-CASTING MAGIC

Casting perfect bullets is no trick once you know the secret.

By Ross Seyfried

Bullet casting is an extremely versatile and useful handloading tool, but there is more to it than pouring hot lead in the direction of a bullet mold. While it sounds odd, it is almost easier to make a great bullet than a bad one...if you know how. When I make bullets I break some rules and make up some of my own, with results that work. I will share most of what I have learned after turning tons of shapeless lead into hundreds of thousands of bullets—bullets that have worked on everything from buffalo to beer cans. With the right metals, tools, and techniques, bullet

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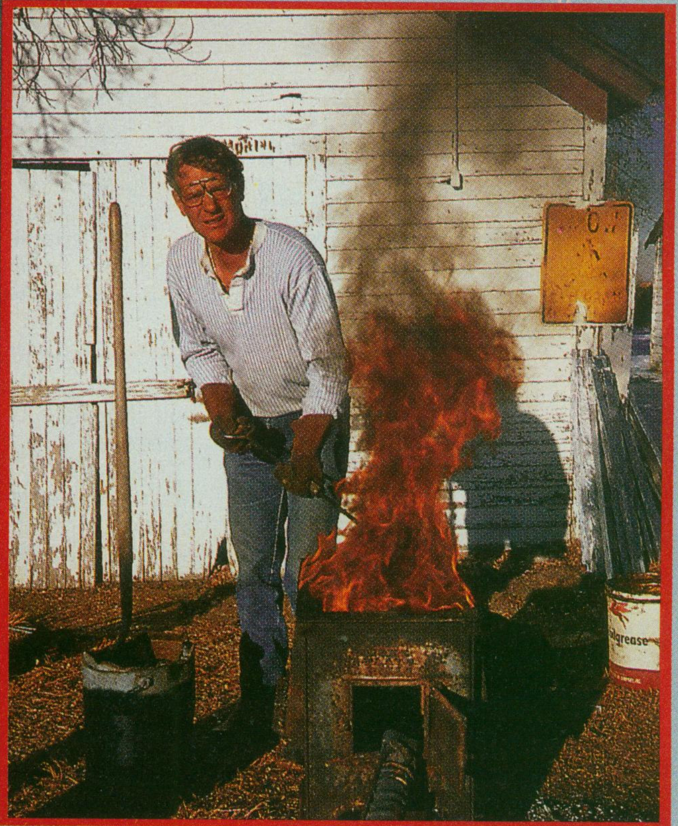
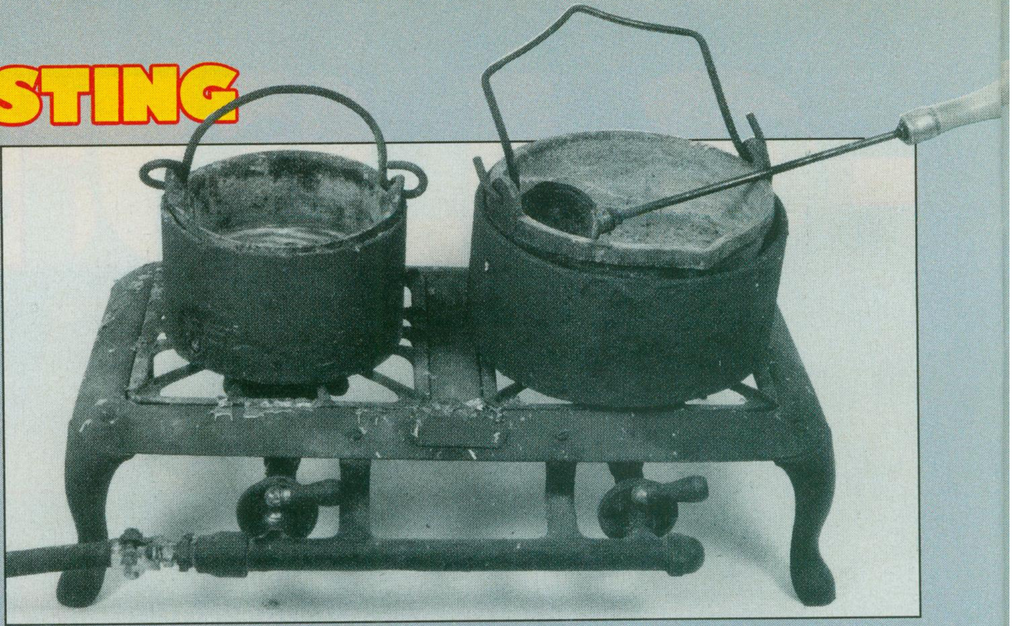


