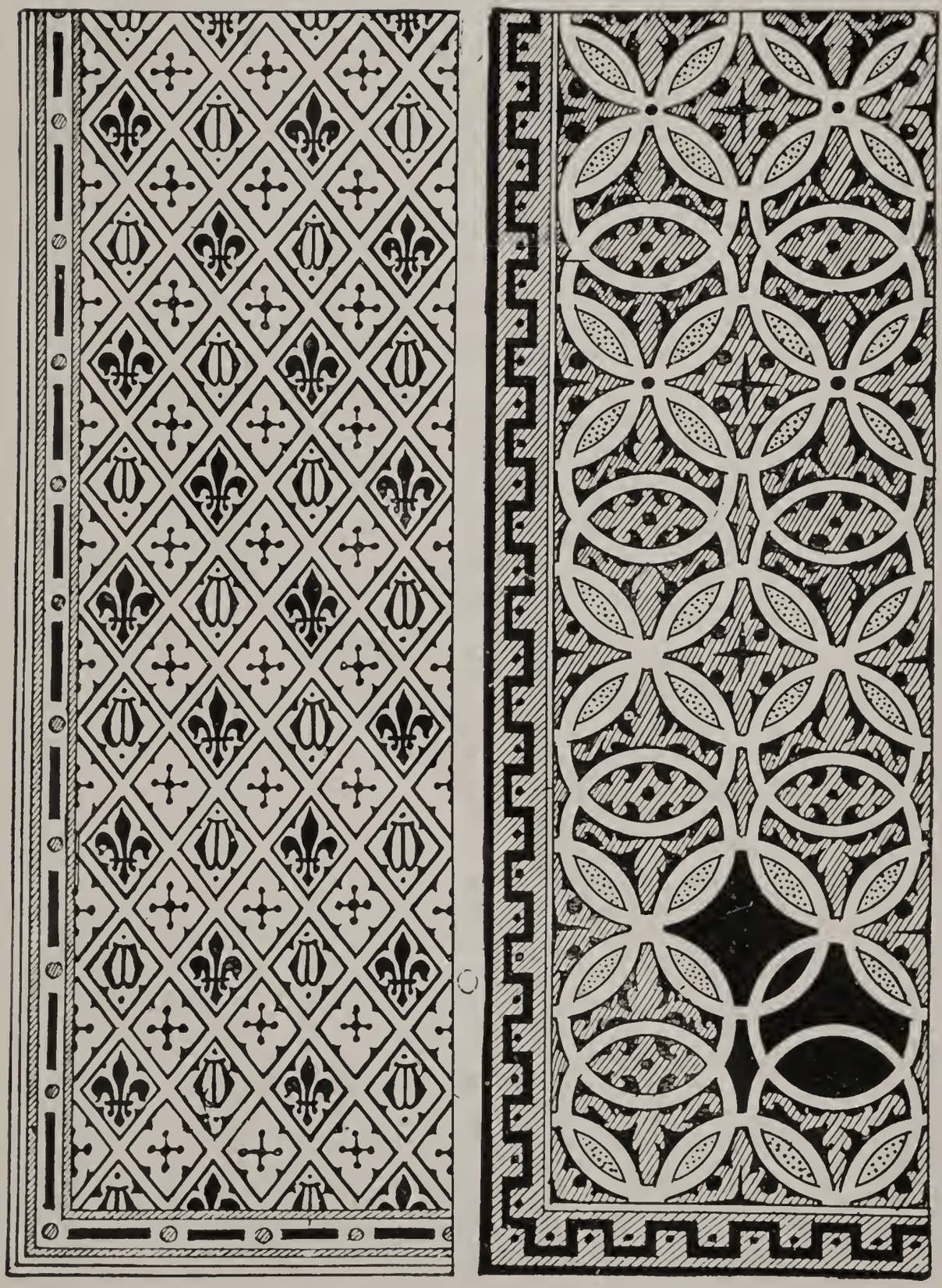
