

oil in not too large proportions, will be as easily saponified as if the latter alone were used.

**Palm-oil Soaps.**—Palm oil is rarely used alone as a soap stock, but generally employed with an admixture of rosin, and it then yields yellow soap; for white soap, however, these are employed in the bleached state. For some kinds of soap, palm oil is saponified with 5 to 10 per cent. of cocoanut oil; more is often used of the latter, and then filled soaps are obtained. Demi-palm is a soap consisting of equal parts of tallow and palm butter, to which is added a very small quantity of rosin and cocoanut butter. 1. Palm oil, 300 lbs.; tallow, 200 lbs.; rosin, 200 lbs. 2. Tallow, 500 lbs.; palm oil, 300 lbs.; rosin, 200 lbs. 3. Palm oil, 450 lbs.; cocoanut oil, 50 lbs. 4. Hog fat, 550 lbs.; palm oil, 150 lbs.; cocoanut oil, 50 lbs.; clarified rosin, 50 lbs. Palm oil may be made into soap exactly in the same way as tallow. If rosin is incorporated, it is better to produce first the combination of the resin with the ley, and mix the same with the finished palm-oil soap. Soap made of bleached palm oil is perfectly white, and can scarcely be distinguished from tallow. Palm soap bleaches when exposed to the light.

**Soft Soap.**—For the manufacture of soft soaps, hempseed oil, linseed oil, poppy oil, rapeseed, colza, whale, and seal oils are used. Saponification is commenced with a ley of 9° to 11° B., and the contents of the kettle kept boiling until the paste becomes of sufficient consistency to draw threads out of the substance. It then undergoes the process of clear-boiling, for which purpose a ley of 25° B. should be used, stirring all the time. When the paste does not sink any more—first it ascends—boils quietly, and shows the formation of scales, it may be considered finished. The barrels in which it is to be offered to the trade should be immediately filled. The quality of soft soaps is estimated according to their consistency. Green soap was formerly made of linseed oil. It is now, however, made principally of whale oils, but as they have a yellow

colour, manufacturers mix the soaps made of the whale oils with finely-powdered indigo, or the indigo-sulphate of lime, which is prepared by dissolving indigo in sulphuric acid, diluting it with water, and saturating the whole with lime-milk. Black soft soap is made by adding to the soap a mixture of a solution of copperas and logwood or gall-nuts.

**TOILET SOAPS.**—In the manufacture of fancy soaps the same crude materials are employed as for the common soaps, but they are in a more refined state, and the superior fats, as hog's fat, cocoanut oil, and olive oil, are substituted for the inferior. The soaps obtained are generally coloured and scented.

**Making Soaps in the Cold Way.**—First the fat is melted in a well-cleaned iron or copper kettle, at a low temperature, it is then filtered through fine linen or muslin into another kettle. Often the fat has to be further purified. This is done by boiling it with one-third of water for about 10 minutes, and straining it off. Some add for 100 lbs. of fat, 6 oz. of salt, 3 oz. of fine pulverized alum. They then let it remain quiet for some hours. To the fat, which must not be warmer than 104° Fahr., the ley is gradually added. In soaps made in the cold way, a very strong ley is used, generally one of 36° B., and for a certain quantity of fat just half of it employed; say, for 80 lbs. of fat, 40 lbs. of ley, or less when the ley is stronger. The ley must be clear and colourless, but it is not necessary to heat it previously when it has been kept in a warm room. For stirring it, a broad paddle of boxwood must be used, having sharp edges at its lower end, rounded at its upper end, so that it may be easily handled. The paddling should be continued until a ring drawn with the spatula may be recognized. At this point the necessary colouring matter and perfume should be added. The paste should then be run into frames previously lined with linen, so carefully that no folds are formed in the edges of the box. Each frame should be entirely

filled, and well closed with the margin of the linen and a wooden cover, and the whole left for 12 hours, by which time saponification will have been produced; it will be seen that the mass, which was nearly cold when run into the frames, has undergone a spontaneous reaction, raising the temperature sometimes over 175° Fahr. At this temperature the constituents of the materials are combined, and a soap produced of a quality almost resembling that of the boiled soaps. At the expiration of 12 hours the soap may be taken out of the frame, cut, and dried. Some add about one-tenth of potassa ley to the soda ley, for the purpose of increasing the solubility, and consequently the quality of the soap; when no potassa is added these soaps are generally hard. Of such soaps, 100 lbs. of fat will yield about 150 lbs.

*Transparent Soaps* are prepared by dissolving well-dried soaps in alcohol; but all kinds of soaps cannot, with equal facility, be thus transformed. It is difficult to work up into a solid consistency soaps made of olive oil, when treated with alcohol, and they invariably assume the opaque form. A good suet soap should always be preferred, and rosin tallow soaps readily yield yellow soaps of a remarkable transparency. The first step necessary for making these soaps transparent is to cut them into very thin ribbons, which can be done with a knife, or with a soap-mill. The soap is extended on strong paper, and exposed to the air and sun until it is thoroughly dried. It is then pulverized in a marble mortar, and passed through a fine sieve. The powder thus obtained is directly dissolved in strong boiling alcohol. While the soap is liquid, the colours and perfumes are incorporated with it. Three and a half gallons of alcohol of the specific gravity of 0·849 are generally used to 50 lbs. of soap. A still, heated by steam or hot water, is used for this operation, as a considerable quantity of alcohol would be lost in a common heating pan, and the direct application of fire would destroy the beauty and transparency of the soap.

*Colouring Soaps.*—For the colouring

of ordinary fancy soaps mineral colours are employed; for superior toilet and transparent soaps, organic pigments are used. Generally, the red colouring matter is derived from vermilion or chrome red, the violet from fuchsine solved in glycerine, the red-brown and brown from camarel and the various kinds of umber. For green, chrome green is used; a beautiful vegetable green is obtained by stirring in the soap, saponified with 7 to 10 per cent. of palm oil, some smalts or ultramarine. For blue, smalts or ultramarine. Yellow is obtained by mixing palm butter with the fat to be saponified. For black, common lampblack is used. Fine toilet soaps and transparent soaps may be coloured as follows:—For a red colour, tincture of dragon's-blood or liquid carmine. Rose, tincture of carthamine or of archil. Yellow and orange, tincture of annatto or saffron. Blue and violet, tincture of litmus, or of alcaet-root, or soluble Prussian blue, basic, or a very little pure indigo in impalpable powder. Green, a mixture of blue and yellow.

*Perfuming Soaps.*—Perfuming is generally done when the paste is in the frame, as, if added in the pan when the soap is hot, most of the essential oils would be volatilized. It is best to mix the colours and the perfumes together with some alcohol or glycerine, and stir well in the paste.

*Windsor Soap.*—1. White. The best is a mixture of olive oil, 1 part; ox-suet, or tallow, 8 or 9, saponified with a ley of caustic soda, and scented after removal from the boiler. The ordinary is curd soap, scented, whilst semi-liquid, with oil of caraway, supported with a little oil of bergamot, lavender, or organum. To the finer qualities a little oil of cassia, or of almonds, or of the essences of musk and ambergris, is also added. The usual proportion of the mixed oils for good qualities, is 1½ lb. per cwt., and 2 lbs., at the least; for the finer ones, exclusive of the alcoholic essences, if any are employed. 2. Brown. Originally this was the white variety that had become yellow and brown by age. It now greatly differs

from the white in being coloured with a little caramel, with umber, or brown ochre. 3. Nine parts of good ox-tallow and 1 of olive oil, scented with oil of carraway, oil of lavender, and oil of rosemary, in the following proportions;—Hard curd soap, 100 oz.; oil of carraway, 1 oz.; oil of lavender,  $\frac{1}{2}$  oz.; oil of rosemary,  $\frac{1}{2}$  oz.

*Honey Soap.*—Ordinary honey soap is the finest bright-coloured yellow rosin soap, coloured by the addition of a little palm oil or palm-oil soap, and scented with oil of rose geranium, or oil of ginger-grass, or with a little oil of bergamot or verbena. Some of the finer kinds are made of olive-oil soap and palm-oil soap, of each 1 part; white curd soap, 3; deepened in colour, whilst in a liquid state, with a little palm oil, or annatto, and scented with 1 to  $1\frac{1}{2}$  oz. of essential oils to each  $\frac{1}{2}$  lb., or 1 to  $1\frac{1}{2}$  lb. to each cwt.

*Musk Soap.*—1. The basis is generally a good ox-suet or tallow soap; the scent, essence of musk or oil of musk, supported with a little of the oils of bergamot, cinnamon, and cloves. The quantity of the essence used depends on the intended fragrance of the product. The colouring matter is usually caramel. 2. Tallow and palm-oil soap, to which add powder of cloves, roses, and gillyflowers, each 4 oz.; essence of bergamot and of musk, each  $3\frac{1}{2}$  oz.; colour, brown ochre, 4 oz.

*Glycerine Soap.*—1. Any mild toilet soap, with which about  $\frac{1}{2}$ th to  $\frac{1}{3}$ th of its weight of glycerine has been intimately mixed whilst in the liquid state. It is generally tinged of a red or rose colour, or orange-yellow. Scent with oil of bergamot or rose geranium, supported with a little oil of cassia, or cassia supported with essential oil of almonds. 2. 40 lbs. of tallow, 40 lbs. of lard, and 20 lbs. of coconut oil, are saponified with 45 lbs. of soda ley and 5 lbs. of potash ley of 40° Baumé, when the soap is to be made in the cold way. To the paste then add, pure glycerine, 6 lbs.; oil of Portugal,  $\frac{1}{2}$  oz.; oil of bergamot,  $\frac{1}{2}$  oz.; bitter almond oil, 5 oz.; oil of vitivert, 3 oz. 3. One hun-

dred parts of olein of commerce, pour it either in a glass flask if the quantity is small, or for a larger quantity into an ordinary boiler, add 314 parts of glycerine, sp. gr. 1.12, heat to a temperature of 90° Fahr., and then add 56 parts of an aqueous solution of caustic potassa, sp. gr. 1.34; stir the mixture well. Keep at rest for 24 hours.

*Almond Soap.*—1. The best quality is usually white curd soap, with an addition of  $\frac{1}{4}$ th to  $\frac{1}{3}$ th of its weight of olive-oil soap, scented with essential oil of almonds in the proportion of about 1 oz. to each  $4\frac{1}{2}$  to 5 lbs., or  $1\frac{1}{2}$  lb. to the cwt.; very fine. The addition of a little oil of cassia, say 4 or 5 oz. a cwt., improves it. Second and inferior qualities are scented with the artificial oil of almonds, instead of the genuine oil. 2. Hard white soap, 28 lbs.; essential oil of almonds,  $4\frac{1}{2}$  oz.; reduce the soap to small shavings, and melt with the aid of a little hot water, adding the essence gradually, and with constant stirring.

*Violet Soap.*—1. Any white toilet soap strongly scented with essence of orris-root, either coloured, or not, with tincture of litmus, or a little levigated smalts, ultramarine, or indigo. 2. White curd soap, 3 lbs.; olive-oil soap, 1 lb.; palm-oil soap, 3 lbs.; melted together, and further scented with a little essence of orris-root, which is best added cold; and coloured, or not, at will. Very fragrant, but it does not take colour very well.

*Louquet Soap.*—1. White curd soap, finest, 17 $\frac{1}{2}$  lbs.; olive-oil soap, 2 $\frac{1}{2}$  lbs.; oil of bergamot, 1 oz.; oil of cassia, oil of cloves, oil of sassafras, oil of thyme, of each, 1 $\frac{1}{2}$  dram; oil of neroli, 1 dram; ochre, brown, levigated, 2 oz.; proceed as for almond soap. It may be varied by substituting oil of lavender for the neroli. 2. White curd soap, 20 lbs.; oil of bergamot, 2 $\frac{1}{2}$  oz.; oil of cloves,  $\frac{1}{2}$  dram; oil of neroli,  $\frac{1}{2}$  dram; oil of sassafras,  $\frac{1}{2}$  dram; oil of thyme,  $\frac{1}{2}$  dram. Coloured with 2 $\frac{1}{2}$  oz. brown ochre. 3. Good tallow soap, 30 lbs.; essence of bergamot, 4 oz.; oils of cloves, sassafras, and thyme, each 1 oz.; colour, brown ochre, 7 oz.

*Rose Soap*—1. Palm-oil soap, in shavings, 3 lbs.; finest white curd soap, in shavings, 2 lbs.; soft water,  $\frac{1}{2}$  pint. Melt together in a bright copper pan, set in a water bath. Add levigated vermilion,  $\frac{1}{2}$  oz.; and when the mixture has cooled a little, stir in finest otto of roses, 2 drams; oil of bergamot,  $1\frac{1}{2}$  dram; oil of cinnamon, oil of cloves, of each,  $\frac{3}{4}$  dram; oil of rose geranium,  $\frac{1}{2}$  dram. Mix well, and pour the mass into an open-bottomed wooden frame, set on a polished marble slab. Sometimes it is coloured with tincture of dragon's-blood, or of archil, instead of with vermilion. 2. White curd soap, 20 lbs.; essence of rose,  $1\frac{1}{2}$  oz.; oil of cloves,  $\frac{1}{2}$  dram; oil of cinnamon,  $\frac{1}{2}$  dram; oil of bergamot, 1 dram; oil of neroli,  $\frac{1}{2}$  dram; coloured with 2 oz. vermilion. 3. Olive-oil soap, 30 lbs.; good tallow soap, 20 lbs.; finely-ground vermilion,  $1\frac{1}{2}$  oz.; essence of rose, 3 oz.; essence of cloves, 1 oz.; essence of cinnamon, 1 oz.; essence of bergamot,  $2\frac{1}{2}$  oz. The hard soaps are to be kept at  $212^{\circ}$  Fahr. for an hour, with 5 lbs. of water in an untinned copper pan, the vermilion then added, and when taken off the fire, the essences mixed well with it, by stirring them together. This is a very perfect soap, possessing a delicious fragrance, a beautiful rescate hue, and the softest detergent properties, which keep- ing cannot impair.

*Cinnamon Soap*—1. Usually a mixture of tallow and soaps, coloured with about  $\frac{1}{4}$  lb. of yellow ochre, and scented with 1 oz. of oil of cinnamon, supported with a little oil of bergamot and sassafras, to each 7 lbs. 2. Finest white curd soap, 6 lbs.; palm-oil soap,  $3\frac{1}{2}$  lbs.; coconut-oil soap, 1 lb.; oil of cinnamon,  $1\frac{1}{2}$  oz.; oil of bergamot, oil of sassafras, of each,  $\frac{1}{4}$  oz.; lavender, 1 dram; levigated yellow ochre,  $\frac{1}{2}$  lb. 3. Good tallow soap, 30 lbs.; palm-oil soap, 20 lbs.; essence of cinnamon, 7 oz.; essence of sassafras,  $1\frac{1}{2}$  oz.; essence of bergamot,  $1\frac{1}{2}$  oz.; colour, yellow ochre, 1 lb. Oil of cassia is often used instead of oil of cinnamon, and always in inferior qualities.

*Lutender Soap*.—The basis of Windsor

soap, scented with oil of lavender, 1 to  $1\frac{1}{2}$  fluid oz. per 7 lbs., supported with a little oil of bergamot and the essences of musk and ambergris. It is often coloured with a little tincture of litmus, or corresponding mineral pigments.

*Orange-flower Soap*.—1. Like rose soap, but using pure neroli, supported with a dash of the essences of ambergris and Portugal, instead of otto of roses, as scent. The French orange-flower soap is scented with equal parts of neroli and geranium. 2. Tallow and palm-oil soap, to which add, essence of orange flowers,  $7\frac{1}{2}$  oz.; ambergris,  $7\frac{1}{2}$  oz.; colour, chrome yellow, 8 oz.; red-lead, 2 oz.

*Rondeletia Soap*.—The basis of cinnamon, rose, or Windsor soap, scented with 1 to  $1\frac{1}{2}$  oz. of the mixed oils and essences used for essence of rondeletia, to each 7 lbs. The colours are those used for bouquet, cinnamon, honey, or brown Windsor soap.

*Flowers of Erin*.—White curd soap, scented with oil of roses, 1 dram; spirits of violet,  $\frac{1}{2}$  fluid oz.; spirits of jasmine,  $\frac{1}{2}$  fluid oz.; spirits of patchouli,  $\frac{1}{2}$  fluid oz.; spirits of vanilla,  $\frac{1}{2}$  fluid oz. Tinged green or rose.

*Primrose Soap*.—This has usually a similar basis to honey soap, faintly scented with mixed oils similar to those used as cowslip perfume, and coloured pale yellow, or greenish yellow.

*Iodine Soap*.—Make a solution of 1 part of iodine of potassium in 3 parts of water; to this add, of pounded Castile soap, 16 parts; melt in a porcelain vessel by the aid of a water bath.

*Mercurial Soap*.—Beat into a homogeneous mass in a Wedgwood mortar, Castile soap, 1 lb.; protochloride of mercury,  $\frac{1}{2}$  oz. dissolved in 4 oz. of alcohol.

