running water, and dry. The negative to be copied should be a weak glass picture, with plenty of detail in the shadows, and not too dense in the bright lights. An ordinary negative is too opaque to produce a good result. Choose a sunny day, and turn the mirror of the camera so that it reflects the sun's light on the condensing lens.

Photo-lithography. — To produce a photo-lithographic impression of a negative proceed as follows;—Procure a solution of gelatine to which is added a small quantity of albumen in combination with a solution of bichromate of potash, and in a warm state spread it on a sheet of fine-textured paper with a flat brush in a room partially darkened, and hang it up to dry, excluding it from light. The negative or glass picture having been placed in a photographic copying frame, place over the negative the prepared paper, over that a piece of fine woollen cloth, and screw all in the frame together, and expose the copying frame and negative to diffused light for 10 or 15 minutes; the light passes through the transparent parts of the negative on to the paper, which, by the chemical action of the light on the chromatized paper, will affect it, turning it from a yellow colour to a deep brown, while the part of the negative which intercepts the light is not chemically acted upon in consequence of the absence of light, and remains light yellow. When removed into a darkened chamber, and the chromatized gelatinized paper examined, a perfect brown impression will be seen impressed thereon. The next operation is to cover the whole surface of the page with lithographic transfer ink, evenly, and reduce in quantity by wiping it off with a fine rag, then lay by for an hour or so. The principle involved by the action of light is to render the chromatized gelatine, when acted on by it, insoluble in warm water; therefore, if the prepared paper be placed therein, it will not affect the brown shade of the impression, which is now covered with transfer ink, but all the rest will immediately wash away, leaving a perfect impression of the picture on the paper in transfer ink; a suitably prepared lithographic stone or plate of zinc is put into a lithographic press, the stone or plate partially warmed, and the transfer, dry, is placed face on stone or plate and passed through the press slowly and with a good pressure, only once through, when on the removal, it will be found effectually transferred to stone or plate, and any reasonable number of copies can be struck off in printers' ink.

Nature Printing. — There are two methods employed for obtaining facsimiles of ferns, leaves, sea-weeds, one suited to the amateur, the other for commercial purposes. 1. For the former the requisites are small quantities of coloured printing inks, black may be used, but the natural colours look much better, a little cotton wool, and some pieces of very soft wash-leather. Either fresh or dried leaves may be used; the former require no preparation, the latter should be dipped in water, and then left between damp blotting paper for some time to become tough, or they sometimes crumble to pieces during the manipulation. A dabber about the size of a marble is made of cotton and soft leather tied up, a small quantity of ink of the desired colour put on a piece of glass, and the dabber covered with it, using as little as possible. The side of the leaf from which the impression is to be taken is then laid, face upwards, on a piece of clean paper, and the dabber employed lightly to coat all the prominent parts of the leaf with the ink. The leaf is then laid, ink side downwards, on a piece of moistened paper, covered with another similar piece, which may be kept in place by lead weights if necessary. The part under which the leaf remains should then be carefully pressed with a dabber, similar to that used for the ink, taking care to go steadily and evenly over the whole surface of the leaf. Of course it is necessary to take great care to prevent the leaf or paper from shifting. Any number of impressions may be taken from one leaf. Inks may be mixed with a small palette knife to obtain any shade of colour, and two

or more colours may be used on one specimen. 2. In the commercial process, the leaf, or other object, is placed on a steel plate, and covered with a lead plate scraped bright; it is then subjected to great pressure, which leaves a beautiful impression on the lead. From this a copper matrix is taken by the electrotype, which in turn serves to produce an intaglio plate in copper, from which impressions may be taken in the usual manner. 3. A piece of writing paper is moistened with olive oil and thoroughly smoked over the flame of a tallow candle, the leaf, which should be dry, is laid upon it covered with a piece of paper, and well dabbed all over, then transferred to a piece of clean paper and the dabbing repeated, when it will leave an impression much like a very delicate pencil drawing.

Photography on Silk.—Pour 20 oz. of boiling water on 100 grains of chloride of ammonium and 60 grains of Iceland moss. When nearly cold, filter, and immerse the silk in it for 15 minutes. To sensitize, immerse the silk in a 20-grain solution of nitrate of silver for 16 minutes. Let the nitrate bath be rather acid. When dry, prepare for printing by attaching the silk to a piece of cardboard a little smaller than itself, by turning the edges over and fastening with small pieces of gummed paper. Slightly over-print. Wash in two or three changes of water, and tone in a gold bath made thus;—29 oz. of water, 2 drams acetate of soda, 4 grains chloride of gold, and a few grains of common whiting. Filter and keep for 24 hours before using. Let the prints be toned slightly bluer than they are required to be when finished. Rinse them in water, and fix in a solution of hypo., 4 oz. to the pint of water; 20 minutes is ample time for fixing. Wash well.

PHOTOGRAPHY FOR WOOD-ENGRAVING.—It is easy to obtain a photograph on the wood; but the nitrate of silver disorganizes it, and renders it unfit for the purpose intended. If varnish is used to protect the wood, the engraver can scarcely operate upon it. These difficulties appear to be obviated by the use of the Worthleytype process—uranium collodion containing so little nitrate of silver as to produce no injurious effect. If desired, when the picture is printed on the block, the collodion may be removed by means of cotton moistened with ether, and an excellent image will be seen on the surface of the wood, which is then in as fit a state for engraving as if the drawing had been made in the usual way. Ivory may be treated in a similar manner.

TO REDUCE OLD BATHS AND NITRATE OF SILVER SOLUTIONS.—Filter the solution of silver proposed to be operated upon until it is clear, and place the filtrate into a clean white bottle of suitable capacity. To each pint of the liquid add 4 oz. or more of mercury, and allow the mixture to remain at perfect rest for a few days. In a very few hours a beautiful sparkling coruscation will be found forming upon the surface of the mercury by what is known as double elective affinity, and for each atom of the silver so deposited, a corresponding amount of mercury is acted upon by the nitric acid of the silver, and passes into solution as nitrate of mercury. The deposition continues until all the silver has been thrown down, when we find over it a strong solution of the nitrate of mercury, which may be obtained in the solid crystalline form by evaporation. In a few days the deposition will be completed, which can be readily seen if the tree ceases to grow. Shake the bottle thoroughly, so that the branches of the tree are detached and broken, and brought in thorough contact with the mercury, where the spangles of silver are quickly dissolved. The watery part of the mixture can now be drawn or decanted off from the mercury, and the latter placed in a bag, or, better, in a large piece of fine tough buckskin, and pressed with force between the hands. When no more mercury can be squeezed through, the bag may be opened and the lump of brittle amalgam removed, and preserved in a well-cleaned and stoppered bottle until more has been accumulated. In case all the mercury should disappear at the end of the process, a

little more may be added to the watery solution to ascertain whether it still contains silver.

BACKGROUND.—Wet the canvas you intend for background and wring out well, then tack tightly as possible on to a frame, say 7 ft. 6 in. by 5 ft. When dry, paint over with the following;—white lead, 1 lb.; driers, 2 oz.; black paint, sufficient to give it the desired shade; turpentine, half pint. Mix thoroughly, and allow to stand a day, when the lead will settle down. Pour off turps carefully, which will rid it of the oil; bring to proper consistency by adding fresh turps. Then add 1 oz. scraped yellow soap, strain through calico, and it is ready for use. The quicker it is brushed over the canvas the better. If done over again it will be improved.

CLEANING OLD VARNISHED NEGATIVES.—These can be cleaned by boiling them a few minutes in a strong solution of soda, wash thoroughly in several changes of water, and wipe dry. Or, when few in number, add to 10 oz. old collodion, 1 dram sulphuric acid, pour over the varnished side, drain slightly, and place another plate face downwards upon it; let them remain in contact about 20 minutes, soak an hour in water, wash well, and wipe dry for use.

Blue Pictures, or the Cyanotypo Process.—Ammonia-citrate of iron, 40 grains; distilled water, 1 oz. Spread evenly over the paper, by means of a flat brush or a glass rod, the above solution. Allow to dry. Expose to light under the negative for a few minutes in the sun, or from half an hour to one hour in the shade, depending on the intensity of the light. Spread over the paper, in the same manner as above, the following;—ferro-cyanide of potassium, 1 dram; water, 1 oz., which immediately on being applied becomes of a blue colour. Allow to remain a few minutes, then wash in water, and a blue positive picture will be the result. To prevent the picture fading, apply a solution of carbonate of ammonia, which turns the picture of a lavender colour; then wash in water and dry, when the blue colour will be restored. If the picture has not been exposed long enough, it will be very faint.

Magic Photographic Pictures.—In the first place an ordinary print must be taken on albumen paper from a negative in the usual manner. When it is sufficiently printed it must be carefully washed in the dark room, so as to remove all free nitrate of silver. Now take it into the dark room and immerse it in the following solution;—saturated solution of bichloride of mercury, 1 oz.; hydrochloric acid, 1 dram. The saturated solution of bichloride of mercury is best prepared by dissolving the solid bichloride in hot water, as much as it will dissolve, then allowing the solution to cool, and pouring off the clear portion for use. The salt that crystallizes out can be preserved for future use. Bichloride of mercury is a violent poison. The print will bleach in this liquid and disappear, from the formation of new and colourless compounds. When the paper appears quite white and colourless it is removed from the bath of bichloride solution, and well washed and dried in the dark room.

Development of the Magic Picture.—Make a saturated solution of hyposulphite of soda, and steep pieces of blotting paper of the same size as the prints which are to be developed in the solution, and dry them for use. Place the whitened picture on a piece of glass, albumen side upward, lay a piece of the blotting paper on this, and moisten it thoroughly with water, and place another piece of glass upon the blotting paper, press closely together by means of a weight or press; in a very short time the picture is restored in all its original detail, and now of a sepia colour.

TO OBTAIN THE GOLD FROM AN OLD TONING BATH.—Add sulphate of iron, either in crystals or solution, to the toning bath. The sulphate of iron will precipitate the gold in a black powder, which can be dried after well washing in several waters, and dissolved in nitro-muriatic acid, when a solution of chloride of gold will be obtained, which can be

evaporated to dryness, after which it should be dissolved in distilled water, and again evaporated so as to get rid of the acid. Another way is to reduce the black powder in a crucible, but an enormous heat would be required. As an alternative to either of the above methods, the residue or black powder may be sent to the smelters, who would undertake to reduce it and allow cash for the same.

Silver from Trimmings of Untoned Prints.—Procure an old iron bucket or pot, and place the cuttings in a few handfuls at a time, and apply a light to them, when they will quickly burn to ashes. As they burn down keep adding the cuttings, which must be stirred up frequently with an iron rod, so as to completely reduce all the mass to fine ashes. Of course the burning must be done out of doors, owing to the dense smoke and disagreeable fumes. If in windy weather, place a piece of sheet iron partly over the bucket to prevent the ashes from blowing away. The fire will be a long time dying out. After the trimmings are reduced to ashes, the ashes can then be reduced to metallic silver in a crucible with equal quantities of carbonate of soda and borax, or sent away to be reduced.

Chloride of Silver from Washing of Prints.—This can be reduced to metallic silver in the same way as the ashes from the trimmings.

To Reduce Nitrate of Silver Bath.—Throw the old baths into the washing waters and convert into chloride of silver, adding common salt till the water ceases to look milky. Or evaporate to dryness, redissolve, and use for printing bath.

To Intensify Negatives after they are Varnished.—When a negative has been varnished, it sometimes becomes so weakened as to cause great disappointment. But a negative need not be given up as hopeless under these circumstances. Make a negative intensifying varnish by adding tincture of iodine—alcohol, 1 oz.; iodine, 10 grains—to any good negative spirit varnish, until of a very deep sherry colour. Label the bottle, and keep for special use. When a negative prints weak and without sufficient contrast, revarnish with this varnish; pour on in the usual manner, allowing a few seconds for the yellow varnish to penetrate the film, and dry by heat in the usual manner of varnishing the plate. The negative will be found to be changed to a more non-actinic colour that will take longer to print, and will produce a more brilliant impression on paper. Many weak, thin, foggy negatives may thus be made to produce passable prints. It is well to keep two varieties of this yellow varnish; one of an ordinary sherry colour for negatives that only want a little intensifying; and another with a very deep port-wine colour—made by adding a greater quantity of tincture of iodine—and using this latter for negatives that are very weak and grey. A varnish of this character may also be used with advantage for varnishing the plate in the first instance, if the negative is found to be not quite intense enough, as the iodine in the varnish unites with the silver deposit, thus increasing the intensity of the negative. It is scarcely necessary to say that these expedients, though useful in cases of extremity, should never be used as a regular practice.

On Reducing the Intensity of Negatives.—When a negative is too dense, and it is wished to reduce the intensity, the usual recommendation is to employ a strong solution of cyanide of potassium to dissolve away the excess of density. This method is effectual when there is an excess of deposit all over the plate, and where the deep shadows will bear reducing, as well as the high lights. When, however, the density is in excess only on the high lights, and the deep shades are already too bare, this method is not only not useful, but is mischievous. By the use of perchloride of iron such negatives may be materially improved and rendered capable of producing satisfactory prints. Make a stock solution of 30 grains of perchloride of iron to the ounce of water. When a negative has been fixed and washed, and is found too dense in the

high lights, take a few drops of the solution and dilute until it has only a pale golden tint. Flow over the negative, or pour on to any part where the intensity is wished to be reduced. The solution acts immediately, according to the strength, making the deposit rather duller in colour. Wash well; no difference will be perceived except the slight dulness. The ordinary fixing solution, hypo. or cyanide, has now to be poured over the plate, and according to the action of the perchloride, so will be the reduction of the density. Where the silver is most abundant on the negative, there the perchloride most readily acts, and this constitutes its most useful peculiarity. It requires most carefully using, or the greater part of the deposit will be changed into chloride of silver, and be soluble in the fixing bath. It is best to experiment on a waste plate or two before trying it on a valuable negative. If the negative is not enough reduced by the first application of the perchloride and fixing solutions, the action may be repeated again and again, until just the desired amount of deposit is left. The perchloride solution should be used very dilute, scarcely coloured; it has no tendency to stain, nor eat away the weakest half-tones. The fixing solution acts immediately. All that it dissolves it does at once, so that but little time is lost. A good washing is required after the hypo. or cyanide, but the perchloride is rapidly washed away. Everything may be done in open daylight.

