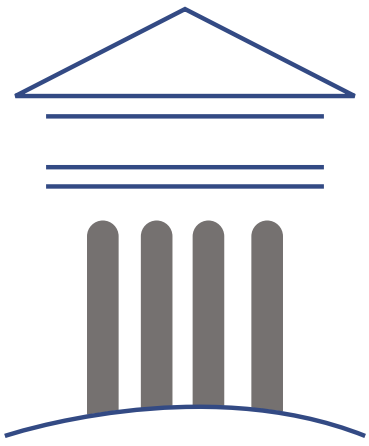
Bullet Swaging and Casting Lesson: 2201

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Objectives

In this lesson, you will learn

1. What die is used to make a short-jacket bullet.
2. The procedure of fluxing when casting lead bullets.
3. The type of alloy used to cast bullets for shotguns and black powder arms.
4. The causes of wrinkles in cast bullets.

Introduction

Shooters have been reloading their own cartridges for many years. They continue to assemble the components of a round — cartridge case, primer, powder, and bullet — for several different reasons.

Some shooters handload because they can make cartridges to specifications that are not available otherwise. For example, shooters may require fast, light loads for varmint hunting; highly accurate loads for target shooting; inexpensive loads for continuous shooting; or very light loads for target shooting or plinking in restricted areas.

Most handloaders get much satisfaction from loading their own ammunition, while saving money at the same time.

Previous lessons discussed the principles of reloading ammunition using factory components, or powder, primers, and bullets, that are already available. This lesson discusses how to make bullets either by casting or swaging.

Swaging

Bullet swaging is the process of forming lead and copper alloy or pure copper jacket materials into finished bullets by using pressure. This differs from casting because no heat is required. The materials are made to flow under high pressure at room temperature into precise conformity with a highly finished, extremely strong die.

Corbin Manufacturing & Supply, Inc. of White City, Oregon, is considered the authority on bullet swaging. Corbin furnishes dies, tools, and equipment for most swaging operations. www.corbins.com

An ordinary reloading press can be used to supply the pressure for swaging several kinds of bullets. Some Corbin dies are made for use in standard reloading presses. Examples include the RCBS Rock Chucker, the Pacific Multi-Power, and the CH Champion. If the press accepts regular RCBS. shell holders, and has standard reloading-die threads ($^{7}/_{8}$ x 14 threads per inch), the Corbin dies will fit the press.

However, some types of presses are more suitable than others for swaging. Turrets, lighter-weight presses, and some special presses where the handle swings over the top are not suitable due to the way the dies operate. Great strength and power are not required for the Corbin dies that are available for reloading presses. All of the bullets that Corbin has for regular presses can be swaged with no more effort than resizing a case in a full-length resizing die.

Pressure is high because the dies are closed, or semiclosed, and the area of the punch is small. If you put 20 pounds of force on the press handle of a compound leverage press, and set the die high enough so that the press barely touches the end of the stroke when the punch touches the bullet, you can easily generate rifle chamber pressures with that die in some calibers. However, brute force is unnecessary and can be damaging.

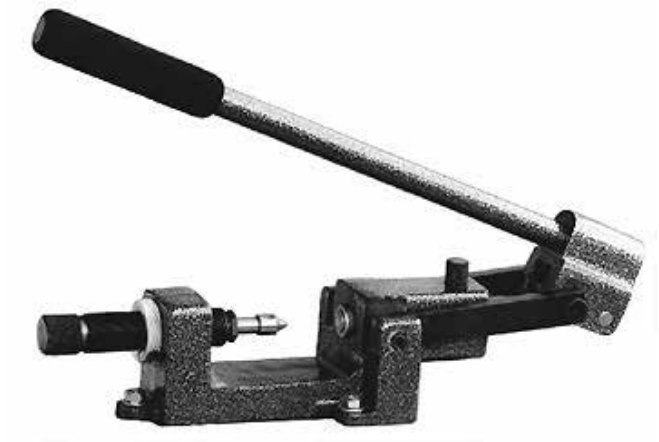


Figure 1: *The S-Press bullet swaging press, a very accurate and extremely powerful press designed for swaging bullets only.*



Figure 2*: Corbin swaging dies.*

Corbin dies for reloading presses are available in .224 and .243 rifle calibers and in the handgun sizes from .25 ACP to .38 Special. They also have jacket-making and bullet-reducing dies for reloading presses. Corbin now makes the S-Press™ which replaced older versions of Corbin's bullet swaging systems.

The S-Press (Figure 1) can handle any caliber and type of bullet. The S-Press is designed to withstand the heaviest requirements of bullet swaging. The CSP-1 was designed as a combination swaging and reloading press, with the emphasis on power, strength, and alignment. Because it can use the special type-S die with a 1-inch diameter body and a thrust-bearing shoulder in its hardened alloy steel ram, the S-Press has the ability to use harder lead. It can handle alloys up to Bhn 8-10 depending on the caliber and complexity of the shape. Blunt shapes in smaller caliber can accept harder material and still produce a good bullet, whereas sharper pointed shapes in larger calibers take a great deal of force even to flow soft lead.

This press uses four precision roller bearings in the links. The ram moves inside two inch-long oil-impregnated bushings. The toggle linkage moves inside a high pressure bearing in the tail of the ram. No moving parts, in fact, are without a bearing in this press design, whereas few other presses have even one bearing. The S-Press works with older Type-M dies and with pre-2002 Type-S Dies (Figure 2) which have a slotted ejection punch head. The 2002 and later version of the S-punch uses a larger diameter head with a hole completely through it. The stop pin, in the front of the press, is different depending on which kind of die is to be used. Older dies with a slotted punch use the *short* pin. Newer dies with a hole through the punch head use the *long* pin. The *long* pin provides for support on both sides of the ram, and is more than 200% stronger than the earlier method of ejection. While the short pin *may* be used with the newer style ejection punch, it does not provide as much support and protection against bending as the new, longer pin.

The exact number of dies and punches needed for swaging depends on the caliber, bullet style, and jacket. Therefore, because of various price ranges, it is not possible to predetermine the exact cost of equipment.

First, there is the jacket and the lead core. All-lead bullets can be swaged, but swaging gives you the choice of jacketed bullets also. Using pure lead in a variety of jacket styles and assemblies gives the density and high-ballistic coefficient of pure lead and the freedom from leading, control over expansion, and precision at high velocity.

Lead cores, which are swaged to form the heart of the bullet, can be cast from scrap lead in Corbin molds. This method is much faster than bullet casting, since Corbin molds eject upward and mount to the bench to be operated with one hand. This produces four cores simultaneously of any weight desired in one caliber. Or, rolls of precision-drawn lead wire can be cut with a die-type core cutter that measures out a precise length of core each time the handle is pulled.

Casting costs less than the lead wire method, but is usually more time-consuming. Cutting lead cores, although faster, is a little more expensive per bullet but still very reasonable compared to buying bullets.

Lead wire is sold in 175,000-grain spools. Divide the bullet weight to see how many bullets can be obtained from one spool.