*Sulphur Soap*.—Cut into small shavings white soap, 8 oz.; beat up in a mortar with sublimated sulphur, 2 oz.; add 1 oz. of alcohol, to which may be added a few drops of any of the odoriferous essential oils; beat the whole into a smooth paste, and roll into balls.

*Antimonial Soap*.—Prepared by dissolving 1 part of golden sulphuret of antimony in 2 parts of a saturated solu-

tion of caustic potash, to this add, of Castile soap in powder, 4 parts, triturate till the whole assumes a proper consistency.

**SHAVING SOAPS.—Shaving Paste.**—1. White soft soap, 4 oz.; finest honey soap, 2 oz.; olive oil, 1 oz.; water, 1 or 2 tablespoonfuls; carbonate of soda, 1 dram. Melt together and form a paste, adding a little proof-spirit and scent at will. Some melt with the soap about 1 dram of spermaceti. Produces a good lather with either hot or cold water, which dries slowly on the face. 2. Hard soap in small shavings, 2 oz.; best soft soap, 6 oz.; melt by the aid of a water bath; add, on cooling, oil of cloves, 1 dram; tincture of ambergris, 20 drops.

**Cream Soap.**—Take white, soft, lard potash soap, recent, but moderately firm, and beat in small portions at a time, in a marble mortar, until it forms a white homogeneous mass; add sufficient essential oil of almonds, supported with a little oil of bergamot, or of cassia, put in during the pounding.

**Shaving Essence or Fluid.**—1. White hard soap, in shavings,  $\frac{1}{4}$  lb.; rectified spirit, 1 pint; water,  $\frac{1}{2}$  pint; perfume to taste. Put them into a strong bottle, cork tightly, set it in warm water for a short time, and occasionally agitate it briskly until solution is complete. After standing, pour off the clean portion from the dregs into clean bottles for use, and at once closely cork them. If the solution is not sufficiently transparent, a little rectified spirit should be added to it before decantation; a little proof-spirit may be added if it is desired to render it thinner. If much essential oil is used to perfume it, the transparency of the product will be lessened. 2. White soft soap,  $\frac{1}{4}$  lb.; liquor of potassa, 2 fluid drams; rectified spirit, 1 pint. Perfume to taste. Proceed as before. The product of both is excellent. By rubbing two or three drops on the skin, and applying the shaving brush, previously dipped in water, a good lather is produced. The choice of perfume is a matter of taste, 15 to 20 drops of essence of musk or ambergris, 1 fluid dram of any of the ordinary fragrant

essences, or 12 to 15 drops of essential oil, simple or mixed, to a pint, are sufficient for the purpose.

**SOAP BALLS.**—These are usually made of one or other of the toilette soaps with the addition of a little starch; sometimes sand is used in place of the starch.

**Camphor Savonette.**—Spermaceti, 2 oz.; camphor, powdered with the addition of a little spirits, 1 oz.; white curd soap, melted with a little water, 24 oz.; amalgamate with a gentle heat and mould into balls.

**Sand Ball.**—Fine old yellow soap, 2 parts; silver sand, 1 part; scent to taste; melt the soap and mix in the sand, afterwards adding the scent and making into balls.

**Marble Working.**—Marbles are generally cut up in the same direction in which they are quarried; this is known as sawing with the grain. Sometimes it is necessary to cut them against the grain, which renders them more difficult to work. Some marbles can only be sawn in the direction in which they are cut up. The marble worker is often obliged to rough hew and work without the help of the saw, casings, columns, and other articles with curved outlines; sometimes, but rarely, he re-works with the chisel badly-executed sawings; he then squares each piece with the saw or chisel to the required dimensions, and finally mounts the marble upon its stone core, and sets up the work in its place. The working of mouldings takes much time and trouble; the first operation is to saw the arris, then to work with a notched chisel, making several successive groovings, on account of the contour and expansion, in which but very small pieces of the material are taken, for fear of splintering it; finish with small common chisels, which should be sharp and well tempered. Cylindrical pieces, such as round pedestals, columns, urns, and vases, are worked with a chisel, and then, if portable, finished on a turning lathe. When it is impossible to place the pieces in a lathe, they are thickly grooved, bolstered with the puncheon, and the desired contours obtained by means of thick panels; they are then worked

with a small chisel, which removes the dust, and thus prepares the marble for polishing.

*Polishing.*—Polishing includes five operations. Smoothing the roughness left by the burn is done by rubbing the marble with a piece of moist sandstone for mouldings, either wooden or iron mullers are used, crushed and wet sandstone, or sand, more or less fine according to the degree of polish required, being thrown under them. The second process is continued rubbing with pieces of pottery without enamel, which have only been baked once, also wet. If a brilliant polish is desired, Gothland stone instead of pottery is used, and potters' clay or fullers' earth is placed beneath the muller. This operation is performed upon granites and porphyry with emery and a lead muller, the upper part of which is incrustated with the mixture until reduced by friction to clay or an impalpable powder. As the polish depends almost entirely on these two operations, care must be taken that they are performed with a regular and steady movement. When the marble has received the first polish, the flaws, cavities, and soft spots are sought out and filled with mastic of a suitable colour. This mastic is usually composed of a mixture of yellow wax, rosin, and Burgundy pitch, mixed with a little sulphur and plaster passed through a fine sieve, which gives it the consistency of a thick paste; to colour this paste to a tone analogous to the ground tints or natural cement of the material upon which it is placed, lampblack and rouge, with a little of the prevailing colour of the material, are added. For green or red marbles, this mastic is sometimes made of gum lac, mixed with Spanish sealing wax of the colour of the marble; it is applied hot with pincers, and these parts are polished with the rest. Sometimes crushed fragments of the marble worked are introduced into this cement; but for fine marbles, the same colours are employed which are used in painting, and which will produce the same tone as the ground; the gum lac is added to give it body and brilliancy.

The third operation of polishing consists in rubbing it again with a hard pumice-stone, under which water is constantly poured, unmixed with sand. For the fourth process, called softening the ground, lead filings are mixed with the emery mud produced by the polishing of mirrors or the working of precious stones, and the marble is rubbed with a compact linen cushion, well saturated with this mixture; rouge is also used for this polish. For some outside works, and for hearths and paving tiles, marble workers confine themselves to this polish. When the marbles have holes or grains, a lead muller is substituted for the linen cushion. In order to give a perfect brilliancy to the polish, the gloss is applied. Well wash the prepared surfaces, and leave them until perfectly dry; then take a linen cushion, moistened only with water, and a little powder of calcined tin of the first quality. After rubbing with this for some time, take another cushion of dry rags, rub with it lightly, brush away any foreign substance which might scratch the marble, and a perfect polish will be obtained. A little alum mixed with the water used penetrates the pores of the marble, and gives it a speedier polish. This polish spots very easily, and is soon tarnished and destroyed by dampness. It is necessary, when purchasing articles of polished marbles, to subject them to the test of water; if there is too much alum, the marble absorbs the water, and a whitish spot is left.

*Mounting.*—Marble workers mount and fasten their works upon plaster mixed with a third-part of dust, as pure plaster repels the marble, and causes it to swell out and burst. These are joined together by cramps and gudgeons of iron and copper, which should be carefully covered, in order that the oxides may not spot the casings. Marble chimney-pieces should be lined with lia stone or plaster.

*Selecting Marble.*—Examine each piece, note its beauties, and endeavour to hide its defects before cutting or working it.

When fine pieces are found, endeavour to cut them into two or three parts, in order to multiply them, cutting them in such a manner that these happy accidents may be reproduced according to taste.

**VENERING WITH MARBLE.**—*Veneering upon Wood.*—Veneering upon wood is preferable, in every respect, to that on stone. For this purpose, as marble, particularly the black, would break by heating it in the usual manner, place the slabs of marble in a caldron, tightly closed, in which let them boil. Then take them from the caldron, and after this preliminary operation, subject the marble to the heat of the fire to receive a mastic of tar. The wood having been prepared in a similar manner, press the marble, coated with the mastic, upon the wood, and a perfect cohesion is effected. The cases of ornamental clocks are hollow, for the movement of the pendulum and other works. This hollowing cannot be effected on stone without detriment to its solidity. When wood is used, a frame is made of it, upon the exterior parts of which marble is to be veneered. The mixture of glue with tar is found an improvement in effecting this veneering.

**VENERING ON METALS.**—As these possess a smooth surface, the substance which should fasten them to the marble cannot incorporate itself with them intimately enough to join both and render them inseparable. It is therefore necessary to interpose between the metal and the marble a third body, which should force them to perfectly adhere; this is effected by the use of sand-paper.

*Marble on Zinc.*—Take a plate of zinc of about  $\frac{1}{16}$  of an inch thick; make a frame of this of the form of whatever article may be wished; upon this form glue sand-paper, leaving the rough side outermost, and upon this rough side apply the marble, having first prepared it by heating in a water bath, and placing between the marble and the sand-paper a coating of mastic of tar. By this means, so perfect an adhesion between the marble and the zinc is

effected, that the marble could be easier broken than removed. The application of marble upon zinc can also be effected by grooving the metal in every direction with strokes of the file, but the sand-paper produces the best results. Zinc is preferred to other metals, because it possesses resistance and cheapness, and causes no other expense in the manufacture than that of cutting up to form the model. Tin does not possess the same resistance or cheapness; sheet iron is dearer; cast iron is too heavy; copper is expensive; by the application of marble upon zinc, articles can be manufactured at the same price as those veneered upon wood. In fastening marble to the metallic plating, the tar which is used in the application of marble to stone will not be sufficient. The parts must first be heated in a water bath, or over a furnace prepared for this purpose, and then, by a sieve, sprinkled with one of the following mordants;—Crushed glass, grains of emery of all sizes, copper filings, castings of any metal, finely-rasped lead, or any kind of powdered stone, such as sandstone, marble, granite, or pumice-stone, and india-rubber, can also be used. When the sheets of metal and of marble have received sufficient mordant, join with a coating of tar, which fastens them strongly together. Any web of linen or cotton can be placed between the marble and the metal; this web being covered with grainy substances, stuck on by glue.

*Marble Veneer on Boxes.*—The marble is first sawn to thickness and form required for the dressing case or box to which it is to be applied. The wood, usually white wood, oak or fir, is cut a little smaller than the marble which is to cover it. This wood is lined with a shaving of beechwood, to prevent warping. This lining is only placed on the side which is to receive the marble; each piece of marble is then applied to the corresponding piece of wood, and stuck on by glue or other mastic. When the marble has been applied, the opposite side of the wood is thinly lined with rosewood or mahogany, so that

this lining for the inside of the box, which is thus prepared for receiving the necessary divisions. The four parts are then dovetailed together, and the top and bottom parts fastened flatwise on the four sides with glue or mastic. The box being finished, the outside is pumiced and polished, and any applications of gilding can be made.

*Sculpture of Marble by Acids.*—Prepare a varnish by pulverizing Spanish sealing wax, and dissolving it in spirits of wine. Trace on the white marble, with a crayon, the design which is to be formed in relief, and cover this delicately with a brush dipped in the varnish; in about 2 hours the varnish will be dry. Prepare a dissolvent of equal parts of spirits of wine, hydrochloric acid, and distilled vinegar pour this solution upon the marble, and it will dissolve those parts which are not covered by the varnish. When the acid has ceased to ferment, and, consequently, will no longer dissolve the marble, pour on some fresh, which continue until the ground is sufficiently grooved. When there are delicate lines in the design which should not be grooved so deeply, they should at first be covered with varnish, to prevent the action of the acids upon them; then, when the reliefs have been made, the marble should be well washed, and the varnish removed from these delicate lines with the point of a pin; then pour on new acid, which will groove it as deeply as desired, care being taken to remove it at the proper time. When the acid has acted upon the marble, it corrodes beneath the varnish, and enlarges the lines in proportion to its depth; therefore draw the lines in relief a little larger than it is desired to leave them. When the work is completed, remove the varnish with spirits of wine, and, as the grounds will be very difficult to polish, they may be dotted with ordinary colours diluted with the varnish of gum lac. The marble being thus grooved, the cavities may be filled in inlaid work with gold, silver, tin, sealing wax, sulphur, crushed pearl shell reduced to powder. These designs can be made either in moulding or in relief,

without changing or injuring the marble; every sort of writing, however delicate it may be, can also be thus traced; and the execution is very rapid, whether in groovings inlaid with gold or silver, or in relief, which can also be gilded or silvered.

*Mastic for Repairs.*—Mastic for stopping up holes, leakages, or cracks in marbles, is made with gum lac, coloured, as nearly as possible, to imitate the marble upon which it is used. Sometimes the gum is mixed with marble dust passed through a silken sieve; in other cases little pieces are used, which are cut and adjusted in the hole to be repaired, and glued there with the gum mastic—the precaution being first taken to heat the marble and the pieces, and to take measures for producing a perfect cohesion.

*Cement Mastic.*—1. Thick mastic is composed of 2 parts wax, 3 of Burgundy pitch, and 8 of rosin; melt and throw into spring water to solidify the paste, then roll it into sticks, and, in using it, melt only so much as is immediately required, this will preserve its strength, as it becomes more brittle by repeated heating. 2. Corbel mastic is used in seams of the flagging of stairways and terraces. Six parts of the cement of good Burgundy tile without any other mixture, pass it through a silken sieve, add 1 part of pure white-lead, and as much litharge, steep the whole in 3 parts of luscid oil and 1 of lard oil, and preserve in cakes or rolls as the preceding. All the materials used should be thoroughly dry, so that they may perfectly mix with the oil which unites them. 3. Fountain mastic is made of the rubbish of stoneware or of Burgundy tile, amalgamated with thick mastic in such a manner as to form a paste proportioned to the use for which it is required; this is one of the easiest to prepare. 4. Mastic of filings is employed in places which are usually damp, or which constantly receive water, as curb stones, flaggings of kitchens, bath-rooms and water-closets, and stone troughs composed of several pieces, either separate or clasped. This mastic is composed of



26½ lbs. of iron filings, or of iron and copper, which must not be rusty, 4½ lbs. of salt, and 4 garlicks; this is infused for 24 hours into 3½ pints of good vinegar and urize; it is then poured off, and the thick paste which is found at the bottom of the vessel is the mastic, which should be immediately used. These mastics should be used upon materials which are perfectly dry, otherwise they do not incorporate well. Choose dry weather, and open the seams well with a curved, sharp instrument, finally polishing them with the chisel. Before laying the mastic, remove the dust from the seam by blowing into it with bellows; a long, straight, iron chafing dish, closed at the bottom, with the grate elevated about an inch to obtain a current of air, is then passed over the seam; this chafing dish is filled with burning charcoal, the heat of which draws out the moisture from the stone or marble. The slightest dust or dampness hinders the adherence of mastic.

*Cold Mastic.*—Hydrochlorate of ammonia, 2 parts; flour of sulphur, 1 part; iron filings, 16 parts. Reduce these substances to a powder, and preserve the mixture in closely-stopped vessels. When the cement is used, take 20 parts of very fine iron filings, add 1 part of the above powder, mix them together, adding sufficient water to form a manageable paste; this paste, which is used for cementing, solidifies in 15 days or 3 weeks, in such a manner as to become as hard as iron.

*Masons' Mastic.*—Pulverized baked bricks, quick-lime, wood ashes, equal parts. Mix thoroughly, and dilute with olive oil. This mastic hardens immediately in the air, and never cracks beneath the water.

*Stucco.*—Stucco is a composition of slacked lime, chalk, and pulverized white marble tempered in water, designed to imitate different marbles used in the interior of buildings or monuments. Calcined plaster of Paris is also used. Although the plaster becomes very hard when properly calcined, it is too porous to admit the polishing of it as of marble. To remedy this, the plaster is diluted

with glue or gum water, which, filling the pores, allows a polish to be given it. Some mix the glue with isinglass or gum arabic. Hot glue water is used for the solution of the plaster, as the want of solidity of the plaster demands that a certain thickness should be given to the works; to lessen expense, the body or core of the work is made of common plaster, which is covered with the composition just described, giving it about an inch in thickness. When the work is dry, it is polished in nearly the same manner as real marble. Pumice-stone may be used. The work is rubbed by the stone in one hand, the other holding a sponge filled with water, with which the spot which has just been rubbed is instantly cleansed, to remove what had been left on the surface of the work; the sponge should be frequently washed and kept filled with fresh water. It is then rubbed with a luen cushion, with water, and chalk, or tripoli stone. Willow charcoal, finely pulverized and sifted, is substituted for this to penetrate better to the bottom of the mouldings, water being always used with the sponge, which absorbs it. The work is finished by rubbing it with a piece of felt soaked with oil, and finely powdered with tripoli stone, and afterwards with the felt moistened with the oil alone. When a colour is wished in the ground, dilute it in the glue water, before making use of it to temper the plaster. When any particular marble is to be imitated, dilute with warm glue water, in different small pots, the colours which are found in the marble; with each of these colours temper a little plaster, then make of each a lump nearly as large as the hand, place these lumps alternately one above another, making those of the prevailing colour more numerous, or thicker. Turn these lumps upon the side, and cut them in slices in this direction, instantly spreading them upon the core of the work, or upon a flat surface. By this means the design of the various colours with which the marble is penetrated will be represented. In all these operations the glue water should be warm without which the plaster will

set too quickly, without giving time to work.