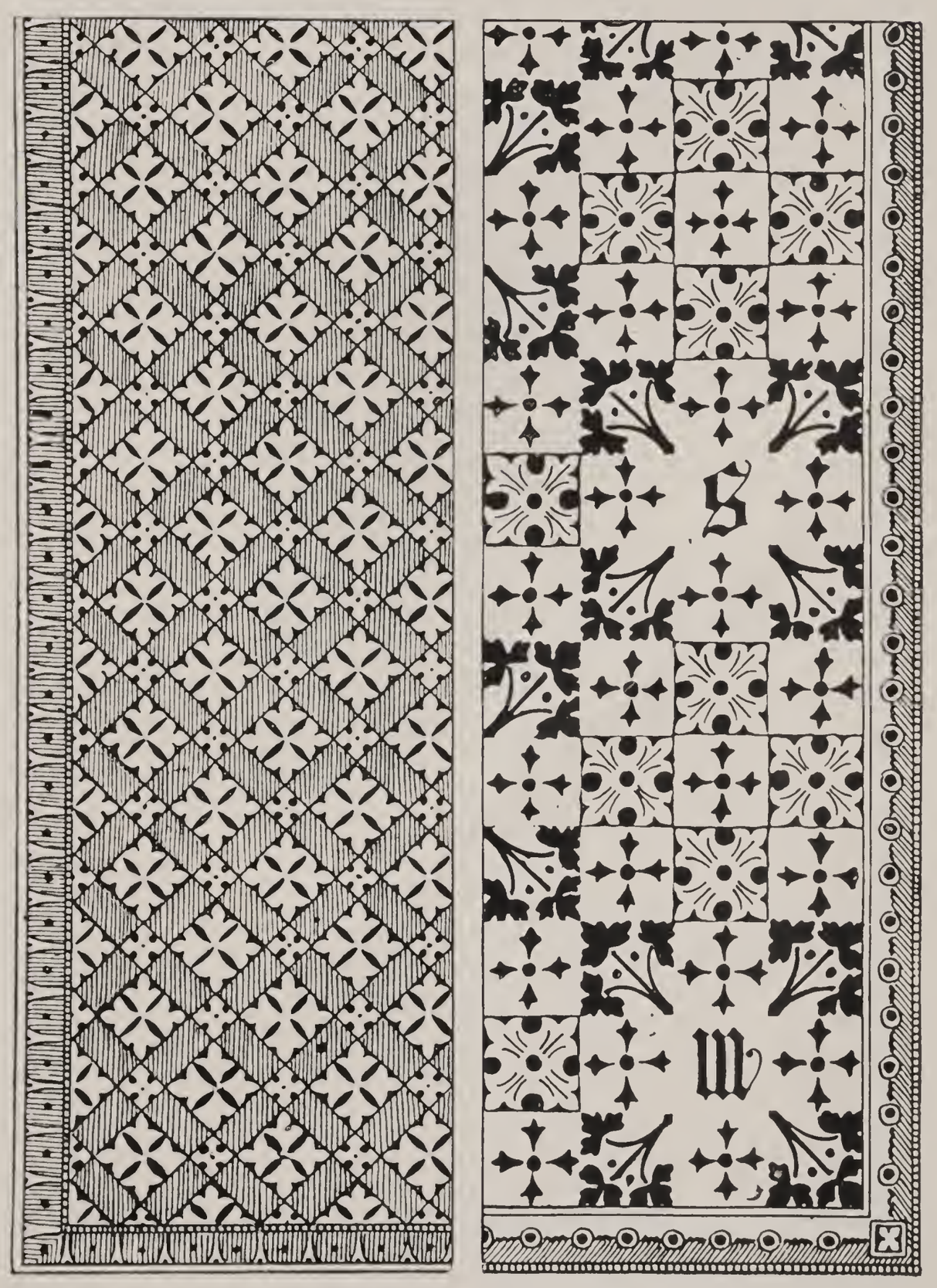