The lead wire used must be small enough to fit into the chosen bullet jacket. To make a core most accurate in weight, a core swage die, shown in Figure 3, is used. This is the first die in the set. It will accept either cast or cut lead cores, which should be 2-3 grains heavier than the weight of the bullet desired. This allows for tolerance of weight. The die will swage these cores to a slightly shorter but larger diameter that is smooth and perfectly round, with correctly shaped ends.



***Figure 3**: Core swage dies.*



***Figure 4**: Corbin's Core seating die.*

The weight is adjusted by the core swage die. Small bleed holes surround the interior of the die and permit the tiny lead wires to be swaged from the surplus lead weight left in the core. Setting the press (adjusting the floating punch holder) so that when the ram moves all the way forward, the precise amount of volume is left between the external and internal punch within the die, gives the correct lead weight. It also removes any variation in the core automatically, by swaging or pressing the excess lead into the bleed holes.

This near-perfect core is ejected automatically from the S-Press die on the backstroke. Next, the core seating die, shown in Figure 4, is used to insert the core into a jacket and to expand both upward to a precise diameter.

The core seating die is a straight, perfectly round, and highly polished cylinder. The internal punch usually presses on the bottom of the jacket, although for special jobs you can do this backward. The external punch determines the kind of bullet that is made.

Bullet jackets vary in thickness, so a punch diameter that fits the jacket is needed. If it is too small, the lead will spurt out around the punch. If it is too large, the punch will plow up jacket material as it is pressed down. Jackets made of copper tubing are usually thick, requiring a small diameter punch. Those made of thin-walled rimfire cases, for making no-cost .224 or 6 mm bullets, require a larger diameter punch.

To make semiwadcutter pistol bullets, use a punch with a cavity machined into the end instead of a flat-tip punch to press the lead core. The lead core is made longer than the jacket so that when it is seated, it expands in the bullet jacket to touch

CORE SWAGE DIES

1 – INTERNAL PUNCH
2 – EXTERNAL PUNCH
3 – DIE
4 – BLEED HOLES
5 – CORE BEING SWAGED
6 – EXTRUSION OF LEAD
7 – FINISHED CORE
8 – HEAD OF INTERNAL PUNCH
9 – DISHED SHAPE MAKES THE DOME ON THE CORE, WHICH GOES TO THE BOTTOM OF THE JACKET.

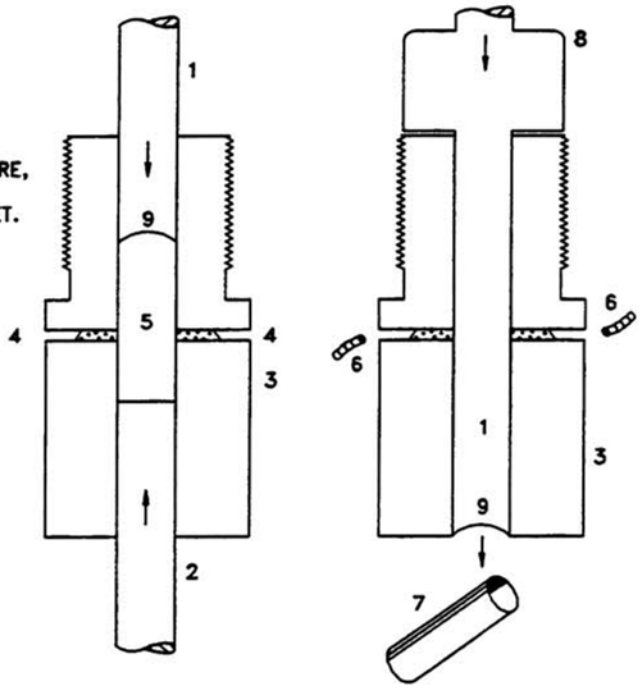
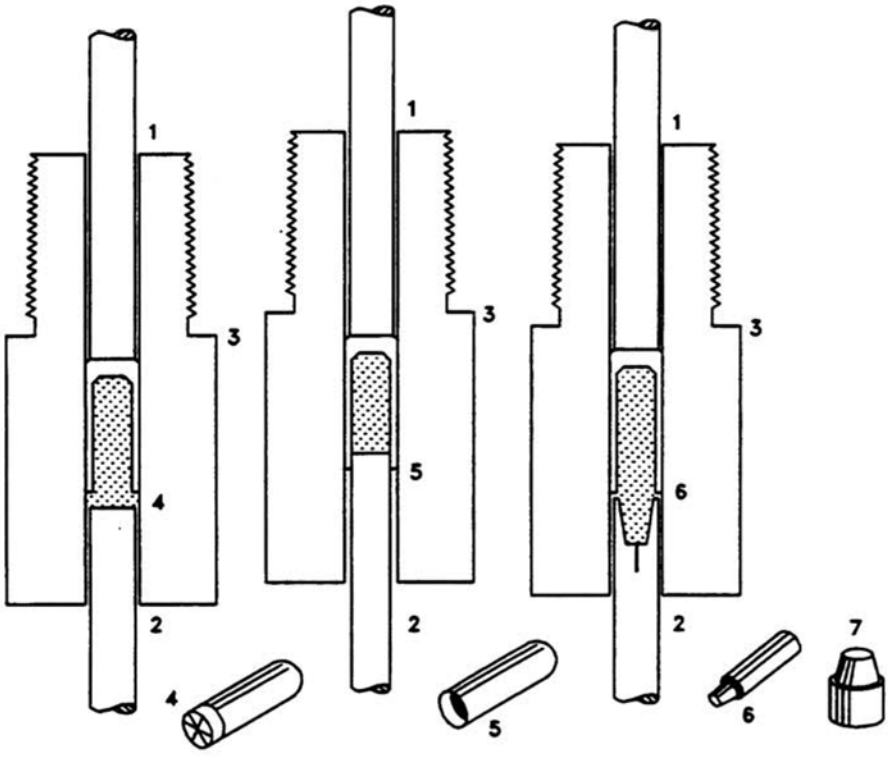


Illustration of core swage dies.



CORE SEATING

1 – INTERNAL PUNCH
2 – EXTERNAL PUNCH
3 – DIE
4 – LEAD TIP CORE SEATING
5 – OPEN TIP CORE SEATING
6 – SEMI–WADCUTTER BULLET SWAGING
7 – HANDGUN BULLET MADE IN A CORE SEATING DIE

Illustration of core seating dies.

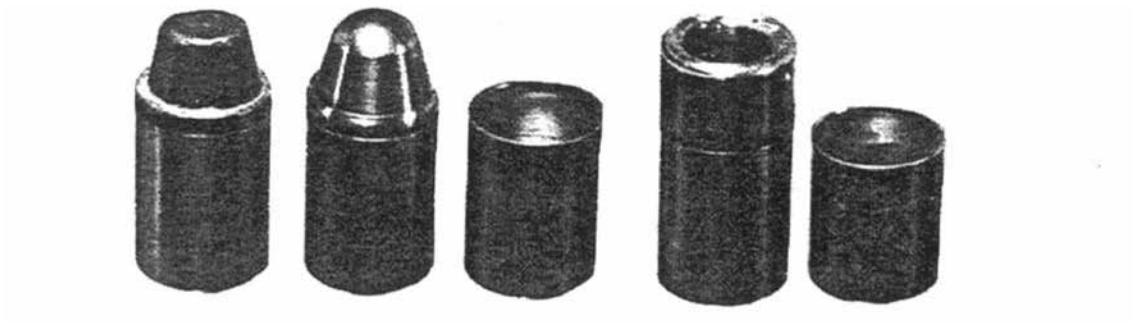


***Figure 5**: Straight-wall dies make bullets such as these, all of which have a small step between the cylinder portion and the actual ogive. These may be called semiwadcutter styles. The actual nose shape is controlled by the cavity in the bottom punch, which can bear only against the lead core, not the jacket.*

the die walls and fills up the cavity in the punch tip, taking the shape of the cavity. A semiwadcutter jacketed bullet, as well as those of any other shape, can be made this way (Figure 5).

