A Lady pointing out to her Children, as an example worthy of imitation, the industrious habits of the Bees.

ARTIFICIANA;

OR,

A GUIDE

TO

THE PRINCIPAL TRADES.

EMBELLISHED WITH

DESCRIPTIVE WOOD CUTS.

SECOND EDITION.

EDINBURGH:

OLIVER & BOYD, HIGH-STREET.

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ADVERTISEMENT.

So diversified are the different employments in which mankind are engaged, that in the present state of society, few are familiarly acquainted with the detail of the various manufactures in which their fellow-labourers are occupied. An attempt to describe these certainly exceeds the opportunities of information which have fallen to the lot of most men, but a great advantage may be obtained by inquiring at the manufacturers themselves. The author of this little Work has therefore submitted every article which it contains to the revisal of *professional* men, and received their sanction.

Edinburgh, Aug. 1, 1820.

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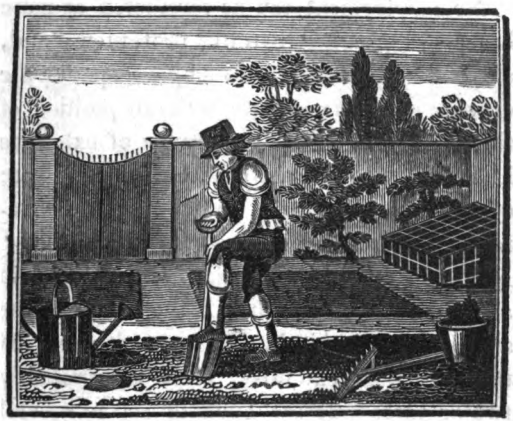
Artificiana;

OR, A

KEY TO THE TRADES.



THE GARDENER.

A GREAT variety of operations are included under Gardening, which may be comprehended under two general heads: First, the laying out of pleasure-grounds; and second, the cul-

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tivation of fruit-trees, kitchen-herbs, and flowers. In common language, however, it is chiefly applied to the latter, and is now more commonly called *Horticulture;* which is a compound Latin word, that signifies the cultivation of the garden.

No employment can be considered as more healthy or pleasing than this profession; and, at the same time, it affords ample scope for the exercise of a correct taste in the disposition of the garden, as well as the display of extensive knowledge and ingenuity in the proper culture of the various plants it may be either convenient or agreeable to rear.

The first object which naturally attracts the attention of the Gardener, is the nature of the soil which it is his business to cultivate. If the garden be extensive, there are probably two or three different kinds of soil in it, and each better adapted for the culture of one species than another; he therefore discovers his judgment by the preference he gives. He next studies the nature of the climate, being well aware that the perfection of his art, in a great degree, consists in suiting the plants he

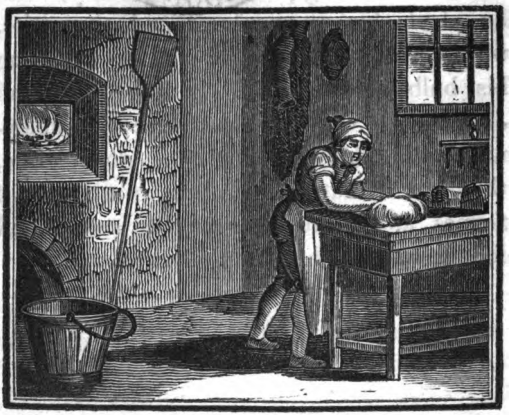
attempts to rear to the climates to which they must necessarily be exposed; and in this immense progress has been made by enterprising gardeners of late years; for, formerly, it was thought quite impossible to rear or reconcile almost any of the beautiful plants and shrubs of warmer climates to the cold unequal and chilling blasts of Britain; but now the Botanist, or Amateur, may be gratified in almost every part of the kingdom, even the more northerly, by seeing hundreds, perhaps thousands, of the natives of almost every country and climate, cultivated with the greatest success; so much so, that many of them have been naturalized, and grow in the open air without the protection of glass or any thing else. The labours of the Gardener being regulated by the seasons, he must know the most suitable time for sowing, planting, transplanting, &c. so as to derive every advantage which circumstances will permit. And as certain situations, soils, and manures, are more suitable to the nature or disposition of one plant than another, he displays his

skill in the proper choice of such of these as is best calculated for their health and growth.

In no occupation is there so much variety as in that of the Gardener. At every season, and during all kinds of weather, he is never destitute of employment, in sowing, planting, transplanting, pruning, grafting, or inoculating the bud of one tree into another. By the latter process, are produced almost endless variety and beauty, both of fruit and flowering shrubs, such as roses of various colours inoculated on each other, or on the common briar.

The culture of fruit-trees, training, pruning, and preventing the attacks of insects, engage his peculiar attention, as also the culinary herbs for domestic use. But in no part of his occupation is he more interested than in the cultivation of the flower or pleasure-garden, which has for a long time, and still continues, to occupy a very considerable share of the Gardener's time and attention, independent of the management of the green-house, hot-house, and conservatory; in short, he need never be out of employment, with spade, rake,

knife, or watering-pan, from February, when he plants his ranunculuses and anemonies, till November, when he finishes planting his bulbous roots; and in December and January he will find abundance of employment, in taking care of the green-house, the more delicate plants, both in and out of frames, and in preparing compost and ground for planting, as the season advances.



THE BAKER.

THE profession of a Baker was held in great estimation among the ancients. Those at Rome came originally from Greece, and enjoyed very peculiar privileges. They were erected into a *college*, or distinct corporation, two centuries before the birth of Christ; and, what is singular, neither they nor their children were allowed to relinquish their profession,

or to follow any other line of business. They appear to have occupied a particular part of the city; and every bakehouse had a *patron* or protector, whose duty it was to advise and assist in conducting the business of the concern. Bakers were sometimes admitted into the Senate.

Bread consists of fermented flour, with yeast or barm, water, and salt. For every four English pints of water, two ounces of salt—the yeast must be regulated by its quality. At the commencement of the process, the yeast should be stirred among a small quantity of the flour intended to be used at the time, and mixed with water of a heat suited to the temperature of the season, with one-third of the quantity of the salt, which is called the sponge. Fermentation should be allowed to go on in this way for a considerable time, until the sponge, which will have risen to a considerable height, begins to drop, and after it has dropped for a time it assumes a sharp smell. It is then ready to be kneaded with the remainder of the flour, salt, and water, into what is called *dough*. It must again lie

for nearly an hour, and then it is ready to be made into loaves, which, being put into shape, should lie a short time before they are put into the oven. The length of the process must be regulated by the quality of the yeast. Yeast obtained from table-beer generally requires the shortest time in the *sponge*. The peck loaf must weigh, by law, seventeen pounds six ounces avoirdupois, and other loaves in the same proportion. A sack of flour ought to weigh two hundred and a half, from which is made, at an average, twenty peck loaves, or eighty quartern loaves. More than an hour is required to heat the oven properly, and one hour to bake the bread. There are two kinds of bread, which only differ in their degree of purity—the *wheat* or *wheaten*, which must be marked with a W, and the *household*, which must be marked with an H. If this be neglected, the Baker subjects himself to a fine.

The greater number of Bakers make rolls in the morning, of which there are also two kinds, the *common* and *French*. They require

to be fermented as before, and kneaded into dough, but made along with less bread than the loaf-bread, and a smaller quantity of salt should be used.—They require only about twenty minutes for baking.

At the victualling-office at Deptford, biscuit-baking is conducted upon a very large scale. The dough consists of flour and water only, which is worked by a powerful machine; and five persons at each of the twelve ovens, are able to furnish daily bread for two thousand and forty men.

The price of bread, which altogether depends on the price of wheat, is regulated by the Magistrates; who have also the power of imposing a fine on the Baker, when his bread is deficient in weight.

A Baker is a very laborious profession, nevertheless the wages are very moderate. Including board, he seldom gets more than ten shillings a-week in London.

THE BREWER.

The process of fermentation has been known from the earliest ages, and though the physical phenomena which occur have only been explained within comparatively these few years; yet, in regard to all the practical results, they have been familiar to all civilized nations.

All vegetable matter is capable of fermentation, in a greater or less degree, and conse-

quently, when subjected to the proper treatment, will afford a certain quantity of ardent spirit. The material, however, most generally employed, and from which it is procured in the greatest abundance, is barley. Barley is soaked in water nearly two days, and afterwards spread on an earthen floor, and when vegetation just begins to appear, it is then dried. This is called *malt.*

The beverage prepared by the Brewer is called malt liquor, and its component parts are, malt, water, hops, and yeast. These are the chief ingredients; but not only are different proportions of these employed in different countries, but almost every district of the same country differs from another. The proportions, therefore, and mode of preparation, are what gives the particular flavour, degree of strength, &c. to the liquors which are brewed.

The malt must next be ground in a mill; but the modern practice of bruising it between rollers is esteemed an improvement. The purpose of this evidently is, to expose as great a surface to the action of the water as possible

in the course of the different operations which follow.

The malt is then *mashed*. The mash-tun is a vessel which has a false bottom. The malt is put upon this, whilst water of 180° of Fahrenheit is admitted by a side pipe into the space that intervenes between the true and false bottom. The water gradually ascends through the holes; and when the vessel is full, then the malt being completely soaked, the process of *mashing* commences. This is kept constantly stirred, in some works with wooden poles, in others with iron rakes, until the water is saturated; but in large breweries it is performed by machinery. At this stage, heat being of great importance, the tun is therefore covered—and when it has stood a proper time, the clear liquor, or wort, is drawn off, and runs into a boiler. It is now boiled with hops, and the stronger the wort, the greater quantity of hops is necessary. In the private breweries in England, the common proportion is one pound of hops to a bushel of malt. The faster it is made to boil, the better; and this must be continued, till, upon examining the liquor, it is

found full of small flashes, not unlike curdled soap.

After it has been boiled a sufficient time, it is drawn out into vessels, called *coolers*, until it be in a proper state for fermentation. That which is intended for immediate use may be from 75° to 80°; but if for keeping, 65° or 70° are sufficient. The liquor is then mixed with yeast, allowing one gallon of yeast to four barrels of beer. The time that it takes depends upon the state of the weather in general. If porter, from one to two days, and if ale, from eight to fourteen days; but this entirely depends upon the strength of the worts, and whether the ale is intended for keeping or immediate use. It is afterwards put into barrels, which are allowed to ferment for a few days, during which, a copious discharge of yeast takes place; and the barrels must be carefully filled up with new liquor. They are then bunged up, and in a short time fit for use.

THE WEAVER.

It is quite unnecessary to distinguish between the silk, the linen, or the weaver of woollen, &c. as the general principles upon which they proceed are the same, so far as regards plain cloth. However, they are nearly as different from each other as almost any other trade; the preparations, utensils, and mode of weaving each of these materials, being so ex-

tremely unlike; and a person who has been taught the one branch, could not, without very considerable pains and trouble, do any of the other two.

The thread, or yarn, is first wound on *wooden bobbins*, to prepare it for being *warped* on what is called a *mill*, by which both the length and breadth of the web are defined, and the threads put in such order, that they are in a state to be delivered to the weaver, who then has to enter them, thread by thread, first through one set of utensils, and then, in one, two, or more, through a second, called a reed or *slay*. When this is done, he has, by these means, power over every thread in the web. To the first utensils he attaches cords above the web, over pulleys, or upon the end of levers, so as, by fixing cords below the web, attached to the same and to treadles, he can separate the one half of the warp from the other. This being done, the weaver, by means of what is called a shuttle, (which is a piece of wood, of a particular shape, of 10 or 12 inches long, 1½ broad, and about an inch thick, in the centre of which is cut out a space of about 5 inch-

es long, to hold a small bobbin fitted with yarn) shoots the woof through between the warp. He then crosses the warp by pressing with his foot on the treadles; then he again passes the shuttle through with the woof, and so on, from right to left, alternately, inserting each time a thread of woof, which, being drove up close into the centre of the warp, in nearly the same proportion or rather more than the warp, and in some cases, or in some particular fabrics, to the extent of one half more woof than warp. This process is continued, making progress, at the rate of the breadth of a thread, each time. The warp is raised up or down, and this sometimes so slow as 150, or even more times, to an inch.

