the easiest to use because, should any error be made in the work, they may easily be washed off, or wiped off with a damp sponge, whereas black varnish is difficult to remove even with turpentine; the varnish, however, is the more durable, and will stand any amount of wear and tear.

All the fine work, if desired, may be done on the film side with a pen and Indian ink, or with a brush charged with opaque or red water-colour, and the bulk of the stopping out on the glass side with black varnish or Brunswick black, taking care that the working on one side overlaps the other.

Another method is to take a rough print from the unblocked negative, cut out the part required, and use the cut print as a mask, which may be pasted on the glass side of the negative. This serves as opaque, and but little fine work may be required on the film side, care, however, being taken to let the working on the film side overlap the paper mask. The latter may, if desired, be wetted and placed on the film side, but it is removed more easily from the glass side of the negative. (*See also* "Camphor.")

Any of the above methods may also be employed for transparency work, but in the case of lantern slides it will be necessary to use a stopping-out mixture which will not crack when subjected to the heat of the lantern illuminant concentrated by the condenser.

The present-day commercial practice is for the photographer to make as good a photograph of the subject as he can, supply a good print, and leave the blocking out to the process worker's artist, the work being done on the print and not on the negative. The photographer can often assist matters by seeing that the background is of such a nature that the work of blocking out is facilitated, as the merging of the picture of a machine, for instance, into the background makes it difficult to see where one ends and the other begins. Frequently it is sufficient to run a line of white pigment between the subject and the background, and the process worker then understands that the latter is not to be included. The aerograph is largely used for blocking out on prints, etc.

BLOOD ALBUMEN (*See* "Albumen.")

BLOTTING-PAPER

Used for blotting off water from negatives, and for drying those papers not having a gelatine or sticky surface. Inked and coloured blotting-paper is not suitable. The paper should be as fluffless as possible; special blotting-papers for photographic purposes are obtainable. Ordinary blotting-paper may be freed from all impurities likely to damage prints by pouring boiling water and a hot weak solution of sodium carbonate over it alternatively two or three times, ending with the boiling water. This treatment removes the acids and sulphites, which might otherwise affect the permanency of the silver prints.

BLOW-THROUGH JET (*See* "Limelight.")

BLUE GLASS, PHOTOGRAPHIC USES OF

Blue glass of good quality has several uses in photography. By looking through a piece of it at the view to be taken, or by fixing a sheet of it over the focusing screen, the photographer is enabled to see the subject with its colour contrasts toned down, and will be the better able to judge what the effect will be in a photographic monochrome print. Some years ago blue glass was advocated for glazing studios, but exposures under blue glass need to be longer than under white glass, and the only gain to the photographer is that he is working in a light that is less trying to his eyes. Blue glass is of service if placed over a harsh negative when printing on P.O.P., it having the effect of giving a softer print, inasmuch as certain organic salts are not acted upon as they would be were the blue glass absent. Blue glass is also of service when copying a faded or yellowish photograph; a piece of pale blue glass is held before the lens during the exposure, and the resultant negative gives increased contrasts, and in general is of better all-round quality.

BLUE TONES

These are obtained most easily on blue-print (ferro-prussiate) paper or by using blue carbon tissue, in both cases a blue print being produced. Good blues are difficult to obtain on P.O.P., a blue-black (*which see*) being the nearest. Bromide prints may be partially or wholly changed to a prussian blue. Ferric ferricyanide is usually employed, it being made as required by mixing together solutions of potassium ferricyanide and ferric ammonium citrate, adding a little nitric acid. The formula for the toner is:—

Potassium ferricyanide	45 grs.	10 g.
Nitric acid (pure) . .	24 mins.	5 ccs.
Ferric ammonium citrate	22 grs.	5 g.
Water	10 oz.	1,000 ccs.

If this works too quickly, add more water. Place the prints, after developing, fixing, and washing, in the above, until of the desired colour, and wash in running water for twenty minutes, or until the whites are clear.