To Remove Silver Stains from the Hands.—1. Wash the hands well in hot water with soap, then rub the stain with a flat piece of pumice-stone; the greater part of the stain may thus be removed. Finish with a piece of cyanide of potassium, by rubbing the hand, while still wet, on the stained part, and the stain will disappear. 2. Wash in a saturated solution of hyposulphite of soda, kept for the purpose. Then wash with plain soap and water, and a little powdered pumice-stone. 3. Keep a saturated solution of cyanide of potassium in one bottle, and a solution, 10 grains to the ounce, of iodide of potassium, to which has been added as much iodine as it will dissolve, in another bottle. Touch the stain first with the iodide solution, wash, and then use the cyanide, rubbing it on the yellow stains. Cyanide must never be used to the hands when the skin is cut, or in any way injured, as pain and danger may result from the absorption of the poison.

Removing Silver Stains from Linen.—Stains should always be removed from linen before it is sent to be washed. Wet the part stained, and put on a few drops of a saturated solution of cyanide, or rub it with a solid lump; if the mark does not quickly disappear, wash, and put on a drop or two of the iodine solution mentioned in the preceding paragraph; the stain will change colour, and a little cyanide will dissolve it. When the linen is double, and the stain goes through, the solutions must be applied to each side.

Removing Yellow Iron Stains from Linen.—Yellow stains, commonly called ironmould, are removed by hydrochloric acid, or hot solution of oxalic acid, washing well in warm water afterwards.

Iron Developer to Produce Dense Negatives.—When nearly the right amount of intensity is supplied by the iron in the first instance, the plan of giving a little increased density to the high lights of a negative by pyrogallic and silver is a very satisfactory mode of working; but when the original deposit is thin, grey, and metallic, then is felt the shortcomings of the iron developer; for not only does the image require a great addition of strength, but it also unwillingly takes the intensity. Under these conditions the picture requires several applications of the pyro. and silver; and when the required density is produced, there is usually found a considerable loss of delicacy. The more forcing the image requires to become dense, the less satisfactory is the result. This defect, the absence of primary intensity, is chiefly found in working in the open air, where the sky forms a large portion of the picture; or in

using samples of collodion containing a large degree of bromide; in copying some kinds of pictures; in using a collodion giving only a thin and blue film; and in using weak nitrate baths. Gelatine added to the iron developer appears to act beneficially by the increased glutinous properties it gives to the solution, it seems to flow more steadily and certainly over the collodion surface, so that, not hesitating or running into irregular lines, it does not cause the stains and markings that it otherwise is prone to. By this means the developer may be poured on more deliberately, and less solution will be required for the plate; the quantity of nitrate of silver thus becomes less diluted; and from this cause it tends to produce a more dense picture. There are several ways in which gelatine may be added to the iron developer. 1. Mix 1 oz., by measure, of ordinary sulphuric acid with 1 oz. of water; let them cool. Then add 120 grains of gelatine; when dissolved, add say 5 oz. of water, and neutralize with ordinary ammonia. Add 1 oz. of glacial acetic acid, and make up the total quantity to 20 oz. of solution. To form a developer, prepare a 20-grain solution of protosulphate of iron, and add to each ounce from 10 minims to 1 or even 2 drams of the above sulphuro-gelatine mixture, according to the intensity desired, remembering that the intensity will be just in proportion to the quantity of the mixture added. 2. Glacial acetic acid, 2 oz.; distilled water, 8 oz.; Nelson's gelatine, 120 grains. Mix these together, and in a short time the gelatine will dissolve. Then add to it—distilled water, 70 oz.; protosulphate of iron, 2. This developing solution does not keep very well, and should not be made in large quantities. In cold weather it is apt to gelatinize, but a little warmth sets it all right. This solution flows like oil on the plate, readily mixing with the free nitrate, and has little tendency to form stains and streaks. The image comes out slowly and steadily, and not with a flash. The high lights, if the exposure be rightly timed, will be found to have nearly or quite the right density by the time the detail is out. If not sufficiently dense when fully developed, the solution may be poured on and off, and the density will increase; or a little fresh solution may be taken, to which a few drops of silver have been added, and any amount of intensity may be obtained. The images dry intense, and are not much reduced in varnishing.

Varieties of the Iron Developer.—The amount of alcohol necessary in the developer depends on the condition of the nitrate bath. The more acetic acid present, or the newer the nitrate bath, the less the need of alcohol, but for general use half a dram of alcohol to each ounce of developer is a useful proportion. 1. Iron, 20 grains; acetate of soda, 6 grains; glacial acetic acid, 20 minims; water, 1 oz. 2. Iron, 2 oz.; formic acid, 1½ oz.; sulphuric acid, 5 minims; water, 16½ oz. 3. Iron, 15 to 20 grains; loaf sugar, 50 grains; glacial acetic acid, 10 minims; water, 1 oz. 4. Iron, ½ oz.; Epsom salts, 1 oz.; glacial acetic acid, ½ oz.; water, 16 oz.

Opalotype Pictures.—Any method for producing glass transparencies will also serve for these pictures, only the printing should not be carried so far.

Opalotypes by the Wet Process.—It is only necessary to use opal glass instead of patent plate, and all the directions given for transparencies for windows exactly apply. Should the colour of the picture not be agreeable, it may be toned with gold by any of the usual processes, taking care to use the solution about one quarter the ordinary strength.

Opalotypes by the Dry Method.—Any of the dry processes may be employed, and the plate may be used, either in the camera, or by direct contact in the printing frame. The development may be conducted the same as for a transparency, and, after fixing, may be toned the same as by the wet process.

Opalotype by Collodio-Chloride.—The ordinary method of producing opal pictures is by collodio-chloride, which is sold with full instructions for use. The plate, when coated with this preparation and dried, is ready to be used in the

printing frame, and may be printed, fixed, and toned, just as a paper print, except that no more washing will be required than for a ordinary negative. The use of opal glass as a material to print upon is recommended, as pictures of greater beauty are yielded than can be produced on paper.

Cabinet Portraits.—The same treatment should be used in producing these pictures as in cartes; but a different lens will be necessary, as those used for the cartes are too short in focus. A half or whole plate lens, or one made expressly, will answer best. The adopted size of the cabinet portraits is as follows,—Size of mounted picture, 5½ in. by 4 in.; mounting card, 6½ in. by 4¼ in.; opening in album, 5¼ in. by 3⅛ in.

Effects of Weather and Temperature.—During an easterly wind, double or treble the exposure is necessary in outdoor work. The window of the dark room will require to be re-yellowed in the spring; chemical darkness sufficient in the winter sun, will be insufficient in spring and summer. An even temperature should be kept in the studio all the year round; in cold weather all the operations are tediously prolonged, unless the rooms are artificially warmed.

PHOTOGRAPHIC NEWS-LETTERS.—To procure these minute photographs, an ordinary negative must be taken, great care being necessary to obtain a negative that is perfectly clear at the edges, as well as in the centre. This operation will produce a photograph as much smaller than the original as the power of the lens and length of focus will allow. From a print taken off the negative thus obtained, another negative still more reduced must be taken, and this operation repeated if necessary until the final photograph is obtained of the desired size. The last positive must be printed on very fine transparent paper, and all the usual operations for toning and fixing carefully performed. On arriving at its destination the letter must be carefully unrolled and mounted on glass, then by the aid of a gas microscope attached to a powerful phantasmagoria lantern the image can be reflected on to a screen, and will be so much magnified as to be easily read and transcribed. If rapidity of copying is desired, the image on the screen may be divided into portions by lines, and several persons set to copy at the same time.

Photo-micrographs, or Photographs for Microscopic Slides.—The lens being removed from an ordinary ¼-plate camera, a mahogany cone, blackened inside, and about 2 in. in depth, is substituted, made to fit tightly into the flange of the camera, and having an opening at the apex through which the tube of the microscope can just pass freely, and only just, and to which an india-rubber band very slightly smaller than the tube of the microscope should be glued, to prevent light entering between the microscope and the cone. The microscope is then placed in a horizontal position, and the eye-piece having been taken out, the tube is passed through the cone and the eye-piece replaced. The object to be photographed, which should be as transparent as possible, is then secured on the stage of the microscope, the manner of doing which, when the stage is vertical, varies with the construction of the microscope. This may be done with two small slips of wood 3½ in. by ½ in. under the stage, one on each side of the opening, and two small india-rubber bands slipped over the ends of both wood and slide. The object can then be focussed on the ground-glass screen, but as the microscope is not specially constructed for the purpose, the chemical and visual foci do not coincide, and the chemical focus must be found by experiment. A few trials, using the fine adjustment, will give the requisite difference between the two foci, which, once found, is constant. A strong light must be employed, but not direct sunlight. The light from a white cloud on a bright day is the best illuminator. No special collodion or developer need be used, beyond being of the best, a necessary point in every photographic operation. The exposure will, of course, vary with the intensity of the light, quality of the lenses of the microscope, sensitiveness of the plate, &c. It should, however, be

short, as the image is very bright with a good microscope. If there are many to do, it will be found advantageous to contrive an arrangement of both microscope and camera on a board which can be screwed to the camera stand. Some operators prefer to work without the eye-piece of the microscope, but there is then sometimes an objectionable flare in the centre of the picture. The eye-piece occasions some little loss of light, and therefore it would be preferable to work without it if possible.

Gilding. — Wood, leather, paper, and similar substances, are gilt by fastening on leaves of gold by means of some cement; metals are gilt chiefly by amalgamation, or by the action of galvanism. The necessary materials are a cushion, knife, and tip, a large, short and thick camel-hair brush, cotton-wool, and oil and japanners' size. Gold leaf is sold in books of 25 leaves, each about 3 in. square. It is reckoned by the hundred, that is, the contents of four books, and gilders calculate a work to require so many hundreds, not so many books. There are 13 varieties of tint, ranging from a deep orange red down to a white approximating silver. The cushion is a piece of wood about 8 in. by 5, covered first with baize, and then with buff leather tightly stitched. At one end there is a raised edge or screen of parchment, which turns partly round the sides. This is to prevent the leaves being blown away by any chance wind. Underneath, the cushion has two, and sometimes three small loops of leather, one for inserting the thumb to hold it by, the others for sticking the knife and camel-hair brush in. The knife for cutting the gold leaf has a long flexible blade, which should not be too sharp, set in a light handle like a palette knife. The knife must be always kept clean and bright. The tip is a large flat brush for taking up and placing the gold leaf. It is made of very long squirrel's hair, set thinly between the flat pieces of card. Cotton-wool and the thick camel-hair brush are used for dabbing down the gold and removing superfluous pieces. There are two kinds of gold size, fat oil and japanners' size. The former is the more durable and brilliant, so that japanners' size should never be employed except for mending small places and imperfections, or where time is of great importance. The gold from which gold leaf is made must be very pure; it is hammered out, after it has been rolled as thin as paper, by being put between the leaves of a book of parchment and extremely thin skins, called gold-beaters' skin; the book is then laid upon a block of marble, and beat with a heavy hammer. When the leaves of gold are extended to the full size of the book, they are divided, and each portion is placed between the leaves of another book, which is hammered as before. This process is continued till the requisite thinness is acquired. Pale leaf gold has a greenish yellow colour, and is an alloy of gold with silver. Dutch gold is copper leaf coloured yellow by the fumes of zinc. It is much cheaper than true gold leaf, and is very useful where large quantities of gilding are wanted in places where it can be defended from the weather, by being covered with varnish; it changes colour if exposed to moisture. Silver leaf is prepared in the same manner as that of gold, but is liable to tarnish, except it is well secured by varnish. If covered with a transparent yellow varnish, it has much the appearance of gold.