THE DYER.

Of all the arts, that of dyeing, perhaps, with respect to its theory, requires the most extensive knowledge of natural philosophy, because it presents the greatest number of phenomena to analyze, of uncertain changes to ascertain, and of relations to establish, with air, light, heat, and many other agents,

of which our knowledge hitherto has been very imperfect.

That this art should have attracted the attention of the philosopher cannot be wondered at, when we consider the variety of beautiful phenomena it exhibits. Brilliant colours have been sought after, more or less, even among the most uncultivated nations.

The origin of this art is of great antiquity, but it is difficult to say by whom, or where, it was first discovered. India is said to be entitled to this honour, and that the Greeks borrowed it from the Indians. But it is not of so much consequence who were the first, as who are now allowed to be the best dyers; and, we believe, the pre-eminence is given either to France or Britain. We should suppose that Britain stands the first, from the much higher state of perfection which her manufactures have attained, although it ought not to be forgot, or denied, that we owe a very great deal to the French philosophers, for their theory in this as well as many other of the sciences.

We know that the savage nations paint their skins, and adorn themselves with feathers,

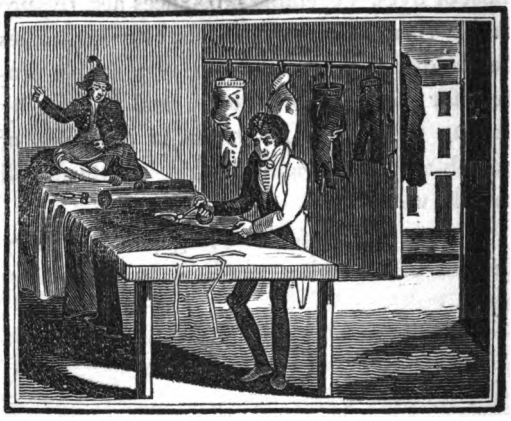
stones, and shells of lively hue. This feeling or attraction to colours was not confined to them, but seems to travel on with civilization, and pervaded all ranks and degrees in older times, from the Indian to the Cæsars, who were so jealous of the powers of the dye of purple, that none were allowed to wear it but themselves, upon pain of death.

Dyeing must be allowed to be a most important and ingenious art, and none can make any great progress in it without a knowledge of the laws of chemistry; at the same time, it cannot be denied, that there are great numbers who practise this art with tolerable success, whose knowledge is exceedingly circumscribed in respect to the science of chemistry. To dye, then, is to give a colour to any substance, whether animal or vegetable; and this is done by means of certain drugs, some forming preparations, or what is technically called mordants, of which there are many, such as alum, both simple and compounded, with the acetite of lead, alkalis, &c. solutions of iron, tin, and other metals, by acids from others. Astringents, such as gall nuts, not only form pre-

parations, but also dyes, by uniting them with iron, &c. Other drugs are used; those which give the various colours, after the article to be dyed has been prepared with the mordant intended for the particular colour, such as indigo for all the shades of blue; mader, cochineal, and brazil wood, for reds; Quincetteran bark, weld, yellow wood, or fustic, for yellows. The first thing to be done by the dyer, is to scour or clean the substances to be dyed, which, if an animal substance, (by which is meant any substance that grows on an animal, such as wool, hair, or even the skins of the animal,) requires to be scoured with alkalic urine, or potash and soap, a well-known process, to deprive it of the grease, &c. naturally attached to it. Silk, although an animal substance, does not require the same process, but simply to be well steeped in a copper of strong soap and warm water; which is either done in a thin bag, or over rods, the rods being through the skins. It requires about eight hours in the bath, to deprive it of the gummy coat attached to it; when this is done, and then well washed in cold water, it is fit for the

most of dyes. Vegetable substances also require to be cleansed from their natural impurities before dyeing; but this is a very simple process for the most of colours, and is done by boiling them for a few hours in a copper of potash and water, and then rinsing them well in cold water.

Linens and cottons undergo the ordinary process of bleaching previous to their being dyed.



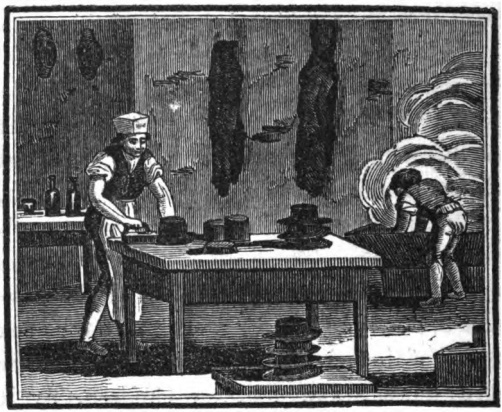
THE TAILOR.

PERHAPS, in the whole circle of the arts, there is not one profession so useful, and requiring the exercise of so much ingenuity, in which so few tools are employed, as in that of the Tailor.

In order to take measure, a few long slips of parchment are required, which, as he proceeds, are marked by him with the scissars, after a way peculiar to himself; for there is no

universal method of procedure in this; and indeed, if it be considered that the fashions are always shifting, it will appear that this would be impossible. Upon the accuracy of the measurement, however, depends altogether whether the clothes suit or not. A pair of scissars, a thimble which is open at the point, needles of different sizes, and a *goose*, constitute the whole. The form of the thimble has never been fully accounted for. It is sufficient to observe, that, by sewing with the back instead of the point of the finger, the person has more power; and that all children, as it were instinctively, sew with the back, and have to be taught, and only acquire by practice, a facility of sewing with the point of the finger. With the goose, when heated, any inequalities in the seams are pressed down, which would otherwise injure the appearance of the dress.

In London, the wages of the Journeymen Tailors are regulated by act of Parliament. They have four shillings and sixpence a day.



THE HAT-MAKER.

THE manufacture of hats, whilst it is an ingenious, is a very complicated art, and of which it is difficult to convey such a description as shall be perfectly comprehended by those who have not had an opportunity of visiting a work-shop where the business is carried on.

Hats are either made of wool, or the hair of different animals. Those, however, that are

more particularly used, and furnish this kind of hair, are the beaver, the rabbit, the hare, and a particular kind of goat to be found in no region of the globe excepting Asiatic Turkey. In this country, it is generally called camels hair, not because it is furnished by those animals, but on account of its being conveyed to the different ports of the Levant on the backs of camels. It is a very curious fact, that the hair of the goats and cats of that country resemble no other in the world.

The skin of the beaver is similar to that of all quadrupeds. It is covered with two kinds of hair, the one longer than the other. The short hair is alone used in the manufacture of hats. The first object which is attended to is to separate them. The long hair is cut with a knife, which resembles that of a shoemaker's, whilst, in order to shave or scrape off the other kind, a knife not unlike a pruning-knife is used. It is then mixed with the fur of rabbits, together with wool, in such proportions as the workman judges necessary to manufacture a hat of a certain fineness.

The materials, being adjusted in due pro-

portions, are laid upon a table called a *hurdle*. In some manufactories it is formed of wood, but the purpose is much better answered if it be made of wire. The hurdle is generally about four feet square. Opposite to the workman the light is admitted, and on each side of him there are two wooden partitions, quite close to each other, so as to prevent the admission of any air, by which the materials he is to work upon would be agitated. If the hurdle be of wood, the deals ought each to be about three inches broad, parallel to the wall, and at the distance of the fortieth part of an inch from one another, in order to allow the impurities to escape. The bow is a pole from six to seven feet long, to which are fixed two bridges, not unlike that which receives the hair in the bow of the violin. Catgut, of about one twelfth of an inch in thickness, is stretched over these. The workman is also provided with a bow-pin, or small stick, with a knob at the end of it; a basket, as it is called, which is a piece of wicker or ozier work, of about two feet square, but not platted, the bars being straight and open, and not crossed,

having the sides, into which the bars enter, bent somewhat into a circular shape; besides, he also employs linen cloths and brown paper. These are the implements of his work.

The first process of hat-making is called *bowing*. The materials being pushed a little to the right hand by means of the basket, the workman, holding the bow in his left hand in a horizontal position, plucks the catgut with the bow-pin, which, from its elasticity, resumes its former position, strikes the fur, and causes it to rise in the hair, whilst some part of it is dissipated, and, from its levity, flies across the hurdle on which, in process of time, it is deposited. This process is repeated till all the hardness of the small lumps or clots disappear, in consequence of the small fibres of which the fur is composed being perfectly disengaged and separated from one another. The quantity thus *bowed* is called a *batt*, or capade, and is then ready for *hardening*.

In performing this, the material being evenly arranged on the hurdle, is pressed by the convex side of the basket, in order to render the surface more smooth or level, then cover-

ed with a cloth, and wrought backwards and forwards with the hand. The hairs, by this process, slowly move towards the root, and are so twisted together as to form a close or firm substance.

The cloth is then taken off, and a sheet of paper, with its corners folded in, forming a triangle, is laid upon the batt. The batt is then folded over this paper, so that its edges shall meet one over the other. It now forms a cone. The edges are soon joined by pressure. Another batt that has been hardened is next laid on the hurdle, and that one which has been folded, placed upon it, with the apex of the cone downwards. This last batt is also folded, so that, of course, the weakest part of the one batt is opposed to the strongest part of the other, and when they are worked on the hurdle, (which requires a considerable time), the cloth is occasionally sprinkled with clear water. This is called *basoning*, during which the felt becomes more compact, and assumes a more firm texture, and consequently contracts. Some recommend that, previous to the basoning, a skin of alumed, or half-

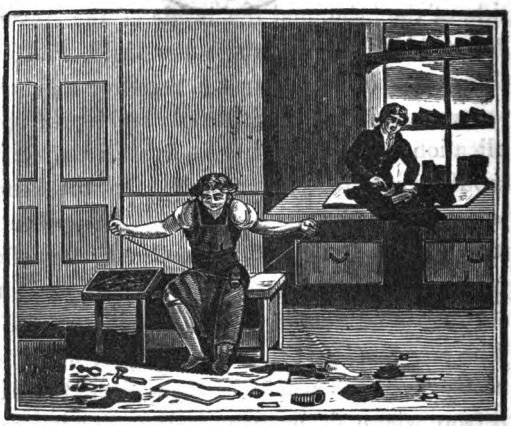
tanned leather, should be used instead of the cloth.

The next operation is called *working*, which is performed at an apparatus called a *battery*. This consists of a kettle or boiler, into which planks of wood, joined together, are so constructed as to meet at its centre, and form an acute angle. This boiler contains water, to which is added as much sulphuric acid as only renders it rough to the tongue. The felt is plunged into the boiling liquor, and this is called *soaking*. It is from time to time, as occasion may require, dipped into the kettle, whilst it is worked with the hands. During this part of the work, any inequalities on the surface of the felt are observed. The knots, &c. are picked out with a bodkin, and, if necessary, more fur is added to particular parts, which is patted down with a wet brush. The beaver for the nap is laid on at this stage. The felt is now quite soft and flexible. Being in the shape of a cone, it is necessary to reduce it to that form which is required. For this purpose the edge of the cone is turned up. The workman then taking hold of the apex, or

top, presses it down, so as to form another interior ring of a similar size with the exterior, and this he repeats until the whole presents a flat appearance of concentric circles, of which the top of the cone is the centre. It is still kept moist with the liquor, and he alternately pulls out the point and presses it down, until he has obtained a flat portion equal to the crown of the hat. He then takes a block of the same diameter with the intended crown, and, applying the flat felt to it, he binds it tightly with a cord, called a commander, and continues to wet and work it until it assumes the shape of the crown. The brim is wrought after a similar manner on the plank, and is pressed out by a tool made of copper, called a *stamper*.

