RELOADING AND CUSTOM AMMO MAKING, METALLIC CARTRIDGES

TAKE YOUR CHOICE, RELOADING OR . . .

Reloading can be a hobby, a part-time profession, or, in the opinion of neglected wives, a disease only slightly more acceptable than alcoholism. Like Women's Lib and hang-gliding, reloading is usually thought of as "new" — it's about as new as diners on railway cars (they may be coming back, too).

Reloading or handloading (the former refers to replacing components in fired cases, the latter to loading new brass) has been around since the development of the primed metallic cartridge. As early as the 1860's, frontiersmen and buffalo hunters packed crude loading tools along with their supplies of lead and blackpowder. Trading posts were few and far apart, and while there was such a thing as "store-bought" ammunition, it wasn't available when and where it was needed most — in the timbered vastness of the mountains and on the expansive open prairies. Also, tailor-made shootables were expensive.

Aside from the fact that reloading was the only way to assure a dependable and economical source of ammo, the practice, then as now, enabled the hunter to match his bullet/powder combination to the size and distance of his quarry. Also, when he was running low on powder, he could use reduced charges and shoot only at short ranges.

FIGURE 1 — For efficiency and safety, the loading bench should be neat and uncluttered.

Yes, America has traditionally been a nation of riflemen. *And* of reloaders, from the dawn of the metallic cartridge era.

EARLY RELOADING TOOLS

By the 1880's there were a number of pocket-size, combination loading tools on the market for all popular calibers (see Figure 2). Like the Swiss army knife, which has attachments for everything but computer programming, these early loading tools were marvels of ingenuity, incorporating a bullet mold and sizer, primer decapper and primer seater, case neck sizer, and bullet seater. Every operation but powder measurement and dropping was performed by the one tool, which then sold for two to three dollars.

FIGURE 2 — Old "nutcracker" loading tool, from the Ideal catalog published about 1891.

Up until the widespread use of smokeless powder and jacketed bullets, more rifles than not were sold *with* loading dies.

There are modern counterparts of the old hand-held loading tools, such as the Lyman 310. Like their predecessors, these "tong-type" (as they're called) loaders accomplish all the basic loading operations (see Figure 3). At least one new tool, the Lee loader (see Figure 4), also "measures" and "throws" appropriate powder charges by means of small scoops or ladles, each of which holds a specified charge of various powders — so many grains of 4350, a greater weight of 4320, etc.

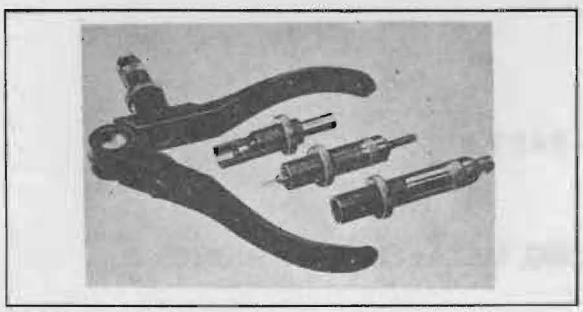


FIGURE 3 — Modern "nutcracker" or tong-type loader with dies. Model shown is the Lyman 310.

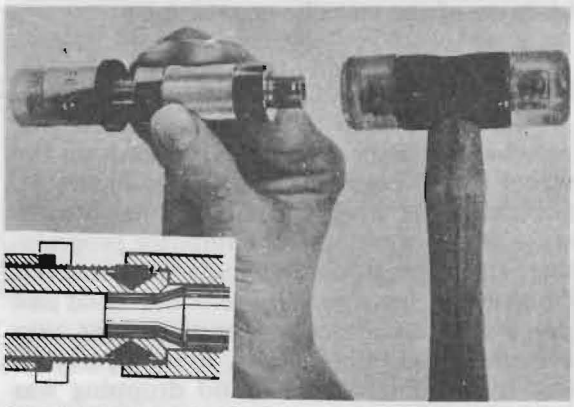


FIGURE 4 — With the Lee loader, cases are resized by tapping them into the die with a plastic mallet.

RELOADING TODAY IS A HUGE INDUSTRY

Today there are well over a million reloaders in the U.S. According to a fairly recent survey by *The Handloader* magazine, annual sales of bullets and primers total more than 50 billion for each component — with the vast majority used for paper punching. Over the past decade, reloading has become a huge and ever-growing industry. Virtually all major equipment and component manufacturers — RCBS, Lyman, Hornady, Speer, Sierra, etc. — publish comprehensive loading and instructional manuals designed to educate and "sell" the center-fire shooter on the advantages of "rolling his own" ammunition.

Economy, fun, and relaxation are the biggest attractions — but once a shooter is exposed to the esoteric but easy-to-master art of reloading, and succeeds in eliciting MOA groups from a rifle that with factory fodder spewed bullets like a salt shaker, economy usually flies out the window! Six months later, chances are excellent that our shooter will have invested a small fortune in a heavy-duty loading press, dies for two or three guns (he bought two more), and enough accessories to stock a small reloading shop (see Figure 5).

The problem (spelled f-u-n) with reloading is that, like a Chinese puzzle, opening one "box" invariably leads to opening a succession of other "boxes." Most shooters start with the idea of saving 50% or more on ammunition. From there they progress to a working knowledge of ballistics, interior and exterior, and before you know it they're designing their own wildcat cartridges. No matter that letters to RCBS or P. O. Ackley for custom dies and a custom barreled action reveal that their new wildcats have already been "invented" by maybe 20 other shooters. (Parallel development is commonplace with many *great* ideas!) He goes ahead anyway.

Naturally, our shooter feels that his new Super Warthog Whanger deserves a custom stock, so he orders a semi-inletted blank, checkering tools, and finishing supplies, not to mention a new scope — necessary, of course, to prove his new creation's superlative accuracy.

By the time he's reached this point, it's possible that our shooter knows quite a bit about guns. It's also possible that he's been deserted by his wife and children for non-support. In any event, he's now a full-fledged member of the grand and exalted legion of "Gun Buffs."

So, be forewarned. Reloading is both a fascinating and insidious adventure. However, unlike the average reloader, you've got some other things going for you — a comprehensive knowledge of guns and ballistics plus a *profit* motive. The hours you spend at your loading bench will be a lot more acceptable to a lonely, foot-tapping wife if you can convince her that the fun is *secondary* — it's part of your education as a gun pro, and potentially money in her purse.

We'll get into the profit-making aspects a bit later. First let's discuss the basics of reloading — which may or may not be familiar to you.

THE LOADING PRESS

The press is the basic tool of the reloader, and there are a number of different types. The most common, and generally the strongest, are those which accommodate one die at a time and are of closed-frame (O) or open-frame (C) construction (see Figures 6 and 7). The O-frame type presses are usually the best for heavy-duty work like bullet swaging as the frame cannot be sprung out of alignment.

With O and C-type presses, a batch of rifle cases is run through the press, completing the depriming and sizing functions by one die before replacing that die with the bullet seating die. (Pistol cases and straight-neck rifle cases will require three dies, as you shall see.)

FIGURE 5 — RCBS offers a complete "Ammo Workshop" which provides all the essentials at a reasonable cost: (1) press, (2) die set, (3) burring tool, (4) lube kit, (5) scale, (6) powder measure, (7) powder funnel. Such "package" combinations tend to reduce initial overspending.

Single-die presses are uniformly simple in construction, consisting of a cast iron frame threaded at the top to accept 7/8" - 14 threaded dies, a handle linked to the ram, and a pivoting primer arm with spring-loaded sleeve into which the primers are inserted — either manually or automatically by means of a feeder tube (see Figure 8).

The ram is a polished steel cylinder which rides up and down through the body of the press when the handle is activated. Appropriate-size shellholders are locked into the top of the ram; when the handle is lowered, the ram and shellholder rise, forcing the cartridge case into the die. When the decapping pin ejects the fired primer, the primer drops through a hole in the axis of the ram, and usually into a primer catcher. Rams are deeply notched on one side to permit the primer arm to pivot under the shellholder, where it presses the primer into its case pocket with a partial stroke of the press handle (see Figure 9).

The ease with which a case is driven into the die depends upon the amount of leverage exerted by the handle. Most single-die presses utilize a simple pivoting-lever arrangement which provides ample force for case sizing and seating operations. When forming and reworking large cases, setting back shoulders, and changing neck diameters, or if you will use your press for bullet swaging, a heavy-duty press like the RCBS Rockchucker (see Figure 10), with its compound-lever system, is ideal. Less muscle is required, which *is* a factor when you're working with a batch of, say, 100 to 200 cases.

HOW TO SELECT A LOADING PRESS

Generally speaking, if you will reload standard rifle or pistol cases only, any of the well-known O or C-frame presses will prove satisfactory. If, however, you will extensively rework large cases, swage bullets, or produce ammo in reasonably large quantity, then a

FIGURE 6 — Champion O-type press.

FIGURE 7 — Redding C-type press.

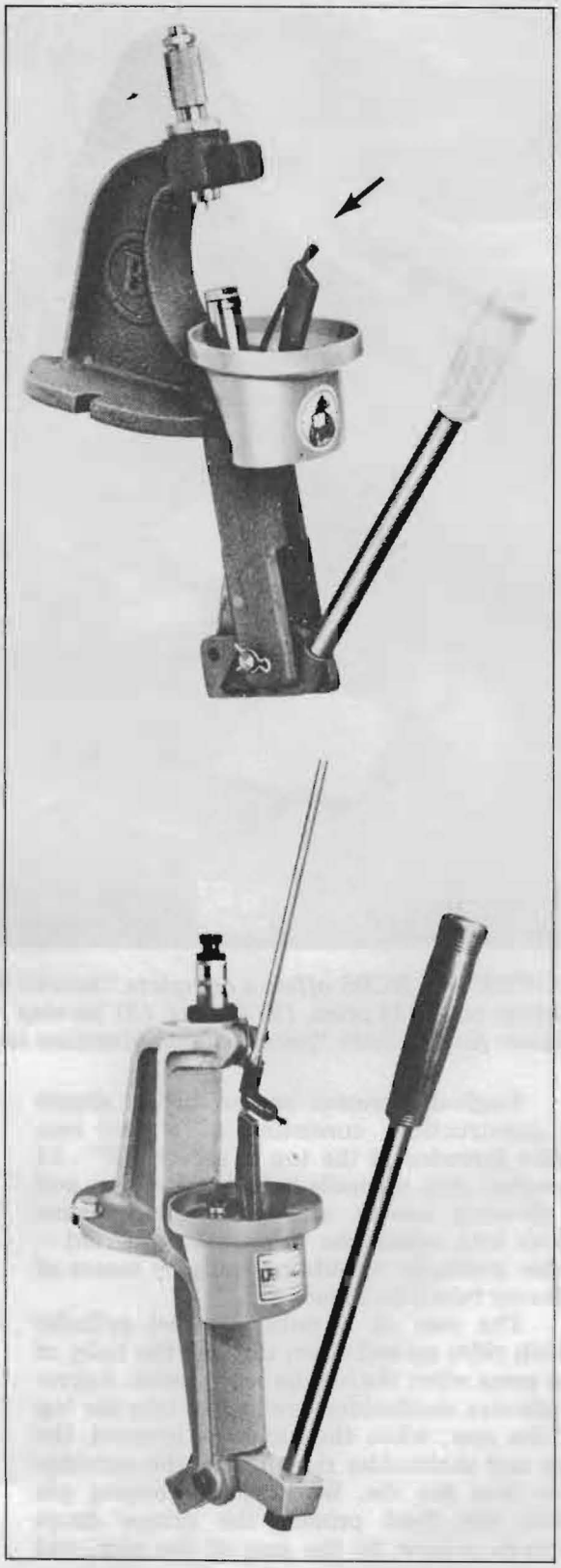


FIGURE 8 — In the Bonanza press at left, primers are inserted manually into the primer arm sleeve (arrow); the Pacific press feeds the primers automatically by means of a primer tube or magazine.

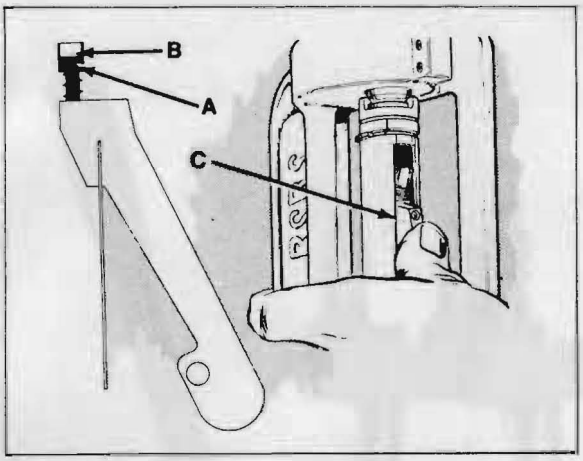


FIGURE 9 — The primer plug (A) and sleeve (B) are usually interchangeable for different-sized primers. After the case has been run up into the sizing die, the primer arm is pressed into the ram (C). The primer is seated as the case comes down out of the die. (Courtesy RCBS)

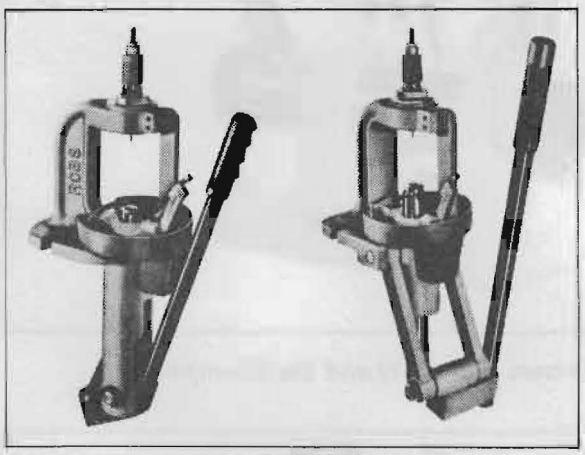


FIGURE 10 — The RCBS Rockchucker press, left, utilizes a compound-lever system and exerts more ram force than the single-pivot RCBS Jr. press.

heavy-duty O-frame type press should be considered (as well as the turret type, which we'll discuss a bit later).

In selecting your press, two other factors should influence your decision: (1) Does it have an automatic primer feed? If it doesn't, and you're producing a lot of ammo, you'll soon go bananas placing the primers, individually, into the primer arm sleeve. (2) How long is the "tube" through which the ram passes compared to that of other presses? The longer the bearing surface that supports the ram in its movement, the less the ram can wobble and the more precise the forming, sizing, seating, and swaging operations. All presses aren't alike, and knowing what to look for can have a lot to do with the quality of your ammunition and the ease and speed with which it can be produced.

Of minor consideration is whether or not the press is adapted for use as a powder measure stand. After completing the decapping, resizing, and priming operations, you're ready to fill the cases with powder. Some presses, like the RCBS models, serve as a powder measure with a special adapter (see Figure 11).

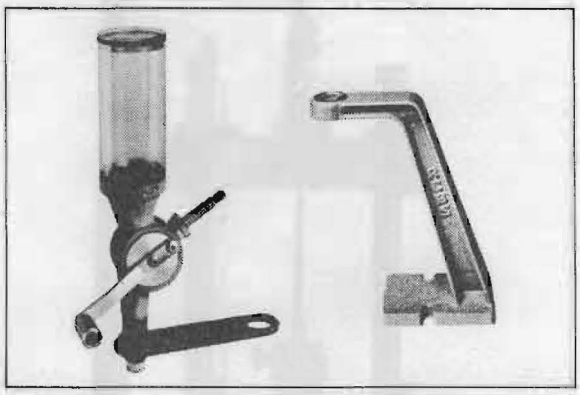


FIGURE 11 — Powder measures are sometimes mounted to the press with an adapter plate as shown at the left. Most often, a separate stand is a better idea. (Courtesy RCBS)

For the hobbyist or gun pro who loads fairly large quantities of ammo, especially of the handgun variety, a multiple-die press may be the answer. Such presses cost more, but, because of increased production capability, they reduce the labor and cost per round proportionately. There are at least three different types of presses in this category.

The H-Type Press

H-type presses such as those made by Bair and CH, are better adapted for producing handgun reloads, although they are also used for making rifle ammunition. Here, pressing the handle down raises a single platform or ram with three shellholders up and against three dies or two dies and a powder measure (see Figure 12). A single case is manually advanced from one shellholder (and die position) to the next, through all three stations. Thus, when a two-die set and powder measure are used, a finished round is completed with three pulls of the press handle. When using three-die rifle or pistol sets, the powder measure is mounted on its own stand.

For two-die rifle loading, a conventional powder measure may be threaded into one of the stations. Each powder drop requires a separate "flip" of the measure handle. When loading two-die handgun rounds, a special "shotshell" type powder bar may be used for greater speed, which at the touch of a button drops a pre-set amount of powder.

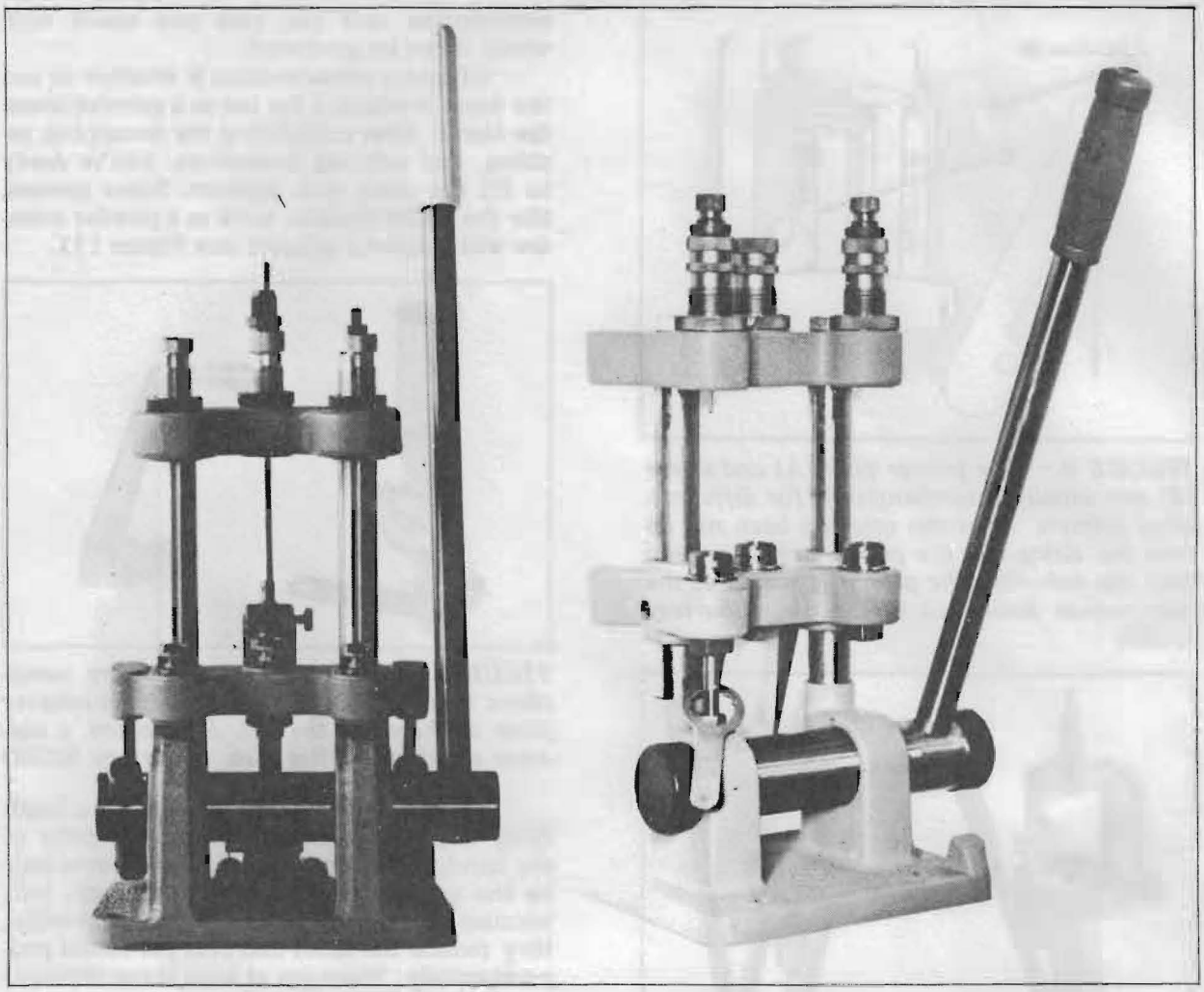


FIGURE 12 — Two H-type presses, the Brown Bair (left) and the Champion.

The better-grade H-type presses are suitable for case forming and bullet swaging. Less expensive and less rugged O or C units are best used for volume reloading of standard pistol or rifle cases only.

Progressive Loading Presses

Progressive, three-stage loading presses like the CH Auto Champion (see Figure 13) are even faster than the H style, but are normally used for loading handgun rounds only. The reloading speed necessary to justify the cost of these expensive units is only possible with a charge bar-type powder measure which isn't adapted to throwing rifle powder charges.

Such presses usually incorporate three rams and shellholders, each containing a case progressively closer to completion, which advance to the next station with each pull of the handle. When all stations are loaded, each pull of the handle produces a finished round, resulting in a volume of up to 50 finished rounds in three minutes.

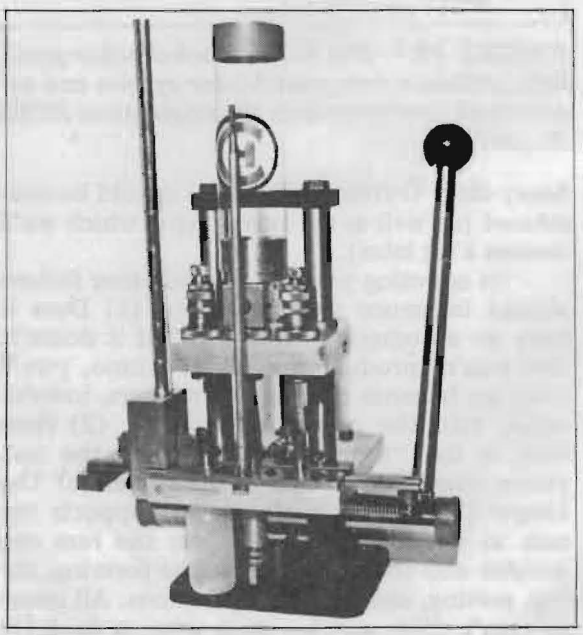


FIGURE 13 — CH Auto Champion press.

Turret Presses

Turret presses like the Hollywood, Redding, and Lyman models (see Figure 14) are probably the best bet for the volume reloader of quality rifle ammunition, standard or wildcat varieties. With this type of press, only one shellholder station is used, with the ram moving up and down by handle actuation. The plate or turret at the top has holes for anywhere from three to eight dies (including powder measure). After each stroke of the handle and raising of the case into the appropriate die, then down to "start" position, the turret is manually rotated or indexed to bring the next die (or powder measure) into alignment with the shellholder — for the next upward movement of the case.

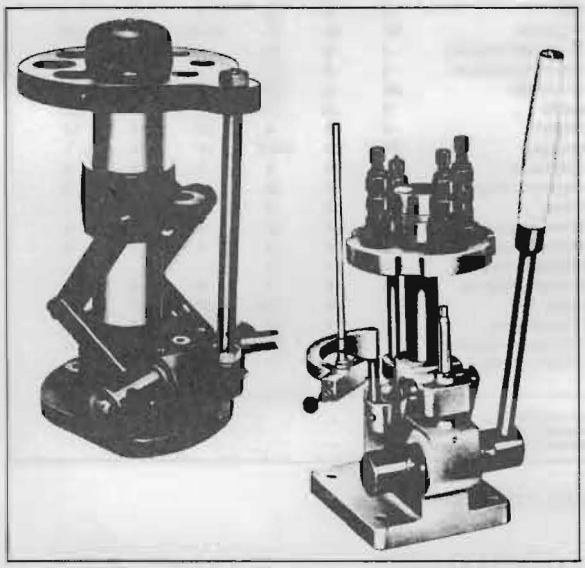


FIGURE 14 — Two superb turret presses, the Hollywood (left) and the Lyman All-American (right).

Turret presses are especially desirable for reworking and reloading cases where several forming dies are involved. Some wildcat cartridges require as many as three or four separate dies, plus the powder measure. With a turret press, each case can be taken through the entire series of dies and the powder drop, resulting in a finished cartridge after four or five pulls of the handle and rotations of the turret.

