place it on a stone previously heated, and when the mixture begins to be in an eliquated state, stir it well with a palette knife, and keep adding more oil by a little at a time, until with the continuance of a gentle heat it assumes the colour of balsam of sulphur, then add, with a less degree of heat, turpentine in small quantities. 1 oz. of the precipitate of gold will make about 1 lb., more or less, of lustre, having more solidity and opacity than the *gold lustre*. The proportions of the fat oil of turpentine to the spirits of turpentine, are 1 part of the former to 3 of the latter.

SILVER or STEEL LUSTRE.—This is prepared by taking platina and dissolving it in aqua regia composed of equal parts of spirits of nitre and marine acid. The solution must be placed in a sand bath, at a moderate temperature; then take 3 parts of the spirits of tar, and 1 part of the solution of platina, mixing the solution with the tar very gradually, for as soon as the combination takes place, an effervescence will arise, the nitrous acid will evaporate and leave the platina in combination with the tar. After the above process has been performed, should the menstruum be found too thin and incapable of using, set it on a sand bath as before for a few hours; the spirit of the tar will evaporate, and by that means a proper consistence will be obtained. It must be used with spirits of tar.

Oxide of Platina. — Dissolve platina as for *silver lustre*. Let the solution fall into a large vessel of water at the temperature of blood-heat; the sal ammoniac must then be added, and the precipitate will immediately descend to the bottom of the vessel in an orange-colour powder; decant off the water, and repeatedly apply to the precipitate boiling water until the water becomes quite insipid; after being gradually dried it is then used for the purpose of producing a silver lustre in the following manner:—First, procure brown earthenware of a full soft glaze, and with a broad camel-hair pencil lay on all over the piece of ware the platina in solution, and fire it at a strong enamelling heat, by which it will acquire a shining steel-colour lustre; then take the oxide of platina mixed up with water to a thickish consistence, and lay it on the steel lustre, and fire it again in a kiln or muffle, but not to exceed a blood-red heat; it is then called silver lustre, being less resplendent, having more solidity and whiteness, and a very similar appearance to silver. On all white earthenware the platina in solution is perfectly sufficient to produce a silver lustre.

Bronze Gold.—2½ parts, burnish gold; 2, oxide of copper; 1, quicksilver; ½, gold flux. Having dissolved the copper in aqua fortis, it is again separated from its solvent and falls to the bottom of the vessel by the addition of iron; the precipitate of copper may be increased or diminished at discretion, which makes the bronze richer or poorer in colour according to the proportion of burnish gold contained in the mixture. It is chiefly used for ornamenting the handles and heads of jars, vases, and so on, and occasionally intermixed with burnish gold.

Solution of Gold.—Put 40 dwts. of aqua regia in a small bottle, to which add 5 dwts. of grain gold, the solution will immediately commence, and may be observed by the effervescence which arises at the time; when the solution is complete, the whole of the gold will be dissolved, which will be accomplished in about two hours if the acids be genuine, but when they are not, it will be requisite to apply heat to assist in facilitating the solution.

Solution and Oxide of Silver.—1 part of nitric acid, and 3 parts of boiling water; add one-third of its weight of silver, dilute with five times its quantity of water, then add a portion of common salt, stirring it all the time and immediately a white precipitate will fall to the bottom of the vessel; the liquor must then be decanted off and boiling water repeatedly added, until the water is quite insipid. This precipitate is the pure oxide of silver, and is the same as that used in the prepara-

tion of burnished gold and in staining of glass.

Solution of Tin.—2 parts of nitrous acid, and 1 part of muriatic acid, with an equal part of water; add granulated tin by small pieces at a time, so that one piece be dissolved before the next is added. This aqua regia will dissolve half its weight of tin; the solution when properly obtained is of a reddish brown or amber colour, but when gelatinous the solution is defective.

Oxide of Tin.—Take any given quantity of grain tin, and granulate it by melting the tin in an iron ladle; when in fusion pour it into a vessel full of cold water, by which means the tin will be reduced into small grains or particles adhering to each other; then take a biscuit dish previously lined with flint, spread it slightly over with pounded nitre, take the granulated tin, and lay it on the dish 2 inches in thickness, adding a little more nitre on the top; 1 lb. of nitre will be sufficient to oxidate 5 lbs. of granulated tin; the dish containing the tin and nitre is to be calcined in a reverberatory furnace or glazing oven; particular attention is required in seating it, so that plenty of room remains to admit a free access of air to pass over the metal, otherwise it is impossible to obtain the whole of it in an oxidated state.

Balsam of Sulphur.—Take 2 parts of flour of sulphur, and 4 parts of turpentine; put them in a vessel over a slow fire until the sulphur is completely dissolved; after which add 8 parts of linseed oil, and continue the same degree of heat for about one hour; previous to becoming cold strain it through a piece of cloth.

Regulus of Zaffre.—112 parts, zaffre; 57, potash; 18½, charcoal. The charcoal being pulverized, and all the materials mixed up together, they are put into large-sized crucibles capable of holding from 3 to 4 quarts, and filled quite full, then placed in a strong brick-built reverberatory furnace, commencing with a slow fire, and continued for some time, but as soon as it is heated to a red-heat, it will require a considerably stronger fire before the cohesion between the different particles is sufficiently destroyed. This operation will be complete in about ten hours, the weight of the regulus being from 31 to 33 lbs.; on examining the scoria, if there remains mixed with it small pieces of metal like small shot, or when pounded, if the scoria has a bluish cast, the fire has not been strong enough; there is but little danger to be apprehended from the most intense heat, provided the particles in fusion do not perforate the crucibles. At the bottom of each cake of regulus there will be bismuth slightly adhering, which is easily separated without the application of any great degree of heat, by placing the cakes upon an iron plate or pan, which will soon bring the bismuth into a state of liquefaction, and it can then be separated from the regulus.

To Refine Regulus of Zaffre.—50 parts, regulus of zaffre; 6, potash; 3, sand; pulverize and well mix, then put in crucibles holding about 1½ lb. each, and fire in a reverberatory furnace, commencing with a slow fire and gradually increase the heat for about eight hours; by that time the regulus will have fallen to the bottom of the crucible, and the scoria found at the top will be of a blackish green; it will then be necessary that another course of refining should take place, in order that the regulus may be obtained in a more perfect state of purity.

Blue Calx.—1. 30 parts, refined regulus of zaffre; 1, plaster; ½, borax. 2. 30 parts, refined regulus of cobalt; 1, plaster; ½, borax. These materials to be made very fine, and well mixed; put the mixture in earthenware biscuit cups 1½ in. high, 3 in. in diameter, and 1½ in. thick, filled nearly to the top; set them in a furnace, the fire to be increased until the mixture is in a state of fusion, the same degree of heat must be continued for about six hours afterwards, and then the fire hastily slackened; this operation will occupy from twelve to thirteen hours; at the top of the cups will be found a blue calx separated from the nickel; but as a large proportion of blue will still remain in the nickel when sunk to the bottom of the cups,

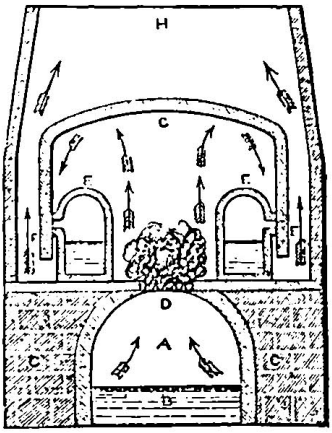
it will be necessary, in order to procure the whole of the blue contained, to pursue precisely the same method over again.

Cobalt Blue, or Regulus of Cobalt.—60 parts, cobalt ore; 50, potash; 25, sand; 10, charcoal. Work the same way as for *regulus of zaffre*.

To Refine Regulus of Cobalt.—50 parts, regulus of cobalt; 6, potash. Refine as for *regulus of zaffre*; the operation of refining must be repeated until the scoria is of a bright colour and of a slight bluish hue; then spread the purified metal, finely pulverized, half an inch thick, on flat pieces of earthenware covered with flint; place in a reverberatory furnace, and apply a moderate degree of heat for a few hours.

Glass Making.—The furnace in which glass is made is a large circular building capable of holding about six pots or vessels, in which the glass is melted. Fig. 1 is an ordinary arrange-

Fig. 1.



ment of this furnace. It is built upon an arch, and the space underneath, included within the arch, is called the cave, as at A. This apartment can be closed by the doors C C, to regulate the draught, as all the air necessary for the support of the fire must enter at these doors. On the upper part of the cave is placed a grate D, to support the fire. The ashes pass through this grate and fall into a tank of water B. Around this grate pillars are constructed, which, being hollow, serve as flues F F. Resting upon these pillars is an iron dome G, and on this is built the principal chimney H. Between these pillars are placed the pots E E, which, from the peculiar construction of the furnace, receive the heat equally on all sides; for, as the flame ascends it strikes the dome, and is reverberated, taking the direction pointed out by the arrows. The pots are constructed in the form of a cylinder, with a hemispherical top, having a small aperture on one side for the admission of the materials, and their removal when formed into glass. When the pots are placed in the furnace, they are so arranged that their openings are on the outside of the fire; they are then built in by a temporary wall, except the orifices, so that no dust or smoke can enter so as to injure the glass. The materials for these various kinds of glass are placed in the pots, and exposed to the heat of the furnace for upwards of forty-eight hours, during one-half of which time the heat is gradually increased, and during the other half gradually decreased, until the *metal*, as the workmen term the glass, is in a fit state for working. During the time the materials are in the pot, the workman takes out a portion, from time to time, on an iron rod, and examines it when cold, to see whether it is free from air bubbles and of good colour. If the materials employed be very impure, there rises to the surface a scum, which is called sandiver or glass gall, and which resembles large flakes of snow.

Flint Glass is employed for making lenses, decanters, drinking glasses, and owes its capability of being thus easily fashioned to the lead contained in it. The following quantities form a very excellent glass:—Fine white sand, 300 parts; red-lead, or litharge, 200; refined pearlashes, 80; nitre, 20; arsenic and manganese, a smaller quantity.

CROWN GLASS is a compound of silica, potash or soda, and lime. It is employed as a window glass, and contains no lead. The proportions for its formation are—Fine white sand, 100 parts; carbonate of lime, 12; carbonate of soda, 50; clippings of crown glass, 100.

BOTTLE or GREEN GLASS is made of the commonest materials, in about the following proportions:—Sand, 100 parts; kelp, or impure soda, 30, wood ashes, 40; potter's clay, 100; cullet, or broken glass, 100.

PLATE GLASS.—Great care is required in the choice of materials, and the management of the process for this glass. The following proportions are used:—Finest white sand, 720 parts; best soda, 450; lime, 80; nitre, 25; cullet, or broken plate glass, 425.

COMMON WINDOW GLASS.—100 parts, sand; 35, chalk; 35, soda-ash, and a considerable quantity of broken glass or cullet.

COLOURS FOR GLASS.—Oxide of gold is employed to impart to glass a beautiful ruby colour. Sub-oxide of copper gives a red colour. Silver, in all states of oxidation, gives a variety of beautiful yellow and orange colours to glass. Antimony, lead, and silver, in combination, are employed to produce the inferior yellow colour. The oxides of iron give to glass various shades of green, yellow, red, and black. Oxide of chromium gives a fine green, and oxide of cobalt a splendid blue. The colour most valued, next to that produced by gold, is the yellow communicated by oxide of uranium, and which has an appearance resembling shot silk. White glass or enamel is made by adding either arsenic or the oxide of tin to the melted *metal*. The various metals employed in colouring glass are also used in the manufacture of artificial gems, and by their means the colour and general appearance are well imitated.

STRASS.—Pure caustic potash, 16 parts; white-lead, 85; boracic acid, 4½; arsenious acid, ½; finest white sand, 50. These materials are carefully selected, placed in a Hessian crucible and fused in a porcelain furnace for a day and a night, then cooled very gradually. Used to imitate the diamond. Other precious stones are imitated by adding to the strass the metallic oxides, as in *colours for glass*.

SOLUBLE or WATER GLASS.—Mix well 200 grains of fine sand, and 600 of fine carbonate of potassa; fuse in a crucible capable of holding four times as much. Carbonic acid escapes; the silica and potassa combine and form glass. Pour out the glass, which is commonly termed silicated potassa, on an iron plate. The compound formed in this manner is pure silica soap.

HARD GLASS FOR RECEIVING COLOUR.—Best sand, cleansed by washing, 12 lbs.; pearlashes, or fixed alkaline salt purified with nitre, 7 lbs.; saltpetre, 1 lb.; and borax, ½ lb. The sand being first reduced to powder in a mortar, the other ingredients should be put to it, and the whole well mixed by pounding them together.

Glazing Windows.—*Crown glass* is made in circular disks blown by hand; these disks are about 4 ft. diameter, and the glass averages about $\frac{1}{16}$ in. thick. Owing to the mode of manufacture there is a thick boss in the centre, and the glass is throughout more or less striated or channeled in concentric rings, frequently curved in surface, and thicker at the circumference of the disk. Consequently in cutting rectangular panes out of a disk there is a considerable loss, or at least variety in quality: one disk will yield about 10 sq. ft. of good window glass, and the largest pane that can be cut from an ordinary disk is about 34 × 22 in. The qualities are classified into *seconds*, *thirds*, and *fourths*.

Sheet glass is also blown by hand, but into hollow cylinders about 4 ft. long and 10 in. diameter, which are cut off and cut open longitudinally while hot, and therefore fall into flat sheets. A more perfect window glass can be made by this process, and thicker, and capable of yielding larger panes with less waste. Ordinary sheet glass will cut to a pane of 40 × 30 in., and some to 50 × 36 in. It can be made in thicknesses from $\frac{1}{50}$ in. to ¼ in.

Plate glass is cast on a flat table and rolled into a sheet of given size and thickness by a massive metal roller. In this form, when cool, it is *rough plate*.

Ribbed plate is made by using a roller with grooves on its surface. Rough and ribbed plate are frequently made of commoner and coarser materials than polished plate, being intended for use in factories and warehouses.

Polished plate is rough plate composed of good material and afterwards polished on both sides, which is done by rubbing two plates together with emery and other powders between them. Plate glass can be obtained of almost any thickness from ⅛ in. up to 1 in. thick, and of any size up to about 12 × 6 ft.

In the glazing of a window the sizes of the panes, that is to say, the intervals of the sash-bars, should be arranged, if practicable, to suit the sizes of panes of glass which can conveniently be obtained, so as to avoid waste in cutting; this consideration is of more consequence in using crown and sheet glass than with plate glass. The woodwork of the sash should receive its priming coat before glazing, the other coats should be put on afterwards. With crown glass, which is sometimes curved, it is usual to place the panes with the convexity outwards. When the glazier has fitted the pane to the opening with his diamond, the rebate of the sash-bar facing the outside of the window, he spreads a thin layer of putty on the face of the rebate and then presses the glass against it into its place, and holding it there, spreads a layer of putty all round the side of the rebate, covering the edge of the glass nearly as far as the face of the rebate extends on the inner side of the glass, and bevelling off the putty to the outer edge of the rebate. The putty is then sufficient to hold the pane in its place, and hardens in a few days. The glass should not touch the sash-bar in any part, on account of the danger of its being cracked from any unusual pressure; there should be a layer of putty all round the edges. This precaution is especially necessary in glazing windows with iron or stone mullions or bars.

Glass Painting and Staining.—The different compounds for painting glass are glasses of easy fusion, chiefly coloured with metallic oxides ground, and laid on the glass with spirits of turpentine. In the production and modification of glass colours much depends on the different preparations of the metals, on the small proportion of the metallic oxides employed in proportion to the vitreous mass, on the degree of fire and time of its continuance, and on the purity of each ingredient intended for vitreous mixtures; from hence difficulties arise which even a skilful operator cannot always remove, and which often frustrate his intention. Having made choice of the subject to be painted, correctly draw the same on a paper exactly the size intended to be on the glass, then place the different pieces in regular order on the drawing and trace the outlines therefrom on the glass; when the tracing is quite dry the ground colours may be washed in together with the dark and prominent shades, and also the stains required. The stains are laid on in various thicknesses, according to the depth of colour required, and when they are dry the glass is ready to be burned in a muffle or kiln constructed for the purpose. The panes of glass are laid on sheets of iron, or earthenware bats, the size of the glass, previously spread over with dried ground flint, to prevent the surface of the glass from being defaced. After the first burning the stain is washed off with warm water, which will bring to view every part of the subject, in fact, every shade according to the thickness of colour applied; to heighten the colour paint on each side of the glass, and burn it a second time. The glass will require from four to six firings, the exact number of firings depending on the subject, the degree of perfection required, and the manner of execution; but after each burning, the pieces of glass will want less labour, some of the colours and stains being perfect at the first and second burning, and few require the utmost quantity. The proper degree of heat to which the glass must be exposed in the muffle is ascertained by

taking out at different intervals small pieces of glass, arranged for the purpose, on which are laid similar colours to those being fired. After the glass is burned it requires great precaution in cooling, for if suddenly cooled it is apt to fly, consequently all sudden changes of temperature should be avoided.

RED ORANGE and YELLOW STAINS.—12 parts, green vitriol calcined; 1, oxide of silver. The vitriol must be calcined to a reddish colour, and repeatedly washed with boiling water until it is completely freed from its acid, which will be known by the water being insipid to the taste, then triturate the silver and vitriol together in a mortar, after which grind them up with spirits of tar for use. Various temperatures in burning produce various coloured stains, the highest a red, a less an orange, and so on to a yellow; but to procure a very deep red, the colour must be laid upon both sides of the glass.

WHITE ENAMEL FOR PAINTING GLASS.—3 parts, borax calcined; 2, flint; 1, oxide of tin; 1, Cornish stone. The basis of this enamel, which is in general opaque, may also be employed in assimilating the opaque natural stones. These ingredients must be well mixed up together, and fused in an air furnace in a crucible, the fire at first applied very gradually, and the whole repeatedly stirred with an iron rod. The mixture by this calcination, and by being kept for some time in fusion in an intense heat, acquires its fusibility and opacity.

PURPLE. — 1. 20 parts, prepared purple; 2½, *enamel flux* (2); 1, *white enamel*. 2. 20 parts, prepared purple; 10, blue process; 5½, *enamel flux* (2); 1, *white enamel*.

ROSE COLOUR.—20 parts, prepared rose colour; 1, *white enamel*. The purples and rose colours for glass painting are nearly the same mixtures as those used for porcelain painting, with the addition of a small proportion of flux and white enamel, the latter gives firmness to the colour; in the course of working the rose colour, if a very small quantity of purple be added, the colour will be perceivably benefited.

RED.—1 part, terra de sienna; 3, *enamel flux* (2). The terra de sienna must be calcined over a slow fire until its colour becomes of a dark red, after which washed several times in boiling water and ground with the flux for use.

TRANSPARENT ORANGE.—1 part, oxide of silver; 10, *enamel flux* (2); 10, *enamel flux* (3); 1, *white enamel*.

YELLOW.—1 part, *yellow, under glaze*, p. 46; 3, *enamel flux* (2); ½, *white enamel*.

DARK BROWN.—1 part, highly calcined copperas; 3½, *enamel flux* (3).

RED BROWN.—1 part, *black*; 1, *red*; 1, *enamel flux* (4).

LIGHT BROWN.—1 part, easy calcined umber; 3½, *enamel flux* (2).

GREEN.—1. 5 parts, cornelian red; 1, prepared purple. 2. 2 parts, *blue*; 1, *yellow*.

BLUE.—1. 8 parts, flint glass; 3, red-lead; 1, potash; 1, blue calx; ½, common salt. 2. 4 parts, borax; 4½, flint glass; 1, flint; ½, potash; ½, prepared purple; 1, blue calx. In preparing these blues, let the materials be calcined in an air furnace, and the whole mass kept in a state of fusion for some time, a fine blue glass enamel will be produced; the cobalt blue calx should be of the finest quality that possibly can be procured, and free from all impurities.

BLACK.—1. 1 part, highly calcined umber; 2, calcined borax; 1, red-lead 1, blue calx. 2. 1 part, manganese; 1, black flux. The best Turkey umber should be procured for the first process, and calcined at the most intense heat that can be produced in an air furnace, after which pound and mix up with the other materials; then calcine the whole together in an air furnace, the degree of heat will be sufficient when the whole mass is in fusion.

BLACK FLUX, *for glass staining*.—15 parts, red-lead; 5, borax; 5, flint; 1½, oxide of blue vitriol.

INDIGO BLUE.—1 part, precipitate of gold; 4½, *enamel flux* (4); ½, *white enamel*. These ingredients are simply ground

together for use. They produce a beautiful colour on glass, of a fine purple hue. This very expensive colour is adapted principally for painting the draperies of figures, and is very susceptible of being injured by a high degree of heat.

ETCHING AND DEADENING COLOUR.—1. 7 parts, red-lead; 2, calcined borax; 2, flint; 1, oxide of tin. 2. 8 parts, red-lead; 6, flint glass; 3, flint; ½, green copperas. The materials of the last two processes must be finely mixed and calcined in an air furnace, each process separately, after which take 2 parts of No. 1 and 3 parts of No. 2, mix them together, and repeat the calcination again in an air furnace; then pound and grind this frit for use, but be particular that it is ground very fine, for much depends on the particles being minutely mixed previous to using. The composition is afterwards laid on the glass with water, and a small quantity of refined sugar dissolved in spring water applied occasionally; the solution of sugar must be of the consistence of thick oil; should too large a quantity of the solution be added, and by that means condensate it too much, add a few drops of acetous acid to the menstruum, it will immediately regain a proper consistence, and not at all injure the colour. When the deadening is laid on the glass, the figures must be engraved or etched with a pointed instrument made of wood, bone, or ivory, suitable to the subject, and afterwards burned in a kiln or muffle appropriated for the purpose. It fires at a less temperature than stained glass, although in some instances it will do in the same kiln.

To Transfer Engravings on Glass.—Metallic colours prepared and mixed with fat oil, are applied to the stamp on the engraved brass or copper. Wipe with the hand in the manner of the printers of coloured plates; take a proof on a sheet of silver paper, which is immediately transferred on the tablet of the glass destined to be painted, being careful to turn the coloured side against the glass; it adheres to it, and so soon as the copy is quite dry, take off the superfluous paper, by washing it with a sponge; there will remain only the colour transferred to the glass, which will be fixed by passing the glass through the ovens.

Annealing Glass.—This consists in putting the glass vessels, as soon as they are formed, and while they are yet hot, into a furnace or an oven, not so hot as to re-melt them, and in which they are suffered to cool gradually. It is found to prevent their breaking easily, particularly on exposure to heat. In large works, annealing is performed by passing the glass through the oven, by means of revolving trays constructed for the purpose.

Cutting Glass.—To cut glass vessels neatly, heat a rod of iron to redness, and having filled the vessel the exact height you wish it to be cut with oil of any kind, proceed very gradually to dip the red-hot iron into the oil, which, heating all along the surface, the glass suddenly chips and cracks right round, when you can lift off the upper portion clean by the surface of the oil. If a tube is required to be cut, notch the tube at the point where it is to be divided with the edge of the file, or of a thin plate of hard steel, or with a diamond; after which press upon the two ends of the tube, as if to enlarge the notch, or what is better, give the tube a slight smart blow. This method is sufficient for the breaking of small tubes. Many persons habitually employ an agate, or a common flint, which they hold in one hand, while with the other they rub the tube over the sharp edge of the stone, taking the precaution of securing the tube by the help of the thumb. For tubes of great diameter, employ a fine iron wire stretched in a bow, or, still better, the glass-cutter's wheel; with either of these, assisted by a mixture of emery and water, you can cut a circular trace round a large tube, and then divide it with ease. When the portion which is to be removed from tube is so small that you cannot easily lay hold of it, cut a notch with a file, and expose the notch to the point of a candle flame; the cut then flies round the tube. A good plan of cutting glass is to make

use of a piece of iron heated to redness, an angle or corner of which is to be applied to the tube at the point where it is to be cut, and then, if the fracture is not at once effected by the action of the hot iron, plunge suddenly into cold water. After having made a notch with a file, or the edge of a flint, you introduce into it a little water, and bring close upon it the point of a wire, previously heated to the melting point. This double application of heat and moisture obliges the notch to fly round the glass. Glaziers use for cutting glass a diamond splinter mounted in a holder.

To Draw on Glass.—Grind lamp-black with gum-water and some common salt; draw the design with a pen or hair pencil; or use a *crayon* made for the purpose.

Stencilling on Glass—Writing on Glass.—Stencil plates may be cut out of thin sheets of metal or cardboard, in the same manner as for wall decoration, &c. If varnish colours are employed, lay them on as evenly as possible, through the perforations in the plate, and harden afterwards in a stove or oven. The metallic preparations used in glass staining and painting are also available, but require firing in a muffle, or a china painter's stove. Should the process commonly called embossing be wanted, paint the portions of glass left uncovered by the spaces in the stencil plate with Brunswick black, dip or cover with hydrofluoric acid, wash in clear water and remove the black ground. Every part that was covered will then present a polished even surface, the remainder will have been eaten into by the acid. If the raised parts are to have a frosted appearance, rub them with a flat piece of marble moistened with fine emery and water. For putting patterns or lines on glass with a wheel, there are two methods, one followed by glass cutters, the other by the engravers on glass. The first-mentioned, rough in the pattern, with an iron mill supplied with a trickling stream of sand and water, smooth out the rough marks on a wheel of York or Warrington stone, polish on a wooden wheel of willow or alder moistened with pumice powder, and finish on a cork wheel with putty and rotten-stone. The engraver cuts in and roughs the pattern with copper wheels, aided by emery of various degrees of fineness, and olive or sperm oil, and polishes the portions intended with leaden disks and very fine pumice powder and water.

Painting Glass for the Magic Lantern.—Draw on paper the size of the glass the subject you mean to paint. Fasten this at each end of the glass with paste, or cement, to prevent it from slipping. Then reverse the glass so as to have the paper underneath, and with some very black paint, mixed with varnish, draw with a fine camel-hair pencil very lightly the outlines sketched on the paper which are reflected on the glass. It would add to the natural resemblance if the outlines were drawn with a strong tint of each of the natural colours of the object; but in this respect the artist must please his fancy. When the outlines are dry, colour and shade the figures; but observe to temper the colours with strong white varnish.

Pigments for Magic Lantern Slides.—The only pigments available are the transparent and a few of the semi-transparent. The transparent include (beginning with the best for the purpose) Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, crimson lake, and ivory black. The semi-transparent include raw sienna, burnt sienna, cappah brown, and Vandyke brown. No particular method of mixing the colours is requisite. Ordinary oil or water colours will do, but they must be ground extremely fine. The pencils must be small and their points unexceptionable. Camel's-hair is preferable to sable for painting upon glass, its elasticity being less, and the trouble of working out the brush marks, which must always be carefully attended to, not so great. The best vehicle to use for thinning the colours is ordinary megilp, and not a drop more than is necessary for properly working should be added, for if the colours be made too thin they will run into each other and utterly ruin the painting. If water colours are

preferred, the best medium for laying on the first wash of colour is a hot solution of transparent gelatine. When this is dry and cold it admits of shading and finishing without being disturbed, provided the pencil be handled gently and the medium be cold water. The oil paintings require no varnishing, but the transparency of the water colours is much heightened by a thin coat of the purest mastic varnish. In colouring the pictures the quality of the light which is to show them must be borne in mind. If it be the lime light, approximate as nearly as possible to nature; but if it be the light of an oil lamp, remember that its rays are greatly deficient in blue, the yellow proportionately preponderating, and arrange the tints accordingly: for instance, the greens must be much bluer than natural, the yellows must incline to orange, and all shades of violet (the complementary of yellow) wholly eschewed.

Glass Cleaning.—Grease may be dissolved from glass by means of carbonate soda, carbonate potass, or better still, by caustic soda, made thus:—10 parts of carbonate soda are dissolved in 100 parts of water (10 oz. to 100 oz.), and heated to ebullition in a clean untinned iron vessel; 8 parts of good quicklime are meanwhile slaked in a covered basin, and the resulting hydrate of lime added, little by little, to the boiling solution of carbonate, with frequent stirring. This will give a very strong caustic solution, and should be used with care. Keep your hands out of the solution, and dip the glass in by means of the pliers, keeping them moving while in the solution. When the grease is dissolved or loosened, scrub with a brush, well rinse in water, and dry.

Frosting Glass.—Roll up tolerably tightly a slip of tin, about 6 in. or 8 in. long and about 2 in. broad, or use a small flat piece of marble. Dip either of these in Croydon or glass-cutter's sand, moistened with water; rub over the glass, whether flat or round, dipping it frequently in a pail or pan of clear water. This is the method employed for frosting mugs, &c. For lamp glasses a wire brush is used, and they are chucked in a lathe. Panes of glass should be laid on a soft bed of baize, or coarse linen. If the frosting is to be very fine, finish with washed emery and water. As a temporary frosting for windows, mix together a strong, hot solution of sulphate of magnesia and a clear solution of gum arabic, apply warm. Or use a strong solution of sulphate of sodium warm, and when cool wash with gum-water to protect the surface from being scratched.

