Paul Pretsch and Photo-galvanography.

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A DAIRYMAID.

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AMONG the pioneers of modern methods of photo-engraving, the names of Fox Talbot, Pretsch and Poitevin stand out prominently. They worked almost contemporaneously, in the early fifties of the last century, upon the same principle of the insolubility of gelatine and other colloids mixed with salts of chromium, dried and exposed to light, but they applied it in different ways. Talbot gave us the method of etching the chromated gelatine image with ferric perchloride, which is still followed in the photo-etching or heliogravure processes, while Pretsch and Poitevin produced incised or relief printing plates by electrotyping from the swelled gelatine film. The latter, however, is recognised more especially as the founder of modern photo-collotype methods, and Pretsch as the originator of the photo-galvanographic methods.

Paul Pretsch was born in Vienna in 1808, and visiting several foreign printing offices, became an experienced printer. In 1842 he joined the Imperial State Printing Office in Vienna under the direction of Herr Auer, whom he assisted in working out the process of nature printing. In 1850 he was sent to Paris and London, and in 1851 to London in charge of the Austrian printing exhibits at the Exhibition. In 1852, after his return, he began working out his idea of obtaining galvanoplastic reliefs by the swelling of insolated chromated gelatine films. In 1854, having perfected his discovery so far as to be convinced of its success in a wider field, he gave up his appointment in Vienna, and went to London. He took out an English patent, No. 2373, dated 9th November, 1854, for "Improvements in producing Copper and other Plates for Printing," and in the following year the Patent Photogalvanographic Company was formed, with works at 8, Holloway Place, Holloway Road, Islington, for working it.

In 1856, the publication was commenced of a work entitled *Photographic Art Treasures*, in folio, of which five parts, each containing four plates, appeared. This is interesting as the first publication of photographically engraved reproductions of works of art. Many of the plates were exceedingly good, considering the novelty and inherent difficulties of the method and the necessity for more or less retouching. The Company broke up after two years, and Pretsch was left to work his process alone. At the Exhibition of 1862, in London, he exhibited half-tone photogalvanographic plates in intaglio and in relief, and obtained the only medal awarded for that class of work. He did a good deal of work in illustrating the *Journal of the British Museum*, and otherwise, but found it, however, difficult to get on in London, and after a serious illness he returned to Vienna

in 1863. He was taken on again in the Imperial State Printing Office. but his health had broken down and he made no further progress in perfecting his methods. In 1873 he died of cholera.

In his English patent of 1854, he stated that his invention consisted in adapting the photographic process to the purpose of obtaining either a raised or a sunk design on glass or other suitable material covered with glutinous substances mixed with photographic materials, which designs could then be copied by the electrotype process, or by other means for producing plates suitable for printing purposes, or could be applied for producing moulds applicable for obtaining plates.

He gave no exact details of his methods of working because they could be variously modified. The sensitive coating was prepared by making a solution of about two parts of clear glue in about ten parts of water, using more or less of either, as might be required, and to one part of a strong solution of nitrate of silver and one part of a weak solution of iodide of potassium, each in a separate glass, he poured a small quantity of the glue solution. The remainder of the glue solution was kept warm, and a strong solution of bichromate of potash well stirred up in it. The glutinous solutions of nitrate of silver and iodide of potassium were then added and the mixture strained for use. He next took a clean plate of glass, a silvered copper plate or other suitable plate, and having set it quite level, poured the above mixture over its surface, so as to form an even coating when completely dry. The print, or other subject to be copied, being laid on the prepared coated surface, they were placed together in a photographic copying frame, and exposed to light. After sufficient exposure, the plate was removed from the frame, and washed, either with cold water, or a solution of borax or of carbonate of soda as might be necessary. The photographic picture or design appeared in relief, and when sufficiently developed was washed with spirits of wine. The surplus moisture was removed, and the plate covered with a mixture of copal varnish, diluted with oil of turpentine. After some time, and before becoming quite dry, the superfluous varnish was removed with oil of turpentine, and the plate immersed in a very weak solution of tannin or other suitable astringent. During this part of the process the plate was carefully watched and removed as soon as the picture or design was considered sufficiently raised ; it was then washed in water and dried. It was then ready to be copied by the customary methods of rendering the coating conducting and placing it in the electrotyping apparatus, or by making a mould from the coated plate, which, being subjected to the electrotype process, would afford the required printing plates ; or sometimes the copying could be done by the stereotype or other like process.

Or, secondly, he proceeded by coating and exposing the plate as above, but after washing with spirit of wine the plate was dried and in due time the picture or design would appear sunk, like an engraved plate. The printing plates were produced therefrom as above described.

A third process was to apply printing-ink to the coating of the plate prepared as above, taking the impression upon paper laid thereon, and transferring it to stone or zinc to be printed by the usual methods.

Instead of iodide of potassium, the bromide or iodide of ammonium might be used to shorten the exposure, and the copy could then be obtained by the photographic camera instead of the copying frame.