*Wax Varnish to Preserve Statues and Marble exposed to the Air.*—Melt 2 parts of wax in 8 parts of pure essence of turpentine. Apply hot, and spread thinly, so as not to destroy the lines of the figures. This varnish may be used upon statues which have been cleansed with water dashed with hydrochloric acid, but they must be perfectly dry when the application is made.

**COLOURING MARBLE IN Imitation of MOSAIC WORK.**—*Colours.*—Solution of nitrate of silver penetrates marble deeply, communicating to it a deep red colour. Solution of nitro-muriate of gold produces a very fine violet colour. Solution of verdigris penetrates marble the twelfth of an inch, giving a fine light green colour. Solutions of gum dragon and of gamboge also penetrate it; the first produces a fine red, and the second a yellow colour. To cause these two substances to penetrate deeply, the marble should first be well polished with pumice-stone, after which the substances should be dissolved in warm alcohol, and applied with a small brush. All the wood dyes made with alcohol penetrate marble deeply. Tincture of cochineal, prepared in this manner, with the addition of a little alum, gives a fine scarlet colour to the marble, penetrating it one-fifth of an inch. Artificial orpiment, dissolved in ammonia and laid on marble with a brush, quickly produces a yellow colour, which becomes more brilliant when exposed to the air. To all the substances employed add white wax; this, when placed on the marble in a melted state, soon penetrates it. If the verdigris is boiled in wax, and then laid melted upon the marble, it will be seen on its removal, when cold, that the design has penetrated the surface to the depth of from one-third to half an inch.

*Application.*—When several colours are to be successively used without blending them, proceed in the following manner. The dyes obtained by spirits of wine and the oil of turpentine should be laid on the marble when it is heated,

particularly in the execution of delicate designs, but the dragon's-blood and gamboge may be used cold. For this they must be dissolved in alcohol, and the gamboge used first; the solution of this gum is quite clear, but soon becomes troubled and gives a yellow precipitate, which is used to obtain a brighter colour. The lines drawn by this solution are then heated by passing a chating dish filled with lighted charcoal closely over the surface of the marble. It is then left to cool, after which the lines which have not been penetrated by the colour are heated in the same manner. When the yellow colouring has been applied, the solution of dragon's-blood, which should be concentrated as much as possible, is employed in the same manner as the gamboge; and while the marble is warm, the other vegetable tints which do not require so strong a degree of heat, may also be applied. The design is completed by the colours mixed with wax, which should be applied with the utmost care, as the slightest excess of heat will cause them to spread, for which reason they are less suited to delicate designs. In colouring marble, the pieces should be well polished, and free from any spots or veins. The harder the marble, the better it supports the heat necessary to the operation; alabaster and common soft white marble are not suitable for the purpose. Marble should never be heated to a red heat, as the fire then alters the texture, burns the colours, and destroys their beauty. Too slight a degree of heat is also bad; for though the marble takes the colour, it does not retain it well, and is not penetrated deeply enough. There are some colours which it will take when cold, but these never fix so well as when heat is employed. The proper heat is that which, without reddening the marble, is intense enough to cause the liquor which is on its surface to boil. The menstrua which are used to incorporate the colours, should be varied according to the nature of the colour employed; a mixture made with urine mixed with 4 parts of quick-lime and 1 of potash, is excellent for certain

colours, common ley of wood ashes is good for others; for some, spirits of wine, others require oily liquors, or common white wine. The colours which succeed best with the different menstruums are the following; blue-stone dissolved in six times its quantity of spirits of wine, or urine and litmus dissolved in a ley of pearlsh; the extract of saffron and sap green succeed very well when dissolved in urine or quicklime, and tolerably in the spirits of wine. Vermilion and cochineal dissolve well in the same liquids. For dragon's-blood use spirits of wine, which is also used for Campeachy wood. For alkanet-root the only menstruum is turpentine. Dragon's-blood in tears gives a beautiful colour when mixed with urine alone. Besides these mixtures, certain colours can be put on dry and unmixed; such as the purest dragon's-blood for the red, gamboge for the yellow, green wax for a kind of green, common sulphur, pitch, and turpentine, for a brown colour. For all these the marble must be considerably heated, and the dry colours then rubbed upon the block. A beautiful golden colour is produced by equal quantities of the crude salts of ammonia, of vitriol, and of verdigris, the white vitriol is the best for this purpose; grind these together, and reduce them all to a very fine powder. All the shades of red and yellow may be given to the marble with the solutions of dragon's-blood and gamboge, by reducing these gums to powder and grinding them with spirits of wine in a glass mortar. When only a little is required, mix one of these powders with spirits of wine in a silver spoon, and hold it over a heated brazier; this extracts a fine colour, and, by dipping a small brush in it, the finest veins may be made upon the cold marble. By adding a little pitch to the colouring, a black shade, or all the varieties of dark red, can be given. Archil diluted in water and applied when cold to the marble gives it a beautiful blue colour; by putting on the colouring in proportion as it dries, it becomes very fine in less than 24 hours, and penetrates deeply. If the paste of archil is used, which is a pre-

paration of the plant with a lime and fermented urine, the colour obtained will be more of a violet than blue; to obtain a perfect blue it must be diluted in lemon juice; this acid will not injure the marble, as it has been weakened by its action upon the archil. Large blue veins may thus be formed upon white marble; but as this colour is apt to spread, it will not be exact unless the coloured parts are instantly touched with dragon's-blood, wax, or gamboge, which checks it.

**CLEANSING MARBLE.**—Scraping marble which has been blackened or turned green by air and damp is dangerous to the design; whatever precautions may be taken, the work is always scratched more or less, and it is impossible to clean the carved parts without breaking the sculpture, or causing incongruities between the designs in relief and those which are sculptured. Soiled articles, which have not been tarnished by exposure to the open air, may be cleaned by potash water, then wash them in pure water, finish with water containing a dash of hydrochloric acid. Soap and water is often sufficient, spread on with a brush, and introduced into the sculptured parts by a somewhat stiff pencil.

*To Remove Stains from Marble.*—

1. Take two parts of soda, one of pumice-stone, and one of finely-powdered chalk. Sift these through a fine sieve, and mix them into a paste with water. Rub this well all over the marble, and the stains will be removed; then wash it with soap and water, and a beautiful bright polish will be produced. 2. Clean with diluted muriatic acid, or warm soap and vinegar; afterwards heat a gallon of water, in which dissolve  $1\frac{1}{2}$  lb. of potash; add 1 lb. of virgin wax, boiling the whole for half an hour, then allow it to cool, when the wax will float on the surface. Put the wax into a mortar and triturate it with a marble pestle, adding soft water to it until it forms a soft paste, which, laid on marble, and rubbed, when dry, with a woollen rag, gives a good polish.

*Restoring the Colour of Marble.*—Mix

up a quantity of the strongest soap lees with quick-lime to the consistence of milk, and lay it on for 24 hours; clean it afterwards with soap and water.

**REPAIRING MARBLE.**—Heat the edges of the marble before a strong, clear, charcoal fire, avoiding dust or smoke, until the marble is sufficiently hot to take small pieces of shellac. Then choose a sufficient number of thin pieces, of such a size as not to project above the surface of the marble, and apply them along the edge of each piece to be joined; but in such a manner, that the bits of lac on each piece of marble will come between those on the other. Then just before applying them together, a hot iron must be passed along each piece at a sufficient distance to fuse the lac, but not to make it run. The pieces of marble must be well forced together.

**MARBLE CEMENT.**—Plaster of Paris, soak in a saturated solution of alum, bake the two in an oven, after which grind to powder. Mix with water.

**POLISHING MARBLE.**—If the piece to be polished is a plane surface, it is first rubbed by means of another piece of marble, or hard stone, with the intervention of two sorts of sand and water; first with the finest river or drift sand, and then with common house or white sand, which latter leaves the surface sufficiently smooth for its subjection to the process of gritting. Three sorts of grit stone are employed; first, Newcastle grit; second, a fine grit brought from the neighbourhood of Leeds; and lastly, a still finer, called snake grit, procured at Ayr, in Scotland. These are rubbed successively on the surface with water alone; by these means the surface is gradually reduced to that closeness of texture, fitting it for the process of glazing, which is performed by means of a wooden block having a thick piece of woollen stuff wound tightly round it; the interstices of the fibres of this are filled with prepared putty powder, or peroxide of tin, and moistened with water; this being laid on the marble and loaded, it is drawn up and down the marble by means of a handle, being occasionally wetted, until

the desired gloss is produced. The polishing of mouldings is done with the same materials, but with rubbers varied in shape according to that of the moulding. The block is not used in this case; in its stead a piece of linen cloth, folded to make a handful, this also contains the putty and water. Sand rubbers employed to polish a slab of large dimensions should never exceed  $\frac{2}{3}$  of its length, nor  $\frac{1}{4}$  of its width; but if the piece of marble is small, it may be sanded itself on a larger piece of stone. The grit rubbers are never larger than that they may be easily held in one hand; the largest block is about 14 in. in length and  $4\frac{1}{2}$  in. in breadth.

**Enamelling Slates.**—The slate having been reduced to a perfectly level surface, a coating of colour is applied according to the stone it is intended to imitate. For black, tar varnish is used with good effect. The slab is then thoroughly baked in an oven heated from  $130^{\circ}$  to  $250^{\circ}$ , from 12 to 48 hours, according to size. The colours, say grey and white, are then floated on to the surface of a cistern of water over which they float naturally into the shapes of the streaks of colour seen in marble. The slate, with its black ground now burnt in, is dipped into the surface of the water, and receives from it a thin coat of colour. The slate again has to go into the oven, and when sufficiently hardened, a coating of enamel is applied. Another baking to harden the enamel, and the slab is then pumiced to reduce it to a level surface. Baked again, it is once more pumiced, and this time goes into the oven with the pumice wet on its surface. If necessary this last operation is repeated. The slab is then ready for polishing, which is effected firstly by woollen cloths and fine sand, next by the finest and softest French merino, and lastly, by the hand and powdered rotten-stone. The dipping process is not applicable to imitations of all stones. Some granites are best imitated by splashing; others by splashing and sponging combined, while some have to be hand-grained.

**Bookbinding.**—*Tools.*—To bind a book well, certain tools are indispensable; but very few will go a good way; and a book may be put together very decently with the aid of no other tools than a shoemaker's hammer and a glue-pot, with the addition of such implements as are usually to be met with in every household. The necessary tools for small work are: a sewing press; a cutting press, the small music-paper size; half-a-dozen pressing boards, as large as the press will admit, and as many of octavo size; as many cutting and backing boards, a bookbinder's hammer, folder, knife, small shears, saw, paste-bowl, a quire or two of demy or royal printing paper, a quire or two of marbled paper, and some leather and coloured cloths for covers. It is desirable that the book should be as thin as possible, and not have a swollen appearance when finished, the sheets ought first to be compressed. The binder does this by beating the volume in sections with a 14-lb. hammer, or passing in between the rollers of a rolling machine. Instead of that we may divide the volume in half-a-dozen sections, and placing one of the pressing boards between each, screw them all together in the press as tight as possible, and leave them there for a night. After being pressed, the sections are taken from the boards; the book is then held between the extended fingers of each hand, and the back and head knocked up square and even; one side of the book is then laid upon a pressing board, beyond which the back must project half an inch or so; a second pressing board of the same size is placed on the upper side, parallel with the first, and the boards being firmly grasped with the left hand, the book is lowered into the cutting press, which is screwed up tight, and three cuts, not quite  $\frac{1}{4}$  of an inch in depth, are made with a saw in the back—one in the middle, and one at about  $2\frac{1}{2}$  in. distant on each side of it; two additional cuts are then made outside of the three, and distant about  $1\frac{1}{2}$  in. from them. These measurements would, of course, be different for a volume of different size, but the proportions will do for any volume.

*Sewing.*—The book is now taken to the sewing press, where the binder suspends three cords from the top rail, which are fastened underneath by means of brass keys, the cords may be shifted to any position, and being made to correspond with the three central cuts in the back of the book, they are tightened and kept in their place by means of the nuts and screws on the side pillars. The sewing is performed in the following manner;—First, a fly-leaf or end paper is laid on the press, and sewed to the cords by passing the needle into the first right-hand cut, or catch-stitch mark, with the right hand; the left hand, which is inserted in the middle of the section, receiving the needle and returning it outwards on the head side of the cord, where it is taken by the right hand, and passed through again on the other side of the cord; thus with all three of the cords, until the needle is brought out at the last left-hand cord or catch-stitch groove, care being taken that the needle never penetrates the cord or twine. The thread is now drawn to the left gently, until only 2 inches or so are left undrawn, at the point where the needle first entered. The first sheet is then laid on, the title-page downwards, and sewn on in the same way, as the needle returns towards the head of the book; when the needle comes out at the catch-stitch mark over the end of the thread left undrawn, the sewing thread is tied to that end in a firm knot. Thus all the sheets are sewn in succession, care being taken, on arriving at the catch-stitch, to fasten each sheet to its predecessor by passing the needle round the connecting thread. After he has sewed 4 or 5 sheets, the binder will find his thread exhausted, when he must join on a new length with such a knot as will not be likely to come undone. Several volumes may be sewn on one set of cords, but some attention is necessary that they be not sewn together, and that the cords be long enough for the subsequent purposes.

*Cutting.*—After sewing, the book is cut from the press, with about 2 inches of the cords protruding on each side.

The back should now receive a coat of glue, and when that is dry, the ends of the cords are untwisted and scraped with a blunt knife till the fibres of the tow are well separated. Now is the time to insert ornamental end-papers, if any are desired; these may be either of marbled or coloured papers; the sheet is folded with the plain side outwards, one-half of it being pasted; it is then laid between the fly-leaves, with the fold of which it is closely worked; the other half is then pasted, and the outside fly-leaf rubbed down upon it. The back of the book has to be rounded, which is done by laying the volume with the fore-edge towards the operator, who, pressing the fingers of his left hand upon it, gently taps the back up and down with a hammer, changing the sides alternately until the back is beaten into a shape somewhat circular. The book is then placed between two backing boards, the thick edges of which are ranged parallel with each other, within about  $\frac{1}{2}$  of an inch of the back. The boards and book, being tightly grasped with the left hand, are lowered into the cutting press, until the boards are flush with the cheek of the press, which is then screwed as tightly as possible. The back is hammered gently and uniformly up and down each side, and a little in the middle, which causes it to spread over the boards so as to form the required projection. The book, thus backed, is ready for the covers, which are of millboard, and, being cut to the required size, either with shears or in the cutting press, are pierced with holes pricked with a bodkin, two at each cord, one about  $\frac{1}{2}$  inch from the edge, and the second as much beyond it. The frayed cords are then sodden with paste, drawn through the outer side of the board or cover, and passed through the other hole to the outer side again. The book is then held in the left hand, while, with the right, the pasted cords are hammered on a smooth piece of iron, a flat iron screwed into the press will do, into the substance of the millboard covers. It should now be left to dry. The next step is that of cutting the

edges, which is rather a difficult process. Hold the book in the left hand, with the fore-edge upwards, and allow the covers to hang down on each side, thrust a paper knife or a flat piece of metal between them and the back of the book. Then placing a cutting board on each side, and opening the covers horizontally, beat the back of the book against the press until it is perfectly flattened. A wedge-shaped cutting board is then placed on the left-hand side of the book, so as to stand with its thick edge considerably higher than the course the knife will take; another board is then placed on the right side, exactly on the line which the knife is to follow, and which line must be previously marked with the point of a pair of compasses, and so measured that the edge when ploughed may fall about the sixth of an inch within the projection of the covers. When the boards are thus placed, the paper knife or flat piece of metal is withdrawn, the covers allowed to hang down, and the volume is thus carefully lowered into the cutting press, until the right-hand board is flush with the cheek, when the press must be screwed tight. The cutting press stands on a hollow frame some 3 feet in depth, which allows of large books being partially lowered into it, and also receives the paper shavings as they are ploughed off. It consists of two wooden cheeks connected by two sliding bars, and two wooden screws. Upon one of the cheeks are two guides, or small raised rails, for the plough to work in. The cutting instrument consists of two sides, connected by a screw with a handle, and by two slide bars. A knife is fastened to the under side of cheek by a strong bolt, which perforates the cheek perpendicularly, and also the circumference of the lateral screw, and is kept tightly in its place by screwing down its nut. The knife is worked by grasping both ends of the lateral screw, moving the plough backwards and forwards, and gradually turning the screw with the right hand, until the whole of the fore-edge is cut through. The book is now taken out of the press, the covers folded in their

place, and the back rounded as before, when the front edge, if the cutting is well done, will be elegantly concave, corresponding with the convexity of the back. The boards, being kept in the ledge or projection produced by backing, are now pulled down about an eighth of an inch from their central position, and the head is ploughed by the knife in the same way as the fore-edge. Before ploughing the opposite end, the boards are pulled below the head as much again as it is intended they shall project; and this end also being ploughed, it will be seen that the projection of the covers is equal on the three sides, or, better still, that it is a little in excess on the fore-edge.