Drilling Glass.—Glass can be drilled with a common drill, but the safest method is to use a brooch drill. No spear-pointed drill can be tempered hard enough not to break. The brooch can either be used as a drill with a bow, or by the hand. It should be selected of such a bore that it will make a hole of the required size, at about one inch from the end. It should be broken off sharp with a pair of pliers, at about an inch and a half, and when the sharp edges are blunted by drilling, a fresh end should be made by breaking off an eighth of an inch, and so on, until the hole is bored. It is always desirable to drill from both sides, as it prevents the glass from breaking; drill lightly, and lubricate with spirits of turpentine and oil of lavender, or a little camphor instead of oil of lavender. Holes may be drilled through plate glass with a flat-ended copper drill and coarse emery and water. The end of the drill will gradually wear round, when it must be re-flattened, or it will not hold the emery. Practically, however, the best means of drilling holes in glass is by using a splinter of a diamond. A brass drill is made to fit the drill-stock, sawn down a little way with a notched knife to allow the splinter to fit tight, and the splinter fixed in the split wire with hot shellac or sealing-wax. The drill is to be used quite dry and with care. If the hole to be drilled is wanted larger than the tool, drill a number of small holes close together to form a circle as large as the hole required, then join the holes with a small file. A splinter of diamond may be bought for 2s. (or ·50) big enough to drill a ¼ in. hole.

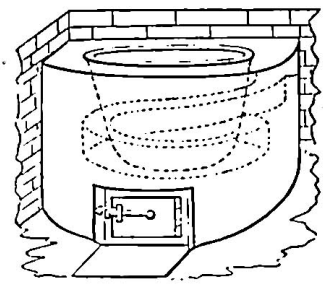
Darkening Glass.—The following, if neatly done, renders the glass obscure yet diaphanous:—Rub up, as for oil colours, a sufficient quantity of sugar of lead with a little boiled linseed oil, and distribute this uniformly over the pane, from the end of a hog-hair tool by a dabbing, jerking motion, until the appearance of ground glass is obtained. It may be ornamented, when perfectly hard, by delineating the pattern with a strong solution of caustic potash, giving it such time to act as experience dictates, and then expeditiously wiping out the portion it is necessary to remove.

Bending Glass Tubes.—If a sudden bend is wanted, heat only a small portion of the tube to a dull red-heat, and bend it with the hand held at the opposite ends. If the bend is to be gradual, heat an inch or two of it in length, previous to bending it. If a gradual bend on the one side, and a sharp one on the other, as in retorts, a little management of the tube in the flame, moving it to the right and left alternately at the same time that it is turned round, will easily form it of that shape. In bending glass, the part which is to be concave is to be the part most heated. An ordinary gas flame is quite sufficient to bend glass by, but that of a spirit lamp is better.

Glass, to Powder.—Make a piece of glass red hot in the fire, and while in this state plunge it into cold water; it will immediately break into powder; this must be sifted and dried; it is then fit for making glass paper, for filtering varnishes, and for other purposes.

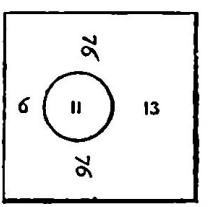
Manufacture of Varnishes.—The building in which varnish is made ought to be quite detached from any other building whatever, and have a door-way in the centre with folding doors made to lift off the hinges. Let the roof of the building slope to the front; fix also in each end wall a frame and door made to lift off the hinges, so that, when necessary, there may be a free draught through the premises. Let three skylights be made and fixed in the roof, not directly over the furnaces, but on one side, so as to throw light on the furnaces. The skylights and flaps must be well secured by lead flushings, to prevent wet getting in, which might be attended with serious consequences. In the left-hand corner, against the back wall, dig out a foundation and fix over a furnace the *set pot*, used for boiling

Fig. 2.



oil, gold size, japan, and Brunswick black. Dig out a foundation facing the front door against the back wall for the boiling furnace, Fig. 2; against the back wall, in the right-hand corner, dig out a foundation for the gum furnace, Figs. 3 and 4; this and all the other fur-

Fig. 3.

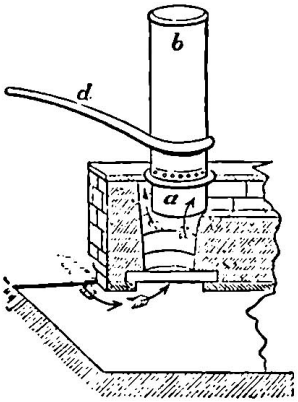


naces require to have slow fires kept in them for a day, in order to dry them slowly, and prevent their cracking. Fig. 3, the top plate, is of cast iron.

Gum pot.—Procure a copper gum pot to fit into the last furnace, Fig. 4. The bottom *a*, Fig. 4, is hammered out of a solid block of copper, and fashioned, all of one piece, exactly like a hat without the brim. The upper part of the pot *b*, is made of sheet copper, of a cylindrical

form, 10 in. diameter at the top, and 2 ft. 2 in. high, about $\frac{3}{8}$ in. thick; the

Fig. 4.



lower part of the cylinder is then riveted to the bottom with copper rivets, the heads of which are inside, and project through the lappings of the copper, flattened on both sides. Previous to riveting on the bottom, a flange of copper, of about $\frac{3}{8}$ in. in thickness, is fixed on to the bottom part, under the large rivets: it is fixed horizontally round the pot. Also previous to riveting on the bottom, put on the iron hoop *d*, $1\frac{1}{2}$ in. in breadth, to which is welded an iron handle, made 1 in. broad by 1 in. thick, gradually increasing to 2 in. in breadth, but decreasing in thickness. The length from pot to handle end 2 ft. 8 in.

Boiling pot.—Procure a copper pot *e* to fit furnace, Fig. 8, the bottom to be beat out of the solid, as the gum pot, and of the following dimensions: Diameter across the bottom outside, 20 in.; height of bottom, 7 in.; the cylindrical or body part of the pot to be 2 ft. 10 in. in depth, and joined to the bottom part with strong copper rivets, made to project through at least three-quarters of an inch, and to be well hammered inside and out; for, as there is no flange, the rivets must be large and strong to support the weight of the pot and its contents while boiling on the furnace plate. It ought to fit the plate neatly, yet so easy as to lift off freely. Seven inches below the mouth of the pot fix on two strong iron handles, one on each side, riveted through each end with two strong rivets; the space for the hands to be 7 in., and $1\frac{1}{2}$ in. in diameter, and to project 4 in. from the pot sides.

Small Tools.—In addition to the furnaces the varnish manufacturer requires two copper ladles, made to hold two quarts each, with turned hardwood handles. Two good ladles for the iron pot, made of sheet copper or sheet iron, with ash handles. For a pot of 40 gallons, or upwards, the ladle to hold 3 quarts. Two copper stirrers, Fig. 5, made from three-quarter diameter copper rods 3 ft. long, beat flat at the one end to $1\frac{1}{2}$ in. breadth, 8 in. up the rod; to be finished with ferruled handles 7 in. in length. One large, strong, copper funnel, with lapped seams, for straining boiling varnish or oil; tin or soldered funnels would melt. One copper oil-jack, Fig. 6, which will contain 2 gallons, for pouring in hot or boiling oil, with a large strong pitcher handle, and spout in front. One brass or copper sieve containing 60 meshes to the inch, 9 in. diameter, for straining the first varnish. A brass sieve, 40 meshes to the inch, 9 in. diameter, for straining gold size, turpentine, varnish, boiled oil, &c. A brass sieve, 40 meshes to the inch, and 9 in.

Fig. 5.

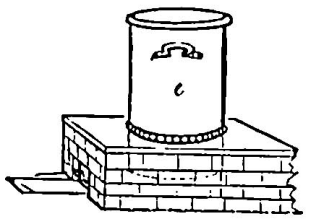
Fig. 6.

Fig. 7.

diameter, for straining japan and Brunswick black. A saddle, Fig. 7, which is a sheet of plate-iron or tin, 12 in. broad, and turned up $1\frac{1}{2}$ in. at each side; it is to lie from the edge of No. 1 pot on

the edge of the funnel, to prevent the spilling of the varnish during the time of taking it out. A tin pouring pot, to hold 3 gallons, made exactly like a garden watering pot, only smaller at the spout, and without any rose; this is never to be used for any purpose except pouring oil of turpentine into the

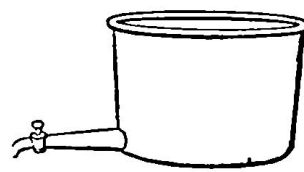
Fig. 8.



varnish. A 3-gallon tin jack, made with a strong handle at back, and a large broad spout in front; used for receiving the washings when poured out from the gum pot. A small broom, termed a swish, made from the waste cuttings of cane tied on a small handle, like a hearth broom, for washing out the gum pot each time it is used; to be always kept clean, and left in oil of turpentine. An iron trevet, made with a circular top 14 in. diameter, with four small cross-bars; the three feet of the trevet 12 in. high; it is used for setting the gum pot upon, with its bottom upwards, for a minute between each running.

Boiling Linseed Oil.—Procure a copper pan, Fig. 9, made like a common washing copper, set it upon the boiling furnace, Fig. 8, and fill up with linseed oil within 5 inches of the brim. Kindle a fire in the furnace underneath, and manage the fire so that the oil shall gradually but slowly increase in heat for the first two hours; then increase the heat to a gentle simmer, and if there is any scum on the surface, skim it off with a copper ladle, and put the skimmings away. Let the oil boil gently for three hours longer, then introduce, by a little at a time, a quarter of an ounce of the best calcined magnesia for every gallon of oil, occasionally stirring the oil from the bottom.

Fig. 9.



When the magnesia is all in, let the oil boil rather smartly for one hour; it will then be sufficient. Lay a cover over the oil to keep out the dust while the fire is drawn and extinguished by water; then uncover the oil, and leave it till next morning; and then, while it is yet hot, ladle it into the carrying jack, or let it out through the pipe and cock; carry it away, and deposit it in either a tin or leaden cistern, for wood vessels will not hold it; let it remain to settle for at least three months. The magnesia will absorb all the acid and mucilage from the oil, and fall to the bottom of the cistern, leaving the oil clear, transparent, and fit for use. Recollect, when the oil is taken out, not to disturb the bottoms, which are only fit for black paint.

Making Varnish on a Small Scale.—First procure a gum pot, Fig. 4, or smaller, if required; then a three-footed iron trevet with a circular top, the feet 16 in. in length, and made to stand wider at the bottom than at the top, which is to be made so that the pot will fit easily into it. Place the trevet in a hollow in a yard, garden, or outhouse, where there can be no danger from fire; raise a temporary fire-place round the trevet with loose bricks, after the same manner that plumbers make their furnaces; then make up a good fire with either coke, coal, or wood-charcoal, which is far preferable; let the fire burn to a good strong heat, set on the gum pot with 3 lbs. gum copal; observe, that if the fire surround the gum pot any higher inside than the gum, it is in great danger of taking fire. As soon as

the gum begins to fuse and steam, stir it with the copper stirrer, and keep cutting and stirring the gum to assist its fusion; if it feels lumpy and not fluid, and rises to the middle of the pot, lift it from the fire and set it on the ash-bed, and keep stirring until it goes down (meantime let the fire be kept briskly up); then set on the gum pot again, and keep stirring until the gum appears fluid like oil, which is to be known by lifting up the stirrer so far as to see the blade. Observe, that if the gum does not appear quite fluid as oil, carry it out whenever it rises to the middle of the pot, and stir it down again, keeping up a brisk fire; put on the pot, and keep stirring until the gum rises above the blade of the stirrer. Then the copper pouring jack is charged with boiled oil, and held over the edge of the gum pot; when the gum rises within 5 inches of the pot-mouth, the assistant is to pour in the oil very slowly until towards the last, the maker stirring during the pouring. If the fire at this time is strong and regular, in about eight or ten minutes the gum and oil will concentrate and become quite clear; this is to be tested by taking a piece of glass and dropping a portion of the varnish on it; if it appears clear and transparent, the oil and gum are become concentrated or joined together. It is now to be further boiled until it will string between the finger and thumb; this is known by once every minute dropping a portion on the glass, and taking a little between the forefinger and thumb; pinch it first, then extend wide the finger and thumb; if it is boiled enough, it will stick strong and string out into fine filaments, like birdlime; but when not boiled enough, it is soft, thick, and greasy, without being stringy. It is a safe plan to have ready a thick piece of carpet large enough to cover the mouth of the boiling pot should it catch fire during the pouring. The moment it is boiled enough, carry it from the fire to the ash-bed, where let it remain from fifteen to twenty minutes, or until it is cold enough to be mixed; have at hand a sufficient quantity of oil of turpentine to fill the pouring pot, begin and pour out with a small stream, gradually increasing, and if the varnish rises rapidly in the pot, keep stirring it constantly at the surface with the stirrer to break the bubbles, taking care not to let the stirrer touch the bottom of the pot, for if it should, the oil of turpentine would be in part converted into vapour, and the varnish would run over the pot in a moment; therefore, during the mixing, keep constantly stirring as well as pouring in at the same time. Have also a copper ladle at hand, and if it should so far rise as to be unmanageable, let the assistant take the ladle and cool it down with it, lifting up one ladleful after another, and letting it fall into the pot. As soon as the varnish is mixed put the varnish sieve in the copper funnel placed in the carrying tin, and strain the varnish immediately; empty it into open-mouthed jars, tins, or cisterns; there let it remain to settle, and the longer it remains the better it will become. Recollect, when it is taken out, not to disturb or raise up the bottoms.

LINSEED OIL.—The choice of linseed oil is of peculiar consequence to the varnish maker, as upon its quality, to a great extent, depends the beauty and durability of the varnish. Oil expressed from green unripe seed always abounds with watery, acidulous particles. The quality of oil may be determined in the following manner:—Fill a phial with oil, and hold it up to the light; if bad, it will appear opaque, turbid, and thick; its taste is acid and bitter upon the tongue, and it smells rancid and strong: this ought to be rejected. Oil from fine full-grown ripe seed, when viewed in a phial, will appear limpid, pale, and brilliant; it is mellow and sweet to the taste, has very little smell, is specifically lighter than impure oil, and when boiled or clarified dries quickly and firmly, and does not materially change the colour of the varnish when made, but appears limpid and brilliant.

SPIRITS OF TURPENTINE.—That which is used for mixing varnish ought to be procured and chosen as pure, strong and

free from acid as possible. Some turpentine being drawn from green trees abounds with a pyroligneous acid, which rises and comes over with the spirit in distillation; it is strong and bitter to the taste, and appears milky, particularly towards the bottom, after standing to settle. Therefore, the longer turpentine is kept before it is used, the purer it will be.

COPAL VARNISHES FOR FINE PAINTINGS.—Fuse 8 lbs. of very clean pale African gum copal, and when completely fluid, pour in 2 gallons of hot oil; let it boil until it will string very strong; and in about fifteen minutes, or while it is yet very hot, pour in 3 gallons of turpentine. Perhaps, during the mixing, a considerable quantity of the turpentine will escape, but the varnish will be so much the brighter, transparent, and fluid; and will work freer, dry quickly, and be very solid and durable when dry. After the varnish has been strained, if it is found too thick, before it is quite cold heat as much turpentine and mix with it as will bring it to a proper consistence.

ARTISTS' VIRGIN COPAL.—From a select parcel of scraped African gum copal, pick out the fine transparent pieces which appear round and pale like drops of crystal; break these small; dry them in the sun, or by a very gentle fire. Afterwards, when cool, bruise or pound them into a coarse powder; then procure some broken bottles or flint glass, and boil the same in soft water and soda, then bruise it into coarse powder like the gum; boil it a second time, and strain the water from it, washing it with three or four waters, that it may be perfectly clean and free from grease or any impurity; dry it before the fire, or upon a plate; set it in an oven. When it is thoroughly dry, mix 2 lbs. of it with 3 lbs. of the powdered copal; after mixing them well, put them into the gum pot and fuse the gum; keep stirring all the time; the glass will prevent the gum from adhering together, so that a very moderate fire will cause the gum to fuse. When it appears sufficiently run, have ready 3 quarts of clarified oil, very hot, to pour in. Afterwards let it boil until it strings freely between the fingers, begin and mix it rather hotter than if it were body-varnish; pour in 5 quarts of old turpentine, strain it immediately, and pour it into an open jar or large glass bottle; expose it to the air and light, but keep it both from the sun and wet, and from moisture, until it is of a sufficient age for use. This is the finest copal varnish for fine paintings or pictures.

CABINET VARNISH.—Fuse 7 lbs. of fine African gum copal, and pour in half a gallon of clarified oil; in three or four minutes after, if it feels stringy, take it out of doors, and mix with it 3 gallons of turpentine; afterwards strain it, and put it aside for use. This, if properly boiled, will dry in ten minutes, but if too strongly boiled will not mix at all with the turpentine; and *sometimes*, when boiled with the turpentine, will mix, and yet refuse to amalgamate with any other varnish less boiled than itself; therefore it requires a nicety which is only to be learned from practice. This varnish is chiefly intended for the use of japanners, cabinet painters, and coach painters.

BEST BODY COPAL VARNISH FOR COACH MAKERS.—Fuse 8 lbs. of fine African gum copal; add 2 gallons of clarified oil; boil very slowly for four or five hours, until quite stringy; mix off with 3½ gallons of turpentine; strain off, and pour it into a cistern.

QUICK DRYING CARRIAGE VARNISH.—8 lbs. of fine pale gum anime, 2 gallons of clarified oil, 3½ gallons of turpentine; to be boiled four hours. This, after being strained, is put into the two former pots, and well mixed together; its effect is to cause the whole to dry quicker and firmer, and enable it to take the polish much sooner.

COMMON BODY VARNISH FOR CARRIAGES.—8 lbs. of the best African copal, 3 gallons of clarified oil, 3½ gallons of turpentine; boiled four hours, or until stringy; mixed and strained, will produce about 5½ gallons. 8 lbs. of the best gum anime, 2 gallons of clarified oil, 3½ gallons of turpentine; boiled as

usual; mixed and strained hot, and put into the former pot of African gum varnish. Put two pots of this anime varnish to one of copal; it will dry quicker and harder than the best body copal, and will polish very soon, but not wear either so well or so long.

QUICK DRYING BODY COPAL VARNISH.—8 lbs. of the best African copal, 2 gallons of clarified oil, ¼ lb. of dried sugar of lead, 3½ gallons of turpentine; boiled till stringy, and mixed and strained; 8 lbs. of fine gum anime, 2 gallons of clarified oil, ¼ lb. of white copperas, 3½ gallons of turpentine; boiled as before; to be mixed, and strained while hot, into the other pot. These two pots mixed together will dry in six hours in winter, and in four in summer; it is very useful for varnishing old work on dark colours.

BEST PALE CARRIAGE VARNISH.—8 lbs. of 2nd sorted African copal, 2½ gallons of clarified oil; boil till very stringy. ¼ lb. of dried copperas, ¼ lb. of litharge, 5½ gallons of turpentine; strained. 8 lbs. of 2nd sorted gum anime, 2½ gallons of clarified oil, ¼ lb. of dried sugar of lead, ¼ lb. of litharge, 5½ gallons of turpentine; mix with the first while hot. This varnish will dry hard, if well boiled, in four hours in summer, and six in winter. As its name denotes, this is intended for the varnishing of the wheels, springs, and carriage parts of coaches, chaises, and so on; also it is that description of varnish which is generally sold to and used by house painters and decorators, as from its drying quality and strong gloss it suits their general purposes well.

SECOND CARRIAGE VARNISH.—8 lbs. of 2nd sorted gum anime, 2¾ gallons of fine clarified oil, 5½ gallons of turpentine, ¼ lb. of litharge, ¼ lb. of dried sugar of lead, ¼ lb. of dried copperas; boiled and mixed as before. When three runs are poured into the boiling pot, the regular proportion of driers put in, and well boiled, this varnish will dry hard and firm in four hours in winter, and in two in summer: it is principally intended for varnishing dark carriage-work or black japan, and is also used by house painters for dark work.

WAINSCOT VARNISH.—8 lbs. of 2nd sorted gum anime, 3 gallons of clarified oil, ¼ lb. of litharge, ¼ lb. of dried copperas, ¼ lb. of dried sugar of lead, 5½ gallons of turpentine; to be all well boiled until it strings very strong, and then mixed and strained. Where large quantities are required, it will always be found best to boil off the three runs in the boiling pot. This varnish is principally intended for house painters, grainers, builders, and japanners: it will dry in two hours in summer, and in four in winter.

Mahogany Varnish is either made in the same proportions, with a little darker gum; otherwise it is wainscot varnish, with a small portion of gold size.

Japanners' Gold Size. — To make 40 gallons of gold size, put 10 gallons of oil into the iron set pot, Fig. 2, make a good fire under it, and boil for two hours; then introduce 7 lbs. of dry red-lead, 7 lbs. of litharge, and 3 lbs. of copperas, by sprinkling in a little at a time; let the oil keep boiling all the time, not in too great a heat. During the time of putting in the driers, keep stirring them from the bottom of the pot, and have the large iron ladle ready to cool it down, if it should appear to rise too high; have also at hand an empty pot—the copper boiling pot will do—into which immediately ladle part of the boiling oil, if it cannot otherwise be kept in the pot, while the assistant is damping the fire with wet sifted ashes, of which there always ought to be a wheelbarrowful at hand, in case of an accident. When the oil has boiled about three hours, and the driers are all in, fuse in the gum pot 10 lbs. of gum anime; and during the time of fusing, heat 2 gallons of raw linseed oil in the copper pouring jack, by placing it on the plate of the gum furnace. After the oil has been poured to the gum, and as soon as it appears boiled clear, take the gum pot from the fire; let it cool for a few minutes, then pour it into the oil in the set pot. Wash out the gum pot, and proceed with another run in

the same way. When both runs of gum are in the set pot, there are altogether 14 gallons of oil, 20 lbs. of gum, and 17 lbs. of driers; increase and keep up a regular fire in the front of the furnace, that it may be drawn out in a moment, if it should be necessary. The gold size will soon throw up a frothy head on the surface, which must be kept down by constantly plying with the ladle when it is likely to rise within four inches of the pot-edge. In about five hours from the beginning of the oil boiling, it will become stringy; but the boiling must continue until it hangs to the ladle, appears quite stringy, yet drops in lumps. When tried upon the glass, if it feels sticky and strings strongly, then it is boiled enough. Draw out the fire, sprinkle it with plenty of water; leave not a spark of fire in the varnish house—not even a lighted pipe of tobacco. While the maker is cooling down the pot, let the assistant have ready at the door 30 gallons of turpentine, fill the pouring pot ready, and have all the doors open. Endeavour to cool it as fast as possible, as it will require at the least one hour and a quarter after the fire has been put out before it will be ready to mix. When the mixing commences, continue the pouring without intermission, until all the froth at the surface disappears, never stirring it until the turpentine is all in. If pouring in the turpentine has commenced while it was too hot, there will be a great loss of turpentine by evaporation; but that will not injure the quality of the gold size. Place the carrying tin close to the side of the pot, lay on the tin saddle, and strain off as quickly as possible. When all the gold size is out, pour into the set pot about 3 gallons of turpentine washings, and with the swish, wash down the pot as quickly as possible; and if the pot is still so hot as to evaporate the turpentine, ladle it out into the washings again, and pour in about 3 gallons of raw linseed oil; and with a palette knife scrape it all round, washing and cleaning it down with a rag until it is quite cleansed all round, then ladle out the oil, and wipe it completely clean and dry. The gold size ought to dry in from fifteen to twenty-five minutes, and in fourteen days it is ready for use. Experienced makers can make gold size that will dry in five minutes, but that requires great practice.

VARNISH, COACH MAKERS' BLACK.—Gum amber 16 oz.; melt in ½ pint of boiling hot linseed oil; add 3 oz. of asphaltum, and 3 resin; mix thoroughly over a fire, and add when cooling 1 pint of oil of turpentine slightly warm.

ASPHALTE VARNISH.—Boil coal tar until it shows a disposition to harden on cooling; this can be ascertained by rubbing a little on a piece of metal. Then add about 20 per cent. of lump asphalte, stirring it with the boiling coal tar until all the lumps are melted, when it can be allowed to cool and kept for use. This makes a very bright varnish for sheet metals, and is cheap and durable.

VARNISH FOR IRONWORK.—Dissolve, in about 2 lbs. of tar oil, ½ lb. of asphaltum, and a like quantity of pounded resin, mix hot in an iron kettle, care being taken to prevent any contact with the flame. When cold the varnish is ready for use. This varnish is for out-door wood and iron work.

VARNISH FOR COMMON WORK.—This varnish is intended for protecting surfaces against atmospheric exposure. It has been used for coating wood and iron work with great advantage. Take 3 lbs. of resin and powder it, place it in a tin can, and add 2½ pints of spirits of turpentine, well shake, and let it stand, occasionally shaking it for a day or two. Then add of boiled oil 5 quarts, well shake altogether, and allow it to stand in a warm room till clear. The clear portion is decanted and used, or reduced with spirits of turpentine until of the proper consistency.

VARNISH FOR IRON PATTERNS.—A good varnish for iron is made as follows:—Take oil of turpentine and drop into it, drop by drop, strong commercial oil of vitriol; the acid will cause a dark syrupy precipitate in the oil of turpentine; keep adding drops of vitriol until the precipitate ceases taking place,

then pour out the liquid and wash the syrupy mass with water, and it is ready for use. Heat the iron to be varnished to a gentle heat, apply the syrupy product, and allow it to dry.

BLACK JAPAN is made after the manner of the gold size. Put 6 gallons of raw linseed oil into the set pot; boil it with a very slow fire. Have a 10-gallon cast-iron pot, with two handles or ears; this pot will fit into the plate of the boiling furnace, into which put 10 lbs. of Egyptian asphaltum, and keep under it a good regular fire all the time of fusion. During the time the asphaltum is fusing, have 2 gallons of oil getting hot to mix it with as soon as it is sufficiently melted. After it is oiled, leave it on the fire about ten minutes; then pour it into the set pot. Carry it out of doors, and with a handful of hay or straw clear it out, and afterwards wash it out with turpentine washings, and dry it with a rag. Proceed and finish three more separate runs like the first, until there are four runs in the set pot, that is, 40 lbs. of asphaltum and 14 gallons of raw linseed oil; then introduce exactly the same driers as for the gold size, and in the same manner. Keep a regular, but moderate fire, so that the boiling continues at a moderate heat for four hours from the last run being poured in the set pot; then draw, and put out the fire for that day. Next morning, as soon as it can be brought to a boil, try it upon a bit of glass; if it but strings strongly, it will not do; it must be boiled so strong, that when a piece is pinched from off the glass, after it has been left to cool, it will roll into a hard pill between the finger and thumb. When it forms hard, and scarcely sticks to the fingers, it is then boiled enough. Put out the fire, as directed before. Leave it one hour and a half before mixing. When cold enough, mix it with 30 gallons, at least, of turpentine, and strain it. If it is too thick when cold, heat and introduce as much turpentine as will bring it to a proper consistency. The japan will dry in 6 hours in summer, and 8 in winter. It is principally intended for and used by coach makers, japanners, or painters, and should be kept at least six months before it is used.

Another Black Japan is made by putting into the set pot 48 lbs. of Naples asphaltum; as soon as it is melted, pour in 10 gallons of raw linseed oil. Keep a moderate fire, and fuse 8 lbs. of dark gum anime in the gum pot; mix it with 2 gallons of oil, and pour it into the set pot. Afterwards fuse 10 lbs. of dark or sea amber in the iron pot. When it appears completely fused, pour in 2 gallons of hot oil, and pour it into the set pot; continue the boiling for three hours longer, and during that time introduce the same quantity of driers as before directed; draw out the fire, and let it remain until morning; then boil it until it rolls hard; leave it to cool, and afterwards mix with turpentine. This japan will appear in colour like the other; but when applied on work, it will dry more hard, compact and glossy, and will not rub down or polish so soon as the other, which is occasioned by the toughness and durability of the amber.

PALE AMBER VARNISH.—Fuse 6 lbs. of fine-picked, very pale, transparent amber in the gum pot, and pour in 2 gallons of hot clarified oil. Boil it until it strings very strong. Mix with 4 gallons of turpentine. This will be as fine as body copal, will work free, and flow well upon any work it is applied to; it becomes very hard, is durable, and is excellent to mix in copal varnishes, to give them a hard and durable quality. Amber varnish will always require a long time before it is ready for polishing.

BRUNSWICK BLACK. *Best.*—In an iron pot, over a slow fire, boil 45 lbs. of foreign asphaltum for at least 6 hours, and during the same time boil in another iron pot 6 gallons of oil which has been previously boiled; during the boiling of the 6 gallons introduce 6 lbs. of litharge gradually, and boil until it feels stringy between the fingers; then ladle it into the pot containing the boiling asphaltum. Let both boil until, upon trial, it will roll into hard pills; then cool, and mix with 25 gallons of turpentine, or until it is of a proper consistence.

Common.—Put 28 lbs. of common black pitch, and 28 lbs. of common asphaltum made from gas tar, into an iron pot, boil both for 8 or 10 hours, which will evaporate the gas and moisture; let it stand all night, and early next morning, as soon as it boils, put in 8 gallons of boiled oil; then introduce gradually 10 lbs. of red-lead and 10 lbs. of litharge, and boil for 3 hours, or until it will roll very hard. When ready for mixing, introduce 20 gallons of turpentine, until of a proper consistence. This is intended for engineers, founders, or ironmongers; it will dry in half an hour, or less, if properly boiled.

IRONWORK BLACK.—Put 48 lbs. of foreign asphaltum into an iron pot, and boil for 4 hours; during the first 2 hours introduce 7 lbs. of red-lead, 7 lbs. of litharge, 3 lbs. of dried copperas, and 10 gallons of boiled oil; add one 8-lb. run of dark gum, with 2 gallons of hot oil. After pouring the oil and gum continue the boiling 2 hours, or until it will roll into hard pills, like japan. When cool, thin it off with 30 gallons of turpentine, or until it is of a proper consistence.