The nap of the hat is next raised with a kind of carding instrument, and then sent to be dyed, because afterwards it could not bear this operation. It is first boiled (if designed to be black) in logwood and a little oak bark, and then immersed in a mixture of green copperas and blue vitriol. It is then stiffened with the grounds of strong beer and thin glue;

these, however, are only applied to the lower side of the brim, and the inside of the crown. After this operation, the hat is rigid, and its shape not quite regular; it is therefore exposed to steam, and thereby softened; and by the application of the brush, and a hot iron, it is moulded into the proper figure. If the brim is not intended to be equally wide throughout, it is cut by means of a wooden or metallic pattern. There are various inventions for cutting round hats unnecessary to be specified. The crown is lastly tied up in paper, which is neatly ironed down, and then given to the person whose department it is to line it, &c. for sale



THE SHOEMAKER.

SHOES must be considered as one of the necessaries of life, particularly in cold climates, where, without this protection, ordinary business could not be conducted, and the health, and even the lives of the inhabitants, would be exposed to the utmost hazard.

Shoes are made of different materials; but they are principally manufactured from leather.

The Boot-maker is only a branch of the same profession. After the leather has been tanned and curried, it is then ready for the Shoemaker.

The first thing to be regarded is, the accurate admeasurement of the foot of the person for whose use the shoe is intended, which is a very simple process. When this is ascertained, the next step is to procure a *last* precisely of the same dimensions. Lasts must always be longer than the foot, in general, from one to two sizes, according to the strength of the shoe and breadth of the toe. The last is an exact imitation of the foot, the making of which is quite a distinct profession from that of the Shoemaker. To cut leather to the best advantage requires much more art than may appear at first sight to be necessary; for it is an undoubted fact, that many industrious workmen have been ruined in consequence of their want of skill in this particular. Ingenuity, together with a good deal of practice, are necessary to acquire this art. The cutting knife is in the shape of a crescent.

The implements necessary for the Shoemaker

are the hammer and lapstone, by which he renders the leather more compact and solid, and its durability much greater—the awl, knife, a stone to sharpen his tools, irons for dressing off the edges and seams, and wax, which he keeps in water in the shape of balls. With this last substance the thread that he uses is waxed over, which both renders it more strong and durable, and makes it keep a much firmer hold of the leather; and as he does not employ a needle, to this is fastened a hog's bristle, by means of which he can easily direct the thread through the hole made by the awl.

The lasts for both boots and shoes are made in two pieces. If too narrow, a piece of leather is put above the upper part to make up the measure; of course, the last has no concern in stretching the legs. Boot-trees are made in three pieces, for dressing of the boots when finished by the workmen, and will, according to the thickness of the wedge put in, stretch them.

There are four branches of the profession, Closers, Boot-men, Shoe-men, and Ladies'-shoe-makers.

The wages of a Journeyman Shoemaker altogether depend upon his expertness in business, and his industry, because he is paid by the piece. In London he will earn thirty shillings a-week.

THE STONE-MASON.

THE Stone-Mason is a profession which is familiar to every one, and has existed in every civilized nation. In the division of labour which takes place in such societies, it includes what are now to be considered different professions, though they were originally one. It must be, however, admitted, that these distinctions do not hold universally, but are frequent-

ly practised by the same person, and from the near relation they have to each other, may in this place be considered under one. These are the Stone-Mason, the Stone-Cutter, and the Carver, or Sculptor in stone.

The business of the first of these consists in hewing or squaring stones, that is, giving them such a figure as shall make them useful and convenient for the different situations they are intended to occupy in the building; and they are afterwards laid, or set, in mortar.

In accomplishing these purposes, he employs various tools; such as, the *bevel*, which has two sides that move on a joint, and can be adjusted to any angle. When Masons make use of the expression, a *bevel* angle, the meaning is, that it is not an angle of ninety degrees, which is a square right angle or trove square, and which is distinguished by means of the instrument of that name. In common with many artists, he has occasion for the *compass*. The use of the *level* is intimated by its name. By means of the *plumb-line*, he ascertains whether a pillar or wall stand upright, and by the *square*, whether

it be a right angle, or equal to ninety degrees.

In hewing stones, the *mallet* and *chisel* are chiefly employed; but when the stone is very hard, the chisel has little or no impression upon it; and then it is wrought with a *hammer*, of which there are various kinds, to suit the work to be done, whose points are very sharp. The hammer is likewise used in building, but of a different form; the *trowel* is an instrument used for laying and spreading the mortar. Masons who carry on large works use powerful machines, the more easily to accomplish the raising of large stones, &c.

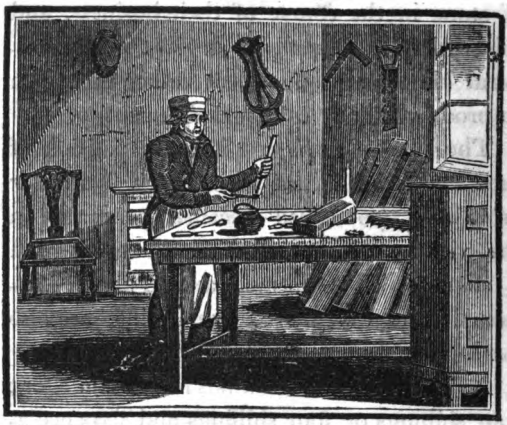
The business of the stone-cutter is principally limited to the hewing and cutting of large stones; and this part of the work, besides using the mallet and chisel, is sometimes performed by means of a *saw*, or thin plate of iron, with a smooth edge, set in a pretty large frame of wood, and, by its motion, drawn backward and forward, cuts the stone by its own weight, with the assistance of a little sand and water.

Both of the above-mentioned professions

make use of a great variety of different kinds of stone in the course of their business, and this variety occasionally is as great as the mineral kingdom produces, or rather is known to produce, in any considerable quantity.

The *mortar* employed is a composition of lime and sand mixed with water. *Plaster of Paris* (so called because prepared in the vicinity of that city) is procured from a stone called Gypsum, and *Tarras*, obtained from Cologne on the Rhine, are also used.

A Journeyman Mason has in London about four shillings or four shillings and sixpence a-day.



THE CABINET-MAKER.

THE Cabinet-Maker may be considered the same profession as the House-Carpenter, although his materials and tools are much finer. He makes bookcases, chairs, looking-glass frames, tables, &c. In some places it is united with that of the Upholsterer.

THE CARPENTER.

THERE were several kinds of Carpenters, the word originally signifying any worker in wood. It is now, however, appropriated to the artist who is employed in executing the rough work in the building of houses. In London, the Ship-Carpenter and the Joiner are two distinct professions, although the same individual frequently unites that of a House-Car-

penter and a Joiner; the latter confining himself to the light sort of work. As the greater part of buildings in London are of brick, the Carpenter is the person that frames it with rough wood. But as in Edinburgh the buildings are all of stone, the Joiner does all the work in buildings.

The Carpenter is not limited to any particular kind of wood, but those chiefly used in this country are oak, fir, elm, and mahogany; and workmen must find their own tools, except for fancy-work.

The saw is one of the most useful tools employed in the mechanical arts, and is known to every one; it is made of the best tempered steel, though they differ greatly from one another in quality; it is ground and polished—the back being always thinner than the edge, in which the teeth are. These are sharpened by a file, and then *set;* that is, one teeth is turned in one direction, and the other reversed, alternately.

The Carpenter also uses the plane very frequently. The stock or shaft is made of beach, in which there is an aperture for receiving a

sharp chisel, in order to smooth the rough surfaces or edges of boards, &c.—Various sorts of planes are used. Some of them differ only in length, and are, it is true, better adapted for certain kinds of work, which can only be acquired by experience. Such are the jack, long, and smoothing-planes. The rabbit-plane, plowing-planes, moulding-planes, hollow-planes, snipe's-bill-planes, &c., shew their different uses from their names. He also has frequent occasion for awls, chisels, (which in many places are called firmers), gimlets, augers, hammers, pincers, compasses, &c.

Scribing is a technical expression for the art of making two pieces of timber join close together. He places the one which is to be *scribed* close to that which it is to be *scribed to*; ascertains by the compasses the greatest distance at which they are separate; then, bearing one of the legs against the side to be scribed to, with the other he draws a line on that which is to be scribed; he then, by a saw or other instrument, cuts exactly to the line, and thus, when placed together, they form a neat joint. But scribing of doors, shutters, windows, and

all bound work that there is a plane upon, is scribed with a template, the reverse of the plane, by which the work is moulded.

Cart-wrights make all sorts of husbandry utensils, such as carts, ploughs, harrows, and different utensils, which are well known to the husbandman. Mill-wrights mount corn and flour mills, threshing machines, &c.—their tools are mostly the axe, adze, mortise, irons, agars, and bench planes, viz. the jack, half long, and hand planes, &c. The Cart-wright's tools are mostly the same as the Mill-wright's.

When a Journeyman Carpenter works by time, he receives in London from three shillings and sixpence to four shillings a day; and in Edinburgh from eighteen to twenty shillings a week.

THE COACH-MAKER.

COACHES are only of modern invention, and were first used in England in the reign of Queen Elizabeth. Some idea may be formed of their shape when first introduced, from the appearance of His Majesty's and the Lord Mayor's state coaches, from which it must be evident that they were not then intended for expeditious travelling.

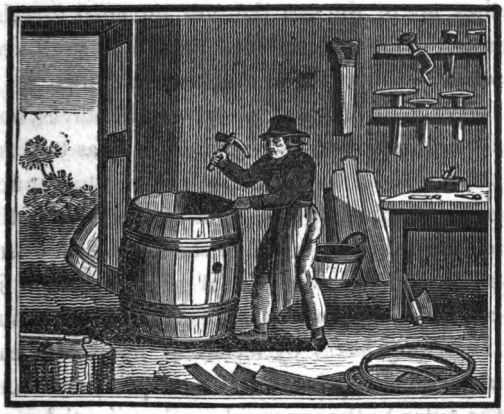
Many different kinds of workmen are em-

ployed in manufacturing of coaches, or chaises. The *body* is principally built with ash; the pannels are mahogany, and the top is made of highly-varnished leather.—The inside of carriages are constructed both for convenience and luxury, being stuffed with horse hair, and lined with woollen cloth, silk, velvet, or very fine leather.

That upon which the body is supported is properly called the carriage—consisting of four wheels, four or more springs, two axle-trees, and a perch. This last is what unites the two ends of the machine, by means of the upper and under transums, which are fastened together by the perch-bolt. This answers the purpose of locking, or turning the carriage.

In order that the fore-wheels may not strike against the body, they are always made less than those behind.

The business of a Coach-maker is divided into many branches, such as the body-makers, carriage-makers, wheelers, harness-makers, trimmers, painters, body-painters, herald-painters, and smiths; under which last, in all large manufactories, there are several branches.



THE COOPER.

THE Cooper's manufacture is confined solely to such articles as are made of oak; such as casks, tubs, pails, &c. America chiefly supplies Britain with oak timber for this purpose, and it is imported in narrow pieces called staves, which are sometimes bent, and at other times straight, according to the particular purposes which they are intended to serve. The staves

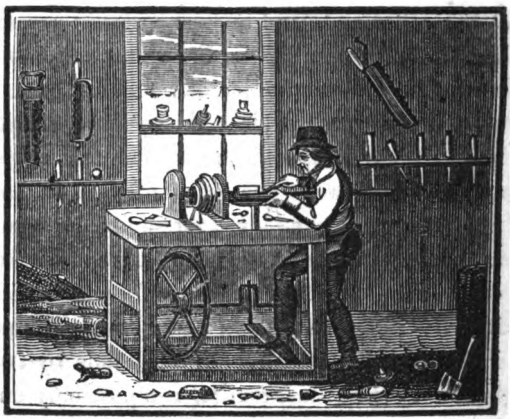
are wider at the top than at the bottom, when they are of the sort that are intended for the construction of tubs, pails, &c., and such vessels whose bottoms are less than the tops.