Oil Gilding on Wood.—The gilding on wood, called oil gold, cannot be burnished, and is always of the natural colour of unwrought gold. It has the advantage that it may be washed and cleaned with water, which burnished gold never can. It is often used for picture frames, parts of furniture, and mouldings of apartments; as it stands the weather, it is also employed for outdoor work. The surface to be gilded should first of all be rubbed smooth, if stone with pumice, if wood with Dutch rushes, if a very bright level effect is desired. After this it should have its priming of glue size, and two coats of oil paint and one of flatting. To enrich the colour of the gold, these last may be laid down in red

or yellow. White, however, is usually preferred, as the darker colour renders any imperfection in the gold-sizing more difficult to detect. When the last coat of paint is thoroughly dry, rub it over with wash leather, to render it smooth and free from dust or grit. If there are any patterns or figures which are to be left ungilded, they should be lightly pounced over with white to prevent the gold leaf adhering to them. Another way is to paint them over with the white of egg diluted with water. If any gold sticks to this, it can be easily washed or wiped off with a moistened handkerchief. When all is ready for sizing, strain sufficient size through muslin, and put some out on the palette, adding to it enough ochre or vermilion, mixed with oil alone, to colour. Then with a stiff hog-hair tool commence painting it on the surface, taking care to lay it on smoothly, and not too thick. If put on too thickly it runs, and leaves wrinkles in the gilding. Size always from left to right, beginning at the top of the surface, and working downwards. Move the brush lightly and firmly, mapping out the surface to be sized into several squares, and finishing and cross hatching each before proceeding onwards. If there are patterns to be left ungilded, carefully trace round their outline first with a sable pencil, and then fill in the interstices. When the whole surface is covered with size, give it a thorough inspection to make sure there is no faulty portion, and if there is, delicately touch in the size with a small pencil. When very perfect gilding is required, it should be sized twice, the first coat being allowed to dry thoroughly before the second is applied. In carved work, be careful to dip the brush down into the hollows of the carving. It is a good plan to size over-night, so as to gild in the morning. But all size does not dry alike, sometimes taking 12 to 24 or 30 hours before it is ready for the gold leaf; in damp weather or positions, always more than in dry. The readiness of the size can only be ascertained by the touch. If on being touched by the finger the surface daubs or comes off, it is not ready, and must be left; if it feels clammy and sticky, it is sufficiently matured. If too dry it must be sized again. The books of gold leaf should always be placed before a fire half an hour previous to use, in order to thoroughly dry the gold and make it more manageable. When all is ready, shake out several leaves upon the gold cushion, and blow them towards the parchment screen. Then carefully raise one leaf with the blade of the knife, and place it on the cushion, gently breathing on it to flatten it out. If it cockles up, work it about with the knife-blade until it lies flat. Then replace the knife in its loop under the cushion, and taking the tip, pass it lightly over your hair, thus acquiring sufficient greasiness to enable the gold to stick to it. Lay the hairy portion of the tip upon the gold leaf, and then raising it, apply it to the sized surface. As in sizing work from left to right be specially careful to let each leaf overlap slightly, so as to avoid gaps and spaces. Lay on whole leaves as far as the space allows, and then proceed to gild the curves and corners which need smaller pieces. Place a leaf flat and smooth on the cushion, and then taking the knife in the right hand, draw the edge easily and evenly along it with a gentle pressure. Divide the leaf into as many pieces as required, and lay on as before. When all the ground is complete, give a very careful inspection to make sure there are no portions ungilt, however small, and mend them at once. Next take a piece of cotton-wool, and gently dab or press the gold down all over, finally brushing off the superfluous pieces either with cotton-wool or the camel-hair brush. It is a good plan to stipple the gold with a large stiff hog-hair tool, quite dry and clear, as this gradually softens and removes the marks of joining and other little imperfections. Finally smooth the gold with a clean piece of wash-leather, and it is completed. With regard to gilding with japanners' size, the same instructions apply, except as to the time necessary to wait between sizing and gilding.

If japanners' size is used pure, it will be ready in from 20 to 30 minutes, but better gilding can be made by mixing one-third oil size with two-thirds of japanners' size. This will be ready in about 2 or 4 hours from the time of putting on. When all the gilding is finished, dilute one-third very clean and pure parchment size in two-thirds water, and brush it all over the surface of the gold to enrich and preserve it. If it is necessary to gild in a position much exposed to touch, as the base of a pillar, or string-courses, it is as well to give the gold a coat of mastic varnish thinned with turpentine. There are various processes which tend to enrich and vary the effect of gilding. Glazings of transparent colour are sometimes applied for the purpose of deadening its lustre. Raw sienna passed thinly over a sheet of gold gives it a leathery appearance. A good effect may be produced by stencilling a small diaper in umber, sienna, or Indian red, over gold, especially if there is foliage or arabesque work upon the gilding, as the small diaper affords an agreeable relief. This is the easiest mode of gilding; any other metallic leaves may be applied in a similar manner.

JAPANNERS' GILDING is where ornaments are drawn in gold upon japanned work, and is often seen in folding screens and cabinets. The ornaments are formed by a camel-hair pencil, with japanners' gold size, made by boiling linseed oil with gum animi, and a little vermilion. When the size is nearly dry, gold powder or gold leaf is applied. In all cases where gold has been fixed on by means of linseed oil, it will bear being washed without coming off.

BURNISHED, OR WATER GILDING, will not bear being wetted, and is only fit for work to be always kept within doors. For this gilding the wood is first covered with 4 or 5 coats of whiting and size; and that the gilding should be perfect, it is necessary that there should be a sufficient body of whiting. When these are dry, they are laid over with a coat of gold size, made of Armenian bole, a little wax, and some parchment size. When the size is dry, a portion of the surface is wetted plentifully with clear water and a soft brush, and a leaf of gold is applied, so as almost to float on the water, when it instantly settles down and adheres to the size. Great care must be taken not to suffer any of the water to come over the gold, or a stain will be produced. When the whole is covered with gold leaf, the effect is what is called matt, or dead gold, and is the natural colour of gold not burnished. Such parts as are required to be burnished are rubbed over with a burnishing tool of agate. Ornaments executed partly matt, and partly burnished, have a very rich effect, which is seen in most picture frames. As already stated, burnished gilding cannot be cleaned with water, though oil gold may; but the matt portion of water gilding is so like oil gold, as not to be distinguished by an inexperienced eye; and it may be very desirable to know, in that case, by which of the two processes it has been executed, with a view to cleaning it when soiled by flies or otherwise. This may be ascertained by observing in some crack or crevice whether the gold is laid on a coat of whiting; and if there is no other method, a small scratch with a knife may be made in some unimportant part to ascertain the fact. On account of the impossibility of washing water gilding without injury, it is necessary to take great care to protect it from flies, or other causes of soiling it, by covering it over with very fine net. Frames executed in water gilding are sometimes required to be regilt; this cannot be done without taking off the whole of the whiting, and commencing the process again, which is expensive. When this is done, the frames may be either regilt in the water or in the oil manner; and as the last is much the cheapest, it is sometimes preferred, although it cannot be burnished.

Gilding Signs or Letters.—The following method is adapted for working in the open air, when the ordinary process with the cushion is rendered difficult if there is much wind to blow the gold leaf about. Take a sheet of tissue

paper and rub it over on one side only with a piece of white wax. This should be rubbed rather briskly over the surface of the tissue paper, which should be placed on something flat, so that the wax is spread evenly throughout. The paper which has thus been rubbed will possess a certain sticky quality, scarcely perceptible to the touch, but sufficient to cause the gold-leaf to adhere to it. After a whole sheet of paper has been waxed as described, it should be cut into squares a little larger than the leaves of the book of gold. The gold-leaf book must be opened and the waxed side of the tissue paper gently pressed upon the gold leaf with the hand. On removing the paper the gold leaf will be found attached to it. The gold leaf being thus secured upon the tissue paper, is ready for use. It is evident that the difficulty experienced through the thinness of the gold is by this means to a great extent overcome. The tissue paper may be used over and over again. It is supposed that the letters to be gilded have been written in the most suitable material, and that they are ready to receive the gold leaf. Take up the tissue paper and place it with the gilded side to the letters, and having rubbed the back lightly with the hand, the old will come off the paper and adhere firmly to the mordant with which the lettering has been written. By this method very little gold is wasted, as the tissue paper being semi-transparent, the gold leaf shows through it, and the operator can see where any portion of the gold adheres to the paper, and can accordingly place it on such portions of the work as it will best fit without an undue number of joinings, though by this process, if the gold leaf is good, not the slightest trace of joining is discernible. The gold leaf should be gently dabbed over with a pad of cotton-wool, which will smooth the surface of the gilt, and remove all superfluous pieces of gold leaf. As a newly-painted surface is sticky, if the gold leaf were to be applied to it, it would adhere to parts of the ground colour where the mordant had not touched and where the gold was not required. It is needful, therefore, before the letters or parts to be gilded are marked out, that the newly-painted surface should be dabbed over lightly with dry whiting; but care should be taken that the loose particles are dusted off by the gentle application of a silk handkerchief. If the ground is a dark one, this pouncing will so far lighten it, that the gilder will be able to distinguish any lines he may make with size, as the size will restore the ground to its original colour. But if the ground is a light one, the pouncing will not have this effect, and it becomes necessary to mix some kind of colour with the size to enable the gilder to make certain that he has thoroughly covered the portion to be gilded. For pouncing, put some powdered whiting in a small linen bag, tie it up tightly, and gently dab it over the parts to be pounced. The whiting is removed from the ground after the gold leaf is applied, by means of a damp chamois leather. The mordants for gilding are of different kinds. Picture-frame gilders generally use gilders' size, made of fat oil, in which yellow ochre has been ground. This is a good material for the sign-writer, but it is too thick for general adoption, especially in cold weather, when it is unmanageable with the sable pencil. In hot weather, however, it is not so thick, and may often be used with advantage. The gold leaf must not be applied to this size for at least 24 hours after its application, and it will remain tacky for 2 or 3 days. When the gilding has to be finished more rapidly, japanners' gold size is generally employed. The gold leaf may be laid on this in about half an hour after its application, as it dries very rapidly. Sometimes the gilder is compelled to prepare his work and put on the gold leaf a few minutes afterwards; in this case, gold size alone is used. But if an interval of a few hours is no object, it is customary to add oil varnish to the gold size, regulating the quantity according to the time at disposal. Linseed oil should not be mixed with gold size to retard its drying pro-

perties, because it is apt not only to destroy the adhesiveness of the size, but to sweat through and discolour the metallic leaf. A few drops of boiled oil may be added to the size occasionally, but as a general rule, varnish will be found preferable to the oils.

Burnished Gilding on Glass.—The gold used is the ordinary gold leaf. Procure some fine isinglass, and place about as much in a tea-cup as will cover a sixpenny piece, and then pour on it about half a cupful of boiling water, which will dissolve the isinglass. Before the water is cold add about as much spirits of wine as there is water in the cup; then strain the whole through a clean silk handkerchief, and the mordant is ready for use. The addition of the spirits of wine is most material, as without it the gilding cannot be satisfactorily accomplished. Whatever may be the design or lettering has to be executed on the glass; it must first be set out on a sheet of white paper, and painted with Brunswick black, so that it can be seen on the reverse side. This paper with the writing reversed should be fixed at the edges or corners to the glass, the writing, of course, appearing backwards. The glass having been thoroughly cleansed and rubbed with a silk handkerchief, the gilding may be commenced, the gold leaf being laid on the reverse side to that to which the paper is attached. It is usual to place the glass in a slanting position on an easel, the lines of lettering not being horizontal, or reading from left to right, but perpendicular, reading from top to bottom. The mordant is put on with a large soft camel-hair pencil, and the gold leaf is lifted from the cushion and placed on the mordant with a tip, after having been cut to the required dimensions. If the line of writing is less than 3 in. in height, it is advisable to gild the whole line, without paying any regard to the shapes of the letters, so that when the line is finished it will be a solid piece of gilding about the same height and length as the letters. The first piece of gold leaf should be placed at the beginning of the line, which is the top of the glass, and each succeeding piece below it, the different pieces just overlapping each other. It is necessary to be particular in this, for if the pieces of gold do not meet, the interstices will probably show when the work is completed, and will prevent the uniformity of burnish. For letters larger than 3 in. in height, the gilding may be made to cover each letter, leaving the spaces between untouched. As soon as this part of the gilding has been completed it should be left to dry in a warm room, or placed before the fire, in which case it will be dry in a few minutes. When the gilding is perfectly dry and bright, it should be rubbed over very gently with a piece of cotton-wool. This will heighten the burnish of the gold, and remove the loose pieces which do not adhere to the glass. After the gilding has been treated as described, a flat soft camel-hair brush charged with the isinglass size should be passed lightly over the work; but not worked to and fro, or it will remove the gold leaf. The size should be flowed on freely and rapidly, and if any small pieces have been omitted, no attempt should be made to retouch them while the size is wet. When it is dry the gilding will resume its brightness. In order to complete the burnish of the gold, sometimes hot water is poured over the gilding, and this not only washes out any little specks which may appear on the front of the gold, but enhances its brilliancy considerably. The hotter the water poured over the work, the brighter does the gilding become, but care must be taken, as beyond certain degrees of heat the water will break the glass. This was very common, but the hot-water bath now is often dispensed with, and the size coated over the gilding is applied hot. This method is not quite so effective but it is much safer. The whole of the gilding has now to be repeated. A second layer of gold leaf over the first is necessary to ensure a satisfactory result. The second coat of gold is put on with the isinglass size, the same as the first; and as it dries, the gilding viewed from the front of the

glass will present a rich and finished appearance. The loose pieces of gold should be removed as after the first coat, by means of cotton-wool gently rubbed over the work. Another coat of size made hot may now be applied, and the gilding is ready to be written upon. It is better to leave the gilding on for a day or two before writing upon it, because the isinglass does not get thoroughly hard, though to all appearance it is perfectly dry in an hour or two. If the gilding is left untouched for two or three months, the action of the spirits of wine will cause the gold leaf to adhere so firmly to the glass that it will be difficult to remove it by any amount of washing with water; whereas in the course of a few days after it is laid on, it may be readily removed by a damp sponge. There are several ways of transferring the outline of the writing to the gold. The most expeditious method is to rub some dry whiting over the front side of the writing, on the paper, place this over the gilding, face downwards, then go over the outline of the letters with a pointed stick or hard pencil. On removing the paper, it will be found that where the letters have been traced, the whiting has marked the gold. Having an outline of the writing or design, next paint the letters with a sable writing pencil, and the ordinary japan black used by coach painters. If on turning the glass round it should be seen that the japan black deadens the gilding, or is perceptible in any way on the front of the glass, another coat of size should be passed over the gold to prevent the black from coming through the gold leaf. When the japan black is hard, the superfluous gold must be washed off with a sponge and warm water. When the japan is dry, the edges of the letters may be cut sharp and true by passing a small chisel along a straight edge, so as to trim the writing and make the tops and bottoms perfectly regular. All the straight lines of the letters may be thus trimmed, but the curved ones must be perfected with a writing pencil. The softened coloured thicknesses added to the letters are painted with the ordinary oil colours thinned with boiled oil and turpentine, the latter being used sparingly. Three or more tints are generally mixed on the palette, with a separate pencil to each, and these are softened with a larger sable pencil, and the outer edges are cut up with a pointed stick guided by a straight-edge, whilst the colour is wet, and the superfluous colour is wiped off with a piece of rag. By this means a sharpness of outline is obtained which the most skilful writer would fail to get by the mere use of the pencil. The shadow is put on as soon as the thickness is dry, and not being softened down, quick drying colours may be employed.