VARNISH FOR PRINTS, ENGRAVINGS, OR MAPS.—1. A piece of plate glass is heated, and, while yet warm, a little wax rubbed over it; water is then poured over the plate, and the moistened picture laid thereon and pressed closely down by means of a piece of filtering paper. When dry, the picture is removed, and will be found to possess a surface of great brilliancy, which is not injured by the process of mounting. 2. Boil Chio turpentine till brittle, powder, and dissolve in oil of turpentine. 3. Canada balsam and clear white resin, of each 6 oz., oil of turpentine 1 quart; dissolve. 4. Digest gum sandarach, 20 parts; gum mastic, 8; camphor, 1; with alcohol, 48. The map or engraving must previously receive one or two coats of gelatine.

TO VARNISH PAPER OR CARDWORK.—1. Boil clear parchment cuttings in water in a clean glazed pipkin till they produce a very clear size, strain it and keep it for use. Give any work two coats of the above size, passing quickly over the work not to disturb the colours; varnish with a paper varnish. 2. Dissolve 1 oz. of the best isinglass in about a pint of water, by simmering it over the fire; strain it through fine muslin, and keep it for use. Try the size on a piece of paper moderately warm; if it glistens, it is too thick, add more water; if it soaks into the paper, it is too thin, add or diminish the isinglass till it merely dulls the surface; then give the paper two or three coats, letting it dry between each being careful (particularly in the first coat) to bear very lightly on the brush, which should be a flat tin camel-hair. The size should flow freely from the brush, otherwise the paper, if a drawing, may be damaged. Then take the best mastic varnish, and with it give at least three coats.

VARNISH FOR COLOURED DRAWINGS.—Canada balsam, 1 oz.; spirits of turpentine, 2 oz. Mix them together. Before this composition is applied, the drawing or print should be sized with a solution of isinglass in water, and when dry apply the varnish with a camel-hair brush.

VARNISH FOR PAINTINGS AND PICTURES.—1. Honey, 1 pint; the whites of 24 fresh eggs; 1 oz. of isinglass, 20 grs. of hydrate of potassium, ½ oz. common salt; mix together over a gentle heat of 80° or 90° Fahr.; be careful not to let the mixture remain long enough to coagulate the albumen of the eggs; stir the mixture thoroughly, then bottle. Take one tablespoonful of the varnish and add to it half a tablespoonful of good oil of turpentine, then spread on the picture as soon as mixed. 2. Digest at a slow heat gum sandarach, 2 parts; gum mastic, 4; balsam capivi, 2; white turpentine, 3; with spirits of turpentine, 4; and alcohol 50-56 parts. 3. Boil 5 parts bitter apple, freed from the seeds and cut, with rain-water 50 parts, down to one-half. Strain and dissolve in the liquor gum arabic, 8 parts; rock candy, 4; and add 1 of alcohol. Let it stand for some days, and filter. 4. Pure linseed oil, to which a small quantity of sugar of lead, ground fine, has been added. 5. Take equal quantities of linseed oil and oil of turpentine, thicken by exposure to

the sun and air until it becomes resinous and half evaporated, then add a portion of melted beeswax. Varnishing pictures should always be performed in fair weather, and out of any current of cold or damp air.

PHOTOGRAPHERS' NEGATIVE VARNISH.—Gum juniper, 2 drachms 8 grains; gum frankincense, 1 drachm 10 grains; alcohol, 4 oz. Filter through paper and use the clear solution.

TRANSFER VARNISH, *for Diaphanic, Engravings, &c.*—1. Pale Canada balsam and rectified oil of turpentine equal parts. 2. Mastic in tears and sandarach, each 1 oz.; rectified spirit, 1½ pint; dissolve, and add pale Canada balsam ½ pint. Melt the balsam with a gentle heat, mix with the other ingredients and agitate violently. No. 1 is also termed *Crystal Varnish.*

GOLD VARNISH.—Digest shellac, 16 parts; gum sandarach and mastic, of each 3; crocus, 1; gum gamboge, 2; all bruised, with alcohol, 144. Or, digest seed-lac, sandarach, mastic, of each 8 parts; gamboge, 2; dragon's blood, 1; white turpentine, 6; turmeric, 4; bruised, with alcohol, 120.

VARNISH FOR GILT ARTICLES.—Gum-lac, 125 parts; gamboge, 125; dragon's blood, 125; annatto, 125; saffron, 32. Dissolve each resin in 1000 parts by measure, of absolute alcohol; two separate mixtures must be made with the dragon's blood and annatto, in 1000 parts of such alcohol; and a proper proportion of each should be added with the gamboge to the varnish, according to the shade of colour required.

BLACK LEATHER VARNISH.—1. Durable leather varnish is composed of boiled linseed oil, in which a drier, such as litharge, has been boiled. It is coloured with lampblack. This varnish is used for making enamelled leather. 2. Digest shellac, 12 parts; white turpentine, 5; gum sandarach, 2; lampblack, 1; with spirits of turpentine, 4; alcohol, 96.

WHITE VARNISH.—1. Tender copal, 7½ oz.; camphor, 1 oz.; alcohol of 95 per cent., 1 quart. Dissolve, then add mastic, 2 oz.; Venice turpentine, 1 oz. Dissolve and strain. Very white, drying, and capable of being polished when hard. Used for toys. 2. Sandarach, 8 oz.; mastic, 2 oz.; Canada balsam, 4 oz.; alcohol, 1 quart. Rectified spirits of wine, 1 quart; gum sandarach, 10 oz., gum mastic, 2 oz.; gum anime, ½ oz. Dissolve in a clean can, with gentle heat. Agitate well when the gums are dissolved; strain through a lawn sieve.

TABLE VARNISH.—1. Oil of turpentine, 1 lb.; beeswax, 2 oz.; colophony, 1 drachm. 2. Dammar resin, 1 lb.; spirits of turpentine, 2 lbs.; camphor, 200 grains. Digest the mixture for twenty-four hours. The decanted portion is fit for immediate use.

TO VARNISH FURNITURE.—First make the work quite clean; then fill up all knots or blemishes with cement of the same colour; see that the brush is clean, and free from loose hairs; then dip the brush in the varnish, stroke it along the wire raised across the top of the varnish pot, and give the work a thin and regular coat; soon after that another, and another, always taking care not to pass the brush twice in the same place; let it stand to dry in a moderately warm place, that the varnish may not chill. When the work has had about six or seven coats, let it get quite hard (which prove by pressing the knuckles on it; if it leaves a mark, it is not hard enough); then with the first three fingers of the hand rub the varnish till it chafes, and proceed over that part of the work intended to be polished, in order to take out all the streaks or partial lumps made by the brush; then give it another coat, and let it stand a day or two to harden.

VARNISHES FOR FURNITURE.—1. Shellac, 1½ lb.; naphtha, 1 gallon; dissolve, and it is ready without filtering. 2. Shellac, 12 oz.; copal, 3 oz. (or an equivalent of varnish); dissolve in 1 gallon of naphtha. 3. Shellac, 1½ lb.; seed-lac and sandarach, each 4 oz.; mastic, 2 oz.; rectified spirit, 1 gallon; dissolve. 4. Shellac, 2 lbs.; benzoin, 4 oz.; spirit, 1 gallon. 5. Shellac, 10 oz.; seed-lac, sandarach, and copal varnish, of each 6 oz.; benzoin, 3 oz.; naphtha,

1 gallon. To darken, benzoin and dragon's blood are used, turmeric and other colouring matters are also added; and to make it lighter it is necessary to use bleached lac, though some endeavour to give this effect by adding oxalic acid to the ingredients; it, like gum arabic, is insoluble in good spirit or naphtha. For all ordinary purposes the first form is best and least troublesome, while its appearance is equal to any other.

CHEAP OAK VARNISH.—Clear pale resin, 3½ lbs.; oil of turpentine, 1 gallon; dissolve. It may be coloured darker by adding a little fine lampblack.

MAHOGANY VARNISH.—Put in a bottle 2 oz. gum sandarach, 1 oz. shellac, ½ oz. gum benjamin, 1 oz. Venice turpentine, and a pint of spirits of wine. Colour red, with dragon's blood, or yellow with saffron. Stand in a warm spot till gum dissolves, when strain for use.

WHITE FURNITURE VARNISH.—White wax, 6 oz.; oil of turpentine, 1 pint; dissolve by a gentle heat. Or white wax, 6 parts; petrolcum, 48; applied to the work while warm, allowed to cool, then polished by rubbing with a coarse cloth.

DARK VARNISH FOR LIGHT WOODWORK.—Pound up and digest shellac, 16 parts; gum sandarach, 32; gum mastic, 8; gum elemi, 8; dragon's blood, 4; annatto, 1, with white turpentine, 16; and alcohol, 256. Dilute with alcohol if required.

VARNISH FOR VIOLINS. — Coarsely-powdered copal and glass, each 4 oz.; alcohol, 64 o. p. 1 pint; camphor, ½ oz.; heat the mixture with frequent stirring in a water bath, so that the bubbles may be counted as they rise, until solution is complete, and when cold decant the clear portion. When oil varnish is used it is made as for *Artists' Virgin Copal*.

VARNISH FOR WOOD WHICH RESISTS BOILING WATER.—Linseed oil, 1½ lb.; amber, 1 lb.; litharge pulverized, 5 oz.; white-lead pulverized, 5 oz.; minium, 5 oz. Boil the linseed oil in an untinned copper vessel, and suspend in it the litharge and the minium in a small bag, which must not touch the bottom of the vessel. Continue the ebullition until the oil has acquired a deep brown colour; then take out the bag and put in a clove of garlick; this is to be repeated 7 or 8 times, the ebullition being always continued. Before the amber is added to the oil, it is to be mixed with 2 oz. of linseed oil, and melted over a fire that is well kept up. When the mass is fluid, it is to be poured into the linseed oil this mixture is to be boiled and stirred continually for 2 or 3 minutes; afterwards filter the mixture, and preserve it in bottles tightly corked. When this varnish is used, the wood must be previously well polished, and covered with a thin coat of soot and spirits of turpentine. When this coat is dry, some of the varnish may be applied, which should be distributed equally on every part with a small fine sponge. This operation is to be repeated 4 times, being always careful that each coat be well dried first. After the last coat of varnish, the wood must be dried in an oven, and afterwards polished.

WAINSCOT VARNISH.—Gum anime, 8 lbs.; clarified linseed oil, 3 gallons; litharge, ½ lb.; acetate of lead, ½ lb.; sulphate of copper, ½ lb. These materials must be carefully but thoroughly boiled together until the mixture becomes quite stringy, and then 5½ gallons of heated turpentine stirred in. It can be easily deepened in colour by the addition of a little gold size.

BROWN HARD SPIRIT VARNISH.—1. Sandarach, 4 oz.; pale seed-lac, 2 oz.; elemi, 1 oz.; alcohol, 1 quart; digest with agitation till dissolved, then add Venice turpentine, 2 oz. 2. Gum sandarach, 3 lbs.; shellac, 2 lbs.; rectified spirit (65 over proof), 2 gallons; dissolve, add turpentine varnish, 1 quart; agitate well and strain. *Very fine.* 3. Seed-lac and yellow resin, of each 1½ lb.; rectified spirit, 2 gallons. 4. Gum juniper, 6 oz.; shellac, 6 oz.; salt of tartar, ½ oz.; Venice turpentine, 1½ oz., and 4 pints of spirits of wine mixed together.

TURPENTINE VARNISH.—To 1 pint of spirits of turpentine add 10 oz. clear resin pounded; put it in a tin can on a stove, and let it boil for half an hour.

When the resin is all dissolved, let it cool, and it is ready for use.

WHITE HARD SPIRIT VARNISH.—1. Gum sandarach, 1 lb.; clear turpentine, 6 oz.; rectified spirit (65 over proof), 3 pints; dissolve. 2. Mastic, in tears, 2 oz.; sandarach, 8 oz.; gum elemi, 1 oz.; Chio turpentine, 4 oz.; rectified spirit (65 over proof), 1 quart. Used on metals; polishes well. 3. Gum mastic, 4 oz.; gum juniper, ½ lb.; turpentine, 1 oz.; spirits of wine, 4 pints; mix together.

MASTIC VARNISH.—1 pint spirits of turpentine, and 10 oz. of the clearest gum mastic. Set it in a sand bath till it is all dissolved, then strain it through a fine sieve, and it is ready for use; if too thick, thin with spirit of turpentine.

SOFT BRILLIANT VARNISH.—Sandarach, 6 oz.; elemi (genuine), 4 oz.; anime, 1 oz.; camphor, ½ oz.; rectified spirit, 1 quart; as before.

SEALING-WAX VARNISH.—Dissolve sealing wax in spirits of wine, and apply the solution (well shaken up) with a soft brush; the spirits of wine will evaporate, leaving an even coating of sealing wax.

ETCHING VARNISHES.—White wax, 2 oz.; black and Burgundy pitch, of each ½ oz.; melt together; add by degrees powdered asphaltum 2 oz., and boil till a drop taken out on a plate will break when cold by being bent double two or three times between the fingers; it must then be poured into warm water and made into small balls for use.

Hard.—Linseed oil and mastic, of each 4 oz.; melt together.

Soft.—Soft linseed oil, 4 oz.; gum benzoin and white wax, of each ½ oz.; boil to two-thirds.

LINSEED-OIL VARNISH.—Boil linseed oil, 60 parts, with litharge, 2 parts, and white vitriol, 1 part, each finely powdered, until all water is evaporated. Then set by. Or, rub up borate of manganese, 4 parts, with some of the oil, then add linseed oil, 3000 parts, and heat to boiling.

BOOKBINDERS' VARNISH.—1. 6 oz. mastic, in drops; 3 oz. coarsely-pounded glass, separated from the dust by a sieve; 32 oz. spirits of wine of 40°. Place the ingredients in a sand bath over a fire, and let them boil, stirring them well. When thoroughly mixed introduce 3 oz. spirits of turpentine, boil for half an hour, remove from the fire, cool, and strain through cotton cloth. 2. 3 pints of spirits of wine of 40°; 8 oz. sandarach; 2 oz. mastic, in drops; 8 oz. shellac and 2 oz. Venice turpentine. Prepare as for No. 1. Apply lightly on the book with a piece of cotton wool, a small sponge, or a brush.

VARNISH FOR WATERPROOF GOODS.—Let a ½ lb. of india-rubber, in small pieces, soften in ½ lb. of oil of turpentine, then add 2 lbs. of boiled oil, and boil for 2 hours over a slow fire. When dissolved, add 6 lbs. of boiled linseed oil, and 1 lb. of litharge, and boil until an even liquid is obtained. Applied warm.

COMMON VARNISH.—Digest shellac, 1 part; with alcohol 7 or 8 parts.

COLOURLESS VARNISH, *with Shellac.*—Dissolve 2½ oz. of shellac in a pint of rectified spirits of wine; boil for a few minutes with 5 oz. of well-burnt and recently-heated animal charcoal. A small portion of the solution should then be filtered, and if not colourless, more charcoal added; when all the colour is removed press the liquor through a piece of silk, and afterwards filter through fine blotting paper. This kind of varnish should be used in a room at 60° Fahr., perfectly free from the least dust. It dries in a few minutes, and is not liable afterwards to chill or bloom. It is particularly applicable to drawings and prints that have been sized, and may be advantageously used upon oil paintings which are thoroughly hard and dry, as it brings out the colours with the purest effect.

COPAL VARNISH (*Spirit*).—1. Melt in an iron pan at a slow heat, copal gum, powdered, 8 parts, and add balsam capivi, previously warmed, 2 parts. Then remove from the fire, and add spirits of turpentine, also warmed beforehand, 10 parts, to give the necessary consistence. Gum copal is made more

soluble in spirits of turpentine by melting the powdered crude gum, and allowing it to stand for some time loosely covered. 2. Pounded copal, 24 parts; spirits of turpentine, 40; camphor, 1. 3. Copal in powder, 16 parts; camphor, 2; oil of lavender, 90. Dissolve the camphor in the oil, heat the latter, and stir in the copal in successive portions until complete solution takes place. Thin with sufficient turpentine to make it of proper consistence. 4. Coarsely-powdered copal and glass, of each 4 oz.; alcohol of 90 per cent., 1 pint; camphor, ½ oz.; heat it in a water bath so that the bubbles may be counted as they rise, observing frequently to stir the mixture; when cold decant the clear. Used for pictures. 5. Copal melted and dropped into water, 3 oz.; gum sandarach, 6 oz.; mastic and Chio turpentine, of each 2½ oz.; powdered glass, 4 oz.; alcohol of 85 per cent., 1 quart; dissolve by a gentle heat. Used for metal, chairs, &c.

WHITE COPAL VARNISH.—4 oz. copal, ½ oz. camphor, 3 oz. white drying oil, 2 oz. essential oil of turpentine. Reduce the copal to powder, mix the camphor and drying oil, then heat it on a slow fire, and add the oil of turpentine, and strain.

BLACK VARNISH FOR STRAW HATS.—Best black sealing wax ½ oz.; rectified spirits of wine, 2 oz.; powder the sealing wax, and put it with the spirits of wine into a phial; digest them in a sand bath, or near a fire till the wax is dissolved; lay on warm with a fine soft hair-brush before a fire or in the sun.

DAMMAR VARNISH.—Gum dammar, 10 parts; gum sandarach, 5; gum mastic, 1. Digest at a low heat, occasionally shaking, with spirits of turpentine, 20 parts. Add spirits of turpentine until of the consistence of syrup.

VARNISH FOR GLASS.—Pulverize a quantity of gum adragant, and let it dissolve for 24 hours in the white of eggs, well beat up; then rub it gently on the glass with a soft brush.

VARNISH FOR POLISHED METAL.—1. Take bleached shellac, pounded in a mortar; place the bruised fragments into a bottle of alcohol until some shellac remains undissolved; agitate the bottle and contents frequently, and let the whole stand till clear; pour off the clear fluid. This forms the varnish. Warm the metal surface, and coat with a camel-hair brush. If not perfectly transparent, warm the varnished surface before a fire or in an oven until it becomes clear. Common orange shellac answers equally well, and for large surfaces even better, as it is more soluble than the bleached variety, and coats more perfectly, but care must be taken not to use the varnish insufficiently diluted. 2. Digest 1 part of bruised copal in 3 parts of absolute alcohol; but as this varnish dries too quickly it is preferable to take 1 part of copal, 1 part of oil of rosemary, and 2 or 3 parts of absolute alcohol. This gives a clear varnish as limpid as water. It should be applied hot, and when dry it will be found hard and durable. 3. Mix equal quantities of Canada balsam with very clear spirits of turpentine, until the whole is of the consistency of ordinary varnish, which can be determined by constantly shaking and allowing to settle: This may be applied without warming the varnish or the metal.

VARNISH FOR SILVER.—Gum elemi, 30 parts; white amber, 45; charcoal, 30; spirits of turpentine, 375. Used in a heated state; the metal to which it is to be applied being also heated.

VARNISH FOR IRON AND STEEL.—Dissolve 10 parts of clear grains of mastic, 5 camphor, 15 sandarach, and 5 of elemi, in a sufficient quantity of alcohol, and apply without heat.

VARNISH FOR BACKING POSITIVES.—Spirits of turpentine, 6 oz.; asphaltum, 2 oz.; white wax, 2 scruples; lamp-black, 1½ scruple. Dissolve in a warm place, and filter through flannel.

REMOVING VARNISH FROM PRINTS.—1. Begin at the corner of the print by rubbing up the varnish with the fingers: a fine white dust will be produced, which is the dry old varnish; proceed all over the print and wipe off this white dust with a rag. Repeat until the print has lost most or all of the old varnish. Now

strain the print on a drawing board, size with weak parchment size; when dry size again with the same size; use the size half chilled; when perfectly dry apply mastic or other varnish. 2. Lay blotting paper on the print, and saturate with pure spirit, which will dissolve and the blotting paper absorb the varnish. Change the blotting paper, and repeat as often as may be needful.

INDIA-RUBBER VARNISH.—1. 2 oz. india-rubber finely divided, placed in a phial and digested in a sand bath, with ½ lb. of camphene, and ½ oz. of naphtha. When dissolved add 1 oz. of copal varnish, which renders it more durable. 2. Digest in a wide-mouthed glass bottle 2 oz. of india-rubber in shavings, with 1 lb. of oil of turpentine, during two days, without shaking, then stir up with a wooden spatula. Add another lb. of oil of turpentine, and digest, with frequent agitation, until all is dissolved. Mix 1½ lb. of this solution with 2 lbs. of white copal-oil varnish, and 1½ lb. of boiled linseed oil; shake and digest in a sand bath until they have united into a good varnish. 3. 4 oz. india-rubber in fine shavings dissolved in a covered jar by means of a sand bath, in 2 lbs. of crude benzole, and then mixed with 4 lbs. of hot linseed-oil varnish and ½ lb. of oil of turpentine. Dries well.

VARNISH FOR GAS BALLOONS.—Take india-rubber and dissolve it in 5 times its weight of spirits of turpentine, keeping them some time together, then boil gently 1 part of this solution with 8 parts of boiled linseed oil for a few minutes, strain and set aside to cool. It must be applied warm.

VARNISH BRUSHES. — All varnish brushes ought to be made of long white hairs of the best quality, and, for the general purposes of varnishing, have a good regular spring, with about one-fourth or fifth part worn off, flat, sharp, and thin at the point, so as to lay on the varnish smoothly and regularly. As the beauty of varnishing depends in a great measure on the brush as well as the manner of laying it on, great care is also necessary that no *oil brush* be put into varnish; therefore, all brushes worn down in oil colour, and intended to be put into varnish, ought previously to be well washed in turpentine, squeezed and dried with a clean linen rag, or well washed with soap and hot water, rinsed in clean warm water, and made perfectly dry. The best method of keeping oil-varnish brushes, when not in use, is to bore a hole through the handle and put a wire skewer through it, and so suspend the brush, in a narrow tin pot containing varnish of the same sort as it was last in, taking care that the varnish in the pot covers the hairs of the brush up to the binding, and no higher. Brushes so kept are always straight, clean, pliable, and in good order; whereas varnish brushes kept in turpentine become hard and harsh, and however well stroked or rubbed out, there will still remain turpentine enough to work out by degrees, and spoil the varnishing, by causing it to run streaky or cloudy.

GREEN TRANSPARENT VARNISH.—Grind a small quantity of Chinese blue and chromate of potash together, and mix them thoroughly in common copal varnish thinned with turpentine. The blue and the chromate must be ground to an impalpable powder, and the tone of colour varied with the amount of each ingredient used. A yellow-green requires about twice the quantity of the chromate of potash to that of the Chinese blue.

GOLDEN VARNISH. — Pulverize 1 drachm of saffron and ½ drachm of dragon's blood, and put them into 1 pint spirits of wine. Add 2 oz. of gum shellac and 2 drachms of socotrine aloes. Dissolve the whole by gentle heat. Yellow painted work varnished with this mixture will appear almost equal to gold.

GUTTA-PERCHA VARNISH.—Clean a quarter of a pound of gutta-percha in warm water from adhering impurities, dry well, dissolve in 1 lb. of rectified resin oil, and add 2 lbs. of linseed-oil varnish, boiling hot.

Choosing Gums and Spirits.—In purchasing gum, examine it, and see that it consists, for the most part, of clear transparent lumps, without a mix-

ture of dirt; select the clearest and lightest pieces for the most particular kinds of varnish, reserving the others, when separated from extraneous matter, for the coarser varnishes. In choosing spirits of wine, the most simple test is to pour a small quantity into a cup, set it on fire, and dip a finger into the blazing liquid; if it burns quickly out, without burning the finger, it is good; but if it is long in burning, and leaves any dampness remaining on the finger, it is mixed with inferior spirit; it may be also compared with other spirit, by comparing the weight of equal quantities, the lightest is the best. The goodness of spirits of turpentine may be likewise ascertained by weighing it, and by noticing the degree of inflammability it possesses; the most inflammable is the best; and a person much in the habit of using it will tell by the smell its good or bad qualities; for good turpentine has a pungent smell, the bad a very disagreeable one, and not so powerful.

LAC-WATER VARNISH.—Pale shellac, 5 oz.; borax, 1 oz.; water, 1 pint. Digest at nearly the boiling point till dissolved, then strain. An excellent vehicle for water colours, inks, &c., and a varnish for prints is made thus of bleached lac. When dry, it is transparent and waterproof.

To Bleach Lac.—Dissolve shellac in a lye of pearlash by boiling; filter, pass chlorine through it in excess, wash and precipitate; afterwards melt it into sticks. This makes an excellent varnish with spirits of wine; its colour also renders it good for white and delicate-coloured sealing wax.

Lacquering.—This is done in two ways, called cold lacquering and hot lacquering. By the former, a little lacquer being taken on a common camel-hair varnish brush, is laid carefully and evenly over the work, which is then placed in an oven or on a hot stove; the heat from this continued only a minute or two is sufficient to set the lacquer, and the work is finished. Care must be taken not to have the work too hot so as to burn the lacquer, nor yet too cold, for in this case the lacquer will not be thoroughly set. By the second method, the work is heated first to about the heat of a flat iron as used by the laundress, and the lacquer quickly brushed over it in this state, the work being subjected to the oven for a minute afterwards or not, according to the pleasure and judgment of the lacquerer. The article, if very small, will require this, because it will have parted with most of its heat in laying on of the lacquer; if heavy, it will retain sufficient to perfect the process. The greatest difficulty is to know the exact degree of heat, and this knowledge cannot be attained except by experience, so different is the nature of the materials, the quality of different lacquers, and the effect to be produced.

TO PREPARE BRASS FOR LACQUERING.—As the object of lacquering is not to give a brilliancy, but to preserve one already obtained, it will be evident that in the preparation of anything the brighter surface obtained the better. Some goods are turned in the lathe, and then polished; sometimes, as in philosophical instruments, burnished also; this makes them sufficiently bright. Other goods, as, for example, such as have chased surfaces, and cannot therefore be turned with a cutting tool, are held against a scratch brush or brush of wire, which is fixed to the lathe like a chuck, and is made to revolve rapidly. This removes all asperities and renders the surface fit to receive the lacquer. A third and more common process is, after the surface is got by other means as clear as possible, to put the goods into pickle, that is, into aquafortis and water, and leave them there for some hours, according to circumstances. The acid eats away the outer coat, leaving a bright surface beneath. The goods are now put into hot saw-dust, and shaken about to dry and clean them, when they will be ready for lacquering. A very convenient plan for keeping the saw-dust warm and dry is to place it in an iron box, under which a number of gas-jets are kept lighted. See *Brightening and Colouring Brass*, p. 16.

RE-LACQUERING BRASSWORK.—After taking the work to pieces, and carefully

removing all iron screws and pins, boil off the old lacquer in a lye made by mixing ½ lb. of potash with 1 gallon of water. Allow the work to remain in this lye about twenty minutes; then plunge into clean cold water, when the whole of the old lacquer will be found to have been removed. The next process is to dip the work in aquafortis, or dipping acid; and the greater the specific gravity of this the better, particularly for old work. The larger pieces are dipped by means of a pair of brass tongs, and the smaller ones by twisting them on copper wire. When they have remained in the acid long enough to become quite bright and clean, plunge them quickly into clean cold water; it is best to have two or three vessels of water, rinsing the work in all of them. When the work comes out of the last supply of water, it is transferred to the saw-dust box, and when dry is ready for lacquering.

LACQUER FOR BRASS.—1. Seed-lac, dragon's blood, annatto, and gamboge, of each 4 oz.; saffron, 1 oz.; spirits of wine, 10 pints. 2. Turmeric, 1 lb.; annatto, 2 oz.; shellac and gum juniper, of each 12 oz.; spirits of wine, 12 oz. 3. Seed-lac, 6 oz.; dragon's blood, 40 grs.; amber or copal (ground on porphyry), 2 oz.; extract of red sandalwood, 30 grs.; oriental saffron, 36 grs.; pulverized glass, 4 oz.; purest alcohol, 40 oz. 4. Seed-lac, 3 oz.; amber and gamboge, of each 2 oz.; extract of red sanders, ½ dr.; dragon's blood, 1 dr.; saffron, ½ dr.; spirits of wine, 2 pints 4 oz. 5. Turmeric, 6 drs.; saffron, 15 grs.; spirits of wine, 1 pint 4 oz.; draw the tincture, add gamboge 6 drs.; gum sandarach and gum elemi, each 2 oz.; dragon's blood and seed-lac, of each 1 oz. 6. Put into a pint of alcohol, 1 oz. of turmeric powder, 2 drs. of annatto, and 2 drs. of saffron; agitate during 7 days, and filter into a clean bottle. Now add 3 oz. of clean seed-lac, and agitate the bottle every day for 14 days. 7. ½ oz. gamboge, 1½ oz. aloes, 8 oz. fine shellac, 1 gallon spirits of wine.

PALE LACQUER.—1 gallon of methylated spirits of wine, 5 oz. of shellac, 4 oz. of gum sandarach, and 1 oz. of gum elemi; mix in a tin flask and expose to a gentle heat for a day or two, then strain off, and add ½ gallon of spirit to the sediment, and treat as before.

GREEN LACQUER.—Add to the pale lacquer when mixing, 6 oz. of turmeric, and 1 oz. of gum gamboge.