*Ornamenting.*—After cutting the edges of a book, the next process is to ornament them. This may be done in a simple way by sprinkling them with a brush dipped in a thin solution of umber, or any other colour, ground fine and mixed with size. A more elaborate method is that of marbling the edges, for which purpose a trough must be provided of convenient size and depth, which is filled with pure gum water. Coloured pigments, spirit-ground and mixed with a little ox-gall, are then dripped on the surface of the fluid from a bunch of quills dipped in them—such colours being used as will float and not sink to the bottom. These are then combed with a coarse comb into a neat pattern, and the book being tied between two boards, the edges are applied to the floating colours, which are thus transferred to them. A dash of cold water over them fixes the colours and heightens their brilliancy.

*Head-banding.*—There are two kinds, stuck on and worked. Head-bands stuck on are formed by cutting a piece of striped linen about an inch deep and as wide as the thickness of the book, folding it over a piece of twine, and gluing it to the back so that the enclosed twine shall in a manner lap over the cut edge, the same being repeated at the opposite end. In well-bound books, however, the head-bands are worked on in the following way;—A strip of string,

prepared by rolling it tight in pasted paper, is chosen of a size suited to that of the book; stout silk thread of one or two colours is then taken; if two colours are used, they are doubled and tied together by the ends, one of them being previously threaded in a needle. The book is placed in the cutting press with the back uppermost, the head being elevated towards the workman; the needle is passed through the middle of the second section, on the left-hand side, just below the catch-stitch, and drawn out far enough to bring the knot joining the two silks close into the middle of the section; the needle is then brought up, and passed again through the same place, and the silk drawn nearly close; the round strip is placed in the loop thus formed, and the silk drawn tight with the left hand; the other silk is brought over with the right, and passed under and over the head-band, and held tight with the left hand; the other silk is now put over that, and also under and over the head-band; they are thus worked alternately over each other for about ten sheets or sections; the needle is then passed below the catch-stitch to keep the head-band in its place, and brought over it again, and the work is proceeded with as before; this weaving and frequent fastening to the catch-stitch goes on as far as the last sheet but one, when the needle is passed through the section and over the head-band twice, and fastened to the back. The ends of the head-band are then cut off, almost close to the silk at each end. The braiding produced by working one silk over the other should rest evenly on the leaves of the book. Both ends of the book being worked in this way, the glue-brush is drawn across the back of the bands, which retains them in their proper places. After head-banding the book should receive a hollow back, which is formed by cutting a slip of cartridge-paper twice the width of the back and the same length; fold the paper in half, glue the back, and stick on one of the folded sides, leaving the other doubled upon it.

*Casuy.*—The volume is now ready

for covering with leather, cloth, or leather and paper. For whole-bound volumes the leather is cut nearly an inch larger all round than the open book, and the edges are pared thin with a sharp knife. The inner side of the leather is now well soaked with strong paste, and a small slice being cut from the corners of the covers where they touch the back, the volume is laid on the pasted leather, care being taken that the covers are in the right position, and the two sides are first covered smoothly but not too tightly. The folding over of the pasted leather inside the covers and outside the back, so as to give a handsome appearance to the ends of the volume, is a matter of some difficulty, which, however, a little practice will overcome. It should be done so that the leather in a manner embraces the head-band, which lies half-concealed within it, and yet does not project beyond the proper projection of the covers. After the ends are finished, which operation will be materially assisted by a paper knife having one pointed end, the corners must be attended to; the superfluous leather meeting at the angle must be cut off, the head and foot must be first smoothed down, and then the fore-edge portion folded over them. This requires to be done carefully to look well, and before doing it the binder must see that the covers are lifted over the projecting ledges of the back into the position they ought to occupy. While the leather is soft and moist with the paste, anything may be done with it, and by the help of the folder it may be moulded so as to form a good-looking head. The leather should be pressed in at the corners where the small pieces were taken off the boards, and the folder passed once or twice up and down the hinges of the cover to ensure their opening easily. Lastly, a piece of thread may be tied round the indented corners of the back from end to end, and the whole left to dry. For half-bound books, which are more easily managed, the back and covers are put on separately, the leather being pared in the same way, and small waste bits being

used for the corners. When a volume has dried after covering, the ends must be pasted down, and it should remain a little time in the press.

*The Finishing Process.*—For this purpose provide a book or two of gold leaf, a plain single bookbinder's fillet, a few alphabets of capital letters, a gold-cushion, which can be made by stretching a piece of calf leather rough side upwards over a pad of wadding on a board 10 inches by 8, and some other small items, the use of which will presently appear. First wash the cover with clear paste water, water in which a little paste is dissolved. Such parts as are to be gilded must then be coated twice with glaire or albumen, which is the white of eggs first whipped into froth, and then suffered to subside into a clear liquid. Do not glaire the leather all over, but apply it with a camel-hair pencil and ruler only on the parts where the fillet of gold is to appear. To gild, spread a leaf of gold on the cushion with a knife and blow it flat, then cut it into strips about the sixth of an inch wide. Heat the fillet at the fire until it is just hot enough to fizz under the wet finger; if it sputters it is too hot, and will burn the leather; touch its edge with a rag slightly moistened with sweet oil, and with the same rag rub over the part of the book to be gilt. Roll the fillet softly on the strips of gold, which will adhere to it; when enough is taken up, roll it with a heavier pressure along the glaired lines, and the gold will be indelibly transferred to the leather, what is superfluous being easily wiped away with a soft rag. When the sides of the book are being filleted it may lie on clean paper on the cheeks of the press, or on a pressing board; but when the back is being done it must be screwed in the press in a horizontal position, the back projecting an inch or two.

*Substitute for Brass Lettering.*—Place an open vessel half-full of water on the fire, and let it boil, and set a small empty tin pot floating within it, loading the pot with some weight that it may sink low in the water. Obtain some ordinary printing types and arrange



them in the required order as a compositor would, in one of those brass frames with wooden handles used for marking linen, and screw them tight in their place, taking care to have them all level with each other on the face. Lay the face of the types in the tin pot, in which some simple contrivance should be placed to prevent their being damaged, and let them get as hot as they will, as in this situation they cannot get too hot. Cut a piece of real morocco leather larger than the size of the label wanted, breathe on it, and give it one coat of glaire; when the glaire is dry rub it slightly over with the oil-rag, and lay on the centre enough leaf gold to receive the impression of the types; place the label on a rather hard pad, and stamp the types on the gold with a sharp even pressure. On wiping off the gold with the rag the impression of the type remains clear and full, and if well done is far more close and distinct than anything which can be done by the most expert finisher with the brass letters of the bookbinder. The label is now cut to the proper size, and pasted evenly in its place on the back of the volume; to look well it should be pared round the edges with a sharp knife until the extreme edge is as thin as paper. After it is dry, a gold fillet may be passed over the juncture of morocco with the calf or other leather by way of finish. The above is the easiest mode of lettering for the amateur, but it is practicable only on real morocco, the heat which can be imparted to printers' metal by hot water not being sufficient to burn the gold into ordinary leather; it is, however, a permanent method.

*To Polish the Edges of the Leaves.*—Screw the book tight in the press between pressing boards, and rub them briskly with an agate or a dog's tooth. It is important that the press should be tightly screwed, otherwise the leaves will cling together when the operation is over.

*TO BIND A BOOK WITHOUT TOOLS.*—All that need be provided is a little melted glue, some paste, a needle and stout thread, some white and some co-

loured papers, and a few other trifling items. Arrange the sheets to be bound in their proper order, and beat them even at the back and head, subject them to a heavy pressure between two flat surfaces, by piling weights upon them. If there is a press handy, press them in that, so as to make them lie as close as possible. Now take two pieces of tape  $\frac{1}{2}$  an inch wide, and each 2 inches longer than the width of the back of the book. Stiffen the tape by drawing it through paste, and let it dry, with as little of the paste adhering to it as possible, before using. Fold the pieces of stiff tape, and place the sheets within them in such a position that the two tapes will divide the length of the back into three equal parts, or thereabouts. With a lead pencil, while the sheets are pressed down firmly with the left hand, draw a line down each side of the tapes, and two other lines, each one dividing that part of the back outside the tapes into equal portions. These lines mark the place for the entrance of the needle. The sheets of the book are to be sewn on to the tapes in the same way as directed where the book is sewn on to the cords; but with tapes it is not quite so easy, as during the sewing of the first two or three sheets there is some difficulty in keeping the tapes in their places; and as there are no cuts or grooves made with the saw, some force is required to get the needle through the paper. When the book is sewn, the threads fastening each sheet are seen outside the tapes. The back must now receive a coating of glue, not too thin, after which it may be left to dry. The glue being hard and set, the book may be cut on the edges, with a straight-edge and a sharp knife. With a thin volume this is easy enough, but with anything approaching an inch in thickness it will be better to clip any projecting leaves with the shears, and to be content with uncut edges, if a cutting press is not available. The back must next be rounded with the hammer, which may be helped by pulling gently at the tapes while tapping with the tool. For the covers use the thinnest

millboard, or stout pasteboard not thicker than a shilling. Cut two pieces of this of the proper size, so that they shall project about the eighth of an inch over the head, foot, and fore-edge of the book, and glue them in their proper position on the projecting tapes, which will adhere to their inner sides. Over the tapes glue strips of coarse canvas an inch wide by six in length, and now glue on the open back in the manner previously directed. When this glue is dry, the volume may be covered with paper, cloth, leather, or vellum. If vellum is used, that must be lined first with clean white paper firmly pasted on it. A cheap covering is dark roan leather; a still cheaper is coloured canvas; but preferable to that are the leather papers sold by stationers. The mode of pasting on the covers has been already described; but if cloth coverings are used, glue and not paste will be necessary to make them adhere.

2. Instead of gluing the tapes to the boards, cut a cloth cover large enough to allow for overlapping, and, allowing for the width of the back, glue the covers on the cloth parallel with each other, and turn in the cloth round the edges. When this is dry, the book may be placed in the cloth cover, the tapes glued to the inner sides, the open back to the back of cloth, the strengthening canvas also being glued over the tapes; and finally, the end-papers being pasted down, the volume is finished. It will look but a homely affair; but it will cost little beyond the trouble, and will effectually preserve the volume. For many volumes published in numbers, the publishers supply covers at the end of the year: these may be securely fastened on by this simple method.

#### MARBLING PAPER AND BOOK EDGES.

—*Wooden Trough*.—This is made of inch deal, about 1½ in. in depth and ½ in. in length and breadth larger than the sheets of paper that are to be marbled. This proportion between the size of the trough and paper should always be observed, to prevent waste of colour; of course, troughs of various sizes will be required, where paper of various

sizes is to be marbled. The trough must be water-tight, and the edges of the sides of it must be sloped or bevelled off on the outside, to prevent any drops of colour which may fall on them from running into the trough and sullying its contents.

*A Skimmer*, or clearing stick, must be provided for each trough; this is a piece of wood, 2½ in. wide, ½ in. thick, and as long as the trough it belongs to is wide inside; the use of this will be explained hereafter.

*A Stone and Muller* of marble, or some other hard stone, the size according to the quantity of colour required to be ground. Also a flexible knife, for gathering the colour together.

A dozen or two of small glazed pipkins to hold colours in. The pots being furnished with

*Brushes* made as follows:—Take a round stick about as thick as your finger, and cut a notch all round one end of it; next, take some bristles, 4 or 5 in. long, and place them evenly round the stick, at the notched end, letting them project 1½ in. beyond the wood; fasten the bristles to the stick by several turns of stout thread; cut away the ragged bristles, and tie up the brush firmly with fine cord. The use of the notch round the end of the handle is to make the bristles spread out when firmly tied up, so that when used the colour may be scattered about more abundantly.

*Rods* for drying the paper on when marbled; they should be round, at least on the upper side, and about 1½ in. in breadth and thickness. Twelve rods 11 ft. long will hang 3½ quires of deiny, or 4½ quires of foolscap.

*Colours*.—Red—vermilion, drop-lake, rose-pink, Venetian red, red ochre. Blue—indigo blue, Prussian blue, verditer. Orange—orange lead, orange orpiment. Black—ivory, blue black. Yellow—Dutch pink, yellow ochre, king's yellow, English pink. The finer the colours are ground, the better and the cheaper will the work be. First, the colours should be finely pounded, then mixed with water to the consistence of paste, and

put in a colour pot with the knife. From the pot, the colour must be taken out a little at a time, and levigated very fine with pure water.

*Compound Colours* are made by mixing the colours above mentioned in certain proportions. To make a red colour, mix 3 parts of rose-pink with 1 of vermilion. A finer red—4 parts of rose-pink, 2 parts of vermilion, and 1 part of drop-lake; for very fine work use drop-lake alone, but use it very sparingly, for it is a dear article. Yellow—2 parts of Dutch pink, and 1 part each of king's yellow and English pink. Green—made by mixing blue and yellow. Dark blue—indigo, which may be made lighter by the addition of verditer. Orange brown—2 parts of Venetian red, and 1 part of orange lead. A fine orange—put some fine yellow ochre in a ladle over a fire, and keep it there till it assumes a dark-red colour. Take of this red ochre, finely pounded, and of Venetian red, equal quantities, and add a little orange orpiment or rose-pink; mix all well together. Umber colour—equal quantities of Venetian red, orange lead, and ivory black; this can be lightened with orange lead, or darkened with ivory black. Cinnamon colour—Venetian red with a little Prussian blue. All other colours which may be wanted can be made by mixing together those already described. In addition to the articles already mentioned, obtain a bottle of ox-gall, a bottle of good oil of turpentine, some pure water. The trough must be filled to within  $\frac{1}{2}$  of an inch of the top, with a solution of gum tragacanth, which is to be prepared as follows:—Gum of a pale white semi-transparent appearance is to be soaked in water for at least 48 hours, in the proportion of  $\frac{1}{2}$  lb. to 1 $\frac{1}{2}$  gallon. Pass the solution of gum through a hair sieve or linen cloth, and pour it into the trough. In all cases, when the trough is to be used, the solution should be well stirred up with a few quills, and the surface of it cleared from film by the skimmer above described.

*Colours intended to represent Veins* are made by adding a small quantity

of gall to the various colours, and stirring each well up with a brush, in order that they may be properly mixed. Previous to use, these mixtures of colour and gall are to be thinned with water to the consistence of cream, and are to be well stirred up.

*Colours for producing Spots like Lace-work.*—Take some dark blue, or other colour, add some gall to it, and about as much, or a little less, oil of turpentine; stir all well together, and dilute with water. To try the colours, throw on the solution, by shaking the various colour brushes over it, some spots of colour. If the spots spread out larger than a crown-piece in size, the colours have too much gall; if the spots, after spreading out a little, contract again, there is too little gall in them. In the one case more colour must be added, in the other more gall. If the colours are in good order, and paper is to be marbled, the whole surface of the solution in the trough must be covered by colours, in spots, streaks, or whirls, according to the pattern required, and laid on according to directions which will be given presently. The paper should be previously prepared for receiving the colours, by dipping it overnight in water, and laying the sheets on each other with a weight over them. The sheet of paper must be held by two corners, and laid in the most gentle and even manner on the solution covered with the colours, and there softly pressed with the hand that it may bear everywhere on the solution, taking care not to let the colours flow on to the back of the paper any more than can be avoided; after which it must be raised and taken off with the same care, and then hung to dry over the rods.

*Patterns.*—1. Throw on red till the solution is nearly covered, then some yellow, black, and green; add, if desired, a little purple with plenty of gall and water in it; twist the colours into any shape by means of a quill. 2. Throw on red, yellow, black, and green, as before; but, for a last colour add some of the dark blue mixed with turpentine. 3. Throw on red, yellow

black, and green, in the desired proportion; then with a quill draw lines through the colours; after which throw on a greater or less quantity of blue, green, pink, or purple, much diluted, and containing plenty of gall and turpentine. 4. Throw on very fine red for veins; then plenty of the turpentine blue. If the colours are good this produces a handsome pattern in a short time. 5. Throw on some dark blue mixed with turpentine, and take this up with a paper previously stained of a yellow, light blue, red, pink, or green colour. To obtain a good green for this purpose, boil French berries in water, add a little spirit or liquid blue, and carefully brush over the paper, which must be good and well sized, with this mixture. When the colours become too thick for use, add fresh ground colour with water and a little gall to them, and stir them up well. Be particular in getting good turpentine. When the solution of gum gets dirtied, throw it away and make a fresh one. The neatest and most convenient method of marbling the edges of books, is to dip one volume at a time, doing the ends first, and throwing back the boards to do the fore-edge; observing to hold the book tight with both hands, and not to dip deeper than the surface, to prevent the solution from spoiling the book. It is the safest way to tie the book between boards before dipping; and, for the sake of convenience and economy, when only a few books are to be marbled, a small trough should be used. Marbled paper is glazed by a machine similar to that with which cottons are glazed. But a machine of this kind would only be required by those who marble very largely. Book edges are polished by the agate burnisher, and so might small pieces of paper be polished, which were required for any particular purpose. Good common pressing, or hot-pressing, might serve as well as glazing. For any fancy work it would have a fine effect to varnish the marble paper after it had been put to its destined purpose and had become dry. Paste and all moisture chase all the glaze away. The

application of a coat of varnish subsequent to the application of the marble would double the beauty of the best marble paper, and much improve the common kind, at a trifling expense.