When the Cooper has dressed the staves, and they are ready to be put in order so as to form the article he wants, he does not bestow much pains in adjusting the edges so exactly that the *whole* surface of the edge shall touch in every point. He is contented if he bring them in contact at the inner surface; and, by drawing them very *hard*, by means of hoops, he can make a closer joint than if he sloped them from the outer to the inner side. Some articles require hoops of iron, but for ordinary purposes they are made either of ash or hazel. To make the vessels hold liquids, or keep it from leaking, split staves, which swell with moisture, are placed between the staves from top to bottom.

The Cooper's tools are numerous, but he has many in common with the carpenter, though some are peculiar to his art. The *hammer* is quite different. With it he drives on the hoops by striking a flat piece of wood, which

he lays on the edge of the hoop; but it is sharp at the other end, and in every respect resembles the *adze* used by the Carpenter, excepting in the length of the handle. The Cooper's *adze*, on the contrary, is of the axe kind, and its blade very thin, in order to take off thin chips, and for hollowing the sides of boards, &c. *Spokeshaves* are employed for similar purposes as the Carpenter's planes; but it is very differently shaped, and the manner of working with it is also different. The Cooper stands behind it, holding it between both his hands by two handles. The *stock-and-bit* compose only one instrument. *Bits* of various bores can be adapted to the *stock*. It is employed for boring small holes, while the *augur* is used for boring large holes. This last is a kind of gimlet.

A Journeyman Cooper in London will earn from three to five shillings a day.



THE TURNER.

THE Turner employs the hatchet, plane, saw, &c. in common with many other artificers; but the principal instrument he uses is the *lathe*, of which there are various kinds. The wheel of some is turned by one or two men, but in most cases it is turned by a treadle, with the foot of the workman. The article to be turned is fixed upon the axis of the small wheel, which is lengthened for the purpose;

but previous to this, it ought to be rounded, and made something like the intended shape, only a little larger. While the wood is rapidly turning round, the chisel, or other instrument, supported by the prop, is made to touch it, so as to take off such shavings as the workman judges proper.

In turning hard substances, such as ebony, box, ivory, &c. gravers are used, with triangular, square, or round ends, and when applied to the wood, are held horizontally; but the instruments employed in turning soft woods, as the hazel, pear-tree, maple, &c. are the gouge and chisel: these must be held obliquely.

In polishing, the skin of the shark, called fish-skin, and Dutch rushes, are employed, and the work is finished by rubbing it with wax or olive oil. In polishing silver, brass, horn, and ivory, various things are used; but generally pounded pumice stone put on leather.

A Journeyman generally earns a guinea and a half a-week; but the wages greatly vary, according to the abilities of the tradesmen.

THE PLUMBER.

THE trade of the Plumber solely consists in working in lead, as the term implies, for *plumbum* is the Latin for lead. The application of lead to the purposes of life is chiefly in the form of sheets and pipes.

Sheet lead is cast on a kind of table or mould, the size of which varies in different manufactories; but it is generally from four to five feet wide, and from sixteen to twenty feet

long. In the process, it is necessary that it should slope a little, and the thinner that the sheet is wanted it must slope the more. It is therefore so constructed that it can be made to slope as much as may be required. This table, not unlike a billiard table, has ledges round it, is covered with sand about two inches thick, and somewhat moist, in order to make it cohere or stick closer together. The surface of the sand is made perfectly smooth, by a piece of wood, called a *strike*.

When the lead is melted, it is put into a triangular pan at the elevated end of the table, and allowed to cool a little; for if the temperature were too high, the purpose of casting could not be accomplished. It is then poured upon the mould, and another workman sweeps the lead forward with the *strike*, and a vessel at the lower end of the table receives the overplus. When cooled, it is fit for any use that may be needed. If any figures are wanted, as an ornament on cisterns, &c. these are delineated on the sand, and cast as before, and the sides are soldered together.

Pipes are cast in a mould of hollow brass or

iron, about two and a half or three feet long, which opens by means of hinges, and shuts by hooks. Into this is put a round piece of solid brass, or iron, a little longer than the mould, which is made to pass through two copper rundles, one at each end, and then closed. Each of these is joined to a small tube about two inches long, and adjusted to the intended thickness of the pipe, which serves to keep the brass rod in the middle of the mould. The lead is poured in through a funnel; a hook is then put into the end of the rod, and is drawn out. If the pipe requires to be lengthened, the same operation is repeated, only that, instead of two rundles and two tubes, one of each is used, because the pipe which has just been cast supplies the place of both at one end. The metal is again poured in, which unites with the pipe already formed; so that it can be extended to any length.

When large pipes are required, sheets of lead are wrapped about cylinders of the proper diameter, and the edges soldered together.

Journeymen earn about thirty shillings a-week.

THE PAINTER.

THE appellation of Painter, as here employed, is confined to the artist who paints historical pieces, landscapes, portraits, sea pieces, &c. The extent of genius, and versatility of talent, which are necessary to become eminent in this profession, afford a sufficient explanation of the fact, that very few, in any age, have distinguished themselves as Painters in any particu-

lar line, and it may be safely affirmed, that no one ever was equally accomplished in all the various and difficult branches of the art. Those who have arrived at great eminence, independently of the most indefatigable application, have confined themselves to one department, such as historical painting, landscapes, &c.; and have seldom succeeded when they ventured out of the path which they had particularly cultivated.

One principal part of the art is the *colouring*, for which the great masters are so distinguished. To grind his colours, therefore, he must have a *stone* and *muller*. Sometimes he performs this with oil, and sometimes with water—from whence is derived the well-known distinction of *painting in oil*, and *painting in water-colours*. The *palette*, upon which he puts his colours for immediate use, is usually made of mahogany or walnut-tree. A *palette-knife* is also requisite to take off the paint from the stone. His pencils are of various sorts. Some are made of what are called camel's hair, and others of badger's hair, or hog's bristles.

While in the act of painting, he sets his

right hand upon a stick about a yard long, to keep his hand steady. This, together with the palette, he holds in his left hand, and to prevent it from scratching the picture, a little cotton, in a piece of soft leather, is tied on the end of it.

The frame upon which the canvass is placed is called an *easel*, and is so constructed, that by means of holes and pegs it can be elevated or depressed at pleasure.

THE SADDLER.

THE saddle is familiar to every one. It consists of the *saddletree*, which, however, is not made by the Saddler, but by the Saddletree-maker, and is a profession by itself. This is a wooden frame, on which is laid wool, horse-hair, &c. neatly covered with leather. To prevent it from galling the back of the horse, it is also stuffed below with similar materials, and fre-

quently what is called a saddle-cloth is used to answer the same purpose.

The implements employed by him are chiefly cutting-knives, hammers, and pincers. Excepting the circumstance of stuffing the saddle, he is indebted to other artists for almost all the furniture necessary for the equipment of a horse, and he shews his address, by putting them together in such a way as both to render them useful and elegant.

Thus, besides the Saddletree-maker, he is indebted to the Iron-founder for all kinds of buckles, stirrups, &c.; and as he also manufactures bridles and harness, the same artist provides him with bits for bridles, and all other furniture made of steel or brass required for harness. These are exceedingly various.—The different tradesmen who are laid under contribution by the Saddler are very numerous.

THE SMITH.

THERE are none of the metals which the ingenuity of mankind has discovered that has contributed so much to the conveniences and comforts of mankind as that of *iron*; and at the same time, it more universally prevails throughout the mineral world than any other metal.

The name of Smith, however, is not confined to those who work in iron alone.—For

there are Gold-smiths, Silver-smiths, Copper-smiths, &c. to whom it cannot apply. Under the appellation of Smith, therefore, we include that artist only whose business it is to manufacture from *iron* the various articles which contribute so much to domestic comfort.

In attempting to describe the means by which he accomplishes his ends, it is necessary to notice briefly the instruments that he employs. The first article that naturally occurs is the *forge*, without which his endeavours would be altogether fruitless. The great object in the construction of a forge, is to procure as great a quantity of heat at as small an expense as possible. This has exercised the thoughts of ingenious men for ages, and yet we find that even at this day great diversity of opinion prevails. The next object is to be able to furnish as powerful and steady a blast to the fire as possible, which is of equal if not of superior importance to the former. Were a Smith's bellows constructed after the manner of those in common use, it will be perceived, upon a little reflection, that a constant blast could not be supplied. Smith's and Founder's

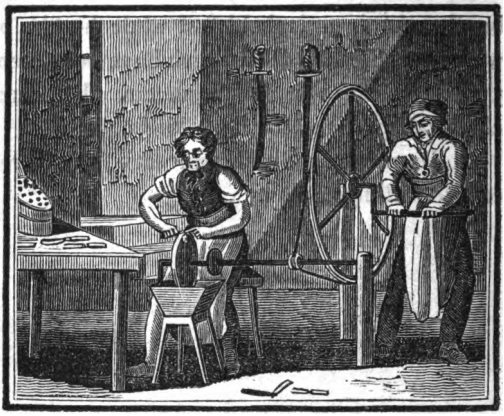
bellows, whether single or double, are wrought by means of a *rocker*, with a string or chain fastened thereto. One of the boards is fixed so as not to play at all. By drawing down the handle of the rocker, the moveable board rises, and, by means of a weight on the top of the upper board, sinks again.

A *trough of water* is indispensible to the Smith. Wet coals throw out a greater quantity of heat than when quite dry. By it also he cools the tongs when they become too hot—and by dipping the red-hot iron into the water it is thereby hardened.

There are several kinds of heat given by the Smith to iron. The *white heat,* when it must be forged both into form and size—the *blood heat,* when it has acquired both, but needs to be smoothed and filed—and the *welding heat,* when two pieces are to be united. These operations are chiefly performed upon the *anvil;* the uppermost surface of which is generally made of steel, and very smooth and flat. At one end is a hole for the purpose of cutting red-hot iron, and into which is fixed a steel chisel or spike when necessary.

By means of the *vice*, which is fixed to the bench, the iron is held fast while he files or works it. Besides those which have been mentioned, he makes use of hammers, files, punches, and pincers of various kinds.

A Journeyman Smith can earn from three to five shillings a-day.



THE CUTLER.

To attempt an enumeration of the almost infinite variety of articles made by the Cutler, would, in this place, be absurd in the highest degree. As the name intimates, he makes all kinds of *cutting* instruments; and we shall therefore be contented with quoting from Thomson's Chemistry, what he says respecting the *tempering of steel*, as it is one that the Cutler is the most anxious to accomplish well.

"Cutting instruments of steel, after being finished, are hardened by heating them to a cherry-red, and then plunging them into a cold liquid. After this hardening, it is absolutely necessary to soften them a little, or to *temper* them, as it is called, in order to obtain a fine and durable edge. This is done by heating them till some particular colour appear on their surface. The usual way is to keep them in oil, heated to a particular temperature, till the requisite colour appear. Now, these colours follow one another in regular succession, according to the temperature. Between 430° and 450°, the instrument assumes a very pale yellowish tinge, at 460° the colour is a strong yellow, and the instrument has the usual temper of pen-knives, razors, and other fine-edged tools. The colour gradually deepens as the temperature rises higher, and at 500° becomes a bright brownish metallic yellow, brown, red, and purple, to 580°, when it becomes of a uniform deep blue, like that of watch springs. The blue gradually weakens to a water colour, which is the last shade distinguishable before the instrument becomes

red-hot. These different shades of colour are supposed to be owing to the combination of the metal with oxygen, and to indicate a succession of oxydes; but the hypothesis is unsupported by proof, and is unnecessary, because the colours might be equally well explained by supposing the coat of oxyde gradually to increase in thickness. The fact that the colours appear while the iron is under the surface of oil, a liquid which readily decomposes the oxydes of iron, is scarcely consistent with the supposition that the colours are owing to oxydizement."