PALE GOLD LACQUER.—1 gallon of methylated spirits of wine, 10 oz. of seed-lac bruised, and ½ oz. of red sanders; dissolve and strain.

LACQUER FOR TIN.—Put 3 oz. of seed-lac, 2 drs. of dragon's blood, and 1 oz. of turmeric powder, into a pint of well rectified spirits. Let the whole remain for 14 days, but during that time agitate the bottle once a day at least. When properly combined, strain the liquid through muslin. It is brushed over tinware which is intended to imitate brass.

LACQUER FOR PHILOSOPHICAL INSTRUMENTS.—Take ¾ oz. of gum guttæ (or gamboge), 2 oz. of gum sandarach, 2 oz. of gum elemi, 1 oz. of dragon's blood, 1 oz. of seed-lac, 2 grs. of oriental saffron, and 20 oz. of pure alcohol. The tincture of saffron is obtained by infusing in alcohol for twenty-four hours, or exposing to the heat of the sun in summer. The tincture must be strained through a piece of clean linen cloth, and ought to be strongly squeezed. This tincture is poured over the dragon's blood, the gum elemi, the seed-lac, and the gum guttæ, all pounded.

HIGH-COLOURED LACQUER.—2 quarts spirits of wine, 2½ oz. shellac, 2 oz. gum sandarach, ½ oz. gum elemi; mix and keep gently warmed for two or three days; strain, colour with dragon's blood to taste, and thin with 1 quart spirits of wine.

CHINESE LACQUER-WORK.—Chinese lacquer-work is done over tin-foil, and consists of a mixture of 2 parts of copal, and 1 of shellac, melted together. When fluid, there are added 2 parts of boiled linseed oil; and, after the vessel containing this mixture has been taken from the fire, there are gradually added 10 parts of oil of turpentine. If colour is required, gum guttæ (or gamboge), dissolved in oil of turpentine, yields yellow; and dragon's blood, dissolved in the same liquid, yields red.

Japanning.—To prepare goods for japanning, they are occasionally coated with a priming, for the purpose of filling up inequalities, and making smooth the surface to be japanned, but commonly the priming is omitted, the coloured varnish or japan ground being applied immediately to the substance to be japanned. The former is the method practised when the surface is very uneven and rough; but when the surface is smooth, as in the case of metals or smooth-grained wood, it is now always rejected. The priming or undercoat makes a saving in the quantity of varnish used, but the japan coats of varnish and colour are liable to be cracked and peeled off by any violence, and will not endure so long as bodies japanned in the same manner without priming.

To Prepare Work for Japan *with Priming.*—Take size of a consistency between common double size and glue, and mix with as much whiting as will give it a good body, so as to hide the surface of whatever it is laid upon; for particularly fine work use glovers' or parchment size, to which add one quarter of isinglass. The work is prepared for this priming by being well cleaned, and brushed over with hot size, diluted with two-thirds water; the priming is then laid on with a brush as evenly as possible, and left to dry. If the surface on which the priming is used is tolerably even, two coats will be sufficient; but if on trial with a wet rag it will not receive a proper water polish, one or more coats must be given it. Previous to the last coat being laid on, smooth with fine glass paper. When the last coat is dry, give the water polish by passing over every part of it with a fine rag or sponge moistened, till the whole appears plain and even; the priming will then be completed, and the work ready to receive the japan ground. *Without priming*, lay on two or three coats of varnish composed of rectified spirits of wine 1 pint, coarse seed-lac and resin, each 2 oz. This varnish, like all other formed of spirits of wine, must be laid on in a warm place, and all dampness avoided; for either cold or moisture chills it, and prevents its taking proper hold of the substance on which it is laid. When the work is thus prepared, the proper japan ground must be laid on.

Japan Grounds.—The proper japan grounds are either such as are formed by the varnish and colour, where the whole is to remain of one simple colour, or by the varnish with or without colour, on which some painting or other decoration is afterwards to be laid. This ground is best formed of shellac varnish, and the colour desired. Any pigments whatever may be used with the shellac varnish, which will give the tint of the ground, and they may be mixed together to form any compound colours; but, with respect to such as require peculiar methods for producing them of the first degree of brightness, we shall particularize them below. They should all be ground very smooth in spirits of turpentine, and then mixed with the varnish. It should be spread over the work very carefully and even with a camel-hair brush. As metals never require the priming of size and whiting, the japan ground may be applied immediately to them, without any other preparation than cleaning. Metals receive from three to five coats, and between each must be dried in an oven heated from 250° to 300°.

Black Japan Grounds.—1. Mix shellac varnish with either ivory-black or lampblack; but the former is preferable. These may be always laid on with the shellac varnish, and have their upper or polishing coats of common seed-lac varnish. 2. A common black japan may be made by painting a piece of work with drying oil, and putting the work into a stove, not too hot, but of such a degree as will change the oil black without burning it, gradually raising the heat and keeping it up for a long time. This requires no polishing. 3. Asphaltum, ½ lb.; melt, then add hot balsam of capivi, 1 lb., and when mixed, thin with hot oil of turpentine. 4. Grind lampblack very smooth on a marble slab with a muller with turpentine, and then add copal varnish to the proper consistency. 5. Asphaltum, 3 oz.; boiled oil, 4 quarts; burnt umber, 8 oz. Mix by heat, and

when cooling thin with turpentine. 6. Amber, 12 oz.; asphaltum, 2 oz.; fuse by heat, add boiled oil ½ pint, resin 2 oz.; when cooling add 16 oz. oil of turpentine.

WHITE JAPAN GROUNDS.—Flake-white, or white-lead, washed and ground up with the sixth of its weight of starch, and dried; temper properly for spreading with mastic varnish. Lay on the body to be japanned, then varnish over it with 5 or 6 coats of the following varnish:—Seed-lac, 2 oz.; gum anime, 3 oz.; reduce the gums to a coarse powder, dissolve in about a quart of spirits of wine, and strain off the clear varnish. The seed-lac will give a slight tinge to this composition; but it cannot be omitted where the varnish is wanted to be hard, though where a softer will answer the end the proportion may be diminished, and a little crude turpentine added to the gum anime to take off the brittleness.

BLUE JAPAN GROUNDS may be formed of bright Prussian blue, or of smalt. The colour may be mixed with shellac varnish; but as shellac will somewhat injure the colour by giving it a yellow tinge, where a bright blue is required the method directed in the case of white grounds must be pursued.

RED JAPAN GROUND.—The base of this japan ground must be made up with madder lake, ground with oil of turpentine; this forms the first ground; when perfectly dry, a second coat must be applied, composed of lake and white copal varnish; and the last with a coat composed of a mixture of copal and turpentine varnish mixed up with lake. Vermilion or carmine can also be used for red japan instead of lake.

YELLOW JAPAN GROUNDS.—1. King's yellow may be used, and the effect will be heightened by dissolving powdered turmeric root in the spirits of wine, of which the upper or polishing coat is made, which spirits of wine must be strained from off the dregs before the seed-lac is added to it to form the varnish. 2. Saffron, cromo yellow, or turmeric, dissolved in spirits of wine, strained, and mixed with pure seed-lac varnish.

GREEN JAPAN GROUNDS may be produced by mixing Prussian blue, or distilled verdigris, with king's yellow and a varnish, and the effect will be rendered extremely brilliant by laying on a ground of gold leaf.

ORANGE JAPAN GROUNDS may be formed by mixing vermilion or red-lead with king's yellow or orange lake; or red orpiment will make a brighter orange ground than can be produced by any mixture.

PURPLE JAPAN GROUNDS may be produced by the mixture of lake or vermilion with Prussian blue. They may be treated as the rest with respect to the varnish.

TORTOISESHELL JAPAN.—Linseed oil, 2 pints; umber, ½ lb.; boil together until the oil becomes very brown and thick; strain through a cloth and boil again until the composition is about the consistence of pitch, when it is fit for use. Having prepared this varnish, clean well the article that is to be japanned, and then lay vermilion, mixed with shellac varnish, or with drying oil, diluted with turpentine, very thinly on the places intended to imitate the clear parts of the tortoiseshell. When the vermilion is dry, brush over the whole with the above umber varnish diluted to a due consistence with turpentine, and when it is set and firm it must be put into a stove and undergo a strong heat for a long time, even two weeks will not hurt it.

PAINTING JAPAN-WORK.—The preparation of colours for japan-work consists in bringing them to a due state of fineness, by grinding on a stone in oil of turpentine. The best varnish for binding and preserving the colours is shellac; this, when judiciously managed, gives such a firmness and hardness to the work, that, if it be afterwards further secured with a moderately thick coat of seed-lac varnish, it will be almost as hard and durable as glass. Painting in varnish is, however, more tedious than in oil or water; it is therefore now usual in japan-work, for the sake of dispatch, and in some cases for the freer use of the pencil, to lay on the colours with *japanners' gold size*. The colours are also sometimes laid on in gum water, but

the work done in this manner is not so durable as that done in varnish or oil. Water colours are sometimes laid on grounds of gold, in the manner of other paintings, and look best without any varnish over them; and they are sometimes so managed as to have the effect of embossed work. The colours in this way of painting are prepared by means of isinglass size corrected with honey or sugar-candy. The body with which the embossed work is raised is best formed of strong gum water, thickened to a proper consistence with bole armenian and whiting, in equal parts; which, being laid on in the proper figures and repaired when dry, may be then painted with the intended colours tempered in the isinglass size, or in the general manner with shellac varnish.

VARNISHING JAPAN-WORK.—The finishing process in japanning consists in laying on and polishing the outer coats of varnish, which are equally necessary, whether the japan ground is painted or not. The pieces of work to be varnished should be placed near the fire, or in a warm room made perfectly dry, and the varnish laid on with a flat camel-hair brush made for the purpose: the varnishing must be done rapidly, but with great care; the same place should not be passed twice over in laying on one coat if it can possibly be avoided: the best way of proceeding is to begin in the middle, pass it to the other end, taking care that, before each stroke, the brush is well supplied with varnish. When one coat is dry, another must be laid over it in like manner, and this must be continued at least five or six times. It greatly improves all kinds of japan-work to harden the varnish by means of heat, which, in every degree that it can be applied short of what would burn or calcine the matter, tends to give it a firm texture. Where metals form the body therefore, a very hot oven may be used, and the work may be continued in it a considerable time, especially if the heat be gradually increased; but where wood or papier maché is in question, heat must be sparingly used after each coat of varnish. If, on trial, there be not a sufficient thickness of varnish to bear the polish without laying bare the painting or ground colour underneath, more must be laid on. When a sufficient number of coats is laid on, the work is fit to be polished, which must be done, in common cases, by rubbing it with a piece of cloth or felt dipped in Tripoli or pumice-stone finely powdered. But towards the end of the rubbing a little oil of any kind should be used with the powder, and when the work appears sufficiently bright and glossy, it should be well rubbed with the oil alone to clean it from the powder and give it a still greater lustre. In the case of white grounds, instead of the Tripoli fine putty or whiting should be used, but they should be washed over to prevent the danger of damaging the work from any sand or other gritty matter that may happen to be mixed with them.

Tunbridge Ware. *Body.*—The articles are usually made of either horse-chestnut or sycamore wood, the whiter the better, and should be well finished off with glass paper: wipe them and give them one coat of spirit varnish; this raises the grain; rub down with fine glass paper when dry; wipe from the dust, and varnish again with *white hard spirit varnish*, and they are properly prepared for painting; but prints or drawings must be put on previous to this preparation. In preparing articles for ladies to paint on, as they use water colours instead of copal colours, omit the two coats of spirit varnish, using instead a white varnish made of finely-powdered flake-white and isinglass size, used hot, rubbed down in the same way and repeated.

Painting.—The colours used are the same as for oil painting, but in a dry state; they are to be ground fine in turpentine, let dry, and are then fit for use; some of the smooth colours, as vermilion, lampblack, &c., do not require grinding in turpentine first. The colours are mixed on a palette or marble slab rather stiff with copal varnish and thinned for use with turpentine; they require copal varnish enough to make

them bind and dry firm and work free, but not enough to make them shining or sticky. When gilding is wished, use japan gold size, bearing in mind that any ground colour, imitation wood, &c., upon which gold ornaments are to appear, must have one coat of spirit varnish over it before sizing, which is necessary also when objects are painted on a black or other coloured ground—the spirit varnish preventing the ground colour from working up. Coloured prints or drawings on paper, pasted close and tight on the wood, form a pretty centre; they must always be sized with isinglass size twice over before they are varnished over with the spirit varnish. Have a little cup of turpentine by you when painting to moisten the camel-hair pencils, and make them work free; wash them in turpentine, and keep the colours from the air as much as possible.

Varnishing.—After the article is ornamented or painted, it must have a square block of wood, according to its size, and from 4 to 6 in. long, glued slightly on the bottom, to serve as a handle in the future process. It must then receive from 6 to 8 coats of *white hard spirit varnish;* this should occupy two days; let it remain the following night in the varnish room, that it may set gradually, and then remove it to an airy place; the more current of air, providing neither damp nor sun can get at it, the better; let it remain here about a fortnight if you wish your work to stand well. When quite hard, the varnish will crack all over in very minute cracks.

Rubbing Down.—To do this, provide yourself with some very finely grated chalk, perfectly free from grit, and a rubber made of *stuff* doubled flat five or six times round a piece of very stiff pasteboard, also a pan of clean water; fix the article by the block in a vice, or any way convenient, soak the rubber in water, then, while wet, cover it with the grated chalk dry, and with it rub the article to and fro, and afterwards crossways, till the cracks are all removed and the surface is perfectly flat and even, continually dipping the rubber in water, and taking fresh dry chalk, but keeping the rubber wet and the hands also, to prevent the varnish printing; wipe off occasionally with the palm of the hand to observe the progress and prevent rubbing through. Be careful not to touch it with the hands dry, as the rubbing softens the varnish; when smooth and even all over, stand by for about a week.

Polishing and Finishing.—This is done in the same way as the rubbing down with dry chalk and water, only using a woollen cloth rubber instead of the stuff one, and less chalk; and the finishing or smoothing is done with the palm of the hand wet, without any rubber at all. When the required polish or brightness is obtained, which takes but very little time, as it is supposed to be perfectly flat, smooth, and even, from the rubbing down, and the polishing is only to give a brightness to the surface by a delicate and very slight friction on the varnish, now thoroughly hard and even. Stand it by till the next day, then knock off the block, scrape any of the unvarnished parts where the chalk and water may have soaked in. Line the inside with silk, satin, velvet, tin-foil, or paper, according to the nature of the article; then oil all over the polished parts with a piece of flannel soaked in Florence oil; clean and finish off with a very soft cotton or silk duster and common flour; dry, and if well done, it will look almost like plate glass.

Carriage Japan.—40 gallons raw linseed oil, 40 lbs. litharge, 20 lbs. red-lead, 10 lbs. black oxide of manganese, 2 lbs. white gum shellac. Set the oil over the fire and bring to the boiling point; add by degrees litharge and red-lead alternately and slowly; add the gum, and when this is melted put in the manganese, and keep the whole in rapid motion from the time the oil is 200° Fahr. until the making is finished. When the mixture is cool enough to bear the finger in a moment, add from 20 to 30 gallons spirits of turpentine.

Carriage Painting.—Carriage painting should be conducted in a room where dust can be entirely excluded, and where ready means of ventilation are

always at hand. The following receipts will give the mode of working both with boiled oil and with raw oil as a vehicle, the exclusive use of either oil being a very disputed question. When the woodwork of a carriage comes into the shop examine it closely, and if the grain has raised in any place, or it wants smoothing with sand paper, be sure and do it before priming the work.

Priming.—For the priming coat use white-lead mixed in prepared raw oil and one-eighth part turpentine, with a shade of lampblack if the carriage is to be a dark colour. The less paint used in priming the better, taking care not to leave it thick upon the edge, or to collect upon the mouldings, but going well over cracks, cheeks, and screw-heads, so that they have at least one coat of paint over the surface which is to be puttied up.

Second Coat.—After the priming has been four days drying, and has then been sand-papered off, give another coat of the same paint used for priming with a little drier, and about one-fourth as much turpentine as oil. Sometimes a third coat is applied. When thoroughly hard, fill in all screw-heads and places to be stopped with putty made of whiting and good drying varnish.

Rough Stuffing.—7 parts, yellow ochre; 1, white-lead; 4, good drying varnish; 1, japan, and about $\frac{1}{16}$th as much raw oil as of copal varnish and japan together; mix, and grind with a muller, or run through a colour mill. After grinding reduce with turpentine, so that it works easily under the brush; apply several coats, each of which will take five or six days to dry. A carriage body will require at least three coats, but smaller vehicles need have but one.

Rubbing Down.—The object of rubbing down is to have a smooth surface free from dents, grains of the wood, tool marks, or anything in the way of making a fine even surface to put the finishing coat of paint on. Saw pumice-stone into blocks of a suitable size, shaping pieces of stone with a small round file to fit the beads. Wet the work with a sponge, and with a wet block of pumice-stone rub until the parts are smooth and level, using the wet sponge frequently to clean the paint and ascertain whether it is rubbed enough. When the brush marks are all rubbed out of the rough stuffing, the rubbing may be considered finished.

Colouring.—After rubbing down apply a coat of lead-colour ground very fine in a paint mill. When this is dry, rub down again very closely with fine sand paper; examine, putty up places neglected in former puttyings, &c.; stand by to harden, and again rub with pumice-stone. Supposing the colour wished for is ultramarine blue, mix up white-lead and Chinese blue to the required tint with 3 parts japan and 1 part oil, put on, dry, and rub down with moss or linen rag. Colour, if black, mix it with 1 part oil and 3 parts japan; if a transparent colour, thin it with sugar of lead and raw linseed oil, and let it dry. Colour, dry, then give from three to four coats of varnish. Observe that between every coat of colour the paint should be well rubbed with woollen cloth and ground pumice-stone. The striping should be laid on before the varnish is applied.

Ironwork.—The ironwork of a carriage should have two coats of oil lead colour, sand paper well, give one coat more, after which give one coat best oil black, two coats black japan, a slight rubbing, and a flowing coat of varnish.

Varnishing and Polishing.—Good coach bodies are seldom polished with less than five or six coats of varnish. The work should be so ordered that decorations, heraldic devices, and so on, have at least two coats of varnish over them. Cheap work intended to be finished with one coat of varnish ought to be laid on rather full and flowing; but if two coats are intended, the first coat should be laid more sparingly, and the second applied the third day after; and in cases where a third coat is applied, the second coat ought previously to be rubbed down to nearly a dead flat with ground pumice dust and water. If it is to be afterwards polished, let it stand at least fourteen days; then take a very fine pumice dust, well sifted through a very fine silk or muslin sieve, wet the work with a brush and clean water, have ready some pieces

of white woollen cloth, folded up in a proper manner, dip a piece in water and then in the pumice dust, begin and rub down the work from top to bottom with a regular pressure, bearing steadily but rather lightly, rubbing the work as nearly all alike as possible, because on that particular depends the beauty of the polishing; wash off from time to time with a sponge and water during the polishing, till with the palm of the hand rubbed two or three times in the same place, the work discover its polish; then with a bit of serge or flannel, dipped in refined linseed oil, rub the work over, and afterwards clean it off with the hand, or a piece of fine leather, dipped in fine dried powder or flour. When cleared of the oil, a piece of fine flannel, dipped in dry flour and rubbed over it, will give it beauty and lustre. Varnishing must be conducted in a warm, dry atmosphere, kept very equable in temperature; it is therefore a good plan always to have a warm stove in the varnishing room. Coach painters are aware that some copal varnishes will answer very well upon one coach body, but when applied upon another will sink in dead, fall into pin-holes, or be otherwise faulty, and are at a loss how to account for such failures; they are not merely the effect of chance, but more frequently occur from the want of the necessary knowledge of oils, colours, and varnishes; for instance, when any piece of work is painted with a hard, solid, heavy, compact metallic or mineral colour, such as white-lead, patent yellow, &c. The grounds are then firm, close, and solid; and almost any copal varnish will look well, appear brilliant, stand polishing well, and sooner, than on any other grounds; it will last, however, but a short time, for if the varnish is deficient in gumminess, the metallic colour will imbibe the virtue of the varnish and cause its decay. The same varnish applied upon green grounds, which are much more absorbent, will sink in *sleepy* or dead, not having a sufficient oily and gummy body. Therefore it is necessary that every painter should be acquainted with the nature of his grounds, and procure his varnish accordingly, namely for hard, compact, solid grounds, a strong, gummy, tough, but flowing varnish; and for all soft absorbent grounds, such as compound greens, lakes, browns, drabs, a soft, strong, oily, free-flowing varnish. Copal varnishes, which abound with oil and gum, are those fittest for all sorts of coach-work, as they possess firmness, toughness, and durability; yet they are slower in drying, and must stand some time before they will bear polishing; whereas all hard brittle varnishes will dry firm and hard, bear polishing very soon, but afterwards crack and fade all over. Coach painters ought to use the best polishing body copal for bodies, and even for carriage-work, where the colours are very pale and delicate, or at least lay the last coat with body varnish. Where the work is dark, there is no occasion to fear using a middling dark carriage varnish, as it is often better than the pale. Amber varnish is often used for varnishing black grounds or black japan, as possessing peculiar properties; besides, it is easy to lay on.

To Prepare Raw Oil.—Add ¼th part good brown japan to 4 parts raw linseed oil. If paint requires any further drier, ½ oz. sugar of lead and ½ oz. white vitriol ground together can be added to each pound of paint.

Yellow Colours.—When a coach is to be painted pale yellow, take 3 lbs. of dry white-lead, 1 lb. of whiting, ½ lb. of litharge, ½ lb. of pale spruce ochre, all well dried; grind with 3 parts raw oil, 1 part turpentine; add sufficient gold size to make it dry, firm, and hard; as soon as dry, sand-paper and putty up the work with hard putty, then prepare a sufficient quantity of the above colours; apply 3 coats, rubbing down with care; after these apply a fourth, and if necessary a fifth coat, made of 3 lbs. of dry white-lead, ¼ lb. of dry spruce ochre, ¼ lb. of pumice-stone, all well ground with 3 parts raw oil, 2 parts turpentine, adding a little pale gold size to dry it firm and hard. When dry and rubbed down, apply the finishing coat, pale patent yellow, ground in 4 parts prepared oil, 1 part turpentine; and 1 coat,

if well laid, looks always more clear and bright than when 2 are applied. The above being a mineral metallic colour, it is compact, firm, and durable, and will dry sooner, firmer, and harder, as well as bear out and support varnishing and polishing better, than most other colours.

LAKE COLOURS.—If a coach is to be finished of a lake colour, proceed with the first four or five applications exactly as for yellow; then take dry white-lead, ground with half oil and half turpentine, stain it with Indian red, and add a little gold size. When dry and hard, rub it very smooth; then apply another coat of good Indian red, ground in prepared oil and turpentine, with very little gold size; next rub that very smooth, let it harden well, taking great care not to cut through the former coat; wash it clean off, wipe it perfectly dry, let it be as free from any moisture as possible, and then apply the finishing coat of pure lake, ground and worked in 4 parts prepared oil, 2 parts turpentine, with a little pale gold size, or else very pale boiled oil, to cause it to dry.

GREEN COLOURS.—In laying the finishing coat of any compound green on coach bodies, it is indispensably necessary that the colour be worked full, and laid off very smoothly and lightly, by working the brush perpendicularly from top to bottom; otherwise compound green colours will always appear shaded, and if highly varnished, the shades will be rendered more conspicuous. Several greens, from the nature of their component parts, will cause the varnish, however good and old, to ferment and fall into pin-holes. Prussian blue, when ground in oil without previous preparation, always becomes *livery*, as it is termed, in a short time, and is then unfit for use; this arises from the blue being composed of prussic acid and vitriol, which act on the oil. The strongest nitrous acid and acetate of lead are component parts of the chrome yellows; and all sorts of verdigris are made either by pyroligneous or vitriolic acids. All colours therefore which contain strong acids, whether mineral or vegetable, destroy the oils in which they are ground and applied, cause the whole body and brilliancy of the colour to fade, and even corrode and destroy the most durable varnishes. To guard against these effects, it is necessary in preparing Prussian blue to grind it very fine in pure soft water, and afterwards to pour on it plenty of boiling soft water, washing it well about, and allowing it to stand 8 or 10 hours to settle: the clear water must then be poured off the surface and more boiling water poured on the blue, which must be washed as before, and when the colour has again settled, must be poured off, and the blue laid upon a linen filter to drain out the water. When the blue has become rather stiff, remove it on to chalk stones, or sheets of white paper, keeping it free from dust; dry it in the sun, if possible; but if not convenient, dry it very gradually by a stove. The more the blue is washed, the finer, softer, and more brilliant it becomes, and the freer it will be from acid.

Repainting Carriages.—Previous to repainting or revarnishing any old coach-work, it is necessary first to wash the work quite clean, and also to rub down the surface with a wet cloth and ground pumice powder, until it appears quite dead, or without gloss. The work should then be washed, and dried with a wash leather; after which it is fit to receive either paint or varnish. Old work is frequently dirty, greasy, and strongly impregnated with various exhalations, very injurious to paint-work and varnish from its being kept shut up in cold damp coach-houses, which have often doors or passages communicating with stables, latrines, and so on. If therefore it be repainted or revarnished, without having been well washed and rubbed down, it seldom or never dries properly, owing to the exhalations with which the surface is in general incrusted: and should the surface be even clear from grease, no paint or varnish will adhere, or can be well applied, on the old glossy surface, without its having been first rubbed down with the pumice powder and water, as that entirely removes all stains, grease,

and gloss from the surface. Paint or varnish will then adhere to the old ground, and can be easily worked and extended with the brush, without the colour *cissing*, as it is termed. Varnish is very apt to *ciss* on old work, if the second coat is not applied as soon as ever the first coat is hard enough to bear varnishing.

Carriage Japanning.—In order to lay a durable ground for finishing carriage-work with japan, examin. all the work, particularly leather; see that it is free from oil, grease, or wrinkles; then prepare a priming colour, of equal parts of white-lead, red-lead, and spruce ochre, all well dried, and ground separately rather stiff in linseed oil; then mix the whole together, and add half a pint of gold size to each pound of colour, with as much turpentine as will cause the colour to work freely and easily. Brush the colour well out, rubbing it into every crack, joint, and crevice. As soon as this coat is dry, putty up all the cracks, and apply a second coat of the same colour. For the succeeding coats, grind equal parts of white-lead and spruce ochre ratner stiff in half raw oil and turpentine; add as much vegetable lampblack as will change it to a dark lead colour; add to each pound ½ pint of good boiled oil, ¼ pint of gold size, and afterwards thin up the colour with turpentine for use, observing that the greater the quantity of turpentine which enters into the composition of the grounds, the less durable they become, and that if the quantity of raw oil was increased, the grounds would become more firm, solid, and durable, but would neither dry nor rub down so soon. All colours intended for old grounds ought to be prepared and used with as much oil as will give a firm, tough solidity. After the dark grounds are properly filled up, rubbed down smooth, and well cleaned, apply a coat of calcined lampblack, sifted very fine and mixed up with black japan, adding as much turpentine as will cause it to work freely. When this coat is dry and rubbed down, apply a finishing coat entirely of japan, without mixing it with varnish, which always causes japan to assume a green tint. Varnish with two or three coats of genuine amber varnish, which will not appear green, and is much more solid and durable than carriage copal varnishes generally are. Some painters put Prussian blue, verdigris, &c., into their last or finishing coat of japan, in order to keep down the *rustiness* of the japan; all such grounds are never black, but of a slatey grey hue, and, when viewed in wet or moist weather, appear all over of a bloom or greenish grey tint. Nothing more effectual can be done by the painter to improve the jetty blackness of japan than proper application, judicious rubbing down, varnishing, and afterwards polishing.

Carriage Graining. POLLARD OAK.—The ground should be formed with patches of Vandyke brown. A softener should be drawn between the patches and the curls or knots formed by turning a short-cut hair pencil, or sponge, tied on the end of a stick between the thumb and finger. To render the work more showy, patches of lake and burnt terra de sienna may be put in. The graining colours are made of equal portions of burnt Turkey umber or Vandyke, raw terra de sienna and burnt copperas, ground separately in boiled oil or turps very stiff, and then mixed together, the whole thinned with spirits of turpentine. A very light coat should be rubbed on the panel with a large sash brush, and while wet a flat graining brush containing a very thin row of hairs should be dipped in the colour and dappled in a spirited manner in various directions. The brush should then be dipped in burnt umber made thin with turpentine, and some fine spirits thrown on. When the colours are set, take the same flat brush, dip it into a thin glaze of burnt umber, and put the grain on in a curly direction. A small part only of the surface should be finished at once, as the work will blend better if kept moist. It is necessary that a sufficient quantity of oil should be put into the colours to bind them.

BIRD'S-EYE MAPLE.—The ground should be light buff, prepared with white-

lead, chrome yellow, and a little vermilion or Venetian red to tone the brightness of the yellow. The graining is made of equal parts of raw umber and terra de sienna ground to a proper consistence in ale. Spread the surface of the work with this colour, have some a little thicker prepared, and immediately take a sash tool or sponge and put on the dark shades, which may be softened with a badger-hair pencil. Before the colour is dry put on the eyes by dabbing with the dotter. When dry, put the grain on the prominent parts with a camel-hair pencil to imitate the small hearts of the wood. When the whole is quite dry apply the varnish.