FIG. 3.

sold specially for filtering. Let a, b, a', b', be a square of the filtering paper. Fold the corner a' over the corner a, then the corner b' over the corner b, and finally cut round the dotted quarter-circle with the scissors, when the paper can be opened out into a kind of conical cup as shown at C. This conical cup being placed in the funnel, some of the liquid to be filtered is poured in gently, and as the liquid runs through clear, more is added. In using a paper filter it is necessary to be careful not to



Two designs, and borders. The five black spaces show outlines of the five stamps, the repetition of which gives this complex pattern. In the other design only three simple stamps are used.



Two designs, with borders.

weaken the apex of the cone in folding. The fold at the apex should be well defined, but there should be no unnecessary handling of the paper. It is well to pour as little as possible of the dregs on the filter until close upon the end of the operation, when the dregs may be poured on and allowed to drain.

For a coarser filtration or straining, a textile material is often used. For example, the jelly-straining cone shown by Fig. 4 is

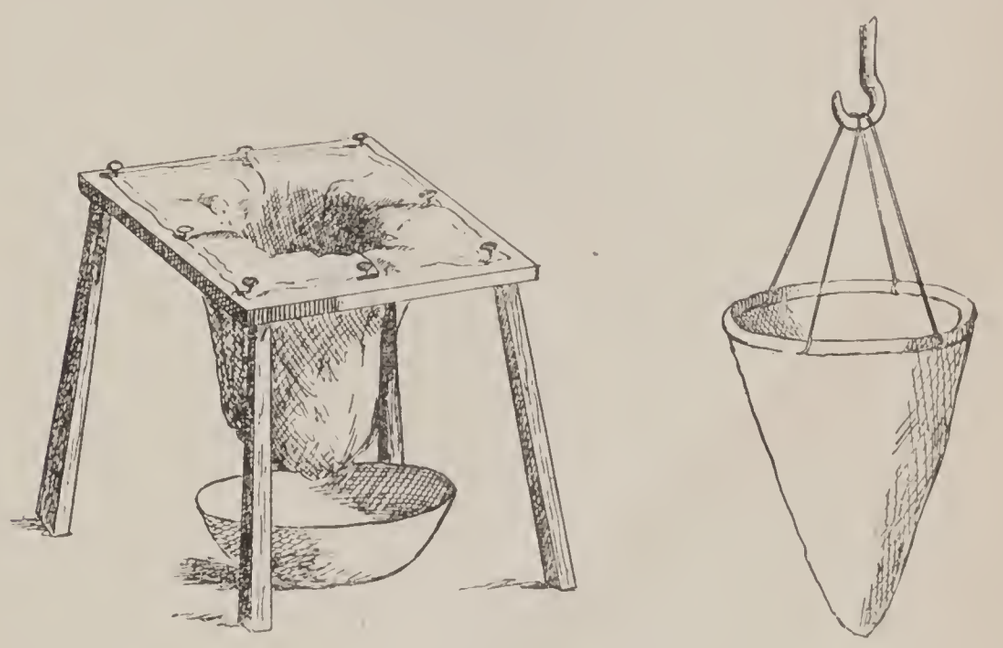


FIG. 4.

convenient; but these cones are expensive, and a cheap substitute for the coarser straining is a square of calico folded as for the paper filter, gathered in a little at the mouth and supported by such a stool as is shown by Fig. 4. A few carpet tacks hold the cloth in position, and the pendant part takes a bag-like shape as shown.

TRUE OR MORDANT DYEING.

Although the title of the present book includes dyes, it is in no sense to be considered as a handbook of the very complex operations incident to mordant dyeing or true dyeing, a process in which certain chemicals called mordants, applied to a textile fabric, absorb the color from a dye bath, and lock it firmly to the fabric. Moreover, several different mordants (all practically colorless) may be printed upon the same piece of cloth, each mordant giving a different color in the dye bath. Mordant dyeing is an ancient art, having been practiced by the Egyptians, whose mode of working is briefly described by Pliny (about 50 A. D.) in a passage of his Natural History (xxxv. ii.) commencing "*Pingunt et vestes in Ægypto*," and his passage may be translated as follows: "In Egypt, textiles are colored in a strange way. When in their original white condition they impregnate them, not with the dye, but with drugs which have the power of absorbing color; this causing no change in the appearance; but when they are steeped in a bath of the prepared dye they are taken out properly colored; the remarkable fact being that although the bath contains but one color, several colors are imparted according to the nature of the drugs first used."

The following experiment in true or mordant dyeing will serve to show its wide range of applicability in producing patterns on textiles. With three stamps or types cut out of cork, impress a pattern on a piece of well-washed calico with the following mordants: (1) common alum ¼ ounce, acetate of soda ¼ ounce, gum ½ ounce, water 2½ ounces; (2) as above, but ⅛ ounce of chrome alum in place of the common alum; (3) as above, but about $\frac{1}{16}$ of an ounce (division of ¼ ounce into four apparently

equal parts is quite near enough) of perchloride of iron in place of the chrome alum. Any required patterns or devices having been stamped upon the calico with these mordants, the piece is stretched out in a damp place and allowed to remain for a week or two, when it is boiled in a dye bath containing 30 grains of artificial alizarine to each pint of water. Those parts mordanted with No. 1 will slowly become bright red ; those parts mordanted with No. 2 will take a deep brownish-red tone, and No. 3 mordant will give a purple color. The general ground of the stuff will appear reddish at this stage, but boiling with soap and water will remove all color except where fixed by a mordant. In a simple form like the above, mordant printing is within the range of home industries, and flags or dress materials may be impressed with devices absolutely fast against washing or exposure to light.

