Column Front Plate and Ram Casting

By R. G. Sparber

12/21/2007

Sand Don't Bend Real Well!

Over the last 2 days I tried over 10 times to ram up a pattern and not have the cope drop out. Yes, it was frustrating but also educational. The main thing I learned is that you can't bend sand. By that I mean that any distortion of the flask after it has been rammed can cause cracks to form. When the flask is in the horizontal position, those cracks cause sections of the rammed sand to drop out.

After receiving a lot of good advice from Gingery_machines on Yahoo, I had to sort out what applied in my situation.

The first piece of advice I took was to add another set of cleats around the bottom of the cope. The idea is that with the cleats at the bottom, all weight would bear on them and there would be no drop out. It did not work possibly because there was more than one thing wrong.

The second piece of advice I took had to do with the rigidity of the cope. My cope, full of Petrobond, weighs about 35 pounds. I did not have handles on the sides so it was difficult to grab and lift. I found myself grabbing opposite corners and pushing in and up. Once I was focused on the problem, it was obvious that the cope was changing from a rectangle to a parallelogram. My quick and dirty solution was to add an external steel frame that would resist this distortion. It ain't pretty but it does work:

I had to add chocks of wood so the cope could be set with the face vertical. The first try had chocks on only one side. You guessed it - I picked up the cope and promptly tried to place it on the non-chock side! Turning it over was enough vibration and jolts to cause it to drop out. You can see that I added chocks to the other side. Only the cope has this bracing since either the molding board or the bottom board always supports the drag.

Adding this bracing clearly helped a lot. The remaining things I tried seemed to help but given variations in how hard I ram the Petrobond, it is hard to be sure.

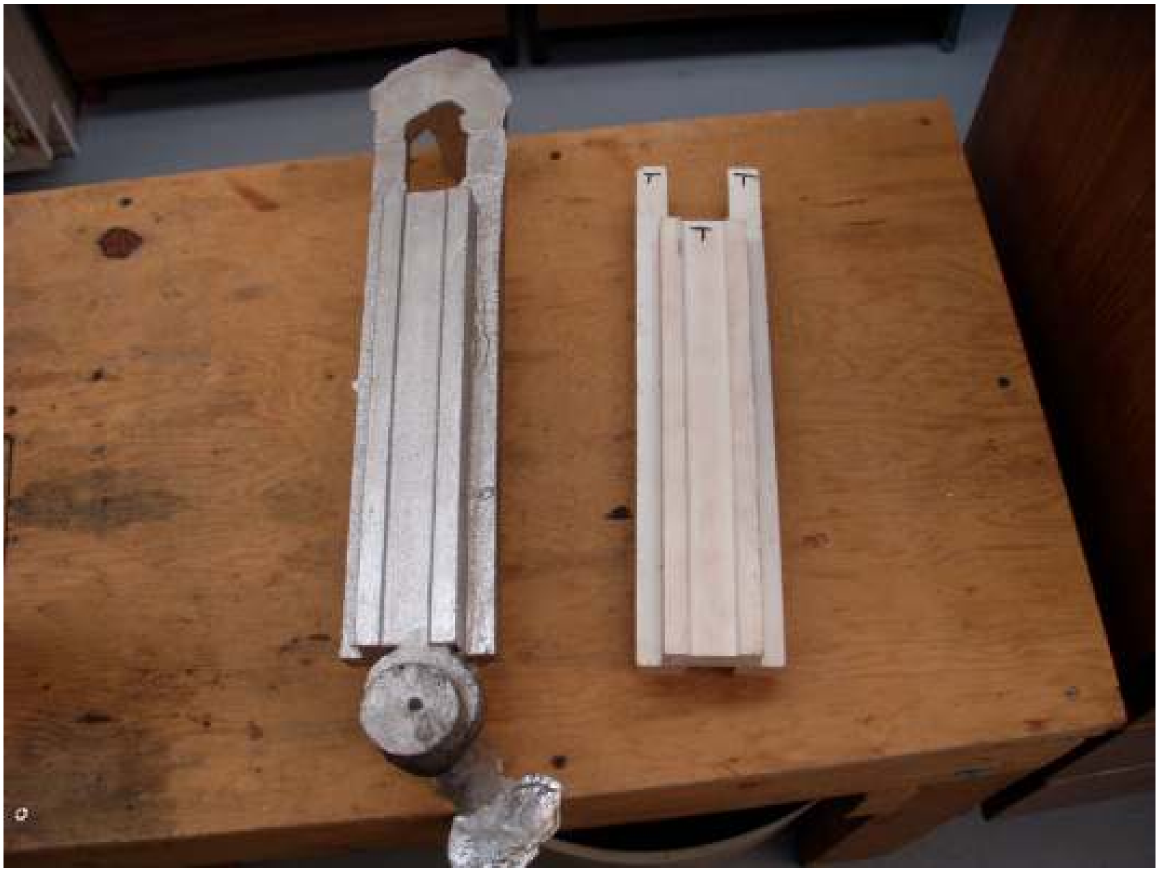
1. I think I saw that reusing the drag caused the cope to drop out. I rammed up the drag and then the cope. If the cope dropped out away from the drag, I just put the cope back on the drag and rammed it up again. At least in one case, the cope's sand stuck to the drag's sand even though I did use the normal amount of dusting powder. So I assume that the drag was rough enough to grip the cope. Subsequent drop outs were followed by ramming both the cope and drag.