To make any bullet with the jacket brought around the nose, like those shown in Figure 7, on page 8, a matched set of two dies must be used. The core seating die is smaller than the point forming die, which is the next die in the set. This enables the slug to be ejected, and to slip easily into the point forming the die's cavity. For example, to make a .357" bullet, use one core seating die for making semiwadcutter bullets, and a slightly smaller die for seating cores to make a bullet with the jacket curved away from the full diameter.

When making a bullet in one die, enough lead must be available to ensure that the external punch does not press against the edge of the jacket (Figure 6). If less than the correct amount of lead is used, the punch will press against the edge of the unfilled area of the jacket cavity, crushing the jacket.

The jacket will not be able to jump over the edge of the punch and will start to curve inside the punch cavity. Jacketed bullets that are made in only one die are called short-jacket bullets.

The difference in die size for making handgun bullets is not enough to worry about. Approximately 0.0002" to 0.0005" is all the difference needed in a match set of swage dies to allow proper operation of a core seat and point forming set. Therefore, it is acceptable to use a core seating die for a semiwadcutter nose shape with a step junction between the jacket end and the start of the nose. For perfection in your handgun bullets, specify the core seater for making the final diameter of the bullet only, not for making rifle-style bullets with a point forming die at a later date.

Each step in swaging requires that the slug fit easily into the next die. A 0.2240" seated core and jacket cannot easily fit into a 0.2240" point forming die. Therefore, the point forming die should be 0.2242" in diameter, or the core seater should produce a 0.2238" seated core and jacket.

The point forming die, shown in Figure 8 on the next page, is the most costly die to make, and requires the highest skill in die making.

At the tip of this die is a tiny hole, just big enough for a tough spring steel pin that is as long as the die. The pin is held back by a spring in regular reloading press dies, or by a tool steel pin in Corbin's S-Press system. The ejection pin is held back from the die cavity while the bullet is being swaged, but upon ejection, it is driven down until it contacts the edge of the tip of the bullet jacket. More pressure makes the pin shove the bullet out of the die by its nose.

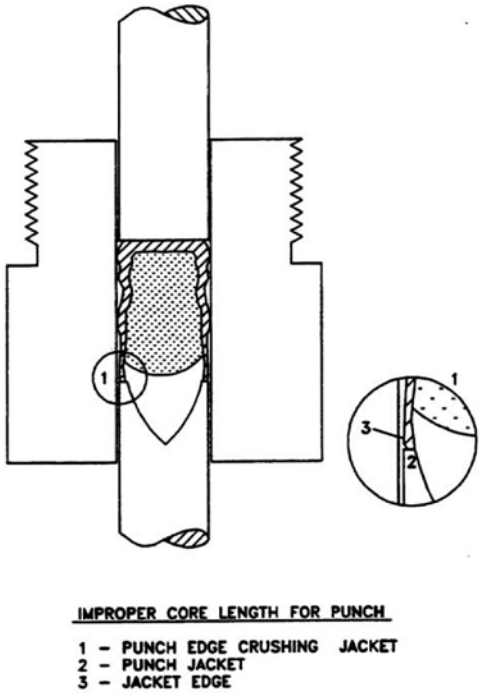


***Figure 6**: Example of improper core length for punch. (1) Punch edge crushing jacket, (2) Punch edge, (3) Jacket edge.*

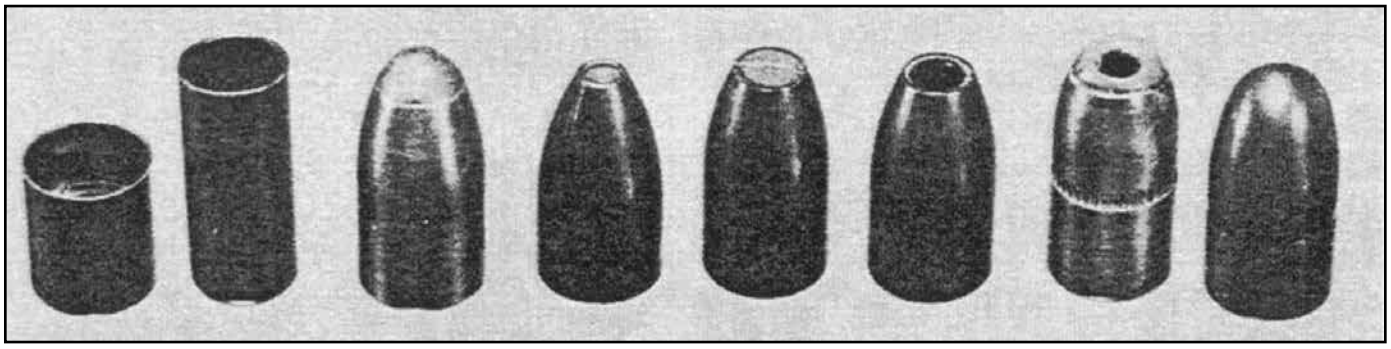


***Figure 7**: All of these bullets are made in two steps. First they must be formed in the core seating or straight-wall die, when they have a straight cylinder shape. Lead is normally left sticking out the end. Then, this slug is run lead-first into the ogive wall die to form the rounded part.*

The size of the ejection pin depends on the size of the tip of the bullet. The die manufacturer needs this information because certain types of bullets and jackets have minimum size limits. If the bullet requires too much ejection pressure, an ejection pin with a very small diameter will bend and cannot eject the bullet.

Also, if you want a lead tip on the bullet, the dies must be designed accordingly.

Pressing the bullet out by its nose means that the flat end of the ejection pin will push a small flat area on the bullet tip. This is fine for most bullets, since the pin is typically about 0.081" or less in diameter. But to form a sharp spitzer lead tip or finish off the lead tip in another way, a die with a slightly larger diameter than the point forming die is needed. The larger diameter enables the bullet to be guided against a special internal punch having the desired shape lapped into its tip. This die, a lead-tip forming die, shown in Figure 9, requires so little pressure that the bullet diameter will not be changed. It is used only when a tiny flat area at the tip of the bullet is not required. This type of die is never used with open-tip bullets where the lead is seated completely with the jacket.

The lead-tip forming die comes with an internal punch only, since the same external punch is used to form the point. The point forming die has a punch that slips easily into its cavity. The bullet is formed with the open end of the jacket toward the top of the point forming die, except for full-jacket, military-ball bullets.

These are formed with the base of the jacket toward the closed end of the die.

