G.—No. 27.

INFORMATION

OBTAINED BY

THE HON. JULIUS VOGEL

RELATING TO THE INTRODUCTION OF

THE USE OF PHOTO-ZINCOGRAPHY

INTO THE

GOVERNMENT PRINTING DEPARTMENT.

PRESENTED TO BOTH HOUSES OF THE GENERAL ASSEMBLY, BY COMMAND OF HIS EXCELLENCY.

WELLINGTON.

1871.

INFORMATION RELATING TO THE INTRODUCTION OF THE USE OF PHOTO-ZINCOGRAPHY.

No. 1.

The Hon. JULIUS VOGEL to the Hon. W. GISBORNE.

SIR,— Charing Cross Hotel, 19th May, 1871.

Before I left the Colony Dr. Hector requested me to make, in England, some inquiries respecting the photo-lithographic process, which he suggested it would be necessary to adopt in New Zealand for the re-production of railway plans, and in connection with the Land Transfer Act.

I ascertained from various sources that Major-General Sir H. James, who is at the head of the Ordnance Survey Department, was the best authority on all such subjects. The Hon Mr. Monsell, the Postmaster-General, was good enough to give me a letter of introduction to Sir H. James. On account of the great pressure of work, however, I found myself unable to visit Southampton, the head-quarters of the Department; and I had, therefore, to entrust the task to Mr. Fox, my Private Secretary.

Sir H. James showed the utmost readiness to communicate all the necessary particulars; and I have now the honor to enclose a very valuable report which Mr. Fox has presented to me.

I am impressed with the desirability of using the process, as suggested by Dr. Hector; but I think it perhaps advisable that the Report and the appended list of apparatus, &c., should be forwarded to Dr. Hector, before any order for materials is given.

I have, &c.,

The Hon. the Colonial Secretary, Wellington. JULIUS VOGEL.

Enclosure in No. 1.

Mr. E. FOX to the Hon. JULIUS VOGEL.

SIR,— Charing Cross Hotel, London, 17th May, 1871.

I have the honor to state that, as instructed by you, I have visited the Ordnance Survey Department at Southampton, with the object of obtaining information respecting the cost of the necessary apparatus, and the nature of the photo-lithographic process, which Dr. Hector considered it would be advisable to introduce into New Zealand, for the copying of plans for railway works, and for maps, &c., rendered necessary under "The Land Transfer Act, 1870," as well as for other purposes.

The process used in the Ordinance Survey Department is, however, photo-zincography, which the Director of the Department, Major-General Sir H. James, has substituted for photo-lithography.

Every stage of the photo-zincographic process was exhibited to me, and was explained by Sir H. James. In the Report which I have the honor to submit herewith, I have endeavoured briefly to describe the several processes, including some which are specially results of the long and extensive practical application of the art, under the direction of Sir H. James. That gentleman showed throughout my visit the greatest interest in supplying information for the benefit of the Colony; stating that, as the head of a Department which is the centre of information of a peculiar kind, he thought it a duty, and felt it to be a pleasure, to enable that information to be used wherever a Government desired to use it.

The detailed list of apparatus required for the introduction of the process, with statement of prices, &c., was specially re-cast from a similar document prepared some time since for the Indian Government.

I have, &c.,

The Hon. J. Vogel. E. FOX.

Sub-Enclosure to Enclosure in No. 1.

PHOTO-ZINCOGRAPHY as applied at the Ordinance Survey Department, Southampton.

MAJOR-GENERAL Sir H. JAMES, the head of the Department, has almost entirely discarded photo-lithography, which was at first adopted. He has done so, because the zinc process, as perfected by himself, is the cheaper, simpler, and more certain: a stone of the size used in reproducing plans, and 6 inches thick, (which was necessary) weighs about 6 cwt., and costs £6. A plate of zinc, which can be easly handled, costs from 15s. to 20s. The plate is not liable to be broken; whereas the stone might split at any moment when an impression is being taken, or be broken by a fall. The plate can be freed from one plan, or work, and be fitted to be used for another, with less trouble and wear than are inevitable in the case of the stone.

Historical documents, rare books, valuable manuscripts, &c., are reproduced by the department; but the practical work which is done by photo-zincography, in connection with the Ordinance Survey of Great Britain, is the reduction of the original $\frac{1}{2500}$ th scale plans to the six-inch scale, and the production of plans of that publicly convenient size.

The negative is obtained by the ordinary collodion process, developed with iron. The glass is dipped three or four times in a bath of bi-chloride of mercury; is then subjected to a stream of cold water;

and is immediately intensified by having hydro-sulphate of ammonia poured over it, a slight rinsing being afterwards necessary. The negative thus intensified is scarely at all liable to injury by friction or dust, or to deterioration in any respect.