2. I tried using 1/4" diameter rods bedded into the sand in place of ribs and gaggers. It was certainly easier to install. However, I still got drop out but it was at the same time I figured that the reused drag was sticking to the cope so I must tried this technique again. The one problem I do see with it is that these rods may act as external chillers and effect the directional freezing in the void.
3. I tried ramming a little lighter in the cope and it dropped out. Subsequent tries were with all of my might and drop out was greatly reduced.

My first casting for the day was with the braced cope, full force ramming, and properly placed ribs and gaggers. It worked fine:

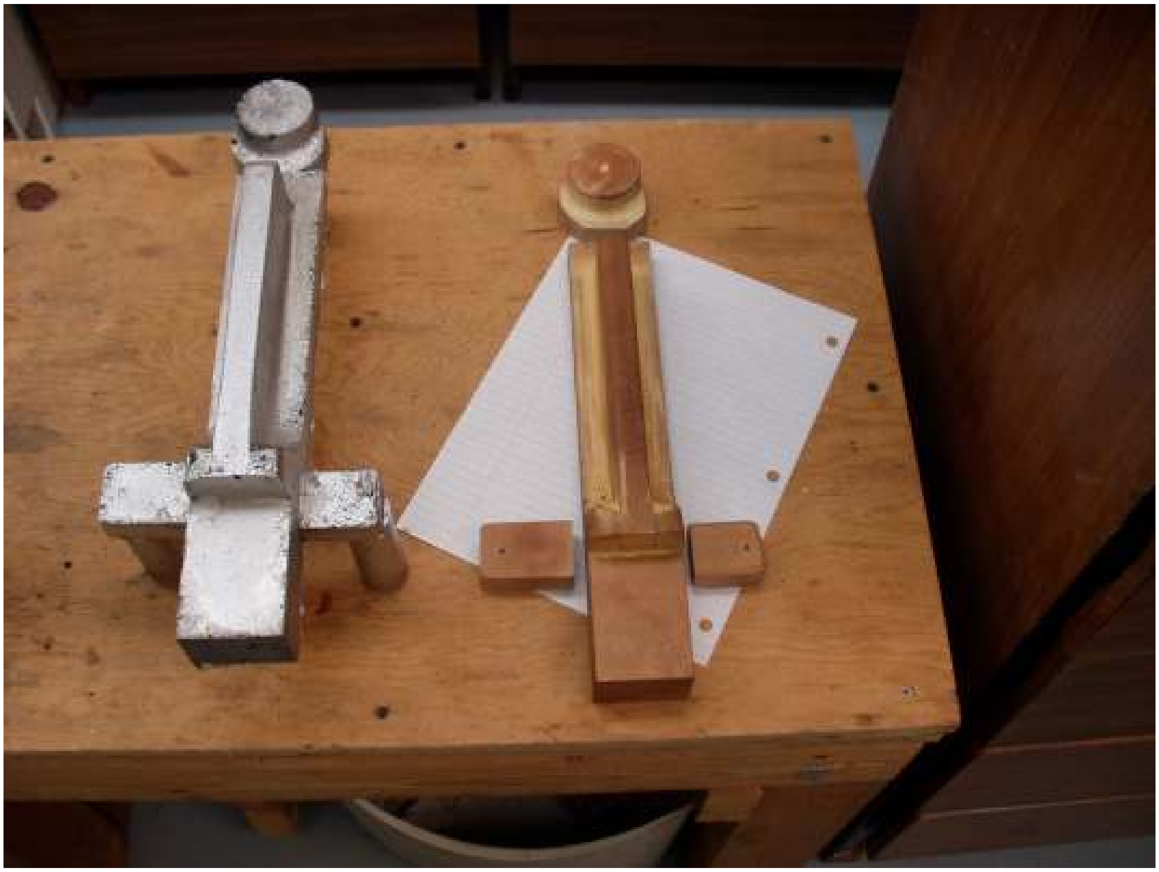
I used information in the U.S. Navy Foundry book to design the sprue, riser, runners, and gates. You can see there was a small amount of shrinkage in the riser but none in the casting.