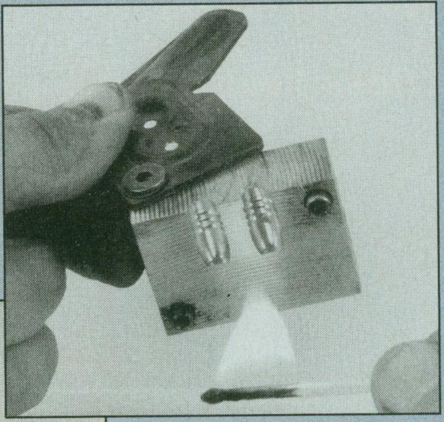
The author uses this old printer's furnace to melt large quantities of wheel weights and cast them into ingots for later use.

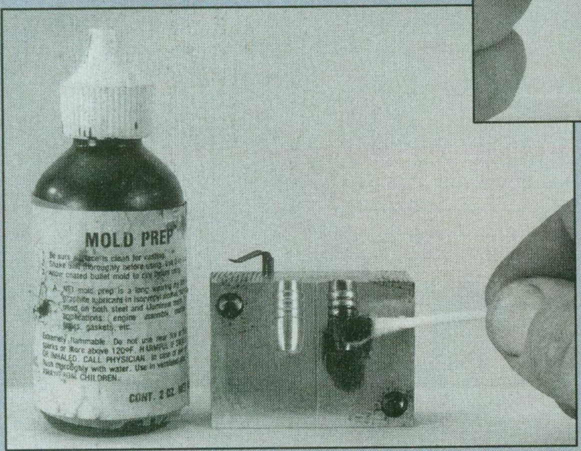


casting is easy and very economical.

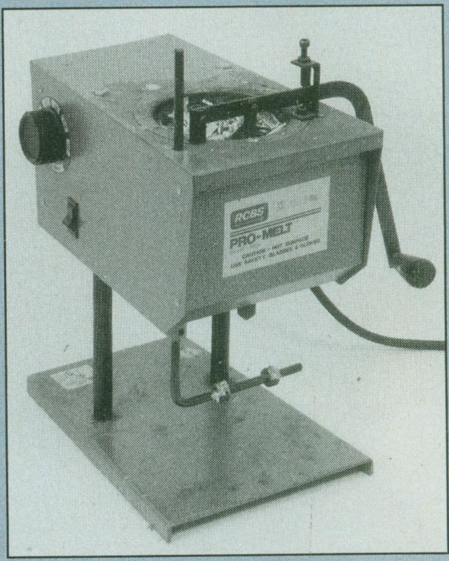
A detailed description of the lead and lead alloys that are used in bullet casting would be very lengthy. Here there is only space to touch the surface, but a basic understanding of some of the options is necessary. The makeup of the metals determines to a great degree the cost, casting qualities, and the ballistic effect of the bullets.

Pure lead is the most basic ingredient. Alone it is very soft, measuring 4 or 5 on the Brinnell scale. Pure lead is used to make muzzle-loading bullets and some low-velocity handgun bullets, and is the base metal for all other alloys. Currently the price for virgin, pure lead is about 60 cents per pound. If you will shop around junk yards you should be able to get lead pipe, cable sheathing, or sheet lead. Lead in this form usually qualifies as pure lead and is normally free of contaminants. Beware of odd-shaped chunks, hammer heads, etc.; you never know what they might contain. Quite often this scrap, pure lead can be purchased at about half the price of virgin lead from the smelters.

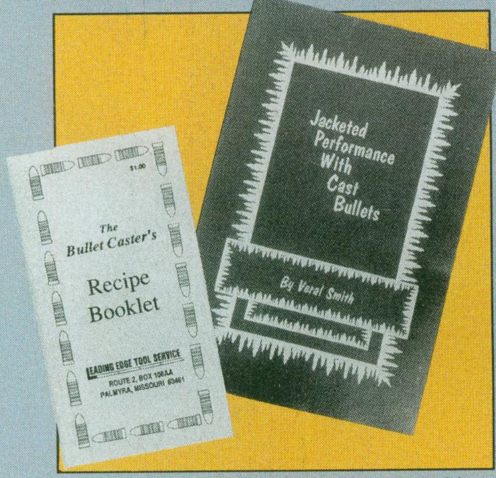




Bullet quality is enhanced by either smoking the mold with a match (above) or using a product like NEI Mold Prep (left), a liquid that is applied to the cavity with a cotton swab. Always be sure to allow the mold to dry before you begin casting bullets.