CURLED MAPLE.—For the ground mix chrome yellow, white-lead, and burnt terra de sienna. For the graining, equal parts of raw terra de sienna and umber, with a little burnt copperas, may be ground in turpentine and be mixed with a small quantity of grainers' cream. Thin the colour with boiled oil; then fill the tool, and spread the surface evenly. Rub out the lights with a piece of buff leather, which must be reasonably wiped to keep it clean. Soften the edges of the work very lightly, and when dry, put on the top grain with burnt umber and raw terra de sienna ground in ale, with the white of an egg beaten into it. When quite dry, varnish.

Varnishing and Polishing Fret-work.—The wood is first well smoothed with fine glass paper, then covered with a thin coating of size, made from transparent glue, to prevent the varnish from sinking into the wood. When dry, pour some varnish into a saucer; take a fine camel-hair brush, and commence to varnish at one corner, gradually spreading over the whole surface. Take care that there is not too much varnish on the brush, if it is applied otherwise an even surface cannot be obtained. The first coating must be allowed to dry, which will take two or three hours. Take a sheet of the finest glass paper, and when the first coating of varnish is perfectly dry, glass-paper the whole surface, and make it smooth as before. This done, with great care spread next coat of varnish on, always using the glass paper when the surface does not turn out very smooth. The whole, when dry, may be rubbed well with a piece of worn woollen till it is bright and smooth. To French polish the work, make the wood smooth as before. Then pour some prepared polish into a saucer, and some linseed oil into another. Then take some pieces of woollen rag, and roll them up into a ball, covering them with a piece of linen drawn tightly over. The rags inside should first be saturated with the polish, and the whole should be taken in the fingers of the right hand in such a way that the linen may be tightly drawn over, and may present to the wood a smooth rounded surface. Begin by polishing with free, circular strokes, and gradually traversing the whole surface. Apply now and then a drop of polish and a drop of oil to the surface of the rubber. When the grain of the wood disappears, allow it to stand for an hour or two till quite hard, and then glass-paper the whole as in varnishing. Repeat the process of polishing until the surface is quite smooth. If dull patches appear in the polish, they may be removed by a few drops of spirits of wine on a new rubber.

French Polishing.—As in varnishing, a warm, dry atmosphere is essential, and all draughts of cold air from door or window must be avoided.

Pour a little linseed oil into a cup and some polish into another; take a piece of woollen rag a few inches square, and having rolled it up into a ball saturate it with polish, and cover with a piece of linen or muslin drawn tightly over it. In this way the rubbers or pads are prepared, and they should, when taken by the fingers of the right hand, be held in such a manner as to draw the linen covering tight, and present a smooth, slightly convex surface to work with; apply one drop of oil and one drop of polish to the surface of the pad, and it is ready for use. Care must be taken that the material of which the rubbers are made is well washed and free from starch or soap. The work having been thoroughly smoothed with fine glass paper and the dust wiped away with a clean cloth, the

polishing is commenced with free, continuous and uniform circular strokes, applied with very slight pressure, and gradually traversing the whole surface, observing not to do more than a square foot at a time; the same process is repeatedly continued, varying the position of the strokes as much as possible, but keeping them about the same size, and taking care that every portion of the surface receives an equal but not excessive quantity of polish, which is regulated partly by the degree of pressure on the rubber, and partly by squeezing it between the fingers.

The process of polishing is continued until the grain of the wood appears to be thoroughly filled up, and the surface exhibits a uniform appearance, well covered with a thin coat of polish. It is then allowed to stand for an hour or two to become thoroughly hard, when it is rubbed with very fine glass paper, to smooth down all the irregularities of the grain of the wood, and also of the polish. The polishing is then repeated, and, if it should be found necessary, it is again smoothed, and the polishing is persevered in until the surface appears quite smooth, and uniformly covered with a thin and tolerably bright coat of polish, but which will, nevertheless, show cloudy marks from the rubber, owing to the presence of the oil, which is finally removed with a few drops of spirits of wine applied on a clean rubber and covered with a clean soft linen rag, with which the work is rubbed with very light strokes, applied first with a circular motion, and when the surface appears nearly dry, straight strokes are taken lengthways of the grain of the wood, and traversed entirely off the ends of the work; this is continued until the rubber and work are both quite dry, when the polishing will be completed. The polish, however, will be partly absorbed by the wood in the course of a day or two; and therefore it is desirable to repeat the process after a lapse of a few days, first slightly rubbing down the former coat with very fine or nearly worn-out glass paper.

STOPPING FOR FRENCH POLISHING.—Plaster of Paris, when made into a creamy paste, with water, proves a most valuable pore-filling material. It is to be rubbed by means of a coarse rag across the woody fibre into the holes and pores, till they be completely saturated, and then the superfluous stucco on the outside is to be instantly wiped off. The succeeding processes are technically termed papering, oiling, and embodying.

When finely-pounded whiting is slaked with painter's drying oil, it constitutes another good pore-filler. It is applied in the same manner as the preceding one, and it is recommended on account of its quickly hardening and tenacious virtues as a cement; sometimes white-lead is used in lieu of the whiting.

Before using either of these, or other compositions for the same purpose, it is best to tint them to correspond exactly with the colour of the article it is intended to size.

Holes and crevices may be well filled up with a cement that is made by melting beeswax in combination with resin and shellac.

Polishing Wood Carving.—Take a piece of wadding, soft and pliable, and drop a few drops of white or transparent polish or French polish, according to the colour of the wood. Wrap the wetted wadding up in a piece of old linen, forming it into a pad; hold the pad by the surplus linen; touch the pad with one or two drops of linseed oil. Pass the pad gently over the parts to be polished, working it round in small circles, occasionally re-wetting the wadding in polish, and the pad with a drop or so of oil. The object of the oil is merely to cause the pad to run over the wood easily without sticking, therefore as little as possible should be used, as it tends to deaden the polish to a certain extent. Where a carving is to be polished after having been varnished, the same process is necessary, but it can only be applied to the plainer portions of the work. Plane surfaces must be made perfectly smooth with glass paper before polishing, as every scratch or mark will show twice as badly after the operation. When the polish is first rubbed on the wood, it is called the *bodying in*; it will sink into the wood

and not give much glaze. It must, when dry, have another body rubbed on, and a third generally finishes it; but if not, the operation must be repeated. Just before the task is completed, greasy smears will show themselves; these will disappear by continuing the gentle rubbing without oiling the pad.

Polishing or Oiling Planes.—Planes made from naturally dried beech-wood are much lighter in colour than those made from artificially dried or steamed beech. For planes made of the first-named beech, use raw linseed oil, 1 gill; dragon's blood, 1 pennyworth; yellow ochre, as much in bulk as dragon's blood; mix these together, and rub the planes all over except the sole or bottom; let them remain about a week. Take them and rub well all over with a clean soft rag; give one more coat of oil alone. Let it dry for three or four days, then rub well with a clean rag; lay them by for a week or two; rub again with rag, and use them if wanted. Let care be taken to keep them free from dust while the oil is wet, or they will be a dirty colour. For steamed beech proceed the same, except not to use more than about half the quantity of dragon's blood.

French Polish.—1. 1 pint of spirits of wine, ¼ oz. of gum copal, ¼ oz. of gum arabic, and 1 oz. of shellac. Bruise the gums and sift them through a piece of muslin. Place the spirits and the gums together in a vessel closely corked, place them near a warm stove, and frequently shake them; in two or three days they will be dissolved. Strain through a piece of muslin, and keep it corked tight. 2. Shellac, 6 oz.; naphtha, 1 quart; benzoin, ¾ oz.; sandarach, 1 oz. 3. Dissolve 1½ oz. shellac, ¼ oz. sandarach, in ½ pint naphtha. To apply the polish fold a piece of flannel into a sort of cushion, wet it well with the polish, then lay a piece of clean linen rag over the flannel, apply one drop of linseed oil; rub your work in a circular direction lightly at first. To finish off, use a little naphtha applied the same as the polish. 4. Pale shellac, 2½ lbs.; mastic and sandarach, of each 3 oz.; spirits, 1 gallon. Dissolve, and add copal varnish, 1 pint; mix well by agitation. 5. Shellac, 12 oz; wood naphtha, 1 quart; dissolve, and add ½ pint of linseed oil. 6. Crush 3 oz. of shellac with ½ oz. of gum mastic, add 1 pint of methylated spirits of wine, and dissolve. 7. Shellac, 12 oz.; gum elemi, 2 oz.; gum copal, 3 oz.; spirits of wine, 1 gallon; dissolve. 8. Shellac, 1½ oz.; gum juniper, ½ oz.; benzoin, ½ oz.; methylated alcohol, ½ pint. 9. 1 oz. each of gums mastic, sandarach, seed-lac, shellac, and gum arabic, reduce to powder; then add ½ oz. virgin wax; dissolve in a bottle with 1 quart rectified spirits of wine. Let it stand for 12 hours, and it is then fit for use. 10. 1 oz. gum-lac; 2 drs. mastic in drops · 4 drs. sandarach; 3 oz. shellac; ½ oz. gum dragon. Reduce the whole to powder.

French Polish Reviver.—1. Linseed oil, ½ pint; spirits of camphor, 1 oz.; vinegar, 2 oz.; butter of antimony, ½ oz.; spirit of hartshorn, ½ oz. 2. ½ gill vinegar; 1 gill spirits of wine; 1 dr. linseed oil. 3. Naphtha, 1 lb.; shellac, 4 oz.; oxalic acid, ½ oz. Let it stand till dissolved, then add 3 oz. linseed oil.

Furniture Paste.—1. To keep wood light, scrape ½ lb. beeswax into ½ pint of turpentine. By adding linseed oil the wood is darkened. 2. Dissolve 6 oz. pearlash in a quart of hot water, add ½ lb. of white wax, and simmer for half an hour in a pipkin; take from off the fire, and when cool the wax will float, which should be taken off, and, with a little hot water, worked into a paste. 3. Beeswax, spirits of turpentine, and linseed oil, equal parts; melt and cool. 4. Beeswax, 4 oz.; turpentine, 10 oz.; alkanet root to colour; melt and strain. 5. Digest 2 drs. of alkanet root in 20 oz. of turpentine till the colour is imparted; add yellow wax in shavings, 4 oz.; place on a water bath and stir till the mixture is complete. 6. Beeswax, 1 lb.; linseed oil, 5 oz.; alkanet root, ½ oz.; melt, add 5 oz. of turpentine, strain and cool. 7. Beeswax, 4 oz. resin, 1 oz.; oil of turpentine, 2 oz.; Venetian red to colour. 8. 1 lb. of white wax; 1 oz. black resin; 1 oz. alkanet root; and 10 oz. linseed oil.

Furniture Cream.—1. Yellow

wax, 4 oz.; yellow soap, 2 oz.; water, 50 oz.; boil, with constant stirring, and add boiled oil and oil of turpentine, each 5 oz. 2. Soft water, 1 gallon; soap, 4 oz.; white wax, in shavings, 1 lb. Boil together, and add 2 oz. of pearlash. To be diluted with water, laid on with a paint brush, and polished off with a hard brush or cloth. 3. Wax, 3 oz.; pearlash, 2 oz.; water, 6 oz. Heat together, and add 4 oz. of boiled oil and 5 oz. of spirits of turpentine.

White Furniture Cream.—Raw linseed oil, 6 oz.; white wine vinegar, 3 oz.; methylated spirit, 3 oz.; butter of antimony, ½ oz.; mix the linseed oil with the vinegar by degrees, and shake well so as to prevent separation; add the spirit and antimony, and mix thoroughly.

Furniture Oils.—1. Boiled linseed oil, 1 pint; yellow wax, 4 oz.; melt, and colour with alkanet root. 2. Acetic acid, 2 drs.; oil of lavender, ½ dr.; rectified spirit, 1 dr.; linseed oil, 4 oz. 3. Linseed oil, 1 pint; alkanet root, 2 oz.; heat, strain, and add lac varnish, 1 oz. 4. Linseed oil, 1 pint; rectified spirit, 2 oz.; butter of antimony, 4 oz.

Oil for Darkening Furniture.—1 pint linseed oil; 1 oz. rose-pink; and 1 oz. of alkanet root, beaten up in a metal mortar; let the mixture stand for a day or two; then pour off the oil, which will be found of a rich colour. Or, mix 1 oz. of alkanet root with 4 oz. of shellac varnish, 2 oz. of turpentine, the same quantity of scraped beeswax, and a pint of linseed oil: this should stand a week.

Furniture Reviver.—Pale linseed oil, raw, 10 oz.; lac varnish and wood spirit, of each 5 oz. Mix well before using.

Polish for Turners' Work.—Dissolve 1 oz. of sandarach in ½ pint of spirits of wine; shave 1 oz. of beeswax, and dissolve it in a sufficient quantity of spirits of turpentine to make it into a paste, add the former mixture to t by degrees; then, with a woollen cloth, apply it to the work while it is in motion in the lathe, and polish it with a soft linen rag; it will appear as if highly varnished.

Cleaning and Polishing Mahogany.—Take 1 pint of the furniture oil, mix with it ½ pint of spirits of turpentine and ½ pint of vinegar; wet a woollen rag with the liquid and rub the wood the way of the grain, then polish with a piece of flannel and soft cloth.

Furniture Polish.—Melt three or four pieces of sandarach, each of the size of a walnut, add 1 pint of boiled oil, and boil together for 1 hour. While cooling add 1 dr. of Venice turpentine, and if too thick a little oil of turpentine also. Apply this all over the furniture, and after some hours rub it off; rub the furniture daily, without applying fresh varnish, except about once in two months. Water does not injure this polish, and any stain or scratch may be again covered, which cannot be done with French polish.

To Polish Wainscot.—Take as much beeswax as required, and placing it in a glazed earthen pan, add as much spirits of wine as will cover it, and let it dissolve without heat. Add either one ingredient as is required, to reduce it to the consistence of butter. When this mixture is well rubbed into the grain of the wood, and cleaned off with clean linen, it gives a good gloss to the work.

Polish for Carved Cabinet-work.—Dissolve 2 oz. of seed-lac, and 2 oz. of white resin, in 1 pint of spirits of wine. This varnish or polish must be laid on warm, and if the work can be warmed also, it will be so much the better; at any rate, moisture and dampness must be avoided. Used with a brush for standards or pillars of cabinet-work. The carved parts of cabinet-work are also polished thus: varnish the parts with the common wood varnish, and having dressed them off where necessary with emery paper, apply the polish used for the other parts of the work.

Copal Polish.—Melt with gentle heat finely-powdered gum copal, 4 parts, and gum camphor, 1 part, with ether to form a semi-fluid mass, and then digest with a sufficient quantity of alcohol.

Polishing in the Lathe.—Good work does not require much polishing, for the beauty of it depends more on being

executed with tools properly ground, set, and in good order; the work performed by such tools will have its surface much smoother, its mouldings and edges much better finished, and the whole nearly polished, requiring, of course, much less subsequent polishing than work turned with blunt tools. One of the most necessary things in polishing is cleanliness; therefore, previous to beginning, it is as well to clear the turning-lathe or workbench of all shavings, dust, and so on, as also to examine all the powders, lacquers, linen, flannel, or brushes which may be required; to see that they are free from dust, grit, or any foreign matter. For further security, the polishing powders used are sometimes tied up in a piece of linen, and shaken as through a sieve, so that none but the finest particles can pass. Although, throughout the following methods, certain polishing powders are recommended for particular kinds of work, there are others applicable to the same purposes, the selection from which remains with the operator; observing this distinction, that when the work is rough and requires much polishing, the coarser powders are best; but the smoother the work, the less polishing it requires, and the finer powders are preferable.

Soft woods may be turned so smooth as to require no other polishing than that produced by holding against it a few fine turnings or shavings of the same wood whilst revolving, this being often sufficient to give it a finished appearance; but when the surface of the wood has been left rough, it must be rubbed smooth with polishing paper, constantly varying the position of the hand, otherwise it would occasion rings or grooves in the work. When the work has been polished with the lathe revolving in the usual way, it appears to be smooth; but the roughness is only laid down in one direction, and not entirely removed, which would prove to be the case by turning the lathe the contrary way, and applying the glass paper; on which account work is polished best in a pole-lathe, which turns backwards and forwards alternately, and therefore it is well to imitate that motion as nearly as possible.

Mahogany, walnut, and some other woods, of about the same degree of hardness, may be polished by either of the following methods:—Dissolve, by heat, so much beeswax, in spirits of turpentine, that the mixture when cold shall be of about the thickness of honey. This may be applied either to furniture or to work running in the lathe, by means of a piece of clean cloth, and as much as possible should then be rubbed off by means of a clean flannel or other cloth. Beeswax alone is often used; upon furniture it must be melted by means of a warm flat iron; but it may be applied to work in the lathe by holding the wax against it until a portion of it adheres; a piece of woollen cloth should then be held upon it, and the lathe turned very quickly, so as to melt the wax; the superfluous portion of which may be removed by means of a small piece of wood or blunt metal, when a light touch with a clean part of the cloth will give it a gloss. A very good polish may be given to mahogany by rubbing it over with linseed oil, and then holding against it a cloth dipped in fine brick-dust. Formerly nearly all the mahogany furniture made in England was polished in this way.

Hard Woods.—These, from their nature, are readily turned very smooth; fine glass paper will suffice to give them a very perfect surface; a little linseed oil may then be rubbed on, and a portion of the turnings of the wood to be polished may then be held against the article, whilst it turns rapidly round, which will, in general, give it a fine gloss. Sometimes a portion of shellac, or rather of seed-lac, varnish is applied upon a piece of cloth, in the way formerly described. The polish of all ornamental work wholly depends on the execution of the same, which should be done with tools properly sharpened; and then the work requires no other polishing but with a dry hand-brush, to clean it from shavings or dust, this trifling friction being sufficient to give the required lustre.

Ivory or *bone* admits 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 them 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 in soapsuds. Care must be taken in this, and in every instance where articles of different fineness are successively used, that previously to applying a finer, every particle of the coarser material be removed, and that the rags be clean and free from grittiness.

Ornamented 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 oil-stone, holding the blade nearly upright, so as to form an edge like that of a currier's knife, and which, like it, may be sharpened by burnishing. Work, when properly scraped, is prepared for polishing. To effect this, it is first to be 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 what the workmen call 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 the operation. The buff is to 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 buff, or *bob*, on which washed chalk, or dry whiting, is rubbed; the comb or other article to be polished is moistened slightly with vinegar, and the buff and whiting will produce a fine gloss, which may be completed by rubbing it with the palm of the hand and a small portion of dry whiting, or rottenstone.

Pigments. INDIAN RED.—When pure this is a native mineral production, it is manufactured artificially by calcining sulphate of iron until the water of crystallization is expelled, then roast it with a fierce fire until acid vapours cease to arise; cool, wash the remainder with water until the water ceases to affect litmus paper, then dry. An inferior quality is made by calcining 11 parts common salt with 25 parts green sulphate of iron, wash well with water, dry, and powder the remainder. As thus prepared Indian red is the same as *jewellers' rouge* and *colcothar*. When used as a pigment it is frequently mixed with red ochre. It is a very permanent colour, can be made of different tints, and is especially useful in fresco and silicious painting. The finest Indian red or *crocus* usually undergoes a second calcination, in which it is exposed to a very intense heat.

LIGHT RED, made from yellow ochre by careful calcination. This colour mixes well with both oil and water, and gives a capital *flesh colour* when mixed with white.

RED CHALK.—A natural clay containing nearly ½ protoxide and carbonate of iron.

RED-LEAD. — Prepared by placing ground and well-washed massicot in iron trays piled up on the hearth of a reverberatory furnace, in a heat of from 600° to 650° Fahr., stirring it occasionally until of the proper colour.

Massicot (*Protoxide of Lead*).—Genuine massicot is the strongest oxide of lead, and its colour is a dull orange yellow, but artists occasionally apply the term massicot to white-lead roasted until it turns yellow. In the preparation of minium the lead is calcined in a reverberatory furnace; this process gives a mixture of massicot and lead; these are separated by washing and trituration; the massicot being much lighter remains

suspended in the water; it is drawn off, and left to settle; the *deposit* which it then forms is collected and dried, and this is the true massicot. It may be employed with advantage in preparing the drying oils; it produces the same effect as litharge when very finely ground. It may be employed as a colour; its tint is not brilliant; but as it is a better drier than white-lead, it may be substituted for it in mixing with colours which dry with difficulty, as the lakes and the bituminous earths.

Minium.—A higher degree of oxidation transforms the massicot into minium. On a large scale minium is prepared by calcining massicot in reverberatory furnaces; it becomes first of a dark orange colour, then purple, but this last tint disappears on its cooling; when at this point, the doors of the furnaces are closed, but not hermetically, so as to allow of a little air entering. The massicot cools very slowly; and as it absorbs the oxygen of the air, it becomes of a strong orange colour and grows finer in proportion to the slowness of its cooling. If instead of massicot we calcine ceruse, a peculiar red, called "mineral orange," is obtained; it is a minium, but of a tint more pure and brilliant than any of its class.

To TEST RED-LEAD.—There are few substances to be found which can be mixed with red-lead without injuring its brilliant colour. Nevertheless, it is often mixed with brick-dust or red ochre. For detecting brick-dust, heat the red-lead in an earthen crucible, and then dissolve it in diluted nitric acid. If brick-dust is present it remains undissolved. To detect red ochre, boil the red-lead in muriatic acid; dilute the solution with water and filter it. Add to a portion of the clear solution a solution of yellow prussiate of potash, and to another portion an excess of a solution of caustic potash. If the first reagent produces a dark blue precipitate, and the second a brown precipitate, the red-lead contains red ochre.

VERMILION.—Vermilion is a sulphide of mercury; it may be used in oil, water, fresco, and silicious painting. In all cases, however, it gets slightly darker in time; this is not a chemical but a physical change. With the exception mentioned, this pigment is very permanent. Vermilion is composed of mercury and sulphur, very intimately combined. It is found naturally formed in the quicksilver mines; but that which is used in painting is an artificial production. 1. Vermilion is prepared by melting one part of sulphur, and adding to it gradually five or six parts of mercury; the heat is continued until the mixture swells up, then cover the vessel and remove it from the heat; when the mixture is cold reduce it to powder and sublime in a closed vessel so placed in a furnace that the flames may play freely around it to about half its height. The heat is gradually increased until the lower portion of the subliming vessel becomes red hot; the cold sublimate is broken into pieces, ground in water to a fine powder, passed through a sieve and dried. At first the mixture becomes black, takes the name of Æthiops mineral, or black sulphuret of mercury; this substance is then reduced to powder, and sublimed in appropriate vessels, when a crystallized mass is obtained, composed of bright filaments of a violet tint; by trituration it becomes of a scarlet colour. But the mere grinding will not be sufficient to give a bright tone to the vermilion; various methods are employed for that purpose, which are not generally known. Some manufacturers grind these ingredients up with plain water or with urine, and afterwards boil it for some time; others treat it with nitric acid; but it does not happen that any of the methods hitherto employed for heightening the colour of vermilion obtained by sublimation, give the same brightness as the Chinese vermilion, the preparation of which is not known. 2. Quicksilver 300 parts, flowers of sulphur 114 parts, grind them together or some hours and then add gradually 75 parts caustic potash dissolved in 450 parts water; continue the grinding for some time longer, then gently heat the mixture in an iron vessel, first stirring constantly, but afterwards only at intervals, keeping the heat as near 115° Fahr. as

possible, and observing to add fresh water as the evaporation takes place. When the colour begins to redden great care is necessary to preserve the mixture at the proper temperature and to keep the sulphuret of mercury quite pulverulent. As soon as the colour is nearly fine the process must be conducted with increased caution and at a lower heat for some hours, until a rich colour is produced. This is well washed in water and dried. It is very injurious for those employed to inhale mercurial vapours, for which reason this operation should be performed only in a place where the chimney has a good current of air; there also should be fixed to the tube of glass with which the mixture is stirred a staff sufficiently long to hold at good distance from the vessel; in the same way the spoon should be lengthened with which the potash is added.

CARMINE.—Boil 1 lb. of cochineal and 4 drs. carbonate of potassa in 7½ galls. of water for quarter of an hour. The pot is taken from the fire and 8 drs. alum in powder mixed into the liquor, which is afterwards well stirred and then allowed to settle for 20 minutes or so. The liquid is poured into a fresh vessel and a solution of 4 drs. fish glue or isinglass, dissolved in a pint of water and strained, mixed with it. When a skin is formed upon the surface the heat is taken away and the liquor rapidly stirred, and allowed afterwards to settle for half an hour or so, when the deposited carmine is carefully collected, drained, and dried.

PAINTERS' CREAM.—Pale nut-oil, 6 oz., mastic 1 oz.; dissolve; add ½ oz. of sugar of lead ground in a little oil; then add water, gradually, until it acquires the consistence of cream, working it well all the time. Used by painters to cover their work when they are obliged to leave it for some time. It may be washed off with a sponge and water.

Lakes.—Lakes are made by adding a solution of alum, either alone or partly saturated with carbonate of potassa, to a filtered infusion or decoction of the colouring substance, and after agitation precipitating the mixture with a solution of carbonate of potash; by precipitating a decoction or infusion of the colouring substance made with a weak alkaline lye, by adding a solution of alum; or by agitating recently-precipitated alumina with a solution of the colouring matter, prepared as before, until the liquid is nearly decoloured, or the alumina acquires a sufficiently dark tint. The first method is usually employed for acidulous solutions of colouring matter, or for those whose tint is injured by alkalies; the second, for those that are brightened, or at least uninjured by alkalies; the third, for those colouring matters that have a great affinity for gelatinous alumina, and readily combine with it by mere agitation. By attention to these general rules, lakes may be prepared from almost all animal and vegetable colouring substances that yield their colour to water, many of which will be found to possess great beauty and permanence. The precise process adapted to each particular substance may be easily ascertained by taking a few drops of its infusion or decoction, and observing the effects of alkalies and acids on the colour. The quantity of alum or of alumina employed should be nearly sufficient to decolour the dye liquor, and the quantity of carbonate of potassa should be so proportioned to the alum as to exactly precipitate the alumina without leaving free or carbonated alkali in the liquid. The first portion of the precipitate has the deepest colour, and the shade gradually becomes paler as the operation proceeds. A beautiful tone of violet, red, and even purple may be communicated to the colouring matter of cochineal by the addition of perchloride of tin; the addition of arseniate of potassa in like manner gives shades which may be sought for in vain with alum or alumina. After the lake is precipitated, it must be carefully collected, washed with cold distilled water, or the purest rain water, until it ceases to give out colour, and then carefully dried in the shade. In this state it forms a soft velvety powder.

DROP LAKE is made by dropping the moist lake through a small funnel on a clean board or slab, and drying it by a gentle heat. A very little clear gum-water is commonly added to the paste

to give the drops consistence when dry. Synonymous with *Brazil-wood Lake.*

BLUE LAKE.—A fugitive colour prepared from some of the blue-coloured flowers. The name is also applied to lump archil, to moist alumina coloured with indigo, and to mixed solution of pearlash and prussiate of potash, precipitated with another solution of sulphate of iron and alum. These are permanent and beautiful, but are seldom used, in consequence of indigo and Prussian blue supplying all that is wanted in this class of colours.

BRAZIL-WOOD LAKE.—1. Ground Brazil-wood, 1 lb.; water, 4 galls.; digest for 24 hours, then boil for half an hour, add alum, 1½ lb., dissolved in a little water; mix, decant, strain, and add a solution of tin, ½ lb.; again mix well and filter; to the clear liquid add, cautiously, a solution of salt of tartar or carbonate of soda, as long as a deep-coloured precipitate forms, carefully avoiding excess; collect, wash, and dry. The product is deep red. By collecting the precipitate in separate portions, lakes varying in richness and depth of colour may be obtained. The first portion of the precipitated lake has the brightest colour. An excess of alkali turns it violet, and the addition of cream of tartar, brownish red. The tint turns more on the violet red when the solution of tin is omitted. Some persons use less, others more, alum. 2. Add washed and recently-precipitated alumina to a strong and filtered decoction of Brazil-wood. Inferior to the last.

CARMINATED LAKE.—1. The residuum of the cochineal left in making carmine is boiled with repeated portions of water, until it is exhausted of colour; the resulting liquor is mixed with that decanted off the carmine, and at once filtered; some recently-precipitated alumina is then added, and the whole gently heated, and well agitated for a short time; as soon as the alumina has absorbed sufficient colour, the mixture is allowed to settle, after which the clear portion is decanted, the lake collected on a filter, washed, and dried. The decanted liquor if still coloured is now treated with fresh alumina until exhausted, and thus a lake of a second quality is obtained. 2. To the coloured liquor obtained from the carmine and cochineal as above, a solution of alum is added, the filtered liquor precipitated with a solution of carbonate of potassa, and the lake collected and treated as before. Scarcely so good as the last. Some makers mix a solution of tin with the coloured liquor, adding the alum or alumina; this brightens the colour. The above lake is a good glazing colour with oil, but has little body.

COCHINEAL LAKE.—1. 1 oz. cochineal in coarse powder; water and rectified spirit, of each, 2½ oz.; digest for a week, filter, and precipitate the tincture with a few drops of solution of tin, added every 2 hours, until the whole of the colouring matter is thrown down; lastly, wash the precipitate in distilled water, and dry it. 2. Digest powdered cochineal in ammonia water for a week, dilute the solution with a little water, and add the liquid to a solution of alum, as long as a precipitate falls, which is the lake. 3. Coarsely-powdered cochineal, 1 lb.; water, 2 galls.; boil 1 hour, decant, strain, add a solution of salt of tartar, 1 lb., and precipitate with a solution of alum. By adding the alum first, and precipitating the lake with the alkali, the colour will be slightly varied. All the above are sold as Carminated or Florence Lake, to which they are often superior.