This front part is 3" longer than Gingery specifies. It is also 1/8" wider to permit the use of a second 1/8" thick gib. This will center the ram in the column.



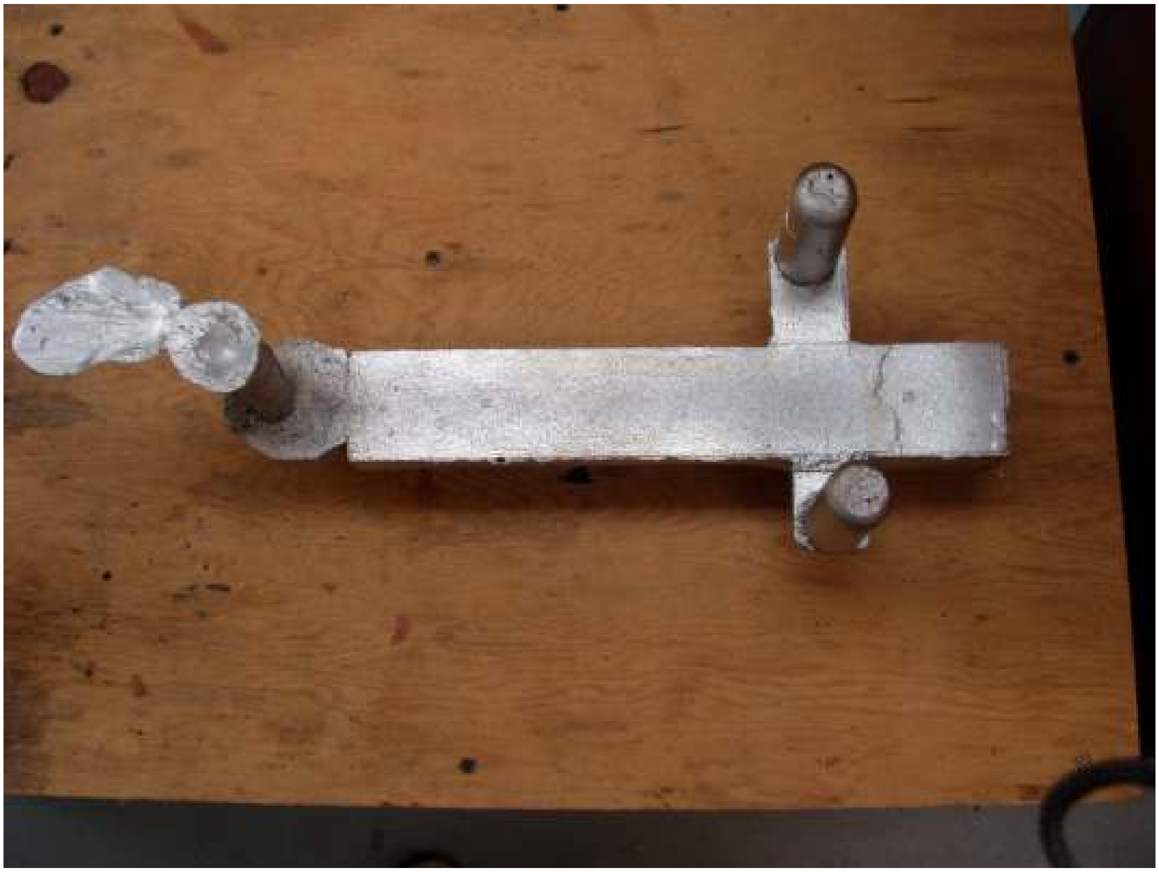
My second casting of the day was of the ram. It had drop out of the cope BUT I recall that my mind was wandering and I put down more than 1" of loose sand on each pass. I also did not ram as hard as I had for the first casting. I also bumped the cope a bit hard as I was lowering it onto the drag.