*Sprinkling the Edges of Books.*—Take an old toothbrush and dip it into a coloured ink; shake off the superfluous ink, that the sparks formed may not be too large, and draw an old comb through it in such a manner as to make the ink fly off in sparks over the edges of the book. The following are a few coloured inks;—Red;  $\frac{1}{2}$  lb. of the best logwood is boiled with 1 oz. of pounded alum, and the same quantity of cream of tartar, with half the quantity of water, and, while the preparation is still warm, 1 oz. sugar and 1 oz. gum arabic are dissolved in it. Blue; solution of indigo with pieces of alumina, and mixed with gum, forms a blue ink. Green; this is obtained from verdigris, distilled with vinegar, and mixed with a little gum. Yellow; saffron, alum, and gum water, form a yellow.

*Polishing Metals.*—The polishing of metals differs according to their kind, but there are some general principles common to all, of which it may be useful to have a clear idea. All polishing is begun in the first instance by rubbing down the surface by some hard substance that will produce a number of scratches in all directions, the level of which is nearly the same, and which obliterate the marks of the file, scraper, or turning tool that has been first employed. For this purpose coarse emery is used, or pumice and water, or sand and water, applied upon a piece of soft wood, or of felt, skin, or similar material. When the first coarse marks have been thus removed, next proceed to remove the marks left by the pumice-stone by finely-powdered pumice-stone ground up with olive oil, or by finer emery and oil. In some cases certain polishing stones are employed, as a kind of hard slate used with water. To proceed with the polishing, still finer powders are used, such as tripoli and rottenstone. Putty of tin and crocus martis are also used for high degrees of polish.

But the whole process consists merely in removing coarse scratches by substituting those which are finer and finer, until they are no longer visible to the naked eye; and even long after that, if the surface is examined by a microscope, it will be seen that what appeared without any scratches is covered all over with an infinity of them, but so minute that they require a high magnifier to be discovered. It is evident that great care must be taken to have the last polishing material uniformly fine, for a single grain or two of any coarse substance mixed with it will produce some visible scratches instead of a perfectly polished surface.

**Polishing Bar Iron and Steel.**—Take an ordinary bar of malleable iron in its usual merchantable state, remove the oxide from its surface by the application of diluted sulphuric acid, after which wash the bar in an alkaline solution, then cover the entire bar with oil or petroleum. The bar is then ready for the chief process. A muffle furnace is so prepared that a uniform, or nearly uniform, heat can be maintained within it, and in this furnace the bar is placed. Care must be taken that too great a heat is not imparted to it, for on this depends the success of the operation. When the bar approaches a red heat, and when the redness is just perceptible, it is a certain indication that the proper degree of heat has been attained. The bar is then at once to be removed, and passed through the finishing rolls five or six times, when it will be found to have a dark polished uniform surface, and the appearance of Russian sheet iron.

**Friction Polish.**—A good polish for iron or steel rotating in the lathe, is made of fine emery and oil; which is applied by lead or wood grinders, screwed together. Three very good oils for lubrication are olive oil, sperm, and neat's foot.

**Polishing Steel.**—1. Use bell-metal polishers for arbors, having first brought up the surface with oilstone dust and oil and soft steel polishers; for flat pieces use a piece of glass for the oil-

stone dust, and a bell-metal block for the sharp red stuff, and a white metal block for the fine red stuff. The polishing stuff must be well mixed up and kept very clean; the polishers and blocks must be filed to clean off the old stuff, and then rubbed over with soft bread; put only a little red stuff on the block and keep working it until it is quite dry, the piece will then leave the block quite clean; use bread to clean off the surplus red stuff before using the brush. If the piece is scratched, put on some more red stuff, which must not be too wet, and try again. 2. The polish on flat steel pieces in fine watchwork is produced with oilstone dust, burnt Turkey stone, and a steel polisher, soft steel, bell-metal, and sharp stuff, grain tin and glossing stuff. The metals are squared with a file, and vary in shape according to the work in hand. 3. Get an 18-gallon barrel and put an iron spindle through the two ends; mount it on trestles in the same way as a butter churn, with a winch to turn it by; cut out a hole in the side by which to introduce the articles to be polished; have a tight-fitting cover to the hole; procure some worn-out casting pots or crucibles, such as used by casters, and pound them in an iron mortar, until fine enough to pass through a sieve which will not allow the steel articles to pass through. Put equal quantities of this grit and of the articles in the barrel; fasten on the cover, and turn the barrel for about an hour, at the rate of about 50 turns a minute; take all out of the barrel and sift out the grit. If a finer polish than this is required, put them through another turning, substituting for the grit small scraps of leather, called mosings, which can be procured from the currier's, and emery flour. Do not more than half fill the barrel.

**Brass Polishing.**—1. Brass may be polished without a burnisher, by using an exceedingly fine cut file, and fine emery cloth. 2. Small articles to be polished should be shaken by themselves for a short time; then some greasy parings of leather should be put in the band with them. After they

have been shaker smooth, the greasy leather parings should be removed and clean ones put in, and the shaking continued until the articles are sufficiently bright. 3. When the brass is made smooth by turning or filing with a very fine file, it may be rubbed with a smooth fine-grained stone, or with charcoal and water. When it is made quite smooth and free from scratches it may be polished with rotten-stone and oil, alcohol, or spirits of turpentine.

*To Polish German Silver.*—Take 1 lb. peroxide of iron, pure, and put half of it into a wash-basin, pouring on water, and keeping it stirred until the basin is nearly full. While the water and crocus is in slow motion, pour off, leaving grit at the bottom. Repeat this a second time, pouring off with another basin. Cleanse out grit, and do the same with the other half. When the second lot is poured off, the crocus in the first will have settled to the bottom; pour off the water gently, take out the powder, and dry it, and put both when washed clear of grit, and dried, into a box into which dust cannot get. If the silver work is very dirty, rub the mixture of powder and oil on with the fingers, and then it will be known if any grit is on the work. If the work is not very black, take a piece of soft chamois leather, and rub some dry crocus on, and when well rubbed, shake out the leather, and let the powder fall off that is not used, or rub it off with a brush. Do not put down the leather in the dust.

**POLISHING WHEELS.**—*Emery Wheels.*  
—1. Can be made with shellac powdered fine, and a small portion of rosin, a piece about the size of a walnut to an ounce of shellac, and a piece of old vulcanized india-rubber about the same size, which gives it toughness. Shellac about 1 oz. to 1 lb. of emery, well melt, and stir about in a small frying pan; well mix the powders before applying heat. Be careful not to burn it, or get grease in it; have a ring of iron and a piece of plate iron prepared with black-lead and beer pretty thick; place the ring upon the plate and make a mould, turn the stuff into it,

and well ram down evenly; put on one side to cool; when cold, turn out and chuck in lathe, and with a piece of red-hot iron bore a hole for spindle; after spindled put between centres, and trice-up with hot iron. Very good grindstones may be made with silver-sand mixed with powdered glass, and it is necessary to have some body besides shellac for coarse emery to form a body to bed the grains in. Emery dust from grinding glass, and Turkey stone slips, and slate, may be used as a substitute for the flour. 2. The best emery wheels are formed of clean emery compounded with just a sufficient amount of boiled lusted oil, the mixture being agitated for a sufficient period under exposure to a considerable temperature and a free access of atmospheric air, or some still more powerful oxidizing agent; it assumes the necessary degree of tenacity, and whilst warm, being exposed to hydraulic pressure in a suitable mould, and subsequent drying in a stove, the emery wheel is complete.

*Artificial Grindstone.*—Washed silicious sand 3 parts, shellac 1 part; melt the lac, and mould in the sand, while warm. Emery may be substituted for sand. Used for razors and fine cutlery.

*Making Glaze Wheels for Finishing Steel.*—For hollow finishing the following wheels are required:—A mahogany wheel for rough glazing. A mahogany wheel for smooth glazing. A lead wheel, or lap. For flat finishing: A buff wheel for rough. A buff wheel for smooth. A buff wheel for finishing. Lastly, a polisher. To make the glaze wheels: Get the spindles, and point them on each end; then get a block of beech and wedge it on the steel at one end with iron wedges, and turn it for the pulley for the band to run on. Take two pieces of flat mahogany and glue and screw them together, so that the grain of one piece crosses the other, to prevent warping. Let it get thoroughly dry, and wedge it on the spindle and turn it true. The lead wheel is made the same way but made wider, and a groove turned in

the edge. Then the wheel is put into sand, and a ring of lead run round the edge; it is then turned true. To make the buff wheels, proceed as with the glaze; but to save expense, pine or deal wood will do as well as mahogany, only save it about double the width of the glaze, which is about  $\frac{1}{2}$  inch wide, by 12 inches or 14 inches across. The buff wheels are covered with glue, and then the leather is tacked on with tacks driven in about half-way, so that they may be easily drawn out again. The leather is then turned true. The polisher is made the same way, but the size of the polisher must be a little less than any of the other wheels, say, about an inch. The buff wheels are dressed by laying on a fine thin coat of clear glue, and rolling them round—No. 1, in superfine corn emery; No. 2, in smooth emery; No. 3, by making a cake of equal parts of mutton suet, beeswax, and washed emery; then it is held on the wheel while it is going round. The glaze wheels are dressed while using, by mixing a little of the emery with oil, and putting it on the wheel with a stick or the finger. The leather of the polisher is not covered with glue, but dressed with a mixture of crocus and water, not oil. Care must be taken to keep each wheel and substance to themselves, and the work must be carefully wiped after each operation, and cleanliness must be studied above all things in using the polisher, as the slightest grease getting on it stops the polishing.

**POLISHING MATERIALS.—Rouge.**—The rouge used by machinists, watchmakers, and jewellers is a mineral substance. In its preparation crystals of sulphate of iron, commonly known as copperas, are heated in iron pots, by which the sulphuric acid is expelled and the oxide of iron remains. Those portions least calcined, when ground, are used for polishing gold and silver. These are of a bright crimson colour. The darker and more calcined portions are known as crocus, and are used for polishing brass and steel. For the finishing process of the specula of telescopes, usually made of iron or of steel, crocus is invaluable;

it gives a splendid polish. Others prefer for the production of rouge the peroxide of iron precipitated by ammonia from a dilute solution of sulphate of iron, which is washed, compressed until dry, then exposed to a low red heat and ground to powder.

**Crocus.**—Put tin, as pure as possible, into a glass vessel—a wineglass does very well when making small quantities—and pour in sufficient nitric acid to cover it. Great heat is evolved, and care must be taken not to inhale the fumes, as they are poisonous. When there is nothing left but a white powder, it should be heated in a Hessian crucible, to drive off the nitric acid. Crocus, mixed with a little linseed oil, makes a hard and useful cement.

**Powders for Cleaning Plate.**—1. Take equal parts of precipitated subcarbonate of iron, and prepared chalk. 2. An impalpable rouge may be prepared by calcinating the oxalate of iron. 3. Take quicksilver with chalk,  $\frac{1}{2}$  an oz., and prepared chalk 2 oz., mix them. When used, add a small quantity of spirit of wine, and rub with chamois leather; or, put sulphate of iron into a large tobacco pipe, and place it in a fire for a quarter of an hour, mix with a small quantity of powdered chalk. This powder should be used dry.

**Jewellers' Rouge.**—A rouge suitable for fine work may be made by decomposing a solution of sulphate of iron with oxalic acid also in solution; a precipitate of oxalate of iron falls, which must be well washed and dried; when gently heated, the salt takes fire, leaving an impalpable powder of oxide of iron.

**Putty Powder or Oxide of Tin.**—Metallic tin is dissolved in nitro-muriatic acid, and precipitated from the filtered solution by liquid ammonia, both fluids being largely diluted with water. The peroxide of tin is then washed in abundance of water. Collect in a cloth filter, and squeeze as dry as possible in a piece of new linen. The mass is now subjected to pressure in a screw press, or between two lever boards, to make it as dry as possible. When the lump thus produced has been broken, it is placed in

a crucible, and closely covered up to prevent jets from cutting, and is then exposed and heated to a white heat, and ground for use in the usual way; this oxide is used specially for cements, and polishing astronomical object-glasses for astro-telescopes. The putty powder of commerce, if of good fair quality, is alloyed with about equal parts of tin and lead, which answers for ordinary purposes, but not for polishing lenses, in which good work is wholly dependent on the quality of the powder.

**Razor Paste.**—Mix fine emery intimately with fat and wax until the proper consistency is obtained in the paste, and then rub it well into the leather strap. Prepare the emery by pounding thoroughly in a mortar the coarse kind, throwing it into a large jug of water and stirring well. Immediately the large particles have sunk, pour off into a shallow plate or basin, and let the water evaporate. This emery is better for engraving and other purposes than that prepared at the emery mills. 2. The grit from a fine grindstone is very efficient for a razor paste. 3. Levigated oxide of tin, prepared putty powder, 1 oz.; powdered oxalic acid,  $\frac{1}{4}$  oz.; powdered gum, 20 grains; make into a stiff paste with water, and evenly and thinly spread it over the strap. With very little friction, this paste gives a fine edge to the razor, and its efficiency is still further increased by moistening it. 4. Emery reduced to an impalpable powder, 2 parts; spermaceti ointment, 1 part; mix together, and rub it over the strap. 5. Jewellers' rouge, black-lead, and suet, equal parts; mix.

**Cutting Pebbles.**—The lapidary's bench is formed with a fly-wheel working horizontally, by hand-crank, with a leather strap passing over and communicating motion to a pulley and spindle, on which as wanted for use are successively fastened the following plates;—1st, the sliding plate of soft iron, very thin, turned up to run quite true on its spindle, the edge dressed with diamond powdered in a hardened steel mortar, and lubricated with oil of brick; turpentine or paraffin is also occasionally used.

The stone is held in the hand. The stone is to be reversed after some progress in the cut, to avoid dulling. The cut being completed, the grinding is performed by substituting the second plate of pewter, dressed with coarse emery and water; 3rd ditto, with fine emery and water; 4th, wooden plate, with sand and water; 5th, pewter plate, with rotten-stone and water; 6th, wood plate, covered with leather dressed with putty powder or tripoli, and slightly watered. There may be other plates or discs, but the object to be attained is having a succession of grindings, so that each succeeding plate shall remove the imperfections of polish left by its predecessor.

**Polishing Vulcanite.**—1. Remove scratches with a smooth wet water of Ayr stone, and then polish in the lathe with fine pumice and a stiff brush. After washing the pumice off, polish it with whiting and soft brush. 2. The mathematical instrument makers treat it as brass—that is, for flat work they first use water of Ayr stone, and then rotten-stone and oil. Turned work is polished in the lathe with rotten-stone and oil, taking care not to use too high a speed, which would heat the work. Some use lampblack and oil to finish with where a very high polish is wanted, or the bare palm of the hand, as in getting up silver plate. Chain and ornament makers use circular buffs for their flat work, made of sea-horse leather, and for work of irregular forms, buffs of calico. A number of pieces, 12 in. in diameter, are screwed together between flanges, like a circular-saw spindle, and used with rotten-stone, always taking care not to heat the work; brushes are not at all suitable for it.

**Polishing Plaster Casts.**—1. Put into 4 lbs. of clear water 1 oz. of pure curd soap, grated and dissolved in a well-glazed earthen vessel—then add 1 oz. of white beeswax, cut into thin slices; when the whole is incorporated it is fit for use. Having well dried the figure before the fire, suspend it by a twine, and dip it once in the varnish; upon taking it out, the moisture will appear to have been absorbed in 2 minutes'



time; stir the compost, and dip the figure a second time; this generally suffices. Cover it carefully from the dust for a week; then, with soft muslin rag, or cotton wool, rub the figure gently, when a most brilliant gloss will be produced. 2. Take skimmed milk, and with a camel-hair pencil lay over the model till it will imbibe no more. Shake or blow off any that remains on the surface, and lay the figure in a place perfectly free from dust; when dry it will look like polished marble. If the milk is not carefully skimmed it will not answer the purpose. 3. Fuse  $\frac{1}{2}$  oz. of tin, with the same quantity of bismuth, in a crucible; when melted, add  $\frac{1}{2}$  oz. of mercury; when perfectly combined, take the mixture from the fire and cool it. This substance, mixed with the white of an egg, forms a beautiful varnish for plaster-of-Paris casts. 4. Of stearine and Venetian soap each 2 parts; pearlsh, 1; the stearine and soap cut small and mixed with 30 parts of solution of caustic potash, boiled for half an hour, stirring continually. Add the pearlsh dissolved in a little rain water and boil a few minutes; stir until cold, and mix with more ley until it is quite liquid; keep well covered up. Remove all dust and stains from the plaster, and apply the wash as long as it is absorbed. When dry, rub with a soft leather or brush. Should the surface not shine, apply another coat. This composition may be preserved for years. 5. Coat with melted white wax, and place them before a fire until the wax is absorbed; a considerable polish can then be obtained by friction. 6. First make very smooth and free from grit with glass-paper or otherwise; oil with luscid oil; when dry, French polish in the usual way. If a bust, or anything similar, required to be white, make smooth size with white size, and varnish with white hard varnish.