The negative is put into an ordinary printing-frame, and is covered with a sheet of paper, which (on the side next the negative) has been coated with a not strong solution of bi-chromate of potass and gelatine. The action of light, where it can pass through the negative, renders this coating insoluble by water. A few minutes' exposure to the sun's rays, is generally sufficient for the production of the "impression" needed at this stage. The tint of the paper can be seen gradually deepening; but success, of course, depends upon the condition of the atmosphere, and upon the eye, or the "feeling" of the operator enabling him to decide how long the exposure shall be continued.

The faint photograph, carefully kept from the light, is next taken to a printing-press, and laid face downwards upon a stone or plate coated with ink—printers' ink made "somewhat stiff"—and the ingredients of which are indicated in the appended List of Chemicals. A single pull of the press thoroughly covers the paper with ink, and care in removing it from the stone or plate is necessary.

The next process is to "float" the photograph in a water-bath, temperature 100°. It should be dexterously and lightly slid along the surface of the water, the inked side being downward, so that the uninked side is not wetted. After it has remained thus for half a minute and more, the photograph must be removed and reversed. A bulging of the inked side will soon be perceptible, giving a rude outline of the plan or drawing photographed. Again the "feeling" of the operator must be the guide as to sufficient "floating," the object being to allow the water to attack the original coating of the paper, and the ink upon it, at all points where exposure to light in the printing-frame has not rendered the coating insoluble. When sufficiently "floated," the photograph must be drawn twice or thrice through the bath, and it must then be laid upon glass, placed on a slight slope. "A piece of old, very soft sponge, and a light, appreciative hand," are needed for the next stage; which is the absolute removal of the ink and the coating from all the parts which have been attacked by the water. Delicate applications, and frequent rinsings of the sponge are necessary; and there is left a minutely accurate and perfect reduction of the original plan or drawing.

If so desired, the paper may be dried by means of hand-fans, and by removals from the glass, to be ready within a quarter of an hour for the transfer process. But I saw used for that purpose a copy which had been prepared as far as the stage described two or three days previously, and which had been left to dry unaided.

The zinc plate, when prepared for the transfer, has a coating of sand, found in the neighbourhood of the department, and applied by means of a soft pumice-stone and water. I was told that Dr. Hector would have no difficulty whatever in obtaining proper sand, but it is necessary that that which is used should have been passed through a very fine gauze sieve. The inked photograph is laid face downward upon the plate, covered with two or three sheets of paper, and "pulled," and very carefully renewed, after being lightly sponged with water. The state of the photograph after transfer is shown by the paper marked A. A weak solution of gallic acid and gum Arabic is poured upon the plate, and a sponge is lightly passed over the surface. The plate is then fanned for ten or fifteen seconds, to increase action of the acid, and is again used, as is also the sponge, and the fanning is renewed. When the acid has been wiped off, turpentine is poured upon the plate, which enables all the ink to be removed; and the plate is then ready for printing. The use of a strong glass does not enable any change in the surface of the plate to be detected; but it is probable that those portions upon which ink has not been impressed are coated with a very light powder of oxide of zinc. The drawing or plan is faintly, but distinctly visible. The use of the fan cannot be dispensed with, nor will the proper effect be produced if a strong solution of the acid is used.

A thousand or more copies can be printed in the ordinary mode from a plate prepared as described; and when one transfer is no longer needed, the use of fine pumice-stone, with fine sand and water, soon fits the plate for receiving another.

The paper marked B was the first impression printed from the transfer I saw effected; C was the second; and D, the third, was exhibited by the foreman as a good impression, the ink having taken properly.

Other specimens of the work done by the Department were given to me by Sir H. James.

The appended estimate, with list, &c., was specially prepared from one which the Department furnished some time since for the Indian Government. It includes all necessary apparatus, chemicals, &c.; but the quantities are the least which, in the opinion of Sir H. James, should be obtained as a beginning.

It will be seen that the stated cost of apparatus of all kinds, together with a supply of chemicals, &c., roughly estimated for a year's work, is £344 12s. 2d.

Sir H. James authorized me to state that any further information, if needed, and any assistance in respect to obtaining apparatus and materials, would be given by him.

London, 16th May, 1871. E. Fox.

SURVEY OF NEW ZEALAND.—Primarily for Railways and Registration, for Copying MS. Plans by Photo-zincography.

Estimate for One Camera and One Press.