My third casting of the day was the ram again. I was back on track except that I planned to blow out the loose sand after moving the drag to the pouring site and then forgot to do it. Once I lowered the drag onto the cope, I was not going to risk another drop out by fooling with it. The results were not all that bad:



I don't think I had enough draft in the vertical rib because it was difficult to pull. You can see voids near the riser gates.

The bottom came out much better. The defect to the right of the riser gates is actually a change in thickness of just a few thou. I'm not sure of the cause but hopefully some share eye's expert out there will have the fix.



You can see in the above picture that the vertical rib is taller than what Gingery specified. The side supports were cut to the same height. Together they are supposed to better support the cap. Also note that I did not cast in a steel core. My plan is to cast the cap, mill it and the ram body for a good fit, bolt them together with shims, and then bore out the hole on my lathe.

My final problem is that the cope is very heavy and difficult to gently lower onto the drag. I did move the drag to the pour site first and then the cope, which saved my back. But lowering it is still hard to do smoothly. If I had to do more of this, I would rig up a simple crane with a counterweight.

One or more people speculated that having my sandbox on a folding table would permit the flask to flex and be jarred which would contribute to drop out. I don't think that is the case. Although the table does move as I ram, both a 3/4" thick board and 2x4s spanning the sandbox solidly support the flask.

Tomorrow we are expecting rain so it will be a day in the shop rather than in the foundry. I am tempted to recast at least one of the side plates since I took off almost 1/8" of thickness out of 3/4" as I relearned how to mill a rough casting.

How much to Melt?

For lots of reasons, it is best to only melt enough metal to fill the flask on hand. One standard way to estimate the needed metal is to weigh the pattern with its risers, sprue, runner and gates. Then apply a multiplier to give an estimate of the needed metal. I bought a digital scale from Harbor Freight ($15) which can read out in ounces. I then weighed a few castings and their associated patterns plus sprue, risers, gates, and runners. The result for me, using mostly MDF for the patterns are that the weight of the pattern times 3 is close. Just to be safe I initially added 10%. On one pour I ended up tossing in 2 more muffin sized ingots and after the pour only got 1.5 back. So now I add 20%. So

Estimated weight of needed aluminum = 3.6 x weight of all wood

Rick Sparber
Rgsparber@AOL.com