BLUE VITRIOL (*See* "Copper Sulphate.")

BLUE-BLACK TONES

In silver printing these can be obtained only by using a toning bath rich in gold, say 1 gr. to 5 oz. or 6 oz., and also a liberal allowance for the prints being toned, 2 grs. or more to each full-size sheet of paper, or fifteen half-plate prints. In addition, a rich print from a strong negative is absolutely essential, the tone of the shadows being very largely determined by their depth. Some toning baths will give blue-black tones much more readily than others; with some, these tones cannot be obtained. In separate toning and fixing the sulphocyanide bath, if strong, will give blue-black tones readily. In combined toning and fixing Bennett's toning bath will give a similar result by increasing the quantities of the B, C, and D solutions. One and a half drams of each should be used to each ounce of the A solution, in place of 1 drm., as given under the heading "Bennett's Toning Bath for P.O.P."

BLUE-PRINT PROCESS

Known also as "Cyanotype" (negative) and "Ferro-prussiate" process, and largely used by

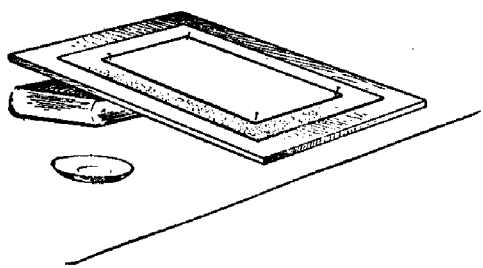
engineers, architects, etc., for reproducing technical drawings. It is one of the oldest photographic printing processes, having been invented by Sir John Herschel in 1840. Paper is coated with a mixture of ammonio-citrate of iron and potassium ferricyanide dissolved in water, then dried in the dark, and printed by daylight in contact with a negative or drawing on tracing paper, when an image in insoluble Prussian blue (Turnbull's blue) is produced. The print is washed to remove the soluble coating unacted upon by light, leaving a finished print, blue on a white ground.

Another blue-print process is the positive cyanotype, or Pellet's process (*which see*, under the latter heading), which gives blue lines on a white ground, the opposite process to the above, it being one in which blue is formed where the light does not act. The negative cyanotype or blue-print process proper is the one particularly suitable for negatives, and is that to which attention is here directed.

Blue-print paper, ready sensitised for immediate use, may be purchased, but as it does not keep well, and is so easy to prepare, it is better to make it as required. A large number of sensitising formulæ have been published from time to time, considerable latitude being permissible in the quantities of chemicals used as well as in the methods of working. They all, however, resemble one another, and yield prints which are all very much alike. Almost any kind of paper can be coated with the sensitive mixture; fairly stout cream-laid notepaper, or a real photographic paper such as Rives, is as good as any; it should be free from wood-pulp or other impurities usually found in cheap white papers, its surface should be fairly hard and not too absorbent, and it should be tough enough to withstand thorough washing. Common rough papers are better if sized before sensitising, because the size prevents the image from sinking into the paper. For the size use the following arrowroot mixture:—Take ½ oz. of arrowroot and mix to a smooth stiff paste with a small quantity of cold water. Add warm water to make 22 oz. in all, and boil gently until clear. Thin papers may be immersed bodily in the warm mixture for a minute or two, and then drained and dried. Thick papers should be pinned by the corners to a flat board and the warm size applied first up and down and then across, by means of a soft sponge or a Blanchard brush (*see* the heading "Brushes"). Then with a clean soft sponge go over the paper again in order to efface all streaks and make the surface smooth; hang up, and when quite dry it is ready to sensitise. The two sensitising solutions are made according to the following formulæ:—

A. Ferric ammonium citrate (brown) .	80 grs.	160 g.
Water . . .	1 oz.	1,000 ccs.
B. Potassium ferricyanide . .	60 grs.	120 g.
Water . . .	1 oz.	1,000 ccs.