When using conventional two or three-die sets, and depending on the "hole" capacity of the turret, two to three complete die set-ups can be mounted and left in the turret, eliminating the usual "make-ready" time and the chance of disturbing perfect die settings.

Some turret presses, like the Lyman, incorporate an automatic primer feeder tube. Others, like the Hollywood Sr., do not. However, the latter, because of its exceptional strength and rigidity, is also one of the best presses available for swaging bullets. It is also the most expensive press on the market.

LOADING PRESS STANDARDIZATION

As in many areas of the firearms industry, standardization of specifications has also taken place in the reloading field. Nearly all presses, powder measures, dies, and lock rings are threaded to the industry standard of 7/8" - 14. In the few instances where presses incorporate oversize, non-standard threads, bushings are invariably supplied. A few powder measures have smaller-than-standard threads — but these, too, come with bushings for adaptation to standard loading presses and powder measure stands.

Standardization was also necessary with shellholders and rams. Loading presses are used with dies made by several manufacturers, and if the dies and/or shellholder from a given manufacturer didn't match up with the ram and shellholder provided with the press from another manufacturer, utter chaos would result. As can be seen from Table 1, different manufacturers employ different designation numbers for their shellholders, but the dimensions are identical. Only the means of locking them into the ram may vary. Sometimes the shellholder is simply rotated and slipped into a "snap spring" slot; other times it is anchored with a set screw (see Figure 15).

PRIMING TOOLS

Most loading presses, regardless of type, have provisions for primer seating — either manually and singly or by means of a feeder tube which eliminates the chore of placing the primers individually into the primer arm sleeve. You may spend many hours making your cases, bullets, and powder charges perfectly uniform, but if the primer isn't seated just right, your care in preparing the other components can suffer.

Incorrectly seated primers which are out of alignment, or inserted too far or not far enough, can raise hob with pressures and accuracy. A primer forced too deeply into its pocket, causing partial crushing of the explosive pellet, may cause a misfire because of the greater distance the pin has to travel to reach the primer. A primer seated too far out may jam the action or puncture a primer, or at the very least cause erratic ignition. These conditions frequently account for the unexplained "flyers" in otherwise tight bullet groups.

Because of the importance of proper and uniform primer seating, many serious shooters and nearly all benchrest riflemen prime their cases in a separate operation after the case has been decapped and resized.

Cartridge	Pacific	RCBS	Lyman*	C-H	Bonanza	Redding
17 Mach IV	16	10	26	15	6	10
17/222	16	10	26	15	6	10
17/223	16	10	26	15	6	10
17 Remington	16	10	26	15	6	10
22 Hornet	3	12	4	Hornet	8	14
218 Bee	7	1	10	3	10	3
222 Remington	16	10	26	15	6	10
223 Remington	16	10	26	15	6	10
222 Remington Magnum	16	10	26	15	6	10
219 Donaldson Wasp	2	2	6	2	4	2
219 Zipper	2	2	6	2	4	2
224 Weatherby Magnum	17	27	3	224 Wea.	....	12
225 Winchester	18	11	5	4	7	4
22-250 Remington	1	3	2	1	1	1
220 Swift	4	11	5	4	7	4
243 Winchester	1	3	2	1	1	1
6mm/244 Remington	1	3	2	1	1	1
6mm/284	1	3	2	1	1	1
240 Weatherby Magnum	1	3	2	1	1	1
25-20	7	1	10	3	10	3
256 Winchester Magnum	6	6	1	12	3	12
25-35	2	2	6	2	4	2
250-3000 Savage	1	3	2	1	1	1
257 Roberts	1	11	2 or 8	4	1	1
257 Roberts Improved	1	11	2 or 8	4	1	1
25-06	1	3	2	1	1	1
257 Weatherby Magnum	5	4	13	6	2	6
6.5mm Japanese	34	15	5	6.5J	....	4
6.5 Carcano	21	9	28	14	....	1
6.5mm x 54mm Mannlicher Schoenauer	20	9	28	14	....	24
6.5mm x 55mm Swedish Mauser	19	2	27	2	7	1
6.5mm Remington Magnum	5	4	13	6	2	6
264 Winchester Magnum	5	4**	13	6	2	6
270 Winchester	1	3	2	1	1	1
270 Weatherby Magnum	5	4	13	6	2	6
7mm Mauser (7 x 57)	1	11	2	1	1	1
280 Remington	1	3	2	1	1	1
284 Winchester	1	3	2	1	1	1
7mm x 61mm Sharpe & Hart	35	26	13	7	....	6

Cartridge	Pacific	RCBS	Lyman*	C-H	Bonanza	Redding
7mm Remington Magnum	5	4**	13	6	2	6
7mm Weatherby Magnum	5	4	13	6	2	6
7.35mm Carcano	21	9	28	14	....	1
7.5 Schmidt-Rubin (7.5 Swiss)	2	2	6	2	....	....
30 M1 Carbine	22	17	19	30 M1	5	22
30-30 Winchester	2	2	6	2	4	2
300 Savage	1	3	2	1	1	1
308 Winchester	1	3	2	1	1	1
7.62 Russian	23	13	17	76	....	15
30-40 Krag	11	7	7	8B	11	8
30-06	1	3	2	1	1	1
30-06 Improved	1	3	2	1	1	1
300 H&H Magnum	5	4**	13	6	2	6
308 Norma Magnum	5	4	13	6	2	6
300 Winchester Magnum	5	4	13	6	2	6
300 Weatherby Magnum	5	4	13	6	2	6
7.65 Belgian Mauser	24	3	2	1	1	1
303 British	11	7	7	8B	11	8
7.7 Japanese	1	2	2	2	....	1
32 Winchester Special	2	2	6	2	4	2
8mm Mauser	1	3	2	1	1	1
8mm/06	1	3	2	1	1	1
33 Winchester	14	14	17	45-70	16	18
338 Winchester Magnum	5	4	13	6	2	6
340 Weatherby Magnum	5	4	13	6	2	6
348 Winchester	25	5	18	348	....	20
38 Special	6	6	1	12	3	12
357 Magnum	6	6	1	12	3	12
35 Remington	26	9	8 or 2	14	14	1
358 Winchester	1	3	2	1	1	1
350 Remington Magnum	5	4	13	6	2	6
35 Whelen	1	3	2	1	1	1
358 Norma Magnum	5	4	13	6	2	6
375 H&H Magnum	5	4	13	6	2	6
378 Weatherby Magnum	14	14	17	....	....	....
44 Remington Magnum	30	18	7	8	9	19
444 Marlin	27	28	14B	8B	27	19
45-70 Government	14	14	17	47	16	18
458 Winchester Magnum	5	4	13	6	2	6
460 Weatherby Magnum	14	14	17	....	....	....

*Lyman Tru-Line Junior Shell holders are suffixed by J.
Lyman All-American and Spartan shell holders are suffixed by X.
**Some SAKO and Norma cases may require a No. 26 shell holder.

TABLE 1 — Shellholder chart, rifle cartridges.

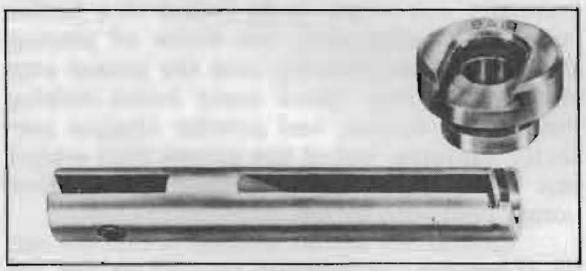


FIGURE 15 — Shellholders are interchangeable and slip into the slot (arrow) at the top of the ram.

Priming tools such as those illustrated (see Figure 16), except for the Lee, are designed to seat the primer to an exact depth. The use of such tools should not discourage close inspection of the seated primers. Less-than-perfect cases are usually set aside for decapping and another try, or for plinking.

Primer seating with a press primer arm is okay for hunting and informal target shooting. For competition, or when striving to get the best accuracy your rifle is capable of producing, a primer seating tool is a must.

LOADING DIES

All modern loading dies are essentially of the same design and construction. They are commonly known as "the Pacific type," as their common ancestor was the die set introduced in 1930 by the Pacific Gun Sight Co. There are, of course, minor variations between the dies made by the various manufacturers, but workmanship and the steel used are what make one die set superior to another. Dimensions must be exact, polishing must be perfect (see Figure 17).

Today most die sets consist of two units — a sizing die and a bullet seating die for bottle-necked rifle and pistol cases. Sizing dies are necessary because, when a cartridge is fired, the brass expands into the slightly larger chamber. A certain amount of spring-back occurs, depending on the chamber size and on the thickness and hardness of the brass, but never enough to return the case to its original dimensions. Because the brass is softer than the die steel, the case is returned close to standard specifications when it is forced into the die. The expander ball, passing through the

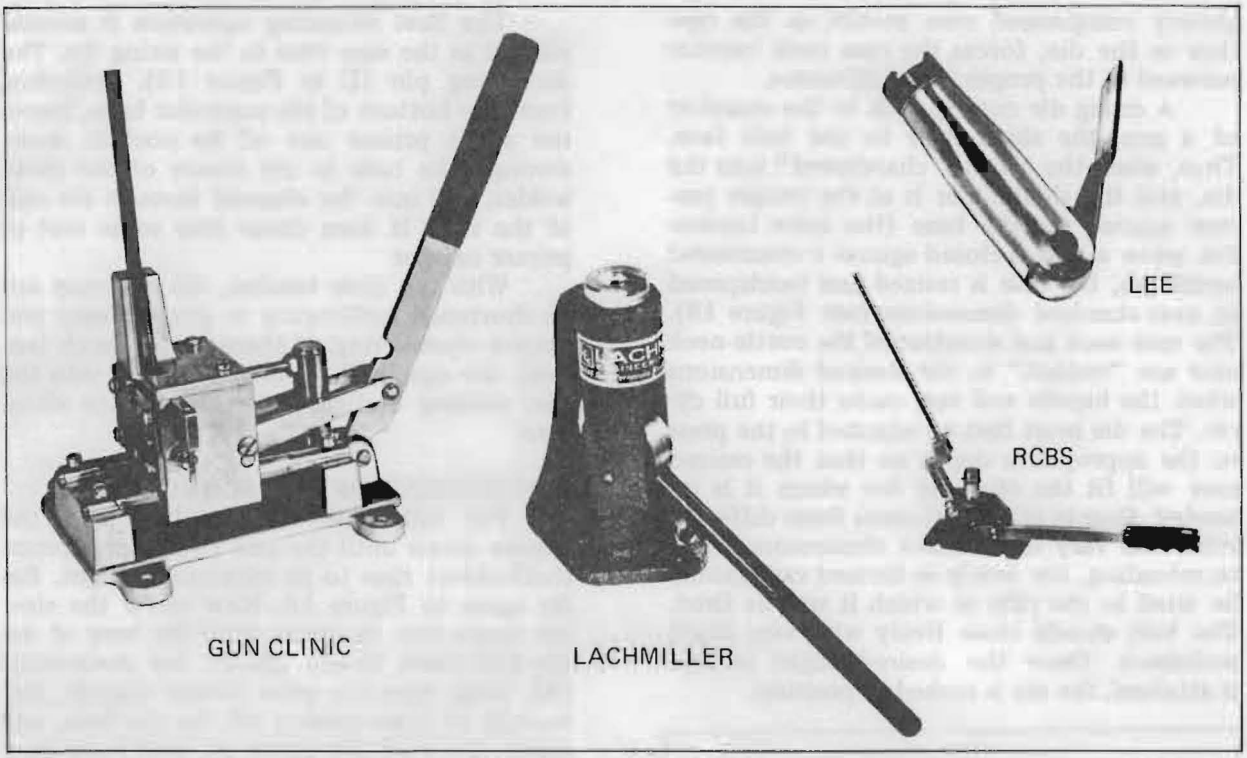


FIGURE 16 — Separate priming tools range from elaborate bench devices to simple hand-held units.

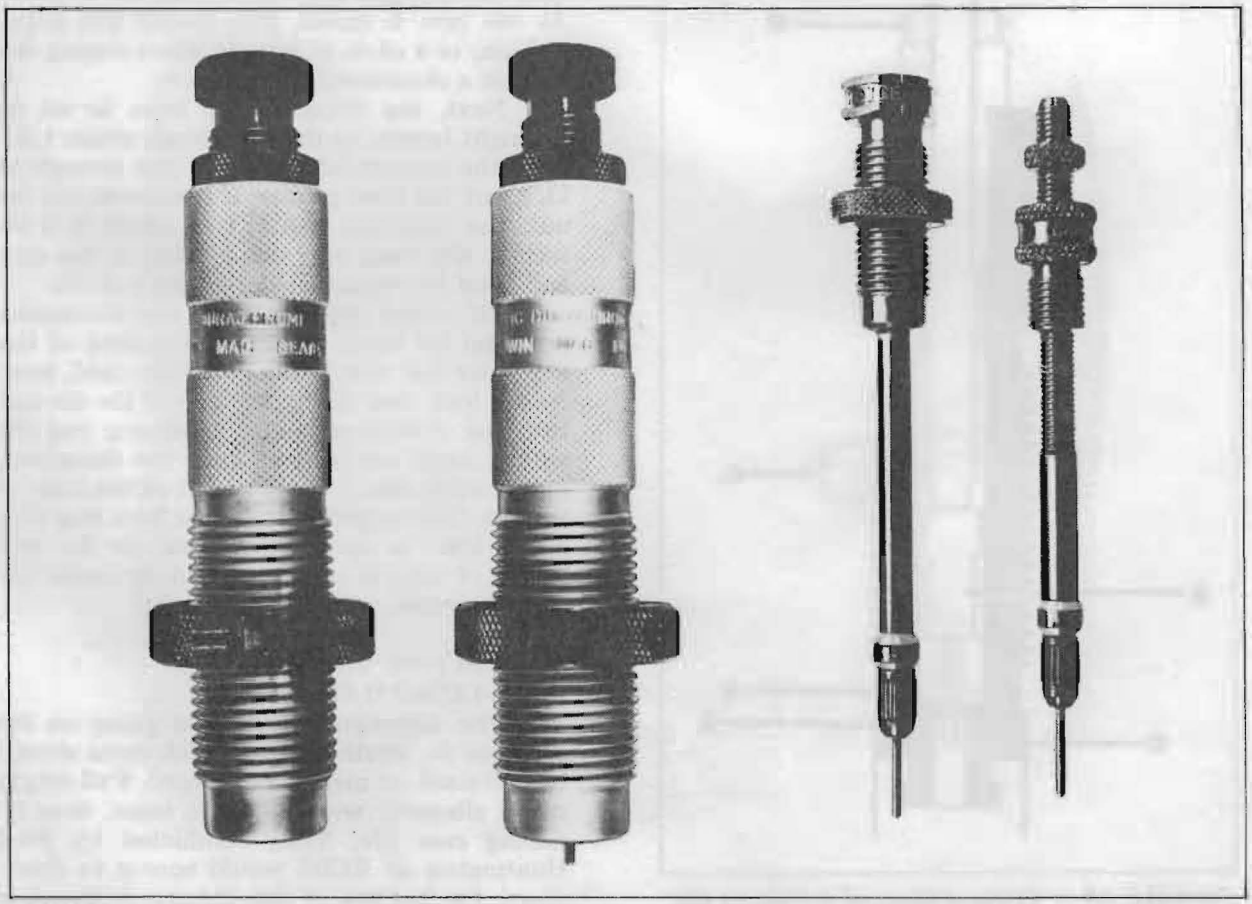


FIGURE 17 — Pacific bullet seating (left) and resizing dies, with different-style expander ball/de-capping pin assemblies.

already compressed case mouth as the case rises in the die, forces the case neck interior outward to the proper bullet diameter.

A sizing die corresponds to the chamber of a gun, the shellholder to the bolt face. Thus, when the case is "chambered" into the die, and the shellholder is at the proper tension against the die base (the same tension felt when a bolt is closed against a chambered cartridge), the case is resized and headspaced to near-standard dimensions (see Figure 18). The case neck and shoulder of the bottle-neck case are "resized" to the desired dimensions when the handle and ram make their full cycle. The die must first be adjusted in the press to the appropriate depth so that the resized case will fit the chamber for which it is intended. Bear in mind that cases from different rifles will vary in chamber dimensions. Prior to reloading, the newly re-formed case should be tried in the rifle in which it will be fired. The bolt should close freely with very slight resistance. Once the desired slight closure is attained, the die is locked in position.

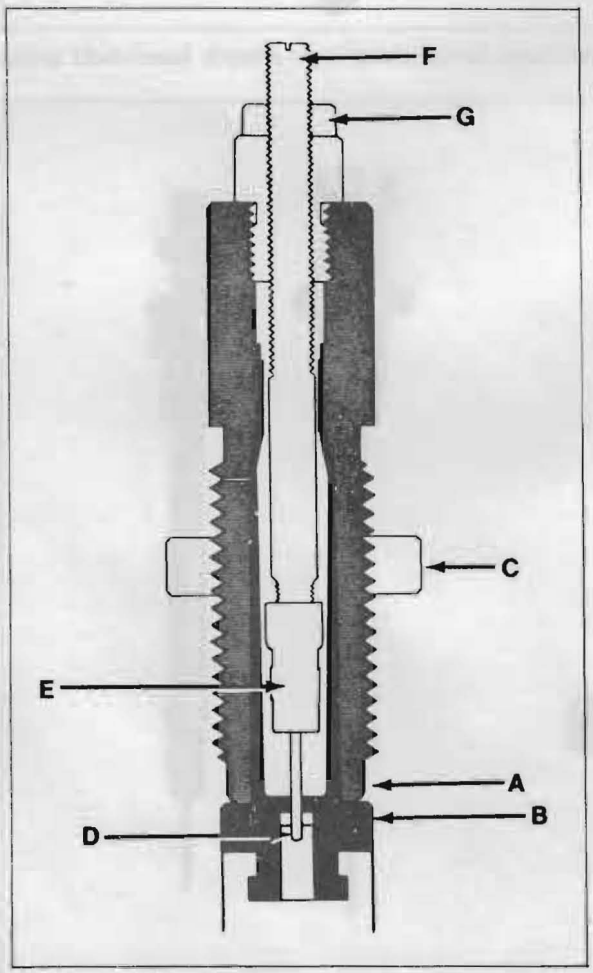


FIGURE 18 — Cross-section of a resizing die. See text for alphabetical reference points. (Courtesy RCBS)

The first reloading operation is accomplished as the case rises in the sizing die. The decapping pin (D in Figure 18), extending from the bottom of the expander balls, forces the spent primer out of its pocket, down through the hole in the center of the shellholder, and into the channel through the axis of the ram. It then drops into some sort of primer catcher.

With too little tension, the case may not be shortened sufficiently to provide easy and proper chambering. If there is too much tension, the case will be driven too far into the die, causing a slight excess-headspace situation.

ADJUSTMENT OF THE SIZING DIE

For full-length resizing, first press the handle down until the ram (with appropriate shellholder) rises to its maximum height. Refer again to Figure 18. Now screw the sizer die down into the press until the base of the die (A) bears firmly against the shellholder (B). Next raise the press handle slightly, just enough to take tension off the die base, and screw the sizer die down an additional one-eighth turn. Tighten down the lock ring (C) with the integral set screw. Test for tension. As the ram is raised, you should feel slight tension, or a click, as you do when closing the bolt on a chambered round.

Next, the decapper pin must be set to the right length, so that it extends about 1/8" from the bottom of the die — just enough to kick out the fired primer. If it extends too far out, the expander ball (E) to which it is attached will bang into the bottom of the case and bend the expander/decapping rod (F).

To adjust the depth of the decapping pin (and to assure correct positioning of the expander ball within the cartridge case), loosen the lock ring (G) at the top of the die and turn the slotted expander/decapping rod (F) with a small screwdriver until the decapping pin extends that 1/8" or so out of the base of the die. Then tighten down the lock ring (G). Never leave a case in the sizing die for any length of time as pressure build-up inside the die may make extraction difficult.

NECK SIZING VS. FULL-LENGTH SIZING

The arguments have been going on for years as to whether bottle-neck cases should be full-sized or merely neck-sized. Full-length sizing allegedly wears out the brass, thus reducing case life. Tests conducted by Fred Huntington of RCBS would appear to disenchant the holders of this theory. A group of .30/06 cases, loaded to factory pressures, was still going strong after 30 firings and full-length

sizings. (With higher-intensity magnum cases, we doubt the record would be as impressive.) Devotees of the neck-sizing-only school claim that a case of exact chamber dimensions, with only the neck sized to grip the bullet, improves accuracy and lengthens case life. How so? By eliminating the "flexing" caused by firing and resizing the case. They, too, have a point. Most competition shooters neck-size only, not so much for case economy as for consistent accuracy.

A point often overlooked is that pulling the sizing button out of the case stretches the body of the case so that, in due time, the case will separate. During use, the case must be trimmed, and it is evident that this brass is extruded from somewhere — it is not just the case neck stretching. So, even with neck-sizing only, the amount of case life added is questionable.

Neck-sizing only is easier simply because little pressure is required. In any event, it's impossible to neck-size only with conventional full-length sizing dies for the simple reason that the case, in rising into the die, is constricted before its neck portion reaches the part of the die which narrows the neck diameter. Special neck dies are available for the purist (see Figure 19).

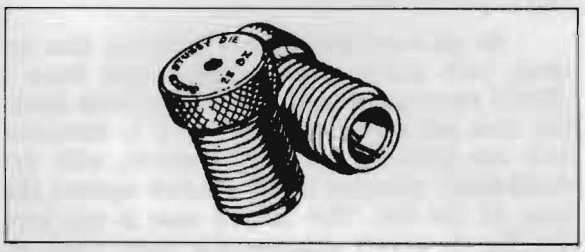


FIGURE 19 — Neck sizing dies are usually full-length, although they constrict only the case neck. Short dies, like the SAECO "Stubbies" shown, will neck-size a number of different, but same-caliber cases.

PARTIAL RESIZING

An economical solution to the controversy, and one used by the majority of knowledgeable reloaders, is partial sizing — which can be done with the full-length sizing die. Here, the critical shoulder portion of the case is left alone. Only the case neck, up to the shoulder, and part of the case body, enough to permit easy chambering, are resized. The overall length of the case (headspacing) and the shoulder remain the same.

The procedure for partial resizing is the same as for full-length resizing except that you leave some space — about 1/16" — between the shellholder and the base of the die for your preliminary setting. The distance between the shellholder and die will vary depending on the cartridge.

Next, run a lubricated case up into the die. The ring formed by the die (see Figure 20) shows the portion of the neck that has been resized. This lube ring should extend nearly to the base of the neck; adjust the distance between the shellholder and die until the lube ring is positioned correctly.

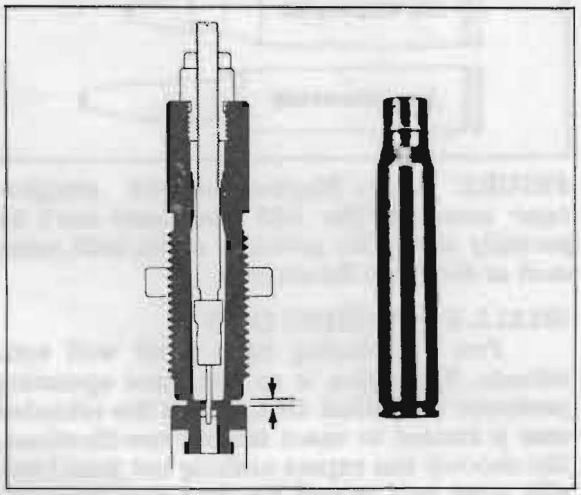


FIGURE 20 — When a lubricated case is partially sized, with more than normal space between the shellholder and die (left), a lube ring (arrow) is formed around the neck which indicates the area of constriction.

FIGURE 21 — A smudge pot isn't always used to warm chilled oranges.

The neck may be measured with a vernier gauge or with a micrometer, but normally the length resized is plainly visible.

There are a few cases, the .243 Winchester in particular, that cannot be partially re-

sized. This is due to the combination of a shallow shoulder and very little taper in the body. Partial resizing tends to swell the shoulder out into a radius which interferes with proper chambering. Such cases can only be full-length sized or neck-sized with special dies (see Figure 22).