Birmingham, Sheffield, Walsall, and Wolverhampton, are the chief places, where the manufactory of cutlery wares is carried on.

The wages of a Journeyman Cutler depend wholly upon the kind of work on which he is employed. At Birmingham, &c. he can easily earn two guineas a-week.

To enumerate the various articles manufactured by the Cutler would be tedious. The leading articles, in the cutlery trade are, knives and forks, razors, pen and pocket knives, scissars, &c. Also making of swords, parti-

cularly the blades, but this being rather a trade by itself, is denominated a Sword-cutler. Swords are mostly manufactured in Birmingham, although some are made in other parts of Britain. Scotland used to be, and is still, famous for the manufacturing of Highland dirks, a kind of short swords worn by the Highlanders—no chieftain being in full dress without his dirk. A very particular department of a complete Cutler is the making of surgical instruments, hence he is denominated Cutler and Surgeons' Instrument Maker; but this designation is generally in large towns only. It may also here be observed, that the making of surgical instruments is carried to higher perfection in London and Edinburgh, and perhaps a few other of the principal towns in Britain, than in any other part of the world. The grinding, repairing, &c. of all sort of cutlery and surgical instruments is also a great branch of the business.

THE IRON-FOUNDER.

Iron is the most abundant and most useful of all the metals. There are a great many varieties of iron, which artists distinguish by different names; but all of them may be reduced to the class of cast-iron, wrought or soft iron, or steel. It is only with the first of these that we are at present concerned.

The ore of iron generally contains a great proportion of clay; the object of the manu-

facturer, therefore, is to separate it from the clay with which it is combined, and thus reduce it to a metallic state. This is accomplished by mixing certain portions of limestone and charcoal, and subjecting the whole to a very violent heat, in furnaces constructed for the purpose. These furnaces, when once heated, are kept so for several years; and some produce, at an average, six tons in 24 hours.

When the metal is allowed to run off, a large furnace is made in sand, and from it so many lesser ones, resembling a comb, which, when filled with metal, the larger is called a *saw*, and the lesser *pigs*; hence the origin of the name.

When manufactured into small articles, such as chimney backs, or fronts of stoves, a mould or pattern is taken in fine sand, into which the metal is poured from a large ladle, when it assumes the exact shape of the thing wanted. But in casting of cylinders for steam engines and pipes, with various branches, patterns are seldom used—the workmen contriving, by a more simple process, to form his moulds in a composition of sand and clay, which is called *loam*.

THE GOLDBEATER.

THE art of the Goldbeater consists in reducing gold to extremely thin leaves, which are employed for the purposes of gilding. Gold is one of the malleable metals, or those which spread under the hammer; and it is worth remembering, that the only metals known to the ancients possessed that property. No other substance in nature is known to be equally duc-

tile and malleable as gold. To enumerate all the facts is quite superfluous; but to communicate some idea of its tenuity and ductility, it is well ascertained, that one ounce of gold is capable of being extended upon silver wire more than thirteen hundred miles in length.

The gold employed to be *beaten* should be of the purest kind, because the least alloy decreases, in a very considerable degree, its softness, and consequently its capacity for being expanded. The manner in which it is prepared is this:—It is melted in a crucible, with a small quantity of borax, and cast into an iron mould, so as to assume the shape of flat ingots, weighing two ounces each. They are then rolled in a *flatting-mill* a great number of times, until they become thin like ribbands. To correct the hardness which the rolling occasions, they must be annealed, or softened by heat to redness, and allowed to cool again.

When the ribband is thus prepared, it is cast into squares of an inch each. These squares are then made up into parcels of one hundred and fifty, with a leaf of fine calf-skin

vellum between each square, and about twenty leaves above and below, on the outside. The plates are carefully laid in the centre, and the leaves are about four inches square; and are then covered by a belt or band, so as to prevent any of the gold from being lost, and to keep the parcel tight together. It is then beaten with a large hammer of about fifteen or sixteen pounds weight, which is nearly four inches diameter, and a little convex.

The bench upon which it is beaten, is so constructed, as to receive a block of marble about nine inches square, with a ledge, or sort of border, upon the two sides and the back; and before, there is nailed a sort of apron, which the workman takes before him, to preserve any of the metal that may happen to escape. The handle of the hammer is short. He frequently turns over the opposite side, but never intermits striking, so that this is done in the interval between the two strokes. From practice he shifts hands; and, if the expression may be used, keeps time notwithstanding. To loosen the leaves, he occasionally rolls them between the hands, in order that the

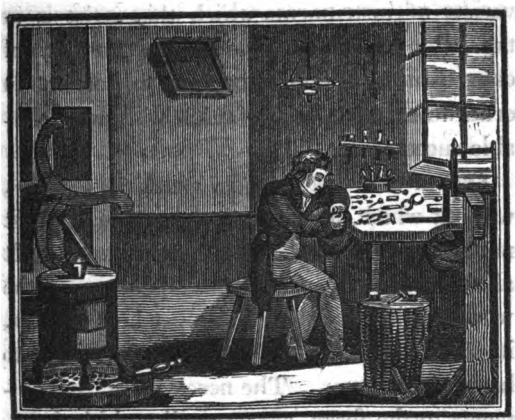
beating may produce the greater effect; and sometimes he puts the centre leaves at the outside, that they may be equal throughout.

When they have attained to nearly the thickness of the skins, they are then taken out, and cut into four equal pieces with a knife, and are again replaced into packets of nearly the same thickness as before, only, instead of vellum, skins, prepared from the intestines of an ox, are interposed. The manner of preparing these skins is kept a secret by the few persons who furnish them to the Goldbeaters.

The second beating is performed with a smaller hammer, and continued till the leaves are extended to the size of the skins. They are then again divided into four, by pieces of very sharp cane crossing each other at right angles. These are made up in a similar manner with the other two packets, and beat out, with a hammer of about ten pounds weight, to the size which is wanted. This is generally from three to three inches and a half square.

The leaves are then put into small books not sewed, the leaves of which have been previously rubbed with red chalk, to prevent

the gold leaf from adhering. The gold-leaves are taken one by one out of the folds with a delicate pair of pincers; then spread upon a leather cushion, and blown up in order to render them flat. They are then cut to the exact size by a square board, which has sharp pieces of cane glued to it; and, being made up into books, twenty-five leaves in each book, are ready for the Gilder.



THE JEWELLER.

The name Jeweller was originally applied only to such as set diamonds and other precious stones; but it is now much more extended, and includes all those who make bracelets, broaches, ear-rings, lockets, necklaces, ornaments for the head, rings, and trinkets of all sorts, &c.

It would be altogether impossible to de

scribe, within any reasonable bounds, the great variety of instruments which this artist is in the habit of employing, or the number of conveniences necessary for him to possess, in order to exercise his profession with any tolerable success.

One of the most essential articles is a *forge*, without which, at some of the stages, almost none of his operations can be performed. It also serves to keep up the temperature of the workroom in winter to a proper height; yet, it must be confessed, that it is injurious to health in summer. The necessary accompaniments to the forge, are an anvil and block.

As the Jeweller has very frequent occasion for the wire of different metals, and of different degrees of fineness, what is called *a drawing-bench* cannot be dispensed with. The method in which wire is drawn is this:—The metal is first made into the shape of a cylinder, and is drawn through several holes, each smaller than the other, until the required fineness be obtained. The wire of gold, being a very ductile metal, is sometimes drawn smaller than a hair, and an ounce may be extended to the length of several thousand feet.

A *flatting-mill* is always to be found in large concerns. It consists of two perfect cylinders, highly polished, which nearly touch one another, the lowermost being much larger than the other. The wire, passing through a slit, in what is called a *ketch*, is directed by a *guide*, or a small hole in a piece of iron, to any particular width of the cylinders that may be required. After being flatted, it is again wound on a bobbin, by a wheel fixed upon the axis of one of the cylinders.

It is necessary that the board at which he works should have a leathern bag before it, to catch the filings of the metals he may happen to be working at. The tools he has occasion to use are chiefly files of various kinds—drills and drill-bow, a hammer, pliers, a crucible, a boiling-pan, brass-stamps, gravers, knife-tools, lamp and blowpipe, piercing-saws, ring sizes, scorpers, shears, spit-stickers, spring-tongues, straining-weights, &c

THE WATCH-MAKER.

THE business or fine art of the Watch-Maker is derived from that most ingenious one of the Clock-Maker. Clocks, in the early stage of their invention, were of such a nature that few could be produced; were long made of such a large size, that they could be placed only in the steeples of great monasteries, cathedral churches, or in the towers of the palaces of some of

the ancient sovereigns. They came gradually to be made smaller, so much so, as to be got into the apartments in the castles occupied by a few of the great lords or barons. From the earliest times, clocks were made to go by weights, till towards the end of the fifteenth century, when the invention of a spring of the spiral form took place, (now well known by the name of the *main spring*), and was substituted to do what had formerly been done by a weight. By this means, they got still farther reduced, and clocks of this kind, from being set or put on a table, were called table or spring clocks, till at last some of them came to be put into cases of metal, such as silver, or brass gilt; something in shape like the watch-case of the present day, but yet so large as could not admit of their being put into the pocket; the diameter of the dials being three or four inches. Some of this sort, when alarm and striking parts were put to them, got the name of camp-watches; but were so rare and expensive, that they got only into the possession of one or two of the great potentates of Europe; such as Charles the V. Emperor of Germany, and

King of Spain; or, his contemporary, and rival in arms, the bold and gallant Francis I. King of France. After the Emperor Charles had renounced the cares of government, and betaken himself to a recluse kind of life, it is said that one of his favourite amusements was, attending to the going and time-keeping of clocks and watches. There is some reason to think that the watches of the Emperor Charles were not pocket ones,* although this

* There is no doubt that what was called a watch at this period was a spring time-piece in the modern language, the technical language of Clock-Makers at this day. The going-side, whether by a weight or spring, is called the watch part, to distinguish it from the striking side, (the two combined is called a clock), and what were called watches in old times, appears to have been a name applied to spring time-pieces of various dimensions, before they came to be so small as to be worn in the pocket, and then the same name, though improperly, was still retained.

The incorporation of Clock-Makers in Paris got a charter from Francis I., granting them the sole and exclusive right of making clocks, alarms, watches, great or small, or any other things of the said art of clock-making, within the said town, city, and precincts of Paris. Those not being free of the said incorporation, and making up such things, were subjected to the pain of having their works confiscated, and of paying an arbitrary fine.

sort, if they were not in his time, must have come very soon in, or immediately after that, having been seen in the courts of Charles IX., and Henry III., kings of France. The pocket-watch which Mary Queen of Scots possessed, is well known to have been in the hands of a private family who lived in Edinburgh, one of whose predecessors having got it from the hands of Mary herself, previous to her unfortunate execution Derham, in his artificial clock-maker, mentions having seen a watch which went a week, and had belonged to Henry VIII. of England, made about the year 1540; but he does not call it a pocket-watch, and what leads to suppose it was not one is, that in the second chapter following, he proceeds to the "*history and invention of pocket foundation watches, &c.*" *

Our illustrious Queen, Elizabeth, succeeded to the throne of England the year after the

* Pocket watches, had they been made at this time, might have been so uncommon a thing, that they would inevitably have been specifically mentioned in the charter. The word small watch cannot here be applied properly to a pocket one, which would undoubtedly have been designed so.

death of the Emperor Charles; and had she been possessed of a watch, it would either have been seen or heard of. Her great political talents did not lesson her vanity for finery, or whatever would contribute to set off the natural charms of her sex. This circumstance tends, in some degree, to show that pocket-watches had not been in use in the time of the Emperor Charles, and they could not be very common till a considerable while after that.