DISCHARGE PRINTING.

Discharge printing is a method of working by which a dyed material is whitened or bleached in certain places where a chemical is printed on, and as an illustration of this method we may instance the discharge of the color on turkey-red calico, whereby white letters can be printed on a permanent red ground. Turkey-red is a madder (or alizarine) color on calico, the mordant being alum ; and it is the most absolutely permanent of red dyes. For perhaps two thousand years, no means have been known of discharging or bleaching a red of this character ; and if we assume (reasonably, as we may) the "scarlet" spoken of by Isaiah (about 760 B. C.) to be a permanent mordanted red of this character, a red which no one of that day knew how to discharge, it is easy to realize the significance of the figure of speech, "though thy sins be as scarlet, they shall be white as snow."

The Chemistry of the last century has given us chlorine, which will bleach out the old indelible red. For discharge printing on turkey-red cloth, the first thing is to wash with soap and hot water to remove traces of fatty matter used in dressing, after which the letters or devices should be stamped on the red calico with cork stamps charged with the following: tartaric acid 1 ounce, water 1 ounce, gum 40 grains. The printed material is allowed to dry

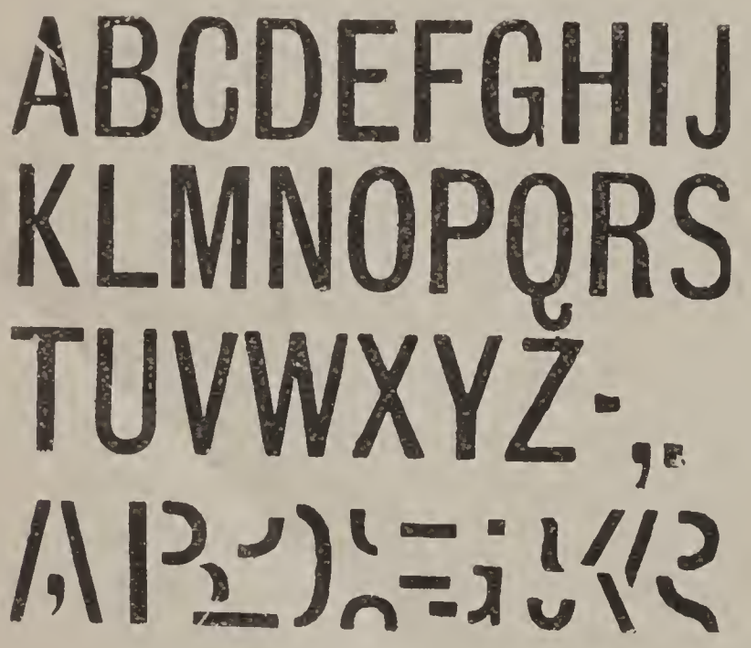
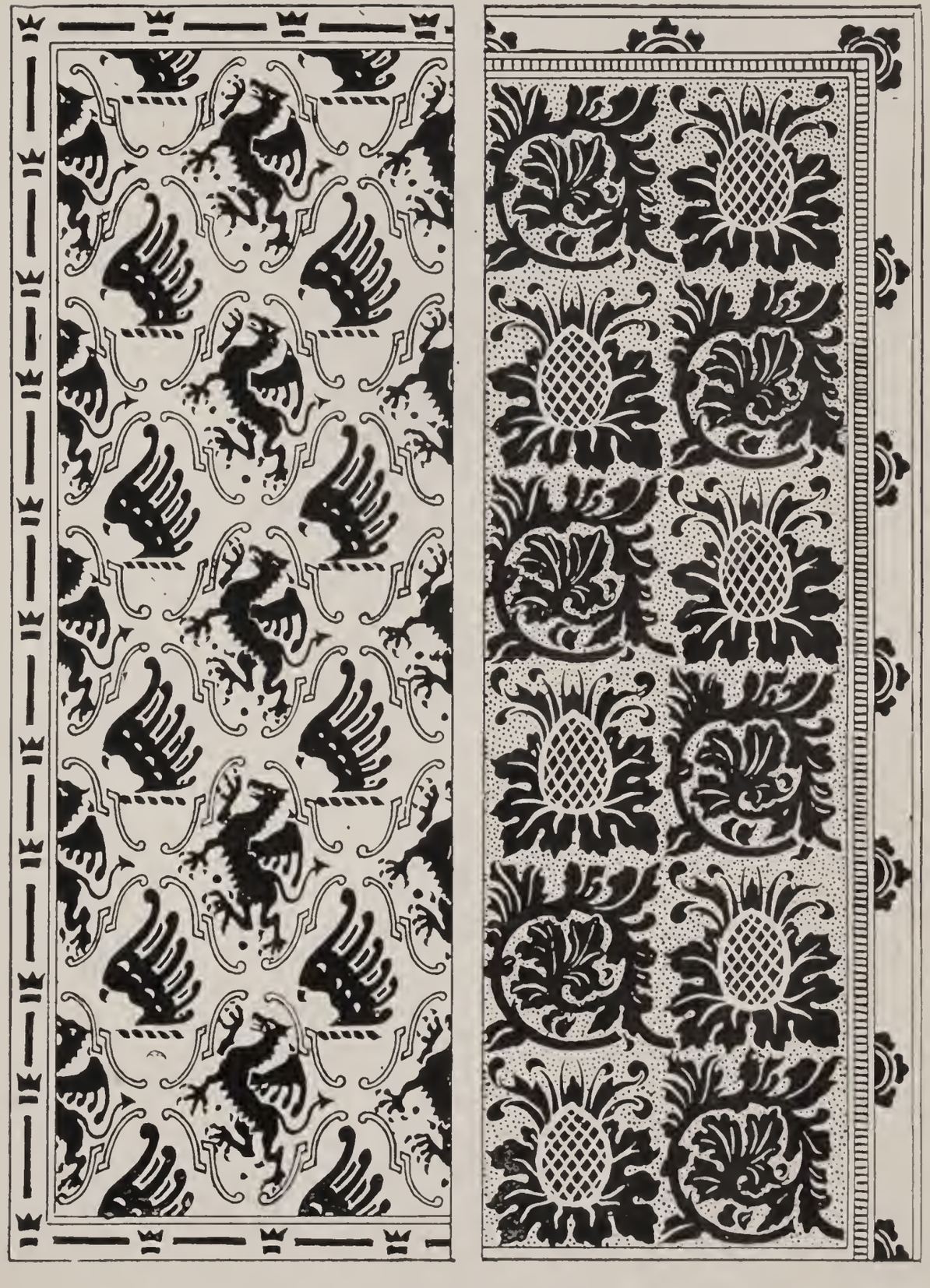


