

Some of the principal Scotch paper-makers have adopted, or are about to adopt, horizontal single-cylinder engines; and we find that, with either one or two cylinders, horizontal engines are slowly working their way into flour mills. Even setting aside their great advantage in point of first cost, we are convinced that, with first-class workmanship, they will ultimately prove themselves superior in every respect to beam engines.—*Engineer.*

### PHOTOELECTRIC ENGRAVING.

One of the most remarkable, if not important results of modern science, is the power of producing an engraved copper-plate without the direct use of instruments—a plate, in fact, which is really an admirable photograph, capable of producing thousands of copies, which resemble ordinary sun pictures in nothing save minute beauty of detail.

It is needless to say that the attempt to cause the image cast by a lens within a camera to register itself on metal or wood in such a manner that impressions in ink might subsequently be obtained, is by no means new; and judging from a specimen engraving taken by Dallas's process, which has been laid before us, this desirable end has been obtained at last with considerable success.

Mr. Dallas has addressed a letter to the Society of Arts on the subject:

"In consequence of the very questionable protection afforded by the patent laws, I deem it advisable at present not to publish the details of my process.

"I can produce, in a period varying from one to three weeks, an engraved plate from a photograph. In this plate, that which constitutes the essence of the photograph and the despair of hand labour—*fac-simile* even to minute and almost microscopic detail—shall be present. To attain this result, all that I require is a good reversed negative (easily produced by reversing the glass), and a positive print merely fixed with 'hypo,' not toned.

"The methods which have hitherto given most promise are the bitumen process, photoglyphy and photogalvanography. The other processes of photolithography and photozincography, from their very nature, cannot rival the richness of plate printing. The bitumen process and photoglyphy are essentially etching processes, and involve much hand labour and consequent loss of fidelity. Photoglyphy is the least satisfactory of the two, as the etching ground employed is of a very delicate nature, and the photographic chemical, bichromate of potash, has the unfortunate quality of destroying detail, the longer it is submitted to actinic influence.

"The most important step in advance was photogalvanography. This process came into my hands when in a most crude and impracticable condition, and after it had been given up as useless by others. By much patient labour, I succeeded in making it practical, and the process has ever since been worked with the improvements which I effected. I was not permitted to reap the fruit of my labours, and after a considerable sum had been expended by my then partners to develop the process in a direction to which it was wholly unsuitable, the process has been almost abandoned.

"Photogalvanography, like photoglyphy, depends

on the peculiar action of bichromate of potash, in combination with gelatine. In this lies its weakness. It loses detail—the more so as it requires a very long exposure, sometimes upwards of six hours, and then without any certainty that the right exposure has been attained. There are constantly numerous failures from this one cause alone.

"I experimented long with this process, and found that the result was due to chromic acid—in other words, that with a composition merely of chromic acid and gelatine, a raised image with granulation could be produced. From this raised image the electrotype plate was subsequently made. Independently of the loss of detail, and the uncertainty in the exposure—both defects inherent in the process—the granulation was of a peculiar zigzag and wiry character, which was of great value in the vigorous parts of the picture, but became broken or unconnected in the half-tones and fine details. This led to a pretty free employment of the graver and roulette, just in the very parts which made hand labour expensive. The process, indeed, was never capable of the high flight which was attempted, and, as I predicted, it broke down. Where expense was no object, the graver was a great assistance, but it lessened the value of the *fac-simile*.

"In photoglyphy and photogalvanography, the results are obtained from a positive impression:

"It was after experimenting some time with photogalvanography that it occurred to me to strike out in a different direction. Any one acquainted with engraving is aware that aquatint and chalk, or stippling, produce fine grain, half-tones and detail. The problem I set myself was how to imitate this combination. The aquatint employs common resin dissolved in spirits of wine. This poured over his plate evaporates, and leaves numerous globules of resin attached to the surface. The size of these globules depends on the proportion of resin to spirit. When the acid is put on the plate, the resin acts as a resist, and a tint is produced in the intermediate parts. If the plate were now electrotyped before the removal of the resin, and a print taken from the electrotype, the resin parts would give a kind of stipple or 'chalk' marks, interspersed with tint. It is something similar to this which I have succeeded in imitating, with peculiarities *sui generis*, by photography and the electrotype. I can also, as it were, modify the size of the dots, obtaining them so fine as to carry almost microscopic detail; but if too fine, there will be deficient depth in the dark. In this as in all things there is the happy medium, and this I believe I have secured. I commence with the negative. This should be reversed. From the negative a positive proof is taken. This I prefer not toned, but merely fixed in the sepia colour by the 'hypo.' I cover the negative, which must be varnished with a material from which I obtain the latent positive. This latent positive I turn by a simple process into a suitable negative, and it is with this negative that I subsequently manipulate. I can time the exposure to a nicety, a few seconds over or under making an inappreciable difference. The excess or deficiency must not, however, extend to minutes. If necessary, I can electrotype direct upon my material; but as this might lead to the