What a painful and tedious task it must have been to make the first pocket-watch! considering that every part must have been done by one and the same individual: the teeth of the wheels set off, and divided by hand; then cut by a sort of saw-file, and afterwards rounded up on the points; the pinions made from a piece of solid steel, their leaves or teeth formed by slitting, with a file, the solid or head part, then bottoming and rounding them up; these operations alone must have consumed a great length of time, which now could be done in a very short while, by means of the wheel-cutting and finishing engine, which divides, cuts the teeth, and

rounds them up, at one operation; and wire for pinions is also now drawn by the draw-mill or bench, into various sizes in diameter, and with leaves of every number requisite, yet not completely formed, and require the art of the pinion-maker to make them useful.

Clocks and watches, before the middle of the seventeenth century, and even for some little time after that, could scarcely be made to keep time nearer than to fifteen or twenty minutes in the twenty-four hours; what regulated them, was, the alternate motion of a balance or fly, not unlike that of the common kitchen-jack, when put to a clock, but infinitely smaller when to a watch. About, or near to this period, two of the greatest improvements took place; so much so, that any thing greater or beyond them is not again likely to happen; the one, was the application of the pendulum to a clock; the other, was a very delicate spiral or regulating spring to the balance of a watch. The consequences of these were, that a clock could now be regulated so as to go to a second or two in the twenty-four hours, and a watch to a minute or two in

that time. For these improvements our ingenious countryman, Dr Hooke, deservedly bore a distinguished title, although the palm was, in some degree, disputed when too late, by M. Huygens, a foreigner of great eminence in almost every science.

The eighteenth century was pretty far advanced before the Watch-Maker got relieved from making many of the parts of the watch, by those who severally betook themselves to different branches, such as spring-making, dial-making, engraving, gilding, &c. yet he still had to make the movement, cut the wheel teeth, make the hands, lastly, the escapement, and to finish the watch, two branches which require all the ingenuity and the nicest execution from the head and hands of the Watch-Maker. In process of time the business came to be still more subdivided, so that we can now reckon, at least, three or four dozen of different branches employed in the making up of a watch. In that of the movement about ten, the motion-maker one or two, the dial-maker three or four, the spring-maker one or two,

the jeweller of the pivot holes one or two, escapement-maker one or two, the finisher one, case-maker three or four, to which may be added the chaser, and the rose-figure or engine turner, some of whose lathes cost six or seven hundred guineas, dial-maker, fusee chain-maker one or two. Young women are sometimes employed in a minor division of this branch, glass-maker one or two, gilder, engraver, one or two, hand-maker, cap-maker, one or two, key-maker, &c.

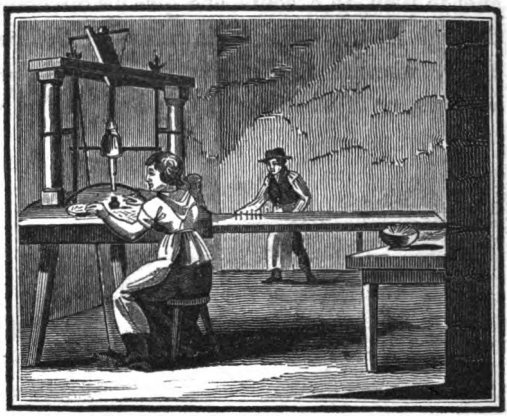
To show how far the value of a rude material can be carried by the ingenuity of the Watch-Maker, watch, pendulum, or balance springs, though made of steel, are so very light and delicate, that an ounce weight of them would amount to a great many hundred pounds sterling.

For the last hundred years or so, the better kind of watch movements have been made chiefly in Prescot, and also in a few other of the small towns, villages, and hamlets, in Lancashire. It is from this county *alone* that Watch-Makers, in general, are supplied. Movements

for low-priced watches are almost wholly manufactured in London, and in great numbers, but not so great as what are said to be made by a M. Gapy, at Beaucourt, on the higher Rhine, being at the rate of seven to eight hundred a day.

One of the many and absurd errors which the vulgar got hold of, the ignorant, and those not well-informed, or who will not take the trouble to be so, is, that the Watch-Maker does nothing but *puts* the watch together, which, in itself, is not a difficult operation, after the watch is properly prepared for being put so. It may be asked, who prepares it for this; because, to do it, will require ingenuity, and such fine execution from the hands and fingers, with the aid of good eyes, as cannot be acquired in a dozen of years, even by those who have the strongest faculties of taste and judgment, gifts of nature which fall but to the lot of few. It may easily be seen, that those who can bring a watch thus far, may very readily put it together. The Watch-Maker, to know his profession, ought to be

somewhat like a good architect, he should be able to plan, to execute, and give his directions through all the different branches of the machine, whether the machines are clocks or watches, or of whatever description.



THE PIN-MAKER.

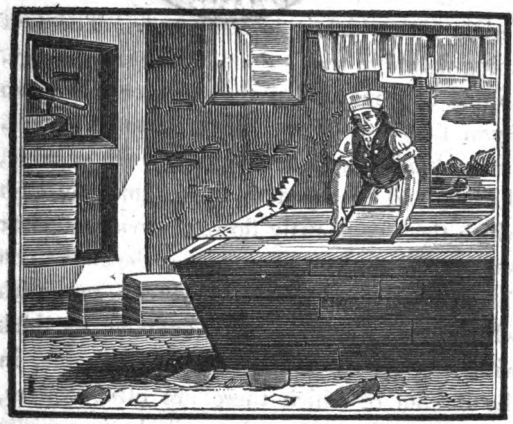
PINS were formerly made of iron wire, but are now made of brass wire. It very often happens that the wire is too thick; in which case it is made to pass through a hole of smaller diameter, in a piece of iron, with great velocity, being wound off from one wheel to another. It is then straightened. This is done in an apartment generally appropriated for the purpose.

Any number of threads of wire which the workman chooses, and of any length, so that they are not longer than the room where the operation is carried on, are tightly stretched, and allowed to remain in that position for a considerable time. By this means they are made perfectly straight. They are next cut into lengths of three or four yards, and again into such lengths as are equal to make six pins. They are then pointed at a grinding-stone, which is turned by a wheel; a pin is cut off from each end, and this is repeated six times. The heads are now formed by what is called a spinning-wheel, and the operation itself is termed *head-spinning*. One piece of wire is wound round another with astonishing rapidity. Upon drawing out the wire, a hollow tube is formed. The heads, consisting of two turns of the wire of the same diameter with the pin, are cut by shears, and made red-hot in a furnace to soften them. They are then given to children, who thrust the blunt end of one of the lengths into one of the heads, and, by means of a lathe, the hammer, a piece of iron of a few ounces weight, is raised,

being wrought by the feet, while, in the meantime, the pin is applied to the anvil and hammer, and the head is fixed. All these operations are executed in a very short space of time. The pin being now complete, to give it a more beautiful appearance, it is thrown into a solution of tin and the leys of wine, and then polished, by means of friction, in a quantity of bran.

Pins are distinguished by numbers, from No 3, to the No 14. They then proceed by *twos*. No 16, 18, and 20 is the largest size. Black pins are made for the purpose of mourning. Pins with double heads are also used by ladies, to fix their hair during the night, without the hazard of pricking.

There are about twenty-five persons employed in making a single pin, between the drawing of the wire and the sticking of the pin in paper. And in no occupation whatever are the effects of the division of labour more strikingly exemplified. Were one man to do the whole work, he could only make a few pins in one day—whereas the above number of persons can make many thousands in the same space of time.



THE PAPER-MAKER.

PAPER of every description is manufactured from what is produced in the vegetable kingdom; fine paper from linen rags, and coarse from ropes, &c. The manner in which both are made is quite similar, so that to describe the one will convey an idea how the other is manufactured.

The degree of fineness or coarseness of paper

altogether depends upon the quality of the materials with which it is composed. The first thing therefore that is done, is to *sort* the rags, so that they may be of the same, or nearly an equal fineness. They are then torn or cut, with a kind of knife fixed into a bench or table, dusted, and conveyed to the engine, through which there constantly flows a stream of clear water. The colour of the paper depends upon the quality of the rags, and the care with which they are washed. A cylinder set thick with iron knives is placed in this engine, in the bottom of which there are other knives, so placed, that when the cylinder is rapidly turned, it lacerates or tears the rags, so that, with the assistance of the water, they are soon reduced to a pulp, and by this process are cleansed, and restored to their primitive whiteness. This thin pulp is removed to the *vat*, which is always kept at a moderate temperature, by means of a furnace below.

The *mould* is made of a great number of wires closely set in a frame, and which can be manufactured after so ingenious a manner, that

the name of any person or any figure can be wrought into it, and is called the water-mark, particularly useful in bank-notes, bills, &c. Around the mould is a moveable frame, exactly of the size of the sheet intended to be made.

The Paper-maker dips the mould and frame horizontally, raises and shakes it, till the water escapes through the wires, and there remains nothing on the mould but a thin coat of pulp, which forms the sheet of paper. Practice enables him to give it what degree of thickness he pleases. He then shoves the mould upon a board over to the *coucher*, who receives it, and having placed it on a woollen cloth, he in his turn shoves the mould back to the workman, who exactly at this time has another sheet ready made. Thus they continue to work to one another's hands till they have made six quires of paper, which is called a *post*. It is then hard pressed. After this, the sheets of paper are separated from the cloths, and again put under the press. This is repeated several times, and they are then hung up to dry.

It is now ready to be *sized*, without which it would not bear the ink. The size is made of a species of glue, manufactured after a similar manner, but much more pure than common glue. The paper is dipped into the vessel containing the size, and is again pressed, and then hung up on lines, about six sheets together, to dry.

When it is dried, it is picked of the small knotty particles, examined, folded, and made up into quires, and finished by the action of very powerful pressing. Last of all, it is made up into reams, and is then ready for the market.

Every quire consists of twenty-four sheets, and each ream of twenty quires. The two outside quires contain only twenty sheets, being made up of damaged paper, called *outsides*, and sold as such. In Scotland, the printing paper has no outside quires, but all made up of perfect paper.

By means of hot plates, some paper is made as smooth as satin. This is called hot-pressing. Blotting paper is paper that has not been sized; and is generally made of cotton rag. Wire

wove paper is made in moulds, which are covered with very fine wire-cloth.

Pasteboard is manufactured after a similar manner to that of paper.

THE TYPE-FOUNDER.

In type-founding we shall begin with the artist who cuts the different letters on steel, for which purpose it is necessary to use a great variety of files, counter-punches made to the different sizes of the letters, gauges of various kinds, &c. After drawing the letter upon the face of the punch, he shapes it with the counter-punches and files, both very accurate and pretty deep,

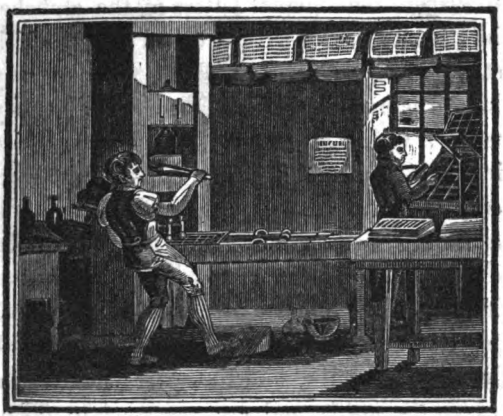
so as it may be properly struck into the *matrice*, which is generally a piece of copper, about an inch and a half long, the thickness of this being regulated by the size of the letter to be struck into it. The letter-punch is then struck into the matrice with a hammer, which is then nicely adjusted with files and gauges, and fixed to the end of the *mould*.—This mould is made of iron and steel, and consists of about fifty pieces when taken asunder, and is cased with wood, to prevent it from turning too hot while casting; but, as it is rather complex, we shall not enter into a description of it.