Fig. 5.

slowly, when the cloth is immersed in a flat pan containing chloride of lime and water in the proportion of one pound of the former to one gallon of the latter. These materials should be well stirred together, and the cloth should lie rather open in the bleaching bath, and be kept in gentle motion until the device is bleached out. Repeated thorough washings in water are essential, and a final boiling out in soap and water is desirable. For making inscrip-



Two designs, with borders.

tions or devices in white on a red ground the above method is admirable, especially for flags or banners which may have to be exposed to bright light.

Stamps for Discharge Printing or Mordanting may be cut with a sharp knife out of cork ; the coarse thick cork sold as bath cork serving for the larger letters. A very few rudimentary parts will serve for stamping plain block letters, as will be evident from Fig. 5, which shows an alphabet followed by a synopsis of parts with which not only the whole may be built up, but also many patterns and borders. Fewer parts will serve if very slight modifications of the latter are allowed. Guide line should be stitched into the calico with thread. The discharge mixture may also be applied with a brush ; a small hog's-hair brush with the hairs cut short, and worked end on like a stamp, being a convenient form.

DYEING SILK OR WOOL MATERIALS WITH ANILINE COLORS.

Soluble aniline colors for this purpose are now sold in packages at a low price. In using these the main thing to be attended to is to dye slowly and with much working and kneading, and for this reason the solution of the dye — best in warm water — should be very weak. In most cases a little soap added to the water facilitates the working.

VARNISHES.

A varnish is ordinarily a solution of a covering substance in a volatile liquid, and when the varnish is used the volatile portion dries off, leaving the covering substance. The "drying" oils are, however, true varnishes of a somewhat different character, as they indurate by absorption of oxygen from the air and not by the

evaporation of a volatile constituent. The best and toughest varnishes are those which contain both a resinous substance which is deposited, and a drying oil which indurates. These are commonly called oil varnishes, and are sometimes spoken of as true varnishes.

GENERAL CONSIDERATIONS AS TO VARNISHING.