**Polishing Slate.**—Slate is faced first with an iron plate with river sand and water, smoothed with pumice-stone; then japanned and baked to harden the japan, and again smoothed with pumice-stone and polished with rotten-stone.

**Polishing Shells.**—1. Marine shells are cleaned by rubbing with a rag dipped in common hydrochloric acid till the outer dull skin is removed, washing in warm water, drying in hot saw-dust, and polishing with chamois leather. Those shells which have no natural polished surface may either be varnished or rubbed with a little tripoli powder and turpentine on wash-leather, then fine tripoli alone, and lastly with a little fine olive oil, bringing up the surface with the chamois as before. 2. The shells are first boiled in a strong solution of potash, then ground on wheels, sometimes through one strata to show an underlying one, then polished with hydrochloric acid and putty powder. In this operation the hands are in great danger. Shell grinders are generally almost crippled in their hands.

**Polishing Mother-of-Pearl.**—Go over it with pumice-stone finely powdered, washed to separate the impurities and dirt, with which polish it very smooth; then apply putty powder and water by a rubber, which will produce a fine gloss and good colour.

**Polishing Horn and Ivory.**—Ivory and bone admit of being turned very smooth, or when filed may afterwards be scraped so as to present a good surface. They may be polished by rubbing first with fine glass-paper, and then with a piece of wet linen cloth dipped in powdered pumice-stone. This will give a very fine surface, and the final polish may be produced by washed chalk or fine whiting applied by a piece of cloth wetted with soap-suds. Care must be taken in this, and in every instance where articles of different fineness are used, that, previous to applying a finer, every particle of the coarser material is removed, and that the rags are clean and free from grit. Ornamental work must be polished with the same materials as plain work, using brushes instead of linen, and rubbing as little as possible, otherwise the more prominent parts will be injured. The polishing material should be washed off with clean water, and when dry, may be rubbed with a clean brush. Horn and

tortoiseshell are so similar in their nature and texture that they may be classed together. As regards the general mode of working and polishing them, a very perfect surface is given by scraping. The scraper may be made of a razor-blade, the edge of which should be rubbed upon an oilstone, holding the blade nearly upright, so as to form an edge like that of a carrier's knife, which may be sharpened by burnishing. Work when properly scraped is prepared for polishing. To effect this it is first rubbed with a buff made of woollen cloth perfectly free from grease. The cloth may be fixed upon a stick to be used by hand; but a bob, which is a wheel running in the lathe and covered with the cloth, is much to be preferred on account of the rapidity of motion. The buff may be covered either with powdered charcoal and water, or fine brick-dust and water. After the work has been made as smooth as possible with this, it is followed by another bob on which washed chalk or dry whiting is rubbed. The article to be polished is slightly moistened with vinegar, and the buff and whiting will produce a fine gloss, which may be completed by rubbing with the palm of the hand and a small portion of dry whiting or rotten-stone.

*Polishing Bullocks' Horns.*—1. Well scrape with glass or steel scraper, afterwards with finest glass-cloth, then with powdered bath brick and oil, and finally with rotten-stone and flannel, or old cloth or felt hat. 2. First scrape with glass to take off any roughness, then grind some pumice-stone to powder, and with a piece of cloth wetted and dipped in the powder, rub them until a smooth face is obtained. Next polish with rotten-stone and linseed oil, and finish with dry flour and a piece of clean linen rag. The more rubbing with the stone and oil, the better the polish. Trent sand is used in the Sheffield factories. It is a very fine and sharp sand, and is prepared for use by calcining and sifting.

*Polish for Leather.*— $\frac{1}{2}$  lb. treacle, 1 oz. lampblack, a spoonful of yeast, 1 oz. sugar-candy, 1 oz. sweet oil, 1 oz.

gum dragon, 1 oz. isinglass, and a cow's gull. Mix well in 2 pints of stale beer. Warm the mixture, and apply with a sponge. It will then produce a softness of the leather, and a high brilliancy of polish.

**Burnishing.**—To burnish an article is to polish it, by removing the small roughness upon its surface; and this is performed by a burnisher. This mode of polishing is the most expeditious, and gives the greatest lustre to a polished body. It removes the marks left by the emery, putty of tin, or other polishing materials; and gives to the burnished articles a black lustre, resembling that of looking-glass. The form and construction of the burnisher is extremely variable, according to the respective trades; and it must be adapted to the various kinds of work in the same art. In general, as this tool is only intended to efface inequalities, whatever substance the burnisher is made of is of little consequence to the article burnished, provided only that it is of a harder substance than that article.

*To Burnish Silver.*—Commence by cleaning off any kind of dirt which the surfaces of the silver articles had contracted whilst making, as that would entirely spoil the burnishing. For this purpose take pumice-stone powder, and with a brush, made very wet in strong soapsuds, rub the various parts of the work, even those parts which are to remain dull, which, nevertheless, receive thus a beautiful white appearance; wipe with an old linen cloth, and proceed to the burnishing.

*Burnishers.*—The burnishers used are of two kinds, of steel and of hard stone. They are either curved or straight, rounded or pointed, and made so as to suit the projecting parts, or the hollows of the piece. Stone burnishers are made of blood-stone, cut, and either rounded with the grindstone, or rubbed, so that they present, at the bottom, a very blunt edge, or sometimes a rounded surface. These are polished with emery, like steel burnishers, and are finished by being rubbed upon a leather, covered with crocus martis. The stone is mounted

in a woollen handle, and firmly fixed by a copper ferrule, which encircles both the stone and the wood. The best blood-stones are those which contain the most iron, and which, when polished, present a steel colour. The operation of burnishing is very simple; take hold of the tool very near to the stone, and lean very hard with it on those parts which are to be burnished, causing it to glide by a backward and forward movement, without taking it off the piece. When it is requisite that the hand should pass over a large surface at once, without losing its point of support on the work-bench, in taking hold of the burnisher be careful to place it just underneath the little finger. By this means the work is done quicker, and the tool is more solidly fixed in the hand. During the whole process, the tool must be continually moistened with black soapsuds. The water with which it is frequently wetted causes it to glide more easily over the work, prevents it from heating, and facilitates its action. The black soap, containing more alkali than the common soap, acts with greater strength in cleansing off any greasiness which might still remain on the surface; it also more readily detaches the spots which would spoil the beauty of the burnishing. In consequence of the friction the burnisher soon loses its bite, and slips over the surface of the article as if it were oily. In order to restore its action, it must be rubbed, from time to time, on the leather. The leather is fixed on a piece of hard wood, with shallow furrows along it. There are generally two leathers—one made of sole leather and the other of buff leather. The first is impregnated with a little oil and crocus martis, and is particularly used for the blood-stone burnishers; the other has only a little putty of tin scattered in the furrows, and is intended exclusively for rubbing steel burnishers, as they are not so hard as the blood-stones. Blood-stone being very hard, the workman uses it whenever he can, in preference to the steel burnisher. It is only in small articles, and in difficult places, that steel burnishers are used;

as they, by their variety of form, are adapted to all kinds of work. In general, the blood-stone greatly reduces the labour. When the articles, on account of their minuteness, or from any other cause, cannot be conveniently held in the hand, they are fixed in a convenient frame on the bench; but under all circumstances be very careful to manage the burnisher so as to leave untouched those parts of the work which are intended to remain dull. When, in burnishing an article which is plated or lined with silver, there is any place where the layer of precious metal is removed, restore it by silvering these places with a composition supplied by the silversmith, which is applied with a brush, rubbing the part well, and wiping it afterwards with an old linen cloth. The burnishing being finished, remove the soapsuds which still adhere to the surface of the work; this is effected by rubbing it with a piece of old linen cloth. But when there are a great number of small pieces to finish, to throw them into soapsuds and dry them afterwards with saw-dust is more expeditious. The burnishing of gold leaf or silver, on wood, is performed with burnishers made of wolves' or dogs' teeth, or agates, mounted in iron or woollen handles. When about to burnish gold, applied on other metals, dip the blood-stone burnisher into vinegar; this kind being exclusively used for that purpose. But when burnishing leaf-gold on prepared surfaces of wood, keep the stone, or tooth, perfectly dry. The burnisher used by leather gilders is a hard polished stone, mounted in a wooden handle—this is to sleek or smooth the leather. The ordinary engravers' burnisher is a blade of steel, made thin at one end, to fit into a small handle to hold it by. The part in the middle of the blade is rounded on the convex side, and is also a little curved. The rounded part must be well polished, and the tool be very hard. This burnisher is used to give the last polish to such parts of copper and steel plates as may have been accidentally scratched, or specked, where false lines are to be removed, and also

to lighten in a small degree such parts as have been too deeply etched or graved. In clockmaking, those pieces or parts are burnished which, on account of their size or form, cannot be conveniently polished. The burnishers are of various forms and sizes; they are all made of cast steel, very hard, and well polished; some are formed like sage-leaf files, others like common files—the first are used to burnish screws, and pieces of brass; the others are used for flat pieces. The clockmakers have also very small ones of this kind, to burnish their pivots—they are called pivot burnishers.

**Burnishing Pewter.**—The burnishing of pewter articles is done after the work has been turned, or finished off with a scraper—the burnishers are of different kinds, for burnishing articles either by hand, or in the lathe; they are all of steel, and while in use are rubbed with putty powder on leather, and moistened with soapsuds.

**Burnishing Cutlery.**—The burnishing of cutlery is executed by hand or vice burnishers; they are all made of fine steel, hardened, and well polished. The first kind have nothing particular in their construction; but vice burnishers are formed and mounted in a very different manner. On a long piece of wood, placed horizontally in the vice, is fixed another piece, as long, but bent in the form of a bow, the concavity of which is turned downwards. These two pieces are united at one of their extremities by a pin and a hook, which allows the upper piece to move freely around this point as a centre. The burnisher is fixed in the middle of this bent piece, and it is made more or less projecting, by the greater or lesser length which is given to its base. The movable piece of wood, at the extremity opposite to the hook, is furnished with a handle, which serves the workman as a lever. This position allows the burnisher to rest with greater force against the article to be burnished, which is placed on the fixed piece of wood. The burnisher has either the form of the face of a round-headed hammer, well polished to burnish those pieces which are plain or convex;

or the form of two cones opposed at their summits, with their bases rounded, to burnish those pieces which are concave or ring-shaped.

**Burnishing Book Edges.**—This is done with a wolf's or dog's tooth, or a steel burnisher; for this purpose place the books in a screw press, with boards on each side of them, and other boards distributed between each volume: first rub the edges well with the tooth to give them a lustre. After sprinkling or staining and when the edges are become dry, burnish the front; then turning the press, burnish the edges at the top and bottom of the volume. Burnish the gilt edges in the same manner, after having applied the gold; but observe in gilding, to lay the gold first upon the front, and allow it to dry; and on no account to commence burnishing till it is quite dry.

**Black for Blackboard.**—1. Paint the board with ordinary black paint such as will dry with a gloss; then apply a coat of black paint, mixed with turps instead of oil, which will dry a dead black. 2. Take  $\frac{1}{2}$  lb. of log-wood, and sufficient boiling water to cover it; allow it to stand for 24 hours. Strain, and apply the solution, boiling, if possible, twice, allowing the board to dry in the interval. Then dissolve  $\frac{1}{2}$  lb. of copperas in about 1 pint of boiling water, and apply it boiling, once or twice, according to the degree of blackness obtained. Before using it, rub it over well with rushes, straw, ferns, or shoemakers' heel-ball. It may be a little difficult to rub the chalk off at first, but after a fortnight's use that will disappear. Use unprepared chalk, which writes well. 3. Place  $\frac{1}{2}$  lb. of lampblack on a flat piece of tin or iron on a fire till it becomes red, take it off and leave it until sufficiently cool, when it must be crushed with the blade of a knife on a flat board quite fine; then get  $\frac{1}{2}$  pint of spirits of turpentine, mix both together, and apply the mixture with a size-brush. If the board is new, it would be well to give it one or two coats of lampblack—not burnt, but mixed with boiled oil—adding  $\frac{1}{2}$  lb. of

patent driers. After the board is thoroughly dried, apply the burnt lamp-black and turpentine. The preparation must be laid on quickly.

**Printers' Rollers.**—1. To 8 lbs. of transparent glue add as much rain or river water as will just cover it, and occasionally stir it during 7 or 8 hours. After standing for 24 hours, and all the water is absorbed, submit it to the action of heat in a water bath, that is, surrounded by water, as glue is generally heated, and the glue will soon be dissolved. Remove it from the fire as soon as froth is seen to rise, and mix with it 7 lbs. of molasses, which has been previously made tolerably hot; stir the composition well together in the water bath over the fire, but without suffering it to boil. After being thus exposed to the heat for half an hour, and frequently well stirred, it should be withdrawn from over the fire and allowed to cool for a short time, previous to pouring it into a cylindrical mould made of tin, tinned sheet iron, or copper, having a wooden cylinder previously supported in its centre by means of its end-pivots or gudgeons. After remaining in the mould at least 8 or 10 hours in winter, and a longer time in summer, the roller is to be taken out of the mould by means of a cord fastened to one of the gudgeons, and passed over a strong pulley fixed to the ceiling; but care must always be taken that the cylinder is drawn out slowly from the mould. Old rollers are recast in the same manner, first taking care to wash them with a strong alkaline ley, and adding a small quantity of water and molasses. The best mode, however, of making use of the old composition, is by mixing it with some new, made of 2 lbs. of glue and 4 lbs. of molasses. 2. Composition for rollers;—Summer use,  $1\frac{1}{2}$  lb. best glue and 4 lbs. treacle; winter use, 1 lb. best glue and 4 lbs. treacle. Soak the glue about  $1\frac{1}{2}$  hour if thick, if thin 1 hour. Take it out of the water, lay it on a board until next day, then melt down in proper melting pot, or put it in a saucepan and place it in another containing water. Do not let the water

run over into the glue; one great secret in roller casting is to have as little water in the glue as possible. Add treacle as above, let boil once, then keep it just under boiling-point until cooked, which takes about 2 hours, more or less; pour out into moulds, well cleaned and greased; if the composition is left too long on the fire it will get thick and spoil. The above is sufficient for an 18-in. roller; other sizes in proportion.

**Hints about Screws.**—Where screws are driven into soft wood and subjected to considerable strain, they are very likely to work loose, and it is often difficult to make them hold. In such cases the use of glue is profitable. Prepare the glue thick; immerse a stick about half the size of the screw and put it into the hole; then immerse the screw, and drive it home as quickly as possible. When there is an article of furniture to be hastily repaired, and no glue is at hand, bore a hole, insert the stick, fill the rest of the cavity with pulverized rosin, then heat the screw sufficient to melt the rosin as it is driven in. Where screws are driven into wood for temporary purposes, they can be more easily removed by dipping them in oil before inserting. When buying screws, notice that the heads are sound and well cut, that there are no flaws in the body or thread part, and that they have gimlet points. A screw of good make will drive into oak as easily as others into pine, and will endure having twice the force brought against it.

**Silkworm Gut for Fishing.**—1. Wash the gut in a little soda, steep it in some alum water, take out if wanted brown; use a strong decoction of tea, if black, it can be done with the addition of a little powdered nut-gall in the tea, and passing it through a little vinegar in which some old nails have been; if salmon-coloured, saffron decoction; if properly done it will have very little gloss upon it. 2. Steep some walnut-leaves in a basin of water for a day or two, having previously bruised them. Then soak the gut in it; the longer it is left in, the darker it will be. This will be found quite dark enough for all

ordinary purposes. To dye brown, steep in strong collee.

**Hair for Brushes.**—In the manufacture of hair pencils or brushes, the hairs are scoured in a solution of alum till they are free from grease, and then steeped 24 hours in lukewarm water. The water is next squeezed out by pressing them strongly from the root to the tip. They are then dried by pressure with linen cloths, and combed as smooth as possible. Bunches of hair are then placed in small flat-bottomed tin pans, with the tips of the hair upwards; on striking the bottom of the pan the hairs get arranged parallel to each other, and the long hairs standing higher than the others may easily be picked out.

**Writing on Slate.**—Draw in the letters with a black-lead pencil; if wanted very accurate, go over with a draw-point, then taking a square graver, cut a deep bold line up the centres of the letters; this line, if done with one cut, will be broken and jagged at the edges; then take a flat tool, a tool about  $\frac{1}{2}$  of an inch broad, and sharpened exactly the same as a joiner's chisel, but mounted in a graver handle, and with the flat side to the slate, cut from the centre stroke to the outside edge of the letter, holding the tool so as to cut the outside of the letter bevelled; it cuts as clean as a bit of cheese, the letter when finished being deep in the centre and bevelled off on both sides.