At a meeting of the Photographic Society of London on the 5th June, 1856, Pretsch exhibited specimens of his work in various stages, and read an interesting and suggestive paper on " Photo-galvanography, or Engraving by Light and Electricity," in which, without going into details of manipulation, he explained

the principles and applications of his process, founded on the peculiar properties of glue and gelatine mixed with chemical ingredients and rendered by the influence of light more or less hard and soft, so that they can be raised or sunk, can be kept soft or made firm, can shrink, swell and become enlarged or magnified. He also explained the different ways of producing an intaglio plate.

I. 1. An ordinary positive on glass or paper.
2. The raised picture on the coated glass reversed.
3. The mould, sunk, right position.
4. The first copper plate, the matrix, raised, reversed.
5. The second copper plate or printing plate, right.
6. The print reversed.

II. 1 and 2 as in I.
3. The copper plate deposited in the electrotype apparatus immediately upon the coated glass glate. The picture intaglio and right.
4. The print from it reversed.

If, however, the positive be reversed or the original placed face upwards in the copying frame, the print will appear right.

III. 1. The positive original on glass or paper.
2. The coated glass plate with picture thereon, sunk, caused by the use of a gentle warmth ; the picture reversed.
3. The mould raised, right position.
4. The copper plate sunk, reversed.
5. The print therefrom, right position.

He also described methods of surface printing, but they were apparently not perfected till later.

In the course of the discussion Pretsch stated that he thought the granular appearance of the films was due more to the formation of silver chromate rather than to the iodide. (*Photo : Journal*, Vol. III., p. 58).

In the same journal, Vol. V., 1859, pp. 109 and 132, there is a reprint of another paper by Pretsch on " Photography subject to the Press," in which he gives his reasons for abandoning the etching methods of photo-engraving in favour of the photo-galvanographic and gave a short sketch of his method, stating that the granulation was a distinctive feature of it, and was indispensable for the reproduction of any tint by a printing plate. He also discussed the question of " touching up " and the necessity for it owing to the imperfections of the originals, and described the electrotyping process and the advantages of his process of reproduction over hand engraving.

Again, in Vol. VI. of the same journal, 1859, p. 1, there is another paper on " Photo-galvanography, or Nature's Engraving," illustrated with a plate from a negative by O. G. Rejlander, " I pays," which is interesting not only as a good specimen of the process, but also because it is an early example of the process of *acierage*, by which the electrotyped plate was coated with iron and so was made capable of yielding the large number of copies required, instead of having to prepare a number of duplicate plates or make a transfer to stone with very inferior results. A description of the *acierage* process is given by Mr. F. Joubert, the inventor, in the same number of the journal.

An examination of this and other prints from Prestch's plates in Dr. Eder's *Geschichte der Photographie*, Volkmer's *Die Photogalvanographie*, shows that they have a very fine grain, more like a chalk grain on stone, than the vermicular gelatine grain seen in Placet's photo-engravings or in collotype plates. There is some falling off of detail in the lights and a certain roughness about them, with an irregularity of outline in places due to uneven swelling of the gelatine.

This is seen more particularly in the reproductions of line work given in Volkmer's book, in which the author has given a full description of Pretsch's and other methods and also a good portrait of Pretsch. The same irregularity is visible in Poitevin's reproduction of line work in his *Traité de l'impression photographique sans sels d'argent*, in which he has described his early researches in photo-engraving.

The most detailed account of Pretsch's process of intaglio photo-galvanography was given in the *Photo : Correspondenz*, 1874, p. 180, by Joseph Leipold, a former co-worker, and director of the Engraving and Galvanoplastic Section of the National Printing Office in Lisbon.

He starts with a photographic *positive* on glass. It must show all the gradations of the picture completely in their proper density and brilliance. The glass must be perfectly plane, as also the glass serving as a support for the sensitive mixture, in order to obtain close contact.

After repeated experiments the following formula was fixed upon.

I.	Glue (preferably Cologne glue),	15	grammes in	90 c.c. water.
II.	Bichromate of potash	2	,,	45 ,,
III.	Silver nitrate	1	,,	45 ,,
IV.	Potassium iodide.....	0·5	,,	30 ,,
V.	8 drops of acetic acid to be added later.			

The glue is soaked in the water for some hours, then dissolved at a moderate temperature in a water bath, as also II., III., IV., to which one part of the warm gelatine solution may be added; then II. and III. are added, with stirring, giving a dark red solution; then adding IV., silver iodide is formed which lightens the colour. Finally, the acetic acid is added and the mixture strained through double linen. The warm filtered solution is then poured over the glass plates, set truly level in a drying oven, and spread evenly with a glass rod. The addition of the acetic acid facilitates the even spreading and the subsequent formation of grain will be finer and softer. The heat of the drying box must not be too high. At a temperature of about 98° F. the plates should dry in three to four hours.

The prepared plates should be kept for some hours in a dark place before exposure, so that an oxidation of the surface may be produced which will greatly influence the formation of grain in the later development of the picture.