In the case of wood the pores must ordinarily be filled in with size as already described (page 11), and the same must be done with paper, plaster of paris, and most other porous materials. Speaking generally, varnishing can only be done satisfactorily on an impervious or non-absorbent surface. Varnishes are applied in various ways, as by brushing, dipping, pouring on, spraying, or by rubbing on with a saturated pad, but the chief point to be attended to in most cases is to give many thin coats of varnish rather than one thick coat. When a brush is used it is generally best to use one in which each hair sets or springs to a definite position, and for straightforward work a flat brush is generally convenient. Little and often on the brush is a good general rule, an obvious way of taking up little being to strike off the excess on the side of the containing vessel. Each coating with the brush should be so thin as not to run into ridges or tears, yet just thick enough for the brush lines to flow into each other. Most of that stated above is subject to exceptions, but exceptions and special cases are best considered under the respective varnishes. French polishing, for example, is a method of varnishing standing quite by itself, and is described after instructions have been given for preparing that varnish known as French polish. All varnishing should be done in a room which is dry and rather warm than cold.

In preparing those varnishes in which alcohol is the solvent, the macerating bottle is generally useful, and a few pieces of broken glass assist in mixing the materials. Absolute alcohol is very much better than the somewhat weaker wood alcohol, as varnish prepared with the former has less tendency to become cloudy or chill if applied in a damp place ; but only few persons will be prepared to incur the expense of using absolute alcohol. Varnishes may be made with more or less solvent than recommended to suit different styles of working.

No. 1. *Medium Hard Varnish, for Labels, Maps, Engravings, or Wooden Articles.*— This is one of the most useful varnishes for the general purposes of the amateur mechanic and decorator. Sandarac 4 ounces, mastic 1½ ounce, Copaiba balsam 1½ ounce, oil of turpentine 1 ounce. Strongest alcohol (absolute if practicable, but ordinary wood alcohol will serve) 10 fluid ounces. These materials are put in the macerating bottle, together with a few pieces of broken glass, and when nothing more dissolves the clear varnish is poured off. Labels, maps or engravings to be varnished must first be sized with a warm solution of one part of clear white gelatin in eight of water. They should be quite dry when the varnish is applied. This and other varnishes, if to be applied by means of the spray bottle, must be diluted ; this varnish with rather more than its own volume of alcohol (or wood alcohol, as the case may be).

No. 2. *Softer and Cheaper Varnish, for Maps, etc.*— Canada balsam one part, oil of turpentine two parts. Sticky, and not very satisfactory.

No. 3. *A Still Cheaper and Less Satisfactory Varnish.*— Pale colophony (common resin) 4 to 5 pounds, oil of turpentine 7 pounds. A very poor varnish, but occasionally useful for out-

door woodwork. Use macerating bottle and broken glass ; see No. 1.

No. 4. *Bright Soft Varnish as Used for Tops.*— Sandarac 2¼ ounces, alcohol or wood alcohol 8 fluid ounces. If the articles to be varnished are quite dry and the work-place is warm, this varnish gives a very brilliant surface, but soft and easily scratched. Wooden articles for finishing with this varnish are usually painted with water colors. The varnish may be somewhat toughened by using ½ ounce of soft elemi in place of the same weight of sandarac. In making this varnish use macerating bottle and broken glass.

No. 5. *White Hard Varnish.*— Bleached shellac (which must be fresh and of good quality) 8 ounces, sandarac 2 ounces, soft white elemi ½ ounce, absolute alcohol or wood alcohol 2½ pints (40 ounces). This is a very useful varnish for light wood, but should be used in a warm room.

No. 6.— *Brown Hard Varnish.*— As No. 5, but with light or dark shellac in place of the bleached shellac. As shellac is always somewhat injured in bleaching, this varnish has better working qualities than No. 5. If light orange shellac is used the color is but faint, and the darker lacs give a range of deeper tints. Dragon's-blood may be added to further deepen the tint.

No. 7. *Shellac Enamels and Sealing Wax Varnish.*— Sealing wax of any color is broken in pieces and put in the macerating bottle with rather more than enough absolute alcohol or wood alcohol to cover it. If not made from ready prepared sealing wax, shellac 4 ounces, Burgundy pitch 1 ounce, pigment 2 to 3 ounces. The pigment may be ultramarine, vermilion, chrome yellow, lamp-black, burnt sienna, white lead, bronze powder, or indeed almost any mineral pigment. When a very light pigment is used a light-

colored, or even bleached, shellac should be employed ; but this latter must be of good quality, and fresh. Lac enamels are best made in the macerating bottle, and plenty of broken glass should be used. A violent agitation every now and again is useful in breaking down the pigment.

