

# Survey of India.

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## NOTES

ON

### THE "VANDYKE" OR DIRECT ZINC PRINTING PROCESS,

WITH DETAILS OF APPARATUS & CHEMICALS REQUIRED FOR A SMALL SECTION.

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COMPILED IN  
THE PHOTO. & LITHO. OFFICE, SURVEY OF INDIA,  
UNDER THE DIRECTION OF  
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## NOTES ON THE PRACTICAL WORKING OF THE "VANDYKE" OR DIRECT ZINC PRINTING PROCESS.

*The Original.*—The best original for the process is a perfectly drawn tracing on blue tracing cloth. Perfectly drawn means that *every line must be absolutely black and opaque*: a good test is to hold the tracing up against a very strong light and carefully examine it for any sign of greyness or transparency in the lines. If found grey or broken it should be returned to the draughtsman for re-inking.

Drawings on paper will also give good results. A smooth wove paper preferably of a bluish shade should be used. Even more care must be taken in drawing on paper as owing to its greater opacity the lines will look blacker than they really are.

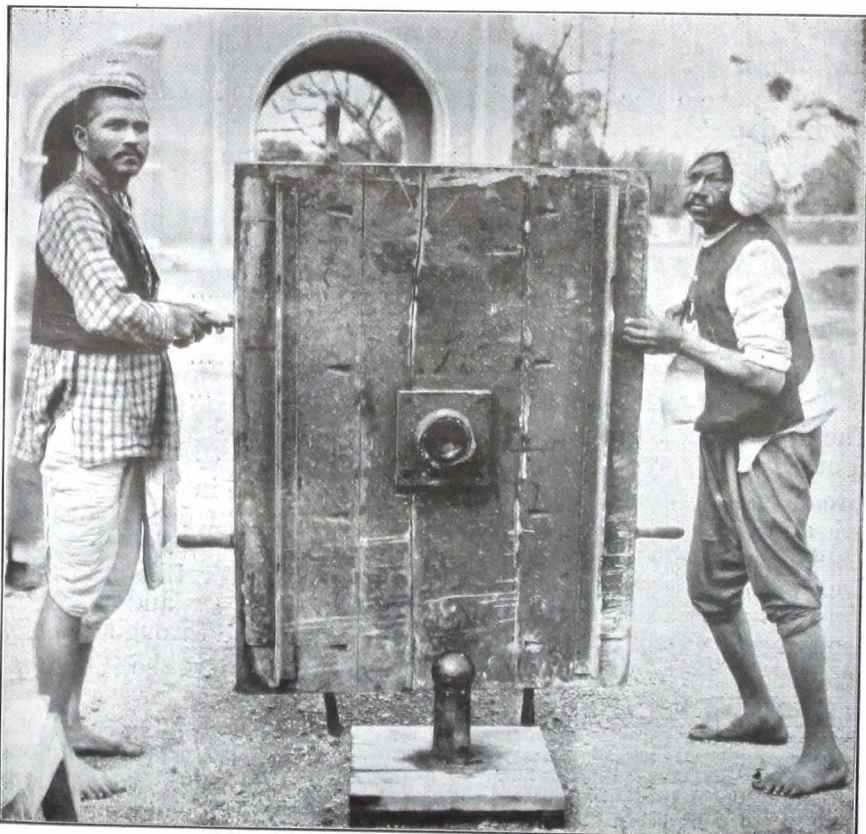
Yellow tracing paper or cloth is quite unsuitable and should never be used.

A good quality Indian ink freshly made up should be used. When drawing on tracing cloth a slight addition of ox-gall will make the ink "take" better. Heavy block letters or border lines may be gone over twice, using "Photopake" the second time.

There are six operations in producing a printing plate, *viz.*:—

- |                 |                     |
|-----------------|---------------------|
| 1.—Graining.    | 4.—1st Development. |
| 2.—Sensitizing. | 5.—Inking.          |
| 3.—Exposing.    | 6.—2nd Development. |

*Graining.*—A wooden trough one foot larger each way than the largest plate to be used, is required as shewn in the illustrations. A socket is provided on the bottom of the trough which is mounted on a wooden post of a suitable height to enable four men sitting to be able to rock the trough backwards and forwards by the aid of the handles provided.





The graining is done with fine river sand sifted through a 120 mesh sieve and water, the grinding action being done with either zinc balls or glass marbles of about  $\frac{3}{4}$  to 1 inch in diameter made to move backwards and forwards over the plate on rocking the trough with a circular tilting motion. Four men is the normal squad for working the box and they can grain 8 plates in a working day of 6 hours.

Old plates with work on them are cleaned by washing off the ink with turpentine and then smearing over with a strong solution of crude caustic potash (1 lb. caustic, 30 oz. water); this is followed by a solution of sulphuric acid (1 to 5); the plate is then well washed and grained.

