



HOW THE BRITISH ADMIRALTY CHARTS ARE PRODUCED.

(Extracts from "*Nautical Magazine*" — May-June 1927).

REPRODUCTION,

All stages of the work of actual reproduction of the Admiralty Charts are now carried out by a branch of H. M. Stationery Office in a special building, which also houses the Admiralty Chart Establishment, the clerical section of the Department concerned with the issue of hydrographic publications. A cartographer, who is assisted by a staff of draughtsmen, acts as a liaison officer between the Department and the Stationery Office.

Methods of reproduction of charts vary greatly in different countries, depending largely on the nature of their productions. For British Admiralty Charts of a permanent nature, no satisfactory substitute has been found for the age-long method of engraving the work upon a copper plate; this is still the basis of practically all our charts, though they are no longer, in the main, printed from these plates.

In preparing a new plate, the borders and graduation are first marked out and the main lines cut. The work is then laid down on the highly polished surface in one of two ways, the plate is coated with a thin film of wax and if the tracing sent is small and the work clear and open, it is laid face downward on the wax surface, fitting exactly by the marks given, and the work marked through on to the wax with a fine pointed style. The most usual method is for the engraver to make a tracing or a series of tracings of the work with a style on a sheet of glass-like gelatine. Into these cuts he rubs a red powder which is transferred to the wax when the gelatine is laid face downward on it. Through these marks on the wax the work is scratched on to the copper with a needlepoint and the wax then polished off. With the original in front of him, the engraver proceeds to the actual cutting of the work which, it will be understood, all appears on the copper backwards. When the difficulties of this work are realised and the neatness and the uniformity of the result considered, it will not be wondered at that an apprenticeship of seven years is required for a professional engraver.

If a correction to a copper plate already engraved has to be made, the copper is beaten up from the back in the area concerned and then scraped and re-surfaced on the front; damaged work around the correction has to be reinstated and the new work engraved in the clear space obtained. When a copper plate has to be printed from, its face is protected by an electrolytic deposit of steel, as otherwise the softness of the metal would allow it to be worn by repeated contact with the paper, resulting in the work becoming shallow and finally failing to print. Some of the copper plates in daily use are nearly a century old and a few date back even farther. The copper has to be specially prepared by hammering to an optimum of hardness

and the surfacing is carried out so that no scratches or pit marks are left. The copper plate for an ordinary double elephant chart (about 42×28) weighs roughly 40 lbs. Engravers tell us that copper is not what it was in the old days; but very possibly John NORDEN and SPEED heard the same complaint in the early seventeenth century.

A much corrected copper plate may eventually crack in the thin portion. This can be treated in several ways; when a plate, in otherwise good condition, shows signs of becoming too thin in one place it can be brought up to the original thickness by an electrolytic deposit of copper on the back and so saved. But if it should have actually cracked, the patch so affected is cut clean out of the plate and the hole filled up by gradually depositing copper, the rest of the plate being protected with wax and a piece of surfaced plate being temporarily placed over the hole for the copper to form smoothly against. Sometimes, however, a plate will be badly buckled as a result of its thin patch or from other causes; there is then no remedy but to make a duplicate of the plate, for if the hole were patched the spring of the buckled plate in the printing press would cause the new copper to come away from the old.

Duplicate plates are of two kinds. The first method is to place the old plate in an electrolytic bath and to grow onto it a matrix plate. When completed this is an exact duplicate of the original plate, save that it is reversed, all the work being raised instead of hollow, and reading, of course, from left to right. This matrix is then placed in the bath, the cracked areas being scraped smooth, and a second plate grown by an electrolytic deposit, which, being again reversed, gives an exact duplicate of the original. The work in the cracked area is then engraved on the part left and after a revision for any small defects the plate is ready for use.

The second method of preparing a duplicate plate is to etch the work with acid. The surface of a copper plate is coated with a special preparation of bitumen which has the peculiar property that when it is acted on by light it becomes a hard surface impervious to the acid. An impression from the old copper plate is printed down onto this sensitised surface which is then exposed to diffused sunlight; after a few days, all parts of the bitumen (known as "the resist") not protected by the black ink of the impression are hardened and the rest, remaining soluble, can be washed off. Thus an exact print of the original plate is left exposed to the acid. The plate is then put over a bath, face downwards, and the acid is sprayed on to it from a large number of fine jets; a few moments suffice for the plate to be bitten to the required depth and after washing and treating to remove the "resist" an impression can be printed from the plate. The engraver can then improve any small defects and after revision the plate is available for use. Plates made by this method are known colloquially as "process plates", and it has one advantage over the electric plate that it can be made on a properly hardened copper, whereas the deposited copper is softer. On the other hand, the nature of the process tends to cause a slight thickening of the work so that it is not suitable for very fine or crowded detail.