No. 8. *A Reviving Varnish for Leather and Book-Bindings.*— Gum benzoin 1½ ounces, wood alcohol, 20 ounces; dissolve in the macerating bottle and filter through paper.

No. 9. *Varnish for Photographic Negatives.*—(*a*) White hard varnish No. 5, 1 ounce; wood alcohol, 2 ounces. The negative is warmed, the varnish is flowed over it, and after draining, the varnish is dried off before a fire or over a lamp. (*b*) Amber and chloroform varnish; amber, 4 grains; chloroform, 1 ounce; macerate and filter. Flowed over the negative (cold), and the excess drained off.

FRENCH POLISH AND HOW TO USE IT.

French Polish is essentially a shellac in spirit varnish similar to No. 6, but ordinarily somewhat more dilute. No. 5 diluted with from half its bulk to equal volumes of wood alcohol will be a very good French polish, but a French polish containing benzoin is somewhat easier to use and gives greater brilliancy. We recommend the following : Shellac 3 ounces, benzoin 3 ounces, boiled linseed oil ¼ ounce, wood alcohol 2½ pints. Dissolve in the macerating bottle (page 3) and filter through paper. The spirit used may be colored beforehand by soaking turmeric (yellow) in it; or dragon's-blood (deep red) may be added to the materials in the macerating bottle.

Preparing the Wood.— Wood for French polishing is ordinarily not sized. It is brought to a high finish with fine glass-paper, and

previously to the final glass-papering the grain and small cavities are filled in with plaster of paris and water, or whiting and boiled linseed oil. When the filling is quite hard, a glass-paper finish is given. The rubber with which the polish is now applied is made by rolling up a piece of flannel about three inches square so as to form a ball. This is saturated with the polish, and is then covered with a square of muslin; the edges of this being gathered by the fingers, and the rubber is so held as to present a convex surface to the work. A trace of linseed oil having been applied to the pad (already saturated with polish) the pad is worked over the wood with light circular strokes, so planned as to range all over the surface of the article, or of a determined area. The rubber being kept charged with polish, and a drop of oil being occasionally applied to the face of the rubber, the above process is repeated until the surface of the wood is uniformly hardened or filled in with the polish, when a few hours' drying is desirable, followed by another application of the finest glass-paper. The polishing is then resumed, and this series of operations is repeated until a sufficient coating of resinous matter is deposited on the wood. The final luster is given by the process of spiriting off. A fresh rubber is slightly charged with spirit, and is applied to the work with very light circular strokes, and finally with straight sweeps in the direction of the grain; this treatment being continued until the rubber is quite dry.

LACQUER FOR METAL, AND HOW TO LACQUER.