All the bullets described so far have a flat base. To make a boat-tail bullet, the open end and the closed end of the jacket must be curved. This presents a problem in a single die, because there is no way to get the bullet back out. However, the boat tail can be formed while seating the core, using the pressure of the lead to push the jacket out to meet the die.

A boat-tail die set differs from the standard flat-base die set, because it includes a boat-tail preforming die between the core seater and the core swager dies. The core seating punch goes into the jacket for open-tip bullets exactly as does a flat-base core seating die. The internal punch matches precisely the base diameter of the boat-tail bullet and is exactly long enough to close the die where the base of the boat-tail bullet will be formed.

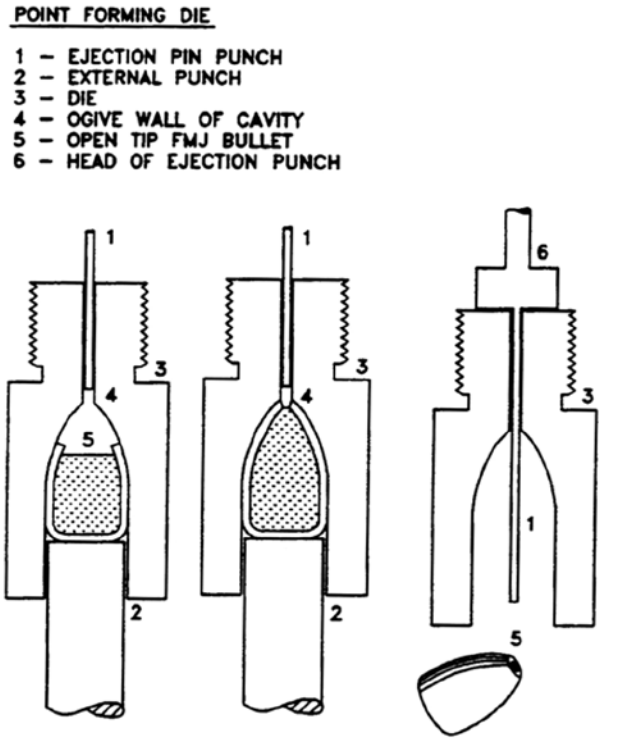


***Figure 8**: Point forming die. (1) Ejection pin punch. (2) External punch. (3) Die. (4) Ogive wall of cavity. (5) Open-tip FMJ bullet. (6) Head of ejection pin.*

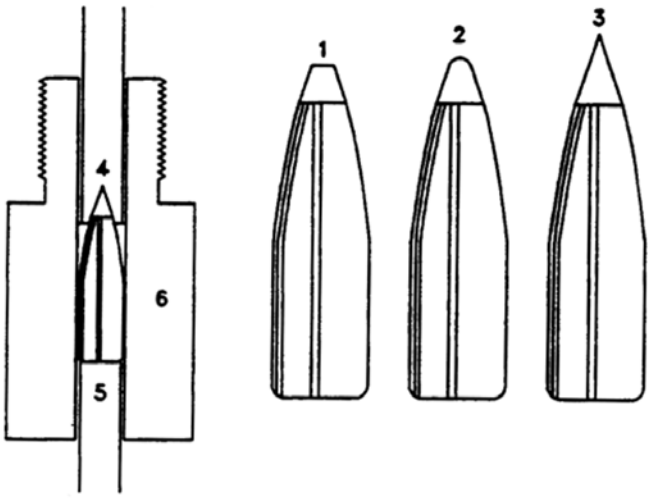


Figure 9: Lead-tip forming die. (1) Lead tip as it comes from the point forming die. (2) Reshaped semi-spitzer tip. (3) Reshaped spitzer tip. (4) Internal punch. (5) External punch. (6) Die.

This punch runs forward to the die mouth to eject the bullet, which at this point is a straight-sided cylinder with a boat tail on the closed end. The core is further seated and the boat tail takes its final form in the second operation. The point forming die does its usual job, but the external punch is replaced with a punch having the boat-tail cavity machined into it.

Since these punches have a very thin edge to avoid putting a shoulder into the jacket, the true boat-tail uses very fragile punches. The slightest misalignment will damage the edges. The rebated boat-tail has many advantages over the true boat-tail. It has longer punch life, is very accurate, and is popular with long-range centerfire shooters.

Jackets for swaged bullets are normally available for about half the cost of a bullet. However, in some of the larger rifle calibers, jackets are not available. In this case, dies are available to close the ends of ordinary copper tubing (type L, hard-drawn copper) and reduce it from standard fractional sizes to any proper diameter for swaging bullets. This is especially handy for bullets in 0.358", 0.375", 0.458", and larger diameters. A copper tubing jacket-maker set, shown in Figure 10, has an end-rounding die that puts a half-caliber round ball end on the piece of tubing cut to the desired length from the straight sections available. A dummy steel core is used inside this jacket in a regular core seating die to flatten and close the end. A draw die is then used to reduce the diameter to the size of the bullet.