	£	s.	d.
Camera and photographic materials	218	14	3
Lithographic Press and materials	100	7	11
Paper	25	10	0
	£344	12	2

LIST of Photographic Apparatus and Chemicals required for taking Negatives, and printing Copies and Reductions of Plans, and the probable quantity of Chemicals which will be necessary for one year, together with the names of the persons from whom these articles can be purchased, and the probable cost.

J. H. Dallmeyer, 19, *Bloomsbury Street, London.*	£	s.	d.
1 Camera for plates, 16×16 inches, each £30	30	0	0
1 Camera Stand, each £5 10s.	5	10	0
1 Lens, each £18	18	0	0
1 Set of Frame Work, each £16	16	0	0
1 Mahogany Board, 50×32 inches, each £3 5s.	3	5	0
2 Printing-Frames for plates, 16×16 inches, each £1 10s.	3	0	0
	£75	15	0

Chance Brothers, Birmingham.	£	s.	d.
12 Doz. Glass Plates, 16×16 inches, per doz., £1 15s.	21	0	0
6 Doz. Glass Plates, 11×14 inches, per doz., £1 5s.	7	10	0
6 Doz. Glass Plates, 10½×8 inches, per doz., 15s.	4	10	0
	£33	0	0

E. Bumpus, 6, *Holborn Bars, London.*	£	s.	d.
One copy of Hardwick's Photography.	0	6	9

L. P. Casella, 51, *Hatton Gardens, London.*	£	s.	d.
2 Thermometers	1	10	0

R. W. Thomas, 10, *Pall Mall, London.*	£	s.	d.
2 Baths for Plates, in mahogany cases, 16×16 inches, each 80s.	8	0	0
2 Developing Dishes (porcelain), 19×19, each 30s.	3	0	0
Graduated Glasses, 2 20oz. at 2s. 6d., 2 10oz. at 2s., 2 6oz. at 1s. 3d., 2 4oz. at 1s. 1d.	0	13	8
6 Glass Rods, each 3d.	0	1	6
6 Glass Funnels, each 10d.	0	5	0
1 Filtering Stand	0	10	6
1 Pneumatic Plateholder	0	3	6
4 Delph Jugs (quart), each 2s.	0	8	0
2 Porcelain Dishes, 20×20, each 20s.	2	0	0
2 do. do. 20×16, each 12s.	1	4	0
2 Pestles and Mortars (Wedgwood), each 4s. 9d.	0	9	6
1 Scales and Weights (apothecaries set)	1	16	0
1 Specific Gravity Bottle	0	5	0
1 Glass Spirit Lamp	0	5	0
1 Silver Metre and case	0	3	6
4 Glass Dippers, each 1s. 6d.	0	6	0
1 Developing Stand	0	7	6
1 Weighing Machine, with weights	1	1	0
2 Sponges, each 10s.	1	0	0
6 yards of Diaper for Towels, at 1s. 6d. per yard	0	9	0
5 pints of Alcohol—Absolute, at 5s. per pint	1	5	0
15 pints do. Common, at 3s. 6d. per pint	2	12	6
3 lbs. Acid, Citric, at 2s. 8d. per lb.	0	8	0
10 pints Acid, Glacial Acetic, at 4s. per pint	2	0	0
5 ozs. Acid, Pyrogallic, at 4s. per oz.	1	0	0
30 pints Ammonium, Hydrosulph., at 2s. per pint	3	0	0
10 pints do. Liquor, at 1s per pint	0	10	0
40 pints Collodion, at 10s. per pint	20	0	0
5 lbs. Cotton Wool, at 3s. per lb.	0	15	0
10 lbs. Gelatine (Nelson's best patent fine cut), at 4s. 6d. per lb.	2	5	0
2 ozs. Gold Terchloride, at 64s. per oz.	6	8	0
10 lbs. Iron Proto-sulphate, at 6d. per lb.	0	5	0
2 lbs. Kaolin, at 8d. per lb.	0	1	0
6 lbs. Mercury, Bi-chloride, at 4s. per lb.	1	4	0
15 quires Resinized Paper, at 8s. per quire	6	0	0
5 quires Filtering Paper, at 1s. per quire	0	5	0
1 ream Bank Post Paper	4	0	0
10 books Litmus Paper, at 2d. per book	0	1	0
10 lbs. Potassium Bi-chromate, at 1s. 6d. per lb.	0	15	8
6 lbs. do. Cyanide, at 3s. 6d. per lb.	1	1	0
5 ozs. do. Iodide, at 1s. per oz.	0	5	0
6 lbs. finely prepared Tripoli, at 4s. per lb.	1	4	0
5 pints Rectified Ether, at 6s. per pint	1	10	0
60 ozs. Silver, Nitrate of (fused), at 3s. 9d. per oz.	11	5	0
60 ozs. do. do. (common), at 3s. 5d.	10	5	0

	£	s.	d.
10 lbs. Sodium, Acetate, at 1s. 6d. per lb.	0	15	0
80 lbs. do. Hyposulphite, at 5d. per lb.	1	13	4
2 gallons Turpentine, at 10s. per gallon	1	0	0
12 pints Crystal Varnish, at 5s. per pint	3	0	0
10 ozs. Iodine, at 2s. per oz.	1	0	0
	£108	2	6

Messrs. Hughes and Kimber, West Harding Street, Fetter Lane, E.C.

