

## A METHOD OF ELECTROPLATING WAX RECONSTRUCTIONS<sup>1</sup>

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The temporary nature of wax models has been a matter of some concern to investigators using the Born method of reconstruction. From a casual examination of the literature I have not found any methods described for making wax models permanent. Paints and varnish have been used with a certain degree of success. Small models when coated with French varnish will not wilt as readily as an uncoated one, the fragility however, is not altered by this process.

In technical literature I found a method for electroplating on wax and other non-metals with the use of graphite. This method was tried but the results were far from satisfactory. I experimented with graphite and bronze powder and finally devised a method which gives good results.

*Electric current.* In larger cities laboratories are often supplied with the direct current. This is generally a 110-volt current and appears to be just the proper current for this kind of electroplating. An Edison storage cell may be used if the direct current is not at hand. To get the proper amperage a lamp rheostat which is easily made (see any text book on electricity) is very convenient. The lamps are arranged in parallel. One 16-candle-power lamp gives approximately one-half ampere, two lamps one ampere, and so forth. The number of amperes to be used will depend upon the size of the object to be plated. A model the size of an ordinary drinking glass will be plated satisfactorily with one-half ampere.

*Bath.* The copper sulphate solution which I have used has the following composition:

CuSO <sub>4</sub> .....	150 grams
H <sub>2</sub> SO <sub>4</sub> .....	50 cc.
Distilled water.....	1 liter

Dissolve the copper sulphate in the water, then add the sulphuric acid. The size of the bath will depend upon the size of the object to be plated. There should be a space of at least six inches between the model and the sides, bottom, and top of the vessel containing the fluid to obtain the best results. For the anode a copper plate may be used. This should be large enough to form a lining to the inside of the vessel.

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*Preparation of model.* First coat the model with graphite (Dixon's flake graphite, No. 2). This may be applied with the fingers. In places which can not be reached with the fingers use a small bristle brush. Next make a paint or suspension mixture of bronze or copper powder in chloroform. With a camel's hair brush paint the graphite coated model with the bronze paint. One should not rub over a spot more than once or twice as the chloroform dissolves the wax. It will require a couple of hours or more for this coat to dry. When it is thoroughly dry the bronze will not rub off and the model should again be coated with graphite, using the same method as in the first coat. If the bronze coat is not even it may be touched up with the bronze paint before the last coat of graphite is put on. Heat a copper wire (preferably an insulated wire, removing about an inch-and-a-half of the insulation from the two ends) and plunge it into the wax, holding it in position until it has cooled and remains firm. For a large model it is advantageous to use a number of wires distributed over the model. At the point where the wire comes into contact with the model the wax should be scraped from the wire. With the point of a knife pack graphite around the wire to insure a good contact between the wire and the coating on the model.

Wax being lighter than the fluid of the bath it is necessary to anchor the model. This may be done in two ways, either by attaching a weight to the wiring or plunge a hot wire hook into the model and attach the weight to the hook. If the weight is metal it should be coated with paraffin.

To determine the polarity of the electric current attach one of the wires to the copper plate and hold the other in the fluid of the bath for a few moments. Copper will deposit on the cathode which is to be connected with the model. When the model is ready to be plated it should be placed in the bath and if it contains cavities it should be turned so that all the air will escape. The current should not be on when the model is being lowered into the bath for the heat generated will melt the wax and insulate the wire attachments from the coating.

After the model is fairly plated over there may be a few spots which have not received a deposit of the copper. Apply the bronze paint to these spots and then graphite and immerse in the bath again.

The thickness of the plating will depend upon the length of time in the bath. To render a model durable it should have a fairly thick coat of copper (from 0.3 mm. to 0.8 mm.). The necessary time required for this thickness will depend upon the size of the model and the amperage and can only be determined by experience.

After the plating is completed, the model should be washed thoroughly in water, then in alcohol, and dried rapidly by fanning. When drying slowly from a washing in water the color of the copper may not be constant.

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