PREPARATION AND GILDING OF PICTURE FRAMES.—Suppose that we have a plain picture frame; it is made by the joiner into a 12-feet length of moulding, and in that state it passes into the hands of the gilder. He first gives it a priming of hot size and whiting, called thin white. The whiting employed by the gilder is not the same as that used for domestic purposes, but is finer and more free from grit. The size employed is prepared by the gilder from parchment cuttings, or glove cuttings. The cuttings are well washed in water, and then boiled in a certain quantity of clean water, until the latter has a particular degree of adhesiveness, which can only be determined by experience; this is then poured off into a clean dry vessel, and allowed to cool. When about to be used, the grease at the top and the sediment at the bottom are cut off with a knife, the size is melted in an earthen pipkin, and a small quantity of finely-powdered whiting is mixed up with it. When the thin white is dry, all holes and irregularities in the moulding are filled up with putty. This putty is not the same as that employed by the glazier, but consists of whiting and size mixed to the consistence of putty. When the puttying is dry, a coating of thick white is laid on with a brush. This thick white differs from the thin white only in having a larger proportion of dry whiting mixed with a given amount of size, the consistence attained being rather thicker

than that of oil paint. When the first thick white is dry, another is laid on in the same manner, and, similarly, a third, a fourth, and a fifth, are laid on, all about equal in thickness, and each one being perfectly dry before the next is applied. As in laying on this large body of thick white, the fine squares, hollows, and fillets would be liable to be stopped up and lose all their clearness and sharpness, opening tools, consisting of crooks, chisels, and gouges, are drawn along the fine parts of the moulding, while the thick white is still wet; by which means the forms of the various mouldings are retained. This is still better effected by the double opening white, which consists of two thick whites; the one laid on almost immediately after the other, by which a thick soft coating covers the moulding. Hard stones, shaped to the forms of the mouldings, together with the opening tools before described, are to be worked over every part of the moulding, by which asperities are smoothed down, depressions filled up, and edges brought up nearly to their required sharpness. In this state the whiting on the moulding is from one-sixteenth to one-twelfth of an inch in thickness. It is now trimmed at the back and edges by cutting off the whiting which had flowed over from the front, which prepares it for the process of smoothing. This is done by means of pieces of pumice and other stones, shaped so as to fit the various parts of the moulding. A sponge or soft brush is used to wet the moulding, and the stone which is to be used, being likewise wetted, is rubbed or worked to and fro along the moulding until that part is perfectly smooth. Another stone, fitting a different part, is then used in the same way; and so on, until every part of the length and breadth of the moulding has been worked over by the stones. The moulding, if the smoothing has been properly performed, now presents a smoothness of surface exceeding, and a keenness of the edge nearly equalling, that which the moulding presented when it left the hands of the joiner; but this must be attained without rubbing off too much of the whiting, since the whole beauty of the frame mainly depends on having a sufficient body or foundation of whiting. The brilliant burnishing on frames is, in a peculiar degree, dependent on the whiting which is first laid on the wood, and which, if deficient in quantity, cannot be adequately replaced by other means. The moulding being thoroughly dried from the effects of the smoothing, is rubbed down with glass-paper or sand-paper, to take off any little asperities that may remain, and to make the whole perfectly smooth. It is now ready for the process of gold-sizing. The burnish gold-size used in this process is composed of ingredients exceedingly opposite in their nature, such as pipe-clay, red chalk, black-lead, suet and bullock's blood. This diversity of ingredients is intended to produce different effects; one substance helps to give a brilliancy to the burnish, another to the mellowness and smoothness, and so on. The form in which the gilder purchases his burnish gold-size is that of a solid rather softer than butter. He first takes some very clear size, boiled purposely to a smaller degree of strength than the size for thick white, or, if already boiled, weakened by water. This size he melts in an earthen pipkin, but without making it very hot, and then mixes the gold size with the melted size by means of a clean brush, much in the same manner as a painter mixes his oil paint; the consistence to be about equal to that of cream. It is a source of some confusion that the same term, burnish gold-size, is applied to this creamy liquid, as to the thicker substance from which it is prepared; it is necessary to say mixed gold-size, or unmixed gold-size, in order to indicate which is meant. This gold size is laid on the moulding either with a very soft hog-hair brush, or by a large camel-hair pencil, fixed in a swan's quill. The gold size must be barely warm, and must be laid on with great care so as to leave it equally thick in every part, and obliterate the marks of the brush; upon the due observance of a medium between hot and cold, strong and weak, and thick and thin, in the gold size laid on, de-

pends much of the beauty of the moulding when gilt. From 4 to 8 coats of this gold size are laid on the moulding, each one being perfectly dried before the next is applied. A soft, partially-worn piece of glass-paper is occasionally used, to take off any little roughness that may exist. When a sufficient body of gold size is laid on, it is carefully washed with clean water, a soft sponge, and a piece of linen rag. This must be done with attention to the soft edges, which are very likely to lose the whole of their gold size, if care is not used; the object is to produce a perfectly smooth surface, especially in those parts which are to be matt gold. The test of good work is to produce the smoothest surface with the least loss of gold size. When the moulding is partially dry from this process, the matt parts are polished with a piece of woollen cloth, and the parts to be burnished receive another coating of gold size, laid on as smoothly as possible. The piece of moulding which is to be gilt is laid along the bench with one end higher than the other; and as the width of the moulding is broken up into several divisions, such as hollows and squares, it would be impossible to make a leaf of gold bend into all the various parts without breaking. The gilder learns by experience how many separate lays, as they are called, of gold will be required to cover the width of the moulding without the breaking of the gold into irregular fractures called spider-legs. In general, a deep hollow, or a depressed square, cannot be gilt at one lay, but must be covered with two strips of gold laid side by side and meeting at the centre of the depression. When the gilder has made his decision as to the number of lays that will be required, he selects one lay, and proceeds with it through the whole length of the moulding before he begins another portion of the width. If the necessary lay be about $\frac{3}{4}$ or $\frac{1}{8}$ of an inch in width, he cuts the leaf which is spread out on his cushion into four strips; if it be about 1 in. in width, he cuts the leaf into three, regulating the division of the leaf of gold according to the width of the lay. It is not often that a larger piece than half a leaf is used at once. The gilder has at hand a pan with clean water, and two or three camel-hair pencils of different sizes. With one of these pencils he wets a few inches of that part of the moulding which is to form his first lay, taking care not to wet much beyond that lay. The water is to be allowed to remain pretty full on the surface, after some of it has been imbibed by the gold size. The gilder then takes his tip in his right hand, and lays it on the slip of gold, which slightly adheres to the hairs; whence he places it on the moulding, with particular attention to straightness of direction. It frequently happens that the hairs of the tip will not take up the gold; in such case it is usual to rub the hairs between the cheek and the palm of the hand, by which their power of taking up the gold is increased. When the gold is laid on it is blown forcibly, to expel as much of the water as possible from beneath it, the dry camel-hair pencil being used to press down any parts which fail to adhere. Another portion is then wetted, and another piece laid on, lapping about $\frac{1}{8}$ of an inch over the end of the former piece. Thus the gilder proceeds, piece after piece, until the one lay is carried down the whole length of the moulding, he then proceeds with another lay joining the former. In doing this he has to observe that the water must be made to flow a little over the edge of the former lay, but not so as to wash it up, or break away the edge; the second lay must lap a little over the first, and therefore the water must likewise extend over the first lay. Thus he proceeds with all the lays into which he has found it necessary to divide the width of the moulding; every piece, lengthwise, lapping over the piece previously put on, and every lay lapping over the previous lay. The moulding is then set aside to dry. There is a particular state or degree of dryness, known only by experience, in which the moulding is in a fit state for burnishing. The burnishers used by the gilder are either of flint or agate, generally the former; the steel burnishers employed by the

jeweller would not do for the gilder. Burnishers of different forms and sizes must be employed, in order to adapt them to the part of the work which is being burnished; they are generally crooked or curved near the end. When the burnishing is done, those parts which have not been burnished are weak sized, that is, they are wetted with water in which a very little clear piece of size has been melted; this helps to secure the gold. When dry, the gold is wiped carefully with a piece of soft cotton-wool, to remove rough or ragged edges of gold; and there are now visible a number of little breaks, holes, and faulty places in the gilding, arising from the impossibility of laying on the gold quite soundly and perfectly. These defective parts are repaired by the process of faulting, which consists of cutting up a leaf of gold into small pieces and laying them on the faulty places, previously wetted, with a camel-hair pencil. If the defective part is on the burnish, it is necessary to be careful not to wet any part but what is to be covered by the gold, as it will stain the burnished gold. When the faulting is dry, the gold is again carefully wiped, and finally wetted with finishing size. This is clear size of a certain degree of strength, laid on the matt parts with a pencil, and completes the process of gilding. When a glass frame is to be gilt, the joiner's work is generally quite completed before the gilder begins, and great care is required in whiting such frames, to prevent filling up the corners with whiting, and giving them a clumsy appearance. For this purpose, modelling tools, such as chisels, gouges, and crooks, are used to clear out the corners from time to time, and preserve the original sharpness and clearness of the several parts.

Composition for Moulding.—The following is used by gilders;—Mix 14 lbs. of glue, 7 lbs. resin, ½ lb. pitch, 2½ pints linseed oil, 5 pints of water, more or less according to the quantity required. Boil the whole together, well stirring until dissolved, add as much whiting as will render it of a hard consistency, then press it into mould, which has been previously oiled with sweet oil. No more should be mixed than can be used before it becomes sensibly hard, as it will require steaming before it can be used again. Another receipt;—Make a very clear glue with 3 parts of Flanders glue and 1 part of isinglass, by dissolving the two kinds separately in a large quantity of water, and mix them together, after they have been strained through a piece of fine linen to separate the parts which could not be dissolved. The quantity of water cannot be fixed, because all kinds of glue are not homogeneous, so that some require more than others. The proper strength may be found by suffering the glue to become perfectly cold; it must then barely form a jelly. The glue is to be gently heated, then mixed with saw-dust sifted through a fine sieve. The moulds are then to be oiled with nut oil, and the glue pressed into the mould, covered with weighted board, and then set to dry near a stove. When the casting is dry it is to be trimmed.

Burnished Gilt Frames.—When new burnished gilding requires varnishing, white hard spirit-varnish is used, or yellow gold lacquer. Old burnished work must be cleaned with great care. First remove the dust with a badger-hair brush; afterwards clean the gilding by passing a clean sponge dipped in gin and water, lightly over the surface, wiping off the moisture with a very soft dry sponge or silk handkerchief; then apply the varnish, and finish.

Cleaning Gilt Frames.—Gilt frames may be cleaned by simply washing them with a small sponge, wet with urine, hot spirits of wine, or oil of turpentine, not too wet, but sufficiently to take off the dirt and fly marks. They should not be afterwards wiped, but left to dry of themselves.

Re-gilding Frames.—Take a sponge and some clean water and wash the frame well, then let it dry, procure some water gold-size; make some thin size from dry hide or parchment, mix enough warm with the gold size to enable you to work it on the frame with a camel-hair brush, give it two coats; when dry, rub it over with a

piece of fine sand-paper; it will then be ready for gilding. When the frame is covered, rest it on its edge to drain; when perfectly dry dip a pencil into water, and wipe the gold over with it; it will take the particles of gold off and make it appear solid. For any parts not covered, take bits of leaf with a dry pencil, and lay on as before, then give the whole a coat of clear parchment size, brush the back edges over with ochre, and the frame is then ready.

Gilding Pottery.—An air-tight kiln is required, which must be lime-washed every time it is used. On a small scale a retort would do well, made of Stourbridge clay, and fixed in brickwork, with access for drawing trials, bits of pitcher with a little gold on, drawn with tongs. Take ½ oz. brown gold, ½ oz. quicksilver, 10 grains tin, 10 grains white-lead, well pound together in Wedgwood mortar and pestle. Then grind on glass slab and muller, with a few drops of water, for several hours; add a drop of water as it dries, then repeat in turpentine, leaving it about the consistency of cream. It is then ready for use, or if kept for a day or two it will work better; it is laid on with a camel-hair pencil. Thin it with turpentine, as it soon dries, and should be kept covered when not in use. A little fat oil is added to make it work better. To make fat oil, evaporate turpentine to the consistency of treacle.

Gilding on Paint.—The paint must first be thoroughly dry. The letters must be written on the paint with gold size, and allowed to get a little dry, or else the writing will appear dull. Now press the gold leaf on the size, and rub it down with a piece of cotton-wool. If by accident there is more than one thickness of gold it will appear dull.

