

PROCESS OF STEEL PLATING OF ENGRAVED COPPER PLATES FOR PRINTING HYDROGRAPHICAL CHARTS

in use at the ITALIAN HYDROGRAPHIC INSTITUTE

The steel plating of an engraved copper plate, for the purpose of printing, has for its object the protection of the engraving from wear when the inking is done, so that its usefulness is almost indefinitely prolonged, since the process of steel plating can be repeated an infinite number of times.

The workshop which is used for the steel plating of copper plates should be equipped with:

1. A dynamo, operated by any system, which is able to supply a current of very low tension (5 volts) but of high intensity (3-400 Amp.) provided with the rheostats necessary to regulate the tension and intensity.

2. A very strong vessel Fig. 1 (bath) of pitch pine wood, having interior dimensions of 130 $\frac{c}{m}$ in length, 52 $\frac{c}{m}$ in breadth and 110 $\frac{c}{m}$ in depth, lined on the inside with a coat of pitch. This is to contain the solution of 30 % ammoniated sulphate of iron in distilled water, and is provided with two ebonite mixers — Fig. 1 — worked mechanically, with the object of keeping the contents in a constant state of agitation, in order to prevent the inconvenience of having layers of different densities.

3. A cement basin or washing tank, having dimensions of 180 $\frac{c}{m}$ in length, 110 $\frac{c}{m}$ in breadth and 22 $\frac{c}{m}$ in depth, so that a copper plate, which, in the case of large hydrographical charts, may be 120 $\frac{c}{m}$ by 100 $\frac{c}{m}$, can be conveniently manipulated.

4. A strong and abundant flow of pure water above the vessel mentioned in N^o 3.

5. A wooden trestle with four legs — length 70 $\frac{c}{m}$; breadth 60 $\frac{c}{m}$; height 25 $\frac{c}{m}$ on which the copper plate can be placed when, during the different processes, it has to be manipulated in the last-mentioned vessel.

6. A covered, copperplated receptacle, rectangular in form, length 125 $\frac{c}{m}$; breadth 110 $\frac{c}{m}$; height 20 $\frac{c}{m}$, in which is boiled the copper plate, afterwards to be steelplated, in order that all greasy substances which would conceal or foul the engraving may be dissolved. The bottom of the interior of this receptacle should be fitted with three or four projecting angles, so that the plate does not rest on the bottom but allows the washing solution to cover it on both sides.

7. A gas — coal or electric oven of such a form and calorific power that the quantity of washing solution in the above mentioned copper receptacle can be brought to boiling point.

8. An iron anode of the best quality — length $120 \frac{c}{m}$; breadth $100 \frac{c}{m}$; and of $5 \frac{m}{m}$ thickness. This anode should always be greater than the plate to be steelated and should have on one of its longest sides, at about $20 \frac{c}{m}$