**Enlarging Woodcuts for Diagrams.**—Trace the desired picture on a piece of ground glass, using a sharp and well-pointed lead pencil. Hang up the large paper intended for the diagram, and using the ground glass as a slide in a powerful magic-lantern, project the image on to the paper, regulating the size of the picture by approaching or receding from it. Copy the lines on the paper, and if the operation is carefully performed the picture will be in perfect proportion, and the most intricate figures can thus be easily reproduced.

**Veneering.**—In veneering with the hammer, cut the veneer a little larger than the surface to be covered,

as it slips a little while laying; it is first roughened on both sides with the toothling plane, or a rough rasp; this removes all grease and saw-marks; the surface to be veneered is treated in a similar way. This roughening causes the glue to adhere. They are then well warmed at the fire. Now clear the bench of all cucumbrances, save glue-pot, hot water, sponge, and veneering hammer. Wet both sides of the veneer, and apply plenty of glue; lay the veneer down on its bed, whilst an assistant holds one end firm; take the veneering hammer in the right hand, press hard down on the head with the left; begin at the middle, and work zigzag ways towards the end and sides, pressing out all superfluous glue; turn the work round, begin at the middle again, and work off at the other end, going over it several times until it has stuck; keep it damp all the time with the sponge; a slight tap with the back of the hammer will tell if it is firm by the sound; lay a weight on it, and set it to dry near the fire. Veneer is laid in two ways, by cauls, and with the veneering hammer. Both systems are used to about an equal extent, the caul being better suited to some kinds of work, and the hammer to others. An amateur will find it much better to use the caul when practicable, as all that is necessary is to prepare the surface of the article, glue it with thick glue, lay on the veneer, and on that the previously heated caul. The hand-screws are now applied, and the whole left until cold. In laying small pieces with the hammer it is merely necessary to glue one side and damp the other, to keep it from curling, but with large surfaces it is necessary to use a heated flat iron in advance of the hammer, and to do this effectively requires no little practice. The cauls should be either soaped before use, or pieces of paper should be placed between them and the veneer to prevent sticking.

**Cauls.**—The cauls are made of dry pine wood, and should be free from knots and flaws. They must be made in shape the exact converse of the surface which is to be veneered. If the veneered

surface is flat, the caul is flat also; if convex, the caul must be concave. In order to ensure perfect contact between the caul and the veneer throughout the entire surface, it is found advisable to make the cauls of such a thickness as will allow them to bend slightly under the pressure of the handscrews. They are then shaped to touch only in the middle of the work, when, by screwing the caul and the work together at the edges, a great pressure commences at the centre and spreads in all directions towards the edges, forcing the superfluous glue out in advance.

*Veneering Hammer.*—Take an ordinary hammer, place the head in the palm of the hand with the handle sticking out forward, place the toe upon a piece of veneer previously glued on the under side, and wriggle the handle backwards and forwards from right to left, at the same time pressing downwards; the superfluous glue will be worked out to the edges, and the veneer will remain sticking to the wood underneath. As the toe of a common hammer is found too narrow in practice, the veneering hammer is substituted, which consists in the simplest form of a flat square of hard wood or iron, with a handle stuck in perpendicularly, and is used in the same manner as described above.

*Removing Blisters from Veneer.*—First wash the exterior of the blister with boiling water, and with a coarse cloth remove dirt and grease; then place it before the fire, or heat it with a caul; oil its surface with common linseed oil; place it again to the fire, and the heat will make the oil penetrate quite through the veneer and soften the glue underneath, then while hot raise the edge gently with a chisel, and it will separate completely from the ground; be careful not to use too great force or it will spoil the work again. If it should get cold during the operation, apply more oil and heat it again; repeat this process to entirely separate the veneer; then wash off the old glue, and proceed to lay it again as a new veneer.

*DYEING WOOD FOR VENEERS.*—Dyeing wood is mostly practised for veneers,

while staining is generally to give the desired colour to the article after it has been manufactured. In the first case the colour should penetrate throughout, while in the latter a surface colour only is essential. In dyeing, pear-tree, holly, and beech take the best black, but for most colours holly is preferable. It is also best to have the wood as young and as newly cut as possible. After the veneers are cut, they should be allowed to lie in a trough of water for four or five days before placing them into the copper; the water, acting as a purgative to the wood, brings out abundance of slimy matter. After this purifying process they should be dried in the open air for at least 12 hours; they are then ready for the copper. By these simple means the colour will strike much quicker, and be of a brighter hue. It would also add to the improvement of the colours, if, after the veneers have boiled a few hours, they are taken out, dried in the air, and again immersed in the colouring copper. Always dry veneers in the open air; for fire invariably injures the colours.

*Fine Black.*—1. Put 6 lbs. of chip logwood into the copper, with as many veneers as it will conveniently hold, without pressing too tight; fill it with water, and boil slowly for about three hours; then add  $\frac{1}{2}$  lb. of powdered verdigris,  $\frac{1}{2}$  lb. of copperas, and 4 oz. of bruised nut-galls; fill the copper up with boiling vinegar as the water evaporates; let it boil gently two hours each day, till the wood is dyed through. 2. Procure some liquor from a tanner's pit, or make a strong decoction of oak bark, and to every gallon of the liquor add  $\frac{1}{2}$  lb. of green copperas, and mix them well together; put the liquor into the copper, and make it quite hot, but not to boil; immerse the veneers in it, and let them remain for an hour; take them out, and expose them to the air till it has penetrated its substance; then add some logwood to the solution, place the veneer again in it, and let it simmer for two or three hours; let the whole cool gradually, dry the veneers in the shade. 3. A good black stain for immediate

use. Boil  $\frac{1}{2}$  lb. of chip logwood in 2 quarts of water, add 1 oz. of pearlsh, and apply hot with a brush. Then take a similar decoction of logwood, and to it add  $\frac{1}{2}$  oz. of verdigris and  $\frac{1}{2}$  oz. of copperas; strain well, add  $\frac{1}{2}$  lb. of rusty-steel filings, and apply.

*Blue.*—1. Into a clean glass bottle put 1 lb. of oil of vitriol, and 4 oz. of the best indigo pounded in a mortar; set the bottle in a basin or earthen glazed pan, as it will ferment; now put the veneers into a copper, or stone trough; fill it rather more than  $\frac{1}{3}$ rd with water, and add as much of the vitriol and indigo, stirring it about, as will make a fine blue; let the veneers remain till the dye has struck through. The colour will be much improved if the solution of indigo in vitriol is kept a few weeks before using.

*Yellow.*—Reduce 4 lbs. of the root of barberry, by sawing, to dust, which put in a copper or brass trough; add 4 oz. of turmeric, and 4 gallons of water, then put in as many white holly veneers as the liquor will cover; boil them together for 3 hours, often turning them; when cool, add 2 oz. of aquafortis, and the dye will strike through much sooner.

*Bright Yellow.*—To every gallon of water necessary add 1 lb. of French berries; boil the veneers till the colour has penetrated through; add the following liquid to the infusion of the French berries, and let the veneers remain for 2 or 3 hours, and the colour will be very bright.

*Liquid for Brightening and Setting Colours.*—To every pint of strong aquafortis add 1 oz. of grain tin, and a piece of sal ammoniac of the size of a walnut; set it by to dissolve, shake the bottle round with the cork out, from time to time; in the course of 2 or 3 days it will be fit for use. This is an admirable liquid to add to any colour, as it not only brightens it, but renders it less likely to fade from exposure to the air.

*Bright Green.*—1. Proceed as in either of the above receipts to produce a yellow; instead of adding aquafortis or the

brightening liquid, add as much sulphate of indigo as will produce the desired colour. 2. Dissolve 4 oz. of the best verdigris, and sap-green and indigo  $\frac{1}{2}$  oz. each, in 3 pints of the best vinegar; put in the veneers, and gently boil till the colour has penetrated sufficiently. The hue of the green may be varied by altering the proportion of the ingredients; and unless wanted for a particular purpose, leave out the sap-green, as it is a vegetable colour very apt to change, or turn brown, when exposed to the air.

*Bright Red.*—1. To 2 lbs. of genuine Brazil dust add 4 gallons of water; put in as many veneers as the liquor will cover; boil them for 3 hours; then add 2 oz. of alum, and 2 oz. of aquafortis, and keep it lukewarm until it has struck through. 2. To every pound of logwood chips add 2 gallons of water; put in the veneers, and boil as in the last, then add a sufficient quantity of the brightening liquid; keep the whole warm till the colour has sufficiently penetrated. The logwood chips should be picked from all foreign substances, with which it generally abounds, as bark and dirt; it is always best when fresh cut, which may be known by its appearing of a bright-red colour; if stale it will look brown, and will not yield so much colouring matter.

*Purple.*—1. To 2 lbs. of chip logwood and  $\frac{1}{2}$  lb. of Brazil dust add 4 gallons of water, and after putting in the veneers, boil them for at least 3 hours; then add 6 oz. of pearlsh and 2 oz. of alum; let them boil for 2 or 3 hours every day, till the colour has struck through. The Brazil dust is to make the purple of a red cast; it may, therefore, be omitted, if a deep blueish purple is required. 2. Boil 2 lbs. of logwood, either in chips or powder, in 4 gallons of water with the veneers; after boiling till the colour is well struck in, add by degrees sulphate of indigo, till the purple is of the shade required, which may be known by trying it with a piece of paper; let it then boil for 1 hour, and keep the liquid in a milk-warm state till the colour has penetrated the



veneer. This method, when properly managed, will produce a brilliant purple, not so likely to fade as the foregoing.

*Orange.*—Let the veneers be dyed, by either of the methods previously given, of a fine deep yellow, and whilst they are still wet and saturated with the dye, transfer them to the bright-red dye till the colour penetrates equally throughout.

*Silver Grey.*—1. Expose to the weather in a cast-iron pot of 6 or 8 gallons, old iron nails, hoops, or other scraps, till covered with rust; add 1 gallon of vinegar and 2 of water, boil all well for an hour; have the veneers ready, which must be air-wood, not too dry; put them in the copper used to dye black, and pour the iron liquor over them; add 1 lb. of chip logwood, and 2 oz. of bruised nut-galls; then boil up another pot of the iron liquor to supply the copper with, keeping the veneers covered, and boiling two hours a day, till of the required colour. 2. Expose any quantity of old iron in any convenient vessel, and from time to time sprinkle them with spirits of salt, diluted in four times its quantity of water, till they are very thickly covered with rust; then to every 6 lbs. add a gallon of water, in which has been dissolved 2 oz. of salts of tartar; lay the veneers in the copper, and cover them with this liquid; let it boil for two or 3 hours till well soaked, then to every gallon of liquor add  $\frac{1}{2}$  lb. of green copperas, and keep the whole at a moderate temperature till the dye has sufficiently penetrated.

*Staining Woods.*—Staining wood is quite a different process to dyeing it, and requires no previous preparation of the wood. There is little trouble in preparing the stain, and its application differs but slightly from painting. Staining is divided into washing, matching, imitating, painting, and improving.

*Washing* consists in coating common white deal or fir with a dilute aqueous solution of clear glue, suitably tinted with a proper combination of two or more colours, such as 1 part red-lead, or Venetian red, with 2 parts yellow-lead, chrome or ochre, for a mahogany

colour; equal parts of burnt umber and brown ochre for the antique hues of old wainscot oak; Venetian red, tinted with lampblack, for the shades of rosewood; ivory black for ebony; whitening, or white-lead, tinted with orange chrome, for the tones of white-yellowish woods; burnt umber, modified with yellow ochre, for walnut, and so on. Wash colour should always be applied in a warm state by a flannel, and the coloured wood ought to be evenly wiped dry with shavings or rags.

*Matching* is to bring different pieces of timber, in an article of furniture, to a responsive tone of colour, so that they may represent the appearance of one entire piece. First bleach the darkest parts, by carefully coating them with a strong solution of oxalic acid in hot water, to which is added a few drops of spirits of nitre. When the bleached parts become dry, coat them two or three times with white polish by means of a camel-pencil. This process does not always prove satisfactory, in which case lay on a delicate coat of white stain, and another of white varnish; then give the intermediate dark parts a coat of common varnish, and proceed to oil all the untouched white portions; next compare the whole, and when the white pieces happen to be much lighter than the dark ones, colour them the exact hue by coating them with a darkening stain.

*Darkeners.*—The darkeners in general use are logwood, lime, brown soft soap, dyed oil, aquafortis, sulphate of iron, nitrate of silver, with exposure to the sun's rays, carbonate of soda, bichromate and permanganate of potash, and other preparations of an acidulous or alkaline nature. Of these the latter three are the most preferable. Procure 1 oz. of one of these alkalies, powder, and dissolve in 2 gills of boiling water; next get 3 bottles, label them 1, 2, 3, or weak, medium, and strong; put  $\frac{1}{2}$  of the solution into No. 3, and  $\frac{1}{4}$  gill into No. 2, and the same into No. 1; then pour an additional gill of clean water into No. 2, and 2 gills of the same into No. 1. By separately dissolving both

alkalies in the manner described, six liquids are obtained capable of staining nearly all casts of wood of a complete series of brown and dark tints. The solutions of carbonate are generally used for dark materials, like rosewood, and those of the bichromate are applicable to all the intermediate and white woods, such as mahogany, oak, and oech. The safest way to use these alkaline fluids is to pour a sufficient quantity into a saucer, into which dip a sponge or a flannel, in order to saturate it thoroughly, then with it rub evenly over the timber, and instantly dry off the stained surface with a handful of rags or other soft waste; to ensure success, follow out this manipulation with great care and the utmost dispatch. When the dark and light portions are neither very black nor very white, varnish the former, and allow the latter to stand in oil for a time.

*Improving.*—An aqueous decoction of barberry root, or an alcoholic solution of gamboge or turmeric, will, if properly applied, impart a delicate yellow hue. Only decoctions of alkanet-root, and alcoholic solutions of dragon's-blood, yield rich mild reds. Rectified naphtha that has been dyed with camwood dust serves for another reddening tincture. Lightish hard wood, such as larch, is frequently improved in colour by being sponged with oil that is slightly tinted with rose madder, or Venetian red. A solution of asphaltum in spirits of turpentine makes a brown stain for coarse oaken work, which is only intended to be varnished with boiled oil. When discoloured ebony has been sponged once or twice with a strong decoction of gall-nuts, to which a quantity of steel dust has been added, its natural bluishness becomes much more intense. The naturally pale ground and obscure grain of Honduras mahogany is often well brought out by its being coated first with spirit of hartshorn and then with red oil. Greyish maple may be whitened by the process already described in matching. Half a gallon of water, in which  $\frac{1}{2}$  lb. of oak bark and the same quantity of walnut shells or peels have been thoroughly boiled,

makes an excellent improver of poor rosewood; it is also far before any other of its kind for bringing out to perfection the veiny figures and ground shades of walnut. Raw oil, mixed with a little spirits of turpentine, is the most efficacious improver of a great number of materials. Beautiful artificial graining may be imparted to various specimens of timber, by means of a camel-pencil, with raw oil alone; that is, certain portions may be coated two or three times, so as to resemble the rich varying veins which constitute the fibril figures; while the common ground shades may only be once coated with the oil very much diluted with spirits of turpentine.

*To Improve the Colour of any Stain.*—Mix in a bottle 1 oz. of nitric acid,  $\frac{1}{2}$  teaspoonful of muriatic acid,  $\frac{1}{4}$  oz. of grain tin, and 2 oz. of rain water. Mix it at least 2 days before using, and keep the bottle well corked.

*Directions for Staining.*—In preparing any of the tinctures, it is of importance to powder or mash all the dry stuffs previous to dissolving or macerating them, and to purify all the liquids by filtration before use. Their colouring powers, which mainly depend on very accurate combinations of the requisite ingredients, should always be carefully tested before a free use is made of them, and the absorbent properties of the materials intended to be stained should be tested likewise. It will be better for inexperienced hands to coat twice or three times with a weak stain than only once with a very strong one, as by adopting the first mode a particular tint may be gradually effected, whereas, by pursuing the latter course, an irremediable discolourization may be the result. Coarse pieces of carving, spongy end, and cross-grained woods, should be previously prepared for the reception of stain; this is best done by putting on a thin layer of varnish, letting it dry, and then glass-papering it completely off again. Fine work merely requires to be oiled and slightly rubbed with the finest glass-paper. Thus prepared, the woody fibre is enabled to take on the stain more regularly, and to retain

a high degree of smoothness. When stain is put on with a flat hog-hair tool, it is usually softened by a skilful but moderate application of a badger-hair softener. The steel comb is chiefly employed for streaking artificial oak, and the mattler is used for variegating and uniting the shades and tints of mahogany. Flannels and sponges are often worked with instead of brushes, but the implements most serviceable for veining or engraining purposes are small badger sash tools and sable pencils. The effect produced by a coat of stain cannot be ascertained until it has been allowed a sufficient drying period.