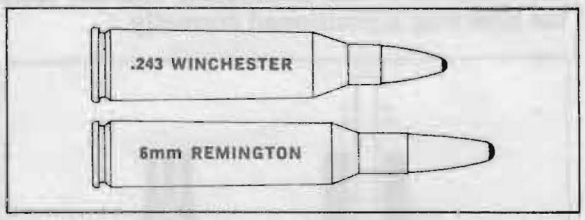


FIGURE 22 — Slope-shouldered, straight-taper cases like the .243 Winchester can't be partially sized. No problem exists with cases such as the 6mm Remington.

SMALL-BASE SIZING DIES

Few autoloading rifles work well with reloads. Extraction is so weak and operating pressures so critical that, unless the reloaded case is resized to exact factory specifications, the shooter can expect nothing but jams (usually after he's missed his first shot at a six-point buck!) As a result, small-base resizing dies, which resize fired cases to slightly smaller than factory specifications, are a must for autoloaders. Even these dies seldom assure perfect functioning. If the powder charge isn't just right, if the chamber isn't perfectly clean and smooth, if the reload isn't to precisely the correct headspace measurement, that gun is going to hang up.

As a result, some reloaders use new factory cases when whipping up hunting loads for their pet autoloaders. When the powder charge is right for the gun's mechanism, the trip through the bullet seating die doesn't change a thing dimension-wise and the gun shoots fine. This represents *some* savings over factory ammo, but very little. Usually, however, the more deeply a person gets into reloading, the less use he has for a cantankerous and generally so-so accurate semi-auto.

Small-base dies are also frequently used when making reloads for lever and pump-action center-fire rifles. Here again, comparatively weak extraction is helped along by resizing the case to slightly smaller than standard dimensions. The dimension factor with these guns isn't as critical as with autoloaders, but if a customer has, say, a Savage 99 and wants to get into reloading, you should sell him small-base dies.

CASE-FORMING DIES

Case-forming dies are most often used in creating wildcat cartridges. In other instances they're employed to transform one standard case into another standard case. Making .300 Savage or .308 Winchester cases from .30/06 military brass is an example.

Forming dies are "preliminary shaping" dies and have neither an expander ball nor a decapping pin (see Figure 23). The top surface of such dies is invariably of tempered tool steel to prevent scratches when the portion of the case extending through the top of the die must be sawed or filed.

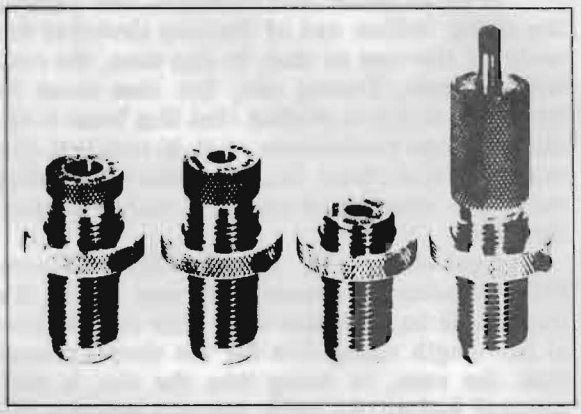


FIGURE 23 — Typical case-forming die set. The die at the right is a conventional sizer, used for final sizing and reloading the previously reworked brass.

As an example of how forming dies are used, let's make a .250 Savage case from a .30/06 case (see Figure 24). Here, three forming dies are required. Die No. 1 is threaded into the press in the usual manner, with the shellholder exerting slight tension against the base of the die. The .30/06 case is run into die No. 1, which changes the body taper to the .250 Savage configuration. (The case mouth is still .30-caliber.) Die No. 2 is now threaded into the press and the slightly modified case is run up into the die.

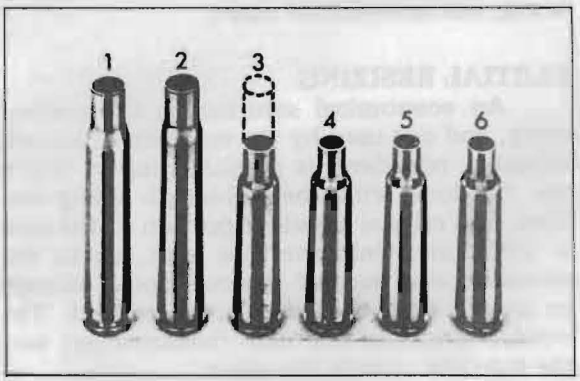


FIGURE 24 — Steps in transforming a .30/06 case to a .250 Savage. See text.

Now the shoulder has been set back to .250 Savage (the bore is still .30-caliber) and

the long case neck extending out of the die must be cut off with a hacksaw. The next step is to file the cut neck with a smooth-cut file (see Figure 25). Don't press too hard or the super-hard surfaces of the die will dull the file.

FIGURE 25 — After setting the shoulder back, the excess neck length must be sawed off, then filed with a fine-tooth file.

Forming die No. 3 is now placed in the press and we're ready to size the case neck down to .257 caliber. One quick stroke does it, but, because the neck is now formed from brass that was formerly part of the case body and therefore thicker, it has to be reamed — either on a lathe-type device or with a special reamer die which is mounted in the press (see Figure 26). After reaming, the case mouth is chambered with a burring tool to assure smoothness inside and out.

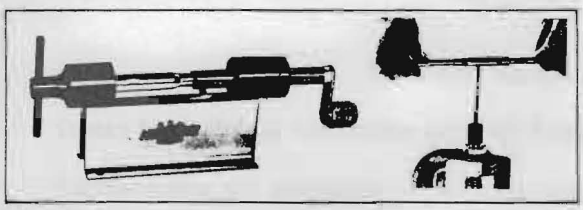


FIGURE 26 — Because of the two-caliber "jump" (from .308 to .257), the necks have thickened and must be reamed, either with a special die (left) or with a lathe-type unit.

The final step is to full-length resize the case in a conventional .250 Savage size die. When the case is reloaded, only the sizer die will, of course, be used.

ANNEALING

When, as in the foregoing instance, the case mouth of a shortened case is "made" from the body of the parent case, that case mouth or neck area should be annealed. The reason is that body brass is usually harder than neck brass, and the neck brass must be soft enough to "give" or it will crack after one or two firings. (Repeated firings make any case neck brittle; for this reason, case necks should be annealed after about ten reloadings.)

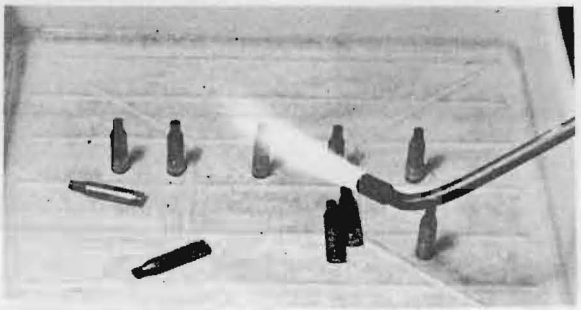


FIGURE 27 — Annealing case necks and shoulders with a propane torch.

Annealing isn't that difficult. Place a group of unprimed or fired cases on a board across a pan of water or in a pan of water. Heat the necks and shoulders evenly with a propane torch, one at a time, but no lower than just past the shoulder, until they turn a bright orange. Then knock each case in turn into the water with a stick. If you overdo it, with the color entering the cherry red spectrum, the brass may be too soft. A general test is to squeeze the case neck between thumb and forefinger. If you can compress the neck, you've overdone the heat treatment and the brass is too soft. A case this soft must be discarded.

After annealing, and if you're going to reload immediately, blow out excess water with an air hose. Otherwise, let those cases dry overnight. The slightest moisture in your powder can greatly affect its performance.

Before going on, please do Programmed Exercise 1. Make sure you write your answers on a separate sheet of paper before looking at the answers on the page specified.

NECKING CASE MOUTHS UP AND DOWN

Normally, case modification requires fewer forming dies and is much less complicated than the foregoing .30/06 to .250 Savage example. Indeed, in forming some wildcat cases, no preliminary or intermediate dies are required. For example, to form a 7mm-.308 or 7mm-.30/06 wildcat, you would simply run the parent case into the wildcat sizing die, which would constrict the neck to the proper diameter while sizing the case.

Generally, when you're only going down one caliber — from .308 to .284, from .284 to .257, from .257 to .224, etc. — a full-length sizing die is all that is needed. (Sometimes, however, the neck must be trimmed.) The .30/06 case will neck down to the .25/06 without trouble. Sometimes you can get by with one die by working the press a partial stroke at a time. It saves a lot of extra dies — and time.

PROGRAMMED EXERCISE

1

1. Which of the following types of bullet presses is best for heavy-duty chores such as bullet swaging? (a) the "old nutcracker." (b) the "new nutcracker." (c) the O-frame type. (d) the C-frame type.

2. A factor that will influence precision in the forming, sizing, seating, and swaging operations of your press is: (a) the length of the bearing surface that supports the ram in its movement. (b) whether the press is of the single or multiple-die variety. (c) the length of the handle on the press (which influences leverage). (d) whether or not the press has an automatic primer feed take.

3. The industry standard in nearly all presses, powder measures, dies, and lock rings is: (a) 5/8" - 12. (b) 3/4" - 14. (c) 17/32" - 14. (d) 7/8" - 14.

4. True or false? A primer seated too deeply in its pocket may cause a misfire because of the greater distance the pin has to travel to reach the primer.

5. True or false? A primer seated too far out (not deeply enough) may jam the action, cause primer puncture, or cause erratic ignition.

6. With regard to accuracy: (a) the best accuracy is achieved when a primer seating tool is used. (b) the best accuracy is achieved when a press is used with a primer arm. (c) primer seating can be speeded up, depending on the tools and press used, but primer seating does not influence accuracy. (d) primer seating does influence accuracy, but not enough to increase the number of hits when all error factors are considered.

7. True or false? A sizing die actually changes the size of the fired brass case, returning it to near-standard dimensions.

8. Why isn't it advisable to leave a case in the sizing die too long?

9. What two advantages are claimed for neck-sized cases as compared to full-sized cases?

10. What extra considerations must be taken into account in reloading for autoloaders?

11. True or false? Forming dies are *preliminary shaping* dies and have neither an expander ball nor a decapping pin.

12. True or false? Repeated firings make any case neck brittle. For this reason, case necks should be annealed after about ten reloadings.

13. True or false? When a rifle bullet is seated too far out, feed problems are often encountered.

14. What are two likely results when bullets are seated so they are too close to, or into, the rifling?

Answers on Page 16

When you're jumping two calibers, an intermediate-form die is usually needed — to prevent the neck from crumpling and/or setting up undue stress in the brass (see Figure 28). Consider the wildcat .257-.308, which is a necked-down version of the .308 Winchester. The first step is to take the case mouth down to 7mm with a forming die. Next, you would run the case into the full-length sizing die, which would take the 7mm mouth down to the required .257 caliber. The same procedure usually holds true when going from .35 cali-

ber down to .308, or from 7mm (.284) to 6mm (.243). Also, when necking down two calibers or more, the necks usually thicken to the point where they must be inside-reamed, or else the bullet will be gripped too tightly — causing excessive pressure and erratic accuracy.

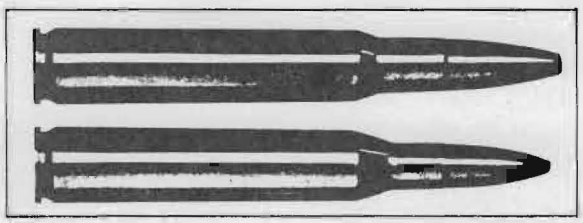


FIGURE 28 — The .25/06 was a wildcat for years. In forming cases from the .30/06 parent (top), an intermediate 7mm forming die was required.

Case necks are remarkably easy to neck up, through use of a tapered expander plug die. As the case rises into the die, the tapered plug expands the neck to the desired caliber. Following neck trimming, if any, the necked-up case is run into the regular full-length sizing die and the job is completed. You can usually expect the neck to be lengthened.

TYPES OF SIZING DIES

While the construction of all sizing dies is very similar, there are two general types — those made of tool steel and those made of harder tungsten carbide steel. The former, when polished occasionally and when care is taken to avoid scratching, will last for a lifetime of even heavy use. Tungsten carbide dies are most often used in progressive or automated handgun ammo presses, where a production of 500 to 1,000 finished rounds per hour is commonplace. Even in these instances, carbide dies are used more in the interest of avoiding jams than because of the wear factor.

Cases used in carbide dies do not have to be lubricated, or even cleaned for that matter.

BULLET SEATING DIES

The last die to be used in any die set is the bullet seating die. Bottle-neck cartridges require only two dies. Some, such as those made by Pacific, CH, Bonanza, and RCBS, permit crimping at the same time the bullet is seated. In other instances dies are used solely for crimping in a separate operation.

Most jacketed rifle bullets do not have cannelures and are not crimped except in the heavier .358 and up calibers, where recoil-induced banging of the bullet tip against the front of the magazine can telescope the bullets into their cases. Crimped, blunt bullets are also desirable for rifles with tubular magazines.

The first step in using a bullet seating die is to thread the die into the press and raise the ram to maximum height. After the shellholder is butting firmly against the bottom of the bullet seating die, lower the ram a bit and back the die from three-quarters to a full turn out of the press, then tighten down the large lock ring (A in Figure 29). The idea is to have a space about the width of a nickel between the shellholder and the bottom of the die. Next, loosen the small lock ring (C) at the top of the die and screw out the seater plug (B) until the bullet is driven only a small distance into the case mouth when the press handle is moved down. By trial and error, screwing the seater plug down a bit at a time, you'll eventually get the correct bullet seating depth — which you previously determined.

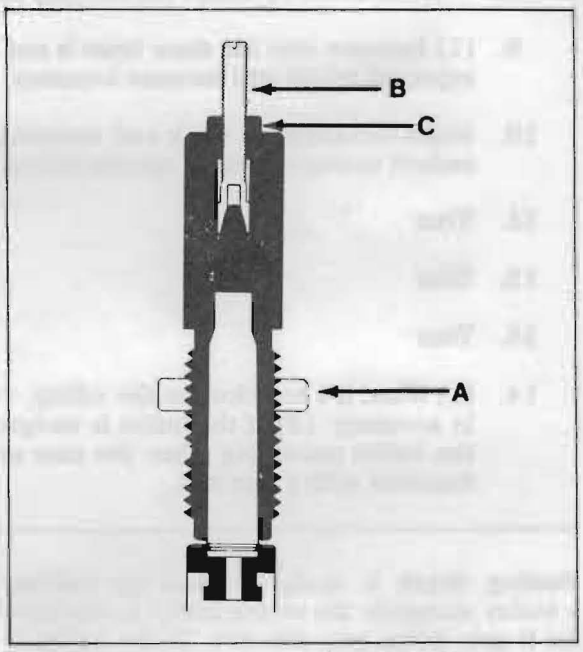


FIGURE 29 — Cross-section of a bullet seater die. Arrows show location of the crimper which "forces" the case mouth against the bullet cannelure when the case is raised all the way into the die. See text. (Courtesy RCBS)

A faster way is to keep a sample or dummy round on hand. To adjust your die, simply back off on the seater plug, run the proper length round up into the die, then screw the seater plug down on the bullet. Tighten down the small lock ring (C) and you're ready to run a batch of cases through the die. The above description deals with non-crimping of the bullet when the case mouth isn't fully into the die, depending on bullet length. Different weights and lengths require adjustment.

ANSWERS

1

1. C
2. A
3. D
4. True
5. True
6. A
7. True
8. Pressure build-up inside the die may make extraction difficult.
9. (1) Increase case life since brass is not worn (allegedly); (2) eliminate flexing of brass in repeated firings and increase accuracy.
10. Since extraction is weak and operating pressures critical in autoloaders, cases must be resized to exact factory specifications. Thus, small-base resizing dies must be used.
11. True
12. True
13. True
14. (1) When it's too close to the rifling, excessive pressures can develop, with resulting loss in accuracy. (2) If the bullet is wedged into the rifling, unloading the gun may result in the bullet *remaining* when the case and powder come out, so that the bullet has to be removed with a ram rod.

Seating depth is easily checked by holding a bullet alongside the seated bullet to see how far it gets down into the case. If the bullet is exceptionally long, the base of the bullet may be seated down into the case, particularly if it would otherwise reach into the rifling. Incidentally, no bullet should be crimped unless it has cannelure grooves.

Bear in mind that the bullet should be seated to take full advantage of the length of the neck for maximum grip. The bullet should not seat against the rifling ahead of the chamber.

SETTING YOUR DIE FOR CRIMPING

Crimping is accomplished in an RCBS seating die by driving the mouth of the case into a recess or crimper in the wall of the die, which prevents the brass from expanding when the bullet is seated. In effect, the case neck is forced into the bullet's cannelure groove. For this reason, it is important that the cannelure of the bullet be positioned exactly even with the case mouth, which is the crimper point (refer to Figure 29). The best way to set your die for crimping is to proceed as with ordinary bullet seating. After the bullet has been seated to the proper depth, and with the cannelure even with the case mouth, loosen the large lock ring (A), the small lock ring (C), and back off quite a ways on the seater plug (B). Now screw down the die as far as it will go. Experiment by raising and lowering the case (in which you've seated the bullet) within the die until you can feel it stop at the crimper. The idea is to get the case mouth as far into the die as it will go, to bring the crimper even with the bullet cannelure. When the die has been screwed in as far as possible and the

shellholder and die base are very close or touching, tighten down the large lock ring (A). Next, raise the bulleted case into the die and screw down the seater plug until it contacts the bullet tip. Tighten down the small lock ring (C) and you're ready to seat and crimp your bullets in one operation. For uniform crimping, all cases in a given lot must be trimmed to the same length. The same procedure is used for crimping handgun bullets.

WHAT IS CORRECT BULLET SEATING?

Bullet seating distance is critical for several reasons. If seated too far out, feed problems may be encountered, particularly with a removable "clip" magazine or box magazine such as in the Mauser, as well as feeding through some lever-action rifles.

The bullet should be seated clear of the rifling. If it touches the rifling, excessive pressures develop and accuracy is lost. For top accuracy, the bullet should be seated 1/16" short up to just short of touching. Trials on the range will establish the best accuracy seating depth somewhere within this distance of 1/16".

Ideally, a bullet should be seated so its base is flush with the base of the case neck. However, and with long bullets especially, this is not always possible because the bullets have to be deep-seated to work through the gun's magazine. If in doubt about seating depth, examine a factory cartridge with the same type and weight bullet. The overall length of the factory cartridge with the same type and weight bullet will give you the overall length of your reload and bullet seating depth. This depends on the bullet — not just weight, but also the shape; i.e., spitzer or round-nose.

Some riflemen, in the interests of accuracy, like to seat bullets so they just engage the rifling. This may work fine at intervals for one-at-a-time target shooting, but it is not recommended for hunting loads. If a bullet is seated too far out when chambered, it may wedge in the rifling. Unloading the gun can result in only the case ejecting and a full charge of powder spilling into the action, and a bullet that must be removed with a ram rod! Under hunting conditions in particular, this can be a bit embarrassing. You don't ordinarily carry a ram rod in your pocket!

THREE AND FOUR-DIE SETS

Three and four-die sets are designed specifically for straight-wall rifle and pistol cases such as the .45-70, .38 Special, and .45 ACP cartridges. To prevent "overworking" of these cases, which are more apt to split than bottle-neck cases (see Figure 30), the sizing and expanding operations are handled separately by two dies. To use one die would resize and expand the case twice — once going in, once coming out.

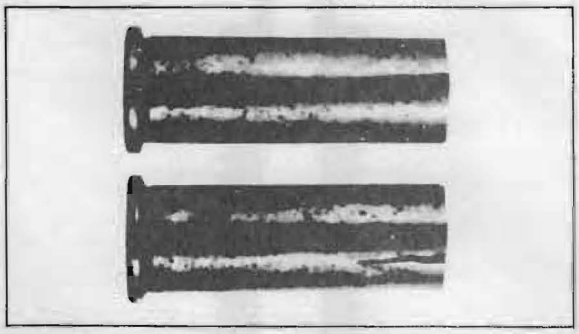


FIGURE 30 — Straight-wall cases split much more easily than the bottle-neck variety. Separate dies are usually used for sizing and expanding to prevent "overworking" of the brass.

In three-die sets, the first die sizes the case exterior. The second die expands the case interior to slightly under bullet diameter, and in some specific calibers flares the case mouth to prevent the "shaving" of lead bullets when they are forced into the case. (Decapping is done in either the first or the second die, depending on the manufacturer and the case length.) The third die seats the bullet and incorporates a crimper. With full or semi-jacketed pistol bullets, only a friction fit is necessary, the same as with jacketed rifle bullets, and the crimper isn't used. With swaged or lubricated lead bullets, the crimper *is* utilized (see Figure 31) — to prevent the bullet from sliding hither and yon under recoil.

Four-die sets (see Figure 32) are essentially the same as three-die sets except that the third, bullet-seating die does *not* have a crimper. The *fourth* die is the crimper. Four-die sets are often used for reloading cartridges where accuracy is extremely important (.357 magnum and .38 Special), where recoil is heavy (.41 and .44 magnum and .44 auto mag), and where the cartridge headspaces against the case mouth (various semi-autos, including the .45 ACP). In the latter instance, a special tapered crimp eliminates the problem of a "normal" roll crimp preventing the case mouth from headspacing against the chamber abutment.

In short, the fourth die affords a more positive means of controlling bullet seating and crimping. The die manufacturers have gone to great pains to develop die sets for straight-wall cases that anticipate and correct reloading problems which are inherent in a given cartridge.

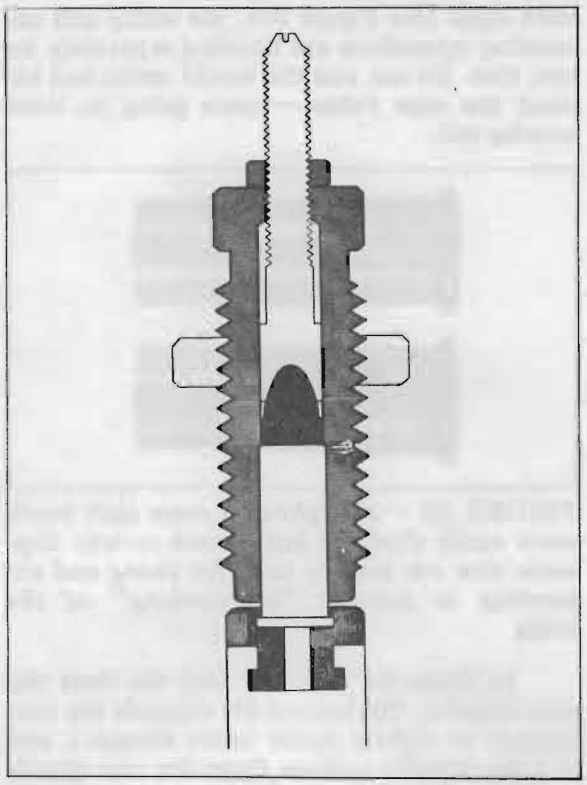


FIGURE 31 — Straight-wall pistol cartridge in seating die. Shellholder is nearly against the bottom of the die and the bullet cannelure is crimped against the case mouth by the crimper shoulder.

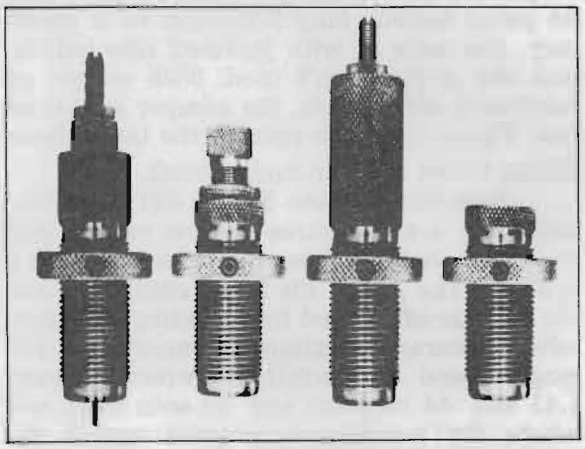


FIGURE 32 — Four-die set for straight-wall handgun cartridges. Die at right incorporates the special crimper used for .25, .32, and .45 ACP pistol ammo.

POWDER SCALES

One of the most important, if not *the* most important, tools in the handloader's kit is the powder scale. You'll find safe charges listed in the loading manuals or you can work up your own powder charges with your Powley computer, *but check with your manual.* You could make a mistake! You may set your powder throw correctly, but everything is relative to the accuracy of your scale. If your scale is off, or if you read it incorrectly, then your powder charges are going to be off — and when you're working with powder, even a few grains too much can spell big trouble.