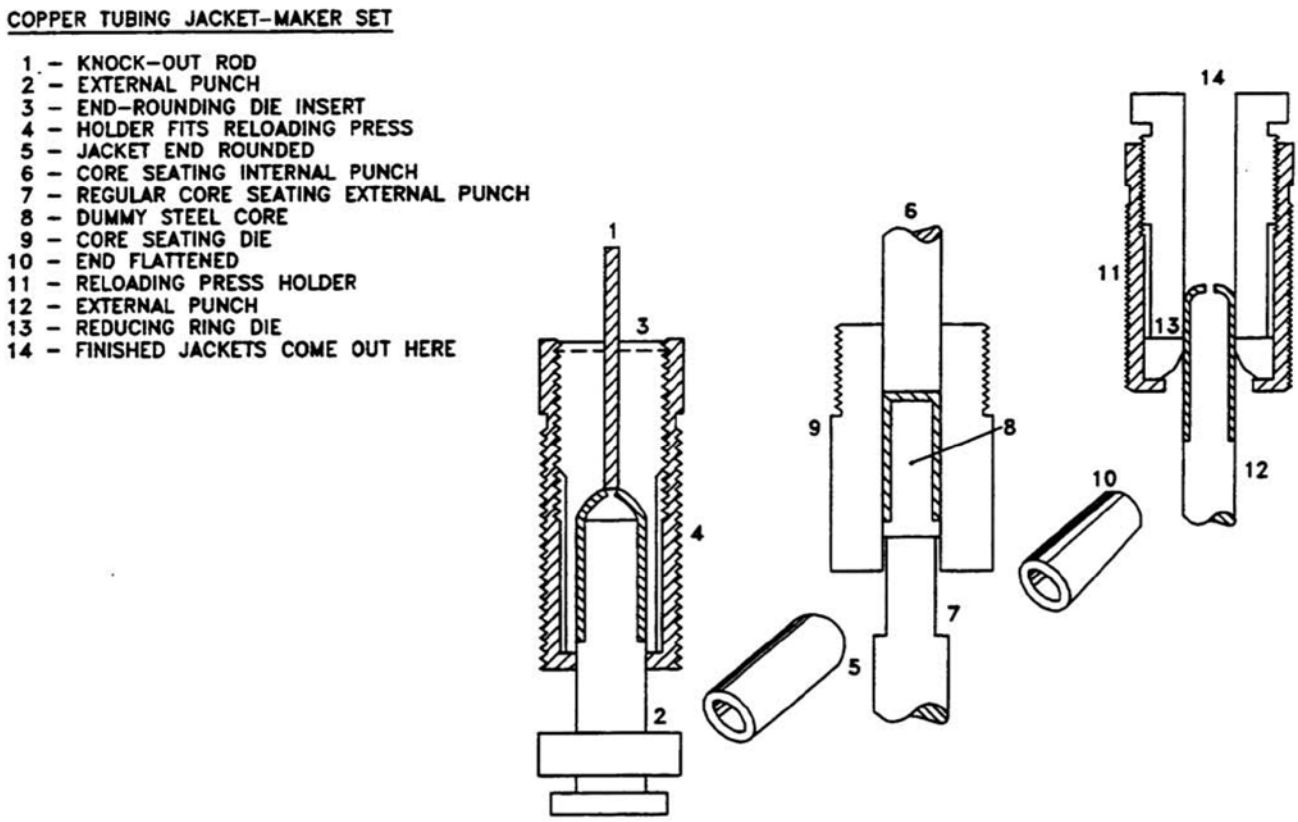


Figure 10: Copper tubing -jacket-maker set.

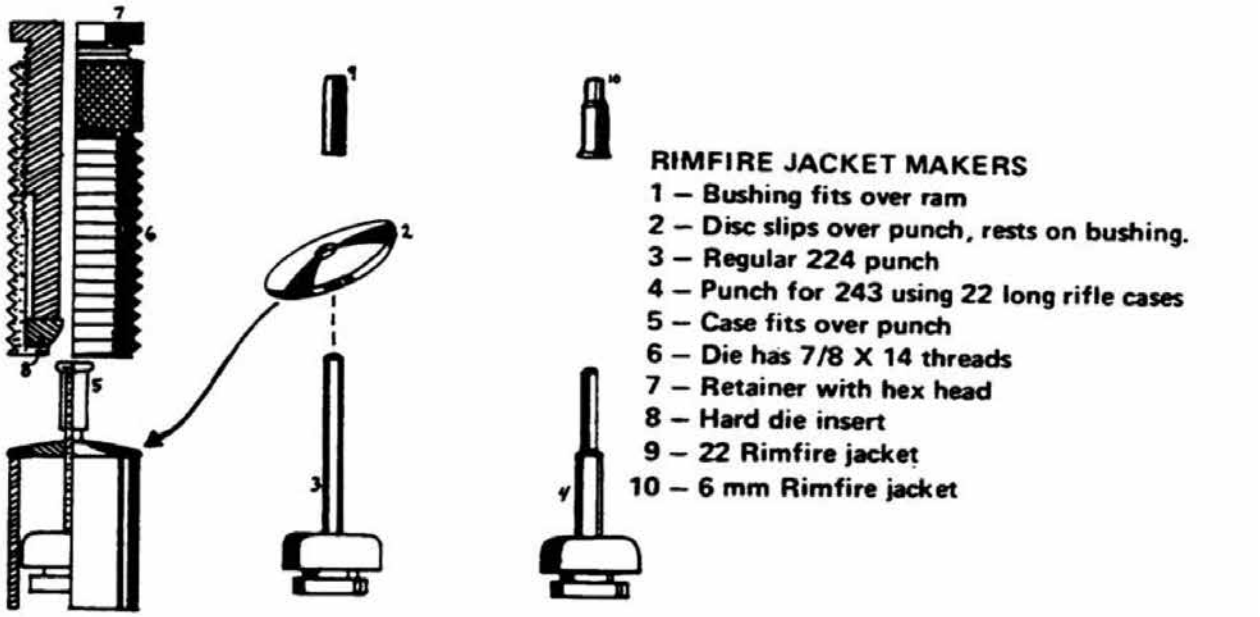


***Figure 11**: Rimfire jacket maker.*

Corbin's rimfire case jacket-maker dies, shown in Figure 11, can draw a .22 Long Rifle, Short, or CB Cap fired case into an excellent jacket for a .224 bullet. Corbin makes similar jacket makers for 6 mm jackets from .22 Long Rifle cases, and also from .22 WMR cases.

To make rifle bullet jackets from fired rimfire cases, wash the cases in hot, soapy water. Dry them and press them partly through the ring die with the punch provided before ejecting them from the punch on the backstroke. A disc slips over the punch and a tube of steel contacts the disc on the down stroke of the press before the punch is installed. After the punch has been installed on a number of these cases, set the die lower and push them all the way through. This method requires very little effort.

After drawing the cases, heat-treat them for about 30 minutes at 500° F in a conventional kitchen oven, and allow to cool slowly overnight. This keeps them from wrinkling and folding when the bullet is swaged. Rimfire jackets are very explosive even at lower speeds, and are so explosive that they cannot be used at much higher than 3,200 fps without exploding in the air. They are ideal for varmint shooting, since they seldom cause a ricochet. The accuracy of these jackets is excellent, and because they are thin, they produce little friction. They are also easy on the rifling as long as the velocity is held to accurate limits. Fouling is almost nonexistent at 3,200 fps, but becomes worse at 3,500 fps and higher.

The advantage of using rimfire jackets is the low cost. If scrap lead is used, bullets can be made at no cost. Many shooters try swaging because of the lure of an unlimited supply of free bullets. The accuracy of these bullets and the satisfaction derived from swaging justifies the initial interest.

BOOKS FOR BULLET SWAGERS

Several books and booklets are available that explain the subject of bullet swaging. Write Corbin Manufacturing & Supply, Inc., 600 Industrial Circle, White City, Oregon 97503 or go to www.corbins.com for their current catalog listing prices and detailed descriptions of their products. Their website is very informative on swaging techniques and products.

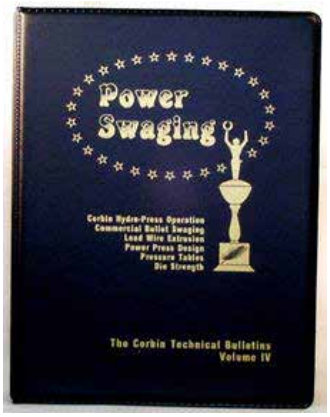


***Figure 12:** Corbin makes several books and dvds on swaging.*

Power Swaging is a technical manual and covers die strength, press design, hydraulic and mechanical systems, air (pneumatic) presses, and more, are discussed in detail (Figure 12). This is the first technical bulletin series to be re-written to reflect changes in design of Corbin products, and is the standard operating manual for the Corbin Hydro-Press and Hydro Junior. The current version was just published and contains updates to earlier work.

Other books on swaging are available, however some are hard to find and your best resource is the Corbin's website.

SELF-TEST QUESTIONS

Please check your answers on page 18.

1. ***True or False*. Bullet swaging, like bullet casting, requires heat to form the bullet shapes.**
2. **Name two bullet diameters for which .22 rimfire fired cases may be used to form the bullet jackets.**
3. ***True or False*. Bullet swaging requires enormous pressure and much physical strength when using hand presses.**
4. **Which type of bullet is easier to form: the flat-base bullet or the boat-tail bullet?**

Bullet Casting

Although both lead and gunpowder were produced in America before the Revolution, most were imported. Both powder and lead came in bulk, requiring that the shooter cast his or her own bullets.

