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Making more than one

Techniques for casting perfect parts in rapid-cure resins

By Tom Piccirillo
Photos by the author

Today's modelers are blessed with a variety of molding and casting materials. Among the most versatile of these are RTV (*R*oom *T*emperature *V*ulcanizing) silicone molding rubbers and fast-curing urethane resins.

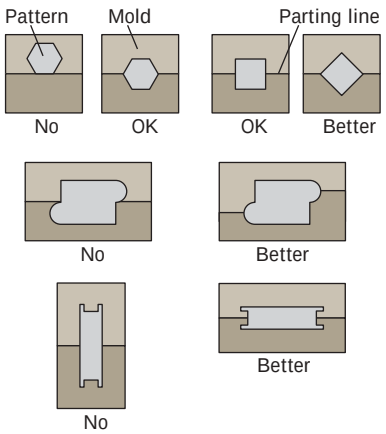
If you've been hankering to make more than one of something, follow along and I'll show you how.

Mastering the master pattern

I need lots of bridges for my layout, since my railroad runs through hill country. Normally I'd scratchbuild patterns for the bridge parts, but in this case a friend had an old die-cast Lionel bridge with girders just the right size. Since Lionel hasn't made this bridge since 1950, I felt no harm would be done if I used it as a pattern for my girders. [Making copies of commercial parts or models for other people is unethical and illegal, whether you charge for them or give them away. – *Ed.*]

I needed several of these girders for my layout, and they're a perfect demonstration project for casting in two-part RTV molds. The bill of materials on page 67 lists the mold-making materials and casting resins I used.

Fig. 1 GOOD AND BAD DRAFT ANGLES



Tom Piccirillo needed several plate girder bridges for his O scale model railroad. Using an out-of-production Lionel bridge girder as a pattern, he made a two-part rubber mold to cast girders in urethane resin.

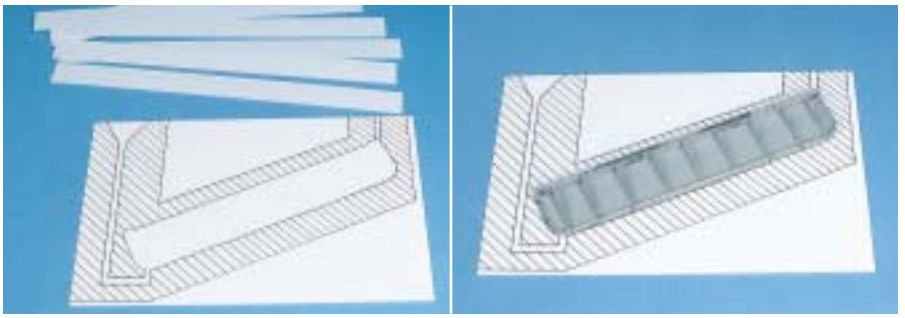


Fig. 2 LAYING OUT THE MOLD BOX. A sheet of .060" styrene serves as the bottom of the box for pouring the first half of the mold. The outlines of the pattern – the Lionel bridge girder – and the box are drawn on the styrene with a felt-tip pen. The 1"-wide strips of .060" styrene will form the sides of the box. The girder is fastened in place with rubber cement for easy removal.

Fig. 3 BUILDING THE MOLD BOX. Tom next built the sides. The mold is angled so the gates (basswood strips) channel the resin into the cavity from the bottom, driving out the air. The short wood strips along the edges will form cavities for alignment lugs.

Fig. 4 FIRST HALF POURED. After coating the pattern, basswood gates and lugs, and mold box with mold release, Tom poured in the mixed RTV and allowed it to cure, undisturbed, for four hours. See page 66 for tips on eliminating bubbles.

Fig. 5 OPENING THE MOLD BOX. Tom has broken away a few sides of the mold box and gently removed the first half of the mold from the pattern.

Because I used a commercial cast part as my pattern, it already had the proper draft angles to make it easy to remove from a mold. Figure 1 shows acceptable and unacceptable draft angles and parting-line locations. While RTV rubber is surprisingly flexible, it's still good practice to avoid undercuts whenever possible so that the mold will last a long time.