There are many scales on the market (see Figure 33), varying widely in price and quality. As in anything else, you get what you pay for. All scales have a calibrated and notched beam which pivots on a fulcrum (usually a knife-edge or agate bearing). The pan or pouring spout is attached to one side of the beam by a detachable "S" hook, while a needle on the other end registers "zero" or the amount, in tenths of grains, the zero setting is "off." A sliding weight on the beam enables you to "pre-set" the desired powder charge. The scale itself must first be "zeroed." With the sliding weight at "zero," the needle is zeroed against the graduated scale by adjusting an adjustable weight on the beam or leveling device (usually a screw pressing against the workbench), which raises and lowers one end of the scale. Several scales come with a precision weight to check your scaled accuracy. Set your scale at the point corresponding to the weight of the unit, adjust the leveling device until the needle points to the weight of the test unit, and you know your scales are on. Without such a check, you're taking the manufacturer's word that his product is accurate. Fortunately, most are — or are not off to any significant degree. If you do not have a test weight, use a bullet of, say, 100 grains. Any deviation of over .03 grain will show up a serious error.

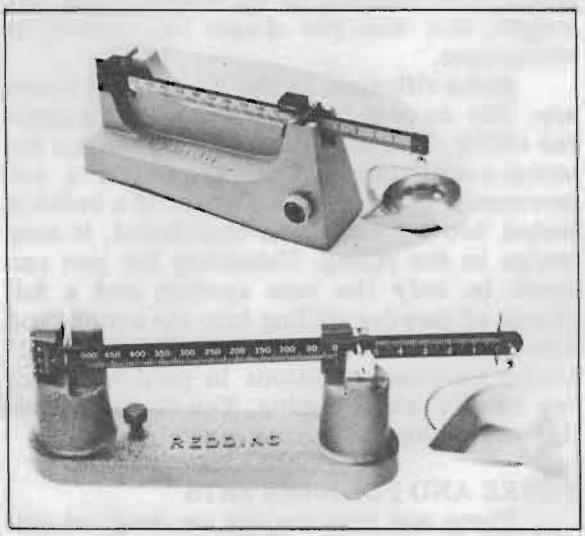


FIGURE 33 — Powder scales may differ in appearance, but they are all based on the same principle and serve the same purpose — checking the powder charge or drop.

Most scales are guaranteed accurate to one-tenth of a grain, some to one-twentieth. Capacities vary from about 300 to 500 to 1,010 grains. A magnetic or oil-type damping device is usually incorporated to make the beam "settle down" for fast readings. The most critical part of some scales is the fulcrum, the knife-edge or agate bearing surface, which must be kept clean and free from rust. Oil should not be used on the fulcrum; a silicone lubricant is best.

Scales are also used in determining case capacity (as has been previously explained), and in checking the drop of shotshell powder and shot bars. It's important that your scale be positioned on a flat, level surface and zeroed to assure accurate readings. (Your scale can, of course, be zeroed on surfaces that are not *perfectly* level. Few benches are!)

POWDER MEASURES

Powder measures aren't indispensible in reloading, but they surely speed things up. This tool is always used in connection with the powder scale, with a given powder drop checked and rechecked against the scale — at the beginning of the production "run" and after 10 to 20 drops.

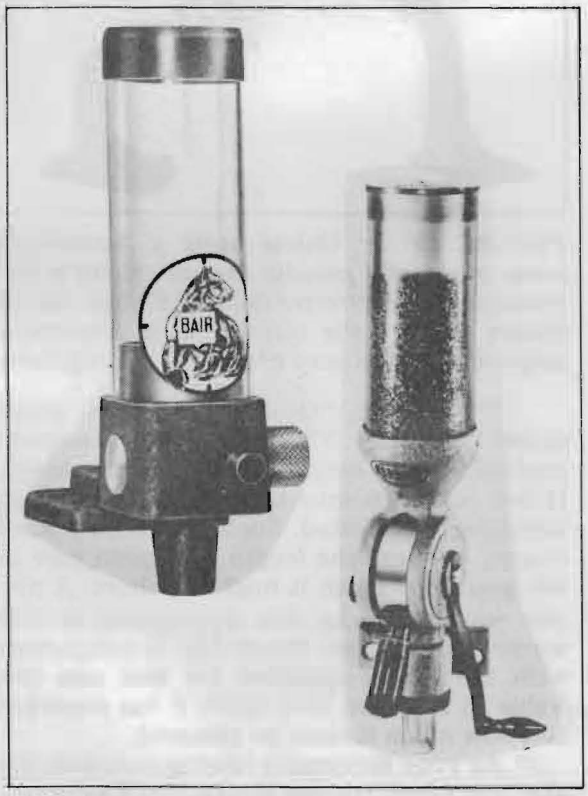


FIGURE 34 — Some powder measures, like the Bair (left), drop fixed charges and are used for pistol and shotgun ammo. Most measures, like the Redding (right), have adjustable powder throws.

Wise reloaders don't use a powder measure in preparing maximum and target ammo unless they're working with a top-grade measure and with fine-grain, ball-type propellants like H380 or the Winchester powders, which permit extremely accurate and uniform powder drops. Large stick propellants like IMR 4350 and 4831 are "chopped" when the metering cylinder is closed, resulting in sometimes substantial variations between drops. When using any of the extruded IMR powders, it's a good rule to use your powder measure only for medium-power hunting and informal target ammunition. When making hot loads or precision target fodder with IMR powders, weigh each charge individually and drop it into the case with a plastic funnel. This procedure takes more time. However, it also assures better accuracy, and with maximum loads eliminates the chance for an overload and ruptured or stuck case and possible personal injury.

DROP VARIATIONS

Even the best powder measures show a disgusting tendency to vary their drops at times, and the reasons are many. The stick-like extruded powders have a built-in tendency to vary drops in even the finest measures due to a "log jam" in the charge tube. This can be precluded by tapping the tube. When working with the IMR powders, always check each case after each drop to see that the powder level in the case is where it should be. Don't just depend upon eyesight, but check regularly with the scales. At most, a powder charge should not vary consistently much more than one-half grain; anything more than that will justify reweighing (see Figure 35).

FIGURE 35 — Always throw four or five charges before loading a case, to let the measure "settle down." Do the same thing after a "log jam" in the drop tube.

Small-caliber cases and small charge tubes, when combined with IMR powders, often cause real headaches!

Another reason for erratic drops is letting the powder level in the hopper get too low. Most measures incorporate baffles in the bottom of the hopper which supposedly equalize the weight of the powder and assure a smooth, even flow into the metering cylinder. The baffles help, but there is *still* a hole in the baffle, and the greater the weight of the powder above, the faster the powder flows into the metering cylinder and vice versa.

It is generally best to refill the hopper when the powder level gets halfway down. So what if you won't use it all? It takes only a few moments to dump the surplus back into its canister.

The "human factor" has much to do with erratic powder throws. You have to get a rhythm going, doing everything almost to a beat, to make those drops even. "Flip that handle, tap that case, take it easy, it's not a race." End of rhythm with reason. Sometimes you have to tap the case lightly with a pencil while the powder is dropping. Other times, with extruded powders, you have to tap the charge tube (to prevent jams) *and* tap the case. In these instances, some experience as a snare drummer is helpful!

TYPES OF POWDER MEASURES

All powder measures have the same function and generally operate in the same manner. A dial or thread-in adjustment determines the amount of powder that will be metered from the hopper and into the measuring cylinder within the body of the measure. When the handle is raised up and then down, the cylinder is rotated — shearing any powder that gets in its way — and dumping its load into the drop tube which is flush against the case mouth. Some measures, like the RCBS Uniflow, have interchangeable cylinders — one for light pistol and shotgun charges, another for rifle drops — that are adjustable. Other measures, like the bar types, drop fixed charges only. Two, and sometimes three, different diameter drop tubes are usually included — or available as extra-cost options. The Ohaus has two chambers, one for pistol and one of large capacity for rifle cartridges.

The majority of powder measures have a standard 7/8" - 14 thread; if not, a 7/8" - 14 bushing is included. Unless you have a turret-type press, where the measure can be threaded into place in the correct loading sequence, you will have to mount it on its own stand.

Case Measuring Gauges

An extremely important tool in the reloader's kit is the often simple and inexpensive case gauge. After repeated firings, all case mouths stretch — the degree depending on the pressures generated, brass hardness, shoulder angle, and other factors. Therefore, all cases, regardless of caliber, should be checked for overall length after three to four firings (more frequently with magnums). Cases a bit too short pose no particular problem, but overly long stretched cases are asking for trouble! Difficult chambering is the least of your worries. If the case neck is forced into the rifling, the bullet is held in a vise-like grip and pressures can soar to dangerous levels. You could damage the gun or yourself; at the very least, accuracy goes to pot.

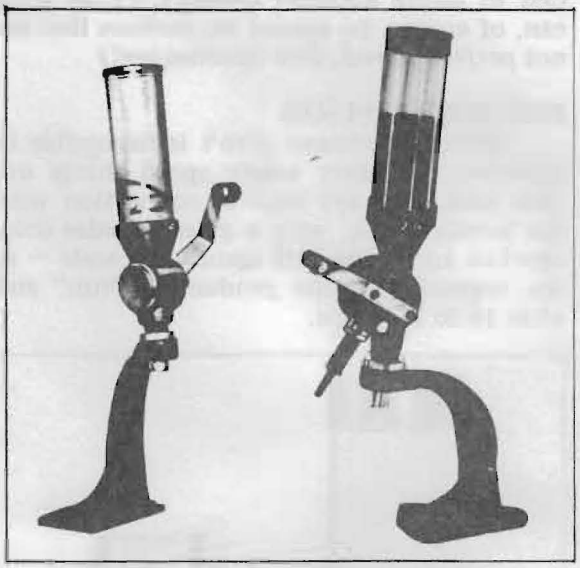


FIGURE 36 — Unless using a turret-type press, a separate powder measure stand is recommended. The Herter (left) and Eagle stands shown position the measure at a convenient height and afford easy access to the drop tube.

The simple "Go-No Go" type gauge shown in Figure 37 indicates the maximum permissible case length for all popular calibers. If the case slips into the recess, fine; if not, trimming is indicated. Such gauges do not, of course, measure the length of a given case or tell you how much it might be short. A precise way of gaining this information is with vernier calipers (see Figure 38). A comparison with the length specified for that case (see Table 2) tells you how much it has stretched and how much it must be trimmed.

As your Brownell's catalog indicates, the sky is the limit on case gauges (see Figure 39). You can get by with a very simple and inexpensive unit, or you can work with expensive combination gauges that also indicate the headspace condition. A case length gauge of some type is a must.

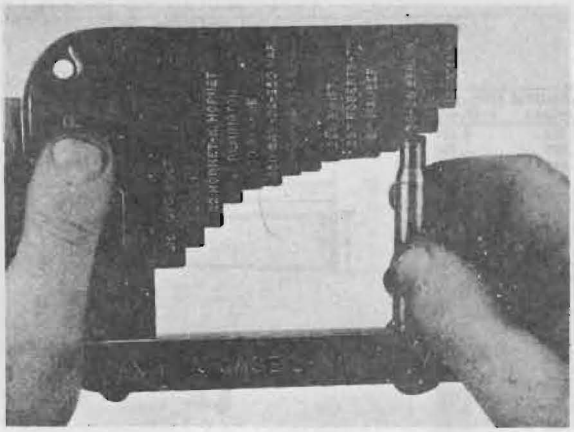


FIGURE 37 — Inexpensive Go-No Go case gauge.

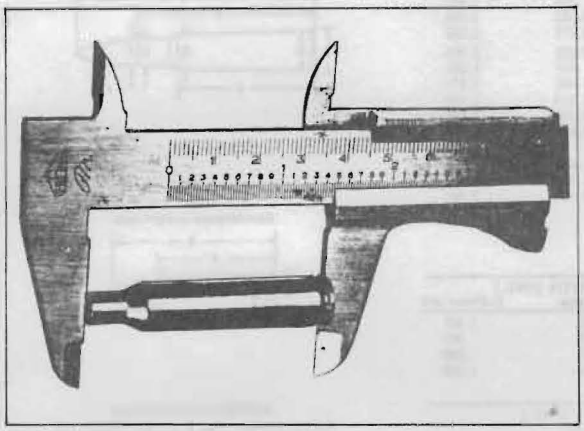


FIGURE 38 — Vernier calipers provide a precise case measurement and show how much the case must be trimmed.

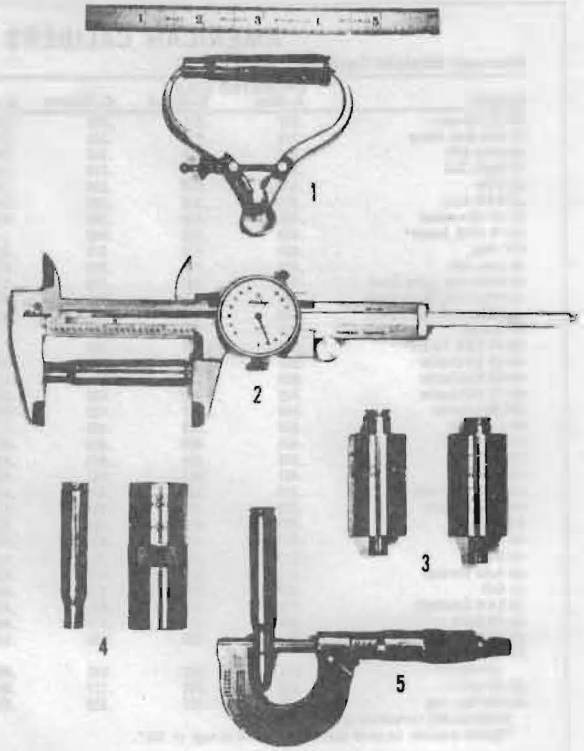


FIGURE 39 — Case measuring tools: (1) steel scale calibrated in hundredths and common caliper, (2) indicating caliper with gauge for measuring overall length and inside and outside neck diameters, (3) trimmer shellholders, showing difference in case head projection before and after trimming, (4) typical case gauge, and (5) micrometer for checking neck diameter. (Courtesy The American Rifleman)

AMERICAN CALIBERS

Rimmed Necked Case

Caliber	DIAMETER (IN.) A–Rim	B–Head	C–Shoulder	D–Mouth	E–Bullet	LENGTH (INS.) a–Base to Shoulder	b–Case	c–Over–all
.218 Bee	.405	.345	.331	.241	.224	.924	1.334	1.670
.219 Zipper	.493	.417	.363	.250	.224	1.361	1.924	2.262
.22 Hornet	.342	.295	.274	.242	.220	.845	1.388	1.712
.22 Jet	.435	.377	.352	.250	.223	.600	1.280	1.641
.22 Savage	.494	.414	.358	.251	.228	1.386	2.042	2.483
.22 WCF	.342	.294	.275	.246	.226	.833	1.400	1.685
.25–20 Single Shot	.376	.317	.301	.272	.250	1.123	1.633	1.883
.25–20 Winchester	.405	.345	.330	.275	.253	.850	1.307	1.583
.25–35 Winchester	.494	.412	.364	.283	.255	1.407	2.036	2.545
.25–36 Marlin	.502	.419	.359	.282	.249	1.491	2.130	2.506
.256 Winchester	.434	.377	.365	.283	.250	.977	1.277	1.550
.30–30 Winchester	.505	.417	.388	.330	.302	1.425	2.045	2.545
.30–40 Krag	.541	.456	.417	.334	.309	1.708	2.309	3.080
.303 Savage	.508	.440	.402	.333	.307	1.352	2.010	2.524
.32 Win. Special	.498	.419	.392	.338	.320	1.466	2.045	2.525
.32–20 WCF	.404	.349	.333	.326	.302	.845	1.300	1.592
.33 Winchester	.600	.495	.434	.359	.335	1.600	2.115	2.777
.348 Winchester	.607	.548	.474	.374	.342	1.667	2.250	2.800
.35 Winchester	.542	.455	.425	.382	.358	2.000	2.411	3.166
.38–40 Winchester	.518	.466	.435	.416	.398	.900	1.303	1.593
.38–56 Winchester	.604	.503	.444	.400	.370	1.268	2.100	2.500
.38–72 Winchester	.521	.459	.427	.397	.377	1.896	2.580	3.174
.40–82 Winchester	.603	.504	.452	.427	.395	1.712	2.393	2.779
.44–40 Winchester	.515	.465	.453	.443	.423	.900	1.300	1.596
.45–75 Winchester	.628	.563	.542	.478	.457	1.040	1.883	2.250
.50 Remington Pistol, Army (M 1871)	.665	.565	.559	.535	.503	.555	.870	1.250
.50–95 Winchester	.625	.560	.550	.533	.493	1.490	1.928	2.270

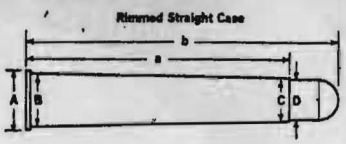
TABLE 2 — Cartridge measurements.

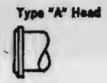
AMERICAN CALIBERS

Rimmed Straight Case

Caliber	DIAMETER (IN.) A–Rim	B–Head	C–Mouth	D–Bullet	LENGTH (INS.) a–Case	b–Over–all
.25–25 Stevens	.376	.300	.278	.246	2.369	2.624
.32 Colt New Police	.375	.337	.335	.312	.925	1.250
.32 Long Colt	.380	.316	.316	.292	.913	1.219
.32 Short Colt	.368	.318	.318	.316	.631	.993
.32 S&W	.370	.334	.334	.313	.600	.918
.32 S&W Long	.373	.338	.335	.314	.914	1.283
.32–40 Winchester	.494	.410	.340	.310	2.125	2.495
.32–44 S&W Target*	.409	.348	.348	—	.979	1.012
.357 Mag.	.435	.379	.375	.352	1.283	1.560
.38 Long Colt	.435	.375	.373	.347	1.028	1.367
.38 Short Colt (Long Case)	.440	.378	.378	.378	.760	1.193
.38 Short Colt (Short Case)	.433	.378	.375	.379	.679	1.100
.38 S&W (Colt New Police)	.437	.386	.385	.357	.763	1.176
.38 Special	.434	.372	.372	.357	1.155	1.544
.38–44 S&W Target*	.437	.384	.384	—	1.466	1.466
.38–55 Winchester	.505	.417	.395	.366	2.127	2.546
.40–60 Winchester	.623	.504	.424	.400	1.874	2.255
.40–72 Winchester	.522	.459	.432	.408	2.583	3.172
.405 Winchester	.544	.457	.432	.409	2.583	3.162
.41 Long Colt	.433	.408	.406	.373	1.127	1.410
.41 Short Colt	.435	.409	.405	.407	.638	1.079
.44 Bulldog	.503	.454	.445	.442	.552	.941
.44 Colt	.483	.461	.451	.449	1.060	1.514
.44 S&W American	.510	.439	.437	.430	.888	1.420
.44 S&W Russian	.505	.457	.455	.425	.954	1.443
.44 Special	.507	.455	.454	.420	1.151	1.586
.44 Mag.	.507	.455	.453	.429	1.277	1.592
.44 Marlin	.510	.467	.451	.422	2.220	2.559
.45 Auto Rimmed	.511	.473	.472	.439	.897	1.266
.45 Colt	.510	.478	.475	.446	1.266	1.575
.45 S&W Schofield	.520	.478	.478	.445	1.118	1.438
.45–70 Gov't	.608	.503	.479	.448	2.104	2.546
.45–90 Winchester	.607	.500	.476	.448	2.400	2.755
.50 Remington Pistol, Navy (M1867)**	.645	.563	.532	.497	.877	1.215
.50–70 Gov't	.660	.565	.537	.503	1.750	2.230
.50–110 Win. Exp.	.605	.552	.532	.502	2.400	2.741

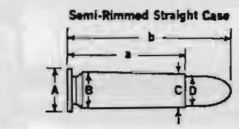
*Bullet seated completely within case.
**Bullet diameter on some specimens may be as high as .531".





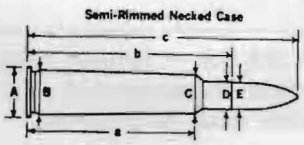
Rimless Straight Case

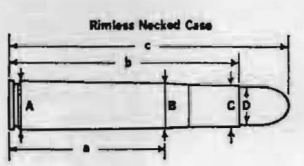
Caliber	DIAMETER (IN.) A–Head	B–Mouth	C–Bullet	LENGTH (INS.) a–Case	b–Over–all
.30 M1 Carbine	.356	.332	.307	1.285	1.681
.35 S&W Pistol	.348	.347	.310	.670	.961
.380 ACP	.373	.373	.355	.675	.980
.45 ACP	.473	.473	.449	.886	1.265



Rimless Necked Case

Caliber	DIAMETER (IN.) A–Head	B–Shoulder	C–Mouth	D–Bullet	LENGTH (INS.) a–Base to Shoulder	b–Case	c–Over–all
.22–.250 Remington	.465	.405	.250	.224	1.517	1.905	2.335
.221 Remington	.374	.356	.250	.223	1.075	1.392	1.810
.222 Remington	.374	.354	.243	.225	1.285	1.696	2.122
.222 Remington Mag.	.373	.353	.247	.223	1.464	1.828	2.270
.223 Remington (5.56 mm.)	.375	.350	.247	.224	1.440	1.752	2.171
.243 Winchester	.467	.447	.275	.244	1.539	2.039	2.669
.244 Remington	.465	.425	.274	.244	1.739	2.229	2.739
6 mm. Remington	.467	.423	.273	.243	1.735	2.225	2.815
6 mm. Navy Lee	.444	.397	.274	.245	1.722	2.353	3.115
.25 Remington	.420	.395	.282	.257	1.497	2.049	2.516
.250 Savage	.466	.413	.282	.254	1.513	1.910	2.444
.256 Newton	.471	.430	.288	.263	1.889	2.245	3.286
.257 Roberts	.469	.428	.289	.259	1.739	2.230	2.708
.270 Winchester	.469	.431	.305	.272	1.967	2.535	3.273
.280 Remington	.467	.436	.311	.282	2.000	2.538	3.313
.30 Newton	.525	.495	.342	.308	2.005	2.517	3.378
.30 Remington	.420	.400	.330	.303	1.499	2.050	2.516
.30–'06 Springfield	.470	.435	.334	.309	1.955	2.489	3.332
.300 Savage	.466	.444	.331	.309	1.555	1.862	2.596
.308 Winchester (7.62 NATO)	.470	.450	.336	.309	1.570	2.004	2.742
.32 Remington	.419	.394	.343	.318	1.485	2.047	2.516
.35 Newton	.525	.500	.384	.358	2.005	2.518	3.325
.35 Remington	.457	.423	.383	.354	1.518	1.914	2.512
.35 Whelen	.468	.440	.380	.358	1.975	2.481	3.302
.358 Winchester	.470	.450	.383	.359	1.571	2.003	2.772





Belted Case

Caliber	DIAMETER (IN.) A–Rim	B–Under Head	C–Shoulder	D–Mouth	E–Bullet	LENGTH (INS.) a–Base to Shoulder	b–Case	c–Over–all
.224 Weatherby Mag.	.426	.414	.390	.249	.224	1.505	1.915	2.415
.240 Weatherby Mag.	.469	.449	.425	.269	.244	2.010	2.490	3.060
.257 Weatherby Mag.	.531	.510	.485	.284	.259	2.030	2.540	3.165
6.5 mm. Rem Mag.	.525	.508	.489	.293	.263	1.700	2.160	2.778
.264 Win. Mag.	.531	.508	.487	.294	.261	2.030	2.492	3.307
.270 Weatherby Mag.	.530	.508	.483	.305	.277	2.040	2.542	3.218
7 mm. Rem. Mag.	.527	.509	.484	.312	.282	2.034	2.496	3.276
7 mm. Weatherby Mag.	.530	.510	.485	.310	.282	2.045	2.538	3.274
.300 Weatherby Mag.	.532	.515	.490	.335	.308	2.338	2.809	3.498
.308 Norma Mag.	.528	.508	.488	.337	.309	2.083	2.547	3.246
.338 Win. Mag.	.530	.510	.485	.364	.338	2.038	2.491	3.309
.340 Weatherby Mag.	.529	.509	.485	.365	.334	2.312	2.820	3.560
.350 Remington Mag.	.525	.509	.490	.382	.358	1.695	2.162	2.750
.358 Norma Mag.	.528	.509	.487	.386	.359	2.075	2.508	3.236
.375 Weatherby Mag.	.530	.511	.484	.401	.371	2.374	2.855	3.515
.378 Weatherby Mag.	.578	.580	.550	.400	.370	2.360	2.906	3.643
.458 Win. Mag.	.531	.510	—	.480	.450	—	2.504	3.312
.460 Weatherby Mag.	.578	.581	.555	.484	.457	2.375	2.909	3.773

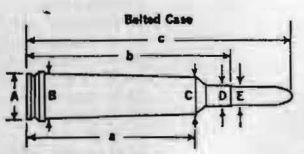


TABLE 2 (cont'd)

Semi-Rimmed Straight Case

Caliber	DIAMETER (IN.) A-Rim	B-Head	C-Mouth	D-Bullet	LENGTH (INS.) a-Case	b-Over-all
.25 Auto	.300	.279	.277	.250	.613	.900
.32 ACP	.357	.337	.334	.306	.679	.980
.32 Win. S.L.	.391	.350	.345	.321	1.286	1.984
.35 Win. S.L.	.404	.382	.375	.350	1.147	1.653
.351 Win. S.L.	.408	.377	.377	.353	1.372	1.886
.38 AMU*	.404	.376	.375	—	1.150	1.175
.38 Colt Auto	.405	.384	.383	.355	.894	1.274
.401 Win. S.L.	.459	.431	.429	.408	1.494	2.009

*Bullet seated completely within case.