Gilding Zinc.—First coat the zinc with copper by the electrotype process, using an alkaline copper bath, and then gild on the copper, as that takes gold very readily. Organ pipes should be first coated with mastic varnish, and then oil-gilded in the usual manner.

Gold Size.—Yellow ochre, 1 part; copal varnish, 2; linseed oil, 3; turpentine, 4; boiled oil, 5. Mix. The ochre must be reduced to the finest powder, and ground with a little of the oil before mixing.

Fat-oil Gold-Size is made by grinding good stone or Oxford ochre very fine in old fat linseed oil: when ground as stiff as possible, it ought to be kept for several years before it is used; the longer it is kept the better it becomes, as it acquires a rich mellow fatness. When this size is to be applied to work, take as much as is necessary, and mix it up with a little good fat boiled oil to a proper consistence, neither too stiff nor too fluid; then apply the size to the ground, laying it very regularly and rather fully, yet not so as to run or fall into wrinkles. Gilding with oil size is suitable for large picture or looking-glass frames, figured or lettered sign-boards, clock faces, and various articles exposed to the weather, where a great breadth of gilt surface is required, as it possesses more durability and boldness than any other kind of gilding, particularly when the gilding is varnished before it becomes foul. When it is necessary to revarnish old gilding in oil, such work ought always to be well cleaned from dust, grease, or any incrustation which covers the surface, otherwise the varnish will not dry off hard, but will remain cloudy and tacky, so as readily to retain dust and flies. Various methods are employed by painters and gilders to clean old gilt work. Some wash the work well with a brush or sponge, which is sufficient in cases where the ground is firm, hard, and of a metallic colour; but where the grounds are absorbent, with gold letters, simply washing with water is in general insufficient. In such cases, employ an alkaline ley, made by dissolving 2 oz. of pearlash in 3 pints of water; then wet the work over with a brush or sponge dipped in the ley; let it remain some time, afterwards, with the sponge and clean water, wash off a part to see if the surface or gilding is properly clean, when it must be thoroughly washed with plenty of pure water, and wiped dry with a soft cloth or a silk handkerchief. Oil of vitriol and water,

mixed until its acidity is equal to that of vinegar, is very cleansing, but requires considerable practice to apply it equally to the work, and it must not remain on too long, otherwise it will not only remove the dirt, but also the paint and gilding; it requires to be used with caution, frequently applying the sponge and clear water, in order to discover whether the surface is clean. When it is well washed and wiped dry, let the work stand to dry, and afterwards apply one or two coats of copal varnish. In revarnishing old work exposed to the weather, it is best to clean it over-night, and if the weather is fine next morning, and no appearance of rain, high wind, or dust, apply the varnish about sunrise, when the warmth of the sun will cause it to flow, set, and dry quickly and hard.

Flock Gold-Size.—Put 12 galls. of linseed oil into the iron set-pot; as soon as it has boiled 2 hours, gradually introduce 12 lbs. of litharge. Continue the boiling very moderately for 6 hours; let it remain until next morning, then bring it to simmer, and run 10 lbs. of gum animi and 2 galls. of oil. When these two runs of gum are poured into the iron pot, put in 7 lbs. of Burgundy pitch, which soon melt, continue the boiling, and keep ladling it down, as directed for the best gold size, boil it moderately strong, but not over-strong, and when right, mix it with 30 galls. of turpentine, or more if required; this should be left a little thicker and stronger than japanners' gold size, as it is used for paper-stainers to lay their flock on, and ought to dry slowly in 1 hour.

Bronzing Gold-Size is japanners' gold size kept till very bright and tough from age, and then heated up and mixed with 1 gall. of very old carriage varnish to 9 galls. of gold size. This is used for laying on bronze and also gold, by writers, grainers, japanners, and gilders. The greater the proportion of carriage varnish, the slower it will dry. Some paper-stainers like it to dry quicker than others, and writers and grainers like it to dry quicker than gilders and japanners.

Gold Powder for Gilding.—Gold powder may be prepared in three ways;—1st. Put into an earthen mortar some gold leaf, with a little honey, or thick gum-water, and grind the mixture till the gold leaf is reduced to extremely minute particles. When this is done a little warm water will wash out the honey or gum, leaving the gold behind in a powdered state. 2nd. Dissolve the pure gold, or the leaf, in nitro-muriatic acid, and then precipitate it by a piece of copper, or by a solution of sulphate of iron. The precipitate, if by copper, must be digested in distilled vinegar, and then washed, by pouring water over it repeatedly, and dried. This precipitate will be in the form of very fine powder; it works better and is more easily burnished than gold leaf ground with honey as above. 3rd. And the best method of preparing gold powder is by beating a prepared amalgam of gold, in an open clean crucible, and continuing the strong heat, until the whole of the mercury is evaporated; at the same time constantly stirring the amalgam with a glass rod. When the mercury has completely left the gold, the remaining powder is to be ground in a Wedgwood's mortar, with a little water, and afterwards dried. It is then fit for use. Although the last mode of operating has been here given, the operator cannot be too much reminded of the danger attending the sublimation of mercury. In the small way here described, it is impossible to operate without danger; it is therefore better to prepare it according to the former directions than to risk the health by the latter.

To Cover Bars of Copper with Gold, so as to be rolled out into Sheets.—First prepare ingots or pieces of copper or brass, in convenient lengths and sizes. Then cleanse them from impurity, and make their surfaces level. Prepare plates of pure gold, or gold mixed with a portion of alloy, of the same size as the ingots of metal, and of suitable thickness. Having placed a piece of gold upon an ingot intended to be plated, hammer and compress them

both together, so that they may have their surfaces as nearly equal to each other as possible; then bind together with wire, in order to keep them in the same position during the process required to attach them. Afterwards mix silver filings with borax, to assist the fusion of the silver. Lay this mixture upon the edge of th plate, and next to the ingot of metal. Having prepared the two bodies, place them on a fire in a stove or furnace, where they must remain until the silver and borax placed along the edges of the metals melt, and until the adhesion of the gold with the metal is perfect. Remove the ingot carefully from the stove. By this process the ingot is plated with gold, and prepared ready for rolling into sheets.

To Gild in Colours.—The principal colours of gold for gilding are red, green, and yellow. These should be kept in different amalgams. The part which is to remain of the first colour, is to be stopped off with a composition of chalk and glue; the variety required is produced by gilding the unstopped parts with the proper amalgam, according to the usual mode of gilding. Sometimes the amalgam is applied to the surface to be gilt, without any quicking, by spreading it with aquafortis; but this depends on the same principle as a previous quicking.

Grecian Gilding.—Equal parts of sal-ammoniac and corrosive sublimate are dissolved in spirit of nitre, and a solution of gold made with this menstruum. The silver brushed over with it turns black, but on exposure to a red heat it assumes the colour of gold.

To Dissolve Gold in Aqua-Regia.—Take aqua-regia, composed of 2 parts of nitrous acid, and 1 of marine acid; or of 1 part of sal ammoniac, and 4 parts of aquafortis; let the gold be granulated, put into a sufficient quantity of this menstruum, and exposed to a moderate degree of heat. During the solution, an effervescence takes place, and it acquires a beautiful yellow colour which becomes more and more intense, till it has a dark golden or orange colour. When the menstruum is saturated, it is very clear and transparent.

To Gild Iron or Steel with a Solution of Gold.—Make a solution of 8 oz. of nitre and common salt, with 5 oz. of crude alum in a sufficient quantity of water; dissolve 1 oz. of gold thinly plated and cut; and afterwards evaporate to dryness. Digest the residuum in rectified spirit of wine or ether, which will perfectly abstract the gold. The iron is to be brushed over with this solution, and becomes immediately gilt.

To Gild by Gold dissolved in Aqua-Regia.—Fine linen rags are soaked in a saturated solution of gold in aqua-regia, gently dried, and afterwards burnt to tinder. The substance to be gilt must be well polished; a piece of cork is first dipped into a solution of common salt in water, and afterwards into the tinder, which is well rubbed on the surface of the metal to be gilt, and the gold appears in all its metallic lustre.

Amalgam of Gold in the Large Way.—A quantity of quicksilver is put into a crucible or iron ladle, which is lined with clay, and exposed to heat till it begins to smoke. The gold to be mixed should be previously granulated, and heated red hot, when it should be added to the quicksilver, and stirred about with an iron rod till it is perfectly dissolved. If there should be any superfluous mercury, it may be separated by passing it through clean soft leather; and the remaining amalgam will have the consistence of butter, and contain about 3 parts of mercury to 1 of gold.

To Gild by Amalgamation.—The metal to be gilt is previously well cleaned on its surface, by boiling in a weak pickle of very dilute nitrous acid. A quantity of aquafortis is poured into an earthen vessel, and quicksilver put therein; when a sufficient quantity of mercury is dissolved, the articles to be gilt are put into the solution, and stirred about with a brush till they become white. This is called quicking. But as during quicking by this mode a noxious vapour continually arises, which proves very

injurious to the health of the workmen, they have adopted another method, by which they, in a great measure, avoid that danger. They now dissolve the quicksilver in a bottle containing aquafortis, and leave it in the open air during the solution, so that the noxious vapour escapes into the air. Then a little of this solution is poured into a basin, and with a brush dipped therein they stroke over the surface of the metal to be gilt, which immediately becomes quicked. The amalgam is now applied by one of the following methods;—1st. By proportioning it to the number of articles to be gilt, and putting them into a vessel together, working them about with a soft brush, till the amalgam is uniformly spread. Or, 2ndly. By applying a portion of the amalgam upon one part, and spreading it on the surface, if flat, by working it about with a harder brush. The work thus managed is put into a pan, and exposed to a gentle degree of heat; when it becomes hot, it is frequently put into a pan, and worked about with a painter's large brush, to prevent an irregular dissipation of the mercury, till at last the quicksilver is entirely dissipated by the repetition of heat, and the gold is attached to the surface of the metal. This gilt surface is well cleaned by a wire brush, and then artists heighten the colour of the gold by the application of various compositions; this part of the process is called colouring.

To Gild Glass and Porcelain.—No. 1. —Drinking and other glasses are sometimes gilt on their edges. This is done either by an adhesive varnish or by heat. The varnish is prepared by dissolving in boiled linseed oil an equal weight either of copal or amber. This is diluted by a proper quantity of oil of turpentine, so as to be applied as thin as possible to the parts of the glass intended to be gilt. When this is done, which will be in about 24 hours, the glass is to be placed in a stove, till it is so warm as almost to burn the fingers when handled. At this temperature the varnish will become adhesive, and a piece of leaf gold, applied in the usual way, will immediately stick. Sweep off the superfluous portions of the leaf, and when quite cold it may be burnished, taking care to interpose a piece of very thin India paper between the gold and the burnisher. If the varnish is very good, this is the best method of gilding glass, as the gold is thus fixed on more evenly than in any other way. No. 2.—It often happens, when the varnish is but indifferent, that by repeated washing the gold wears off; on this account the practice of burning it in is sometimes had recourse to. For this purpose, some gold powder is ground with borax, and in this state applied to the clean surface of the glass by a camel-hair pencil; when quite dry, the glass is put into a stove heated to about the temperature of an annealing oven; the gum burns off, and the borax, by vitrifying, cements the gold with great firmness to the glass; after which it may be burnished. The gilding upon porcelain is in like manner fixed by heat and the use of borax.

Gilding on Glass.—The glass must be thoroughly cleaned and polished. A size must be prepared as follows;—Isinglass 1 oz., dissolve in just sufficient water to cover it; when dissolved, add a pint of rectified spirit of wine, then increase the quantity to a quart with water; keep tightly corked. Or, take best rum ½ pint, isinglass, ½ oz. Dissolve the isinglass in the rum at a low temperature, then add ½ pint of distilled water, and filter through a piece of old linen. Place the glass flat on a perfectly level table, then with a clean brush flood the glass with the size to the depth of $\frac{1}{8}$ of an inch, raise the gold leaf with a tip and lay it flat on the size; it will almost instantly adhere to the glass; in 5 minutes afterwards place the glass endways at a slight angle against a wall that the surplus size may drain off. Allow the glass to remain in that position for 24 hours, by that time it will be perfectly dry. Draw the pattern or letter on a piece of paper, and with a thick needle pierce holes on the lines at the distance of $\frac{1}{16}$ of an inch apart; place the pounced paper on the gold surface, then dust some powdered whiting well on the paper that it may

penetrate the holes; remove the paper carefully, and there will remain a correct copy of the design on the gold. Now fill up the outlines of the design with oil gold-size in which has been ground some orange chrome, thin it with a little boiled oil and turpentine. When thoroughly dry, wash off the surplus gold with water and a piece of cotton-wool. Back the glass with any suitable colour.

To Gild Leather.—In order to impress gilt figures, letters, and other marks upon leather, as on the covers of books and edgings for doors, the leather must first be dusted over with very finely-powdered dried white of eggs, yellow resin, or mastic gum, upon which lay a leaf of gold. The iron tools or stamps are now arranged on a rack before a clear fire, so as to be well heated, without becoming red hot. If the tools are *letters*, they have an alphabetical arrangement on the rack. Each letter or stamp must be tried as to its heat, by imprinting its mark on the raw side of a piece of waste leather. A little practice will enable one to judge of the heat. The tool is now to be pressed downwards on the gold leaf, which will, of course, be indented, and show the figure imprinted on it. The next letter or stamp is now to be taken and stamped in like manner, and so on with the others; taking care to keep the letters in an even line with each other, like those in a book. By this operation the resin is melted; consequently, the gold adheres to the leather; the superfluous gold may then be rubbed off by a cloth, the gilded impressions remaining on the leather. The cloth alluded to should be slightly greasy, to retain the gold wiped off; the cloth will thus be soon completely loaded with the gold. When this is the case, these cloths are generally sold to the refiners, who burn them and recover the gold.

