No. 3.

PRINCIPLES and PRACTICE of PHOTO-LITHOGRAPHY as worked at the New Zealand Government Photo-Lithographic Department, Wellington.

THE object of photo-lithography is to reproduce in fac-simile, or on a reduced scale, maps, plans, manuscript, &c.; and before proceeding to describe the manner in which photography is used in the process, it would be as well, perhaps, to first refer to the method of ordinary lithographic printing from transfers.

Lithographic stones are limestone of a porous nature, and readily absorb water. They are cut to a suitable size, about two or three inches thick, and are ground flat, polished with pumice and snake-stone, and, being thoroughly dried at the fire, are laid upon the bed of the lithographic press ready for the transfer. As an instance of the method of producing copies of the transfers, we will take an ordinary departmental circular. This is written upon transfer paper with transfer ink. The transfer paper is paper coated with a certain composition, in which isinglass figures as the chief item. The peculiarity of the ink consists in the fact of it containing grease.

Now the stone being ready, as stated above, the back of the transfer is damped with a wet sponge; the damp being readily absorbed by the isinglass renders the face "tacky," and in this condition the transfer is laid face downward on the stone, backed with a few sheets of paper, and passed several times through the lithographic press. The immediate result of this is that the stone, from its peculiar nature, retains the grease from the ink with which the transfer is written. Water is next poured on the stone, which absorbs it freely, except in those parts or spots holding the grease from the transfer ink. The process of printing may now be easily understood, at least its theory, by considering the natural antipathy to each other existing between water and grease. A roller charged with ink, containing grease, is rolled over the wet stone, the ink taking readily to those portions which have previously received the greasy ink from the transfer, but being repelled by the water in the other portions of the stone. Sufficient ink being rolled on, a sheet of paper is placed over it, and the proof pulled.

Photo-lithographic transfers are treated in precisely the same manner, being, in effect, photographs in greasy ink upon a substance that will stick sufficiently to the stone in transferring.

The Production of the Photographic Negative.

The map or plan to be reproduced is pinned on the wall at one end of the operating room, and the camera, which, mounted on a heavy stand, runs on a tramway carefully adjusted at right angles to the plane of the wall, is brought to its position and focussed according to the size of the reproduction required. The lens generally used is Dallmeyer's "rapid rectilinear," but for certain classes of work his "triplet" is substituted. The glasses mostly used are 16 in. square, patent plate.

The ordinary process of photography as practised now for portraits, views, &c., with the bromo-iodide of silver, is unsuitable for the production of negatives for photo-lithography, which should be absolutely clear and free from fog in the shadows or lines, and as intense and non-actinic in the lights as possible. Operators work differently to secure this *desideratum*. The following is the method practised in this office:—

The collodion is made as follows, and is never used until at least a week after iodizing:—

Rectified sulphuric æther (s.g. ·720)	6 pints.
Alcohol (s.g. ·806)	3 „
*Pyroxyline	1450 grains.

Iodized with the following:—

Alcohol (s.g. ·815)	3 pints.
Iodide of potassium	840 grains.
Iodide of ammonium	150 „
Iodide of cadmium	90 „

The nitrate bath is prepared with—

Distilled water	13 pints.
Nitrate of silver	20 ozs.

To this is added, before filtering, a few drops of iodizing solution.

After exposure in the camera the plate is developed with—

Water	80 ozs.
Proto-sulphate of iron	3 „
Glacial acetic acid	2½ „
Spirits of wine	Quant. suff.

The development must not be prolonged, nor must it be forced on under exposed plates. A rather stronger solution of cyanide of potassium than is generally used is employed to dissolve the unaltered iodide of silver, and the plate should now show as a fully exposed positive with perfectly clear shadows. A few drops of a strong aqueous solution of iodine in iodide of potassium is next diluted with water to the colour of brown sherry, and the plate flooded with it in presence of white light, after which is applied a dose of ordinary re-developing solution composed of pyrogallic and citric acids with a little dripping silver. This stage requires especial care that the intensifying be not carried too far, for if the silver be piled on to any great extent it will overlap and injure the sharpness of the fine lines, or may destroy them altogether. The negative is now, after careful washing, plunged into a saturated solution of bi-chloride of mercury, the first effect of which is to turn the film black, but after a short time it becomes quite white. It is immaterial what time the plate remains in the bath of corrosive sublimate, provided it is long enough to convert the whole of the metalic silver into

* Made according to Hardwich's formulæ. Sulphuric acid, s.g. 1·845, 2 fluid ounces; nitric acid, s.g. 1·45, 1 fluid ounce; water, ½ fluid ounce; cotton, 30 grains. Temperature, 170° Fahr. Time of immersion, five minutes.