While modern electric self-contained melting pots are convenient, the author still finds use for an old gas hot plate and old-fashioned pots and ladles from time to time. Either method requires good ventilation for safety.

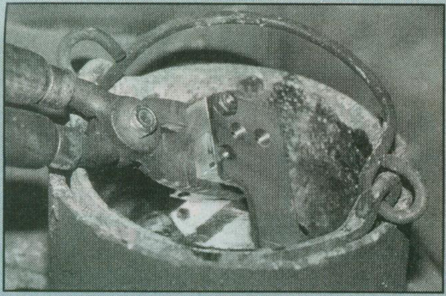


These two booklets provide a wealth of valuable information on the subject of bullet casting and should be a part of every caster's library.

Tin is used to harden the lead and to make it easier to cast with. Tin acts as a surfactant, decreasing the surface tension of an alloy. This makes it easy to make wrinkle-free bullets with crisp, sharp corners. An alloy of 10 percent tin is about as hard as a tin/lead mixture will get. Even at this level it is wasteful of the very expensive ($7 to $20 per pound) tin. Alloys of tin and lead will not heat-treat (increase hardness) when hot bullets are quenched in water. The melting point of tin is lower than that of lead, making it very easy to alloy with the base metal.

The real workhorse of hard bullets is antimony. Antimony is a hard, brittle, crystalline metal with a melting point almost twice as high as lead. When used in bullet alloys antimony forms a suspension, not a solution, with lead. That is, there are particles of pure antimony floating around in the lead. Salt in water makes a solution, dissolving to a molecular level, while even fine clay in water makes a suspension as antimony does in lead.

Unlike tin, pure antimony has been a mean critter to deal with. Starting with lead, tin, and pure antimony to make your own special bullet metal has been almost prohibitively difficult. The antimony almost refuses to mix with the lead. We turned to hard lead shot or wheel weights to get pre-mixed antimony. Now the Leading Edge Tool Service has made "user-friendly" antimony available. With this a bullet caster



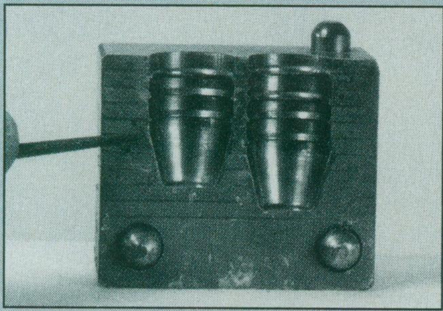
Preheating the mold by dipping it into the molten lead helps to ensure well-formed bullets. A mold that is too cold generally does not fill out well.

The author uses a Rowell bottom-pour ladle (below) to fill molds and a rawhide mallet (right) to open the sprue plate. With the correct techniques, deformed bullets like those below right are the exception.

can easily make any lead alloy he desires. Alloys of lead, tin, and antimony (with minute traces of arsenic found in lead shot or wheel weights) can be heat-treated just like carbon steel to control bullet hardness.

Wheel weights have been and will continue to be the backbone of my cast bullets. Scrap wheel weights are relatively inexpensive and extremely useful. While they are maligned by some, I have fired literally tons of them. Their basic content is 1 percent or less tin, 2 to 4 percent antimony, and the rest lead. The actual tin/antimony/lead content varies and you will benefit from melting down large batches at a time to help maintain uniformity. Be especially careful of shiny weights with rusty clips.

Flux helps remove impurities. Powdered antimony and special flux for mixing it with your lead are available (below).



Grooves in the mold blocks help vent gases. Sometimes these vents must be slightly enlarged with a needle file.

They may contain zinc or aluminum. If these metals get mixed into your bullet metal they will make casting perfect bullets very difficult. Also, the strip, tape-on wheel weights are almost pure lead. If your WW scrap contains many of these it will be softer than expected. Wheel weights by themselves make fine .45 auto bullets, but the addition of 2 percent tin makes casting easier and reduces leading. The same alloy can be heat-treated to extreme hardness, almost as hard as copper. The humble wheel weight will make 3,000-fps rifle bullets or handgun bullets usable against the heaviest game. They are also an excellent low-cost base metal for building any other alloy with the addition of tin, antimony, and/or pure lead.