Semi-Rimmed Necked Case

Caliber	DIAMETER (IN.) A-Rim	B-Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
.220 Swift	.469	.446	.400	.257	.225	1.702	2.196	2.668
.225 Winchester	.469	.417	.400	.253	.224	1.530	1.924	2.437

BRITISH CALIBERS

Rimmed Straight Case

Caliber	DIAMETER (IN.) A-Rim	B-Head	C-Mouth	D-Bullet	LENGTH (INS.) a-Case	b-Over-all
.380 Revolver (Mk I, II)	.433	.384	.384	.359	.759	1.236
.44 Webley (.442 Revolver)	.500	.457	.446	.430	.708	1.154
.450 Nitro Exp.	.617	.545	.478	.452	3.247	3.853
.455 Revolver (Mk II)	.529	.474	.472	.442	.757	1.261
.500 Nitro Exp. 3"	.650	.570	.531	.509	2.989	3.746
.577 Nitro Exp 3"	.739	.659	.604	.582	2.991	3.619
.577 Snider (coiled brass case)	.741	.657	.614	.564	1.942	2.434

Rimmed Necked Case

Caliber	DIAMETER (IN.) A-Rim	B-Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
.303 British	.533	.455	.395	.339	.312	1.799	2.204	3.033
.375 Flanged Mag.	.563	.513	.440	.400	.375	2.400	2.921	3.794
.450/400-3¼" Nitro Exp.	.615	.543	.485	.434	.409	2.008	3.241	3.850
.577/450 Martini-Henry*	.745	.660	.614	.482	.450	1.400	2.355	3.064
.465 Nitro Exp.	.643	.572	.529	.489	.467	2.165	3.239	3.833
.470 Nitro Exp.	.646	.571	.525	.502	.471	2.400	3.242	3.864
.475 No. 2 Jeffery	.669	.580	.540	.506	.481	2.760	3.492	4.313
.577 Snider (drawn brass case)**	.750	.661	.622	.599	.565	1.125	1.610	2.140

*May be drawn brass case or coiled brass case.
**Dominion Cartridge Co., other manufacturers' case length up to 2.000".

Semi-Rimmed Necked Case

Caliber	DIAMETER (IN.) A-Rim	B-Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
.280 Ross	.556	.525	.420	.318	.288	2.172	2.600	3.455

Rimless Necked Case

Caliber	DIAMETER (IN.) A-Head	B-Shoulder	C-Mouth	D-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
.242 Nitro	.465	.421	.282	.250	2.006	2.387	3.186
.318	.466	.439	.356	.330	1.953	2.400	3.392
.333	.543	.487	.359	.333	1.754	2.485	3.493
.350 Rigby Mag.	.516	.448	.380	.358	2.333	2.748	3.540
.404 Jeffery	.546	.529	.449	.420	2.009	2.874	3.510
.505 Gibbs	.636	.589	.530	.499	2.433	3.140	3.833

Belted Case

Caliber	DIAMETER (IN.) A-Rim	B-Under Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
.240 Belted	.476	.455	.401	.276	.244	1.925	2.493	3.210
.244 H&H Mag.	.530	.508	.446	.275	.244	2.312	2.783	3.595
.275 H&H Mag.	.530	.513	.448	.318	.285	2.100	2.494	3.294
.300 H&H Mag.	.524	.508	.446	.335	.310	2.125	2.847	3.574
.375 H&H Mag.	.530	.513	.442	.400	.375	2.380	2.840	3.575

TABLE 2 (cont'd)

METRIC CALIBERS

Rimmed Straight Case

Caliber (mm.)	DIAMETER (IN.) A-Rim	B-Head	C-Mouth	D-Bullet	LENGTH (INS.) a-Case	b-Over-all
9.3x72R	.480	.429	.383	.369	2.832	3.351

Rimmed Necked Case

Caliber (mm.)	DIAMETER (IN.) A-Rim	B-Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
6.5x53R Dutch & Roumanian Mannlicher	.528	.448	.418	.294	.263	1.640	2.107	3.054
7x72R	.482	.425	.337	.311	.284	2.000	2.835	3.395
7.62x54R M1891 Russian	.564	.485	.454	.336	.310	1.510	2.100	3.023
8x51R French Lebel	.630	.538	.516/.450	.350	.330	.875/1.452 (dbl. taper)	1.987	2.949
8x57JR	.528	.467	.426	.344	.317	1.817	2.241	3.244
8x58R Danish Krag	.577	.503	.467	.357	.322	1.662	2.277	3.000
8.15x46R	.482	.422	.387	.344	.323	1.150 (slight shoulder)	1.812	2.332
8.2(8)x50R Mannlicher	.552	.492	.475	.355	.323	1.485	1.980	3.000
9.3x74R	.523	.465	.407	.387	.364	2.358	2.935	3.686
11 M1871/84 Mauser	.585*	.515	.507	.465	.433**	1.497	2.363	3.015
11(.43)Spanish Rem.	.630	.518	.507	.459	.433	1.637	2.250	2.831

*Type "A" head. See illustration
**Measured over paper patch

Semi-Rimmed Necked Case

Caliber (mm.)	DIAMETER (IN.) A-Rim	B-Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
6.5x50 Jap Arisaka	.473	.450	.416	.293	.264	1.528	1.990	2.998

Rimless Straight Case

Caliber (mm.)	DIAMETER (IN.) A-Head	B-Mouth	C-Bullet	LENGTH (INS.) a-Case	b-Over-all
9 Luger	.386	.373	.355	.750	1.150

Rimless Necked Case

Caliber (mm.)	DIAMETER (IN.) A-Head	B-Shoulder	C-Mouth	D-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
5.6x61 vom Hofe	.476	.452	.259	.225	1.730	2.395	3.145
6.5x52 Italian Carcano	.448	.430	.296	.267	1.628	2.057	2.992
6.5x54 Mannlicher/Sch.	.449	.425	.290	.263	1.645	2.111	3.040
6.5x55 M1894 Norwegian & Swedish	.476	.433	.297	.265	1.696	2.161	3.078
6.5x57 Mauser	.467	.431	.296	.263	1.767	2.227	3.151
7x57 Mauser	.475	.430	.318	.284	1.731	2.240	3.056
7x64 Brenneke	.466	.425	.310	.286	2.025	2.517	3.435
7x66 vom Hofe	.543	.497	.311	.282	2.094	2.596	3.299
7.35x51 Italian Mannlicher/Carcano (Terni)	.450	.424	.325	.300	1.638	2.017	2.894
7.5x54 M1929 French	.485	.444	.338	.309	1.692	2.118	2.985
7.5x54.5 Swiss	.493	.453	.335	.307	1.763	2.182	3.050
7.63 Mauser	.387	.372	.330	.309	.763	.987	1.362
7.65 Luger	.391	.375	.328	.307	.604	.844	1.140
7.65x53 Mauser	.472	.430	.343	.310	1.755	2.101	3.075
7.7x58 Japanese	.472	.434	.339	.310	1.866	2.270	3.139
8x51 Short Mauser	.469	.437	.345	.318	1.530	1.989	2.768
8x56 Mannlicher/Sch.	.464	.426	.348	.324	1.795	2.220	3.039
8(7.92)x57 JS	.467	.430	.351	.324	1.820	2.238	3.162
8x57J M1888	.470	.430	.343	.318	1.830	2.238	3.245
8x60S	.472	.428	.354	.322	1.920	2.355	3.155
9x56 Mannlicher/Sch.	.464	.420	.378	.354	1.830	2.215	3.056
9x57 Mauser	.469	.429	.385	.359	1.804	2.218	3.182
9.3x57	.470	.430	.389	.366	1.816	2.214	3.104
9.3x62	.469	.442	.385	.363	2.046	2.436	3.288
9.5x57 Mannlicher/Sch.	.467	.452	.400	.373	1.817	2.235	2.972
10.75x68 Mauser	.498	.473	.450	.424	2.069	2.674	3.179

Belted Case

Caliber (mm.)	DIAMETER (IN.) A-Rim	B-Under Head	C-Shoulder	D-Mouth	E-Bullet	LENGTH (INS.) a-Base to Shoulder	b-Case	c-Over-all
7x61 S&H	.532	.512	.463	.316	.285	1.975	2.392	3.258
7x73 vom Hofe	.535	.527	.490	.315	.280	2.110	2.871	3.701 ■

TABLE 2 (cont'd)

CASE TRIMMERS

Once you know a case neck is too long, you need a means of trimming. There are basically three types of trimmers: (1) simple, hand-held devices like the Lee trimmer which sell for about $3.00; (2) the trim die, which threads into a press; and (3) the various bench-mounted lathe types and some that can be used with a drill press.

The hand-held units have some application at the shooting range, where one might experiment by firing a shot or two and then

change the case length in the interest of accuracy, but such tools are most often used by those just getting started.

The trim die is preferred by some reloaders if they do not load to any great extent, but this becomes expensive if you load several calibers. The trim die is extremely precise (see Figure 40). For this reason, many shooters order a trim die along with the regular die set for a given caliber. After filing down the protruding portion of the case neck, the neck must be chambered and beveled, inside and out, with a burring tool (see Figure 41).

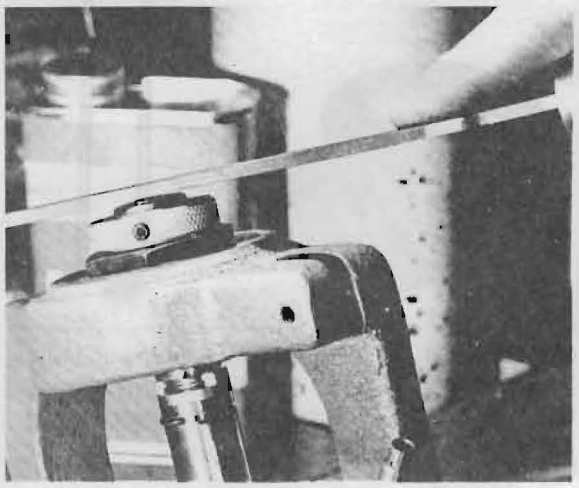


FIGURE 40 — A trim die requires no further adjustment for "repeat" trimming once the lock ring has been tightened down.

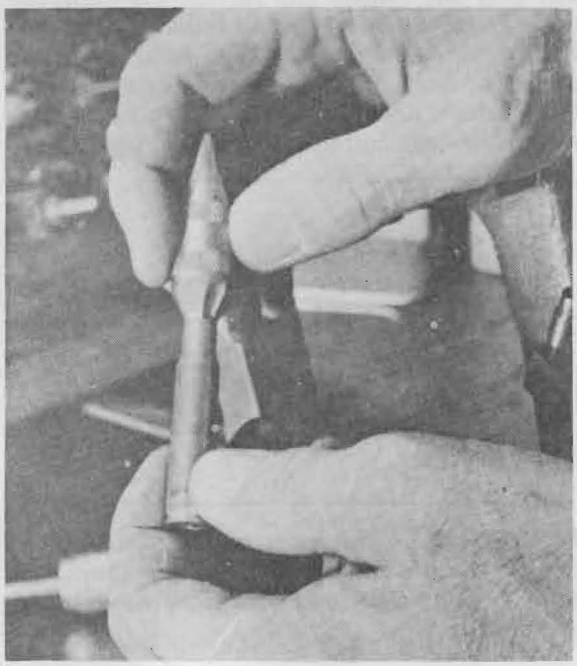


FIGURE 41 — After trimming and before full-length sizing, the case mouth should be chamfered and beveled with a burring tool.

Probably the fastest and most versatile trimming tool of all is the miniature lathe type such as the Forster (see Figure 42). An adjustable chuck or collet holds a variety of different-sized cartridge heads securely; interchangeable pilots, one for each caliber, hold the case mouth securely while the rotating handle rotates a multi-edged cutter against the case mouth. The depth of the "trim" is established by the position of a lock collar. Some tools of this type use a standard shellholder to hold the case head; others, like the Bonanza trimmer, employ a mandrel which is inserted into the primer pocket. Still others utilize a universal pilot which accommodates all case mouth diameters.

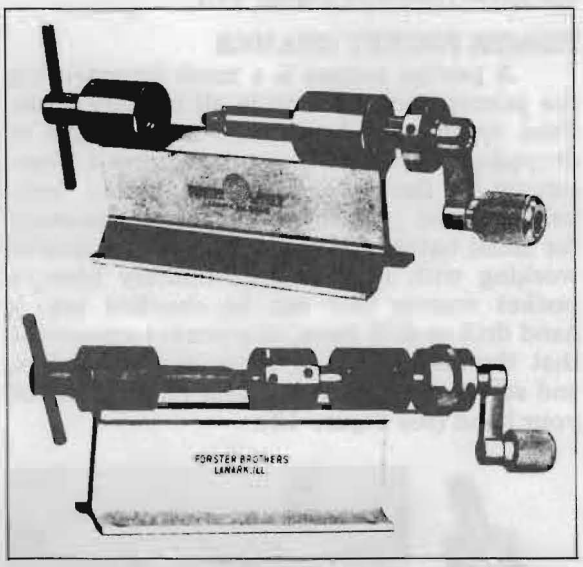


FIGURE 42 — One of the most versatile trim tools is the Forster (top), which with a special collar also turns down neck diameters. Not shown is the reamer and other attachments which make this tool a multiple winner.

An advantage of some lathe-type trimmers over trim dies is that the former, with appropriate attachments, can also be used for neck reaming — "boring out" thickened case necks to the proper bullet diameter — and for outside neck turning. Some cases, after repeated firings, become so thick in the neck that reaming isn't enough. In order to provide the necessary .002" to .003" clearance between the case neck and the neck of the chamber, the outside of the case neck must be turned down.

There are a number of case trimming, reaming, and neck-turning tools on the market, ranging from about $2.00 for hand-held models to about $7.50 for trim dies, and on up to approximately $13.00 to $50.00 for the various manual and electric-powered lathe-type units.

CHAMFERING-BURRING TOOL

Nearly all cases, after trimming, are rough at the mouth both inside and out. Burrs or roughness on the *inside* can be removed by inserting the pointed end of the tool into the case mouth and rotating the tool a turn or two with light pressure. This procedure slightly "cones" the case neck, making for easier and more uniform bullet seating.

Burrs on the *outside* are smoothed away by slipping the cutting edges at the other end of the tool over the case mouth and rotating the tool with light, even pressure. Chamfering-burring tools are *not* used for neck reaming or turning down oversize necks, where the cut must be uniform down the full length of the neck. (Refer to Figure 41.)

PRIMER POCKET REAMER

A pocket reamer is a must for removing the primer pocket crimp in all military brass. Even commercial brass, after many firings or dropping in the dirt or mud, requires a clean-out of the flashhole. Simple hand-held, manually rotated pocket reamers are satisfactory for small batches of cases. If, however, you're working with large lots of military brass, a pocket reamer that can be chucked into a hand drill or drill press, or a pocket swager die that threads into your press, is a better idea and surely saves wear and tear on the palm of your hand (see Figure 43).

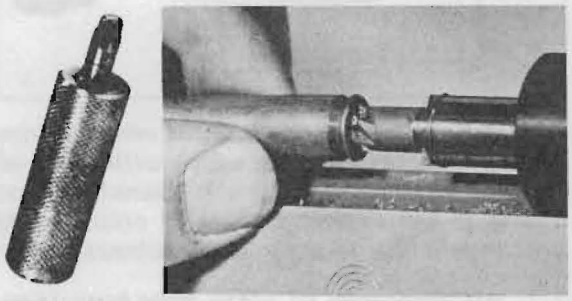


FIGURE 43 — Pocket reamers may be of the simple hand-held type (left) or in the form of an accessory for a lathe-type trimming tool. Shown at right is the pocket reamer used with the versatile Forster case trimmer.

MISCELLANEOUS RELOADING ACCESSORIES

To this point we have discussed the essential tools needed on any reloading bench. Following are brief descriptions and the functions of some of the tools and accessories you should have and probably will purchase in the future. A few are nice to have, but are not of critical importance or are downright luxuries.

Primer Tray

Spend a few minutes (or hours) trying to set your primers same side up for easy pick-up and you'll see the virtue of this simple and inexpensive tool. Simply scatter the primers on the grooved tray and shake (the tray, that is). In a few moments they're all anvil side up, ready for manual placement on the primer arm. For feed tube pick-up, place the cover over the tray, turn everything over, and remove the top section. The primers are then shiny side up (see Figure 44). After all, it only costs $1.00.

FIGURE 44 — A primer tray and automatic feeder tubes, such as the RCBS units shown, make priming a "no sweat" operation.

Bullet Pullers

Nobody's perfect, and somewhere along the line you're going to make up a batch of reloads that don't shoot worth a dang. You can blast them off to get rid of them or you can pull the bullets and salvage the components. There are two types of bullet pullers (see Figure 45). The inertia type holds the case in a clip. Bang the bottom end against a hard, flat surface and the bullet and powder pop out of the case and into the plastic holder.

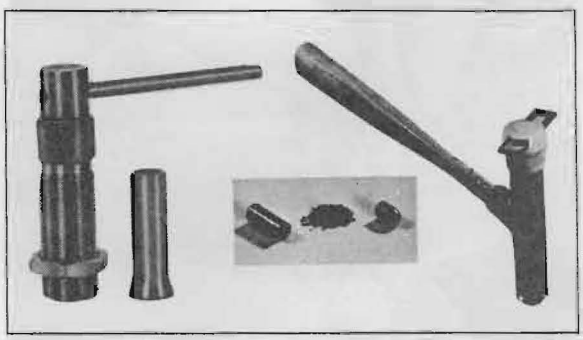


FIGURE 45 — The most popular bullet pullers are the die-collet (left) and the simple inertia type (RCBS and Kexplore models, respectively).

A second, more precise, but more expensive puller is the collet-die type which mounts by standard 7/8" - 14 threads into the loading

press. The loaded cartridge is raised into the die and the collet is tightened down around the bullet. The ram is then lowered and the bullet remains in the collet. Release the tension and the bullet drops into your hand. Separate collets are required for each caliber.

Bullet pullers are also useful when you've goofed and seated a bullet too deeply in the trial-and-error seating adjustment. There are also times when military ammo is available at low cost. By pulling the full-jacketed bullet and replacing it with a hunting bullet of equal or lighter weight (don't use a heavier bullet), you can produce acceptable hunting or plinking ammo at much less than the usual cost.

Powder Funnels and Dribblers

A powder funnel is very nearly a necessity when making up maximum loads or match ammunition. You weigh the charge on your scale, then drop it in the case via the funnel. Powder tricklers are great when weighing individual rounds on your scale. If your spoonful of powder or whatever is a bit under the desired weight, you dribble in extra powder a few granules at a time until the needle on the scale rests at zero (see Figure 46).

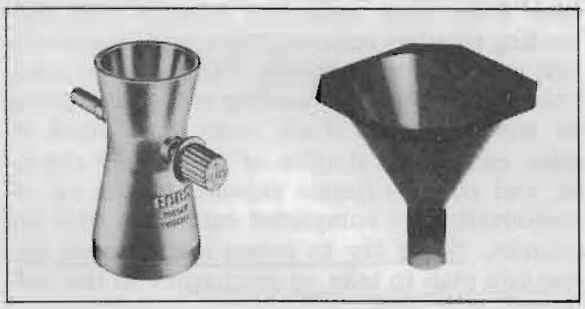


FIGURE 46 — Two near-necessities for the reloader are a powder funnel and a powder trickler (dribbler).

Stuck Case Puller

There are few reloaders who at one time or another haven't forgotten to lube a case and jammed it firmly into the sizing die. (This usually happens when a buddy drops by and you yak it up instead of minding the business at hand.) When this happens, the sensible thing to do is unscrew the die from the press. Drill and tap the flashhole, then screw the die partway (maybe five or six turns) back into the press. Place a washer over the bottom of the die hole, then run a screw up into the threaded base of the case. By turning the head of the screw with a wrench, the case is pulled from the die.

If you don't have a tap and die, tools especially designed for this purpose are available at low cost from several manufacturers (see Figure 47).

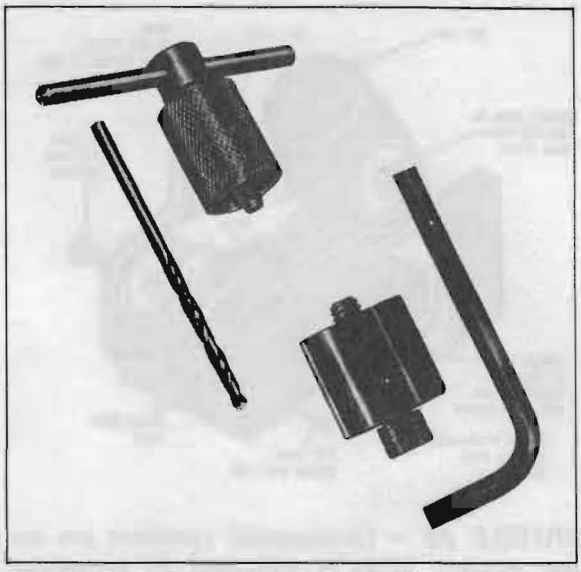


FIGURE 47 — Stuck cases are removed with a drill and tap tool such as the Herter unit at left. Broken cases with the head missing are extracted with the MSS tool, which is slipped inside the stuck case remnant.

If, however, you or a customer have attempted to remove a stuck case by pounding on the case rim with a screwdriver or other sharp object, and have succeeded only in tearing off the rim (leaving the case body inside the die), you have to use another type of tool. This consists of a collet-type serrated cylinder which is inserted up into the die. When the handle is turned, the rough edges on the cylinder expand outward and "bite into" the brass, providing an easy means of extracting the case.

A way to remove a broken case from a sizing die is to unscrew the expander ball-decapping rod assembly and pull it out the top of the die. Now, using your bore light, very carefully scratch the interior of the case remnant. (Take care not to scratch any exposed part of the die wall.) Next, mount the die vertically in your vise, plug the bottom with cleaning patches or a small rag, and pour Cerrosafe into the die from the top. After it hardens, the cast, including the stuck case, can be driven out of the die from the top by tapping a length of cleaning rod with a hammer.

Cartridge Case Tumbler

Few things gladden the heart of the ardent reloader more than a batch of reloads that look as shiny bright as factory fodder. This pristine purity of appearance is best accomplished with an electrically driven tumbler (see Figure 48) containing sawdust, rice, or ground-up walnut hulls. A few minutes of tumbling removes all die marks or scratches from the finished rounds.

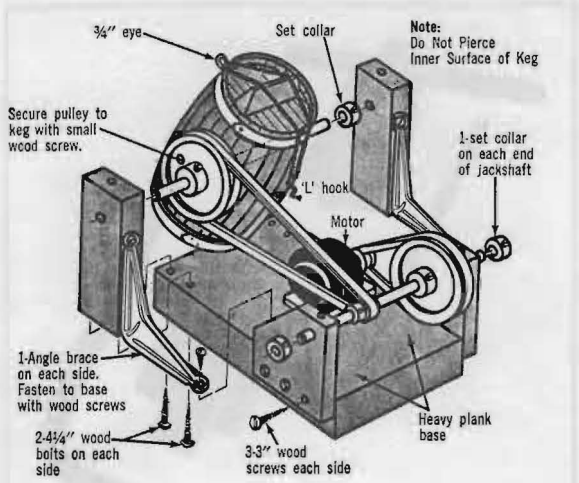


FIGURE 48 — Commercial tumblers are on the market (they're identical to gemstone tumblers), but you may wish to make your own. Sketch provides the details. (Courtesy NRA)

And Then There's . . .

