

The Second National Conference on  
Metal Typecasting & Design

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American Typecasting Fellowship



ELECTRO-FORMING

by

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for

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My part of this conference is a short talk on "How I make mats by electro-forming."

This dissertation will be an attempt to lead you through several months of my experimental stumbling in developing a process of electro-plating mats suitable for hand or machine die casting. Keep in mind that I was unaided by any prior experience or printed directions. In the beginning, I had a finished display mat manufactured by the Monotype Company in one hand and a desire to make mats for the then recently acquired Bruce Type Caster. You know the old saying? - - "If everything else fails, read the instructions." Well, believe me, there were times when I would have been real happy with any kind of help - written or otherwise.

I'll omit the details on blind alley sojourns and other disasterous unproductive side trips. The "what-not-to-dos" and blind alleys will be compiled at some later date and they should fill a full length volume. Also, in my "re-inventing the wheel," I found myself lacking in other abilities and dexterities by the bunches. So much for that, let's move along.

Why have I called my process electro-forming? This was a misnomer on my part. As I said before, looking at a finished manufactured mat, the question to be answered was - "how to form this cavity? - thus electro-forming was coined. It was some months later before I found out that the trade referred to it as "electro-plating."



I will assume that anybody that is still with me has the basic letter press knowledge and is conversant with the common terminology of the printer industry. (Omit preceding line for A.T.F.) If you follow me through this, you will find it's a simple matter to form mats. There are only four items needed. Simply, they are:

1. The model or original type piece.
2. A brass blank to form and finish a type cavity.
3. A holder or jig to position the brass blank and type piece in the proper location.
4. The plating bath with a power supply.

I guess I should have said, "five items are needed," the fifth being a lot of patience.

We can skip over the first item very quickly. Just keep in mind, the model or original must be a good, clean, sharp piece of type with all of its printing surface facets. Be sure that your model is clean - no oil, ink, or gunk.

For the brass blank, cut or shear 3/32" x 3/4" half-hard yellow brass bar stock into 1-1/8" lengths. The cross cut should be true and square. The reason will be evident, as you will see a little later on. To cut a square hole with a beveled edge, I chucked a milling cutter in the old lathe and vised the brass blank. With the compound set at 90°, I vise feed the blank up and down and left and right for a milling cut. Using a counter-sink cutter, the perimeter bevel was cut. As a guide for cutting, I generally scribe through the jig with allowance or correction for the set width. A wider hole for the "W," "M"; much narrower hole for the "I," "F," etc. The top of bevel on the side-bearing side of the mat should day-light



at the outside corner of mat. This will allow the 8 to 9 points side distance normally required by most casters. If you have ever run linotype mats on your Thompson, you will know the "L" stop requires an 8 point spacing mat adjacent to the character mat.

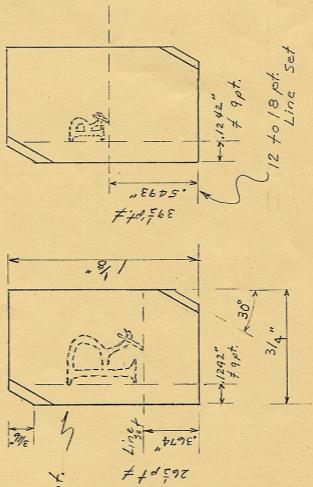
The jig or holder design and its fabrication really taxed my machining capability. The general idea for the holder was to have a vise that would accept any piece of type as a model, and position it in the proper location with respect to the brass blank so that after copper plating; the cavity of the mat would have proper alignment and correct depth-of-drive, namely, to control the X, Y and Z axis for rough fitting. By rough fitting, I mean correct position; say, to the closest 2 or 3 one thousandth of an inch. Note the depth control should be on the plus side or for an over drive dimension.

Having set the casting positions for different size of body, I machined a gravity mold for hand casting from type metal. The position setting required me to make one jig size and two core sizes - one 18 pt. core for 12 through 18, and one 36 pt. core for 20 through 36. Drilling each casting for a hanger wire and threading lock-set screw completed the holder, except for the hand finishing. To allow for normal heat contraction and initial brass hammer-set, I finished the holders for approximately 51-1/4 thousandth drive to be used with 50/1,000 type molds. The general positions and arrangements of the holder are shown on the sketch.