To Gild, or Finish, Books.—The work, if leather, must be compassed off and marked with a folding stick wherever it is intended to run a straight line. This serves as a guide when the gold is laid on. For good work the pattern must be worked in blind, and, after being washed with a solution of oxalic acid or a thin paste-wash, carefully pencilled in with the glaire-pencil. For morocco bindings, the glaire is sometimes diluted with water. In preparing glaire from the egg for immediate use, a few drops of oxalic acid will be found of service. The gilding is commenced by oiling slightly, with a small piece of cotton, the whole of the work, and arranging the hand-stamps and rolls so as to be conveniently accessible. To lay on the gold, take a book of the metal, open the outside leaf, and pass a knife underneath the gold; with this raise it, carry it steadily on to the cushion, and spread it even, by a light breath on the middle of the leaf. Afterwards the gold must be cut with the gold knife to the breadth and length of the places to be covered, by laying the edge upon it and moving the knife slightly backwards and forwards. Then rub upon the work a little sweet oil, and apply the gold upon the places to be ornamented with a cotton or tip, rubbed on the forehead or hair to give it a slight humidity and cause the gold to adhere. The tools, which must be previously heated, are then applied. Calf will require them hotter than morocco and roan, and these warmer than russia and vellum. To ascertain their proper heat, they are applied on a damp sponge, or rubbed with the finger wetted. The gold which has not been impressed by the gilding tools must be well rubbed off with the gold rag, and cleared with a piece of fine flannel or india-rubber, so as to display the delicate lines of the ornaments as perfectly and clearly as possible. Attention should be paid to this particular; for let a book be finished in the most tasteful manner possible, unless well cleared off the effect is entirely lost. For gilding publishers' work, or where a quantity of gilding is desired at little expense, a stamping-press is brought into requisition, and by means of tools cut for the purpose, called blocks or stamps, the design is impressed on the side. The stamps are fixed to an iron plate, called a back or foundation-plate, upon which a piece of stout

paper has been glued. Let the paper be glued equally over the surface, and proceed to form the pattern by arranging the stamps upon the plate so as to exhibit the design; then take a little paste and touch the under side of each stamp, and place them in exact position. After this is done and the paste has become hard, lay the stamp or pattern thus formed upon the side of the volume, taking care to have the same margin on the front, back, and ends. Then place the board or side upon which the stamp is placed, upon the platen of the stamping press, leaving the volume hanging down in front of the platen, which is then moved to the centre of the upper platen, so that the clamps will touch the plate on both edges at the same moment; then pull the lever so as to put a slight pressure upon the plate in order to keep both it and the side in their proper place; adjust the guides to the fore-edge and head or left-hand side, and screw them fast; throw back the lever, take out the book; examine and correct any irregularity in the margin of the pattern by moving the guides. When perfectly square, place a soft pasteboard under the stamp, pull down the press, and apply heat. This will set the stamps or harden the paste and glue in a short time, so that they will not fall off in stamping. Work for stamping does not require so much body or preparation as work gilt by hand. Morocco can be worked by merely being washed with urine; but it is safer to use a coat of size, or glaire and water mixed in proportions of 1 of the former to 3 of the latter. Grained sheep, or, as it is called, imitation morocco, requires more body to gild well. The books are ready for laying on after an oiled rag has been lightly passed over the surface of the leather, to cause the gold to adhere until it is put under the press. The gold leaf is cut upon the cushion to the required size, or, if the volume is large and the stamps will cover its superficial extent, the leaf may be lifted from the gold book by means of a block covered with wadding or cotton lap, and laid immediately upon the side. Examine the press to see if sufficiently heated for the purpose. A little experience will soon determine the requisite amount of heat. Leather work does not require as hot a tool for stamping as for hand-work, while cloth or muslin-work requires a short, quick stroke, and the press to be hotter than for leather. The stamping press is heated by introducing steam or gas through tubes perforated for the purpose. After the press is properly heated, throw back the lever; take out the pasteboard from under the stamp; regulate the degree of pressure required for the stamp; then place the side to be stamped upon the bed-plate, holding it firmly against the guides with the left hand, while with the right the lever is quickly drawn to the front. This straightens the toggles, and causes a sharp impresssion of the stamp upon the leather; immediately throw back the lever; take out the side, and rub off with a rag the superfluous gold.

To Gild Writings and Drawings on Paper or Parchment.—Letters written on vellum or paper are gilded in three ways. In the first, a little size is mixed with the ink, and the letters are written as usual; when they are dry, a slight degree of stickiness is produced by breathing on them, upon which the gold leaf is immediately applied, and by a little pressure may be made to adhere with sufficient firmness. In the second method, some white-lead or chalk is ground up with strong size, and the letters are made with this by means of a brush; when the mixture is almost dry, the gold leaf may be laid on, and afterwards burnished. The last method is to mix up some gold powder with size, and to form the letters of this by means of a brush.

To Gild the Edges of Paper.—The edges of the leaves of books and letter-paper are gilded whilst in a horizontal position in the bookbinder's press, by first applying a composition formed of four parts of Armenian bole, and one of candied sugar, ground together with water to a proper consistence, and laid on by a brush with the white of an egg. This coating, when nearly dry, is

smoothed by the burnisher. It is then slightly moistened by a sponge dipped in clean water, and squeezed in the hand. The gold leaf is now taken up on a piece of cotton, from the leathern cushion, and applied on the moistened surface. When dry, it is to be burnished by rubbing the agate over it repeatedly fr m end to end, taking care not to wound the surface by the point of the burnisher. A piece of silk or India paper is usually interposed between the gold and the burnisher. Cotton-wool is generally used by bookbinders to take the leaf up from the cushion; being the best adapted for the purpose on account of its pliability, softness, and slight moistness. 2. Screw the book up as tightly as possible between boards placed even with the edges, scrape the edges perfectly smooth with a steel scraper, burnish with an agate, then colour over with red bole, or chalk ground in soap, rub immediately dry with fine clean paper shavings and burnish again. The size, prepared by well beating up the white of an egg, with three times the quantity of water, must then be applied evenly with a large camel-hair pencil, and the gold laid on with a tip. When dry burnish carefully, to avoid rubbing off the gold. If it is desired that the edges should show red under the gold, first colour the edges with vermilion mixed with glaire, and a little liquor ammoniæ; when dry, moisten with a little gold size, and while the edge is damp lay on the gold.

To Gild Copper by Amalgam.—Immerse a very clean bright piece of copper in a diluted solution of nitrate of mercury. By the affinity of copper for nitric acid, the mercury will be precipitated; now spread the amalgam of gold rather thinly over the coat of mercury just given to the copper. This coat unites with the amalgam, and will of course remain on the copper. Now place the piece operated on in a clear oven or furnace, where there is no smoke. If the heat is a little greater than 66 degrees, the mercury of the amalgam will be volatilized, and the copper will be beautifully gilt.

To Heighten the Colour of Yellow Gold.—Six oz. saltpetre, 2 oz. copperas, 1 oz. white vitriol, and 1 oz. alum. If it be wanted redder, a small portion of blue vitriol must be added. These are to be well mixed, and dissolved in water as the colour is wanted.

To Heighten the Colour of Green Gold.—One oz. 10 dwts. saltpetre; 1 oz. 4 dwts. sal ammoniac; 1 oz. 4 dwts. Roman vitriol; and 18 dwts. verdigris. Mix them well together, and dissolve a portion in water as occasion requires. The work must be dipped in these compositions, applied to a proper heat to burn them off, and then quenched in water or vinegar.

To Heighten the Colour of Red Gold.—To 4 oz. melted yellow wax, add 1½ oz. red ochre in fine powder; 1½ oz. verdigris, calcined till it yields no fumes; and ½ oz. calcined borax. It is necessary to calcine the verdigris, or else, by the heat applied in burning the wax, the vinegar becomes so concentrated as to corrode the surface, and make it appear speckled.

To Separate Gold from Gilt Copper and Silver.—Apply a solution of borax, in water, to the gilt surface, with a fine brush, and sprinkle over it some fine powdered sulphur. Make the piece red hot, and quench it in water. The gold may be easily wiped off with a scratch-brush, and recovered by testing it with lead. Gold is taken from the surface of silver by spreading over it a paste, made of powdered sal ammoniac, with aqua-fortis, and heating it till the matter smokes, and is nearly dry, when the gold may be separated by rubbing it with a scratch-brush.

Gilding on Steel.—Dissolve any quantity of gold or platina in nitro-muriatic acid, until no effervescence is occasioned by the application of heat. Evaporate the solution of gold or platina thus formed to dryness in a gentle heat; and redissolve the dry mass in as little water as possible; next take an instrument which is used by chemists for dropping liquids, known by the name of a separating funnel, having a pear-shaped body, tapering to a fine point, and a neck capable of being stopped with the finger or a cork; fill it with the liquid

about one quarter part; and the other three parts must be filled with the very best sulphuric ether. If this is rightly managed, the two liquids will not mix. Then place the tube in a horizontal position, and gently turn it round with the finger and thumb. The ether will very soon be impregnated with the platina or gold, which may be known by its change of colour. Replace it in a perpendicular position, and let it rest for 24 hours; having first stopped the upper orifice with a small cork. The liquid will then be divided into two parts; the darkest coloured being underneath. To separate them, take out the cork, and let the dark liquid flow out; when it has disappeared, stop the tube immediately with the cork; and what remains in the tube is the gilding liquid. Let it be put into a bottle, and tightly corked. When an article is to be gilded, a vessel of glass or unglazed ware must be provided, of just sufficient size to admit the article; it must then be filled with the gilding liquid, nearly to the top. The steel must be very highly polished, and entirely free from rust or grease. A basin, full of clean water, must be ready at hand; the article must be immersed into the gilding liquid, and quickly removed; then quickly plunged into the water, and well rinsed; it must next be dried with blotting paper, and be placed in a temperature of 150° Fahr. till it be completely heated throughout; it may then be polished with rouge and a soft leather, or be burnished. Pure gold must be employed. The ethereal solution may also be concentrated by gentle evaporation. Care must be taken not to wipe the steel until the heat has been applied. This gilding is an effectual protection against rust, and is very ornamental.

Gold Leaf for Illumination.—For illumination on a large scale ordinary gilders' size can be used on stout paper. For fine work or water-matt, gold size is useful, but not easy to bring to a smooth surface. Clear gum arabic, used as thickly as is convenient for the paint-brush, makes a good ground for the gold leaf. The ordinary gilding size must be left till it is tacky, that is, all but dry. Having seen that the size is properly tacky, or having breathed on the water size or gum, lay the gold leaf on the work, pressing a piece of slightly-greased paper gently on with the fingers. In a few minutes take up the paper rather briskly from the work, and it should bring away all superfluous gold.

Gold Paper-hangings.—The part which is to show the gilt, is first printed in common size mixed with a little water; when dry, rolled up and reprinted in gold size, and as it is being printed the piece is drawn out from the table into a trough, technically called a drum, and then the metal, which is Chinese bronze, is slightly laid over the surface, and the drum tapped underneath with a common cane, which causes the metal to adhere to the gold size; it is then carefully drawn out of the drum and hung up till dry, then rolled up; to improve the appearance, the hangings are passed between two embossing rollers, which give the finishing touch.