There are certain things you will need when you start reloading that are so obvious they hardly need mention, much less a detailed description. In this category are your lube pad and lubricant, brushes for lubing the inside of case necks, loading blocks to hold and segregate cases in various stages of progress, and, of course, a wrench and pliers to tighten down and remove dies.

There are many items that we haven't covered here, such as gauges for measuring variations in bullet concentricity and in neck thickness; drill-type devices which put hollow points into swaged or full-jacketed bullets; chronographs, etc. These tools and devices are all listed in your Brownell's catalog.

Now let's get on with the procedures involved in actual reloading.

RELOADING — GO-NO GO SAFETY PROCEDURES

Before getting into specific reloading instructions, let's discuss some specific and general rules that will make your operation safer while assuring better-quality reloads.

Knock Off the Smoking

Smokeless powder is safer to handle than gasoline, cleaning solvents, or even lighter fluid. It is classified as a propellant, not an explosive — *but it will burn like blue blazes.* When reloading, you're going to have stray powder granules on your bench, filled cases in loading blocks, perhaps a pan of powder on your scale. A flipped ember from a cigarette or accidentally banging a lighted butt against your press could produce a shower of sparks, setting your shop off like a Roman candle. Never, under any circumstances, smoke at your bench or permit your friends to do so. Life is short enough.

Okay, now that that's settled, here are some more precautions and good-sense rules that will keep you here today and here tomorrow.

Powder Identification

If you can't identify a powder, discard it. Keep *only one* canister of powder on your loading bench at one time.

Use stick-on labels on your powder charger so that the powder in use is always identified.

Don't use old canisters from other powders. The color of the can may confuse you.

Don't try to identify powder by its similarity to another.

Don't reuse powder from old loads or military ammunition.

Can the Small Talk

If your buddies want to watch as you make up a batch of reloads, fine, providing they keep their collective mouths shut. Reloading requires concentration, and near clocklike precision movements. Carry on a running conversation while reloading and you're going to wind up with stuck cases you forgot to lube, cases with double or no powder charges, and those ultimate tributes to the art of conversation — completed cartridges with no primers. Never try to prime loaded cases unless you plan to take up the harp! Pull the bullet and start over.

Try to Be Neat

Loading benches, after short use, tend to reflect the organization of a buzzard's nest. Make a habit of cleaning up after each session, and return all tools, equipment, and components to their proper places. Always set out only those items you'll need for a particular batch of reloads. Your reloads will be better, you'll work faster, and there'll be no frustrated howls emanating from your workshop. There's nothing worse than being midway into a batch of ammo, then discovering you've "lost" a shellholder, pilot, or other small but important item.

Wear Safety Glasses

Primers have been known to explode in the seating process, setting off a chain reaction and a blizzard of flying brass. Primers are replaceable. Your eyes are not.

Store Components Out of the Reach of Children

Always empty powder charges.

Curiosity and prying fingers can lead to tragedy. If you have little ones about, keep your components under lock and key; if you don't, make sure no one has access to your components without your direct supervision.

NOW LET'S GET STARTED

We'll assume that you have your basic loading equipment — a press, dies, scale, lubricant and pad, a powder measure or funnel, and the required accessories. If you're going to start with new, primed or unprimed brass, the necks may still need attention.

Case Preparation

You'll probably start with a batch of fired cases — your own or a mess that somebody gave you. Could be they're dirty, resulting from time spent in the dust at a firing range or from rattling around in the trunk of a car. Inspect those cases. Closely. Those with split necks, impressive dents, or signs of incipient head separation should be discarded immediately (see Figure 49). Unless the cases are in better than average shape, they should be cleaned; nothing will ruin a set of dies faster than running dirty, gritty cases through them. Boil those cases in hot, soapy water, then rinse and dry them thoroughly. When the spent primers are left in during cleaning, the pockets should be reamed out and cleaned later.

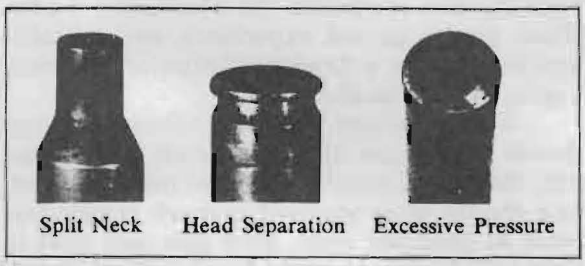


FIGURE 49 — Always check cases for the above signs before loading.

Some reloaders decap dirty cases before washing. The cases are first wiped reasonably clean, then are run partially up into the sizing die without lubrication. To prevent the dirty cases from contacting the die walls, the sizing die is screwed into the press until it contacts the shellholder, then is backed off at least two turns. The decapping pin is threaded down until it extends about 3/8" from the bottom of the die. (Some dies won't permit the pin to extend this far.)

The primer pockets are then boiled clean, along with the rest of the case. If they're still crudded up, they should be reamed out prior to resizing.

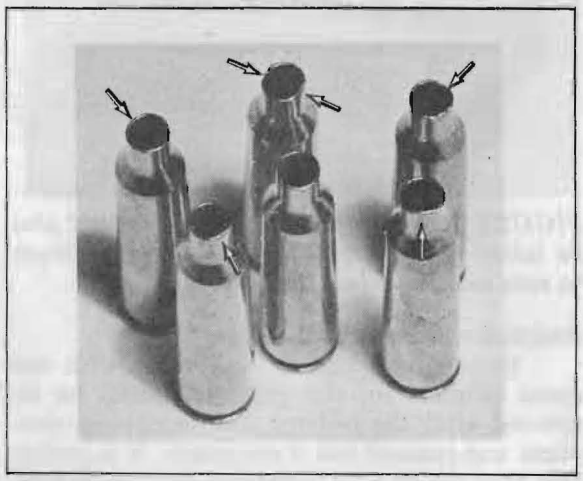


FIGURE 50 — New brass is no guarantee of perfection. Arrows point to deformed case mouths which require chamfering and deburring.

Case Lubrication

Most beginners make the mistake of using too much lubricant which, when trapped between the case and die walls, causes flutes or creases on the shoulder of the case (see Figure 51). When fired, such cases will usually fire-form back to normal. The best procedure is to roll three or four cases at a time on the pad, using only enough lubricant for a slight "feel." The case should never feel "tacky." A smart idea is to apply your lubricant to the pad a few hours before, or even the night before, you reload. In the interim, the lubricant saturates the pad, making the desired light lube film a lot easier to apply.

The inside of the case neck should be lubed with a dry lubricant (see Figure 52). If a liquid-type lubricant is used inside the case neck, you run the chance of ruining the powder charge or, at the very least, causing a "log jam" in the case mouth.

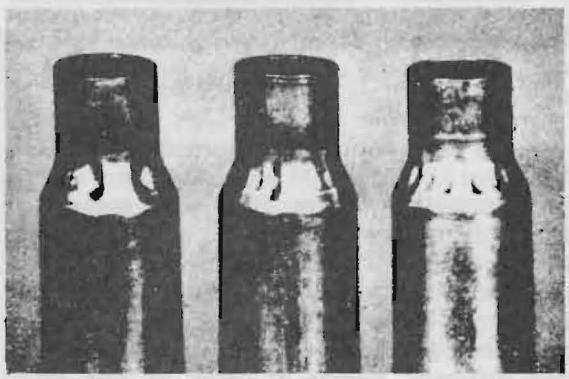


FIGURE 51 — Fluted or creased shoulders always indicate excessive lubricant.

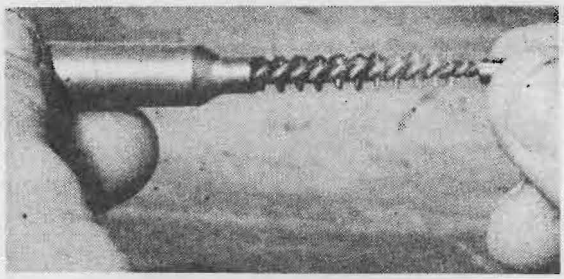


FIGURE 52 — Case neck interiors should also be lubed — very lightly — with a nylon brush to ease expander ball friction.

Resizing and Priming the Case

If you have boiled your cases with the spent primers in, the pockets should be inspected after the resizing and decapping operation and reamed out if necessary. It is preferable that the case be deprimed first. Only then is the new primer inserted. Following the resizing, decapping, and priming procedures, the case is necked for proper overall length with a Go-No Go gauge or vernier calipers (see Figure 53). You'll probably find that some are definitely too long, others just make it, and the majority are okay. In measuring your brass, set aside one case with the shortest permissible length and use it as your "guide case" in establishing the trim length for the entire group of cases. Then run all the cases through your case trimmer. In this way, all cases in this particular batch are of the same size, which is necessary for optimum accuracy.

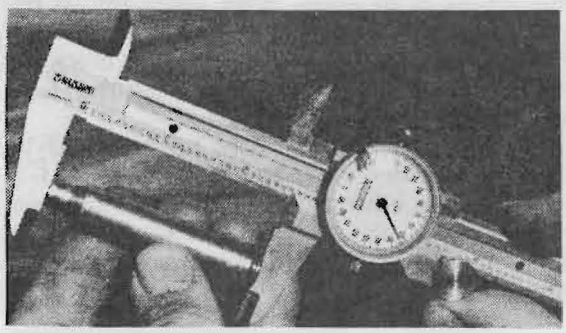


FIGURE 53 — Fired brass of uncertain age should always be checked for length after resizing.

All cases should be trimmed under specifications; i.e., a .30/06 which is 63mm should be trimmed to 62mm. It doesn't make that much difference because it will be 63mm shortly after two or three firings.

Incidentally, it's also a good idea to separate your cases by brand. You'll be surprised how accuracy (and pressure) varies between two different brands of cases, all else being equal, because of slight differences in brass thickness and case capacity. Following the trimming operation, bevel and chamber each case mouth (see Figure 54) just enough to remove burrs and aid bullet seating. You're now ready to drop your powder.

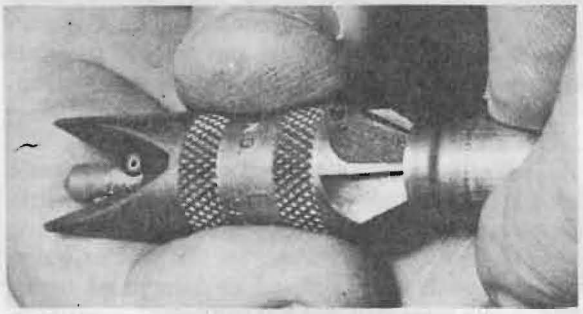


FIGURE 54 — Following trimming, the case mouths must be beveled and chambered. Easy does it.

Dropping the Powder Charge

If you're using a powder measure, check and recheck your initial setting and occasionally (every ten rounds or so) weigh the charge as you go along. When starting reloading, always use the *lowest* powder charge listed in your loading manual. If you've been working out loads with your Powley computer, *always* check them against a reputable loading manual. Inexperience with use of the computer, plus inexperience at reloading, can be a potentially dangerous combination. In fact, it's a good idea to become thoroughly acquainted with reloading and acceptable powder/bullet combinations for a given gun *before* you use your Powley computer for calculating loads. When you've gained experience, any mistake you've made in a Powley calculation will ring a gong in your head.

We emphasize that the novice reloader should always use minimum loads (see Figure 55). Beginners sometimes make mistakes, and you should leave yourself as much margin for error as possible. Also, your gun may have a tight barrel. Always make sure you're working with the correct powder. *Don't ever guess.* Selecting the wrong powder (like using 55 grains of IMR 4320 when the manual calls for 55 grains of IMR 4350) is responsible for more reloading accidents than any other factor!

When making up medium or higher-intensity rifle loads, it's almost impossible to dump a double powder charge and not be aware of it, for the reason that the two charges will overflow the case. This is not the situation with handgun ammo. Most pistol cases will easily hold a double charge of the small-grain or flake powders; if and when this happens, you're in for big trouble. Keep your mind on what you're doing, and your friends

out, when loading handgun ammunition. You don't need distractions. Also, always check the filled cases for powder uniformity before seating bullets in rifle or pistol ammo. Use a flashlight or a marked dowel. It is impossible to look in a case and tell the difference between two or four grains of pistol powder!

.308" Dia. SPEER 180 GR. SPITZER

	WT IN GRAINS	MUZ VEL	200 YD VEL	200 YD ENERGY	300 YD CORR
N205 POWDER	**74.0**	**3030**	**2612**	**2723**	**6.5**
	72.0	2968	2558	2612	6.8
	70.0	2859	2464	2424	7.4
H450 POWDER	***72.0**	**3014**	**2598**	**2694**	**6.5**
	*70.0	2942	2536	2567	6.9
	*68.0	2838	2446	2388	7.5

.308" Dia. SPEER 165 GR. SPITZER

	WT IN GRAINS	MUZ VEL	200 YD VEL	200 YD ENERGY	300 YD CORR
N205 POWDER	**77.0**	**3226**	**2816**	**2902**	**5.5**
	75.0	3134	2736	2740	5.9
	73.0	3049	2662	2593	6.3
H450 POWDER	***77.0**	**3145**	**2745**	**2758**	**5.8**
	*75.0	3060	2671	2611	6.2
	*73.0	2973	2595	2465	6.7

FIGURE 55 — Even experienced reloaders usually start with minimum loads for a new rifle. Tight barrels may produce higher velocities (and pressures) than indicated.

Bullet Seating

Bullet seating is the easiest of all reloading operations except when a crimp is required. This procedure has been explained previously. The methods of casting, sizing, and lubing lead bullets will be discussed in Part 2 of this study unit.

After completing a given batch of cartridges, you'll save time the next time around (and assure uniformity) if you prepare a dummy round with the appropriate bullet and without powder or primer as a bullet seating guide. Then, when you're ready to make up another group of cartridges, you simply back off on the seater plug, run the dummy round up inside the die, then screw the seater plug down until it bears against the tip of the bullet. Tighten down the small lock ring and your seating depth is established.

Good dies, such as those made by RCBS, Pacific, CH, Bonanza, and Redding, align the bullet with the case mouth *before* seating, which assures perfect bullet concentricity. This can't be said for all dies. Some reloaders, as a matter of course, seat a bullet halfway, then rotate the cartridge a half turn in the shellholder and complete the seating. This tends to even out any variation in concentricity.

At this point, if you've thoroughly absorbed the information in this study unit, you should be capable of turning out quality reloads at big savings over factory ammunition (see Table 3). You've learned some tricks of the trade not available to the average reloader, and if you pay good attention to what you're doing — *and review and absorb your instruction completely* — you'll be ready to go into custom ammo-making sooner than you think.

NUMBER OF CHARGES PER CANISTER OF POWDER

Charge (grs.)	8-oz. Canister	11-oz. Canister	13-oz. Canister	1-lb. Canister	Charge (grs.)	8-oz. Canister	11-oz. Canister	13-oz. Canister	1-lb. Canister
2	1750	2406	2843	3500	51	68	94	111	137
3	1166	1604	1895	2333	52	67	92	109	134
4	875	1203	1421	1750	53	66	90	107	132
5	700	962	1137	1400	54	64	89	105	129
6	583	802	947	1166	55	63	87	103	127
7	500	687	812	1000	56	62	85	101	125
8	437	601	710	875	57	61	84	99	122
9	388	534	631	777	58	60	82	98	120
10	350	481	568	700	59	59	81	96	118
11	318	437	517	636	60	58	80	94	116
12	291	401	473	583	61	57	78	93	114
13	269	370	437	538	62	56	77	91	112
14	250	343	406	500	63	55	76	90	111
15	233	320	379	466	64	54	75	88	109
16	218	300	355	437	65	53	74	87	107
17	205	283	334	411	66	53	72	86	106
18	194	267	315	388	67	52	71	84	104
19	184	253	299	368	68	51	70	83	102
20	175	240	284	350	69	50	69	82	101
21	166	229	270	333	70	50	68	81	100
22	159	218	258	318	71	49	67	80	98
23	152	209	247	304	72	48	66	78	97
24	145	200	236	291	73	47	65	77	95
25	140	192	227	280	74	47	65	76	94
26	134	185	218	269	75	46	64	75	93
27	129	178	210	259	76	46	63	74	92
28	125	171	203	250	77	46	62	73	90
29	120	165	196	241	78	44	61	72	89
30	116	160	189	233	79	44	60	71	88
31	112	155	183	225	80	43	60	71	87
32	109	150	177	218	81	43	59	70	86
33	106	145	172	212	82	42	58	69	85
34	102	141	167	205	83	42	57	68	84
35	100	137	162	200	84	41	57	67	83
36	97	133	157	194	85	41	56	66	82
37	94	130	153	189	86	40	55	66	81
38	92	126	149	184	87	40	55	65	80
39	89	123	145	179	88	39	54	64	79
40	87	120	142	175	89	39	54	63	78
41	85	117	138	170	90	38	53	63	77
42	83	114	135	166	91	38	52	62	76
43	81	111	132	162	92	38	52	62	76
44	79	109	129	159	93	37	51	61	75
45	77	106	126	155	94	37	51	60	74
46	76	104	123	152	95	36	50	59	73
47	74	102	121	148	96	36	50	59	72
48	72	100	118	145	97	36	49	58	72
49	71	98	116	142	98	35	49	58	71
50	70	96	113	140	99	35	48	57	70

TABLE 3 — By dividing the number of charges into the price of the canister, your powder cost per reload can be quickly calculated.

STUDY UNIT 10 – PART 2

BULLET-MAKING – CASTING, SIZING, LUBRICATING, AND SWAGING

BULLET-MAKING IS FUN, BUT IF YOU NEED AN EXCUSE . . .

Nobody wants to cast the first stone. But casting the first bullet? That can be a rewarding experience. Bullet-making is an old-time art, preceding the metallic cartridge and the rifled bore. Early hunters and frontiersmen didn't really have a choice — if they didn't mold their own projectiles, they didn't shoot. Nobody liked a bullet mooch, especially when the arrows were zipping about. But why today? Today's firearms enthusiast joins the pot-and-mold fraternity for a number of reasons.

The biggest appeal of bullet casting is, of course, economy (see Figure 1). When a man and his family shoot a lot, that six to seven cents a pop with jacketed factory bullets is more than most can afford. The bullet is always the most expensive ammo component (when a case will be reloaded a number of times) unless you cast your own, at an average cost of about two cents per casting.

Many shooters have learned that their center-fire big game rifles, when fed a diet of cast bullets and reduced powder charges, serve admirably for small game, plinking, and informal target work. The cost per round is little

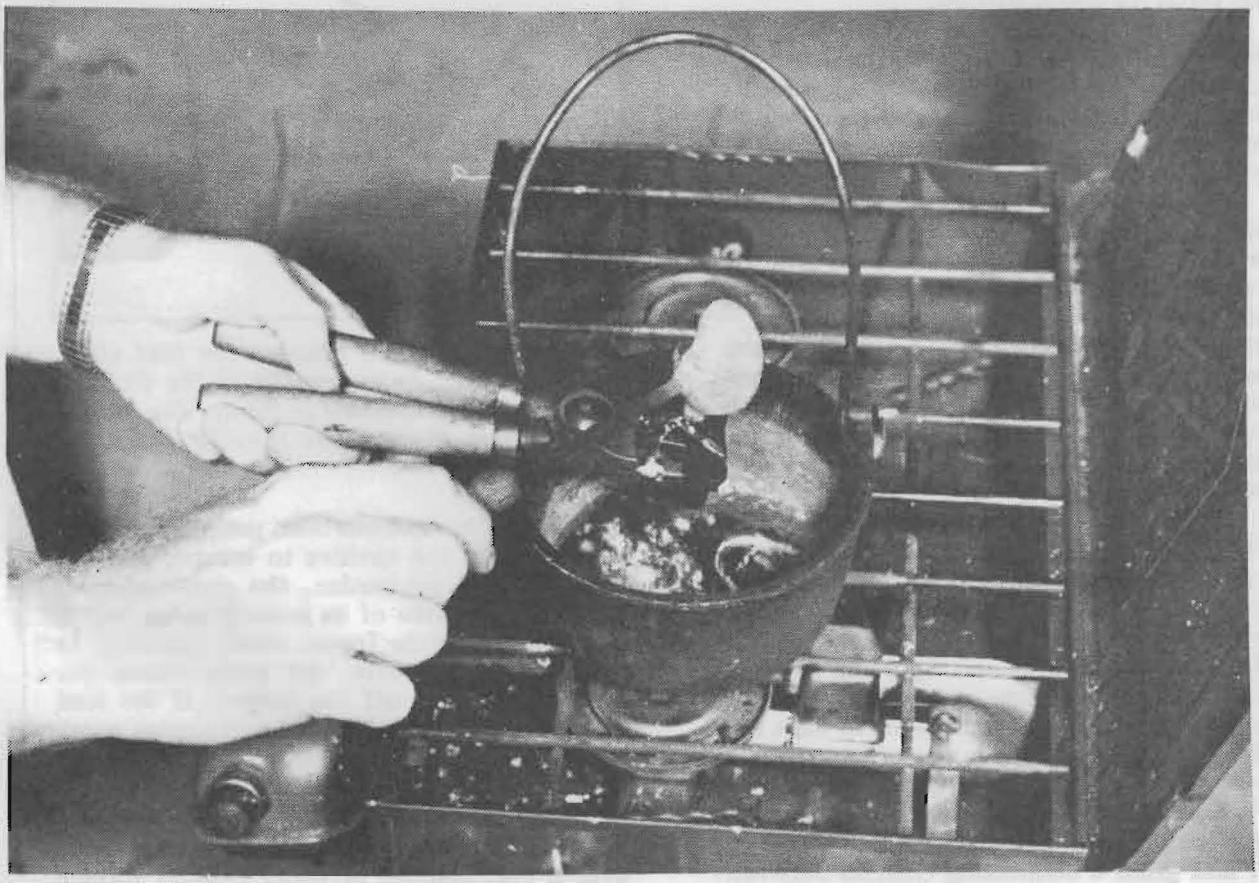


FIGURE 1 — It costs little to get started at bullet casting. Most items, other than the mold, can be improvised. Here, a camp stove substitutes for an electric furnace, a spoon for a ladle.

more than that of a .22 WMR, the recoil is light, and the barrel wear is non-existent. Besides, using one rifle year-round, and getting to know that rifle, pays off big when the time comes to load up the hot stuff and lay your crosshairs on a distant or bounding buck.

The same economy holds true for handgun shooters. Even in fussy semi-autos, handcast bullets can be used with minimum hangups. Here, too, do-it-yourself projectiles afford substantial savings over the full and semi-jacketed commercial variety.

Like other aspects of reloading, bullet casting is fun. The man who heats his lead over the kitchen stove may not look like he's indulging in a bit of nostalgia, but who knows? In his mind, that gas burner may be a campfire flickering in a prairie breeze, over which he's making bullets for the morning buffalo hunt. More likely he's worried about messing up the stove.

BASIC EQUIPMENT NEEDED

Bullet Casting Molds

The first item needed is a melting pot. Ohaus has an inexpensive melting pot and a cast iron trivet that may be used with a propane torch for about $10.00.

A more expensive electric bullet casting furnace and ingot mold are available from Lyman for $56.75. The electric furnace has the advantage of maintaining a better temperature control, ranging from 450°F. to 850°F. The second item required is a lead dipper (ladle).

The basic tool for bullet casting is the mold. Depending on size, molds cast from one to ten bullets at a time. A mold is made up of two handles which, by a scissors arrangement, open to expose two metal blocks — each making up half of the mold. When the handles are closed, the blocks close and a pivoting sprue plate is locked into place which forces the blocks firmly together. The sprue plate has as many holes as there are bullet cavities (see Figure 2).

The mold is then supported by a block of wood, to prevent lead spilling and strain on your arm, and the molten lead is poured into the sprue holes (see Figure 3). If the holes aren't connected by a channel (most aren't), little speed can be gained by using gang or multiple molds over one or two-cavity molds. The holes are small, the lead tends to back up, and by the time you pour one or two cavities the lead has started to solidify.