GREEN LAKE.—Made by mixing blue and yellow lake together. Generally prepared extemporaneously by the artist on his palette.

LAC LAKE.—Boil fresh stick-lac in a solution of carbonate of soda, filter the solution, precipitate with a solution of alum, and proceed as before. A fine red.

MADDER LAKE.—1. Crop madder, 2 oz.; tie it in a cloth, beat it well in a pint of water in a stone mortar, and repeat the process with about 5 pints of fresh water until it ceases to yield colour; boil the mixed liquor in an earthen vessel, pour it into a large basin, and add 1 oz. of alum, previously dissolved in a pint of boiling water; stir well, and while stirring, pour in gradually of a

strong solution of carbonate of potassa or oil of tartar, 1½ oz.; let the whole stand until cold, then pour off the yellow liquor from the top, drain, agitate the residuum with boiling water in separate quantities, 1 quart; decant, drain, and dry. Product, ½ an oz. The Society of Arts voted their gold medal to the author of this formula. 2. Add a little solution of acetate of lead to a decoction of madder, to throw down the brown colouring matter, filter, add a solution of tin or alum, precipitate with a solution of carbonate of soda or of potassa; proceed as before. 3. Ground madder, 2 lbs.; water, 1 gall.; macerate with agitation for 10 minutes, strain off the water, and press the remainder quite dry; repeat the process a second and third time; then add to the mixed liquors, alum, ½ lb. dissolved in water, 3 quarts; and heat in a water bath for 3 or 4 hours, adding water as it evaporates; next filter, first through flannel, and when sufficiently cold, through paper; then add a solution of carbonate of potassa as long as a precipitate falls, which must be washed until the water comes off colourless, and, lastly dried. If the alkali be added in 3 successive doses, 3 different lakes will be obtained, successively diminishing in beauty.

ORANGE LAKE.—Spanish annatto, 4 oz.; pearlash, ¾ lb.; water, 1 gall.; boil for half an hour, strain, precipitate with alum, 1 lb., dissolve in water, 1 gall., observing not to add the latter solution when it ceases to produce an effervescence or a precipitate; strain, and dry the sediment in small squares, lozenges, or drops. The addition of some solution of tin turns this lake on the lemon yellow; acids redden it.

RED LAKE.—Pearlash, 1 lb.; clean shreds of scarlet cloth, 3½ lbs.; water 5 galls.; boil till the cloth is decoloured, filter the decoction, and precipitate with a solution of alum, as before. See *Madder Lake*.

YELLOW LAKE.—1. Boil French berries, quercitron bark or turmeric, 1 lb., and salt of tartar, 1 oz., in water, 1 gall., until reduced to one-half; then strain the decoction, and precipitate with a solution of alum. 2. Boil 1 lb. of the dye-stuff with alum, ½ lb.; water, 1 gall.; as before, and precipitate the decoction with a solution of carbonate of potash. See Orange Lake.

White Pigments.—ALUM WHITE.—Powdered Roman alum, 2 lbs.; honey, 1 lb.; mix dry, powder, calcine in a shallow dish to whiteness, cool, wash, and dry. A beautiful and permanent white, both in oil and water.

DERBYSHIRE WHITE.—From chalk or heavy spar, by grinding and elutriation.

MINERAL WHITE.—Precipitated carbonate of lead.

NEWCASTLE WHITE. — White-lead made with molasses vinegar.

NOTTINGHAM WHITE. — White-lead made with alegar. Permanent white is now commonly sold for it.

PEARL WHITE.—Fard's Spanish white. Trisnitrate of bismuth.

PERMANENT WHITE.—Artificial sulphate of baryta, prepared by precipitating chloride of barium with dilute sulphuric acid, or a solution of glauber salts. A good fast white unchanged by sulphurous fumes. Used to mark jars and bottles for containing acids or alkalies, as it is affected by very few substances; also to adulterate white-lead.

SPANISH WHITE. — The softest and purest white chalk, elutriated, made into balls, and well dried. Used as a cheap white paint.

WHITE-LEAD.—Made by suspending rolls of thin sheet lead over malt vinegar, or pyroligneous acid, in close vessels, the evaporation from the acid being kept up by the vessels being placed in a heap of dung, or a steam bath. Commercial carbonate of lead, however prepared, is not the pure carbonate of lead, but always contains a certain proportion of hydrate. It is generally largely adulterated with native sulphate of baryta or heavy spar, and sometimes with chalk. The former may be detected by its insolubility in dilute sulphuric acid, or a solution of oxalic acid or oxalate of ammonia, after having been treated with sulphuretted hydrogen, or a hydrosulphuret, to throw down the lead. Pure carbonate of lead does not lose weight at a temperature of

212° Fahr.; 68 grains are entirely dissolved in 150 minims of acetic acid diluted with 1 fl. oz. of distilled water; and the solution is not entirely precipitated by a solution of 60 grains of phosphate of soda. The solution in nitric acid should not yield a precipitate when treated with a solution of sulphate of soda. Used as a superior white paint, and, in medicine, as an external astringent refrigerant, and desiccant. The particles of carbonate of lead prepared by precipitation, or by any of the quick processes, are in a somewhat crystalline and semi-translucent condition, and hence do not cover so well as that just noticed; also called fine white, and flake white. The following are some of the varieties of white-lead found in commerce.

Dutch White-lead.—1. From flake white, 1 cwt.; chalk, 3 cwt. 2. (Ordinary.) Flake white, 1 cwt.; chalk, 7 cwt. These form the best white-lead in the shops.

2. English White-lead.—Flake white lowered with chalk; covers badly, and the colour is inferior to the preceding.

French White-lead.—From litharge dissolved in vinegar and the lead thrown down by a current of carbonic acid gas from coke. Does not cover so well as flake white.

Hamburg White.—From flake white, 1 cwt; chalk, 2 cwt. Also sold for best Dutch white-lead.

Venetian White.—From flake white, or pure white-lead and chalk, equal parts.

Sulphate of Lead.—From an acetic or nitric solution of litharge precipitated by adding dilute sulphuric acid, and the white powder washed and dried. The clear liquid decanted from the precipitate is poured on fresh litharge, when a second solution takes place; this may be repeated for any number of times.

Chinese White.—Take as much as is required of zinc white finely ground, put it on a marble or glass slab, mix it into a cream of the required consistence by adding mucilage of gum tragacanth, grinding with a glass muller. For quantity required to fill an ordinary sized Chinese white bottle, add to above 10 or 12 drops of thick mucilage of gum arabic and 5 or 6 drops of pure glycerine; grind well together, and fill bottle by aid of palette knife. Make tragacanth mucilage by putting a small piece, size of a horse bean, into 2 oz. of cold water, letting it remain a day or two till gum swells up and absorbs water, then beat into a pulp. It will easily regrind when dry with a little fresh medium. As required consistence depends much on habit and practice, we do not specify any exact proportions. It is easy to add white or medium to suit taste. The cost when thus made is very trifling.

Whiting.—The same as prepared chalk, but prepared more carelessly, in horse-mills.

Wilkinson's White.—From litharge ground with sea water until it ceases to whiten, and then washed and dried.

Green Pigments. — Barth's Green.—Yellow lake, Prussian blue, and clay, ground together.

Bremen Green.—This is properly green verditer, but other preparations are frequently sold under the name.

Brighton Green.—Sulphate of copper, 7 lbs., add sugar of lead, 3 lbs.; each separately dissolved in water, 5 pints; mix the solutions, stir in whiting, 24 lbs., set the paste on chalk stones, and when dry grind it to powder.

Brunswick Green.—A saturated solution of sal ammoniac, 3 parts, is poured over copper filings or shreds, 2 parts, contained in a vessel capable of being closed up, and the mixture is kept in a warm place for some weeks, when the newly-formed green pigment is separated from the unoxidized copper, by washing the mixture on a sieve; it is then washed with water, and slowly dried in the shade. Colour very deep and rich. The lighter shades are produced by the addition of sulphate of baryta. In another method a solution of crude carbonate of ammonia or bone spirit is added to a mixed solution of alum and blue vitriol, as long as it affects the liquor; in a short time the precipitate is collected, washed, and dried. The various shades of green are produced by using different quantities of alum, which "pales" and "cheapens" it.

CHROME GREEN.—Prepared by melting in a crucible equivalent quantities of anhydrous boracic acid and bichromate of potassium, and treating the fused mass with water. The hydrated oxide thus produced is washed and finely triturated. Common chrome green is a mixture of chrome yellow and Prussian blue.

EMERALD GREEN.—A pulp is formed with verdigris, 1 part, and sufficient boiling water, and after being passed through a sieve, to remove lumps, is added gradually to a boiling solution of arsenious acid, 1 part, in water, 10 parts, the mixture being constantly stirred until the precipitate becomes a heavy granular powder, when it is collected on a calico filter, and dried on chalk stones.

GELLART'S GREEN.—A mixture of cobalt blue and flowers of zinc with some yellow pigment.

IRIS GREEN.—A pigment prepared by grinding the juice of the petals of the blue flag with quicklime. It is very fugitive.

MOUNTAIN GREEN.—Native green carbonate or bicarbonate of copper ground to powder, either with or without the addition of a little orpiment or chrome yellow. That of the shops is commonly prepared by adding a solution of carbonate of soda, or of potassa, to a hot mixed solution of sulphate of copper and alum. Green verditer is commonly sold for this article.

PRUSSIAN GREEN.—The sediment of the process of making Prussian blue from bullock's blood or horns, before it has had the hydrochloric acid added to it. It is also prepared by pouring liquid chlorine upon freshly-precipitated Prussian blue. As sold, this pigment is generally a mixture of Prussian blue and gamboge.

SAP GREEN.—A very fugitive pigment, prepared from the juice of buckthorn berries. The berries are allowed to ferment for a week or eight days in a wooden tub. The juice is then pressed out, strained, a little alum added, and the whole evaporated to a proper consistence; it is next run into pigs' bladders, and hung up in a dry situation to harden. An inferior article is made from the juice of black alder, and of evergreen privet. It is a common practice to add ¾ pint of lime water and ½ oz. of gum arabic to every pint of either of the above juices. Powdered arsenious acid, 11 oz.; carbonate of potassa, 1½ lb.; boiling water, 1 gall.; dissolve, filter, and add the solution, as before, to another solution of crystallized sulphate of copper, 2 lbs., in water, 3 gall. Product, 1½ lb. A very fine grass-green colour.

SCHEELE'S GREEN.—White arsenic in powder, 1 part; commercial potash, 2 parts; boiling water, 35 parts; dissolve, filter, and add the solution gradually, whilst still warm, to a filtered solution of sulphate of copper, 2 parts, as long as a precipitate falls; wash the newly-formed pigment with warm water, and dry it.

VIENNA or SCHWEINFURT GREEN.—Arsenious acid, 8 lbs., is dissolved in the least possible quantity of boiling water, and added to verdigris, 9 or 10 lbs., diffused through water, at 120° Fahr., the pap of the latter being first passed through a sieve; the mixed ingredients are then set aside till the mutual reaction produces the proper shade. 2. Sulphate of copper, 50 lbs., and lime, 10 lbs., are dissolved in good vinegar, 20 gall., and a boiling-hot solution of white arsenic, 50 lbs., is conveyed as quickly as possible into the liquor; the mixture is stirred several times, and then allowed to subside, after which it is collected on a filter, dried, and powdered. The supernatant liquor is employed the next time for dissolving the arsenic.

MANGANESE GREEN.—Prepared by mixing intimately 3 or 4 parts caustic barytes, moistened with water, 2 parts nitrate of barytes, and 2 of oxide of manganese; then introducing the mixture into a crucible heated to dull redness, and when it has fused, pouring it out, pulverizing it, digesting it in boiling water washing it with cold water, and drying it in an atmosphere which contains no carbonic acid. It answers well for paper hangings, being applied by means of thin glue, and for some other purposes, white of egg being used instead of the glue.

Yellow Pigments. — CHROME YELLOW.—1. Add a filtered solution of nitrate or acetate of lead to a like solu-

tion of neutral chromate of potash, as long as a precipitate falls; then collect this, wash it well with clean soft water, and dry it out of the reach of sulphuretted vapours. 2. Dissolve acetate of lead in warm water, and add a sufficient quantity of sulphuric acid to convert it into sulphate of lead; decant the clear liquid, wash the residuum with soft water, and digest it with agitation in a hot solution of yellow neutral chromate of potash, containing 1 part of that salt to every 3 parts of sulphate of lead; decant the liquid, which is a solution of sulphate of potash, and carefully drain, wash, and dry the newly-formed pigment. The product contains much sulphate of lead, but covers as well, and has as good a colour as pure chromate of lead, whilst it is much cheaper. The shade may be varied by increasing or lessening the quantity of the chromate.

KING'S YELLOW, or ORPIMENT.—A native sulphuret of arsenic. It is prepared artificially by sublimation from a mixture of arsenious acid and sulphur; or by collecting the precipitate when a stream of sulphuretted hydrogen gas is passed through a solution of arsenious acid.

NAPLES YELLOW.—1. Powdered metallic antimony, 3 parts by weight, oxide of zinc 1, red-lead 2, mixed, calcined, ground to a fine powder and fused in a closed crucible; the fused mass is ground to a fine powder and well washed. 2. Washed diaphoretic antimony 1 part, red-lead 2, grind with water to a stiff paste, and expose in a crucible to a red heat for 4 or 5 hours.

Blue Pigments.—ULTRAMARINE.—Pure lapis lazuli reduced to fragments about the size of a pea, and the colourless pieces rejected; 1 lb. is heated to redness, quenched in water, and ground to an impalpable powder; to this is added, yellow resin, 6 oz.; turpentine, beeswax, and linseed oil, each, 2 oz., previously melted together; the whole is next made into a mass, which is kneaded in successive portions of warm water, as long as it colours it blue; from these it is deposited on repose, and is then collected, well washed with clean water, dried, and sorted according to its qualities. The first water, which is usually dirty, is thrown away; the second gives a blue of the first quality; and the third and following ones yield samples of less value. Ultramarine is the most costly, but at the same time the most splendid and permanent, of our blue pigments, and works well in oil.

ULTRAMARINE ASHES.—Obtained from the residuous mass from making ultramarine, by melting it with fresh oil, and kneading it in water containing a little potash or soda; or, by burning away the wax and oil of the mass and well grinding and washing the residue with water. Very permanent, but much less brilliant than ultramarine.

AZURE BLUE, or PARIS BLUE.—1. Sulphur, 2 parts; dry carbonate of soda, 1 part; mix well; gradually heat them in a covered crucible to redness, or till the mixture fuses, then sprinkle in, by degrees another mixture of silicate of soda and aluminate of soda (containing 72 parts of silica and 70 parts of alumina), and continue the heat for an hour. The product contains a little free sulphur, which may be separated by water. 2. Kaolin, 37 parts; sulphate of soda, 15; carbonate of soda, 22; sulphur, 18; charcoal, 8; intimately mixed and heated from 24 to 30 hours, in large crucibles; the product is then heated again in cast-iron boxes, at a moderate temperature, till the required tint is obtained; it is finally pulverized, washed, and dried. 3. Take crystallized carbonate of soda, 1075 grs.; apply a gentle heat, and, when fused in its water of crystallization, shake in finely-pulverized orpiment, 5 grs., and, when partly decomposed, add as much gelatinous hydrate of alumina as contains 7 grs. of anhydrous alumina; finely-sifted clay, 100 grs., and flowers of sulphur, 221 grs., are next to be added; the whole placed in a covered crucible, and at first gently heated, to drive off the water; but as soon as this is effected, raised to redness, the heat being so regulated that the ingredients only "sinter" together, without actually fusing; the mass is then to be cooled, finely pulverized, suspended in river water, and brought upon a filter;

the product has now a very beautiful delicate green or bluish colour, but on being heated in a covered dish, and stirred about from time to time, until the temperature reaches that of dull redness, at which it must be kept for one or two hours, it changes to a rich blue. If the heat of the first calcination has been properly regulated, the whole of the mass taken from the crucible will have uniform colour; but if too little heat has been used, and the ingredients have not been properly mixed, there will be colourless parts, which should be rejected; if too much heat has been used, or the mass allowed to fuse, brown parts will appear, especially if the crucible is of a bad kind, or easily destroyed; these must also be rejected.

COBALT BLUE.—Prepared by slowly drying and heating to dull redness a mixture of freshly-precipitated alumina freed from water as much as possible, 8 to 10 parts; arseniate or phosphate of cobalt, 1 part. By daylight it is of a pure blue, but by artificial light the colour turns on the violet.

PRUSSIAN BLUE.—Mix alum, 2 parts, with sulphate of iron 1 part, add water sufficient to dissolve. Then make a solution of yellow prussiate of potash, add to it a little sulphuric acid, and when mixed drop in the first solution until the precipitate falls slowly; wash well on a filter and dry. Or add a solution of protosulphate of iron to one of red prussiate of potash; wash and dry.

SAXON BLUE.—Dissolve in 1 gallon of water 1 oz. sulphate of iron and 8 oz. alum; add together separate solutions of prussiate of potash and ordinary pearlash, until the mixture ceases to deposit a precipitate. After the deposit has stood for some time it should be collected, washed thoroughly, and dried.

Black Pigments.—IVORY BLACK.—Take any quantity of ivory-turner's waste or ivory dust, place in a closed crucible and expose for a sufficient time to strong heat. Cool the crucible, remove and powder its contents, wash in warm water and dry. An inferior pigment termed Bone Black is made by treating bones in a similar manner.

LAMPBLACK.—Cooley's 'Cyclopædia' has the following receipts for the preparation of this useful pigment. 1. A conical funnel of tin-plate furnished with a small pipe to convey the fumes from the apartment, is suspended over a lamp fed with oil, tallow, coal-tar, or crude naphtha, the wick being large and so arranged as to burn with a full smoky flame. Large spongy, mushroom-like concretions of an exceedingly light, very black, carbonaceous matter gradually form at the summit of the cone, and must be collected from time to time. The funnel should be united to the smoke-pipe by means of wire, and no solder should be used for the joints of either. 2. On a large scale, lampblack is made by burning bone-oil, previously freed from its ammonia, or common coal-tar, and receiving the smoke in a suitable chamber. In one process the coal-tar is violently agitated with lime water until the two are well mixed, after which it is allowed to subside, and the lime water having been drawn off, the tar is washed several times with hot water. After subsidence and decantation, it is put into stills, and rectified. The crude naphtha in the receiver is then put into a long cast-iron tube furnished with numerous large burners, underneath which is a furnace to heat the pipe to nearly the boiling point. Over each burner is a sort of funnel which goes into a cast-iron pipe or main, which thus receives the smoke from all the burners. From this main the smoke is conveyed by large pipes to a succession of boxes or chambers, and thence into a series of large canvas bags arranged side by side, and connected together at top and bottom alternately. Fifty to eighty of these bags are employed; the last one being left open to admit of the escape of the smoke, which has thus been made to traverse a space of about 400 yards. As soon as the bags contain any considerable quantity of black, they are removed and emptied. The black deposited in the last bag is the finest, and best, and it becomes progressively coarser as it approaches the furnace. The state of minute division in which the carbon exists in good

lampblack is such as cannot be given to any other matter, not even by grinding it on porpmyry, or by elutriation or washing over with water. On this account it goes a great way in every kind of painting. It may be rendered drier and less oily by gentle calcination in close vessels, when it is called Burnt Lampblack, and may then be used as a water colour; or its greasiness may be removed by being passed through water slightly alkalized with potassa.

Russian Lampblack is the soot produced by burning the chips of resinous deal. It is objectionable chiefly from being liable to take fire spontaneously when left for some time moistened with oil.

BLUE BLACK.—Vine-twigs dried and then carefully carbonized, in covered vessels, until of the proper shade. Pit-coal, carefully burnt at a white heat, then quenched in water, dried, and well ground, forms a cheap, good, and durable blue black, fit for most ordinary purposes.

Ochres.—These substances are hydrates of iron mixed in various proportions, and sometimes closely combined with various sorts of earth. The greater the proportion of clay, the brighter will be the colour: when there is a portion of clay, the substance feels greasy to the touch, and has more body than those have which are mixed with chalk and silex. The yellow ochres become red by calcination: the brown ochres, when pure, produce the finest red. Ochres may be prepared artificially, by moistening the rust of iron, and precipitating, by the alkalies, solutions of this metal. For instance, in precipitating it by the sub-carbonate of soda, or of muriate of potass, of nitrate, of acetate of iron, or persulphate of iron, the most brilliant brown ochres are obtained. If the sulphate of iron is of a low oxidization, the precipitate is olive-coloured, but it soon becomes yellow at the surface by absorbing a greater quantity of oxygen. To extend this operation to all the precipitates, it only requires exposure to the air, by stirring it up for a sufficient time. The same thing may be obtained in winter quite easily, by exposing it to the action of frost in wide shallow pans: the water passing into the state of ice leaves a small quantity of air disengaged, which unites with the precipitate, and is sufficient to give it an even yellow tone. When bright ochres are required, it will be necessary to mix alum, in certain proportion, with sulphate of iron; the solution is then to be precipitated by lime water. There exist in the natural state ochres of so very fine a quality, that they require no other preparation than that of being washed; therefore it is scarcely worth while to manufacture them artificially.

Cake Colours.—Procure a small slab and muller of glass, and grind the powders into a smooth stiff paste with equal parts of isinglass size and thin gum water; compress into squares as closely as possible, and dry with a very gentle heat. Old crumbling cake-colours may be powdered very finely in a biscuit-ware mortar, sifted through fine muslin, and ground up as above, omitting the gum water in the medium. If the powders are rubbed up with honey to the consistence of thick cream, they answer admirably as moist colours.

Jay's Metallic Paint.—Break common resin into dust or small pieces, and then dissolve in benzoline or turpentine until the solution acquires the consistency of syrup or treacle, or equal parts of each of the above spirits or hydrocarbons, and any other hydrocarbon that will dry and combine with drying oils, can be used instead of turpentine or benzoline. When the solution is complete it is gradually added to oxide of zinc, which has previously been made into a paste with boiled linseed oil, until the whole mixture acquires the consistency of paint suitable for use. A white paint is thus produced of a durable and glossy character. Other pigments, such as sulphate of barytes, oxide of iron, Brunswick green, or red-lead, can be added to make any desired colour of paint. One great advantage of its use, says the inventor, is its effectual resistance to heat and moisture. It never blisters or cracks, even under the hottest sun or the most inclement weather.

Paint for Wirework.—Boil good linseed oil with as much litharge as will make it of the consistency to be laid on with the brush; add lampblack at the rate of 1 part to every 10 by weight of the litharge: boil three hours over a gentle fire. The first coat should be thinner than the following coats.

Economical Paint.—Skim milk, 2 quarts; fresh-slaked lime, 8 oz.; linseed oil, 6 oz.; white Burgundy pitch, 2 oz.; Spanish white, 3 lbs. The lime to be slaked in water, exposed to the air, mixed in one-fourth of the milk; the oil in which the pitch is previously dissolved, to be added a little at a time; then the rest of the milk, and afterwards the Spanish white. This quantity is sufficient for 27 square yards, two coats.

Anti-corrosive Paint.—Take equal parts by weight of whiting and white-lead with half the quantity of fine sand, gravel, or road-dust, and a sufficient quantity of colouring matter. This mixture is made in water and can be used as a water colour; but it is more durable to dry it in cakes or powder after mixing, and then use it as an oil-paint by grinding it again in linseed oil. The preparation of oil recommended for this purpose is 12 parts by weight of linseed oil, 1 boiled linseed oil, and 3 sulphate of lime, well mixed. One gallon of this prepared oil is used to 7 lbs. of the powder.

Bronze Paint (*for Iron* or *Brass*).—Chrome green, 2 lbs.; ivory black, 1 oz.; chrome yellow, 1 oz.; good japan, 1 gill; grind all together and mix with linseed oil.

Painting in Oil Colours.—The implements and materials necessary for oil painting are: oil, varnish, colours, brushes, a palette, a palette knife, an easel, a rest stick, canvas, and a little chalk or crayon.

PALETTES.—Palettes are made of mahogany, and of satin and other light-coloured woods also; those made of the latter are preferable, because the colours and mixed tints are best seen upon them. They should be light in weight, and thin, and so perforated as to rest well-balanced on the thumb. Palettes are made of oval and oblong shapes; the latter form is more generally useful and convenient, as affording a greater space for the working of tints, as well as for their advantageous arrangement. Wooden palettes should be prepared for use by rubbing into them as much raw linseed oil as they can be made to imbibe. If this dressing with oil be thoroughly effected, and the palette be then suffered to dry till it becomes hard, the wood will subsequently not be stained by the absorption of colour A palette thus prepared is easily cleaned, and presents a hard and polished surface, exceedingly agreeable for the preparation of tints. It is important to keep the palette free from indentations and scratches, and on no account to neglect cleaning it; the colour never being allowed to harden upon the wood.

The Easel.—The easel is a frame which supports the painting during its progress. Easels are of various forms; but the most convenient is undoubtedly the rack-easel, which allows the painter to raise or lower his work with speed and convenience, as occasion may require. The commoner and cheaper kinds are supplied with pegs for this adjustment of the height of the work. It is desirable that the easel should stand firmly, and not be liable, as is too often the case, to be overset by any slight cause.

The Rest, or *Mahl Stick.*—This is used to rest or guide the right hand or arm when particular steadiness is required, as is the case in the painting of small objects and minute details. It is usually formed of cane or of lance-wood, and it should be light, yet firm. The lower end of the stick is held in the left hand, while the upper extremity, which is covered with a soft round ball or pad of leather, to prevent injury, rests on the canvas or some other convenient support.

Brushes for Oil Painting.—To paint with effect it is of the first consequence to have the brushes well selected, and of the best quality that can be procured. They are of various kinds:—of hog-hair, sable, badger, fitch, and goat-hair. Of these, the most useful are the hog-hair, sable, and badger brushes. The black fitch and white goat-hair are but seldom

used, as the sable and hog tool will effect all that can be done by the former. Nothing can be superior to a well-made, fine, white bristle tool, in larger work; or to a good red sable for details.

Hog-hair Tools.—These brushes are made both round and flat. Flat hog-hair are generally more useful than round ones; they are preferred, as assisting in giving a squareness and crispness of touch. They should be strongly and neatly made; and in selecting them be sure that the hair has not been cut at the points, for this is sometimes done with inferior brushes; but such brushes have an unpleasant and coarse touch, laying on the colour in a scratchy manner. It will be found to be a good test, if they be made of a very fine silky-looking hair, and be very soft to the touch. They should however be firm, yet elastic; springing back to their form after being pressed laterally upon the hand. Lastly, their shape should be flat and wedge-like, without straggling or diverging hairs. Let the handle be of cedar, and polished; the cedar is pleasant and light to hold, and being polished is easily cleaned. The old white pine handles, sooner becoming ingrained with colour, are both dirty and disagreeable to work with.

Sable Brushes.—The observations regarding hog-hair tools will apply to the sable tools; but these latter should have the additional property of coming to a fine, yet firm point. Be careful in choosing sable brushes, the hair of which is of a pale yellowish cast; and see that the brush is firm, and that it springs well to its point. The round sable tool is as serviceable as the flat one, and is used in working the finishing parts of a painting. Round brushes in quills, known by the name of sable pencils, are also applicable to the same purpose. Pencils that bag or swell where the hair is inserted in the quill, or the hairs of which diverge and form several points, are worthless.

Badger Tools are of various sizes; and the hair, instead of coming to a close end or point, as in other brushes, diverges or spreads out, after the manner of a dusting brush. When good, the hair is long, light, and pliant, of a reddish brown or black, with clean white ends. The chief use of the badger tool is to soften or sweeten broad tints, such as skies, water, distances, and the like; it is a very valuable assistant to the young painter; but must be used with caution, because its injudicious use frequently destroys forms, and produces woolliness. If the badger tool be much employed on a large surface of colour, the points of the hair frequently become so loaded with colour, that it is necessary to clean it often. This is best done by pinching up the brush rather tightly at the ends, and wiping it on a clean rag. The brush is thus kept free from colour during the progress of the work, which might otherwise be sullied and deteriorated in the purity of its tones. The badger brush is also useful to the landscape painter, for carrying minute points of colour into those wet parts of the work which require to be lightened, enriched, or varied.

Cleaning Oil-paint Brushes.—All brushes, after being used, should be carefully cleaned. This is best effected by immersing the hair of the brushes in a little raw linseed oil; the oil should afterwards be washed out with soap and warm water, till the froth which is made by rubbing the brushes on the palm of the hand is perfectly colourless. The brushes should next be rinsed in clean water, and the water pressed out by a clean towel. The hair should then be laid straight and smooth, and each brush restored to its proper shape, by passing it between the finger and thumb, before it is left to dry. Care should be taken not to break the hair by too violent rubbing, as that would render the brushes useless. Many painters use turpentine instead of linseed oil, in the cleaning of brushes, it effects the object more quickly, but the only use of turpentine that should be permitted, is to rinse the brushes in it slightly, when it is required to clean them quickly; but on no account should they be permitted to remain soaking in the turpentine, as this practice is certain to injure the brushes; rendering the hair harsh and intractable, and frequently dissolving the cement by

which the hair is held in the socket of the handle.

Canvas.—This is the general material used for painting. It is kept prepared in rolls of various widths, and is sold also strained on frames of any required size. The ground or preparation of the canvas should be thin, yet completely covering the threads of the fabric; and it should be free from projecting lines and knots.