	£	s.	d.
1 Lithographic Printing Press	35	0	0
3 Zinc Tympans	0	12	0
2 Boxwood Scrapers	0	10	0
1 Elastic Bed	0	10	0
1 Mahogany Block	2	17	6
4 Printing Rollers	3	0	0
2 Ink Slabs	0	10	0
2 Palette Knives	0	3	0
4 Sieves	2	0	0
20 yards of Canvas	0	16	8
10 lbs. Printing Ink	5	0	0
10 lbs. middling Varnish	0	17	6
2 lbs. thick Varnish	0	4	0
6 lbs. thin Varnish	0	9	0
Cans for ditto	0	6	0
5 lbs. Vermilion	1	5	0
5 lbs. Blue	1	5	0
5 lbs. Brown	0	15	0
5 lbs. Yellow	0	15	0
½ lb. Writing Transfer Ink	0	12	6
3 Zinc Mullars	0	15	0
1 Tool for cutting Zinc Plates	0	7	6
1 Stone Mullar	0	6	6
1 Scraping Tool	0	8	6
2 Tools with extra-plane irons for smoothing plates	1	4	0
25 lbs. Pumice Stone	0	9	0
20 lbs. Gum Arabic	0	15	0
20 lbs. Zinc Polishing Stone	0	6	6
5 gallons Sifted Sand	0	15	0
50 D. E. Zinc Plates, (cases hooped and battened)	35	0	0
2 Large Sponges	0	4	0
12 Small Sponges	0	3	0
1 lb. Nutgalls	0	2	8
½ lb. Phosphorus in Sticks	0	2	9
2 Engravers Etching Points	0	1	8
1 Paper Knife	0	3	0
12 Razor Blades	0	7	6
1 Large File	0	2	6
20 lbs. Snake Stone	0	6	8
½ lb. Caustic Potash	0	1	3
2¼ lbs. Burgundy Pitch	0	4	6
6 ozs. Palm Oil	0	1	6
6 ozs. White Wax (For carbon transfer ink)	0	1	3
12 ozs. Asphaltum	0	3	0
3 lbs. Middle Varnish	0	6	0
1 pair Roller Handles	0	1	6
	£100	7	11

Messrs. Hollingsworth, Turkey Mills, Kent.

	£	s.	d.
2 reams Lithographic Printing Paper, at 9s. 5d....	18	10	0
5 quires D. E. Lithographic Tracing Paper, at £1 4s.	6	0	0
10 quires Proving Paper, at 2s.	1	0	0
	£25	0	0

No. 2.

REPORT on the Photo-lithographic Process, by Dr. HECTOR.

THE Photo-lithographic process was first applied to the reduction of the amount of draughtsman work in the Land and Survey Department of the Victorian Government, having been invented, or at least

perfected, by Mr. Osborne, one of the staff of that Department in the year 1861, and the right of using it purchased from him by the Government. It possesses the great advantage of enabling many absolutely accurate copies on any scale to be made of survey maps or plans. In Victoria, I believe that there is only one map boldly drawn on a large scale, prepared direct from the field books, and on which every detail is put that can be required for any purpose. When, for instance, the Crown grant is to be prepared of any section, a reduced photograph is taken of that portion of the maps, and printed actually on the back of the grant, several copies being taken without any possibility of discrepancies arising from errors in drawing. Large and beautifully executed maps, teeming with information, abound in Land and Survey Offices in the Colony, which are inaccessible to the public, because they are on too large a scale for handy tracings, and their reduction by hand would not only be expensive, but compel the omission of many details. This has been particularly felt in the mining districts, as at the Thames, and the want has been partially met in several cases by ordinary photographs, executed by private enterprise. But they are not only expensive, but smudgey, as may be judged from the specimen attached.

In the case of plans to be attached to specifications, the use of such an art is obvious, as many copies of the plans could be prepared and distributed to different places where tenders are being called for, instead of requiring all to be referred to one office.