When the graining is complete the plate should appear perfectly smooth, with an even matt surface.

The plate is then thoroughly well washed, back and front, the surplus water squeezed off, and the plate quickly dried by heat. This is very important; otherwise the surface becomes oxidised and will give trouble in the after processes.

No pains should be spared to get perfectly grained plates as the success of the work depends on that.

Should a graining machine be installed, the time required to grain any size of plate is half to three-quarters of an hour.

#### *Sensitizing—*

##### *Sensitizing solution—*

China glue ( bazar )	...	...	...	1 oz.
Ammonium bichromate ( Merk's pure )	...	...	...	50 to 85 grains.
Frankfort black	...	...	...	50 grains.
Water	...	...	...	4 oz.

The larger proportion of Bichromate is found more suitable for originals drawn on thick paper.

Break or cut the glue into small pieces and soak in 3 oz. of water till swelled and soft, then dissolve in a water bath; an open stove may be used but great care is required to prevent "burning". The glue being dissolved add the bichromate in fine powder, and stir till dissolved. The frankfort black is then well ground in 1 oz. of water and added to the solution, and the whole thoroughly mixed and strained through fine cloth.

The room used for coating the zinc plates should be illuminated by yellow light; either yellow glass windows or ordinary windows covered with two thicknesses of deep yellow cloth will suffice. It is not necessary but preferable to make up the solution in the coating room. Place the clean zinc plate on a sheet of paper a few inches larger than the plate, and coat by means of a soft sponge. Two sponges should be used, one for giving the preliminary coat and the other for finishing off.

The coating should not be thick and should show no bad streaks. A good deal of knack is required to do this quickly and successfully. When using the finishing sponge the strokes should be given the long way of the plate, finishing by two the short way one across each end.

The plate is then dried by heat and should not be made hotter than can be comfortably borne by the back of the hand. If this heat is exceeded the plate will be spoilt.

All operations from the coating of the plate to the 1st development must be done in a yellow lighted room, and great care should be taken that no daylight reaches the plate as even a momentary exposure will cause trouble.

*Exposure.*—The tracing to be copied is placed in the printing frame and the sensitized plate on top, the backing put in place and securely locked up. For sizes up to 36" × 24" the ordinary box pattern printing frame will give good contact, but for anything larger a pneumatic frame is necessary. Whichever pattern is used, care must be taken that the plate and tracing are in perfect contact, otherwise good results are impossible.

Direct sunlight is best for exposure and no fixed time can be given. A few trials will indicate the correct exposure. Length of exposure and class of original should be noted with a view to obtaining a correct scale of exposures for each class of original.

*1st Development.*—The exposure being complete the frame is taken into the yellow-lighted room, and the plate removed to a sink and well washed in running water. If the exposure has been correct, the lines of the drawing will develop out as sharp lines of clean zinc. Over exposure is denoted by the lines refusing to develop, or, where the exposure is only slightly in excess, by a slight scum on the lines; this can sometimes be remedied by gently passing a piece of soft cotton wool over the plate under running water, but it requires a light hand.

Under exposure is shown by the lines developing up thick and open, and the ground breaking away in spots or patches. If the exposure has been much deficient the whole film will wash off the plate. The development being finished, the plate is drained for a few seconds and is then blotted off with smooth sheets of clean blotting paper, which should not be rubbed but only patted: this prevents the wet paper being damaged and it can be dried and used over and over again. The plate being thoroughly blotted off is then dried, and all defects such as spots, scratches on the film, finger marks, &c., &c., gummed out with a thin solution of gum arabic; a small quantity of aniline violet should be added to the gum to make the touching up visible. The edges of the plate and large patches of ground with no work can be gummed in by a small sponge. For smaller parts and working close to lines or lettering a fine sable hair brush should be used.

The gumming out finished, the plate is dried and is then ready for inking up.

#### *Inking.*—

##### *The Ink*—

1	{	Lithographic writing ink	...	4 sticks (4 oz.).
		Burgundy pitch	...	8 oz.
		Turpentine	...	20 oz.
2	{	Bitumen	...	16 oz.
		Benzole	...	10 oz.
		Turpentine	...	20 oz.
3	{	Special zinco. ink	...	1 lb.
		Lucca oil	...	2 oz.

Melt the burgundy pitch and then add the sticks of litho. writing ink, stirring till all is dissolved. Remove from the fire and away from lights, and add 20 oz. of turpentine, a little at a time, stirring well.

Grind the bitumen to a fine powder, and put in another dish, add the benzole, let it stand for a few hours stirring occasionally till all the bitumen is dissolved, then add the remaining 20 oz. turpentine.