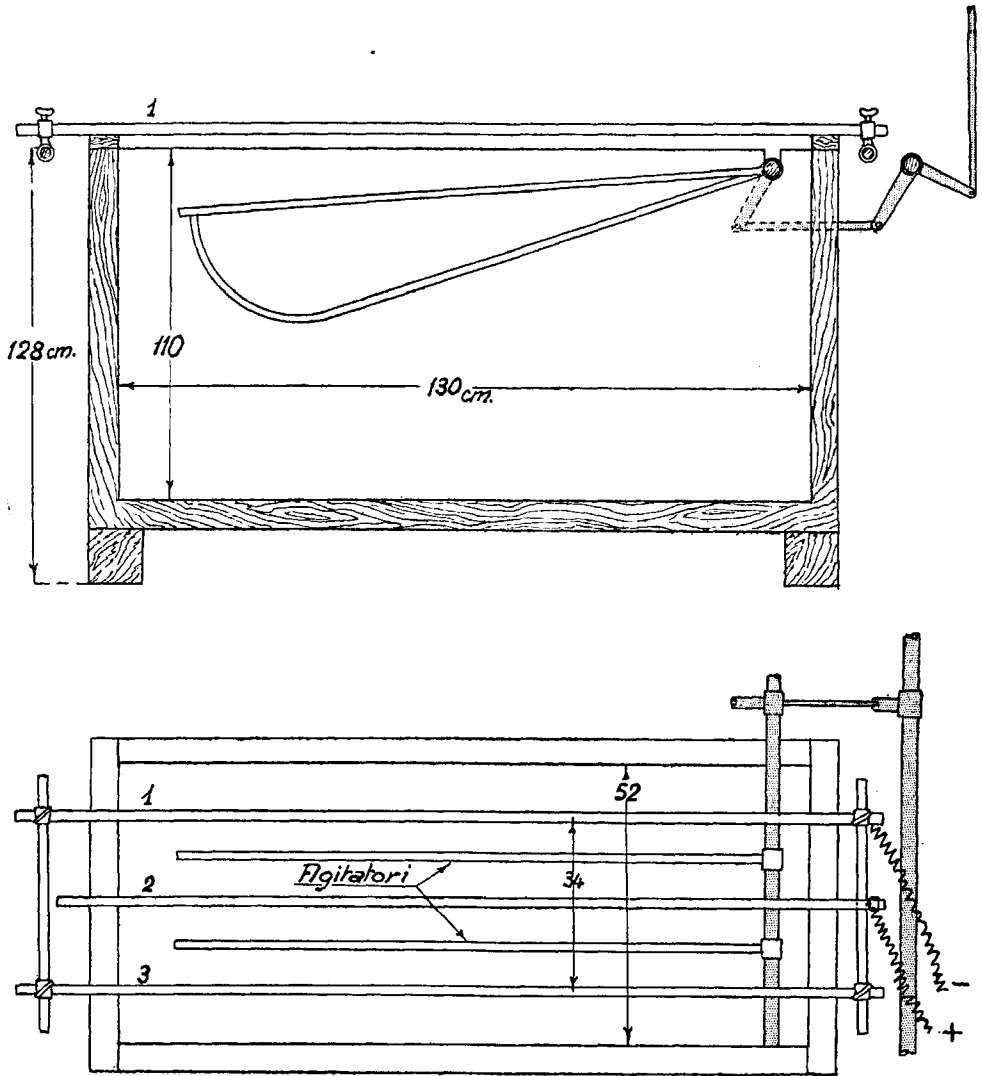


Fig. 1

from the ends, two hooks cut from a sheet of copper of a thickness of $6 \frac{m}{m}$ and width of $40 \frac{m}{m}$. These are double as is shown in Fig. 2. The upper hooks are traversed by a bar with an eye in the centre so that, with the help of a small pulley, the anode can be raised from the bath when necessary, whereas the two lower ones join the anode to the copper bar, positive pole of

the dynamo (No 2 Fig. 1). It should be noted here that the electrical connections joining the dynamo to the steelplating bath ought to be made of cylindrical copper bars about $18 \frac{m}{m}$ in diameter, because of the high intensity they must carry.