Silvering Looking-glasses.—The metal used is quicksilver. The substance employed to make the mercury or quicksilver adhere to the surface of the glass is tin-foil, as thin as paper, and which has a strong attraction for mercury. A drop of mercury combines with the tin-foil, and they become one substance, which adheres pretty firmly to glass. The glass to be silvered is made perfectly clean on both sides, particularly on that which is to be silvered. If the slightest speck of dirt be allowed to remain on the surface, it will appear very conspicuous when the glass is silvered. The tin-foil is generally made in sheets about 6 ft. long and of various widths, varying from 10 in. up to 40, the diversity of widths being to enable the silverer to cut out small pieces suitable to various-sized glasses. For larger sizes, the foil is generally made to order, and of a greater thickness than for smaller glasses. A sheet of tin-foil being unrolled, is laid down flat, and cut to the same shape as the glass, but an inch larger each way. It is then laid down as smoothly as possible on the silvering stone, which is a

very large and carefully-prepared slab of slate, porphyry, or marble, perfectly flat and smooth. The foil is worked out level and smooth on the silvering stone by means of a smooth wooden roller, which is worked over it in every direction. The silverer pours some mercury into a wooden bowl, and then, by means of an iron ladle, pours the mercury over the whole surface of the foil till every part is covered. The glass plate is then laid upon the liquid mercury; but it is not laid at once flat down on it, being made to slide on the edge of the glass first coming in contact with the mercury. As it is slid along, it pushes before it the greater part of the mercury, because the edge of the glass almost scrapes along the foil as it passes, that all air-bubbles and impurities may be pushed off, allowing only a thin film of very pure mercury to remain between the glass and the foil. In this much care and delicacy are required. It is a matter of some difficulty to clean the glass so perfectly as not to show any marks or streaks after it is silvered. It is often necessary to remove it from the foil two or three times after it has been laid down, to wipe off specks of dirt which are visible when the glass is silvered, however difficult of detection they may previously be; this is especially the case in damp weather. This renders it necessary that the foils for large glass, which necessarily require a longer time than small ones to perform the different processes, should be thicker than those for smaller; for such is the attraction between the mercury and the foil, that if a glass, after having been removed for further cleaning, is not speedily replaced on the mercury, the latter will combine with the foil, and give it a rottenness which will prevent its adhesion to the glass; the thicker the foil, the less this is likely to occur. When the glass is properly placed on the tin-foil, and it is ascertained that all specks and air-bubbles are removed, it is covered almost in every part by heavy iron or leaden weights; so that a large glass will have several hundredweight pressing upon it. This pressure is to force out from between the glass and the foil as much mercury as possible, so that the thinnest film only shall remain between them. To effect this more completely, the silvering stone is made to rest on a swivel underneath, by which it can be made either perfectly horizontal, or thrown into an inclined position. While the glass is being laid on the foil, the silvering stone is horizontal, to prevent the mercury from flowing off; but when the superfluous mercury is to be drained off, the stone is made to assume an inclined position, so as to ensure one general direction for the flow of the mercury. A hollow groove runs round the sides of the stone, into which the mercury flows as it is forced out from between the glass and the foil. A pipe, descending from one corner of this trough, conveys the mercury into a bottle placed beneath to receive it. Although an immense weight of mercury must be poured on the foil for the silvering of a large glass, yet the quantity which actually remains between the glass and the foil is extremely small. The glass, with the weights upon it, is allowed to remain in the inclined position for several hours, or, if the glass is large, it is allowed to remain until the next day, in order that as much as possible of the mercury may be pressed out before the weights are removed. On the removal of the weights, one end of the glass is tilted up and supported by blocks, the other end still remaining on the stone. A piece of foil is then laid on the lowest corner, to draw off the mercury which collects in a little pool at the bottom of the glass. In this state the glass remains from a few hours to 3 or 4 days, according to its size. When as much of the mercury as possible has drained from the glass in this way, the glass is taken up, when it is found that the two metals have combined together, and in the combined state adhere to the glass, which neither the one nor the other would have done separately. The removal of the glass from the stone is effected in different ways, according to its size. If it is not too wide for the arm-

span of the silverer, he takes it by the two edges, lifts it from the stone, and places it edgeways on a shelf or on the floor of the silvering room, resting its upper edge against the wall, and allowing one corner to be lower than the rest, so as to facilitate the draining towards that corner. If the glass is long and narrow, two men take it up instead of one, but in the same manner. If, however, the glass is very large, the following mode is sometimes adopted. The draining room is situated beneath the silvering room, and an opening in the floor of the latter is so arranged that a portion of the silvering table can be let down through it, on account of its facility of motion round the swivel. By a gradual turning of the silvering table, the stone and the glass upon it can be brought into a nearly perpendicular position. In this position of the glass, several men in the lower room grasp it by the edges, and place it against the wall of the room, where it is left to drain. When the plate is thus placed against the wall of the room, it is left to drain for a time, varying from one day to several days, according to its size, in order that any remaining superfluous mercury may leave it, and that the foil may become still better attached to the surface of the glass. When the draining appears to be complete, the glass is ready to be applied to its intended purpose. The above is the process for silvering plate glass. But there is an important reason why common glass, used for cheaper purposes, such as the inferior sort of dressing-glasses, cannot be silvered in this way; for any heavy pressure on such glass breaks it at once, on account of its thinness and crookedness. These common glasses, which are always small in size, are not silvered on a stone, but on a board or flat box. The foil is cut to the requisite size, and laid on the board and covered with mercury, as in the former instance. But instead of sliding the glass on to the mercury, a piece of clean paper is laid on the mercury, and the glass is laid on the paper. The silverer now, laying one hand pretty firmly on the glass, takes hold of the edge of the paper with the other, and by a quick motion, draws out the paper from between the glass and the foil, and with it the greater part of the mercury, together with air-bubbles and impurities,—leaving the glass resting on a thin but brilliant film of mercury; this is a process requiring much manual dexterity. The common glass employed for these purposes is always irregularly bent at its surfaces; it is a general rule to silver the concave side, when one side is more concave than the other. The crown glass now made is better than that which was produced a few years ago, and although it is always curved, yet the curvature is pretty nearly the same in different tables from the same crate. This circumstance assists the silverer, for each silvered glass acts as a weight to another of the same size. It is usual to silver a great number of the same size at the same time; and as each one is silvered, it is placed flat down on a shelf, or in a shallow box; and on it the others are successively laid as they are silvered. The concave side of each is silvered, and as the concavity is nearly equal in all, each one helps to press out the superfluous mercury from the one beneath it. The silvering in common glasses is seldom found to be so perfect as on plate glass, from the impossibility of giving equal pressure in every part.

Silvering Cheap Looking-glasses.—Place a sheet of glass, previously washed clean with water, on a table, and rub the whole surface with a rubber of cotton, wetted with distilled water, and afterwards with a solution of Rochelle salts in distilled water, 1 of salt to 200 of water. Then take a solution, previously prepared by adding nitrate of silver to ammonia of commerce; the silver being gradually added until a brown precipitate commences to be produced; the solution is then filtered. For each square yard of glass take as much of the above solution as contains 20 grammes, about 309 grains, of silver, and to this add as much of a solution of Rochelle salt as contains 14 grammes of salt, and the strength of the latter solution should be so adjusted to that of the silver solution

that the total weight of the mixture above mentioned may be 60 grammes. In a minute or two after the mixture is made it becomes turbid, and it is then immediately to be poured over the surface of the glass, which has previously been placed on a perfe tly horizontal table, but the plate is bloc. ed up at one end, to give it an inclination about 1 in 40; the liquid is then poured on in such a manner as to distribute it over the whole surface without allowing it to escape at the edges. When this is effected, the plate is placed in a horizontal position at a temperature of about 68° Fahr. The silver will begin to appear in about 2 minutes, and in about 20 or 30 minutes sufficient silver will be deposited. The mixture is then poured off the plate, and the silver it contains afterwards recovered. The surface is then washed four or five times, and the plate set up to dry. When dry, the plate is varnished, by pouring over it a varnish composed of gum dammar, 20 parts; asphalt or bitumen, 5; gutta-percha, 5; and benzine, 75. This varnish will set hard on the glass, and the plate is then ready for use.

Partially Resilvering Pier Glass. — Remove the silvering from the injured part, clean the glass, form a wall of beeswax round the spot, pour on it some nitrate of silver, and precipitate the silver by sugar, or oil of cloves and spirits of wine. This does not leave a white mark round the prepared place.

Silvering Curved Glass. — This is a French process, used not only for flat surfaces, but also for those which are curved, or cut into patterns. Dissolve 600 grains of neutral nitrate of silver in 1200 grains of distilled water, add 75 drops of a solution composed of 25 parts of distilled water, 10 of sesquicarbonate of ammonia, and 10 of ammonia, sp. gr., 980; add also 30 grains of ammonia, same sp. gr., and 1800 grains of alcohol sp. gr. ·85. When clear, the liquor is decanted or filtered, and mixture of equal parts of alcohol and oil of cassia added to the silver solution in the proportion of 1 of the essence of cassia to 15 of the silver solution; the mixture is agitated and left to settle, then filtered. Before pouring upon the glass surface or into the glass vessel to be silvered, the solution is mixed with 1-78th its bulk of essence of cloves, 1 part oil of cloves, 3 parts alcohol. The glass is thoroughly cleaned, and the silver solution applied and warmed to 100° Fahr. for about 3 hours; the liquid is poured off, and the silver deposit washed, dried, and varnished.

Silvering Glass, Drayton's Process.— A mixture is made of 1 oz. of coarsely pulverized nitrate of silver, ½ oz. spirits of hartshorn, and 2 oz. of water; which, after standing for 24 hours, is filtered, the deposit upon the filter, which is silver, being preserved, and an addition is made thereto of 3 oz. of spirits of wine, at 60° above proof, or naphtha; from 20 to 30 drops of oil of cassia are then added; and, after remaining for about 6 hours longer, the solution is ready for use. The glass to be silvered with this solution must have a clean and polished surface; it is to be placed in a horizontal position, and a wall of putty or other suitable material formed around it, so that the solution may cover the surface of the glass to the depth of from ⅛ to ¼ of an inch. After the solution has been poured on the glass, from 6 to 12 drops of a mixture of oil of cloves and spirits of wine, in the proportion of 1 part, by measure, of oil of cloves to 3 of spirits of wine, are dropped into it at different places; or the diluted oil of cloves may be mixed with the solution before it is poured upon the glass; the more oil of cloves used, the more rapid will be the deposition of the silver; but the operation should occupy about 2 hours. When the required deposit has been obtained, the solution is poured off; and as soon as the silver on the glass is perfectly dry, it is varnished with a composition formed by melting together equal quantities of beeswax and tallow. The solution, after being poured off, is allowed to stand for 3 or 4 days, in a close vessel, as it still contains silver, and may be again employed after filtration, and the addition of a sufficient quantity of fresh ingredients to supply the place of those which have been used. About 18

grains of nitrate of silver are used for each square foot of glass; but the quantity of spirit varies somewhat, as its evaporation depends upon the temperature of the atmosphere, and the duration of the process. By the addition of a small quantity of oil of carraway or thyme, the colour of the silver may be varied. The oil of cassia purchased of different manufacturers varies in quality; therefore on being mixed with the solution it must be filtered previous to use.

Silvering Large Mirrors for Photography.—Dissolve 150 grains of nitrate of silver in 6 oz. of distilled water, and to this add ammonia, drop by drop, until the precipitate at first thrown down is redissolved. Now, having made a solution of caustic potash, in the proportion of 2½ oz. of the potash to 50 oz. of water, add 15 oz. of this to the above solution of silver; and add ammonia as before, until the deep-brown precipitate again thrown down is redissolved. Now add 29 oz. of distilled water, after which allow some solution of nitrate of silver to be dropped in, gently stirring all the while with a glass rod, until a precipitate begins to be formed. Previous to the immersion of the glass to be silvered, dissolve 1 oz. of sugar of milk in 10 oz. of water. This must be filtered and kept in a separate bottle. Have ready a clean glass vessel of a size sufficient to contain the glass plate to be silvered; when everything is ready, mix together the silver solution with that of the sugar of milk, in the proportion of 10 of the former to 1 of the latter. Lower the glass down in the solution until it is a little distance from the bottom, and allow it to remain there for a period of time, varying from 15 minutes to 4 hours, according to the thickness of the coating of silver desired. After removing it from the bath, wash with distilled water, and, when dry, polish by means of a soft pad of cotton-velvet charged with rouge. An intensely brilliant surface may be thus obtained on both sides of the glass plate. Make a 3-grain solution of ammonio-nitrate of silver. Render it slightly turbid by excess of nitrate of silver, and then filter it. Just before using it add to each ounce of the foregoing solution 2½ grains of Rochelle salt, immerse the glass as before, and expose to a subdued light while it remains in the bath. In about 2 hours the deposit of silver will be sufficiently thick.

SILVERING MIRRORS.—Ten grains of pure nitrate of silver to 1 oz. of distilled water; add carefully, drop by drop, strong ammonia, until the brown precipitate is redissolved. When adding the ammonia keep stirring with a glass rod. In another bottle make a solution of 10 grains of pure crystallized Rochelle salt to 1 oz. of distilled water; then, when you have all ready, pour on sufficient to cover all the glass, using two-thirds of the silver solution, and one-third of the Rochelle salt. The mirror can be prepared well by cleaning it with a little wet rouge, and polished dry with a wash-leather; then warm the glass before the fire, or by letting it lie in the sun, to about 70 or 80°. Pour on the solution as described above, and let it stand in the warm sunshine half an hour or an hour. When silvered, pour on it some clean soft or distilled water, and while still wet wipe it very gently all over with a little soft wadding, wet; this will take off all the roughness, so that it will take but little rubbing with the rouge leather to polish it. When perfectly dry it is easily rubbed up to any exquisite polish.

TO SILVER GLASS SPECULA.—Prepare three standard solutions. Solution A—Crystals of nitrate of silver, 90 grains; distilled water, 4 oz.; dissolve. Solution B—Potassa, pure by alcohol, 1 oz.; distilled water, 25 oz.; dissolve. Solution C—Milk-sugar, in powder, ½ oz.; distilled water, 5 oz. Solutions A and B will keep in stoppered bottles for any length of time; solution C must be fresh.

The Silvering Fluid.—To prepare sufficient for silvering an 8-in. speculum, pour 2 oz. of solution A into a glass vessel capable of holding 35 oz. Add, drop by drop, stirring all the time with a glass rod, as much liquid ammonia as is just necessary to obtain a clear solution of the grey precipitate first thrown down. Add

4 oz. of solution B. The brown-black precipitate formed must be just redissolved by the addition of more ammonia, as before. Add distilled water, until the bulk reaches 15 oz., and add, drop by drop, some of solution A, until a grey precipitate, which does not redissolve after stirring for three minutes, is obtained; then add 15 oz. more of distilled water. Set this solution aside to settle. Do not filter. When all is ready for immersing the mirror, add to the silvering solution 2 oz. of solution C, and stir gently and thoroughly. Solution C may be filtered.

To Prepare the Speculum.—Procure a circular block of wood, 2 inches thick, and 2 inches less in diameter than the speculum. Into this should be screwed three eye-pins, at equal distances. To these pins fasten stout whipcord, making a secure loop at the top. Melt some pitch in any convenient vessel, and, having placed the wooden block, face upwards, on a level table, pour on it the fluid pitch, and on the pitch place the back of the speculum, having previously moistened it with a little spirits of turpentine, to secure adhesion. Let the whole rest until the pitch is cold.