American-made flintlock rifles played an important role on the frontiers in the eighteenth century, and nearly all were supplied with bullet molds made by the gunmaker who made the rifle. However, these molds often were lost or became worn — requiring that new molds be made.

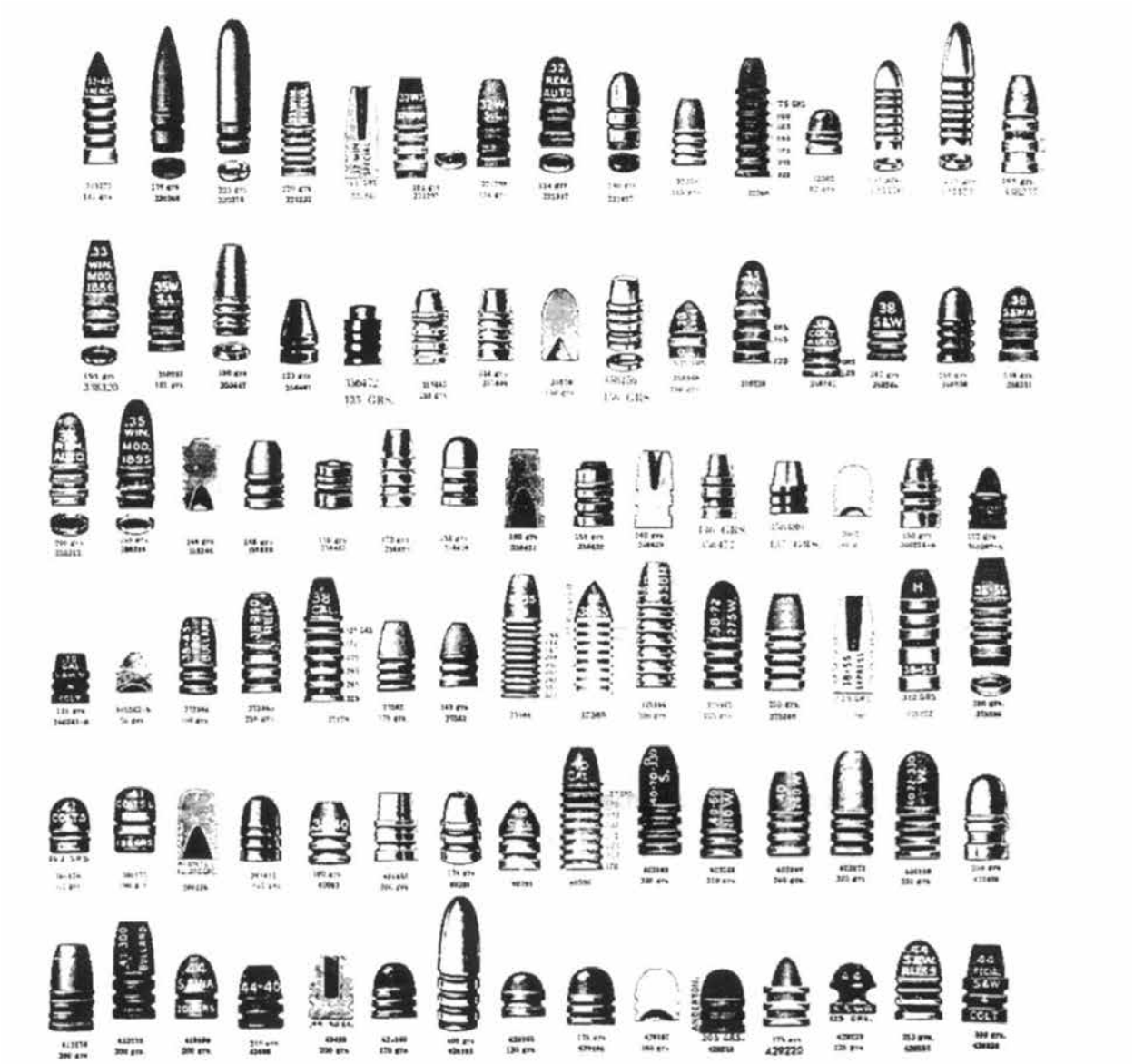


***Figure 13**: Bullet molds were once made in hundreds of different types, dozens of which were used in one caliber of rifle or handgun. Now, only the most popular bullet types remain.*

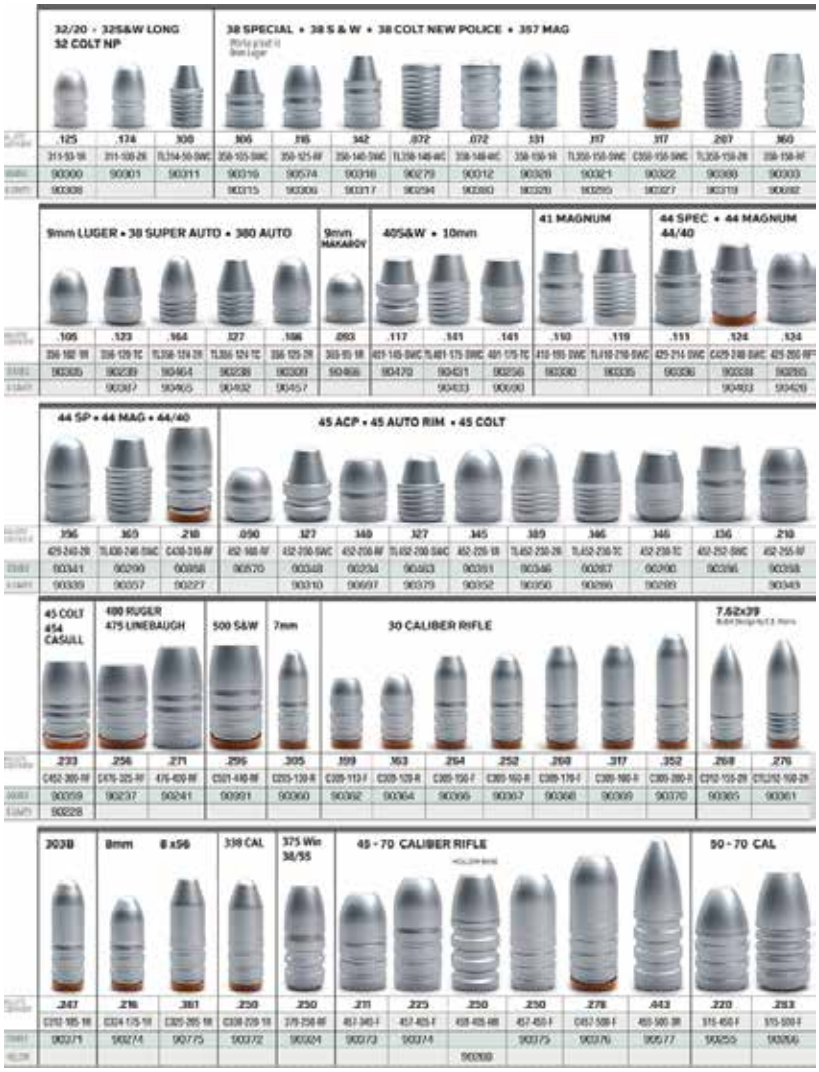


Figure 13A: Modern bullet molds available from Lee Precision.

