

IMAGES AND INFORMATION CONCERNING THE COPE AND DRAG FOUNDRY TECHNIQUE

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This paper documents the simple foundry technique called **greensand molding** which is suitable for pouring bronze and aluminum. These images were taken in the Summer of 2007 in the foundry studio of my good friend, Richard Remsen, from West Rockport, Maine, where he maintains a foundry and glass shop. The purpose of this paper is to disseminate this simple foundry technique which is terrific for replication of simple shapes. The great value of this technique is its rapidity of process. For example the items laid out and patterned here can be molded and poured within an hour's time. When done the mold material can be revitalized by simply re-wetting and seiving, ready to use again. It is the most economical of all foundry technologies.



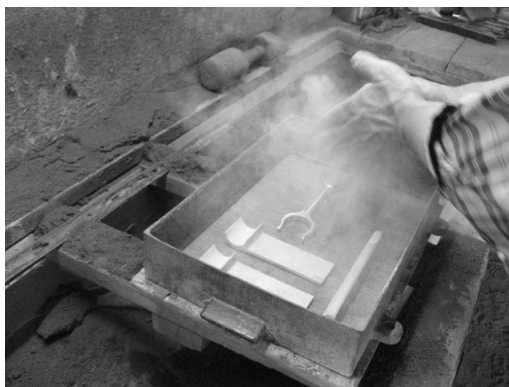
The beginning of any project begins with a pattern. Here Richard is going to make a set of oar locks and a couple of boat deck plates plus another object which will be part of the sprewing system. These will be cast in bronze. The layout of these patient objects is important as you will see. They should draft outward so they can be more easily removed.



The greensand mixture is dampened with a water can and shaken through a riddle or vibrating screen. For a small project this can be hand screened.



The items are arraigned on a board leaving space for making gates and sprews. This metal encasement is called the DRAG.



These pattern pieces are then dusted with talc. This will help with the separation issue later when they are removed from the greensand.



Here Richard is hand-sifting the first layer of greensand. The idea here is to place a finer quality of greensand next to the pattern pieces to magnify chances of a good casting surface with the thought to eliminate other possible casting faults.



The ramming maul is used to pack the greensand. The upper part of this gizmo is somewhat wedge shaped and is first used to pack the initial material in the mold. The tool is then reversed and the flatter side is used to compact the greensand material.



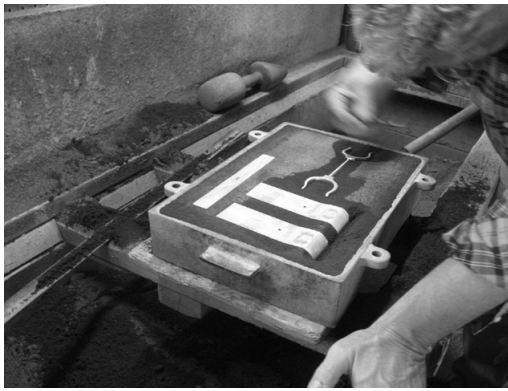
The mold is flipped and the board is removed.



With a spatula or a foundryman's spoon the greensand is trimmed back to the mid-line of the pattern pieces.



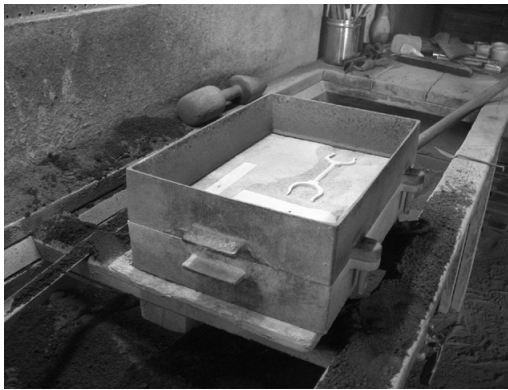
This work goes along relatively quickly.



Just a little more fussing around to get it right.



The DRAG mold is again dusted with talc.