The proper compound for type-metal is lead, antimony, and tin. These are melted in a large furnace, and, when properly incorporated together, are cast in small bars, which are delivered out to the casters. The metal is made of various qualities, to suit the different sizes of types.

In the casting of types, every workman is furnished with a small furnace, in which he melts the metal, and where he stands filling his mould with a small ladle; then, by a sudden

jerk of the hand, and a nod of the head, the metal runs into the cavity of the matrice, and receives the impression. The mould is then opened, and the letter thrown out, and so on with each letter. Boys are employed in breaking off the superfluous metal from the bottom of the types, and in polishing the broadsides on a stone—after which the letters are ranged on long sticks for the purpose, and taken to the finisher, who examines them minutely, throwing out the bad, and dresses off the bottom with an iron plain of a particular construction.

A type-founder will cast 3000 types in a day, of some of the smaller sizes. A complete sorted font of letter includes all the single and double letters, points, borders, head and tail pieces, numerical characters, besides the running letters.



THE PRINTER.

THE invention of the art of Printing forms one of the most important eras in the history of the human mind, and is comparatively of modern date.

There are two kinds of workmen employed in this art; these are called *Compositors* and *Pressmen.*

When the kind of type to be employed is

fixed on, it is the business of the Compositor to dispose the different letters of the alphabet into separate square cases called *boxes*, which stand upon an inclined plane, that he may have a more full view of them, and that they may be within his reach. These are divided into the upper and lower cases, the former containing the capitals, the small capitals, the accented letters, figures, and marks of reference; and the lower case containing the small letters, which he has occasion to use much more frequently, together with the double letters, the stops, and the spaces that go between the words, and are necessary to fill up short lines. Besides one pair of cases for the *Roman* types, there is generally upon the same frame another for the *Italic*.

The next thing to be attended to is the length of the line; for every line in the same page (whether it be blank or not) must be of equal length. Having the *copy* before him, whether manuscript or printed, he begins to compose. He holds, in his left hand, a small frame of iron, called *a composing stick*, in which he places the first letter of the first word of

the copy, then the second, and so on till he completes the word; he then places a blank after it, and goes on in the same way with every word to the end of the line; but as it seldom happens that the blanks or spaces he has between, exactly answer to finish the line, perhaps too much or too little, the length of the words and his own taste must direct him in the spacing of it. He proceeds in the same manner with the rest of the lines.

The composing-stick is of sufficient size to hold several lines, and when it is filled up, is carefully emptied into what is called a *galley*. He proceeds as before, till he has formed a page, the number of lines of which has been previously settled, and then ties it up tightly with a cord. When he has completed the number of pages in a sheet, he carries them to the *imposing-stone*, where they are arranged, and made fast in a *chase*, which is termed *imposing*. Chases are of various dimensions, according as the work is in folio, quarto, octavo, duodecimo, &c.

In making up the wood work, which is put around the pages in imposing, the greatest

exactness is required, without which the Pressmen can never make good work. The woods employed are named *head-sticks*, from being placed at the tops of the pages; others are called *back-sticks* and *gutters*. These, when placed at their proper distances, are made completely fast in the chase, by means of small wedges called *quoins*, from a French word that signifies a wedge, and driven in between the chase and the foot and side-sticks with a mallet and a piece of hard-wood, called a *shooting-stick*. The *form* is then said to be *locked up*. It is then carried to the press, and an impression taken from it, which is called *a proof*. On the margin of this proof, the corrector of the press makes the necessary alterations, and it is given to the Compositor, who, after the form is carried back to the imposing-stone, loosens the quoins, takes out the types that are wrong placed or faulty, by the help of a sharp-pointed bodkin, and replaces them with others; then another proof is taken at the press, and the same process is gone through, and repeated, until it is considered perfectly correct. The form being ready for press, is given to

the Pressmen to be printed off, who place it upon the press-tablet, which is a flat, finely polished surface, either of stone or cast metal. The form is then adjusted in its proper place; and as it is a matter of great nicety to make the pages fall exactly on the back of each other, (which is called *register*), it occasions a great deal of trouble to the Pressmen, if the pages or furniture be not exact.

There are various presses in use among Printers, some of which are of late invention, and considered as great improvements in that art.

Besides the printing-press, three things are required, viz. paper, ink, and balls. The paper is dipped in water, and, in order that it may be all equally wetted, is pressed between boards with a large stone. This is necessary to be done, in order to produce a fair impression. The ink is compounded of various ingredients, the chief of which are oil and lamp-black. The *balls* are a sort of wooden funnells, with handles, nearly of the shape and size of a mason's mallet, stuffed with wool, and covered with undressed sheep's skin. One of these,

of which there are two required for each press, being applied to the *ink-block*, retains a small quantity of ink, and is wrought with the other till the ink is equally spread over both.—There is lately introduced a new mode of working the ink, and spreading it on the types. It is done with a roller, which is a composition of *treacle* and *glue*. Its length can be made to answer a form of any description.—The Pressman then inks over the form till it is sufficiently blackened, after which he spreads a sheet of paper straight on a frame called a *tympan*, which confines two sheets of parchment, and two folds of blanket between them. A thin frame of iron is fastened to the tympan by hinges, called a *frisket*. The sheet is put between the two, and the latter is covered with paper cut in the proper places, that the ink may not injure the margins. A sheet of paper, of the same size with that on which the work is to be printed, is fixed on the tympan, and on each side there is an iron point, which makes holes in the sheet. When the impression is to be made on the other side, the points are placed in the same holes.

After the required number of copies are printed, the form is washed with a strong *lie*, and well rinsed with water. The Compositor lays it on a board, unlocks it, and replaces each letter in its proper division. This is called *distribution*.

In Printing, there are also *rules* made of brass for black lines, exactly of the same height as the letter employed. There are other ornaments, for the division of books, chapters, &c. such as borders, flowers, &c. Head and tail pieces are cut in copper, brass, pewter, or wood.

THE BOOKBINDER.

THE art of Bookbinding may, with great propriety, be ranked among the elegant professions, as no workmen exhibit more elegance of design and neatness of work than is displayed upon a book, when bound in the best style.

We read of Bookbinders as a separate trade before the reign of Queen Elizabeth, and in very old books, much neatness of design is

often found, though differing from the present taste. It is a truth worthy of remark, that no trade produces fewer real good workmen, although the term of apprenticeship is in general seven years.

The first step in binding a book is to fold the sheets, in which state it comes from the printer. The person who folds is guided by the signatures at the foot of the first page, that is, the letters of the alphabet, generally excluding J, V, and W. Folios are folded into two leaves, quartos into four, octavos into eight, and so on. It is essential to the appearance of the book that this be correctly done.—The book, when folded, is taken to the beating-stone, and beat with a large hammer until it be quite smooth, taking great care that this be equally done, that the book may press even and solid, and also that the ink is not thrown off when the book is newly printed. It is then put into the press, and, after being some time as firmly pressed as possible, it is taken out, and made ready to be sewed. Four leaves of white paper are put to each side, and, if the back is to be smooth, draughts for the cord on

which it is to be sewed are cut with a saw; if the bands are to be raised in the old way, these draughts are not required. Folios have in general six bands, quartos and octavos five; and when the book is sewed, it is cut from the bench on which the cord is fixed and glued on the back; when dry, it is ready for the forwarder, who turns the back round with a hammer, and places it between two boards, called backing-boards; he then presses it hard in the laying-press, and hammers the back solid and smooth: this is necessary, to make a groove on each side to contain the paste-board, or boards to the book. The paste-board is then cut to the size of the book, holes are made in the boards, and a part of the cord, having been left when the book was cut from the bench, is drawn through them, and hammered smooth; the book, after being again pressed, is then ready for cutting. This is done in the laying-press, with a knife of a particular shape fixed in a machine which is called a plough. Great care is necessary in cutting, to make the book square and neat in its proportions.

The book is now ready to be coloured on

the edge of the leaves; if sprinkled, the spots are thrown on with a large brush; the marbling is done by prepared colours, floated upon size in a trough. In gilding edges, the edge is hard pressed in the laying-press, then damped with gold size, and the gold laid on, and burnished when dry. The head-bands are then wrought upon the head and bottom; this is not essential to the strength, but, when properly done, add much to the beauty of the book. The cover is next cut; if calf, or fresh leather, it is damped, and pasted on the inside with paste made of flour and water, with a little alum to keep it from running. If the cover be of morocco, it is put on as dry as possible, and the back gets a second coat of glue before the cover is put on; care must be taken to cut the corners, and to lay them neat at the head-bands, without soiling the edges. It is then put to the fire, which softens the glue, and it is rubbed at intervals, while at the fire, until the back is smooth and hard. If the book has bands, it is placed in two boards, and the bands bound with cord until the back is fired. This finishes the forwarder's department.

When the book is dry, it is taken by the finisher, whose part is to colour, letter, and place the ornaments upon it; the colours are done with alkalies and dye-stuffs. When coloured, a piece of morocco is pared very thin, and pasted upon the back, which is called the title-piece. To give the book brightness, and to make the gold adhere, it gets three coats of the white of an egg, called glaire, allowing each coat to dry before another is put on. When the last is quite dry, the leather is damped with sweet oil or lard, and the gold leaf laid on. Whatever ornament is the fancy of the finisher (all which are cut in brass by a separate tradesman, called a tool-cutter), is placed in the fire until it is of the proper heat, and then it is pressed upon the gold. When all the parts are done, the superfluous gold is rubbed off with a *gold* rag, which leaves only what the tool was pressed upon. Some of the tools are circular, and run in sheers; others are fixed in wooden handles. The title is printed on with heated brass letters, and stamped on one by one. The utmost accuracy is required in this, and attention to the heat of the tools.

If too cold, the gold will rub off; if too hot, the gold will be dim and burned; a gentle tip, when touched with a wet finger, is the proper heat. The book is now polished with a hot iron, and pressed in bright tin plates. If any ornaments are to be placed on without gold, it is done when the book is in this state, and is the last part of the process.

The Bookseller and the Bookbinder regulate the price of binding, of which they have printed lists.

THE ENGRAVER.

It is the business of the Engraver to furnish the Copper-plate Printer with the prepared plate, from which impressions are taken.

The instruments which he uses are not numerous, and are very portable. The *graver*, from which he derives his name, is most frequently employed, and requires to be of well empered steel. It is small, and is fitted into a

handle of wood. There are two sorts of gravers, the one square, which is only used for making broad strokes, and the other of the form of a lozenge, for lines that require to be more faint and delicate. The scraper is three-edged, with which any roughness raised by the graver is scraped off. The burnisher is made of hard steel. As its name implies, it is polished, and round at the end, in order that such lines as are too deep may be rubbed down, or for correcting any defects that may be in the copper. A *stone* for sharpening the graver—and an *oil-rubber* and *charcoal*, which must be very fine, are for polishing the plate. Sometimes, but not always, a *sand-bag* is also used for the convenience of turning round the plate. These are his tools.

The copper used by the Engraver is manufactured both in London and Edinburgh. The first thing to be done is to cover the plate with a thin skin of virgin wax—the drawing, or picture, is to be copied with a black-lead pencil, or any substance that contains no gum—the pencilled side of the paper is laid upon the wax, and carefully pressed down, so

that when it is withdrawn, the impression may be quite discernible upon the plate—the design is then traced through the wax to the copper, which is punctured with a sharp pointed instrument—the wax is now cleaned off, and the engraving to be finished with the gravers.