Oil Sketching Paper is an extremely serviceable material for the young artist. It is made of drawing paper, covered with two or three thin coats of oil colour, so as to furnish a ground similar to that of prepared canvas. It is cheap and portable, and serves very well for early attempts and for preparatory sketches; for trying the effects of any work previous to its commencement, as well as during its progress. The paper has this advantage, that, if the sketch is required to be preserved, it can readily be pasted or glued upon the canvas, and then mounted on a deal frame, when it will present the appearance of strained canvas.

Grounds.—Much diversity of opinion has existed respecting the colour of the surface of the prepared canvas. It is a subject of considerable importance, for it is impossible to paint a richly-coloured picture, with life and warmth, upon a dull unsuitable ground. A landscape, if carefully handled, can be brought on and finished in a more brilliant manner on a white ground than on any other. It has however been objected to a purely white ground, that it is liable to impart a cold chalky effect; but it must be remembered that what is at first white in oil, becomes in a short time of a yellowish hue, and its coldness of tone is thereby lowered. The white, or pale cream-coloured, and pale, warm, drab-coloured grounds, seem to surpass all others. The reason is that they throw a light, and consequently a transparency, through the work; and, as all colours in oil painting have a tendency to sink into the ground on which they are laid, and to become darker, this tendency can be counteracted only by having grounds of considerable lightness and brilliancy. Cold grey grounds have been used in landscape painting; but they impart a heaviness of colouring much to be avoided. Some artists have painted on grounds of a dull red, or leather-coloured tint, and much richness may be gained by such tints; but after a time the colours of any portion that may have been thinly painted sink into this strong ground, and the effect produced is heavy and disagreeable. Upon the whole, a white ground is to be preferred, as soon as the learner has acquired some experience of the subsequent effect of his colours; but as the inexperienced find much difficulty in preventing the coldness and poverty of expression which it is likely to cause under their hands, it will be advisable for the beginner to take the usual light stone drab that is generally given to canvas; for it furnishes him with a middle tint or tone to start from, which, when visible in shadows and middle tints, has not the raw chalkiness shown under similar circumstances on an unskilfully or imperfectly covered white ground.

VEHICLES are used to temper and thin the colours, for the purpose of bringing them to a proper working state. All oils or varnishes act more or less to the eventual prejudice of the colour with which they are combined for application. What is desired in oil painting is a vehicle which, while it has an agreeable working quality, shall neither change nor be degraded by time, nor interfere with the purity of the tints as they appear at the moment they are first laid on;—a vehicle, that shall neither perish nor crack as it becomes old.

Oils.—The linseed, poppy, and nut oils are the fixed oils used as vehicles; turpentine and occasionally spike-lavender are the essential oils so used. Of the fixed oils, linseed is in most common use. It should be of a pale amber colour, transparent, and limpid; and, when used in moderately warm weather, it should dry in a day. The most valuable qualities of linseed oil, as a vehicle, consist in its great strength and flexibility. It is by far the strongest oil, and the one which dries best and firmest

under proper management. The next in importance is poppy oil. It is inferior in strength, tenacity, and drying, to linseed oil; but it has the reputation of keeping its colour better than linseed oil; and it is on this account generally employed in grinding white, and most of the light pigments. Nut oil is more uncertain in its qualities than either linseed or poppy oil; and is frequently extremely long in drying. Poppy oil, however, supplies its place so well, that it is not commonly required. Oils are all more or less influenced in their drying by the colours with which they are combined; some of which greatly accelerate, while others retard it. With certain colours some oils will scarcely dry at all, unless means are employed to cause them to do so.

Japanners' Gold Size is sometimes employed as a powerful means of drying dark and transparent colours, which are in general comparatively bad dryers.

Megilps.—The vehicles known by this name are in great favour with artists. They possess a gelatinous texture, which enables them, while flowing freely from the pencil, yet to keep their place in painting and glazing. The megilp generally in use is formed by mixing together equal parts of strong mastic varnish and drying oil. After remaining undisturbed for a few minutes, it assumes a gelatinous texture, resembling a thin, transparent, amber-coloured jelly. Megilp varies in colour, as it is made with either a pale or deep-coloured drying oil. The palest is made by using instead linseed oil, in which a small quantity of finely-ground sugar of lead has been diffused. With equal parts of this compound, and of mastic varnish, a very light megilp is obtained. Another megilp is made by mixing 1 part of a saturated solution of sugar of lead in water, with 3 parts of linseed or poppy oil. These are to be well stirred or shaken together, till they are combined; and then 2 parts of mastic varnish added, and well mixed with the preceding. By this means a white creamy emulsion is obtained, which, though opaque in use, becomes quite transparent as it dries. A compound used occasionally in combination with megilp, and consisting of 1 part of copal varnish, 1 part of linseed or poppy oil, and 1 part of turpentine, will furnish a pleasant and serviceable vehicle for general use. Care must be taken, however, to force its drying by the addition of ground sugar of lead, when employed with slowly-drying pigments.

GLAZING.—A glaze is a thin transparent film of colour, laid upon another colour to modify the tone, or to aid the effect of the latter; the work thereby appearing distinctly through the superimposed layer of glaze, from which it receives a characteristic hue. Glazing is effected by diluting proper transparent colours with megilp or other suitable vehicle. Thus diluted, these colours are laid upon portions of the work, either in broad flat tints, or in touches partially and judiciously distributed. The object of this process is to strengthen shadows, and to give warmth or coldness to their hue; to subdue lights that are unduly obtrusive, or to give additional colour and tone to those that are deficient in force and richness. Should it be necessary to lighten the tone of any part of the picture, this cannot be done by merely glazing; the first tints must first be concealed with brighter colours, of sufficient body for that purpose, and the glaze may then be applied. The glaze should usually be darker than the ground colour upon which it is to be laid; and, as a rule, it may be observed that the first painting of the picture should be brighter than the subject may require, in order that the subsequent glazings may lower and obscure it to a proper and effective degree of tone. Glazing is generally effected by the application of diluted transparent colours; but occasionally semi-transparent colours are used for this purpose, provided they are rendered sufficiently transparent by the admixture of a large proportion of vehicle. These latter glazings are capable of being applied with excellent effect, where it may be necessary to modify the tones of those parts of the

picture which do not appear satisfactory, or to produce particular effects, such as representations of smoke, dust, mists, and the like. Caution is, however, necessary in glazing with opaque colours; because, if used in excess, they will deteriorate the picture, by destroying its transparency. Should a glazing produce a result different from what was intended, the glaze may easily be removed by a rag, or, if the spot be small, by the finger, provided the removal be effected *immediately*, that is, before the glaze has had time to fasten itself upon, or to soften, the colour on which it is laid, and in no case must glazing be attempted before the colours over which it is laid have become perfectly dry and firm.

Impasting. — In oil painting, the shadows, or dark portions of the picture, are painted thinly, while the lights are laid on, or impasted with a full pencil and a stiff colour. In the lights of the foreground, and of parts not intended to be remote, or to retire, the impasting should be bold and free; while, in the more brilliant lights, it cannot well be too solid. There is, however, a reasonable limit to the practice; since actual protuberance or prominence of the paint itself will, in certain lights, produce a false shadow, and therefore a bad and false effect. This will be understood, from observing that the loading of thick masses of colour upon the picture, so as to make them project considerably from the surface, is done with the view of their being strongly illuminated by light actually incident upon the picture, and of thus mechanically aiding in the production of roundness and relief, or in giving a sparkling effect to polished objects or glittering points. But this artifice must be had recourse to sparingly and cautiously; else it defeats its own object, and produces a coarse and vulgar air and effect. The palette knife has always been a favourite instrument of this impasting, or laying on of colour, capable as it is of producing an agreeable brightness on, and of giving an appropriate flatness to, the pigment. A clear and appropriate tint, for instance, skilfully swept across a sky by these means, often produces a surprisingly brilliant and charming effect.

Scumbling.—Scumbling, the opposite process to that of glazing, is done by going lightly over the work with an opaque tint, generally produced by an admixture of white. For this purpose a hog-hair brush is employed, charged with colour but sparingly; and with it the tints are drawn very thinly, and somewhat loosely, over the previous painting, which should, as in the case of *glazing*, be dry and firm. Scumbling is used to modify certain effects, by rendering the portion, to which it is applied, cooler, greyer, and in fact less defined, than it was before, and to give air and distance to objects that seemed too near. It is thus of service both in correcting a tendency to muddiness or dirtiness of colour, and to what may be called hardness or over-distinctness of detail, and in weakening the force of colours that are too powerful by softening and uniting such tints as may be too violently contrasted. It is desirable to avoid, as far as possible, scumbling over shadows, as an inexperienced hand might thus destroy their transparency.

Harmony of Colours. — Harmony of colour is produced by an equable use and distribution of the primary colours, whether used simply as such, or united in various proportions in their compounds. Harmony is recognized in a picture when nothing exists in it that disturbs the eye by violent opposition or contrast of colours; judicious contrast, however, tends much to produce harmony, when the force of the contrast is diminished by the *juxtaposition of tones partaking more or less of the colours employed in producing the contrast*. This we shall find is the process employed by nature, the reds in which are harmonized with the contrasting green by hues of orange, or yellow green; and so with other colours. Harmony of colour in painting is best obtained by setting the palette with those pigments which, through the prevalence of any of the primaries, blend, or, as it were, run into

each other. Thus, commencing with white, we proceed to yellow, orange, or yellow-reds, red, blue-reds, blues, green-blues, greens, browns, grey, and black. A palette can be set warm or cold, as the subject may require, by selecting pigments in which blue predominates or is deficient.

Primaries.	Blue is contrasted by ..	Red and Yellow,	or Orange.	Secondaries.
	Red is contrasted by ..	Blue and Yellow,	or Green.	
	Yellow is contrasted by ..	Blue and Red,	or Purple.	
Secondaries.	Orange, or	Red and Yellow,	is contrasted by Blue.	Primaries.
	Green, or	Blue and Yellow,	is contrasted by Red.	
	Purple, or	Blue and Red,	is contrasted by Yellow.	

Painting in Water Colours.—

The practice of the art consists of sketching the outline, of tinting or shading with sepia, bistre, or india-ink; and of the application of the pigments, in three or more successive stages, to the attainment of a finished drawing. Our instructions must, of necessity, be of a general character, because almost every artist of genius finds out for himself and practises some peculiar methods of applying the pigments, which can only be learned by those who become his pupils. These peculiar methods constitute the various styles of the masters of the art, by which their works are so readily recognized and distinguished.

Materials.—The principal materials required by the painter in water colours are drawing paper, ivory, for miniatures, a drawing board, pigments or colours, lead pencils, hair pencils, or brushes, palettes, slabs, and saucers, cups or glasses for holding water, sponge, gum water, ox-gall, india-rubber, drawing pins, a sharp convex-pointed knife, a flat ruler.

The Painting Room.—The choice of a situation for the practice of painting is not a matter of indifference: the room should be well lighted, of a northern aspect, if possible, and free from reflected colours from opposite objects. As dust and grease are inimical to the delicacy and integrity of water-colour painting, it will be the first care of the student to guard against them. The light should fall on the left hand of the painter, and not be admitted below the head. A room lighted from above, or by a skylight, is much to be preferred.

Pencils, or *Brushes for Water Colours.*—The hair pencils, or brushes used in water-colour painting are made of camel-hair, and fitch, or sable. The best are those known as soft brown or black sables; those made of red sable are not so useful, as they possess the bad quality of stiffness, and disturb the colours by their harshness. These brushes will hold a considerable quantity of fluid, and should be used full, but not to overflowing, so as to become unmanageable. After using, they should be carefully washed in clean water, and then slightly pressed in a piece of clean linen rag. A brush put away unwashed, especially if it has been used for india-ink, or any dark pigment, can scarcely ever be cleaned again so as to be fit to use with light or delicate pigments. For large drawings brushes are prepared, both round and flat, mounted in tin; these are also useful in washing. The most essential quality of a good pencil is, that it should yield a good point, for it is that part only which is used; the hairs when moistened should form a cone terminating in a fine and delicate point. It should also be firm, yet elastic, returning to a straight direction immediately upon being lifted from the paper.

Management of a Water-Colour Drawing.—The manipulation in water-colour painting is of the greatest simplicity, consisting merely in selecting the pigments required, mixing from them the various tints the subject demands, and leaving them in their proper places upon the paper. These pigments are rubbed with boiled or distilled water, on earthenware slabs, with the addition of a small quantity of gum water, for the strong marking of the shadows, and so on. It is the usual practice to lay on the first tints or washes with the hard-cake pigments ground on the slabs, while the middle or foreground is painted with the soft, or body-colours; which, by remaining constantly moist, are always ready for use.

The pigments should be ground in sufficient quantity, and with so much water as to be quite fluid, and capable of entirely filling the brush; the superfluous quantity can be easily removed by slightly pressing the brush on the edge of the palette; for unless the pigments are reduced to this state of fluidity, the drawing acquires a dry and harsh appearance; while, at the same time, an excess of fluidity produces a thinness and meagreness, leaving a dark edge surrounding the coloured surface, which inevitably betrays the inexperienced hand. The progress of a water-colour drawing is from simply washing with the requisite colours, as a preparatory stage, and proceeding by gradual and delicate additions where they are required, and so on to the finishing, which consists in applying the colours in their full body and strength, giving solidity to the forms, and a definiteness to the outlines that constitutes a finished picture, equal in vigour, freshness, and richness of tone to oil painting. Many parts of the drawing must unavoidably be gone over with colour that should be left white for the high or brilliant lights: the colour must be removed from these places by rubbing with a sharp scraper or by moistening the spot to be reclaimed with a pencil dipped in clean water; after it has remained a few moments, the moisture is removed with a piece of clean blotting paper, and then rubbing the surface of the paper by means of a white handkerchief, india-rubber, or bread-crumbs.

House Painting.—To produce the different tints, various colours are added to the white-lead base, in quantity according to the intensity of the tint desired, amounting, sometimes, to an exclusion of the white-lead in the upper or finishing coats. The following are the colours generally used by the house painter:—

White. — White-lead, Nottingham white, flake white.

Black.—Ivory black, lampblack, blue black, patent black.

Yellows.—Chrome yellow, King's yellow, Naples yellow, yellow ochre, raw sienna, yellow lake.

Browns.—Burnt umber, raw umber, Vandyke brown, purple brown, Spanish brown, York brown.

Reds.—Vermilion, scarlet lake, crimson lake, Indian red, Venetian red, red-lead, orange-lead, burnt ochre, burnt sienna.

Greens.—Brunswick green, emerald green, verdigris.

Blues.—Prussian blue, indigo, cobalt, ultramarine.

To bring these colours to a state fit for use, they are ground up with a small quantity of oil; but for painting in distemper, the colours must be ground up in water. Linseed oil is that which is in general use, and is quite sufficient for the purpose of the plain painter, especially when improved by being kept for several years, as it then loses a great part of its colour. In rare instances, where the least yellowness in the oil would be injurious, nut or poppy oil may be used with advantage. Spirit of turpentine is largely employed in painting; it is obtained by distillation from crude turpentine, which is procured from the larch and fir trees: being of a volatile nature, it is used by the painter to produce what is called a flat; it evaporates, and leaves the paint without the least shine. It is also employed in those situations where oil would not dry, as in the first coat on old work, which is likely to be a little greasy from smoke.

DRIERS.—To hasten the drying of paints, driers are generally used. Those most in use are sugar of lead, litharge, and white copperas. These, when well ground and mixed in small portions with paint, very much assist them in drying; indeed, some colours will not dry without them. Red-lead is also an excellent drier; and in cases where its colour is not objectionable, is much used. Sugar of lead is, however, the best drier, though somewhat more expensive than the others. It should be observed that, in the finishing coats of delicate colours, driers are generally avoided, as they have a slight tendency to injure the colour. Linseed oil has sometimes a drying quality given to it by boiling with drying substances, which renders it extremely

useful on some occasions. A very good drying oil is made by boiling 1 gallon of linseed oil with a ½ lb. of litharge, or red-lead, reduced to a fine powder. It must be kept slightly boiling for about 2 hours, or until it ceases to throw up any scum; when cold, the clear oil must be poured off, and kept for use.

HOUSE PAINTERS' TOOLS.—The brushes used are of all sizes, both round and flat, and are made chiefly of hog-hair. The large round brush called the pound brush, and a smaller one called the tool, are those mostly used in plain work. The smallest hog-hair brushes are called fitches, and are used for putting in small work where the tool would be too large. The pound brush is used as a duster for some time previous to putting it in colour, and thus it is rendered much softer. The smallest brushes are the camel-hair pencils with long or short hair, according to the work to be done. The stopping knife has a shorter blade than the palette knife, and is pointed. It is used for making good the holes and cracks with putty. Putty is made of common whiting, pounded fine, and well kneaded with linseed oil, till it becomes about the consistence of stiff dough.

GRINDING COLOURS FOR HOUSE PAINTING.—When a colour-mill is not used, the grindstone and muller is an apparatus necessary to every painter, as the purity of the colours sold ready ground at the shops is not to be depended upon; and some colours, as lakes and Prussian blue, will not keep long after grinding. The grindstone is a slab of porphyry marble, or granite, about two feet square; the chief requisite is, that it be hard, and close-grained. The muller is a hard and conical-formed stone, the diameter of the base or rubbing surface of which should be about one-sixth of that of the grindstone, and the cone high enough to get a sufficient hold of it with the hands. The face of both grindstone and muller should be perfectly flat and smooth. A large palette knife is used to gather the colour from the stone as soon as it is sufficiently ground. All substances employed for painting in oil require to be ground up with a small portion of the oil, previous to mixing them with the whole quantity required for use; for this purpose, they must first be pounded, and passed through a tolerably fine sieve, then mixed with a portion of linseed oil, just sufficient to saturate them; a quantity, about the size of a small egg, is to be taken on the point of the palette knife, and placed on the stone; the muller is then placed upon it, and moved round about, or to and fro in all directions, bearing a little weight on it at the same time. This should be continued until it is ground perfectly fine, having the consistence and smoothness of butter. The colour must be occasionally trimmed from the edges of the stone and muller with the palette knife, and put under the muller in the middle of the stone. When sufficiently ground, it is removed from the stone with the palette knife, and a fresh quantity taken. It is not well to have much colour on the stone at one time; it makes it more laborious, and will take a longer time to grind the same quantity equally well.

MIXING COLOURS FOR HOUSE PAINTING.—Before the colours which have been ground can be applied to the work, they must be rendered fluid by the addition of linseed oil, or spirits of turpentine, or certain proportions of both. When a tinted colour is required to be mixed up, a small quantity of the proper tint should be first prepared on the palette, which will serve as a guide to mix the whole quantity by. With the ground white-lead there should first be well mixed a portion of oil, and then the tinting colour should be added, as ascertained by the pattern on the palette. When these are thoroughly mixed and matched to the proper tint, the remaining portion of the oil or turpentine is to be added; this is better than putting in all the oil at once: it should then be strained through a piece of fine canvas, or fine sieve, and should be about the consistence of cream, or just so as to work easily. If it is too thick, the work will have an uneven, cloudy appearance, and it will be hard to spread; while, if it be too thin, it will be likely to run, or will require a greater

number of coats to cover the ground, and render the work solid. The straining ought not to be neglected where the appearance of the work is studied.

PAINTING NEW WORK. — Clean the work, carefully removing all projections, such as glue, or whiting spots; this is easily done with the stopping knife and duster; then cover over the knots with a composition of red-lead, called knotting. If the knots are very bad, they must be cut out. After knotting comes the priming, or first coat of paint. When the priming is quite dry, all nail-holes, cracks, and defects, are to be made good with putty; then proceed to the next coat, called the second colour; when this is dry, those places are to be stopped which were omitted in the last coat: and proceed according to the number of coats intended to be given. It should be observed that second colour for new work is made up chiefly with oil, as it best stops the suction of the wood; but second colour for old work is made up chiefly with turpentine, because oil colour would not dry or adhere to it so well. The colour should be spread on as evenly as possible; and to effect this, as soon as the whole, or a convenient quantity, is covered, the brush should be passed over it in a direction contrary to that in which it is finally to be laid off; this is called crossing. After crossing, it should be laid off softly and carefully, in a direction contrary to the crossing, but with the grain of the wood, taking care that none of the crossed brush marks be left visible. The criterion of good workmanship is, that the paint be laid evenly, and the brush marks be not observed. In laying off, the brush should be laid into that portion of the work already done, that the joining may not be perceived. Every coat should be perfectly dry, and all dust carefully removed, before the succeeding one is laid over it.

PAINTING OLD WORK.—Carefully remove all dirt and extraneous matter with the stopping knife and duster; those places near the eye should be rubbed with pumice-stone, and greasy places should be well rubbed with turpentine. Bring forward new patches and decayed parts with a coat of priming; stop and make good with putty, then proceed with the first coat, or second colour, in turpentine. The quality of the next coat will depend upon the manner in which it is to be finished. If it is to be painted twice in oil, and flatted, the next coat, or third colour, should be mixed up chiefly in oil, and tinted like the finishing colour, to form a ground for the flatting. The greater the shine of the ground, the more dead will be the finishing coat or flatting: likewise, the more dead the ground, the better will the finishing oil shine; therefore, it is a general rule that for finishing in oil the under coat should be turpentine, and for finishing flat, the under coat, or ground colour, should be oil; but observe, that all turpentine undercoats have a little oil with them, and all oil under-coats, except the priming or first coat on new work, have a little turpentine with them. Knotting is made with red-lead, carefully ground, and thinned with boiled oil and a little turpentine. For inside work, red-lead carefully ground in water, and mixed up with double size, is a good substitute, and is generally used: it must be used hot.

Priming for New Work.—This is made of white-lead, with driers and a little red-lead to harden it, and further to assist its drying; it is thinned entirely with oil, and should be made very thin, as the new wood, or plaster, sucks it in very fast. It is a frequent practice with painters to save the oil coats by giving the new work a coat of size, or size and water, with a little whiting, called clearcole; but where durability is consulted, this should not be done. The size stops the suction of the wood or plaster, but at the same time it prevents the oil paint from adhering to the work; the consequence is, that it is apt to peel or chip off, especially in damp places. Clearcole is sometimes advantageously used on old greasy work on which oil paint would not dry.

Second Colour for New Work, or oil

second colour. — This is white-lead thinned with oil and a little turpentine, with suitable driers. The proportion of driers for ordinary cases is about 1½ oz. to 10 lbs. of white-lead; but in winter, or under other unfavourable circumstances, the quantity of driers must be increased.

Second Colour for Old Work, or turpentine second colour. — This is white-lead thinned with about 3 parts of turpentine, and 1 of oil, also a little driers. Where much turpentine is used, less driers are required.

Turpentine Colour.—This is only used when the work is to be finished in oil; that is left shining. It is thinned almost entirely with turpentine, that the finishing coat may have a better gloss.

Third, or Ground Colour, is thinned with two-thirds oil and one-third turpentine, and tinted a shade darker than the finishing colour.

Finishing Oil Colour is thinned with a little more oil than turpentine, and tinted to the desired colour.

Flatting, or finishing turpentine colour, is thinned entirely with turpentine, and has no shine.

Bastard Flat is thinned with turpentine and a little oil, which renders it more durable than the perfect flatting. To procure a good flat, it is necessary to have a perfectly even glossy ground, and it should be of the same tint, but a little darker than the finishing flat.

Clearcole and Finish. — Stop defects with putty, clearcole, and finish with oil finishing colour, as directed.

Two Coats in Oil.—Turpentine second colour, and finishing oil colour.

Two Coats in Oil and Flat.—Turpentine second colour; third colour; and flat.

Three Coats in Oil. — Turpentine second colour; turpentine colour; and finishing oil colour.

Three Coats in Oil and Flat (old work). —Turpentine second colour; turpentine colour; third, or ground colour; and flatting.

Four Coats in Oil (new work).—Oil priming; oil second colour; turpentine colour; and oil finishing colour.

Four Coats in Oil and Flat (new work). —Oil priming; oil second colour; turpentine colour; third or ground colour; and flatting.

Colours for House Painting. — *Stone Colour.*—White-lead, with a little burnt or raw umber, and yellow ochre.

Grey Stone Colour.—White-lead, and a little black.

Drab.—White-lead, with burnt umber and a little yellow ochre for a warm tint, and with raw umber, and a little black for a green tint.

Pearl Colour, or pearl grey.—White-lead with black, and a little Prussian blue.

Sky Blue.—White-lead, with Prussian blue.

French Grey. — White-lead, with Prussian blue, and a little lake. These last, used in various proportions, will make purples and lilacs of all shades.

Fawn Colour.—White-lead, with stone ochre, and a little vermilion or burnt stone ochre.

Buff.—White-lead and yellow ochre.

Cream Colour. — Same as the last, with more white.

Lemon Colour. — White-lead, with chrome yellow.

Orange Colour. — Orange-lead, or chrome yellow and vermilion.

Peach Colour.—White-lead, with either vermilion, Indian red, purple brown, or burnt stone ochre.

Gold Colour.—Chrome yellow, with a little vermilion and white.

Violet Colour. — White-lead, with vermilion, blue and black.

Sage Green. — Prussian blue, raw umber, and yellow stone ochre, with a little white, and thinned with boiled oil and a little turpentine.

Olive Green. — Raw umber, with Prussian blue, thinned as before.

Pea Green.—White-lead, with Brunswick green, or with Prussian blue and chrome yellow.

Chocolate Colour.—Spanish brown, or Venetian red and black, thinned with boiled oil and a little turpentine.

Lead Colour.—White-lead and black.

Plain Opaque Oak Colour.—White-lead, with yellow ochre and burnt umber.

Plain Opaque Mahogany Colour. — Purple brown, or Venetian red, with a little black.

Black should be ground in boiled oil, and thinned with boiled oil and a little turpentine. It will be obvious that the proportions of the colours above mentioned must be determined by the particular tone of colour required.

Cleaning House Paint.—Old paint work should be first well dusted, then cleaned by washing with a ley of pearlash and water; it is sometimes necessary, after the washing, to give a coat of weak size, and as soon as it is dry, apply varnish, using copal for light work, and carriage for dark. Some hand-rails, doors, and so on, are so saturated with grease, that no washing will remove it. When this is the case, brush the foul parts over with strong fresh-made lime-wash, let that dry, then rub it off; if the grease is not removed, repeat the lime-washing, until the grease is thoroughly drawn out; wash the lime clean off, and afterwards apply the sizing, and lastly the varnish.

To Paint Plaster.—Five coats are generally requisite to paint plaster well; but where it is not of a very absorbent nature, four are found to answer. The first is composed of white-lead, diluted with linseed oil, to rather a thin consistency, in order that the plaster may be well saturated; and into this is put a small quantity of litharge to ensure its drying. In painting quick plaster, the oil in this coat is entirely absorbed, thus hardening it to the extent of about the eighth of an inch inwards from the surface. When this is found to be the case, the second coat should also be thin, that the plaster may be thoroughly saturated; and it will be found necessary after this to give other three coats, making in all five. The second coat will be found to be but partially absorbed, and it is therefore requisite to make the third coat a good deal thicker, and to introduce into it a little spirits of turpentine, and such of the colouring pigments already enumerated, as may bring it somewhat near to the tint of which the apartment is to be finished. The fourth coat should be as thick as it can be well used, and should be diluted with equal parts of oil and spirits of turpentine. The colour of it ought to be several shades darker than that which is intended for the finishing coat, and the dry ingredient, sugar of lead instead of litharge. These coats ought all to be laid on with much care, both as to smoothness and equality, and each lightly rubbed with sand paper before the application of the other. The finishing or flatting coat, as it is termed from its drying without any gloss, is next applied. It ought, like others, to be composed of pure white-lead, ground as already described, and diluted entirely with spirits of turpentine; and it should appear, when mixed, a few shades lighter than the pattern chosen for the wall, as it darkens in the drying. The drying ingredient should be a small portion of japanners' gold size. This coat must be applied with great care and dispatch, as the spirits of turpentine evaporate very rapidly, and if touched with the brush after that takes place, which is in little more than a minute after its application, an indelible glossy mark will be left on the surface. Nothing has been said of the time that each of the coats will take to dry sufficiently to receive the next, as that depends much upon the state of the weather, the quantity of driers employed, and the atmosphere kept up in the apartment. It may be observed, however, that under any circumstances the first coat ought to stand a few days before the application of the second; the second a little longer before the application of the third; and the third, unless in four-coat work, should have still longer time to harden. But the coat immediately before the flatting or finishing coat ought not to stand above two days, as much of the beauty and solidity of the work will depend on the latter dying into, and uniting with the former.