The special zinco. ink is put in a small iron pot with two oz. lucca oil, and the oil and ink mixed by the aid of gentle heat and stirring : this is a slow job and must be carefully done as the ink is easily burned. When the zinco. ink and oil have been mixed, a little of No. 2 is added and again well mixed ; by gradually adding No. 2 the whole can be got into solution. When solution is complete No. 1 is then added and if the mixing has been properly done the ink should be of a smooth oily consistency and free from lumps of any kind. The ink is now strained through a cloth to remove any insoluble particles, and will keep indefinitely in a wide-mouthed stoppered bottle. The solution should always be well stirred up and vigorously shaken before taking out a supply for the day's work since the ingredients are inclined to separate after standing for some time.

The zinc plate to be inked up is laid on a sheet of paper and a little of the ink solution poured on the centre and then spread evenly and thinly over the plate by means of a cloth pad ; if the ink is too thick to do this comfortably it may be thinned by adding a little of—

Turpentine	... 4 parts.
Benzole	... 1 part.

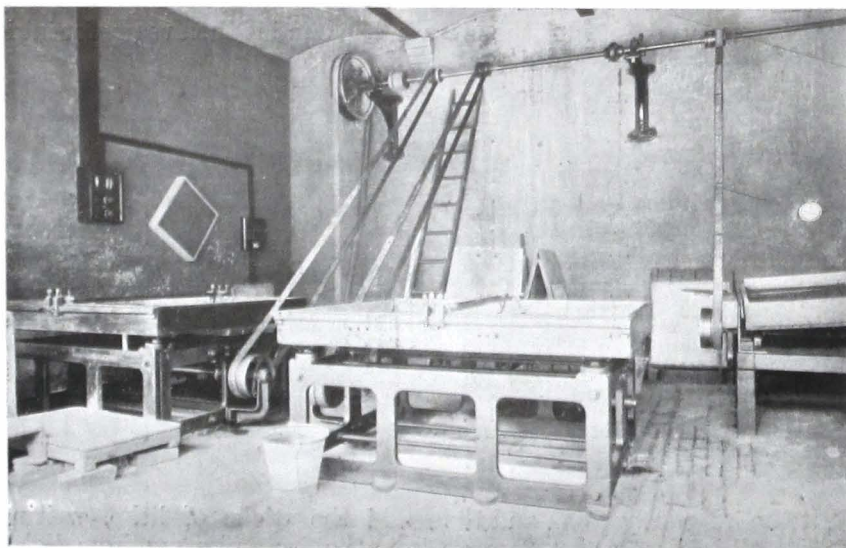
After inking up, the plates are put out in the sunlight for a few hours to thoroughly dry.

After drying the following powder is well rubbed into the ink with a soft cloth :—

Powdered French chalk	... 1 part
Powdered black lead	... 1 part

*2nd Development.*—Immerse the plate in hot water for from 15 to 30 minutes and then put under running water, and develop with a soft sponge or a plug of cotton wool.

When development is nearly complete the plate is immersed for about 1 minute in a 1—500 solution of hydrochloric acid, then well washed, and the final cleaning completed with water and carbonate of magnesia : all spots, dirt, &c., are removed by using the magnesia powder with a pointed stick or a piece of felt. The plate is finally rinsed and wiped with a clean cloth and hung up to dry. When dry it is ready for the printer.



Electric power Graining Machines as used in the Photo.-Litho. Office, Calcutta.

The following apparatus and chemicals would be required to start a small "Vandyke Process" Section. All these can be obtained locally in any large city in India with the exception of those where the name of the firm from whom they can be obtained is given in brackets:—

*For the preparation of the plate.*

	Rs.	a.	p.
1 Graining machine (Messrs. Furnival & Co., London) ...	1,000	0	0
1 Motor for do. ( do. do. ) ...	400	0	0
Zinc Balls, 10,000 ...	240	0	0
Hunters improved pneumatic printing frame, 63" × 39½" (The Calcutta Phototype Co.) ...	390	0	0
Drying Box, 5' × 5' × 6' 8", teakwood frames, enclosed all sides with sheet iron ...	100	0	0
Lightning Geyser, Ewarts ...	100	0	0
3 Sink tables, 10' × 3', zinc lined ...	75	0	0
Teakwood table, 14' × 3' ...	60	0	0
Almirah ...	50	0	0
Teakwood dish, 50" × 40" × 4", inside pitched ...	31	14	4
1 Sheet thin zinc, 45" × 34" ...	4	10	8
1 Do., 42" × 31½" ...	4	0	0
1 Do., 32" × 24" ...	2	4	0
1 Do., 21" × 15" ...	1	1	3
2 Measure glasses (20 ozs.) ...	3	10	6
Velvet sponges, ½ lb. ...	20	0	0
1 Brush (double size of No. 12) ...	6	12	0
3 Brushes (writing R. S. H. No. 3) ...	1	0	0
Small kerosine stove ...	3	0	0
Sauce pan, enamel iron with handle, 6" dia. ...	1	0	0
2 Enamel cups, 6" diam. ...	0	10	0
Palette knife, 12" ...	3	4	0
4 Aprons, drill cloth ...	3	4	0
Blotting paper ...	½	ream.	
Cotton wool (country) ...	5	lbs.	
Mul-mull ...	1	than.	
Dusters ...	6		
Felt ...	½	yard.	