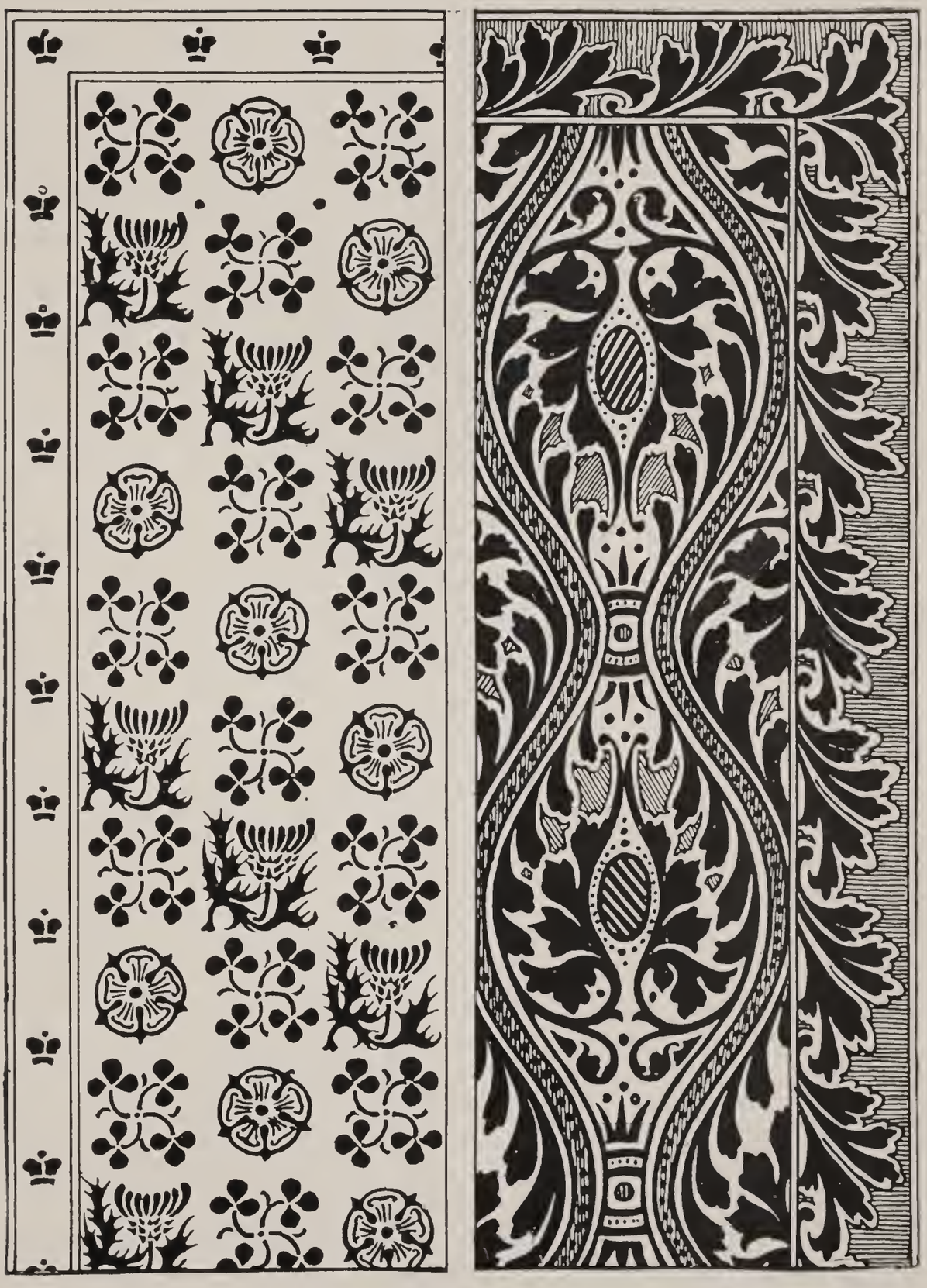
A lacquer for brass or other metal is a thin spirit varnish (see also No. 12 celluloid varnish), generally colored with dragon's-blood, saffron, annatto, gamboge or red sanderswood. There is no occasion whatever to give a number of recipes, as one will serve

all purposes if the conditions for varying it are indicated. Orange shellac, 3 ounces; wood alcohol, 20 ounces. Dissolve in the macerating bottle. This will ordinarily be too pale for brass, although very suitable for gun metal or copper. To color it, from 20 to 40 grains of any one of the above-mentioned coloring materials may be soaked in each ounce of the lacquer; 30 grains of turmeric and 5 grains of saffron to each ounce of the plain lacquer giving a very suitable color for brass. The best way of applying the lacquer to brasswork is to warm the carefully cleaned and polished brass before a kitchen fire, and after having allowed it to cool to about the temperature of the room, the lacquer is applied with long sweeping strokes of a camel's-hair varnish brush, after which the work is placed in the oven to dry or is held before the fire. Lathework made slightly warm by the friction of the final cleaning is allowed a little time to cool down, when the lacquer is applied while the lathe is slowly turned. The lacquer is then dried off as above described. The process above described is known as cold lacquering. Hot lacquering is done by applying the lacquer to the metal object heated to about the temperature at which it becomes uncomfortable to handle. Drying in this case is almost instantaneous.

No. 12. *Celluloid Varnish.*— Celluloid, 1 ounce; amyl acetate, 6 ounces. A tough varnish suitable for almost any purpose. If made up with double the above-mentioned quantity of amyl acetate, it makes a good varnish for photographic negatives, and also a good colorless lacquer for protecting metals from corrosion. It is merely necessary to brush it on the metal; no heat being required.

No. 13. *True or Oil Varnish.*— Few will care to make varnishes of this character on a small scale, and one example of a varnish of this kind will be sufficient; the copal varnish made as follows being

as suitable for fine woodwork as for use on oil paintings. A small copper pot holding about 5 pints is set up over a Bunsen gas burner, in a yard or outhouse where a blaze-up of the contents can do no great harm. In this pot, fuse half a pound of clear white gum copal, stirring well with a copper stirrer till the copal is thoroughly melted; now slowly add, and stir in 20 ounces of good boiled linseed oil, maintaining the heat until oil and copal are thoroughly incorporated. Turn out the gas and stir in 2 pints of oil of turpentine. When cold, the varnish is ready for use.



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