Unless quite fresh and clear the ferricyanide crystals should be washed before weighing, and dried between blotting-paper, to free the crystals from powder or crust. Mix the solutions, and keep in a stone bottle or in a dark place. The solution is usable at once, but works better when a week or ten days old, but it must be filtered just before using, and if older than this, should be preserved by adding to every 2 oz. of it 1 gr. of potassium bichromate. The sized common paper or the plain good paper, with blotting-paper underneath it, should be pinned to a flat board, placed (as illustrated) at an angle of about 20° to the horizontal in preference to being either flat or upright. Sufficient of the sensitive solution should be poured into a saucer and then applied to the paper with a sponge, Buckle brush, or large soft camel-hair mop. The coating must be done in artificial light or very weak daylight, and the solution should be spread upon the paper by strokes across the sheet, beginning at the top and joining the second stroke to the first. The strokes should then be made vertically in order that the paper may receive a perfectly even coat, without any of the sensitive mixture running in rivulets down the sheet. When evenly coated the paper must be dried as quickly as possible, and in the dark—a warm cupboard is a good place—but no very great heat should be applied to the wet paper to hasten the drying. The coated paper



Paper Ready for Coating in Blue-print Process

will not keep good for many days; a heavily-coated poor paper will not keep so long as an unsized or lightly sized good one. The colour of the sensitised paper may be a dirty greenish yellow tinge, but will vary according to the sensitising formula. The paper is placed in contact with a negative or drawing on tracing paper, and printed by daylight, preferably in strong sunlight. On exposure to light the colour of the paper gradually changes through bluish-green and bluish-grey to a kind of dirty olive-green, the image having a choked-up appearance when fully printed. The print is washed for about fifteen minutes in water, which should remove the soluble salts and leave a brilliant blue print. The water serves both as a developer and fixer, the print needing no further treatment. Prolonged washing weakens the image, as will also water containing carbonate of lime. Brighter prints are obtained by adding about 20 grs. of citric acid to the pint of water. A solution of 5 parts of alcohol in 95 parts of water has been advocated for improving the whites, and a 2½ per cent. alum solution has been recommended for brightening the blue colour; but neither of these aids is necessary if the water is free from lime, the negative or tracing a suitable one, and the paper properly prepared.

An alternative method is to use single solutions, one for sensitising and the other for developing the faint image, obtained by printing in the usual way, to the desired blue colour. The sensitising mixture is as follows:—

Ferric ammon. citrate (green)	110 grs.	220 g.
Uranic nitrate . .	35 ,,	70 ,,
Water	1 oz.	1,000 ccs.

Paper is coated with this mixture and printed in the manner already described. The faint image is developed to its full strength by placing in—

Potassium ferricyanide	22 grs.	44 g.
Water	1 oz.	1,000 ccs.

The print is completed by washing in water. This process is more rapid than the one first described.

The blue-print processes are used for printing upon fabrics and for the making of blue transparencies for window decoration. For the latter it is necessary to use a plate coated with gelatine to serve as a vehicle for the sensitiser.