American bullet molds were made of iron, brass, stone, and clay-lined wood. Since many of the smoothbore weapons for which bullets were made were not particularly accurate, small irregularities in the bullets were not important.

TYPES OF CAST BULLETS

Since the advent of powder and ball, there have been thousands of varieties of bullets, with points of many different shapes and sizes. Some bullets have flat bases, others have depressions of various depths and shapes, some were patched, and others have lubrication grooves. A few of the bullet molds available a quarter of a century ago are shown in Figure 13. However, since that time, some bullet casting molds have become almost extinct; only the most popular ones remain. Still, many are available to suit the shooter's every need.

Figures 13A and 13B show modern bullet molds available from Lee Precision (leeprecision.com).



Figure 13B: Blank for custom six cavity mold built by Lee Precision.



Figure 15: A good quality electric furnace will greatly simplify your lead-melting operation.

BULLET CASTING TOOLS

Very few tools are needed for casting bullets. A simple ladle like the one shown in Figure 14, a lead-melting pot, and a bullet mold is all that is needed to get started. You can use the kitchen stove as your heat source, but an electric furnace designed specifically for bullet casting is the best choice (Figure 15).

For best accuracy and to keep the bullets from leading your rifle bore too quickly, you will need to size and lubricate the bullets. A complete bullet casting kit, shown in Figure 16, on page 14, should fulfill the needs of the most demanding bullet caster.



Figure 14: *Besides bullet molds and a melting pot, a ladle is about all you need to start casting.*

SAFETY PRECAUTIONS

Heed the following safety precautions when using heat to cast bullets:

- Wear heavy clothing and shoes that will protect you if you spill or splatter molten lead.
- Wear safety goggles or a face shield when working with molten lead.
- Wear heavy leather gloves when working with molten lead or when handling the bullet molds.
- Never allow liquids to come near the molten lead.

A drop of liquid in the hot lead will cause a violent eruption, causing lead to splatter. Also guard against perspiration dropping into the molten lead.

BULLET METAL

All shotgun slugs and bullets for muzzleloading weapons should be cast from pure lead. To cast bullets for other modern rifles, Lyman recommends No. 2 alloy, which shooters have used for decades. This alloy is quite hard, but not quite as hard as Linotype metal. Consequently, to obtain the highest velocities with cast bullets, Linotype metal, combined with the finest high-speed lubricants, should be used. However, for general shooting, the No. 2 Alloy is the type of bullet metal recommended.

The metal required to make No. 2 alloy can be gathered from junkyards, gas stations, automotive supply houses, plumbing supply houses, hardware stores, and printing shops. Many of

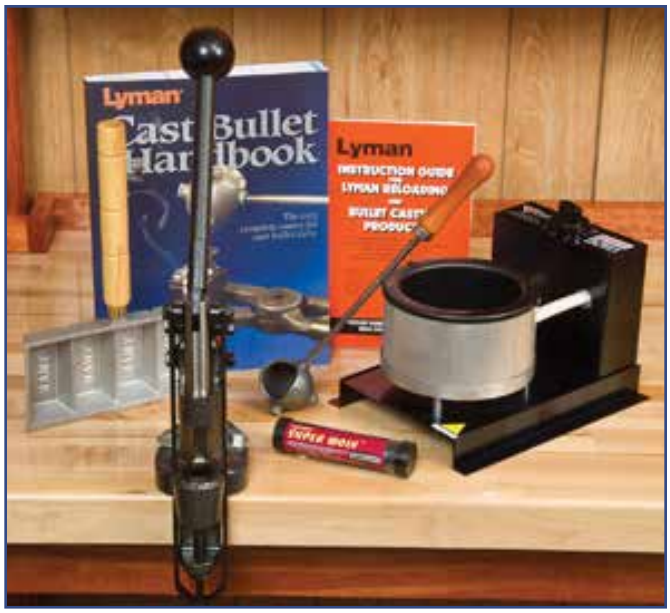


Figure 16*: A complete set of bullet casting tools is available from Lyman.*

these materials will contain traces of other metals, but for bullet making, they may be considered pure.

Never use lead from auto or marine batteries, since the material can be harmful. Ten pounds of No. 2 alloy for bullet casting may be made using the following:

- 9 pounds wheel weights and 1 pound of 50/50 solder.
- 4 pounds Linotype, 1 pound 50/50 solder, and 5 pounds of pure lead.

MELTING BULLET METAL

One of the first requirements for working with bullet metal is a suitable heat source capable of heating the metal to about 750˚-800˚ Fahrenheit. If necessary, a simple cast iron pot to hold metal and almost any heat source (kitchen stove, camp stove, etc.) will suffice. However, an electric lead-melting pot is better. It is cleaner, safer, and more convenient. A lead-melting pot with an adjustable thermostat allows the best control of the melt temperature.

Regardless of the type of heat used, heat the metal for about 20 minutes until it becomes liquefied and flows freely. As the metal melts, a gray scum will rise to the surface, contrasting sharply with the silver brightness of the molten lead. The scum contains tin which should not be removed because it is the most valuable component of bullet metal.

To combine this tin with the lead, a process known as fluxing must be performed. This operation is extremely important to obtain good bullet metal and should be done carefully. Drop a small bit of beeswax or bullet lubricant into the mixture so that a smoky gas arises from the top of the pot. This gas should immediately be ignited with a match to eliminate the smoke.

The fluxing procedure can also be performed by using a dry substance, such as Marvelux (Figure 17), to eliminate smoke and greasy fumes and to obtain a good flux.

Whichever fluxing substance you choose, be sure to stir the mixture with a suitable instrument — like the lead dipper or clean iron rod—to mix air in with the molten mixture. Properly fluxed metal is almost mirror-bright and flecked with small black and brown particles which must be skimmed off and discarded.



Figure 17: MARVELUX eliminates greasy fumes to obtain a good flux.

CASTING BULLETS

After fluxing, when the metal is hot enough to pour easily through the dipper, it is ready for casting. Use a hardwood stick about 2" in diameter and about 10" or 12" long to open the bullet mold. Place a thick pad on the bench next to your lead melting pot or furnace. This will prevent the hot bullets from being damaged as they drop from the mold.

If you are using a melting pot and lead dipper, fill the dipper half-full of the molten bullet metal and place the spout of the dipper against the pouring hole. Holding the mold and dipper together, slowly turn them to a vertical position to fill the mold.

The extra metal that runs over the top of the mold is called sprue. It will take only a few seconds for the sprue to harden, and when it does, use the hardwood stick to give the hinged sprue cutter on top of the mold a sharp tap. This will cut off the sprue evenly with the base of the bullet. Save the excess sprue to remelt later.