Knowledgeable bullet casters either purchase molds with channeled sprue plates or mill and grind a connecting channel between the holes. The channel tends to direct the flowing lead into two or three holes simultaneously, while acting as a shallow funnel to prevent the lead from backing up (see Figure 4).

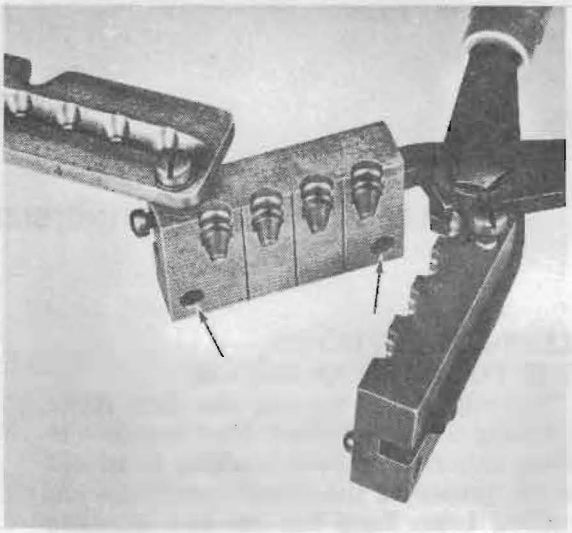


FIGURE 2 — Conventional four-cavity mold, open. Sprue plate has been pivoted out of the way (top left). Arrows point to recesses for dowel locking pins.

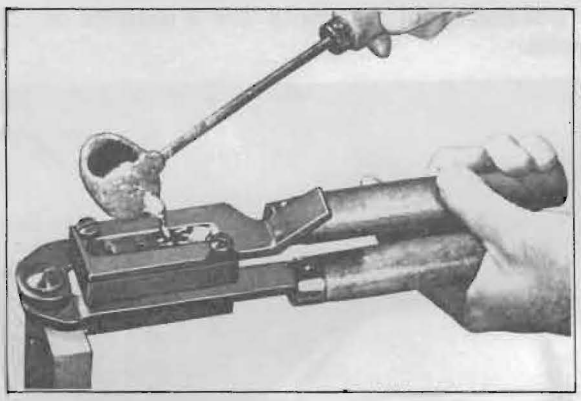


FIGURE 3 — When pouring the lead alloy, the mold must be supported at the front — usually by a wood block or frame. The molten metal enters the cavities through the sprue holes.

After the lead has been poured slowly to permit air in the cavities to escape, and has been allowed to harden, the sprue plate is gently tapped free of its locking point with a plastic or rawhide (never steel) hammer. In pivoting to the side, the plate shears the "tails" or sprues off the bullets. If the lead hasn't been allowed to cool and harden properly, the sprue will be "smeared," resulting in uneven bullet bases which will later cause problems in the sizing die.

The mold is then turned upside-down over a soft blanket or other padded surface and the bullets fall free of the mold. (Sometimes a bit of tapping with a plastic hammer

is needed.) Cast bullets are easily deformed, hence the need for the padding (see Figure 5).

FIGURE 4 — Gang mold (left) has a sprue plate channel. Center, two-cavity mold has individual sprue holes and no channel. Mold at right has had a channel milled in by the owner.

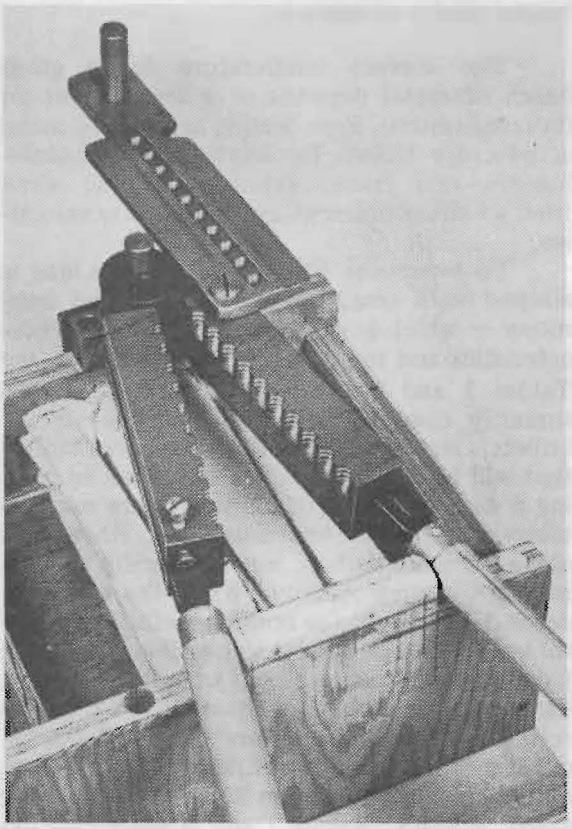


FIGURE 5 — A casting box, as shown, supports the mold during pouring and contains padded material which prevents deforming of the bullets when they drop out of the mold.

Mold blocks are most often made of malleable (soft) iron, sometimes of aluminum, which prevents alloys with too much tin from "soldering" themselves to the walls of the blocks. Because of mass production and low cost, dimensions of the bullet cavities can't be exact. For this reason, manufacturers make their molds slightly oversize, and with rare exceptions the bullets have to be die-sized to proper bore diameter.

New molds usually come from the factory with a thin film of oil which must be removed. If it isn't, imperfect bullets result. Boil the blocks in a detergent or degreasing solution, and rinse and dry thoroughly — or clean them with a good hydrocarbon solvent (gasoline or a safety cleaner), followed by a rinse in acetone. Commercial block cleaners are available from Brownell's. Do such work outside or in a well ventilated area.

Beginners frequently encounter problems in casting perfect bullets, but by cleaning their molds they know that oil isn't responsible for the difficulty.

Alignment of the blocks is critical. Dropping a mold on the floor, or hitting the sprue plate with a steel hammer or with excessive force, can easily knock the blocks out of line.

Melting Pots and Furnaces

Lead and lead alloys can be melted down in anything from a simple melting pot costing only two or three dollars to an elaborate electric furnace with heat controls, in the $20 to $50 bracket (see Figure 6). The small-capacity "stove pots" are suitable for limited bullet production; the electric furnaces, which hold from 10 to 20 pounds of metal, are for the guy or group going into casting in a big way.

FIGURE 6 — When using gang molds, an electric furnace is desirable, to reduce the time lost between melts. The SAECO unit shown here holds 20 pounds of metal and has an automatic heat control.

Avoid using the kitchen stove as your heat source, as is sometimes done.

Melted lead puts out dangerous fumes; wherever you do your bullet casting, it is mandatory that the room be well ventilated. The kitchen is not the place!

Working with lead is messy at best, and can be dangerous if conducted improperly, not only to furnishings and floors, but also to animals and children. Be sure you have a secure place in which to work, where you can devote your full attention to the project at hand.

The propane torch can serve at the beginning; if you decide to go into bullet casting later in a major way, you can invest in better equipment.

In addition to your melting pot and ladle, you're going to need gloves; no bullet caster in his right mind approaches the job with unprotected hands. A plastic, wood, or other "soft" hammer for tapping the sprue plate is also a must (see Figure 7).

FIGURE 7 — Inexpensive accessories for the bullet caster by Ohaus. From left: melting pot, ingot mold (for casting scrap lead), wooden mallet, and dipper.

The biggest "trade secret" in casting perfect bullets is in reaching and maintaining the correct temperature for the lead and the blocks. Cold molds require hotter lead than do molds that have heated up after prolonged use. The first dozen or so bullets from a cold mold should be eased back into the melting pot. It takes a while for the temperature of the mold to rise to the proper point and even out. Some bullet casters hasten the warm-up process by dipping the mold blocks in the molten lead for 10 to 15 seconds.

Generally, when the "surplus" lead in the sprue holes remains molten for about four seconds after pouring, the lead temperature is right. If your first bullets come out as wrinkled as a newborn baby's face, either the mold or the lead is too cold. If the bullets have a gray, frosted appearance, the blocks or the lead are too hot. (This doesn't necessarily mean the bullets are flawed.) We emphasize — be sure to let the lead cool adequately or you'll bollix up the bullet bases when you shear them with the sprue plate (see Figure 8).

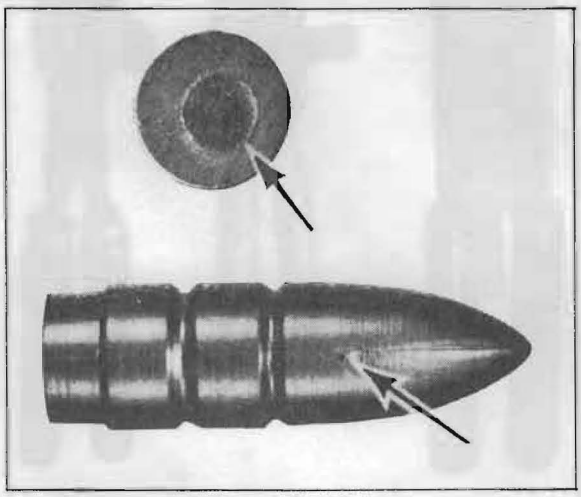


FIGURE 8 — Some molds cast sprues slightly off-center (top). By marking the bullet relative to the sprue position, and loading the gun with the bullet mark always in the same position, such bullets will have the same (approximate) center of impact.

The correct temperature for a given batch of metal depends to a large extent on its composition. Pure lead is too soft to make satisfactory bullets for anything but muzzleloaders, and causes excessive leading when fired in rifled bores at even moderate velocities.

To overcome this drawback, the lead is alloyed with small amounts of tin and antimony — which govern the hardness flow characteristics and melting point of the metal (see Tables 1 and 2). A lead/tin mixture is customarily used for low and medium-velocity bullets, lead/tin/antimony alloy for bullets that will be driven at higher velocities. In gaining a desired degree of hardness, care must be taken not to use too much tin, which has some hardening effect, but is basically used to improve casting quality. When the ratio exceeds 10% tin, you're coming awfully close to solder — which is almost impossible to remove from either molding blocks or rifling without damaging the metal underneath. For this reason, alloys containing more than 10% tin are never used. If a harder bullet is wanted, more antimony is added, which is solely a hardening agent, doesn't "solder," and is much less expensive than tin. Lead/antimony alloys can be made that are four times as hard as pure lead. Antimony is about three times more costly than lead, tin about 12 times more expensive.

% Tin	Melting Temp. °F	Brinell Hardness
0	619	4
10	577	10
20	532	12
30	490	15
40	445	16
50	400	15
60	370	15

TABLE 1 — Brinell hardness scale related to percentage of tin and melting point of a lead/tin alloy.

% Antimony	Melting Temp. °F	Brinell Hardness
0	619	4
6	572	6
8	554	16
10	518	17
15	482	18

TABLE 2 — Brinell hardness scale related to percentage of antimony and melting point of a lead/antimony alloy.

COMMON ALLOY RATIOS

The faster a lead bullet moves, the harder it must be — for good accuracy and to prevent undue bore leading. For low-velocity handgun loads, around 700 to 800 fps, almost any soft, low-tin/antimony-content alloy will work (see Figure 9), although a ratio of 95:5 (tin or antimony) is preferred. When ratio numbers are used, the first number refers to lead, the second and third to tin and antimony, respectively.

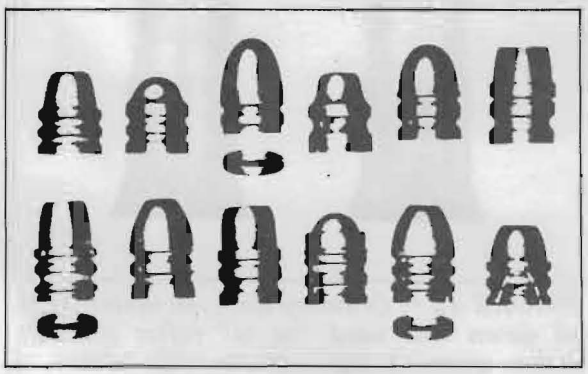


FIGURE 9 — Cast handgun bullets like the .45-caliber bullets illustrated are usually driven at low velocities and utilize a soft lead alloy. For higher velocities, harder alloys and/or gas checks are required.

Slightly harder alloys are required for high-velocity handgun loads and for autoloaders — to prevent feeding and chambering problems. In these cases, the mixture should not be softer than about 80:10:10.

Cast rifle bullets, which are driven at higher velocities than handgun bullets, utilize alloys of around 90:5:5 hardness for medium-range, 1,000 to 1,700-fps loadings. For higher velocities, around 2,000 fps, a ratio of 80:10:10 works very well (see Figure 10). Bullets this hard will not accept gas checks, but, then, they're not needed. If you want to use gas checks, back off to a ratio of 90:5:5. It's impossible to make a cast lead bullet *too hard* for high-velocity rifle use. Even with such super-hard bullets, barrel wear is nil.

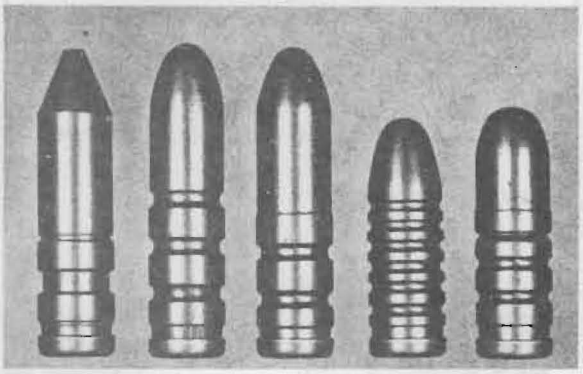


FIGURE 10 — Cast rifle bullets like the high ballistics coefficient versions shown here are normally cast of extremely hard alloy.

Cast bullet (or alloy) hardness is based on the Brinell scale, where the distance the metal is penetrated by a pointed scribe under a given amount of pressure gives the "hardness" readout (see Figure 11). (This procedure is quite similar to the Rockwell testing method used to determine the hardness of steel).

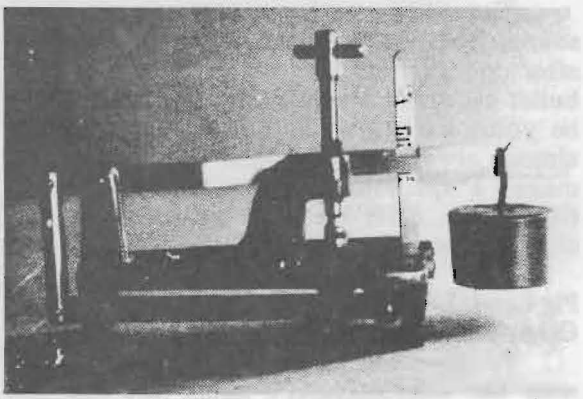


FIGURE 11 — Lead alloy hardness can be measured with instruments like the Potter tester. By forcing a small steel ball into the metal, the depth to which the ball penetrates registers on a calibrated "hardness" scale.

Before going on, please do Programmed Exercise 1. Make sure you write your answers on a separate sheet of paper before looking at the answers on the page specified.

PROGRAMMED EXERCISE

1

1. True or false? The first thing you should do when you get a new mold from the factory is oil it lightly.

2. True or false? When bullets are cast so that the alloy is harder than necessary, a great deal of extra barrel erosion will result.

3. Why is it not advisable to do your lead-melting on the kitchen stove?

Answers on Page 8

WHERE TO FIND BULLET CASTING METALS

Commercial bullet casting alloys, usually a 90:5:5 mix, as well as pure metals, are on the market. However, the cost of "store-bought" alloys (including shipping charges) is sufficiently high to discourage the would-be bullet maker — whose objective, after all, is economy. Cheer up. Acceptable alloys can be found and are most inexpensive.

Here are some of the scrap metals you can use successfully for bullet casting, and at a cost of "pennies per pound" . . .

Wheel Balance Weights

Tire shops and gas stations are your source. Balance weights are always discarded after one-time use, and unless there are other bullet casters in the neighborhood, they could be yours for the asking. The composition is almost always a "standard" 90:9:1, which makes a splendid medium to high-velocity rifle bullet. After melting down, the steel rim clip is, of course, removed.

Pig Lead, Lead Pipe, and Other Exciting Discoveries

Commercial pig lead comes in ingots, with the manufacturer's name cast into the face. Pig lead and lead pipe often turn up in salvage and junkyards, as do window sash weights and lead cable sheathing. All can be treated as pure lead. (A simple test is to scratch the surface with your thumbnail. If it's soft enough to mar, it's lead.)

Print Shop Metals

Used linotype bars can often be secured from small newspapers and some commercial printers. The hardness of type metal may vary slightly, but the composition is usually 86:4:10, which is great for medium and high-velocity rifle bullets. The less common monotype metals are even harder, about 72:9:19, which is about as hard as anyone wants or needs to go for high-velocity cast bullets.

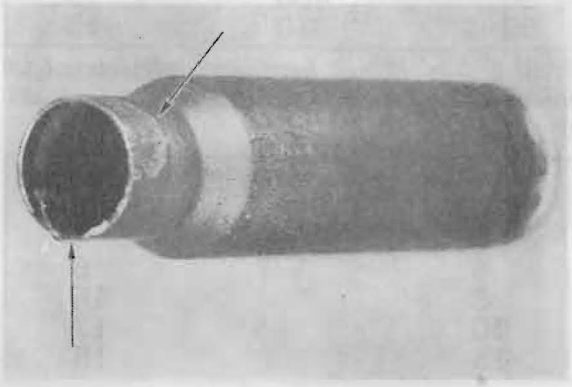


FIGURE 12 — Short-neck cases like the .308 Winchester tend to shave metal (arrows) from soft and medium-hard bullets in the bullet seating process. This does not mean that excessive leading in the bore or poor accuracy will result.

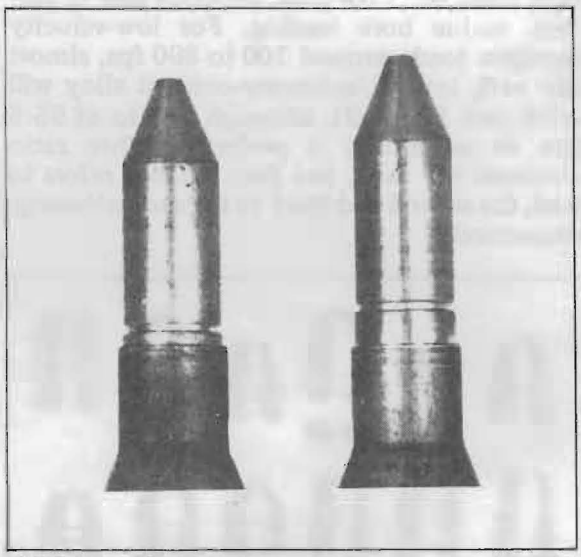


FIGURE 13 — Ordinary linotype metal, melted down and used "as is" (after fluxing), makes splendid high-velocity rifle bullets. A variance in seating depth, as shown, often improves accuracy.

Storage Battery Plates

These normally contain about 90% lead, the rest antimony. However, in the melting and fluxing process, so much of the antimony is lost with the crud (which is considerable) that what remains is nearly pure lead. Tin and antimony should be added except for very low-velocity handgun loads.

Sources of Scrap Tin

Commercial, pure block tin is expensive. Again, junkyards are often the answer. Coils from old refrigerators, soda fountains, and beer coolers are sometimes made of tin. Remember, too, that junk dealers can be mistaken in their inventory "labeling." To find out if the metal you carted home *is* tin, place a piece of lead and a tin sample in your melting pot. Lead melts at 600°F., tin at 400°F. If your sample melts before the lead, eureka, you've found it!

Commercial Solder

Commercial solders also constitute a ready source of tin. Plumber's solder is about one-third tin, the rest lead. Body shop bar solder (used to fill dents) varies, but has the proportions cast into the bar. Half-and-half solder is marked in the same way. Commercial solder isn't cheap, but the convenience afforded by working with *known* ratios more than offsets the cost factor. Pure antimony is available from metal supply houses.

FLUXING THE ALLOY

"Fluxing" is another word for "cleaning" the molten metal of impurities; when you're using scrap metal, you're going to have quite a bit of crud in your melting pot. There are synthetic fluxes, but pure rosin (available from Brownell's) is the best. To clean a batch of metal, sprinkle a small amount of rosin into the molten metal. This causes the impurities (dross) to rise to the surface (see Figure 14). This crud is then skimmed off with a ladle and discarded. Only pure alloy remains, and at least half the battle of turning out perfect cast bullets has been won. Each batch of metal should be fluxed regularly during casting to *keep* it clean.

Also, tin, being lighter than lead or antimony, has a tendency to "leave" the pot when the crud is skimmed off. About 1% tin should be added to a given mix each time the metal is remelted.

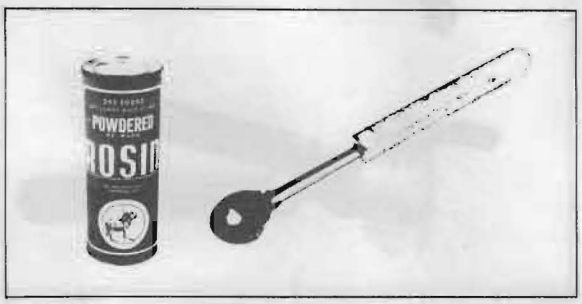


FIGURE 14 — Powdered rosin and a ladle are necessary for fluxing the molten metal. Rosin can also be used to prevent vise jaws from slipping on metal surfaces.

MIXING AND MATCHING

The percentages given for alloy composition always refer to weight rather than to volume. By using a commercial alloy, you know the *exact* ratios. By working with scrap metal, you know *approximate* ratios. Often you'll melt down, flux, and use the scrap "as is." Other times you'll want to soften the mix by adding more lead, or harden it by adding antimony. Tin, remember, is used mostly to make the metal flow more evenly into the mold. Its hardening properties are slight. With practice, you'll learn to juggle the various components to gain the desired hardness or softness.

The percentages aren't too critical with the exception of the tin ratio. Too-hard bullets cause no particular problems other than requiring excessive force against the sprue plate to shear the bullet bases. Too-soft bullets for a given velocity cause excessive leading. Too much tin in a given mix can cause big problems by "soldering" the alloy to the mold blocks or into the gun's rifling.

HOW MANY CAVITIES?

A vast number of molds are available from Lee, Lyman, and others in every conceivable caliber for handguns and rifles, in many different bullet weights, and in conventional, minie ball, and round-ball configurations (see Figure 15). Some molds, like the Lee unit, come complete with handles. Other manufacturers, like Lyman, offer handles which are interchangeable with many different molds (usually dependent on the number of cavities).

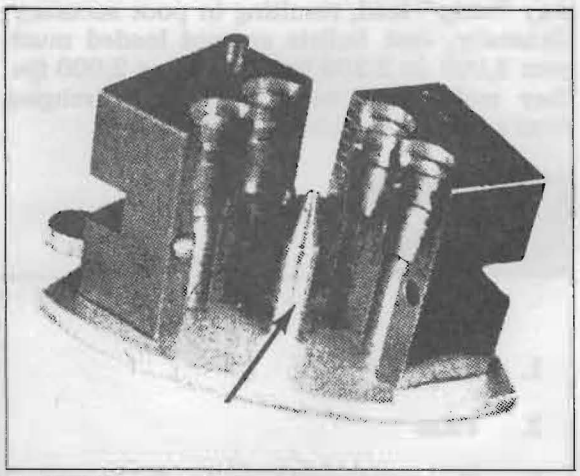


FIGURE 15 — Molds for making hollow-point bullets utilize a separate pin (arrow) which fits in a channel at the top of the bullet. When the alloy is poured, the pin, protruding into the bullet, creates a hollow point. Different-depth pins for different-depth cavities are interchangeable.

Molds are available for casting as many as ten bullets at a time. However, most experts agree that a four-cavity mold is best because the metal stays at a uniform temperature (see Figure 16). When pouring into a multiple-cavity mold, the metal tends to cool and harden by the time you reach the last holes. Finally, always try to get molds with the sprue holes connected by a channel.