In addition to heat-treating, there are what I will call two other categories of bullet metal: medium-hard and linotype. The medium alloys are similar to the commercially available Lawrence Magnum (2 percent tin, 6 percent antimony, 92 percent lead) and the old standby Lyman #2 (8 percent tin, 8 percent antimony, 84 percent lead). The latter actually contains more expensive tin than is really necessary.

Linotype is one of the old alloys used in the printer's trade. There were harder metals, sterotype and monotype, but both of these were so high in antimony as to be brittle as glass and not useful in their pure form as bullet metal. Should you encounter any of these old metals they are often very inexpensive sources of antimony. They might still be found at some old, small-town newspapers. Back to linotype. This is a great bullet metal just as it is. The composition is 4 percent tin, 12 percent antimony, 84 percent lead. Its hardness is BHN 22. This alloy is less dense than wheel-weight metal and is the metal used to calculate the weight of NEI bullet molds. Their mold speced for 325 grains will throw a wheel-weight bullet that weighs 345 grains. Conversely, bullet molds designed around more-dense metals will be light when lino is

continued on page 83

BULLET CASTING

continued from page 59

used. I have taken a lot of big game with linotype bullets. It is about the best compromise of hardness and toughness. Any metal with a higher antimony content will shatter when it hits bones at handgun velocities. Lino is absolutely explosive at rifle velocities. The real drawback to linotype is—or was—its cost. At a local smelter the price is $1 per pound in 100-pound lots. Often lino is much more expensive. With the previously mentioned L.E.T.S. antimony and scrap lead you can create linotype at a lower cost.

Some months ago I wrote about the L.E.T.S. as a source of pure tin and antimony pre-alloyed 50/50 with lead. This was a very good start. Now they supply pulverized antimony and a special flux that lets you mix the antimony, in its pure state, right in your own casting pot. The secret is the pulverizing

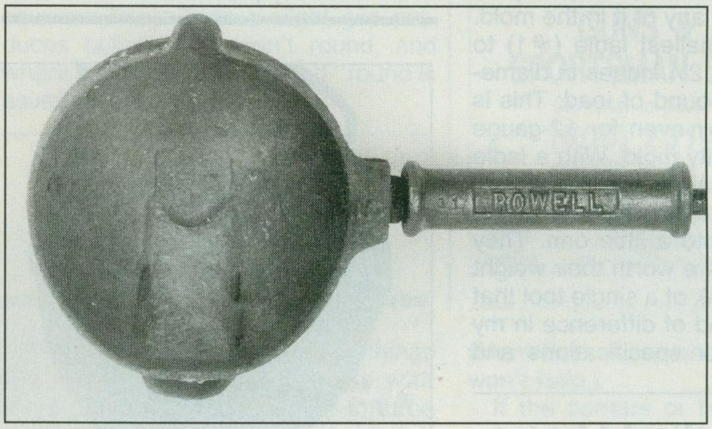
"...flux early and flux often."

process and the awesome flux. Starting with wheel weights (or pure lead) heated to 750 degrees, you add the prescribed amount of pure tin and then a mixture of L.E.T.S. flux and pulverized antimony. The results are simply magic. The antimony crystals disappear into the lead/tin solution.

The best analogy I can give you, so that you don't have to experience the antimony nightmare and still appreciate the grand step forward in technology, is to imagine trying to get a lump of grease to dissolve in a pan of cold water. That is equivalent to molten lead and a lump of antimony. Now, boil the water and add a big squirt of dishwashing detergent and you will have the effect of the new flux and "usable" antimony. Using wheel weights and L.E.T.S. metals you can make lino at about two-thirds or less the cost of commercial linotype. Better yet you can make *any alloy you want*. The L.E.T.S. booklet called *The Bullet Caster's Recipe Booklet* gives you instructions on how to use the metals and recipes for several basic bullet alloys. For a copy of the booklet and prices for tin, antimony, and special fluxes, send $1.50 to Leading Edge Tool Service, Dept. GA, Route 2, Box 108AA, Palmyra, MO 63461.