To Clean the Speculum.—Place the speculum, cemented to the circular block, face upwards, on a level table; pour on it a small quantity of strong nitric acid, and rub it gently all over the surface with a brush made by plugging a glass tube with pure cotton-wool. Having perfectly cleaned the surface and sides, wash well with common water, and finally with distilled water. Place the speculum, face downwards, in a dish containing a little rectified spirits of wine, until the silvering fluid is ready.

SILVERING GLASS GLOBES.—1. Take ½ oz. of clean lead, and melt it with an equal weight of pure tin; then immediately add ½ oz. of bismuth, and carefully skim off the dross; remove the alloy from the fire, and before it grows cold add 5 oz. of mercury, and stir the whole well together; then put the fluid amalgam into a clean glass, and it is fit for use. When this amalgam is used for silvering, let it be first strained through a linen rag; then gently pour some ounces thereof into the globe intended to be silvered: the alloy should be poured into the globe by means of a paper or glass funnel reaching almost to the bottom of the globe, to prevent its splashing the sides; the globe should be turned every way very slowly, to fasten the silvering. 2. Make an alloy of 3 oz. of lead, 2 oz. of tin, and 5 oz. of bismuth; put a portion of this alloy into the globe, and expose it to a gentle heat until the compound is melted; it melts at 197° Fahr.; then by turning the globe slowly round an equal coating may be laid on, which, when cold, hardens and firmly adheres. This is one of the cheapest and most durable methods of silvering glass globes internally. 3. Nitrate of silver, 1 oz.; distilled water, 1 pint; strong liquor ammonia, sufficient quantity, added very gradually, to first precipitate and then redissolve the silver; then add honey, ½ oz. Put sufficient quantity of this solution in the globe, and then place the globe in a saucepan of water; boil it for 10 to 30 minutes, occasionally removing it to see the effect.

SILVERING BRASS.—1. Take ½ lb. of cyanide of potassium and ½ oz. of nitrate of silver; dissolve all the cyanide in 16 oz. of distilled or boiled water, and the silver in a similar quantity in another vessel. Into the vessel containing the silver throw a spoonful of common salt; stir this up well with a clean piece of wood and let it settle; dissolve some salt in water, and after the silver solution is settled mix a few drops of the salt water in it. If there is any cloudiness formed it proves that all the silver is not thrown down, and more salt must be added, and then stir and allow to settle. If the addition of salt water has no effect, the water may be decanted off, carefully preserving the white deposit. Now pour some boiling water on this deposit; let it settle, and pour off as before. Do this at least three times; pour off as dry as possible, and add about a pint of clean water, and then, by ½ oz. at a time, the cyanide solution, till all the white precipitate is dissolved; add enough water to make half a gallon. Stir well after each

addition of cyanide solution. If on dipping the article, which must be well cleaned with brick-dust and water, into this solution the silver deposits on immediately and in a dark powder, it must be weakened by adding more water; if it coats slowly, more white precipitate must be prepared, washed, and added to it. This must also be done when the solution is getting short of silver. It works best at about 60 or 70 degrees of heat; a dry, warm room suits the operation. Brass and copper only can be silvered; other metals require a battery. This method gives a beautiful result when the work is polished and burnished. 2. Clean the articles thoroughly, and then immerse them for a few seconds in a solution of cyanide of silver, which will plate them without any further trouble.

SILVERING FOR BAROMETER AND THERMOMETER SCALES.—Take ½ oz. of nitrate of silver; dissolve in half a teacupful of cold water; add ½ lb. of cream of tartar, with 1½ lb. of common salt, beaten or ground fine. Mix and stir well together, adding water until it attains the consistence of a thick paste. Now lay the scale on a board, the brass or copper being previously well cleaned and cast off from fine sand-paper; rub the silvering on with your hand until it attains the appearance of silver, which will be a minute or so; now take the work off the board and rub a little wet whiting over it, wash out in clean cold water, and dry in saw-dust. If varnished with a thin coat of white hard varnish, reduced in spirits of wine, this will last for years. The above quantity of silvering used with care will silver six dozen brewers' thermometers, 14 in. long.

Oxidizing Silver Articles. — Oxidize silver-plated articles by dissolving sulphate of copper, 2 dwts.; nitrate of potash, 1 dwt.; and muriate of ammonia, 2 dwts.; in a little acetic acid. Apply with a camel-hair pencil; but warm the article first, and expose the article to the fumes of sulphur in a closed box; the parts not to be coloured must be coated with wax.

Silvering Powder.—Take 40 grains of silver dust; cream of tartar, 3 drams; common salt, 2; and 40 grains of powder of alum. Polish any silver articles with this powder and a soft leather.

Silvering Powder for Coating Copper.—Nitrate of silver, 30 grains; common salt, 30; cream of tartar, 3½ drams. Mix, moisten with water, and apply.

Silvering by Heat.—Dissolve 1 oz. of silver in nitric acid; add a small quantity of salt; then wash it and add sal ammoniac, or 6 oz. of salt and white vitriol; also ½ of an ounce of corrosive sublimate; rub them together till they form a paste. Rub the piece which is to be silvered with the paste, heat it till the silver runs, after which dip it in a weak vitriol pickle to clean it.

Mixture for Silvering.—Dissolve 2 oz. of silver with 3 grains of corrosive sublimate; add tartaric acid, 4 lb.; salt, 8 quarts.

Platenizing Silver.—Place some platinum in a small quantity of aqua-regia or nitro-muriatic acid, and keep it in a warm place a few days, it will dissolve. As soon as it has dissolved, evaporate the liquid at a gentle heat until it is as thick as honey, so as to get rid of the excess of the nitric and muriatic acids. Add a little water, and it is ready for use. A dozen drops of this solution goes a long way in platenizing silver. The operation is performed in a small glass or beaker, covered with a watch-glass to keep in the fumes, and placed in a little sand in a saucer, to equalize the heat.

Varnished Silver Leaf.—Use first, prepared ox-gall; next, isinglass; then, alum, to kill the former; finish with hard white lac.

Nitrate of Silver.—1. Add silver to nitric acid, previously diluted with twice its weight of water, in a flask, and apply a gentle heat until the metal is dissolved the clear liquor is then separated from any black powder which may be present, evaporated, and crystallized. The crystals are dried by exposure to the air, taking care that they do not come in contact with any organic substance. 2. Dissolve the silver in pure nitric acid and evaporate. The nitrate is yielded in square anhydrous tables. Dissolve

this in distilled water, filter, and evaporate again, and the nitrate is obtained pure.

To Separate Silver from Copper.—Mix sulphuric acid, 1 part; nitric acid, 1; water, 1; boil the metal in the mixture till it is dissolved, and throw in a little salt to cause the silver to subside.

Silvering Cast Iron.—Fifteen grammes of nitrate of silver are dissolved in 250 grammes of water, and 30 grammes of cyanide of potassium are added; when the solution is complete, the liquid is poured into 750 grammes of water, in which 15 grammes of common salt have been previously dissolved. The cast iron intended to be silvered by this solution should, after having been well cleaned, be placed for a few minutes in a bath of nitric acid of 1·2 sp. gr., just previous to being placed in the silvering fluid.

To Brighten Tarnished Jewellery.—First wash the articles in this cleansing solution;—Liquor potassæ, 1 fluid oz.; water, 20 fluid oz.; mix. Rinse them in cold or warm water, and then immerse them in the following gilders' pickle;—Common salt, 1 part; alum, 1; saltpetre, 2; water, 3 or 4; mix. Let them remain, stirring them now and then, until the surfaces assume a bright golden appearance. Five minutes at most will suffice, less time is generally required. Wash them again in cold or warm water, and dry them with chamois leather or in hot boxwood saw-dust.

Plating.—1. Nitrate of silver, 1 part; common salt, 1; cream of tartar, 7; powder and mix. 2. Nitrate of silver, 1 part; cyanide of potassium, 3. Both are applied by wetting with a little water and rubbing on the article to be plated, which must be quite clean. Plating done by the above will be very thin, but it will be silver. 3. Get a glazed earthen vessel, put in 1 oz. of nitric acid, place it on a slow fire, it will boil instantly, and then throw in some pieces of real silver; this will be dissolved at once. As soon as dissolved throw in a good handful of common salt to kill the acid, then make into a paste with common whiting. The article required to be silvered to be cleaned from grease and dirt, and the paste to be applied with a little water and wash-leather. This will keep for years.

Frosted Silver.—Dip the article in a solution of nitric acid and water, half and half, for a few minutes, then wash well in clean water and dry in hot saw-dust. When thoroughly dry brush the saw-dust away with a soft brush, and burnish the parts required to be bright.

Silvering Clock Dials.—Rub the dial with a mixture of muriate of silver, tartar, and sea-salt, and afterwards rub off the saline matter with water. This silvering is not durable, but it may be improved by heating the article, and repeating the operation, once, or oftener if thought necessary.

Desilvering.—The following is a liquid which will dissolve silver without attacking copper, brass, or German silver, so as to remove the silver from silvered objects, plated ware, &c. It is a mixture of 1 part of nitric acid with 6 parts sulphuric, heated in a water-bath to 160° Fahr., at which temperature it operates best.

Scouring Articles of Dress.

Among the spots which alter the colour fixed upon stuffs, some are caused by a substance which may be described as simple, and others by a substance which results from the combination of two or more bodies, that may act separately or together upon the stuff, and which may therefore be called compound.

Simple Stains.—Oils and fats are the substances which form the greater part of simple stains. They give a deep shade to the ground of the cloth; they continue to spread for several days; they attract the dust, and retain it so strongly that it is not removable by the brush; and they eventually render the stain lighter coloured upon a dark ground, and of a disagreeable grey tint upon a pale or light ground. The general principle of cleaning all spots consists in applying to them a substance with a stronger affinity for the matter composing them than this has for the cloth, and which shall render them soluble in some liquid menstruum, such as water,

spirits, naphtha, or oil of turpentine. Alkalies are the most powerful solvents of grease; but they act too strongly upon silk and wool, as well as change too powerfully the colours of dyed stuffs, to be safely applicable in removing stains. The best substances for this purpose are;—1. Soap. 2. Chalk, fullers' earth, soap-stone, or French chalk. These should be mixed with a little water into a thin paste, spread upon the stain, and allowed to dry. The spot requires now to be merely brushed. 3. Ox-gall and yolk of egg have the property of dissolving fatty bodies without perceptibly affecting the texture or colours of cloth, and may therefore be employed with advantage. The ox-gall should be purified, to prevent its greenish tint from degrading the brilliancy of dyed stuffs, or the purity of whites. Thus prepared it is the most precious of all substances known for removing these kinds of stains. 4. The volatile oil of turpentine will take out only recent stains; for which purpose it ought to be previously purified by distillation over quicklime. Wax, resin, turpentine, pitch, and all resinous bodies in general, form stains of greater or less adhesion, which may be dissolved out by pure alcohol. The juices of fruits, and the coloured juices of all vegetables in general, deposit upon clothes marks in their peculiar hues. Stains of wine, mulberries, black currants, morellos, liquors, and weld, yield only to soaping with the hand, followed by fumigation with sulphurous acid; but the latter process is inadmissible with certain coloured stuffs. Ironmould or rust stains may be taken out almost instantaneously with a strong solution of oxalic acid. If the stain is recent, cream of tartar will remove it.

Compound Spots.—A mixture of rust of iron and grease is an example of this kind, and requires two distinct operations; first, the removal of the grease, and then of the rust, by the means above indicated. Mud, especially that of cities, is a compound of vegetable remains, and of iron in a state of black oxide. Washing with pure water, followed, if necessary, with soaping, will take away the vegetable juices; and then the iron may be removed with cream of tartar, which itself must, however, be well washed out. Ink stains, when recent, may be taken out by washing, first with pure water, next with soapy water, and lastly with lemon juice; but if old, they must be treated with oxalic acid. Stains occasioned by smoke, or by sauces browned in a frying-pan, may be supposed to consist of a mixture of pitch, black oxide of iron, empyreumatic oil, and some saline matters dissolved in pyroligneous acid. In this case several reagents must be employed to remove the stains. Water and soap perfectly well dissolve the vegetable matters, the salts, the pyroligneous acid, and even the empyreumatic oils in a great measure; the essence of turpentine will remove the rest of the oils and all the pitchy matter; then oxalic acid may be used to discharge the iron. Coffee stains require a washing with water, with a careful soaping, at the temperature of 120° Fahr., followed by sulphuration. The two latter processes may be repeated twice or thrice. Chocolate stains may be removed by the same means, and more easily. Stains which change the colour of the stuff, must be corrected by appropriate chemical reagents or dyes. When black or brown cloth is reddened by an acid, the stain is best counteracted by the application of water of ammonia. If delicate colours are injured by soapy or alkaline matters, the stains must be treated with colourless vinegar of moderate force. An earthy compound for removing grease spots is made as follows:—Take fullers' earth, freed from all gritty matter by settling in water; mix with ½ a pound of the earth so prepared, ¼ a pound of soda, as much soap, and 8 yolks of eggs well beaten up with ½ a pound of purified ox-gall. The whole must be carefully triturated upon a porphyry slab; the soda with the soap in the same manner as colours are ground, mixing in gradually the eggs and the ox-gall previously beat together. Incorporate next the soft earth by slow degrees, till a uniform thick paste is formed, which should be made into balls or cakes of a