A great deal of work of a temporary or quasi-permanent nature is now reproduced by lithographic methods. This process, accidentally discovered by the Bavarian, SENEFFELDER, towards the end of the eighteenth century, is based upon the antipathy between grease and water. The drawing is made on a special type of stone or upon the finely granulated surface of a zinc plate; the surface is kept perfectly clean of all grease or dirt and the ink used is made of greasy substances, combined with lamp black to enable it to be seen. When the plate is put in the printing press it is damped, and the moisture is held in the granulations: the ink from the rollers will then only adhere to the greasy portions and an impression can be taken from it. As with the copper-plate engraving, all work must appear reversed on the lithographic surface and the proper performance of this work calls for great skill that is only to be acquired after a long apprenticeship.

An increasing use is now being made of a combination of copper engraving and lithographic drawing for charts subject to the continual change in one portion, such as harbours and river entrances. The outline and topography and, possibly, more stable portions of the water-work, are engraved on the copper, the rest of the plate being blank. This can be transferred to a lithographic surface by means of an impression pulled with greasy ink on a plaster surfaced paper. When this work is on the stone surface, the rest of the water-work is drawn in thereon, thus saving the continual correction of the copper plate. Should a new edition of this sheet be required the process is gone through again and a new stone prepared.

Lithographic surfaces give excellent results for a time, but will not stand numerous printings, the work getting thicker; also the nature of the method makes the work more liable to damage and it cannot be repeatedly corrected without a tendency of the grease to spread.

PRINTING.

Although charts used to be printed almost entirely from the copper plate, the method has several disadvantages, the worst being that, in order to allow the paper to absorb the ink properly from the cuts, it has to be damped and thus the resulting print shrinks considerably on drying. Also the continual use of the copper plates leads to wearing of the surface in spite of its protection of steel and to a buckling of plates worn thin with many corrections. For these, and other reasons of economy, charts are now chiefly printed by lithography, an impression of the copper plate being taken in special ink as described above and laid down in a zinc surface. This zinc plate is then placed in a flat bed direct printing machine and, once it is "made ready", copies can be run off with great rapidity. As the only damping occurs in laying the transfer to the zinc, when it is under pressure, little or no distortion by shrinkage occurs. The drawback to this method is that the time taken to "make ready" on the machine makes it extravagant to print only a few copies this way, whereas on the hand-operated, copper plate press one proof is pulled at a time. Thus for a few copies of a large number of different plates, copper plate printing is quicker and more economical, but for a large number of copies of a few charts the lithographic machine is enormously more efficient.

When colours are introduced into printing, the lithographic method is essential, as the shrinkage on a copper plate proof would effectively prevent any possibility of the colours fitting the desired outline. A separate zinc plate is made for each colour, the black work being shown upon it in an indelible ink which does not print; the adjusting to get exact "register" in printing these colours may take some time and this, with the extra printings involved, adds greatly to the expense of producing charts of this nature.

The sections of charts in red and black that are appended to many Notices to Mariners are printed from lithographic stones, the work being transferred from the original plate. These are known colloquially as "blocks" from the fact that many years ago they were printed with the letterpress from actual photo-zinco blocks.

When the original of a chart is a lithograph, either a zinc plate or a stone, this is never used for printing purposes, but a transfer is made to a second zinc in order to preserve the original in good condition. If a copper plate is under correction so that it cannot be used for printing, a transfer to zinc is made unless there is already a printing lithographic plate in use. When the correction is completed and the new edition ready for issue, this zinc is put aside to be cleaned and used again, and a fresh transfer is made.

The nature of the plate used for printing any chart may now be found in the letters just inside the extreme south-east corner of the sheet; in cases where the plate is a transfer from some original, the year date in which that transfer was made is given. The following list will assist identification, the capital letter indicating the actual plate used, and the small letters the original, if that is not being printed from.

<i>C</i> = Copper	}	originals.
<i>P</i> = "Process"		
<i>E</i> = Electrotpe		
<i>Z</i> = Zinc		
<i>S</i> = Stone		

ZC } An original stone or zinc, a portion of the work on which has been transferred from an
SC } incomplete copper plate.

- Zc.Zp.Ze.*) Printing plates or stones made from complete
Sc.Sp.Se.) original copper plates.
- Zs.Zz.*) Printing plates or stones made from complete
Ss.Sz.) original lithographic plates or stones.
- Zsc.Zzc.*) Printing plates or stones made from composite
Ssc.Szc.) lithographic originals.

Certain other signs on the chart may be here explained as their meaning is not obvious at sight. Near the number of the chart, in the south-east corner, will be found figures in brackets, as for example (34.23 × 28.15). This shows the exact dimensions of the chart in inches, measured on the copper plate, along the innermost of all the lines of the graduation. These figures will be found of assistance if it is desired to ascertain what shrinkage has taken place in printing. Just outside the north border, at the eastern end of the sheet, will be found two numbers, as thus: — 62.27, indicating that the printing of this copy was done on the sixty-second day (or 3rd of March) of the year 1927.