The tools required to make fine cast bullets are relatively simple. Of course you need bullet molds, but I have found that the mold itself is the least controlling factor in bullet quality. Yes, the mold must be correctly machined, but beyond that I have made perfect bullets in iron, brass, and aluminum molds by virtually every mold maker in the country. Some molds are almost magical, refusing to make a bad bullet. Others take a bit of coaxing. They all must be free of grease and oil. I wash them with solvent or hot, soapy water (being sure to let them get thoroughly dry before casting). I also smoke the cavities with a match or propane lighter. Better yet, there is a commercial juice called NEI Mold Prep. This is an alcohol-based compound that puts a thin, non-stick surface on the cavities, sprue plates, and other working surfaces. I find it to be tougher, easier, and slicker than real smoke.

Bullet-making requires some heat source and pot to hold the lead. The all-in-one electric, bottom-pour pots are the easiest to use but in my opinion the most difficult to make perfect bullets with. The fact that the molten lead squirts out the bottom with considerable force causes the greatest difficulty. Also, as the metal level in the pot decreases the pressure of the "squirt" decreases, making uniformity suspect. Adjusting the pot to the minimum flow rate that will fill the mold fast enough to avoid wrinkles works best for me.



The Rowell bottom-pour ladles recommended by the author help keep impurities out of the bullet mold.

Letting the jet of lead hit the edge of the "funnel" in the sprue plate, rather than centering the hole, helps avoid the turbulent splashing about the cavity that creates bubbles and voids. Sometimes, with a well-vented mold, I center the pot's nozzle in the sprue-plate funnel and hold the mold tightly against it. This seals the hole and actually forces the lead into the mold under pressure. This works with some molds and is disastrous with others. Keeping a second pot of molten metal near the bottom-pour pot and using this additional material to keep the casting pot full also helps. Beyond that, I prefer to make bullets with an open-top pot and ladle.

There are several options at this point. I have two setups, one for making bullets, the other for smelting scrap metal into clean usable-size pieces. The scrap smelter is an old printer's furnace that I bought at a junk yard. The "pot" is a rectangular trough that holds 200 pounds of lead. I use a propane weed burner to fire it. This is an outdoor, once-a-year, best-in-winter proposition. When the metal melts, I flux it with grease and ladle it into ingot molds that I make from 1½-inch-wide x 4-foot-long pieces of angle iron. After that I cut the 4-foot ingots into 6-inch lengths with an axe.

Plumbers used to make lead joints, which today seem to be obsolete. Along with them went the gasoline and propane-fired plumber's furnaces that handled 20 to 40 pounds of lead. These were a great source of pots and fire for both smelting and casting. To date I haven't found a reasonable source of new pots and furnaces, but there should be plenty of used ones lurking around if you search junk yards and plumbing shops.

Assuming that by hook or by crook you have bullet metal in clean, usable sizes, you need a pot and heat source to make bullets. If you are making small bullets or small quantities of larger ones the 10-pound pots are fine, but beyond that I like a 20 to 40-pound casting pot. Lyman makes an electric open-top pot for ladle casting that holds 20 pounds. Beyond this I resort to separate pots and heat sources. I use an old two-burner gas hot plate for heat. I have bored out the orifices and use propane so I can get the thing up to warp-drive and melt 40 pounds of alloy in about 20 minutes. At gentle idle it will hold the correct casting temperature. While mine is antique, modern gas hot plates are available from stores that sell gas appliances. A Coleman stove generates plenty of heat for bullet casting. You just need to keep the weight down to a reasonable level, or beef up the structure so it doesn't collapse under the weight of the lead.

With a heat source you need a pot.

continued on page 84

BULLET CASTING

continued from page 83

My 20 and 40-pounders are both relics of the plumber's trade. Right now I do not know where to get new, large-capacity smelting pots. If you know of a source I would appreciate the information. I do have an alternate plan. This would be to use a big Rowell ladle, without handle, as a melting pot. They come in sizes from 1 to 10. Their #7 holds 25 pounds and #8 holds 40 pounds of lead, with a cost around $40.

Beyond using them as melting pots the Rowell ladles are *the* answer to pouring lead into ingots and especially into bullet molds. They are called "bottom pour." This means that the lead that comes out the spout is delivered from the *bottom* of the ladle. You can have a lot of debris on the top of your metal and not get any of it in the mold. I use Rowell's smallest ladle (#1) to make bullets. It is 2¼ inches in diameter and holds a pound of lead. This is an ample reservoir even for 12-gauge slugs or a six-cavity mold. With a ladle you also have total control of the flow rate, pushing lead quickly into a big cavity or slowly into a little one. They cost $13.40 and are worth their weight in gold. I can't think of a single tool that has made this kind of difference in my bullet casting. For specifications and prices, send $1 to Advance Car Mover Co., Dept. GA, P.O. Box 1181, Appleton, WI 54912.