Almost any material is acceptable for building your own pattern: styrene, metal, wood – even paper will do. Keep in mind that the casting will reproduce virtually every feature of the pattern, including dings and scratches. It's worth extra effort to make your pattern as close to perfect as you can, including making a second try if your first attempt falls short of the mark.

Building the mold box

You'll need to build walls around your pattern so you can pour the first half of the mold around it. I use .060"-thick styrene sheets, as shown in fig. 2. The mold walls should be at least ½" from the edges of the pattern – see fig. 3.

Providing a way for air to get out is an important consideration in designing a mold; the odd shape of this one allows the casting resin to enter the mold cavity from the bottom and force air to escape through a vent at the top. Not shown is a change I made later – air was being trapped and I cut in a second vent at the lower end of the girder to release it.

Glue the pattern to the bottom of the mold box with rubber cement so it will be easy to remove later. Seal around the edges of the pattern so the RTV can't flow underneath and trap it in the mold. Irregularly shaped patterns may require building up a bead of modeling clay around their edges, but that wasn't necessary with my bridge girder.

Brush the pattern and the sides and bottom of the mold box with mold

Fig. 6 PREPARING FOR THE SECOND POUR. After replacing the pattern in the first half of the mold, Tom filled the gates with stripwood to keep them from filling with rubber.

Fig. 7 SECOND HALF MOLD BOX. Tom built a box for pouring the second half around the first half. The alignment cavities are empty so the second pour will form lugs.

Fig. 8 SECOND POUR. After coating the pattern, stripwood, box, and first mold half with mold release, Tom poured the second half of the mold and let it cure for four hours.

Fig. 9 COMPLETED MOLD. Here's the finished two-part mold, ready for making castings.

Fig. 10 COMPLETED CASTINGS. These are a couple of Tom's finished bridge girders, one still in place in the mold and one that's been removed but which is still attached to the sprue from its pouring gate.

SIX HANDY CASTING TIPS

When Tom asked me to contribute some casting tips to his article, I dug back through my notes from better than three decades of tinkering with RTV and various casting materials to come up with these. Here goes:

Measuring rubber or resin. To find how much rubber you need to fill a mold box, or resin to fill a mold, just add water! Then pour the water into a graduated container to see how much rubber or resin to mix. Dry the box or mold thoroughly before using.

Brushing and blowing RTV. If you get air bubbles trapped against your master pattern (appearing as unwanted spheres on the face of your castings), brush a thin coat of RTV over the pattern, then blow out the bubbles with a stream of air from your airbrush or even a drinking straw! Once you've eliminated the bubbles on the face of the mold, use Tom's thin-stream pouring technique to add the rest of the RTV.

Old molds need never die. You can recycle old RTV molds when you make new ones by chopping them up and placing the pieces in the corners of the mold box, away from the patterns. Since RTV bonds to itself extremely well, the old material will serve as filler for the new, reducing the amount of fresh RTV required.

Paint the mold! For a head start on painting your model, paint the mold before pouring in the resin. I use Floquil Railroad Colors – the kind with the Dio-Sol solvent – and airbrush the mold cavities immediately before each pour with a primer or with the color of the finished part. Spray cans of lacquer also work well.

The resin bonds to the paint, which also serves as a mold release. Urethane resins don't need mold release, but if you use other casting materials such as epoxy or polyester, the layer of paint serves as a barrier and extends the life of the mold.

Chill the resin. That small refrigerator under my workbench isn't just for cold drinks! Some of today's urethane casting resins cure so quickly that I have trouble using even a small batch before the material starts to harden, or "kick."

I keep the A and B bottles of the resin in the refrigerator, which adds several minutes of working time to each batch. Be sure to replace the caps on the bottles before returning them to the fridge – resin and moisture don't go well together.

Or warm the mold. If, on the other hand, you're in a hurry, warm the mold. This happens naturally as you cast parts, which is why your first parts take longer to kick than the tenth and twentieth ones you pour. – *Bob Hayden*

release in preparation for pouring the RTV rubber.

Pouring the first half of the mold

Mix the RTV according to the directions. Micro-Mark mold rubber uses a 1:1 ratio that makes it easy to mix. Most liquid molding rubbers consist of two parts of different colors, so you can tell when they're thoroughly mixed by the uniform tint of the material.