*Wurrall's Process for Imitating Woods.*

—The surface of the wood is first made perfectly smooth and level, and if close-grained the surface is covered with strong or dilute alkalies, such as potash, soda, and ammonia, or other alkalies and their carbonates, or with ethylic, or methylic ethers and alcohols, or spirits of turpentine, camphine, benzole, and chloroform, or with oils of, or solutions of, soaps, hot or cold, so as to soften and dissolve out the resinous substances naturally present in the cells or pores of the wood. If the wood is very close-grained, the surface is to be covered with any corrosive acid, such as concentrated sulphuric, nitric, hydrochloric, or chromic acids, so as to corrode, or etch the soft parts of the wood, and leave the harder parts elevated, and to enlarge the pores; this process is repeated until the desired effect is obtained.

*Imitating Oak Wainscot.* — 1. To make American ash like oak wainscot, both in vein and shade, commence by sketching out, upon certain parts of the ashen exterior, the requisite white veins by means of a camel-pencil with white stain; that done, coat the veins with thin varnish, and then darken the general ground, dealing carefully throughout the entire process with the veined portions. 2. The best mode of producing a representation of oak wainscot upon white materials like beach and fir, is as follows;—A coat of Stephens' satin-wood stain is regularly laid on, then a soft graining comb is gently drawn along

the stained space, and when the streaks are all correctly produced, the veins are formed with white stain, made by digesting  $\frac{3}{4}$  oz. pearl white, subnitrate of bismuth, and 1 oz. of isinglass, in 2 gills of boiling water. The tone of this stain may be modified by being diluted with water, or tinted with other stains.

*To Imitate Various Woods.*—Shovey elmroot, after being delicately darkened, passes in appearance for Italian walnut. To imitate the contour and rich ground of rosewood upon inferior white materials, produce the ground shade by sponging with a decoction of Brazil wood, and the fibril veins by brushing partially with black liquor, which is prepared by boiling logwood chips, sulphate of iron, and steel filings, in equally proportioned quantities of vinegar and water. Sometimes a graining comb is passed over the ground shade longitudinally, and with a slight vibrating motion, so as to effect natural-looking streaks, previous to the pencilling or veining. The aspect of ebony may be given to any species of wood by the application of three distinct coats of black liquor; and after being smoothed, the counterfeit ebony may be embodied with white polish; this greatly helps to preserve the transparent density of the dyed material.

There is a method of colouring woods not generally known in the trade; the surface to be coloured is smeared with a strong solution of permanganate of potash, which is left on for a longer or a shorter time, according to the shade required; in most cases 5 minutes suffice. Cherry and pear tree woods are most easily attacked, but a few experiments will serve to show the most favourable circumstances; the woody fibre decomposes the permanganate, precipitating peroxide of manganese, which is fixed in the fibre by the potash simultaneously set free. When the action is ended, the wood is carefully washed, dried, and afterwards oiled and polished in the ordinary way. The effect of this treatment on many kinds of wood is surprising, particularly on cherry woods, to which a beautiful red-

dish tone is communicated. The colour is permanent in light and air.

**Mordants.**—The virtues of dye-stuffs may be much enhanced by the addition of a mordant to modify and fasten the shades they impart. Spirit of nitre for the satinwood stain; a powerful solution of oxalic acid for the oak; and dilute nitrous acid for the mahogany.

**Imitating Mahogany.**—When curly-veined birch and beech have been regularly brushed with aquafortis and dried at the fire, they both look remarkably like mahogany. A decoction of logwood and fustic, when put on in a tepid state, produces a similar effect. The French mode consists in brushing the white timber with a dilute solution of nitrous acid; it is then coated once or twice with finishing spirit, in which a quantity of carbonate of soda and dragon's-blood has been dissolved, the proper proportions to 1 gill of spirit being  $\frac{1}{4}$  of an ounce of the soda, and  $\frac{1}{2}$  of an ounce of the blood; the wood is afterwards finished with varnish or polish of a reddish-brown tint. In producing this shade of colour, London stainers frequently use a rich brownish-red kind of chalk, the colour of which is analogous to that of fine Spanish mahogany. It is commonly applied in the form of a dry powder, by means of a brush, and then well rubbed with another brush or coarse flannel.

**To Stain Beech a Mahogany Colour.**—Put 2 oz. of dragon's-blood, broken in pieces, into a quart of rectified spirits of wine; let the bottle stand in a warm place, shake it frequently; when dissolved it is fit for use.

**Imitation of Mahogany.**—Plane the surface smooth, and rub with a solution of nitrous acid. Then apply with a soft brush 1 oz. of dragon's-blood dissolved in about a pint of alcohol, and with  $\frac{1}{2}$  of an ounce of carbonate of soda mixed and filtered. When the brilliancy of the polish diminishes, it may be restored by the use of a little cold-drawn linseed oil.

**Mahogany Stain.—Dark.**—1. Boil  $\frac{1}{2}$  lb. of madder and 2 oz. of logwood chips in 1 gall. of water, and brush well over

the wood while hot; when dry, go over the whole with pearlash solution, 2 drams to the quart. **Light.**—2. Put 2 oz. of dragon's-blood, well bruised, into 1 quart of oil of turpentine; let the bottle stand in a warm place, shake frequently, and when dissolved, steep the work in the mixture. 3. Raw and burnt sienna. Grind the raw sienna on a painter's stone, mixed with beer; this will give a very light mahogany stain. Then grind the burnt, and add as much of it to the raw sienna as is required to make it the necessary colour; lay it on moderately thin with a brush, and then wipe it off with a piece of wadding or cotton wool; when dry, oil, size, varnish, or polish it, whichever required. It is very cheap.

**To Remove Stains from Mahogany.**—Mix 6 oz. of spirit of salt and  $\frac{1}{2}$  oz. of powdered salt of lemons. Drop a little of this mixture on the stains, and rub well with a cork until they disappear, then wash off with cold water.

**Imitating Rosewood.**—1. A transparent liquid rose-pink, used in imitating rosewood, consists in mixing  $\frac{1}{2}$  lb. of potash in 1 gall. of hot water, and  $\frac{1}{2}$  lb. of red sanders wood is added thereto; when the colour of the wood is extracted, 2 $\frac{1}{2}$  lbs. of gum shellac are added and dissolved over a quick fire; the mixture is then ready to be used on a groundwork made with logwood stain. 2. Boil  $\frac{1}{2}$  lb. of logwood in 3 pints of water till it is of a very dark red, add  $\frac{1}{2}$  oz. of salts of tartar. While boiling hot, stain the wood with two or three coats, taking care that it is nearly dry between each; then with a stiff flat brush, such as is used by the painters for graining, form streaks with black stain. This imitation will very nearly equal the appearance of dark rosewood. 3. Stain with the black stain, and when dry, with a brush as above dipped in the brightening liquid, form red veins in imitation of the grain of rosewood. A handy brush for the purpose may be made out of a flat brush, such as is used for varnishing; cut the sharp points off, and make the edges irregular by cutting out a few hairs here and there, and you

will have a tool which will actually imitate the grain.

**Bronzing Inlaid Work.**—A method used for decorating inlaid work is the use of a bronzing liquid, which consists of a fluid bronze composition formed by combining metallic powder of gilding and bronze powder with collodion, which composition is capable of being applied as a bronze liquid to surfaces of wood, iron, or any solid material, for the purpose of coating the same for decoration or preservation.

**To Imitate King or Botany Bay Wood.**—Boil  $\frac{1}{2}$  lb. of French berries in 2 quarts of water till of a deep yellow, and while boiling hot give two or three coats; when nearly dry, form the grain with black stain, which must also be used hot. For variety, to heighten the colour, after giving it two or three coats of yellow, give one of strong logwood liquor, and then use the black stain as directed.

**Black Stain.**—Boil 1 lb. of logwood in 4 quarts of water, add a double handful of walnut peel or shells; boil it up again, take out the chips, add a pint of the best vinegar, and it will be fit for use; apply it boiling. This will be improved, if, when dry, a solution of green copperas, an ounce to a quart of water, is applied hot over the first stain.

**Black Stain for Immediate Use.**—Boil  $\frac{1}{2}$  lb. of chip logwood in 2 quarts of water, add 1 oz. of pearlash, and apply it hot to the work with a brush. Then take  $\frac{1}{2}$  lb. of logwood, boil it as before in 2 quarts of water, and add  $\frac{1}{2}$  oz. of verdigris and  $\frac{1}{2}$  oz. of copperas; strain it off, put in  $\frac{1}{2}$  lb. of rusty steel filings; with this go over the work a second time.

**Brown Stain.**—Paint over the wood with a solution made by boiling 1 part of catechu, nutch, or gambier, with 30 parts of water and a little soda. This is allowed to dry in the air, and then the wood is painted over with another solution made of 1 part of bichromate of potash and 30 parts of water. By a little difference in the mode of treatment, and by varying the strength of the solutions, various shades of colour may be given with these materials, which

will be permanent, and tend to preserve the wood.

**Red Stain.**—1. Take 1 lb. of Brazil wood to 1 gall. of water, boil 3 hours with 1 oz. of pearlash, brush it hot on the wood, and while hot brush the wood with a solution made with 2 oz. of alum in 1 quart of water. 2. An infusion of Brazil wood in stale urine, in the proportion of a pound to a gallon for wood; to be laid on when boiling hot, and should be laid over with alum water before it dries. Or, a solution of dragon's-blood in spirits of wine may be used.

**Red Stain for Bedsteads and Common Chairs.**—Archil will produce a very good stain of itself when used cold; but if, after one or two coats being applied and suffered to get almost dry, it is brushed over with a hot solution of pearlash in water, it will improve the colour.

**Walnut Stain.**—Water, 1 quart; washing soda,  $1\frac{1}{2}$  oz.; Vandyke brown,  $2\frac{1}{2}$  oz.; bichromate of potash,  $\frac{1}{2}$  oz. Boil for 10 minutes, and apply with a brush, in either a hot or cold state.

**Oak Stain.**—Equal parts of American potash and pearlash—2 oz. of each to about a quart of water. This gives a good stain; it requires careful application, as the American potash is a strong solvent, and will blister the hands; it softens a good paint-brush once using, so use a very common brush, and apply the staining with it. Keep it corked up in a bottle, and it is always ready for use; if it strikes too deep a colour, add more water.

**Ebony Stains.**—1. Stain work with the black stain, adding powdered nutgall to the logwood and copperas solution, dry, rub down well, oil, then use French polish made tolerably dark with indigo, or finely-powdered stone blue. 2. Hold an ordinary slate over gas, lamp, or candle, until it is well smoked at the bottom, scrape a sufficient quantity into French polish, and well mix; then polish the article in the ordinary way. If there are any lumps gently rub them down and apply another coat. 3. Prepare a decoction of logwood by adding a small

handful of chips to a pint of rain water. Allow this to simmer until reduced one-fourth, and whilst the liquor is hot dress the work to be ebonized two or three times. To the remainder of the liquor add two bruised nut-galls, a few very rusty nails, bits of iron-hooping, or a piece of sulphate of iron the size of a walnut, and as much more rain water as will make about three-quarters of a pint of liquor. Apply this, which will be a black stain, hot as before, giving two coats, and when thoroughly dry, polish with ordinary French polish, to which sufficient powdered thumb-blue has been added to perceptibly colour the polish. Use a glazed pipkin in which to prepare the stain. Take care that no oil or grease comes in contact with the brushes used or the surface of the wood until ready for polishing. Let each coat of stain dry before the next is added, and rub down with well-used, fine glass-paper. Sycamore, chestnut, and plane-tree, are the best woods for ebonizing in the above manner. 4. Infuse gall-nuts in vinegar in which rusty nails have been soaked, rub the wood with the infusion, dry, polish, burnish. 5. Stain in the first place with a hot saturated solution of logwood, containing a little alum; and, when dry, brush it over with common writing ink.

**Graining Woods.**—**GROUNDS.**—These are generally applied by the house painter, ready for the grainer. When the grounds are finished to the tint required for the woods to be imitated, they must be left to get quite dry; the work is then ready for the graining operations.

**Mahogany.**—Orange chrome, Venetian red, and white-lead mixed in such proportions as will give the desired tint. Vermilion, raw and burnt sienna, are also employed to modify the shades.

**Rosewood.**—Vermilion, Venetian red, a little scarlet lake, and white-lead. For ordinary work the scarlet lake may be dispensed with.

**Bird's-eye Maple and Satin Wood.**—White-lead mixed with a little yellow ochre, care being taken not to make the ground of too dark a tint, as the varnish

to be afterwards applied will still further darken it. All the colours for these light grounds must be rubbed quite smooth, and be well strained.

**Dark Oak.**—1. Raw sienna, burnt umber, white-lead, and Venetian red. 2. Yellow ochre, Venetian red, and white-lead.

**Wainscot Oak.**—**Dark.**—Oxford ochre, white-lead and Venetian red, or chrome, yellow ochre, and white-lead.

**Light.**—Yellow ochre and white-lead; the desired tint is obtained by the use of more or less of the yellow ochre.

**Oak Graining in Oil.**—1. Vandyke brown and raw sienna for dark oak, or finely-ground burnt umber and raw sienna for a lighter tint, mixed with equal parts of turpentine and linsed oil. Add patent driers. Lay this colour on thinly and evenly with a large brush; it does not dry very rapidly. Care must be taken not to lay on too much colour, or it is liable to have a dirty appearance. Stipple with a dry dusting brush, so as to distribute the colour evenly over the work. As in real oak it is invariably found that one side of a slab is coarser than the other, this peculiarity of pattern must be imitated in the combing process. Take a cross-cut gutta-percha comb, and draw it down one side of the panel, use a finer comb to complete it. This operation produces straight lines of the grain from top to bottom. Next take a fine steel comb, and go over all the previous combing; in drawing the comb down, give it a short, quick, wavy motion, or move it diagonally across the first lines, thus imitating the pores of the real wood. Cork combs may also be used, and some grainers use a coarse steel comb, with a fold of thin rag placed over the teeth. By a skilful combination of the combs, and a tasteful variation in their use, the different kinds of oak may be most successfully imitated. In graining joints of the various portions of a piece of a work, it must be remembered that in the real wood some of the grain would necessarily have a perpendicular direction, and another part would run horizontally, and that one part would

appear lighter than another, owing to the different angles in which it would receive the rays of light. After combing, the figure, or veining, must be wiped out before the colour is dry. Hold several thicknesses of fine rag, or a piece of clean wash-leather over the thumb nail, wipe down a few veins, then move the rag or leather slightly, so as to present a clean surface for the next wipe. A piece of thin gutta-percha, softened in warm water, and pressed to the shape of the thumb, may be used to preserve the nail, but cannot be relied on to remove the colour so cleanly as the nail covered with rag or leather; it is useful for common work, as it protects the nail from injury and wear. After having wiped the figures, they must be softened in appearance by still further wiping the grain away from their edges with a small roll of clean rag, so as to imitate the appearance of the wood, where the grain is always darker than the parts next to it. When the oil colour is dry it must be overgrained.

*Overgraining.*—This operation is performed in the same manner both upon work which has been oil grained or spirit grained. In overgraining, water-colours are used; and, in order to make them adhere to the underlying graining, whether in spirit or in oil, it is necessary to prepare the work to receive them, otherwise they would run off the surface at once. One method is to rub dry powdered whiting quickly over the surface with a soft rag, removing superfluous powder afterwards, and the grainer can at once finish the work. Another plan, which is principally used when a large piece of work is in hand, is to rub a mixture of fullers' earth and water over the graining, and wait until it is perfectly dry before commencing to overgrain. Griaud Vandyke brown, or burnt umber in water, and thin with equal proportions of water and table-beer. The colour should be a trifle darker than the undergraining; a little practice will teach the tints that are best suited to the various woods to be imitated. The colour is applied by a

wide hog brush, drawn over the work, generally in the direction of the veins formed by the combing. There are several descriptions of overgraining brushes in use; those most generally employed are thin and flat, with occasional intervals between the tufts of hair. The knots and figures must be lightly touched up with the overgrainer, and the whole gone over quickly with a badger softening brush. The overgraining dries quickly, and the varnish may be then applied, although it is well to wait some hours, so as not to run any risk of removing the graining colour. Sometimes a tolerably strong solution of soda with a little burnt sienna is used for the figures, applying the mixture where these are required, and then washing over the work with a sponge and water. Wherever the soda has been applied, the graining colour will be removed. Go over the whole with a wash made of equal parts of table-beer and water, and then overgrain, as above described. As a general rule avoid harsh contrasts between the graining colour and the ground. 2. In the mixing of oil graining colour it is necessary that the colour should work clean and free. Sometimes the colour will work stiff and dirty, and in this state will not only produce dirty work, but will occupy thrice the time in rubbing in, compared with colour properly mixed. Oil graining colour also requires to be megilped—that is, oil colour alone will not stand when it is combed; the marks made with the comb will all run one into the other, and will thus be obliterated. To prevent this running, the colour requires to be megilped, so that the comb marks will retain the exact form left by the comb. This is accomplished by the use of beeswax, soft soap, hard soap, lime water, whiting, and pure water. When beeswax is used, the best means of dissolving it is to cut the wax into thin shavings or shreds; these are put into a suitable can half filled with pure ligseed oil, into which a red-hot poker is plunged, and stirred well. This will dissolve the wax thoroughly and mix