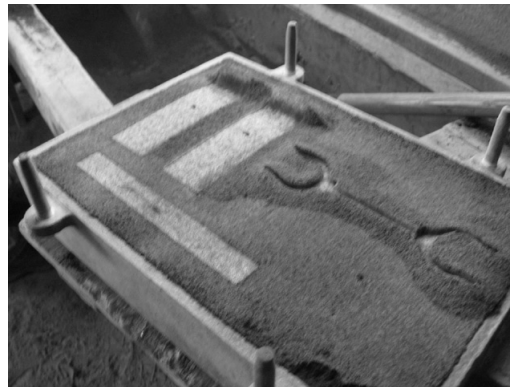
The COPE is aligned using the built-in alignment pin holes.



This COPE mold half is rammed with the maul.



The mold halves are carefully separated.



The image of the pattern pieces are captured in the COPE half of the mold. You can see the alignment pins in this photo.

Here the oar locks are embedded in the bottom part of the mold, the DRAG. This was the first part rammed. The job at hand is to loosen the pattern parts and release them, which requires a little bit of light tapping and sometimes some whispered swears.



Here Richard is using a pair of tweezers to raise the pattern part from the greensand encasement.



The other pattern parts will be removed shortly.



This is the other half of the mold, the COPE. The feeder channel is carved into the sand.



From a lifetime of experience Richard knows how to shape the feeder channel. If you are new to this you will have to rely on intuition. Just remember this stuff has to be chased off the finished bronzes. Too aggressive here and you make a lot of extra work for yourself, but too little and you might have a pouring failure.



More of the pattern parts are removed.



Using a tube cutter, Richard has punched a few holes into the COPE which will be the spew and vents.



This is the very top side of the COPE and this shows the pouring basin and spew, the large hole in the middle. The other two holes are for venting.



While using a careful touch the two parts of the mold are aligned using the pins and holes.

The setup is placed on the floor. Notice the clamps and weights. This is to keep the mold together during the pour so there will be no separation. Initially this might seem overly cautious but keep in mind the metal is heavy and can actually cause the top part of the mold to float if it were not secured as shown here.



The furnace is opened and the crucible is removed.



Here the mold is filled: notice the metal is showing in all three holes. That is good.



After the castings are sawed apart using a hacksaw, the pieces are belt sanded to shape using a Bader Belt Sander, a nifty shop tool if you are going into production. But if you are making one-offs chances are that a file and a saw and sand paper will work for you. Oh and a couple of chasing chisels might fit into your tool box.

From the foundry floor this is the finished product. The potential for a perfect finished piece must be here. Notice the little icicles off the tips of the deck plates and oar locks. These are little vent holes Richard poked into the greensand to make sure the tips of the casting would pour correctly. If you study this picture you can analyze what was the game plan for the screwing and venting.

Greensand is a very versatile technique, not suitable for every job, but for what it does, it does well. The great advantage is the speed and reproducible nature of the process. If you give thought to your design (meaning you might have to simplify the design) this process might work for you.

A Greensand Formula from a phone call with Richard Remsen:

For those interested in this process he suggests you purchase a book called *The Metalcaster's Bible* by C. W. Ammen. "Used" on Amazon this goes for around \$10.00 hardcopy.

He also suggests you could make a greensand from a mixture of sharp sand, clay, and wood flour. Sharp sand is natural occurrence in some parts of the world. I think the Ottawa, Illinois, sands might be of this type but also there are some from Pennsylvania. The clay component is supposed to be Southern Bentonite. Wood flour is very fine sawdust.

Formula by weight:	%	to %
Sharp sand 160 mesh	94.50	95.00
Southern Bentonite	4.00	4.00
Wood flour (200 mesh)	1.50	1.00

I really don't think you would have to be too fussy. I have made a greensand just using regular river sand and fire clay. The organic material would help keep the hot metal from merging or fusing with the sand. It would improve the surface quality of the casting. Too much and it would tend to produce gas and extra bubbles.

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