"Water should be considered a grave enemy when you cast."

I have two more tools that I feel are essential to making perfect bullets. A good pyrometer (casting thermometer) that will go up to 1,000 degrees gives you control over casting temperature. Different molds, alloys, and casting techniques require different temperatures. Guessing is a hard way to go. This tool is available from Lyman, Brownells, and some industrial supply houses.

I also routinely use an LBT Hardness Tester. This little unit gives a reasonably accurate readout of the Brinnell hardness of a finished bullet. While the hardness of some bullets doesn't matter, you need to know the BHN of high-velocity bullets and those you will use on big game.

We have progressed to the point that we have a pot of metal with a fire under it; now we get down to making bullets. First a few safety precautions. Lead and lead vapors as well as the fumes from some fluxes are poisonous. Make sure that you use adequate ventilation, including a fan to create a cross-draft, so that you don't inhale the fumes. Also, wear gloves and wash after you handle the lead. Heat resistant gloves, safety glasses, goggles, or a face shield are mandatory.

Water should be considered a grave enemy when you cast. A drop of water on top of a pot of lead is harmless, but even a few water molecules *under the surface* of the molten lead can cause a very untidy explosion. I begin with a cold pot, with my metal piled in it, start the fire, and rest the ladle on top. This gradually brings all of the components up to temperature and drives off the moisture that may condense on the surfaces. Dipping a cold ladle under the surface of molten lead or dropping in large chunks of cold metal is an invitation to disaster. The cold metal, often coated with hygroscopic oxides, will carry water under the surface and may cause some real fireworks.

With the metal up to about 700 degrees, flux, stir, and skim off the impurities. I use commercial fluxes but actually prefer bullet lube, paraffin, or beeswax. Whatever you use, flux early and flux often. This keeps out the oxide contaminants and makes the metal a lot more agreeable, as well as keeping the antimony in solution.

Now a real secret: preheat the bullet mold by putting it on and then *in* the molten metal. I hold the handles and let the blocks float on the lead until I am sure all moisture has evaporated. Then, after making sure the mold is closed tightly, I submerge about a third of the mold blocks. At first lead will freeze and cling to the blocks. As the blocks reach the temperature of the metal, the lead that holds onto the blocks will melt away. Next submerge about half of the sprue plate until it too is as hot as the metal.

I know that there are authorities who will tell you not to do this "preheating," but I do it to every mold I own, including those priceless ones out of original cased rifle sets. Let the hot mold stand for 30 seconds or so to normalize, then fill the cavity. Have you ever noticed that when you begin to cast bullets you have to work and struggle to get good bullets? Then, when you are almost done, perfect bullets fall out almost every time. Quite often this is simply because the bloody mold has finally gotten hot. We just took care of that!

While various specialized fluxes are available, more-common materials like ordinary paraffin also work well.

A ring of steel pipe is used around the melting pots as a heat shield to save energy and protect hands and tools.

Aside from the cool mold, a very common trouble is a too-hot mold. Impatience is part of the problem. You want to make bullets, not wait, so you open the sprue plate too quickly. This overheats the mold, smears lead on the sprue plate, and causes fins on the base of the bullet. If you know how badly I dislike waiting, you won't be surprised that I have devised something wonderfully productive to do while I wait for the metal in the mold to harden properly: I make another bullet! I almost always use two molds in rotation. They needn't be for the same or even similar bullets. All you do is get one preheated and casting perfectly, then put it down without dumping the bullets. Preheat the second mold, make one or two casts, and then put it down while you dump and refill the first. Rotate from now on; pick up the resting mold, knock out the bullets, refill, put it down, and pick up the resting mold. If your metal temperature is correct the molds will maintain a perfect temperature for hours.

Now that we are happily casting away we'll backtrack a bit. There are ways and there are *ways* to pour the metal into the mold. Using the ladle I like to pour from ¼ to 1 inch above the mold. This gives you control over the pressure "pushing" the lead into the cavity. Normally big bullets, 250 grains or more, will need a bit higher pour than smaller ones. Don't be afraid to experiment.