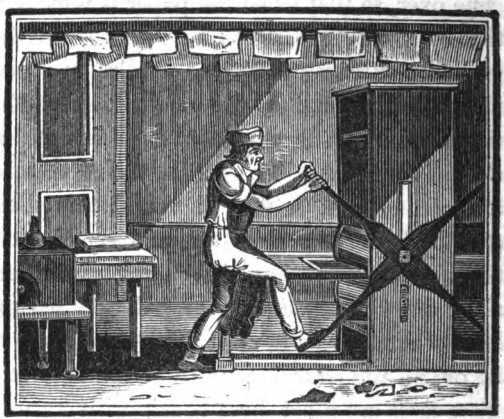
The second kind of engraving is called the *dry-point*, or *needle*. It is not used till the ground be taken off, and then only for the light parts of water, sky, drapery, &c.

The third is termed *etching*. In this the graver is not used—the lines, or strokes, are *bit in* with nitrous acid, commonly called aqua-fortis. The plate, being gently heated, is covered with thin varnish, and then blackened with the smoke of a wax candle. The next part of the process is to trace the drawing on oiled paper, with a pen and ink mixed with a quantity of *ox's gall*. *Flake-white* is then rubbed on another piece of white paper, and the white side is laid on the varnish—immediately above this is put the traced oil-paper, very equally stretched, and secured with *bordering* wax to the plate. With a blunt etching

needle, the tracing on the oil-paper is now gone over, so that when the paper is removed, the lines will appear to be removed to the ground. Etching points, or needles, are used for drawing through the marked lines, the depth of which is regulated by the taste or skill of the artist. To contain the aquafortis, a border of wax is formed round the plate, and the liquor is poured on, and remains till the operation is completed; but experience alone can give the time required. When the lines wanted to be faintest have had time to be bitten, the plate is washed and dried, and these lines are filled by a pencil with varnish and lamp-black, and the aquafortis again poured on. After a requisite time, the plate is cleaned, and the wax and ground taken off.

In the *stroke* engraving, the plate is begun by etching, and finished with the graver.

Engravers use a screen of cambric paper, suspended at the window at which they work, for the purpose of keeping off the glare of light.



THE COPPER-PLATE PRINTER.

THE business of the Copper-plate Printer is, with some degree of probability, said to have owed its origin to accident, about the year 1457. It was not, however, practised in England till about 150 years after that period.

When a plate comes to be printed at the copper-plate press, the Printer, after cleaning it out with soap, lie, or turpentine, lays it on a

flat stove, in order to warm the plate; he next smears it over with ink, two or three times, to make it go into the engraving, then wipes it over once or twice with a rag, on which there is whitening, and using, last of all, the flat part of his hand, he thoroughly cleans the surface, without taking any of the ink out of the work. The plate is now laid upon the press-plank, or board; the moistened paper is spread over it; the cross is pulled, and the plank and plate is carried between the two cylinders, the upper one of which, being covered with cloth and moistened paper, brings away the engraved strokes, which form the impression. The ink generally used is composed of *Frankfort black* and burned linseed oil, in the grinding of which a mullar and stone are used.

Sometimes the plate is twice passed through the press, according as the work is requisite.

THE GLASS-BLOWER.

THERE are perhaps few manufactures which contribute more to the convenience and elegancies of life than that of glass. This is a substance which is formed by the fusion of siliceous earth, with various salts and metallic oxides; but the manufacture is of so very complicated a nature, that it is almost impossible to communicate it by a mere description.

Glass-houses are large cones, the furnaces of which are built upon a vault, high enough to permit them to remove the rubbish. In the top of this vault there is an aperture to admit air and fuel.

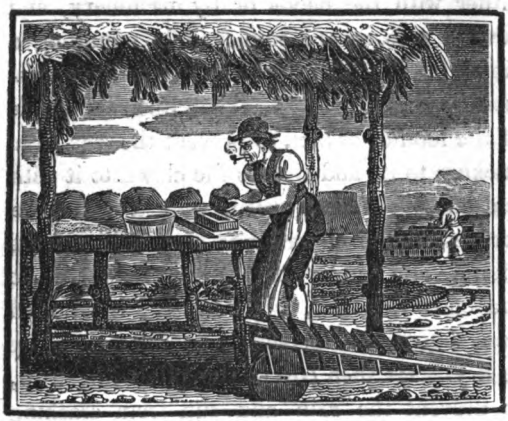
The crucibles, or pots, used in a glass-house, are the most important article. They are made of clay, and the greatest care is bestowed upon their manufacture.

There are three kinds of glass; bottle, window, of which there are several kinds, and plate.

About six persons are employed in making one bottle. One dips a tube red-hot into the metal, to which it readily adheres, allows it to cool a little, immerses it again, and brings out what is necessary. He then hands it to the blower, who, by rolling it on a plate, brings it to the end of the tube; he next places it on a mould, and, by blowing through the tube, the glass, getting cold, retains the shape of a bottle. The *finisher*, by means of a cold piece of iron, and by merely touching the neck, which is still red-hot, cuts it off from the tube as if done by a diamond.

Window-glass is manufactured after a similar manner, by blowing and rolling, only it is cut up, and spread flat upon a table.

The materials for making plate-glass must be of the finest quality. After it is properly fused, it is cast on a strong wooden table, covered with smooth copper, and the fluid glass is rolled flat by a heavy cylindrical roller of copper, and the thickness is regulated by machinery. It is then placed in the annealing oven, and allowed to cool gradually. It is next *squared*, or cut, with a large diamond, and afterwards ground and polished.

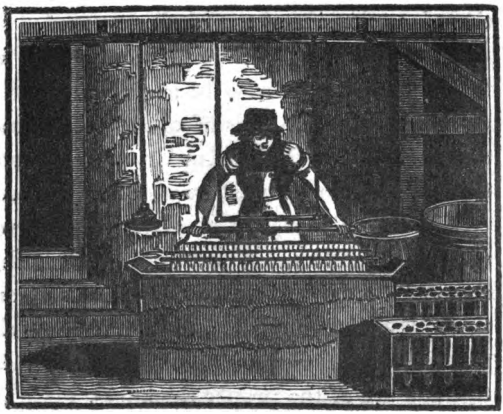


THE BRICK-MAKER.

WHERE stones cannot be procured, bricks are a most admirable substitute. In a great part of England bricks are used in the erection of almost every house; and their size is regulated by government to be nine inches long, four broad, and four and a half thick;. every thousand paying a duty of 5s. 10d., and are made either of pure clay, or of clay mixed with sand and ashes.

The clay is first moistened, and wrought, either with the hands or by machinery, and several persons are employed in moulding a single brick. The workman begins the operation by sprinkling a little sand upon the inside of the mould, or box, to prevent the clay from sticking to it, and throws the clay into it with considerable force; then, with a ruler, he scrapes off the superfluous clay, lifts up the mould, and conveys it between two boards to the barrow, which, when loaded, is wheeled away by another person, who piles them up to dry. He then covers the pile with straw, to prevent the rain and sun from cracking them, and when gradually dried, they are burned in a kiln. Great art is required in arranging them in the kiln, that the fire may circulate in all directions. The fuel employed is small coal cinders, which continue burning till the bricks are thoroughly hardened. Furnaces and stoves are made of what is called fire-brick, in the formation of which a particular clay is requisite.

The manufacture of *tiles* is pretty similar to that of bricks.



THE TALLOW-CHANDLER.

TALLOW-CHANDLERS, or Candlemakers, make candles of tallow, spermaceti, or wax. It will be sufficient to describe the making of tallow candles, which is composed of bullock's and sheep's tallow. The best season for manufacturing them is the spring, because the atmosphere is then best adapted for the purpose.

The cotton, after being spun, is wound into large balls,—the workman draws out the

threads from five, six, or eight balls, and cuts them into the size of the candles wanted.

After taking off any inequalities, knots, &c. from the cotton threads, the *wicks* are placed at equal distances, on rods of about half an inch diameter, but in other places a kind of hoop, suspended from the roof by a pulley, is used.

The tallow is melted in a large copper vessel, the impurities skimmed off, and when thus refined, it is poured into a trough or tub, and the cottons are dipped into it. When cold, they are dipped a second and third time, &c. till they are of the proper thickness.

The second kind of candles are cast in moulds, the frame of which is of wood, the hollow cylinders are commonly made of pewter, of the diameter and length of the candle wanted, and shaped like a funnel at the neck, with a hole pierced in the middle to allow the cotton to pass through. To prevent the tallow from escaping, a small plug is introduced into this hole, which also holds the cotton tight. The other end is fastened perpendicular, and exactly in the middle of the mould,—the tallow is then poured in, and allowed to stand till it be quite cool before the candle is drawn out.

THE ROPE-MAKER.

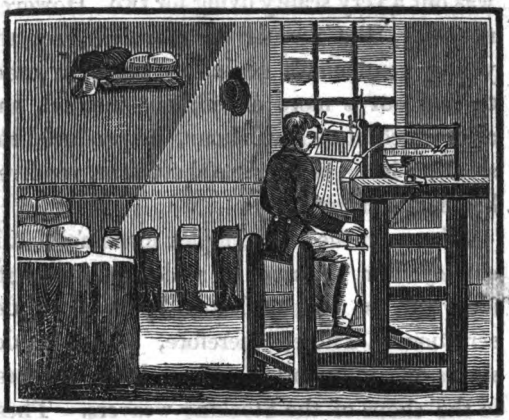
Ropes are made of hemp, and the manufactory is called a *rope walk*, at one end of which is a spinning-wheel. The person who forms the cord, or rope, having a bundle of hemp round his waste, fixes as many ends to a hook in the wheel as he judges proper—the wheel is then turned round, and the threads are twisted, and the rope lengthened, as he goes backward. The twisted part draws out more

fibres out of the parcel bound round his waist, which he assists with his fingers, taking care that they come equally from both sides, and by the ends, that the thread may be of equal thickness throughout; for in this, and in twisting, lies the art.

On coming to the end of the walk, he calls out, the wheel is stopped, and the thread unhooked and taken to the reel. When it is begun to be reeled, keeping the end of the thread tight to prevent it from untwisting, he follows up the thread to the reel slowly, and when finished repeats the same operation. To prevent the rope-yarn from weighing down, there are a number of posts with pegs in them, on which he throws the yarn.

When several yarns are twisted together, it is, by seafaring men, called a *strand*,—two or more of which make large ropes and cables.

In order to prevent ropes, &c. from rotting, they are tarred when the hemp is in the state of yarn.



THE STOCKING-WEAVER.

It is said that the Stocking-Loom was first invented by a gentleman of Oxford.

Of the origin of the stocking-loom the following story is told: A young gentleman of Oxford, having fallen in love with and married a young woman of inferior rank, without the consent of his relations, was disowned by them, and the newly-married pair were soon reduced to the greatest difficulties. They had no other means of subsistence but upon what the young woman earned by knitting of stockings, which

was but a very scanty living for two. However, necessity, the mother of invention, set the young gentleman's genius to work, in order to find out a more expeditious method, and after much time and labour, he produced the stocking-loom, which, in a short time, rendered him independent.

It is one of the most complex machines that is employed in the arts, of which no adequate idea can be communicated by a mere description. Those, therefore, who are desirous of information, must have recourse to the shops of the Stocking-weavers. These looms will cost from fifty to one hundred and fifty guineas.

Journeymen are paid so much for each pair of stockings, according to the fineness of the worsted, thread, cotton, or silk, of which they are manufactured. They pay to the master two shillings a week for the use of the loom, and great application is necessary to earn a guinea and a half a-week.

THE END.

Oliver & Boyd, Printers, Edinburgh.