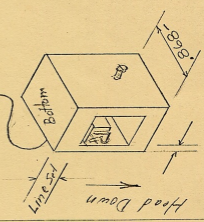
Assemble the three parts - the jig, the model and the brass blank. Lock the type piece in position with lock-set screw and secure the brass blank to the jig with a couple of rubber bands. These three parts now form the plating case or block which is ready for waxing and then the acid bath for plating.



Half hard yellow brass stock  
 $\frac{3}{32}$ " x  $\frac{3}{4}$ " x 12"



20pt. to 36pt.



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The idea of securing the parts together with a rubber band may seem a little sloppy or careless - but it isn't. Just remember, the jig has vertical and horizontal controls built into it. By using side and end register of the jig and brass blank, the rubber bands maintain correct position until the parts are cemented together by the waxing.

Coat the entire block except the type face and beveled square hole with a wax or paraffin. I use a cheap 3/8" wide paint brush to apply the hot wax, the finished coat being between 1/16 to 1/8 inch thick. Be sure to check the type face, seat around the face, and the bevel for any stray wax prior to plating.

For a power supply, any simple 2-diode setup with a wire-around variable rheostat is O.K. See your local Radio Shack for help and advice. A couple meters are also helpful.

We are now ready to start the plating process. Electro-form the waxed block in an acid bath consisting of 27 avdp. oz. blue-stone (copper sulfate) and 6-1/4 avdp. oz. (which is about 3-1/4 fluid oz.) of  $H_2SO_4$  per gallon of water. Set the voltage drop across the unit at less than 0.2 volts with no more than 3 to 5 millampers per square pica of plating area. The sacrificial electrode (or crow's foot per trade jargon) can be copper bar, copper plate, or copper tubing whichever is handy or easy to come by. Try to balance the submerged electrode area to the plating area at 1-1/4 to 1 ratio. Stalactite growth can be lessened by adding some organics to the plating bath. I've used 1/4 oz. of molasses per gallon.

Let the flower grow for 7 to 10 days. Adjusting the current flow and electrode area every 2 or 3 days is the extent of the required labor during this phase of the work. The exception to the foregoing statement would be the need for



rewaxing. Rewaxing becomes necessary if stalactites start growing or if leakage in the paraffin insulation has developed in some other portion of the plating block. Remove the case and wax over the unwanted growth areas and return to the plating bath.

If rewaxing is necessary, keep the cavity filled with water to prevent the virgin copper surface from oxidizing. An oxidized surface will cause a faulting zone or fracture in the mat under the heat of casting.

Remove the case from the plating solution when the flower growth appears to be nearly the depth of the wax coating.

The moment of truth is at hand, the separation between the model and the virgin copper. De-wax the block, remove the hanger wire and place your new little gem on a wooden anvil. Using a small hammer, about 4 to 6 oz, and a small cold chisel, separate the jig and the brass blank with clear, sharp taps of the hammer. Use the chisel on alternate ends of the block to get a near perpendicular back-off. Thoroughly wash the plating solution off the mat and inspect for any malfunctions that might have happened along the way.

If the floor of the mat appears to be O.K. and the separation was complete, then you are ready to finish the mat. If separation wasn't complete and some of the copper is still stuck to the model - - - well - - - have a happy 4th of July. The best parting agent is clean type. Finish the mat by:

1. Hand honing the face of the mat to the correct drive depth.  
    I allow approximately 1/1,000th inch over drive.
2. Mill off the flower on the back.
3. Mill the end for front alignment.
4. Cut compound angles for mat holder.



If somebody will turn off the lights, we'll show just a very few slides on some of the typical operations and equipment used for the preparation, plating and finishing of electro-formed matrix or matrices. After the slides, feel free to ask any questions, If I'm lucky, I'll have some right answers for you.

Any more questions? If not, this portion of matrix making adjourns.