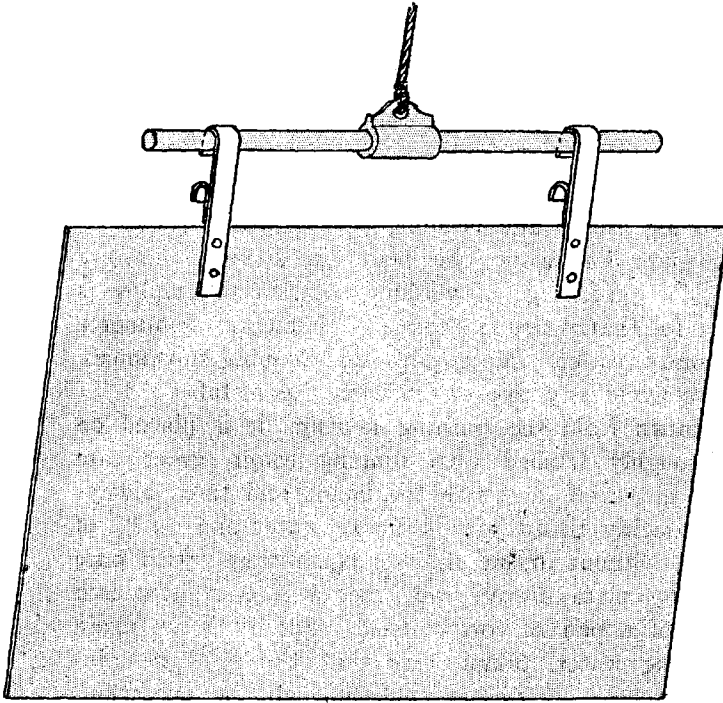


Fig. 2

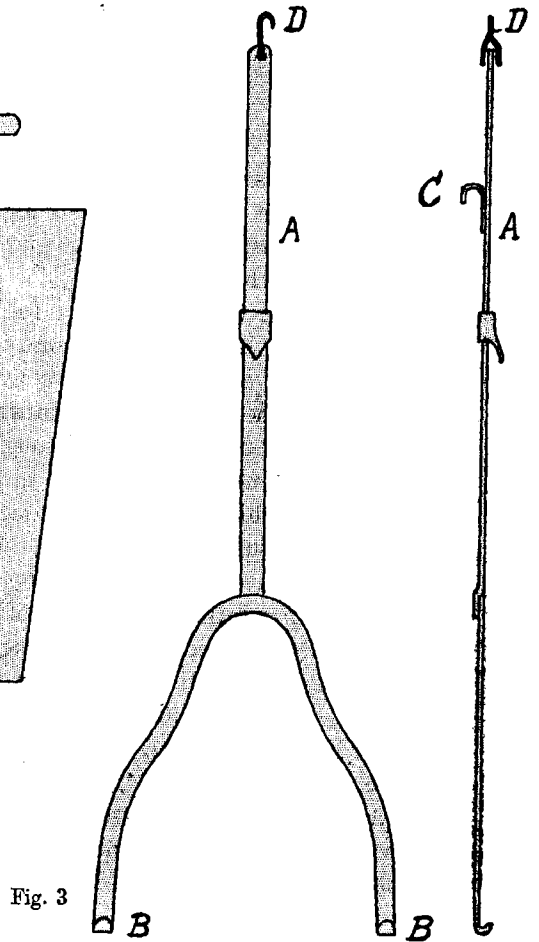


Fig. 3

9. An ordinary iron armature, Fig. 3, in the form of a fork, terminated at the lower extremity of the two arms by a hook (*B*) to support the copper plate. A slide, also formed like an inverted hook, traverses the bar (2); this serves to keep the plate in position against the armature (*A*). The armature is terminated at the upper end by a hook (*D*) so that it can be hung to a nail when not in use. At about $20 \frac{c}{m}$ from this hook is soldered a copper hook of $40 \frac{m}{m}$ width and $6 \frac{m}{m}$ thickness, the purpose of which is to hold up the whole armature and plate to one of the copper bars (1 or 3 Fig. 1) negative pole of the dynamo (cathode).

10. Ordinary sulphuric acid, cotton wool, English red very finely ground, refined olive oil of the best quality, ammoniated sulphate of iron, washing solution, rags, whiting (which is prepared before using and which is preserved

in a damp state for a long time). The last-mentioned is mixed with ordinary water and, after being stirred, the mixture is decanted in such a way that the liquid carries with it the atoms of whiting which are in suspension, leaving at the bottom the granulous waste which, if not excluded, would damage the smooth surface of the plate, as also the engraving.

STEEL PLATING.

Good results from steel plating depend entirely on the care taken in preparing the plate, by removing grease and cleaning the surface. Above all it is necessary to boil the plate for about two hours in a very carefully prepared washing solution. The percentage of washing solution to employ is in proportion to its strength; for that which is ordinarily found in commerce 6 % weight is put in ordinary water. More powerful cleaning substances, must not be used, in order to avoid any risk of oxidising the metal.

When the plate is withdrawn from the washing solution, it is placed on the wooden trestle and thoroughly washed with running water, great care being taken not to touch the engraved face with the hands and then, always without touching it, it is thoroughly rinsed with ordinary water and 20 % of commercial sulphuric acid and, without drying it, it is again rinsed with pure water. This done, keeping the plate always wet, the surface is powdered with damp whiting by means of a pad of cotton wool. Finally it is again thoroughly washed with running water, taking care that the plate remains uniformly wet with no dry patches. If this is neglected, all the operations carried out up to now must be repeated.

The plate is then quickly placed on the iron armature Fig. 3. care being taken not to touch it with the hands on the engraved face, and it is immediately submerged in the tempering bath, being connected by means of the hook C to one of the negative conductors of the vessel (1 or 3 Fig. 1), and left thus for about 5 minutes; after which it is quickly reversed on the armature and again submerged in the bath for 5 minutes.

However, the time necessary to obtain a resistant steel-plating varies according to the quantity of steel that it is wished to deposit on the plate. Generally it is left about half an hour in the bath, being frequently turned.

In all these operations it cannot be too strongly emphasised that the greatest care must be taken not to touch the plate with the hands, especially if they are not very clean, and to manipulate the plate with the utmost rapidity so that it cannot dry either totally or partially.

When the plate is taken out of the steel-plating bath, it is thoroughly rinsed with pure water, using a piece of very fine silk material to render the operation of rinsing more complete; lastly it is rapidly dried with very soft, clean rags.

The surface of the plate will have an opaque aspect; in order to polish and clean it, the steel plate is rubbed with very fine English red and refined olive oil put on a pad of cotton wool.

Finally the plate is cleaned with benzine to remove the English red which may have remained in the engraving and now, after careful drying, it is ready for use.

In order that a steel plating may be preserved for a long time without injury, the plate is heated and covered with a layer of wax, which is removed by a similar process.

REMOVAL OF STEEL PLATING.

When it is necessary to remove the steel plating from a plate, in order to make corrections, the latter is boiled for about two hours in the solution described above, after which it is thoroughly washed in running water and finally submerged in a solution of water and 20 % ordinary sulphuric acid.

The receptacle which it is intended to use for this solution is made of ordinary strong wood. It is 125 $\frac{\text{cm}}$ in length; 110 $\frac{\text{cm}}$ in breadth; and 25 $\frac{\text{cm}}$ in height, lined inside with sheet lead which entirely covers it even on the edges.

TENSION AND INTENSITY.

The tension commonly used is 5 volts and the intensity to choose is proportional to the surface of the plating and should be maintained at about 1.5 Amp. per square decimeter.

The temperature of the bath should never be below 18°.

LIFE OF A STEELPLATING BATH.

If the bath is kept free of dust and impurities by means of a cover, it can last from 8 to 10 years without changing its properties.

The anode should always be entirely submerged in the solution of ammoniated iron.