Now, open the bullet mold and let the bullet fall out onto the thick pad on your bench. If the bullet does not fall out freely, use the hardwood stick to rap the hinge pivot sharply. Use only wood for this purpose and never strike the mold blocks. The first few bullets may be imperfect. However, as heat builds up in the mold blocks from casting one bullet after another, the quality of the bullets will improve. The mold-heating process can be sped up by setting the mold on the rim of the furnace or propping it against the top of the melting pot. Never put the mold into the molten lead; doing so can warp it, making it useless.

Wrinkled bullets, like the one shown in Figure 18, indicate that the mold and/or metal is too cool. Frosted bullets indicate that the mold and/or metal is too hot. If either of these two conditions exist, adjust the heat accordingly. Good bullets should fill the mold and be clean and sharp. Imperfect bullets should be collected and, along with the sprue, returned to the pot for remelting.

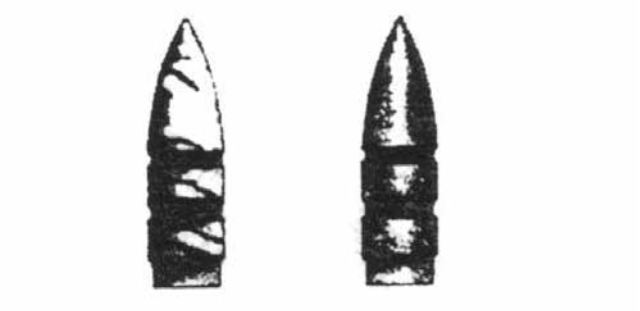


***Figure 18**: A wrinkled bullet (left) indicates a cool mold; a frosted bullet (right) indicates that either the mold or metal is too hot.*

Some bullet casting furnaces have a bottom-pour spout, which eliminates the need for the dipper. Position the top of the bullet mold relatively snug onto the spout, lift the melting pot's valve handle for a second, and then release it. Once the mold is filled and the sprue has hardened, the remaining operations are the same as discussed previously.



***Figure 19:** The Lee bullet lubricating and sizing kit is inexpensive and simple to operate.*

SIZING AND LUBRICATION

For best accuracy and to ensure cleaner-shooting bullets, all cast bullets should be sized and lubricated. The equipment required for this operation can range from inexpensive to somewhat costly if you purchase a bench-mounted lubricator/sizer and related dies and punches. In general, the sizing process is a method of swaging cast bullets to a standard size that corresponds to, or is slightly larger than, the groove diameter of the rifle. Bullet sizing also ensures that the bearing bands of each bullet in the group are perfectly round.

The Lee lubricator/sizer kit, available from Lee Precision, Inc. (leeprecision.com) or MidwayUSA and costs less than $25 (Figure 19). First, place bullets in the container and drop in the Lee Liquid Alox onto the bullets. Gently shake the bullets in an orbital motion to coat the bullets. Make sure they are coated completely. Then, spread the bullets onto waxed paper and let dry overnight. Load at least one bullet into a case and check to be sure it easily chambers in the gun. If it fits tightly, you must resize the bullet before loading.

Sizing dies are made in a number of diameters for the same caliber bullets. Selecting the correct size requires that you measure the dimensions of your rifle barrel accurately, at both the muzzle and directly ahead of the chamber. To obtain these measurements, drive a pure lead slug into the barrel or chamber mouth, remove it, and then measure the results with a micrometer. Your cast bullet must never be smaller than this diameter, but it can be a few thousandths of an inch larger. Try different bullet sizes until you find the best one for your rifle or handgun.

Gas checks are little cups of gilding metal or copper used on the bases of bullets to protect the bases and sides of the bullet from gas-cutting. In turn, the rifle bore is protected from exposure to tiny pieces of molten tin, which would be ironed into the bore walls as the bullet overtakes them.

Normally, gas checks are applied as a part of the sizing and lubrication operation. It is important that the gas checks be squarely seated on the bullet. A crooked gas check will cause bullet inaccuracy.

To install the gas check, fit it on the bullet base as you are placing the bullet into the sizing die. The top punch will then push the bullet into the sizing die to swage it and the gas check to the proper diameter. Lubricant is applied to the bullet at the same time. On reversing the handle of the press, the bottom punch pushes the bullet back out the top of the sizing to be grabbed with the fingers and set aside for later loading into your cases. The lubricant is forced into the sizing die by screw pressure, the same way hand-operated automotive grease guns work.

SELF-TEST QUESTIONS

Please check your answers on page 18.

5. **What is the alloy number that is recommended by Lyman for casting modern rifle bullets?**
6. **What causes a molded bullet to come out of the mold wrinkled?**
7. **What causes a molded bullet to come out of the mold with a frosted appearance?**
8. **Once the bullets have been cast, what must be done before they can be loaded satisfactorily into the cases?**

Answers to Self-Test Questions

1. False.
2. .224 and .243.
3. False. It requires no more strength than normal reloading.
4. Flat-base bullet.
5. No. 2 alloy.
6. Either the bullet mold or the bullet metal is too cool.
7. Either the bullet mold or the bullet metal is too hot.
8. The bullets should be sized and lubricated.

Lesson Questions

THIS IS LESSON NUMBER 2201.

Make sure you print your name, student number, and lesson number in the space provided on the Lesson Answer Form. Be sure to till in the circles beneath your student number and lesson number.



REMINDER: A properly completed Lesson Answer Form allows us to evaluate your answers and send the results and additional study material to you. Do not hold your Lesson Answer Forms to send several at one time. You may run out of study material if you do not send your answers for evaluation promptly.

You may also complete your exam online at www.sdi.edu, click on the *online exams* tab.

1. **One tool required to perform bullet swaging is**
   a. A melting pot.
   b. A furnace.
   c. A press.
   d. A ladle.

2. **The die used to make a short-jacket bullet is**
   a. Core swage die.
   b. Core seating die.
   c. Point forming die.
   d. Lead-tip forming die.

3. **A cheap jacket for .224 bullets can be made from a fired .22 case.**
   a. True.
   b. False.

4. **On a short-jacket bullet, the shape of the bullet tip is formed by the**
   a. External punch.
   b. Core seating die.
   c. Point forming die.
   d. Lead-tip forming die.

5. **A flat-base, round-nose, full-metal-jacket bullet is made using**
   a. One die.
   b. Two dies.
   c. Three dies.
   d. Four dies.

6. **The temperature that is required to melt lead for bullet casting is**
   a. 350˚-400˚ Fahrenheit.
   b. 550˚-600˚ Fahrenheit.
   c. 750˚-800˚ Fahrenheit.
   d. 950˚-1,000˚ Fahrenheit.

7. **Which of the following is not used as a flux during casting?**
   a. Beeswax.
   b. Marvelux.
   c. Bullet lubricant.
   d. Linotype.

8. **If the bullet you have just cast is wrinkled, what is most likely the problem?**
   a. The mold is too cool.
   b. The metal is too hot.
   c. The mold is too hot.
   d. The lead has too much flux.

9. **When casting bullets, if the bullets have a frosted appearance rather than being bright and shiny, the most likely cause is:**
   a. The mold is too cool.
   b. The metal is too cool.
   c. The mold is too hot.
   d. The metal is the wrong alloy.

10. **Bullets for black powder arms and shotguns should be made from:**
   a. No. 2 alloy.
   b. Pure lead.
   c. Linotype.
   d. Marvelux.