When a graining box is used in lieu of a graining machine the cost of the box is about Rs. 30 (including setting up); 4 stools about Rs. 3 each.

If gas is not laid on, an Ewarts oil geyser could be used, obtained from Messrs. T. E. Thompson, 9, Esplanade Road, Calcutta, Price Rs. 215.

Zinc balls are made for the Survey of India at the Calcutta Mint from old zinc plates. If glass marbles are used instead the cost of 10,000 would be Rs. 50.

*List of Chemicals.*

China glue	...	...	...	16 lbs.
Ammonium Bichromate	...	...	...	$\frac{1}{2}$ kilo.
Frankfort black	...	...	...	1 kilo.
Special zinc ink	...	...	...	1 lb.
Bitumen	...	...	...	1 lb.
Burgundy pitch	...	...	...	$\frac{1}{2}$ lb.
Lucca oil	...	...	...	$\frac{1}{2}$ pt.
Hydrochloric acid	...	...	...	15 lbs.
Black lead	...	...	...	1 lb.
French chalk	...	...	...	1 lb.
Gum arabic	...	...	...	2 lbs.
Magnesia powder	...	...	...	5 kilos.
Kerosine oil	...	...	...	1 tin.
Rubber tubing, red, $\frac{1}{2}$ " int. diam.	...	...	...	4 yards.
Turpentine	...	...	...	3 gallons.
Methyl, violet dye	...	...	...	1 lb.
Dick	...	...	...	1 yard.
Rubber tubing, grey, for suction pump, $\frac{3}{16}$ " int. and $\frac{1}{2}$ " ext. diam.	...	...	...	4 yards.
Benzole	...	...	...	1 gallon.
Litho. writing ink	...	...	...	2 sticks.

*For zinc printing.*

	Rs.	a.	p.
1 Hand Press (D. E.), (Hughes & Kimber, London, E. C.)	...	550	0 0
1 Litho. iron bed for press, D. E., (Furnival & Co.) or (A. W. Penrose & Co., London, E. C.)	...	420	0 0
Plates, 100, Double Imperial	...	453	6 8
Inks, 50 lbs., chalk black, Litho. No. 1, Winstone's	...	275	4 2
Sponges 1 lb., common	...	28	0 0
4 Hand rollers, Litho., French calfskin, 12"	...	40	0 0
Gum arabic (Senagal) soluble, 100 lbs.	...	53	2 0
Litho. thin varnish, 10 gallons	...	52	8 0
Litho. writing ink, 5 sticks, Vanhymbecks	...	12	8 0
Sulphuric acid, 50 lbs.	...	9	14 4
Caustic, 50 lbs., potash crude	...	16	10 8
Brushes, pens, &c.	...		
2 Palette knives, 12"	...	6	8 0

To the above estimate must be added the cost of installing the various appliances, the laying on of water and where a graining machine is used instead of a graining box the cost of installing the machine and the motor. The monthly cost of gas and electricity consumed must not be lost sight of.

One operator and two coolies can produce 10 to 15 plates per day.

The time required to prove one plate would be  $\frac{1}{4}$  hour and to print 100 copies of the same about 4 hours.

These figures are average and approximate only dependent of the skill of the operator. The cost would be as given in the table below:—

	Double Imperial.	Double Elephant.	Imperial.	Foolscap.
	<i>Rs. As. P.</i>	<i>Rs. As. P.</i>	<i>Rs. As. P.</i>	<i>Rs. As. P.</i>
Preparation of plate ...	0 10 0	0 9 0	0 5 0	0 3 0
Proving ...	5 0 0	4 0 0	3 0 0	2 0 0
Hand printing per 25 pulls ...	5 0 0	3 0 0	2 0 0	1 8 0
Paper (Litho.) ...	3 0 0	2 5 0	1 8 0	0 12 0

Only Double Imperial plates have been included in the estimate of articles required as these can be cut down to the other sizes when necessary. This is the cheapest method.

The staff required would be one operator at approximately Rs. 35 rising to Rs. 100. Two to three coolies at Rs. 8 to assist the operator.

A Second operator would be required for printing at approximately Rs. 25 rising to Rs. 35 with two coolies at Rs. 8 per mensem to assist him.

Four coolies on Rs. 8 to work the graining box or where a graining machine is installed, one cooly on Rs. 12 to Rs. 20 with an assistant on Rs. 8.