I pour the metal right at the center of the hole, holding the blocks nearly level. There is no need to pour the metal so fast that it runs over all of the sides, but be sure to pour faster than the hole can drink it. You must also keep pouring a little while after the mold is full. This gives the base time to fill out and keeps the metal at the base molten while bubbles find their way out. The idea is to get a smooth flow into the cavity as quickly as possible, without undue turbulence or bubbles, and to maintain it while the metal in the cavity stabilizes.

Knowing how fast and how long to pour is easy, once you *see* it. The lead runs into the cavity just like water down a sink drain, and when the cavity gets full you can see the flow rate change. It is subtle, like "seeing" a rainbow pick up a #22 wet fly, but once you get the knack it jumps right out at you. When you see the lead in the sprue hole "bounce," pour about a half to 1 second longer and quit. Be sure to leave the sprue funnel full. The bullet will draw metal from this small reservoir as the lead freezes and shrinks.

With a multiple-cavity mold, tilt the blocks slightly (about 10 degrees) downward, low end away from you. Fill the lower cavity first, then when you are ready to quit pouring just move the stream up to the next hole. Trying to let metal run from one cavity to the next or having the overflow splash into an empty cavity usually makes a lot of bad bullets. Take care of each cavity in turn and your results will be more efficient.

Opening the mold and getting the bullets out is simple. My favorite tool is a Garland mallet. This is made of rolls of rawhide and is used in leather carving. You can get one from Tandy or any other store that sells leather-working tools. Garland mallets last forever, won't melt, and, most importantly, won't mar the mold.

I dump all sprues and scrap into a separate container. Mine happens to be a VW hubcap, but any heat-resistant wide-mouthed receptacle will do. Dumping the sprues back into the pot can splash metal onto the block faces and will leave unmixed antimony on the surface. This is another reason for a big pot. You can cast for a long time and have plenty of metal without remelting sprues. After a gentle tap to cut off the sprues (I turn the mold on its side before I hit the sprue plate, knocking them directly into the hubcap), I open the mold fully. This is important, because if you don't "open wide" the soft bases of the bullets hit the opposite block. This damages the all-important bullet base. I dump my bullets on a piece of carpet, but *not* on the fuzzy side. The hot bullets will melt the carpet fiber. I use the back, burlap side of the carpet. This cushions the fall of the soft bullets but doesn't burn, stick, or mar the molds.

Before you refill the mold, be sure to close it tightly, ending with a good squeeze on the handles. Some molds will close automatically; others with tight alignment pins will stay open a few thousandths of an inch unless you squeeze them. Even a slight gap produces bullets that aren't round, and where accuracy is concerned "round is usually where it's at."

"The tools required to make fine cast bullets are relatively simple."

If you have done all of these things you should get perfect bullets with sharp corners and no wrinkles in three or four pours. (Don't worry about a frosty surface; the gun barrel, target, and critters can't tell that the bullet isn't shiny.) If your bullets refuse to come out perfect, here is a checklist and some cures:

If you have wrinkles you may need to increase the temperature of the metal and/or mold, degrease the mold, smoke the cavities, flux the metal, or increase the tin content of the alloy. (More than 4 percent or 5 percent tin won't help.)

If the corners or base refuse to fill out sharply, consider the above and then suspect the mold's venting system. I see a lot of molds that are not properly vented. LBT does a superb job of venting its molds. The company uses a fast cross-feed on its milling machine to create a series of minute grooves on the faces and top of the blocks. This gives the air inside the cavity an almost infinite number of trails out. If the cavities won't "leak" air you can't make good bullets.

If a mold refuses to fill perfectly you may need to vent it a bit. I use a needle file, drawing it away from the cavity, to make little grooves in the block face. Usually the upper corners of the bullet will need help. Also, using a flat file to slightly "break" the corners of the top of the block will allow air to escape from the base portion, under the sprue plate.

As you can see, the magic is not so magical. My methods are almost primitive, but come to think of it so are lead bullets, unless you consider their success in modern firearms and especially in handguns. A mixture of old and new technology makes bullet casting easy. If you are going to go to the trouble to make your own bullets they might as well be good ones.

DIRECTORY

BLOUNT, INC. (RCBS)
Dept. GA, P.O. Box 856
Lewiston, ID 83501

BROWNELLS
Dept. GA
Route 2, Box 1
Montezuma, IA 50171

LBT
Dept. GA, P.O. Box 357
Cornville, AZ 86325

LYMAN PRODUCTS
Dept. GA, Route 147
Middlefield, CT 06455

NEI
Dept. GA
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Portland, OR 97220