A couple of tricks will eliminate most air bubbles from marring the face of your mold. First, stir, don't whip, the rubber to mix it. Rapid stirring doesn't help and simply incorporates extra bubbles in the RTV.

Next, pour the mixed rubber slowly into one corner of the mold box and let it flow over the pattern. Hold the container of rubber 5" or 6" – even a foot – above the mold box and dribble in the RTV in a thin stream. This gets rid of most bubbles, as any bigger than the diameter of the stream will pop.

Don't waste time worrying about how much RTV you need to fill the mold box. Instead, start with a batch slightly smaller than required, then mix additional batches to build up the thickness of the mold. Set the first half

Bill of materials

Micro-Mark
340 Snyder Ave.
Berkeley Heights, NJ 07922
800-225-1066
www.micromark.com

80352 Mixing Set
80475 Mold Release
82057 CR-600 Casting Resin
82083 One-to-One/Rapid Mold Rubber

Miscellaneous
.060" styrene sheet (Micro-Mark 80903 or Evergreen Scale Models 9260)
3/16" x 1/4" basswood strip (Micro-Mark 81291 or Northeastern 70262)
1/8" aircraft plywood (Micro-Mark 50197 or Midwest Products 5244)
rubber bands

THE SQUASH METHOD

I molded the parts for this four-wheel freight motor using a different technique than in the main story. Instead of filling the mold by pouring through a gate, I first filled the bottom half of the mold with resin, then pressed the top half into it, completely filling the cavity and driving out the air.

This is aptly called the "squash method." It's particularly good for deep cavities like the ends of this car. The two-part mold for the sides includes vents to let air escape, but the one-part mold for the roof uses a glass plate on its open side, giving the bottom of roof castings a smooth, flat surface. – *Tom Piccirillo*

aside to cure for four hours. Figure 4 shows the completed first-half pour.

Second-half heroics

In fig. 5, I've removed the first half of the mold from the box after the rubber has cured. Figure 6 shows the pattern replaced in the first half, ready for the second half to be poured over it. Fill the gates with stripwood to keep them open, but leave the alignment cavities open to form matching lugs. Figure 7 shows the new, higher mold box that I built up around the first half.

A thorough application of mold release is especially important before making the second pour. Although RTV readily peels away from most materials – even porous stuff like wood – it bonds to itself like crazy. Make sure you have a thorough coating of mold release wherever the second pour of mold rubber will contact the first half of the mold.

Mix and pour the second mold half as you did the first, fig. 8, allow it to cure, then remove the sides of the box and peel the halves apart as in fig. 9. Remove the pattern and inspect the mold carefully for places where excess rubber may need to be trimmed away from the gate attachment points. Do this with a brand-new no. 11 blade or single-edge razor blade.

Casting parts

Here's what we set out to do at the beginning! I used Micro-Mark CR-600 casting resin, a two-part, 1:1 mixture that can be de-molded in about ten minutes. Although the parts are quite flexible when removed from the mold, the castings firm up quickly, and the resin hardens fully in a few hours. In curing it turns from clear to almost pure white, making it easy to paint.

Silicone molds usually don't need mold release for urethane resin castings. With this mold, all I did was align the halves and back them with slabs of 1/8" aircraft plywood to hold them flat, then held the sandwich together with heavy rubber bands.

With the mold positioned so the gate was vertical, I poured in the resin. Commercial casters may use vacuum or pressure material – sometimes both – to ensure the mold cavity fills completely without bubbles. Since the Micro-Mark resin is water-thin, this isn't necessary. All we need to do is give the air in the mold cavity an easy way to escape, and this mold is designed to accomplish that, especially after I added a second vent as explained on page 65.

As fig. 10 shows, it works! The chemical reaction of the resin generates heat, which helps it cure. This means that big parts with thick cross sections generate more heat and so cure faster than little parts with thin sections.

After a few minutes of cleanup under a strong light, I washed the girders, painted them, and built the finished bridge shown on page 64.

You should try casting your own model parts. You'll find that it isn't difficult and will become a handy addition to your bag of modeling tricks.

Tom is general manager of Micro-Mark and a lifelong O scale traction modeler. His Somerset County Traction System was described in the April 1996 MODEL RAILROADER.