Fresco Painting.—The preparation of a wall for fresco painting is a matter of time and should proceed with much carefulness, for on the goodness of this portion of the work depends in a great measure the durability of the painting. If the wall is already covered

with plaster or laths it should be cleared, the bricks thoroughly scraped, and afterwards well chipped. See that the bricks are in good condition and perfectly dry, and then proceed to lay on the first coat, consisting of river sand and the best old lime, mixed to about the usual thickness. This should be laid on so as to leave a level but rough surface. At some places on the Continent small flint pebbles are mixed with this composition to give the requisite roughness. This ground-work should be allowed to dry thoroughly; indeed, unless the lime is old, it will be some considerable time before it will be safe to put on the intonaco or painting-surface. This should be prepared with the very best old lime, perfectly free from grit. The lime is mixed in troughs to the consistence of milk, and is then passed through hair sieves into jars, where it is allowed to settle, and the water poured off. It is then ready to be mixed with the sand (fine quartz sand, well sifted, is the best) in the proportion of one part lime to two parts sand. The implements used to float on the last coat are made of wood or glass, but trowels of iron may be used if free from rust, and care is taken not to press the iron too forcibly on the intonaco. When the lime and sand coating is ready to be laid, the rough cast must be wetted thoroughly, and the intonaco floated on in two coats, the last with rather more sand than the first. The thickness of the two should be about $\frac{1}{16}$ths of an inch. After these are spread, go over the whole with a roll of wet linen, which will remove the marks of the trowel, and prevent the surface being too smooth. While the ground is being prepared a cartoon or drawing on paper is made of the subject, executed with a correct outline and with the wished-for effect properly shown. When the finished cartoon is made the same size as the painting it is usually executed in black and white with ink or crayons, but it is also necessary to have a study of the subject in colours, and this is generally done on a small scale. The pigments used are mostly minerals, and are ground and applied with pure water. With the surface of the wall still wet but firm and smooth, the tracing is laid over the portion prepared, and the lines of the cartoon slightly indented on the plaster with a blunt point; or the lines have small holes in them pierced at certain intervals and the design thus pricked out, laid upon the ground and dusted with a pounce-bag containing fine dry powder, and thus the outline is repeated on the ground by the dots of powder which have passed through the minute holes. When the intonaco has become firm enough to just bear the pressure of the finger the first washes of colour may be put on. If the painting is intended to be large, only sufficient plaster is put on to serve for the part which can be accomplished in the time at the disposal of the painter, usually enough only for a day's work, and this portion should end at the edges of some bold outline, as flowing drapery, a pillar, and so on. A difficulty in fresco painting is that the colours become much lighter after the plaster dries, and for this allowance must be made; however by practice the painter may overcome this difficulty, and can test the difference between the colour as wet and as dry by putting a touch upon a piece of umber, which instantly dries the colour and shows it as it will be when the intonaco has dried.

Transparent Painting on Linen.—The colours used in transparent painting are mixed with megilp as a vehicle, except in the case of very light colours, when turpentine and copal varnish must be used. The material upon which transparencies are executed is fine muslin; and this, before being worked upon, should be strained in a straining frame, and sized with either gilder's size, isinglass size, or fine colourless gelatine dissolved and properly diluted. After the first coat of size is dry the muslin will slacken and hang loosely on the frame. It should be stretched; another coat of size applied; and when dry the muslin again extended. A small piece of muslin should at the same time be prepared as a trial-piece, strained in the same way as the larger piece, and when dry it can be

used to determine whether the muslin is sufficiently sized, or whether the colours are in working condition. The design having been prepared, it may be traced, copied, pounced or stencilled upon the prepared muslin, care being taken that the outline from which the tracing is made consists of strong and decided lines, that stencil plates are made of oiled paper, and that powdered charcoal is used in preference to any other powder for pouncing. The instructions for *oil painting* will apply equally to painting transparencies, except that for very fine tints sponge can be used with great advantage to rub in broad flat tints, however delicate. Fine effects may be produced by the use of two transparencies, arranged one behind the other. On the front surface is painted all that is required to be seen in the clearest relief, the painting on the surface behind being modified in its effect by being seen through the front surface.

Transparent Painting on Paper.—The same colours as those of landscape painting are used for transparencies, and the processes are also the same: only it is requisite to be very attentive in washing in the tints with the utmost possible correctness, both with respect to form and to the power of colour, as the surface of the paper must be preserved clear in every part, and this clearness is always more or less injured by washing out or sponging. The paper should be the thinnest hard-wove drawing paper that can be procured, carefully selected, and free from unevenness or inequality of texture. When the paper has been selected according to the size of the proposed subject, it should be laid on a drawing board and fastened there, with a piece of thick paper beneath, in order that the tints may be distinctly seen during the painting. After having completed the subject so far as relates to the front, it may be cut off, leaving a margin of ¾ inch in breadth, for the purpose of gluing it down in the following manner. Take a sheet of Bristol-board, or, if the subject is larger, a thicker material, for the purpose of preserving the surface of the whole even and flat. From the centre of this board let a piece be cut out corresponding with the size of the painting, which must be placed on a drawing board, with its face downwards. Let it then be covered for a few minutes with a damp cloth, to cause it to expand a little; and in the meanwhile cover, with thick gum or glue, the edges of the aperture in the board, to correspond with the width of the margin cut off with the painting. The damp cloth may now be removed, and the painting turned with its face upwards, placing the board upon it accurately, in such a manner that the margin may adhere securely to the gum or glue in every part. The whole may then be laid on a flat surface to dry. In this way the Bristol-board will form a frame of such width as may be adapted to the painting, and this frame may be afterwards ornamented according to the taste or fancy of the student. It may be observed that the brilliancy of a transparent painting will be increased by the opacity of the border by which it is surrounded, and its width should be regulated by the size of the painting. As soon as the whole is thoroughly dry, the painting must receive such additions at the back as may be requisite to bring it up to the full luminous effect intended. For this purpose, the most convenient position will be one inclined in a sloping direction, similar to an artist's easel, and immediately in front of a steady light. When the painting has been placed in this position, it will immediately be perceived, that however strongly it may have been previously tinted or touched in the front, a strong light will cause it to appear comparatively feeble. But as the original intention of the workman will still be impressed on his mind, this weakness in the effect, which only becomes apparent by transmitted light, will suggest the addition of tints to produce the intended power. Where more is required, it must be cautiously applied at the back of the painting, taking all possible care to preserve the colours clear, and not to injure or ruffle the

texture of the paper, repeating the tints till the due power is obtained. When considerable power is required, such colours of Indian red, Cologne earth, or vermilion, must be selected as have a semi-opaque body; but care must be taken not to lay them on so thickly as to produce blackness. When richness is required, lake, Prussian blue, and gamboge, which are perfectly transparent, are well adapted to communicate not only richness but delicacy and power to finish. When, by carefully employing the means just pointed out, all possible harmony and effect have been imparted to the painting, it may be rendered partially or wholly luminous, by judiciously applying mastic spirit varnish. With a camel-hair pencil moderately charged with this varnish, let such parts as are in the highest lights be carefully touched as well as the major part of the sky, and the principal objects of the piece together with whatever part may require it in accordance with the character of the scene. If the whole of the subject is covered, it will be requisite to spread the varnish with a flat camel-hair brush, passing it quickly from side to side, and from top to bottom, so that the varnish may be equally spread with all possible expedition. The picture must then be left to dry. After the varnish has become dry, by mixing a little ox-gall in the water used for the colours, additional beauty of tint, as well as harmony, may be imparted to such parts as appear crude or harsh.

Painting and Preserving Ironwork.—A good black paint for coarse ironwork may be made by mixing plumbago with hot coal-tar. Equal parts of asphaltum and resin dissolved in common turpentine make also a good, cheap covering for heavy ironwork. For machinery, dissolve 2 lbs. india-rubber, 4 lbs. resin, and 2 lbs. shellac, in 5 galls. of benzine. This may be used with any other paint as a vehicle. Wrought-iron bridges are painted with white-lead as follows: The ironwork is first made clean by scrubbing and brushing it with wire brushes: this done, all the cavities and fissures are filled up with a putty of litharge, linseed oil, varnish, and white-lead; this filling being dry, brushing is repeated. Afterwards a paint is applied, consisting of 300 lbs. of white-lead, 10 galls. of crude linseed oil, 1 or 2 galls. of boiled linseed oil, and 1¼ gall. of turpentine. This paint is repeated when sufficiently dry, and finally evenly overspread with white sand. Galvanizing is employed also to prevent rusting. A galvanizing paint consists chiefly of zinc powder and oil varnish. Rusting is further prevented by rubbing the red-hot iron with wax, tallow, pitch, or coal-tar. Rubbing with heavy petroleum is also well adapted for keeping ironwork clean.

Painting Sign Boards.—Sign or pattern boards ought to be chosen of old well-seasoned wood; oak or mahogany is much the best, but many are made of pine, which ought to be sound, straight, close-grained, well-dried, and made with pieces let in across the back, to prevent warping. Thus prepared, brush the board over back and front with equal quantities of raw linseed oil, japanners' gold size, and turpentine, to which add a little ground white-lead; driving or rubbing out the colour well: for the second coat, take equal quantities of white-lead, common spruce ochre, and whiting, all well dried, and ground fine and stiff, separately with raw oil; mix the whole together; add sufficient of gold size to cause it to dry quickly, firm, and hard; dilute with turpentine to a proper consistence, and apply two or three coats of the above colour. When dry and hard, rub it smooth with either sand-paper or pumice-stone and water; then grind equal portions of spruce ochre, whiting, bath-brick, and white-lead, with two parts oil and one part turpentine, adding a little gold size, diluted with turpentine, and apply one, two, or three coats, if necessary, taking care to rub down and wash off the panel between each coat, repeating rubbing and colouring until the panel is as smooth and level as plate glass; it is then fit to receive the required last coat, to write, marble, paint, or grain upon. The finishing application, whether it be a plain ground,

landscape, figure, or letters, ought to stand until thoroughly dry and hard; it should finally be varnished twice over with best body copal or amber varnish, as the delicacy of the painting will admit.

To Prepare Picture Canvas.—Take suitable new canvas, stretch it well upon a stretching frame, wet it well with clean water, and afterwards dry it thoroughly; then stretch it a second time. Grind equal quantities of white-lead and whiting, well dried, with five parts of raw oil, and add one part boiled oil; prime the cloth over on the face with a brush, palette knife, or trowel; the latter is preferable, to those who can use it. After the canvas has had sufficient time to dry, scrape off from the back any superabundant colour which may have passed through the canvas; then repeat a second coat on the face, leaving it as smooth as possible. When hard and dry, rub it smooth with a piece of light pumice-stone and water, so as to cut off or lay all the knots in the canvas; then grind two parts white-lead, two parts whiting, and one part burnt ochre, with a small quantity of pumice-stone, all well ground separately rather stiff in raw oil; afterwards mix the whole, adding a little gold size, dilute with half raw oil and half turpentine, and apply a third, fourth, or fifth coat; repeat rubbing down with pumice-stone and water until smooth enough for painting upon.

Varnishing valuable Paintings.—Some artists employ for new paintings white of egg as a varnish, others do not varnish their paintings for one or two years after being finished, when the colours are completely hardened and mellow. Mastic varnish is the only one which can be removed at pleasure, and for that reason is generally preferred to all others, although it is very liable to chill; that is, it becomes all over of a bluish steamy hue, which obscures the beauty of the painting, and appears disagreeable to the eye. Many circumstances contribute towards causing it to chill; for instance, varnish made from weak, unripe gum mastic and common spirits of turpentine will chill, particularly if applied on new paintings, where the grounds, oils, and colours are fresh, soft, and absorbent. In order to prevent this, if possible, employ no varnish but that made from fine, ripe gum mastic and rectified turpentine. Varnish for oil paintings, after being properly made, ought to stand for at least twelve months in large wide-mouthed glass bottles, without a cork, covering the mouth with a piece of glass, so as to admit the air, but prevent dust falling in; place the bottle so as to receive a full light, but no sun. The light and air so change and modify the essential quality of the turpentine, that the varnish becomes elastic, clear, and brilliant, having so much improved during that time as seldom or never to chill or become steamy, and by age it loses that attraction which all new-made varnishes possess for moisture and impure exhalations. Therefore, as a preventive against varnish chilling, employ none but good old varnish; never apply it on new or old paintings until properly cleaned, and well dried from moisture; apply the varnish in a warm room, where the painting and varnish also receive a proper warmth; after the varnish is applied, let it remain until properly dry; recollecting that with all new-painted pictures, where the grounds and colours are soft and absorbent, and where the pictures are afterwards exposed to strong moist exhalations, the varnishing in time will chill; but when paintings are properly cleaned and varnished, and afterwards hung up in dry rooms or galleries, there is no reason to fear their chilling.

To Preserve a Scaling or Cracked Painting.—The preparation is a mixture of equal parts of linseed oil and methylated chloroform, which is to be poured over the painting if the colours are too brittle to bear the friction of a soft brush. After remaining on the surface of the painting for a day or two, the excess of oil may be removed by means of a piece of cotton-wool, or a soft brush, a fresh portion of the preservative applied, and the excess removed as before. The process must be repeated from time to time until the colours are firmly fixed, when the painting will bear friction, and

may be submitted to the cleaning process or varnished. It is advisable, however, to remove as much of the dirt as possible from the picture, by careful washing with soft water, previously to the application of the fixing agent. The mixture will not restore the cracks in a painting, but simply fixes the colours, and renders the painting very elastic. A mixture of one part of methylated chloroform and two of linseed oil is used for reviving the colours of paintings. A small portion is rubbed over the pictures, after washing, with cotton-wool, and on the following day the painting is wiped over with a soft silk handkerchief. Oil and chloroform, when used in the proportion given, possess the property of restoring the faded colours of paintings, and develop colours which have perished, to the eye, by age.

Drying Oils.—Poppy Oil.—Take 3 lbs. or pints of pure water, 1 oz. of sulphate of zinc (white vitriol), and 2 lbs. of poppy oil. Expose this mixture in an earthen vessel capable of standing the fire, to a degree of heat sufficient to maintain it in a slight state of ebullition. When one-half or two-thirds of the water has evaporated, pour the whole into a large glass bottle or jar, and leave it at rest till the oil becomes clear. Decant the clearest part by means of a glass funnel, the beak of which is stopped with a piece of cork: when the separation of the oil from the water is completely effected, remove the cork stopper, and supply its place by the forefinger, which must be applied in such a manner as to suffer the water to escape, and to retain only the oil. Poppy oil when prepared in this manner becomes, after some weeks, exceedingly limpid and colourless.

Fat Drying Oils.—1. 8 lbs. nut oil or linseed oil, 1 oz. white-lead, slightly calcined, 1 oz. yellow acetate of lead, also calcined, 1 oz. sulphate of zinc (white vitriol), 12 oz. litharge, and a head of garlic or a small onion. When the dry substances are pulverized, mix them with the garlic and oil, over a fire capable of maintaining the oil in a slight state of ebullition; continue it until the oil ceases to throw up scum, assumes a reddish colour, and the head of garlic becomes brown. A pellicle will then be soon formed on the oil, which indicates that the operation is completed. Take the vessel from the fire, and the pellicle being precipitated by rest, will carry with it all the unctuous parts which rendered the oil fat. When the oil becomes clear, separate it from the deposit, and put it into wide-mouthed bottles, where it will completely clarify itself in time, and improve in quality. 2. 1½ oz. of litharge, ½ oz. sulphate of zinc, and 16 oz. linseed or nut oil. The operation must be conducted as in the preceding case. The choice of the oil is not a matter of indifference. If it be destined for painting articles exposed to the impression of the external air, or for delicate painting, nut oil or poppy oil will be requisite. Linseed oil is used for coarse painting, and that sheltered from the effects of the rain and of the sun. A little negligence in the management of the fire has often an influence on the colour of the oil, to which a drying quality is communicated; in this case it is not proper for delicate painting. This inconvenience may be avoided by tying up the drying matters in a small bag; but the dose of the litharge must then be doubled. The bag must be suspended by a piece of packthread fastened to a stick, which is made to rest on the edge of the vessel in such a manner as to keep the bag at the distance of an inch from the bottom of the vessel. A pellicle will be formed, as in the first operation, but it will be slower in making its appearance. 3. A drying quality may be communicated to oil by treating, in a heat capable of maintaining a slight ebullition, linseed or nut oil, to each lb. of which is added 3 oz. of litharge, reduced to fine powder. 4. 2 lbs. of nut oil, 3 lbs. of common water, and 2 oz. of sulphate of zinc. Mix these matters, and subject them to a slight ebullition, till little water remains. Decant the oil, which will pass over with a small quantity of water, and separate the latter by means of a funnel. The oil remains nebulous for some time; after which it becomes clear, and seems to be very little coloured. 5. 6 lbs. of nut oil

or linseed oil, 4 lbs. of common water, 1 oz. of sulphate of zinc, and 1 head of garlic. Mix these matters in a large iron or copper pan; then place them over the fire, and maintain the mixture in a state of ebullition during the whole day: boiling water must from time to time be added to make up for the loss of that by evaporation. The garlic will assume a brown appearance. Take the pan from the fire, and having suffered a deposit to be formed, decant the oil, which will clarify itself in the vessels.

RESINOUS DRYING OIL.—Take 10 lbs. of drying nut oil, if the paint is destined for external, or 10 lbs. of drying linseed oil, if for internal articles. 3 lbs. of resin, and 6 oz. of turpentine. Cause the resin to dissolve in the oil by means of a gentle heat. When dissolved and incorporated with the oil, add the turpentine: leave the varnish at rest, by which means it will often deposit portions of resin and other impurities; and then preserve it in wide-mouthed bottles. It must be used fresh: when suffered to grow old it abandons some of its resin. If this resinous oil assumes too much consistence, dilute it with a little essence, if intended for articles sheltered from the sun, or with oil of poppies.

Distempor for Photographic Backgrounds.—Take whiting, 1½ to 2 lbs.; lampblack, 3 oz.; damp blue, 4 oz.; glue, 1½ oz. Dissolve the whiting in 2 quarts of water, add nearly all the blue, then add the black, gradually drying after each addition by dipping in it a piece of paper and drying at the fire, till you get the exact colour required. Then having dissolved the glue in warm water, pour it in, to keep the colour from falling off, mix thoroughly together, and strain through canvas.

To Prepare Zinc for Painting.—Dissolve 1 part of chloride of copper, 1 of nitrate of copper, and 1 of sal ammoniac, in 64 parts of water, and add 1 part of commercial hydrochloric acid. Brush the zinc over with this, which gives it a deep black; leave to dry 24 hours, when any oil colour will firmly adhere to it, and withstand both heat and damp.

Vehicle for Colour.—1 oz. of borax, 2 oz. of shellac, 1 pint of water. Boil a few minutes, stir with a piece of wood; or 1 oz. of liquid ammonia, 2 oz. shellac, 1 pint of water. Add more or less shellac, as it may be required.

Putty.—Glaziers' putty is made of whiting and oil. The whiting should be in the form of a very dry fine powder; it should be specially dried for the purpose, and passed through a sieve of 45 holes to the inch, and then mixed with as much raw linseed oil as will form it into stiff paste; this, after being well kneaded, should be left for 12 hours, and worked up in small pieces till quite smooth. It should be kept in a glazed pan and covered with a wet cloth. If putty becomes hard and dry, it can be restored by heating it and working it up again while hot. For special purposes white-lead is sometimes mixed with the whiting, or the putty is made of white-lead and litharge entirely.

Purifying Linseed Oil.—It is requisite that artists should have the linseed oil they use perfectly colourless, as otherwise it would spoil the more delicate tints. To purify it is extremely easy—even putting a bottle of the oil in the sun for some days will accomplish the object; but as this process is somewhat tedious, it is better to put in a 2-oz. phial three-quarters full of good common linseed oil, a piece of whiting as big as a nut, previously powdered. Shake them together, and put the phial on the hob of a stove, or in an oven. In two days, and sometimes in a few hours, the whiting will have carried down to the bottom all colour and impurity, and the refined oil floating at top may be poured off for use.

Silicate of Soda Paint.—A solution of silicate of soda has been found by Abel, when applied like paint to wood, to give it a very considerable protection against fire, as well as to form a hard coating durable for several years; it can be used with the ordinary colours like distemper. The silicate of soda must be in the form of a thick syrup of a known degree of concentration, and is diluted with water when

required for use, according to the prescription given below. The lime-wash should be made by slaking some good fat lime, rubbing it down with water until perfectly smooth, and diluting it to the consistency of thick cream. It may be coloured by admixture with mineral colours. The protective coating is produced by painting the wood, firstly with a dilute solution of silicate of soda; secondly, with a lime-wash; and lastly, with a somewhat stronger solution of the silicate. The surface of the wood should be moderately smooth, and any covering of paper, paint, or other material, removed entirely, by planing or scraping. A solution of the silicate, in the proportion of 1 part by measure of the syrup to 4 parts of water, is prepared in a tub, pail, or earthen vessel by stirring the measured proportion of the silicate with a very small quantity of the necessary water until a complete mixture is produced, and then adding the remainder of the water, in successive quantities, until a perfect mixture in the requisite proportions is obtained. The wood is then washed over with this liquid, by means of an ordinary whitewash brush, the latter being passed two or three times over the surface, so that the wood may absorb as much of the solution as possible. When this first coating is nearly dry, the wood is painted with the lime-wash in the usual manner. A solution of the silicate, in the proportion of 1 part by measure of the syrup to 2 parts of water, is then made as above described, and a sufficient time having been allowed to elapse for the wood to become moderately dry, this liquid is applied, upon the lime, in the manner directed for the first coating. The preparation of the wood is then complete. If the lime coating has been applied rather too thickly, the surface of the wood may be found, when quite dry after the third coating, to give off a little lime when rubbed with the hand. In that case, it should be once more coated over with a solution of the silicate of the first-named strength.

To Line Old Paintings. — 1 Take a piece of unbleached calico, strain upon a frame, and size it with weak size. When dry, take ½ oz. spirits of turpentine, 1 drachm camphor, dissolve in it 4 oz. cold-drawn linseed oil, 2 oz. white-lead, stiff ground do. umber, 4 oz. finely-washed and dried whiting. Mix all together; apply to the calico well, rubbing it in; after the second coat, pumice to erase the lumps. Give the picture a coat, and pumice that; then coat both, and put them together upon a level board face down upon a piece of brown paper well sized. Well press, and rub the air out, so as to bring them in perfect contact, and in a few days it may be tacked upon a frame. 2. Make a temporary stretcher, and let it measure inside a little larger than the outside of the picture about to be lined, and on it stretch some unbleached calico; trim the picture square, cutting off all the old nails and ragged edges. Oil a piece of paper the size of picture with linseed oil, and lay it on a flat surface; now lay the picture face downwards on the oiled paper, and coat it with glue or paste until there is sufficient to make it stick well; then lay the unbleached calico on, rub well with the flat of the hand, iron it with flat iron till quite dry, taking care to put a piece of paper between the calico and the iron, or it may stick. Be sure the iron is not too hot; and if it is a large picture, it will be as well to have two irons, one getting hot while the other is in use. When the picture is quite dry it is ready for putting on the new stretcher, which should be one with two cross-bars, and can be obtained at any artist's colourman's. If you cannot make some good stout paste yourself, you had better buy it at the leather seller's, and add glue enough to make it a good strength, and let the two be well mixed together.

Ox-Gall Purifying.—Evaporate fresh ox-gall to a syrup, and then spread it out to dry in a thin layer on a plate placed near the fire. This is the pharmacopœia plan, but it takes none of the colour out of ox-gall. It simply desiccates the bile, which can in this condition be preserved from putrefaction for any length of time in closely-stop-

pered bottles. If fresh ox-gall is evaporated to dryness on a water bath, and then treated with alcohol, the mucus and epithelium are precipitated; but the colouring matter still exists, and is not precipitated or discharged by digesting. Again, boil 1 pint of fresh ox-gall with 1 oz. of alum, and in another vessel a second pint, with 1 oz. of common salt. After standing three months in separate bottles, the clear portion from these solutions is to be mixed for use. But the solutions do not become altogether clear, although they keep very well without putrefaction. Ox-gall may be thoroughly discoloured by slightly acidulating it with acetic acid, and passing through it a stream of chlorine gas.

To Remove Old Paint.—Wet the place with naphtha, repeating as often as is required; but frequently one application will dissolve the paint. As soon as it is softened, rub the surface clean. Chloroform, mixed with a small quantity of spirit ammonia, composed of strong ammoniac, has been employed very successfully to remove the stains of dry paint from wood, silk, and other substances.

To Destroy Paint.—Mix 1 part by weight of American pearlash with 3 parts quick stone lime, by slaking the lime in water and then adding the pearlash, making the mixture about the consistence of paint. Lay the above over the whole of the work required to be cleaned, with an old brush; let it remain 14 or 16 hours, when the paint can be easily scraped off.

Fireproofing Shingle Roofs.—A wash composed of lime, salt, and fine sand or wood-ashes, put on in the ordinary way of whitewash, renders a shingle roof fiftyfold more safe against fire from falling cinders, in case of fire in the vicinity. It has also a preserving influence against the effect of the weather; the older and more weather-beaten the shingles, the more benefit derived. Such shingles are generally more or less warped, rough, and cracked. The application of wash, by washing the upper surface, restores them to their original or firm form, thereby closing the space between the shingles, and the lime and sand, by filling up the cracks, prevent it warping. By the addition of a small quantity of lampblack, the wash may be made of the same colour as old shingles, and thus the offensive glare of a whitewashed roof is removed.

Remedy for Damp Walls.—¾ lb. of mottled soap to 1 gall. of water. This composition to be laid over the brickwork steadily and carefully with a large flat brush, so as not to form a froth or lather on the surface. The wash to remain 24 hours, to become dry. Mix ½ lb. of alum with 4 galls. of water: leave it to stand for 24 hours, and then apply it in the same manner over the coating of soap. Let this be done in dry weather.

To Whitewash, or Colourwash.—If a room is to be whitewashed or coloured, the walls and ceiling are to be washed with clean water, frequently changed, the rough patches scraped smooth, swept with a broom, and all cracks and loose places carefully stopped. When this is done, before proceeding further, all the rubbish should be cleared from the room and the floor swept. In some instances, as after illness, it will be the best to make the whitewash of lime, for lime is a good purifier. But as lime-wash is apt to turn black, whitewash is generally made by putting whiting to soak in water overnight, and afterwards mixing very smooth, as thick as cream, and with about a teacupful of size to 2 galls. of wash, which will prevent its rubbing off when dry: or potato starch may be used, which leaves the white uninjured. Another mode is to mix into a stiff paste, with cold water, 6 balls of whiting; to this add 2 lbs. of very hot, but not boiling, size, and a small quantity of blue black ground fine, and let the whole get cold. Whitewash thus prepared may be altered to any required colour: yellow ochre mixed with a small quantity of blue black makes a stone-colour; without the black, a buff or straw colour; and warmer tints may be produced by using indigo or the blue black above mentioned, or Venetian or

orange red; vermilion will give different shades of pink, and a green may be obtained with mixture of indigo and yellow ochre. Some care will be required in the mixing, but if too much of the colouring matter is not added at first, it will not be difficult to get a colour according to taste. By a little management the wash may be laid on without splashing, the method being, not to take too much at a time into the brush, or to jerk it at the end of the stroke. As a rule, ceilings or walls should be whitewashed at least once a year, and oftener whenever necessary. For common work a mixture of ½ a bushel of lime, 1 lb. of common salt, ½ lb. of sulphate of zinc, and a gallon of sweet milk can be used. For brickwork exposed to damp, take ½ a peck of well-burnt lime, fresh from the kiln, slake with water, then add a sufficient quantity of water to reduce it to a paste, pass through a fine sieve; add a gallon of clean white salt, which has been dissolved in boiling water, and a thin smooth paste, also hot, made from 1 lb. of fine rice flour; also ½ lb. of best glue, made in a water bath. Mix these ingredients all together, stir them well, and then add ½ lb. of best Spanish whiting dissolved in 5 qts. of boiling water. Stir again, and cover over to retain the heat and keep out dirt. Let it stand a week, when boil again and apply hot. The above proportions will suffice to cover 40 square yards.

Paper Hanging.—If the walls are quite new and smoothly finished, the only preparation usually necessary is to lay on a thin coat of weak size, the use of the size being to make a surface to which the paper will stick better than to the bare wall. In preparing an old whitewashed or coloured wall for paper, the wash or colour is wetted with water and scraped off with an old plane-iron, or any piece of steel which has a smooth edge, after which the wall should be swept down with a stiff broom to remove all that the scraper may have left and make an even surface. If there is any loose plaster, those parts should be well sized and have a piece of thin strong paper pasted over them; but the best way is to get the place re-plastered. Cracks or holes may easily be filled with a little putty; in no case should they be left. If not stopped in any other way, slips of paper should be pasted over them, or else the cracks will soon show through the outer paper. After all this is done the room may be sized, and the size will be dry enough in an hour for the papering to be commenced. If the room has been already papered, it will be necessary to go over the walls and tear off all the loose pieces, especially at the top and bottom, corners and edges. If the bare wall is exposed by the tearing off, these spots should be sized. The walls of rooms finished in a superior manner are generally plastered three coats, and upon the plaster, when quite dry, a coating of lining-paper is laid to obtain a smooth surface. Sometimes common thin canvas is used instead of lining-paper, and occasionally instead of plaster. In the latter case battens should be fixed against the walls to fasten the canvas to and prevent it touching the walls. The preparations having been made, the hanging of the paper may be proceeded with: the rule is, that the edges of the paper, when hung, shall be towards the window. The appearance of many a handsome paper has been spoiled from carelessness or ignorance in this particular; but when this precaution is observed, the lapped joints scarcely show. First of all, the edges of the paper are to be cut, and as the hanging is to begin at the window on each side, that edge which is cut close for one side must *not be cut close for the other.* This point being decided, unroll a yard or two of one of the pieces of paper, cut the edge, unroll a yard or two more, roll up loosely the part that is cut, and continue till the end is reached, when the process being repeated with the other edge, the piece will be at last rolled up again as it was at starting. Not more than about a ¼ inch of paper should be left at the edge which is not cut close. If there is a back and a front window in the room, the same rule must be observed, and the finish will come in the corner most out of sight, by the mantel-