Toning Blue-prints.—Blue-prints may be toned to several other colours, but the various formulæ published are uncertain in their action on home-made papers, two samples of which are seldom alike; they answer better with commercial blue-print papers. Before toning, wash the prints thoroughly. *Green.*—Make a saturated solution of ferric protosulphate, acidify with sulphuric acid, and dilute with an equal quantity of water. Immerse the blue-print until the required tint is obtained, wash well, and dry. A weak solution of sulphuric acid (acid 4 drops, water 1 oz.) will also give the print a greenish tinge. *Lilac.*—For lilac-violet, immerse in a hot solution of lead acetate, or a cold solution of borax. A 2 per cent. solution of potassium sulphocyanide (10 grains in 1 oz. of water) gives a pink-lilac tone, after obtaining which blot off superfluous solution, expose to strong sunlight, wash, and dry. *Greenish Black.*—Dissolve 30 grs. of borax in 1 oz. of water and add sulphuric acid drop by drop till the solution just reddens litmus paper; next add a weak solution of ammonia till the red colour begins to change, and finally add 4 grs. of catechu, shake well and filter; tone, wash, and dry. *Brownish Black.*—Add 6 drops of liquor ammoniæ to 1 oz. of water, immerse the blue-print, and allow to remain until the colour has vanished; then wash and place in water 1 oz., tannic acid 9 grs., in which the bleached print gradually assumes a brown or brownish black colour; wash and dry. *Purple Brown.*—Add 30 grs. of tannic acid and 1 gr. of pyrogallic acid (or even less) to 1 oz. of hot water, immerse the blue-print until toned to a lilac, rinse, and place quickly into a weak solution of caustic potash (potash 8 grs., water 1 oz.); wash and dry. *Black.*—A good black is difficult to obtain; success depends upon the quality of the negative and upon the depth of the blue-print. The deep shadows tone to a rich black, but there is a falling-off in the half-tones. Of the many formulæ, Lagrange's is the best, but one of the most troublesome. Rinse the print in distilled water and, in a yellow light, bleach in a silver nitrate solution (9 grs. in 1 oz. of distilled water). Wash well in distilled water, expose to the fumes of ammonia, and afterwards develop with an ordinary ferrous oxalate developer; the print may then be washed and dried. *Grey to Red.*—Print darker than usual, wash for ten minutes, and immerse in a solution of copper nitrate (24 grs. to 1 oz. of water) to which a little liquor ammoniæ has been added cautiously, a few drops at a time, until the precipitate first formed is just redissolved, leaving the liquid a deep blue. This bath turns the blue-print mauve, then grey, and after a time red. Prints dry more blue than they appear when wet. The bath does not act well on prints showing great contrasts, since by the time the dark parts have turned grey the half-tones and lighter tones will become red. Most of the tones obtained by the above methods are unsatisfactory. (*See also* "Window Transparencies" and "Fabrics, Printing on.")

Bleaching Blue-prints.—Instructions are given under "Drawings Made from Photographs."

BLURRING

In a photographic image, the absence of sharp or crisp definition, a point of light becoming a nebulous circle, and a fine line a hazy broad band. Blurring may result from several independent causes. A large working aperture of the lens may be necessitated by the nature of the subject demanding a rapid exposure, and the difference in the various planes of the subject may result in some being out of focus, and consequently blurred. Or occasionally, the entire image may be out of focus, either by accident or design. Many lenses, when used at full aperture, will not give sharp definition over the entire plate, and while the central part is crisp and well defined, the corners are blurred. Or the camera may move during the exposure, with the result that the whole image is blurred. Or, again, in photographing moving objects, the exposure may not be sufficiently short to prevent the object showing movement on the plate. A lens that has been tampered with and put together incorrectly, may give a blurred effect.

BOLOMETER (Fr., *Bolomètre;* Ger., *Bolometer*)

Practically an extremely sensitive thermometer formed of one, two, or four metallic grids or gratings so connected as to form a Wheatstone bridge, and carrying a very sensitive galvanometer mirror. It is used to measure extremely small differences in temperature (0·0000001° C.). S. P. Langley utilised this instrument in conjunction with a series of rocksalt lenses and prisms, and received the deflected light from the galvanometer mirror on a strip of bromide paper. Thus he was able to measure further into the infra-red and map out the absorption lines with remarkable accuracy.

BOLTING CLOTH (Fr., *Etamine;* Ger., *Beuteltuch*)

A material of fine regular texture, originally made for bolting or sifting flour; known also as bolting silk and silk bolting cloth. It is used for obtaining softness of definition in a print. For use when enlarging upon bromide paper, a piece of the cloth, slightly larger than the enlargement to be made, is stretched free from creases on a light wooden frame. This is interposed