This must not, however, be unduly prolonged, otherwise the coating loses sensitiveness and will only give bad and flat pictures. It is otherwise when the plates are placed in a warm room and dry in about twenty-four hours, when the oxidation takes place during the longer drying at a lower temperature. This method of drying is not recommended, because the plates may easily be spoilt by it.

No definite rules can be given for the exposure of the coated plates under the positive cliché. It depends upon the quality of the positive and the strength of the light. A strong positive with dense shadows will require a long exposure, but it should only be given in the shade, preferably at a window away from the sun. Direct sunlight makes the image hard with loss of half-tone and consequently useless. The exposure is a difficult matter only to be learnt from experience. After a certain time the image will appear more and more distinct, but until all the details in the shadows appear the exposure is incomplete. His plates were exposed for three to five hours, in daylight, and sometimes he protected the deep shadows by covering them with a mixture of gum and lamp-black.

With proper exposure the subsequent operations for the development of the image are easy. The plate is first immersed in a bath of 1 part of alcohol to 15 parts water, which does not develop the image so quickly as water alone would. After a few seconds it is taken out and dried off quickly with blotting paper. On

examination it will be found that only the stronger shadow parts and outlines have risen and are grained. The full development of the image should not, however, follow too quickly so that the glutinous coating may not take up too much moisture and the grain become coarse. The damp plate is left in the air for a time to dry and the damping and drying are proceeded with at moderate intervals till all the details of the image are developed. It is then thoroughly dried for some hours in the air and finally placed in water to remove all remaining bichromate salt, and the picture will then appear completely developed.

In order to transform by galvanoplasty such a relief with all its delicacy into a metallic plate suitable for printing, it is first necessary to make a perfect mould of some substance suitable for electrotyping. Those acquainted with the subject will know the difficulties attending the making of electrotyped copies from ordinary engraved plates, but with these very soft and delicate reliefs they are greatly increased. Paul Pretsch considered this the most difficult part of the whole process. He used oily and resinous substances mixed with gutta percha, which became liquid when heated, and in that state was poured on the reliefs. He himself, however, had not been successful with gutta percha and used the following composition :—

I.	Spermaceti	420	grammes.
II.	Stearic acid	200	,,
III.	White wax	170	,,
IV.	Asphaltum	70	,,
V.	Plumbago	70	,,

The asphaltum is first melted, then I., II., III. are added to it. When all are completely melted with constant stirring at a temperature of about 190° F. the plumbago is mixed in.

This composition has many advantages for the above purpose. It becomes fluid at a low temperature and so easily sets on the soft relief. It hardens when quite cold and there is no fear of the mould being spoilt by the brush when making it conductive with plumbago, and it separates easily from the gelatine relief. This composition has been used for all sizes of moulds and has always easily given brilliant and perfect matrices.

After the complete development of the image in the last water bath, it is well dried with blotting paper. The grain will, however, appear too strong and the image too high. The glue image has expanded from excess of moisture and this is the origin of the strong coarse grain. In order, therefore, to reduce this moisture and give the relief the necessary fine granulation and other properties for the subsequent printing of the plate, the moist surface is struck in all directions, especially the deepest shadows, with a fine brush, so that the relief may be to some extent again dried and contracted and the grain become finer and softer.

The image being thus ready for moulding is surrounded with a frame of four metallic strips and the composition heated to the melting point, poured on from one corner. The separation of the mould from the relief picture is easily accomplished, if after the mass has set and somewhat cooled, the glass plate is turned upwards, when separation begins. It is then only necessary to lift the glass a little at one place when it will separate entirely. From the ease and certainty with which the moulding process is carried out, as well as from the brilliant and complete characters of the mould itself, the operator can finish his work, if carefully carried out, with certainly satisfactory results.

When the mould is quite cold, it can be made conductive with the finest graphite. The image will not suffer from the soft brush being taken carefully over it. It will become more brilliant and at once ready for electrotyping.

Placet improved on Pretsch's process by coating sheets of mica or other thin transparent material with a similar sensitive coating, but exposing them under the positive from the back, by which means the irregular swelling of the gelatine underneath the printed picture was obviated and the resulting relief represented more truly the lights and shadows of the picture.

These and other similar methods of electrotyping directly from the coated plate were succeeded by those in which a positive pigment print was transferred to a glass or polished copper plate, developed with warm water, then dried, made conductive and electrotyped. They have been largely used for map work in line and also for half-tone subjects, but electrotyping is always more or less tedious and uncertain, and the methods based on it have now almost entirely been superseded for half-tone work by the Klic process, in which a positive pigment print from a reversed negative is transferred on to a copper plate grained with powdered asphaltum and etched with perchloride of iron, as first suggested by Fox Talbot.

It is interesting to note that this supersession of the photo-electrotype methods by the photo-etching methods, like Talbot's photo-glyphy, was foreseen so far back as 1859 by a writer in the *Photographic News*, Vol. III., p. 28.

In any case Pretsch did good work in demonstrating the practical possibilities of the photo-galvanographic methods of photographic engraving, and his labours merited fuller recognition and reward.

"What Have You Caught?"

E. Hamel & Co.

Photograph by Freckleton & Co.