Working drawings in the same way might be multiplied and reduced to a convenient size, both for use and for preservation; but all these are applications on which it would be desirable to obtain the opinion of the gentlemen who conduct the business of these departments. I mentioned the matter, among others, to Mr. Vogel, as one on which information would be useful, as it has always been stated that the introduction of this invention has effected not only a great saving, but has also extended the application of Government printing in every branch.

The improvement on Osborne's process, adopted by the English Ordinance Survey, of substituting the cheaper and more manageable zinc plates for stones, is evidently a great advance, but I observe in a late report, that in preliminary experiments, for the purpose of introducing a similar process to that which is in use in Victoria, into the Government Printing Office at Sydney, a very marked improvement in another part of the process has been effected by Mr. Sharkey. This avoids the application of ink to the photograph, the floating in water, and all other delicate manipulations, the print from the negative being laid direct on the surface of the stone, passed through the press, and then peeled off, as in the ordinary transfer. A printing-ink is then applied which develops the impression; and the new process is stated to be more speedy than the old, requiring less delicate manipulations, and no special skill, and is quite as capable of producing fine work. If these two improvements could be combined, so that Mr. Sharkey's were applied to zinc plates, instead of stone, it would be a still further advance towards perfecting the process.

I observe, among the samples of the art enclosed, with Mr. Vogel's letter that there is one in which the great desideratum of copying half-tint shades appears to have been achieved, but no explanation of this modification of the process is given. Both Mr. Osborne's and Mr. Sharkey's plans are only able to copy work that consists of direct lines and dots; but from the specimen I refer to, it is evident that the process might be applied to shaded drawings, and what is still more important, to the copying of natural objects.

JAMES HECTOR.

26th July, 1871.

No. 3.

The Hon. JULIUS VOGEL to the Hon. W. GISBORNE.

SIR,— Charing-Cross Hotel, London, 1st June, 1871.

I have received from Mr. E. Fox some particulars, additional to those sent *vid* Brindisi, respecting the photo-zincographic process; and I have pleasure in forwarding them to you.

I have, &c.,

The Hon. the Colonial Secretary, New Zealand. JULIUS VOGEL.

Enclosure in No. 3.

Mr. E. FOX to the Hon. JULIUS VOGEL.

SIR,— Charing-Cross Hotel, London, 1st June, 1871.

I have the honor to present to you detailed statements as to the composition of solutions and an ink used in the photo-zincographic process, as carried out at the Ordnance Survey Office, Southampton; the information being supplementary to the account of that process contained in my report dated London, 16th May.

I have, &c.,

The Hon. Julius Vogel, &c. E. FOX.

Sub-Enclosure to Enclosure in No. 3.

PHOTO-ZINCOGRAPHY.

Composition of the Sensitizing Solution.

Potash Bichromate	1½	ounce.
Patent Gelatine	3	ounces.
Water	40	ounces.

Lithographic Transfer Ink.

Lithographic Printing Ink	8	ounces.
Middle Lithographic Varnish	4	ounces.
Burgundy Pitch	3	ounces.
Palm Oil	$0\frac{1}{2}$	ounce.
White Wax	$0\frac{1}{2}$	ounce.
Asphaltum	1	ounce.

The lithographic printing-ink is of a superior quality, known to the trade as "Best Chalk Litho Ink." The Ordnance Survey Department obtains it from Benjamin Whinstone, 100, Shoe Lane, City, London.

Etching Solution.

Four ounces of Aleppo galls are bruised, and steeped in three quarts of cold water for twenty-four hours. The water and galls are then placed in a vessel over a fire, and allowed to boil up. The decoction is then strained. One quart of the decoction of galls is added to about three quarts of gum-water, which should be about the consistence of cream; and to the mixture is added about three ounces of a solution of phosphoric acid, prepared as follows:—Sticks of phosphorus are placed in a pint bottle of water, the bottle being stopped by a cork in which a small hole has been cut. The bottle is three-quarters filled with water; and the ends of the sticks of phosphorus rise above the surface, and become oxydised by the air admitted into the bottle. The phosphoric acid, as fast as it is formed, is dissolved by the water. In a few days the solution is strong enough for use.

Before adding the acid to the decoction of galls and gum-water, it should be tested on a piece of polished zinc, when it should merely effervesce. If it acts strongly on the plate it should be diluted.

One of the plates sent to the Hon. the Colonial Secretary by the last mail, shows a covered van, with a man standing beside it. Sir H. James gave the plate, or print, to me as a sample of an attempt to reproduce half-tint drawings or engravings, which he said had created much interest; but he added, that the art had not been, in every sense, completed.

Samples of paper, before and after being coated with the sensitizing solution, are sent herewith.

E. Fox.

London, 1st June, 1871.