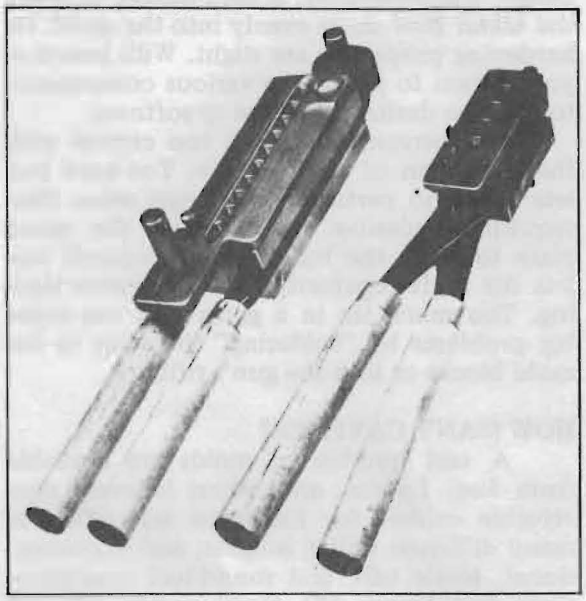


FIGURE 16 — Gang molds like the 10-cavity job at the left cause arm fatigue and other problems. A four-cavity mold (right) is better, especially for the novice.

It should be noted that cast bullets for center-fire rifles loaded to standard velocities may "strip" lead, resulting in poor accuracy. Generally, cast bullets are not loaded much over 2,000 to 2,200 fps. Loaded at 2,000 fps, they make good small game loads, ranging from grouse and rabbits to wild turkey.

ANSWERS

1

1. False
2. False
3. Your lead-melting and bullet-casting area should be well ventilated since hot lead produces dangerous fumes. Besides, the process can be messy, and hot lead will ruin your stove top, kitchen floor, and cabinets.

Before going on, please do Programmed Exercise 2. Make sure you write your answers on a separate sheet of paper before looking at the answers on the page specified.

PROGRAMMED EXERCISE

2

1. How would you *flux* the metal you plan to use in bullet casting?
2. Why is it best to use a mold with four cavities or less when casting bullets?

Answers on Page 10

BULLET SIZING

There are a number of steps involved in converting lead alloy to cast bullets, and if it's accuracy you're after, no consideration is more important than the sizing operation.

If molds had cavities of *exact* bullet size and diameter, they would have to be machined,— and would cost in the neighborhood of $100 a copy. Even so, they wouldn't *guarantee* perfect bullets because of variations in the alloys used, metal temperatures, and the skill of the bullet caster. As it stands, molds are cast from iron or aluminum and are a bit oversize (see Figure 17).

FIGURE 17 — Most molds, like the Lyman shotgun slug unit at top, have cast iron blocks. The Lee mold below utilizes cast aluminum blocks.

Older molds (and there are still plenty of them around) kicked out bullets anywhere from .005" to .008" oversize. Modern molds, due to improved manufacturing techniques, do much better. Bullets are seldom more than .001" over bore diameter (see Figure 18). The best mold, however, is seldom capable of producing bullets of perfect roundness and concentricity. The die must therefore take the bullet down to correct bore diameter while straightening and rounding its sides.

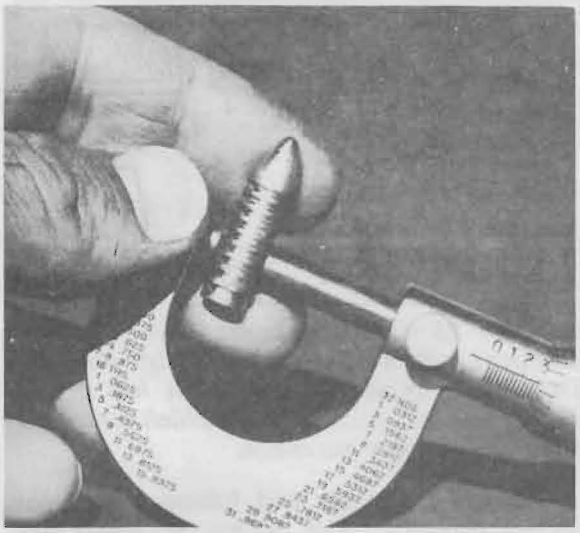


FIGURE 18 — Bullets should be miked after coming out of the mold. Reducing diameter by more than .003" in the die will probably distort the bullet and ruin accuracy.

Aside from the work involved in swaging down a grossly oversize bullet, such bullets become deformed in the process (see Figure 19). Generally, cast bullets that have been sized down more than .003" seldom fly true in rifles when the velocity exceeds 1,500 to 1,600 fps. When handgun bullets are reduced that same .003" or more, accuracy falls off at around 800 fps. In other words, the diameter of the bullet in relation to the bore is less important than the amount the bullet has been reduced in the die. A bullet may be slightly oversize, but still shoot accurately. A bullet reduced to the same slightly oversize diameter, but from a considerably larger diameter, will shoot lousy. Lack of distortion is the reason new minimum-tolerance molds produce more accurate bullets than do old maximum-tolerance molds — which are not a bargain at any price!

Some guns, generally those with "loose" bores, shoot very well with bullets that haven't been sized at all, only lubricated. They are, however, exceptions. Remember, the sizing die also helps achieve concentricity, and without concentricity, accuracy is impossible.

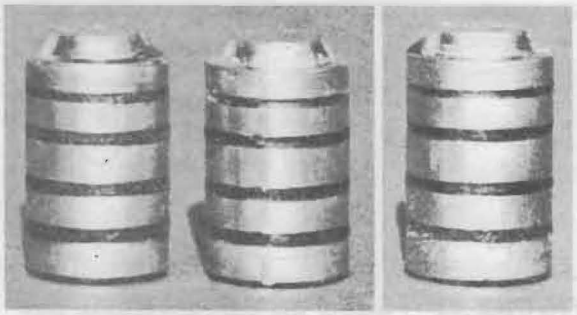


FIGURE 19 — The .38-caliber wadcutters at left and right were each sized down .002" and look and shoot fine. The center bullet was sized down .005". The distortion is apparent, and accuracy will suffer.

Types of Sizing Dies

Sizing dies aren't mounted in the loading press like other dies. They require their own holders or tools, which may range from a simple tong-type, hand-held holder to a bench-mounted unit which handles sizing, lubing, and crimping of gas checks in one operation.

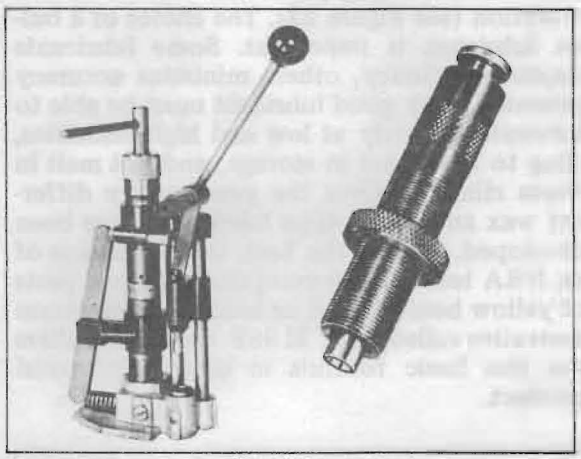


FIGURE 20 — Cast bullets are sized with combination "Lubri-Sizers" like the Phelps unit at left, or with a simple die which is inserted into a tong-type hand tool (Lyman die for .310 tool is shown at right).

All sizing dies incorporate a cylindrical cavity sufficiently large to accept the as-cast bullet (see Figure 21). Older dies have shoulders which "bump" the bullet down to bore size without any attention to proper centering and which frequently shear lead off one side, resulting in a poorly balanced projectile. Modern dies utilize a gradual taper that assures the bullet's being centered. The bullet is driven into the die by a cylindrical ram of the diameter to which the bullet will be sized. Lead isn't trimmed off to reduce bullet diameter. It is compressed and, if the compression is too great, bullet deformation (and poor accuracy) results.

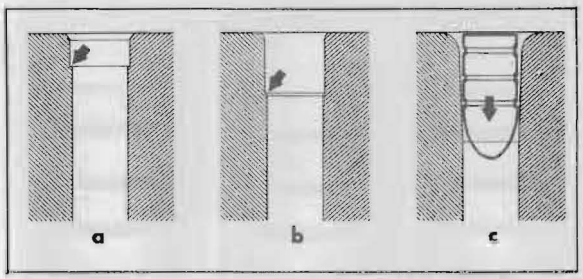


FIGURE 21 — Sizing die configurations. Bullet enters point first, from the top, and is pushed into the die by a cylindrical ram (C). Old-style dies (A) have a sizing shoulder or square "step" (arrow) which shears metal and doesn't center the bullet. More modern dies (B and C) are tapered to guide and center the bullet.

BULLET LUBRICATION

All cast lead and alloy bullets must be lubricated to prevent excessive bore leading and to minimize the "soldering" effect of high tin-to-lead alloy ratios. This is the reason cast bullets are deeply grooved — for lubricant retention (see Figure 22). The choice of a bullet lubricant is important. Some lubricants improve accuracy, others minimize accuracy potential. Any good lubricant must be able to lubricate properly at low and high velocities, cling to the bullet in storage, and not melt in warm climates. Over the years, many different wax and grease-type lubricants have been developed. One of the best, in the opinion of an NRA test team, is composed of equal parts of yellow beeswax and an industrial petroleum derivative called Alox 2138F. Several suppliers use this basic formula in their commercial product.

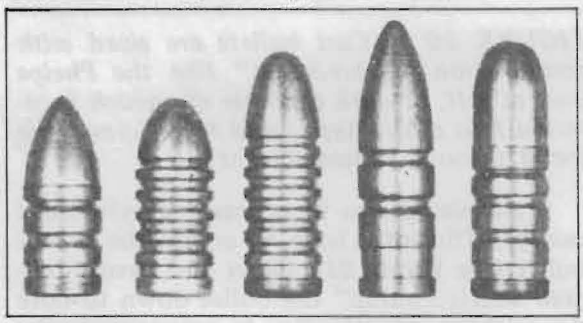


FIGURE 22 — Cast bullets vary in design and lube groove placement. That portion of the bullet forward of the grooves doesn't, or shouldn't, bear on the lands. The bottom ring is known as the "driving band." Bullets with curved rather than square-cut grooves separate from the mold more easily.

The best and most convenient method of lubing bullets is with a tool that sizes and lubricates at the same time. There are many to choose from. After the bullet has been sized, actuation of the handle floods the grooves with lubricant. Tools like the Phelps (refer to Figure 20) use a "straight-through" method of sizing and lubing. Bullets are inserted with the base down, and with a gas check (if desired) affixed. One stroke of the handle and presto, the gas check is crimped into place (see Figure 23) and the bullet is sized, lubed, and dropped into your hand.

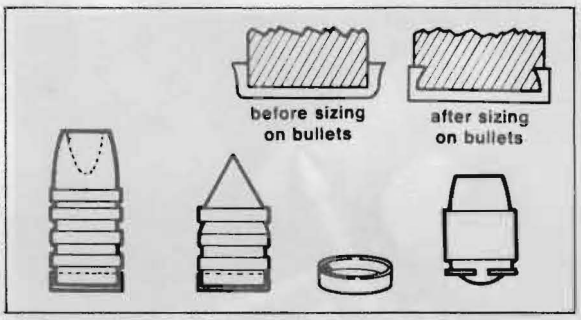


FIGURE 23 — Gas checks are frequently used on pistol bullets when driven at high velocity. The Harvey-type bullet at right has a zinc washer swaged into the base, which serves the same purpose as a gas check.

Elaborate sizing and lubing equipment isn't a necessity. The novice can easily size his bullets with an economical hand-held or bench unit, then do the lubing separately by placing the bullets base down in a shallow pan of melted lubricant (see Figure 24). The excess lubricant is then removed by running the bullets individually into a hand tool such as the Lyman Kake Kutter or the Lee Lub Cutter. While such tools are relatively slow, they do enable you to do a job every bit as good as that accomplished with more expensive equipment (see Figure 25).

ANSWERS

2

1. Use a synthetic flux or pure rosin. Sprinkle it into the melting pot with your metal. When the metal melts, impurities (dross) cling to the rosin, rise to the top, and can be skimmed off.

2. If there are more than four cavities, the metal will probably have cooled down too much for good casting by the time you reach the last holes.

FIGURE 24 — Expensive Lubri-Sizers aren't a necessity. After sizing, the bullets can be lubed in a shallow pan, using a wax-type lubricant.

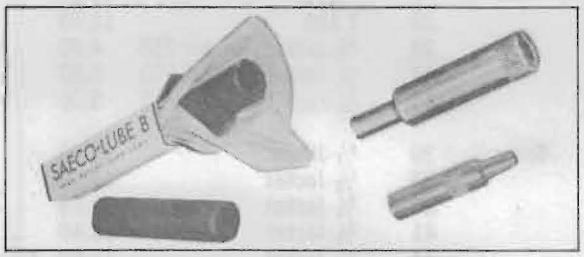


FIGURE 25 — Lube may also be applied to bullets with a stick applicator (left). Excess lubrication (from the dip method) is removed with lube cutters such as the Lyman (top) and Lee devices illustrated.

There are also various stick and dip-type lubricants which are rubbed into or dripped over the bullet grooves. They do the job, but uniformity and accuracy aren't as satisfactory as with the other methods described. Casting is hot work. Why waste it with skimpy or inadequate lubrication?

The grooves on cast bullets also serve as cannelures. All cast bullets, whether for handgun or rifle use, should be crimped into the case. Neck tension against the slick, coated bullet isn't enough to keep the bullet in place when in the magazine and under recoil.

GAS CHECKS

Gas checks are essentially very short "jackets" made of gilding metal (a zinc/copper alloy). When crimped to the base of a lead alloy bullet (refer to Figure 23) which is driven at comparatively high velocity, the gas check prevents the bullet from melting, minimizes bullet/bore contact, and reduces leading. When an extremely hard alloy is used, with a high antimony-to-lead ratio, equally high velocities may be utilized without bullet deformation or heavy leading. It's a toss-up as to which type of bullet — gas check or hard alloy — produces the best accuracy. Gas checks are pressed into place during the sizing operation.

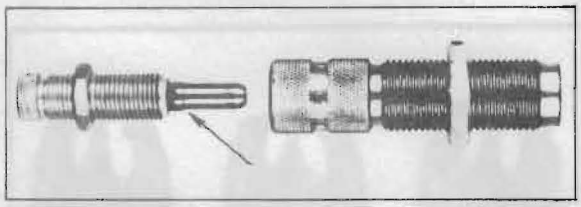


FIGURE 26 — Conventional sizing dies are usually employed in resizing cases for cast bullets. Special dies are available. The Lyman sizer die illustrated incorporates an expander plug with a shoulder (arrow) which slightly flares out the case mouth to minimize bullet shaving. In the bullet seating operation, the flare is "ironed out" by the crimper.

BULLET SWAGING

Following a successful venture into bullet casting, the next step for the avid projectile producer is usually bullet cold-swaging — the making of jacketed bullets for handguns and rifles. Here, too, the economy is the beckoning carrot — but the satisfaction of downing a game animal or shooting a tight group with a handload and bullet of one's own manufacture has a lot to do with swaging's growing popularity (see Figure 27).

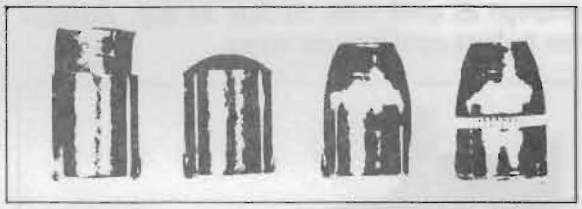


FIGURE 27 — Four stages in making a swaged handgun bullet. From left, gilding metal cup with lead wire core inserted by hand; the cup and core after core seating in die; the bullet after swaging; finished bullet, complete with cannelure.

Bullet swaging involves two components — a gilding metal jacket or cup and a lead core. The cylindrical jackets are available from a number of manufacturers, in a wide variety of calibers and lengths, for both handguns and rifles (see Table 3). The cores are usually of soft, pure lead for maximum expansion and ease of working through the dies, and can be purchased in wire form in 20, 25, 100, and 250-pound spools. Diameters vary from 1/8" for .17-caliber on through larger diameters for all conventional calibers. Some bullet-makers prefer to cast their cores with special molds

which result in even better economy, and less weight variation between the bullets in a given batch (see Figure 28). Most devotees, however, go the wire spool route and chop the lead into appropriate lengths with an adjustable lead core cutter (see Figure 29).

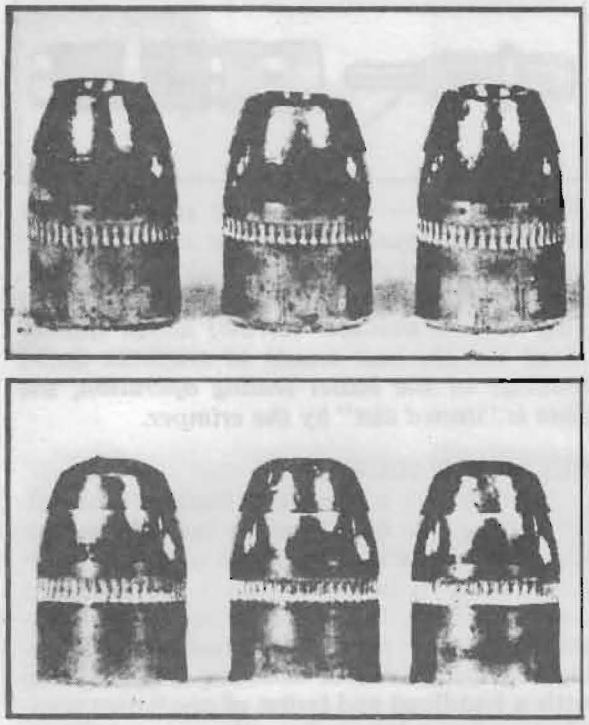


FIGURE 28 — Cast lead cores produce more uniform bullets than lead wire cores. Note the variance in wire core bullets at top. Bottom row bullets contain cast cores.

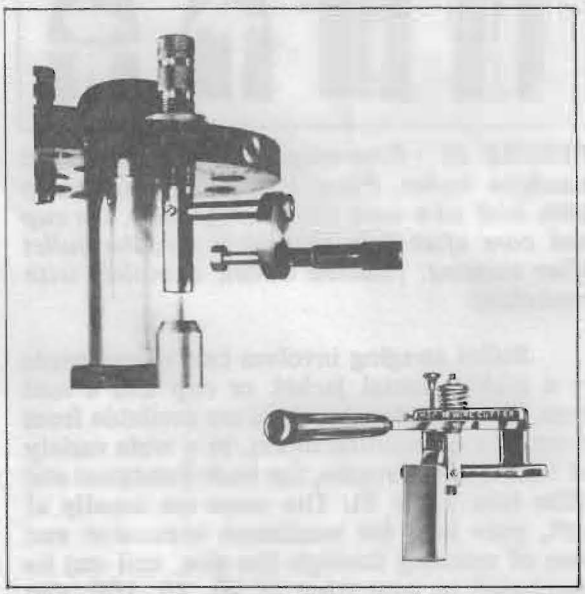


FIGURE 29 — Core cutting tools range from elaborate mount-on units like the Hollywood cutter (top) to simple bench devices like the Herter cutter (bottom).

GILDING METAL JACKETS
Rifle and Handgun

Make	Cal.	Description		Per M
Bahler	17	N.A.		$12.50
	38	½-Jacket		10.00
	38	¾-Jacket		12.50
	44	½-Jacket		10.00
Herter	38	.281 Inch		5.97
	401	.281		7.97
	44	.250		8.29
	45	.281		8.29
	22	.172		5.47
	243	.281		5.47
	30	.312		6.47
SAS	22	.705		13.50
	243	.880		15.00
	25	.975		16.00
	30	1.100		18.50
	38	¾-Jacket	per 250	4.00
	44	¾-Jacket	per 250	5.00
	45	¾-Jacket	per 250	5.00
Speer	30	½-Jacket		15.00
	38	½-Jacket		15.00
	38	¾-Jacket		17.60
	41	¾-Jacket		18.40
	44	½-Jacket		17.60
	45	½-Jacket		17.60
	45	¾-Jacket		18.40

TABLE 3 — Gilding metal cups or jackets are widely available. Rifle bullet jackets are available in specified lengths; handgun jackets are designated "one-half" or "three-quarters" jacketed. (Prices are as of Spring, 1975)

Heavy-Duty Press Required

An exceptionally rugged press, of O-frame or turret design and with a strong levering action, is necessary because of the much greater than normal stresses exerted in the swaging process (see Figure 30). You might get by with an inexpensive "standard" press when swaging short-jacketed pistol bullets. For making long, nearly full-jacketed rifle bullets, however, forget it — unless you've got the strength of Samson and are willing to risk springing your frame (yours *and* the press's).

There are a number of presses made exclusively for bullet swaging which add up to a good idea if you're going into this project full-bore. They're inexpensive; others cost a bundle. More important, they don't tie up your regular press when you want to make up a group of handloads (see Figure 31). These presses usually require their own dies, which in most instances can't be used with conventional loading presses.

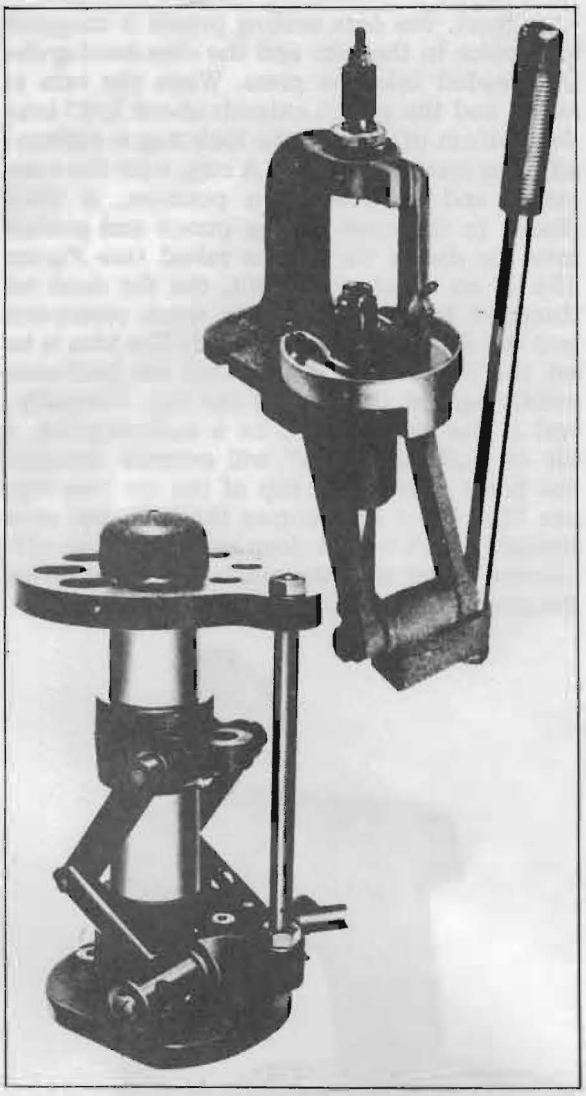


FIGURE 30 — Heavy-duty loading presses, such as the RCBS Rockchucker (top) and the Hollywood turret (shown with turret locking rod in place), are ideal for bullet swaging.

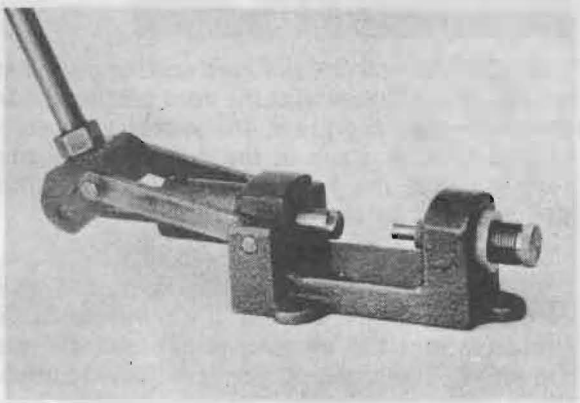


FIGURE 31 — The SAS Mity-Mite swage press is used for bullet-making only, and handles all calibers up to .458. This unit is relatively expensive.

Swaging Dies

Swaging die sets are usually two-piece (see Figure 32). The first die is used for core seating, the second for bullet swaging or forming. In addition, two "punches" — which replace the shellholder and hold the bullet in the ram — are included with the dies. One punch, the core seating punch, is used (surprise!) with the core seating die. The second, or swaging, punch is used with the swaging die. Optional swaging punches are usually offered with handgun swaging dies as the punch determines the bullet nose shape — and there is a demand for a great many *different* shapes (see Figure 33). Swaging die sets, unless designed for specific bullet swaging presses, are threaded to the standard 7/8" - 14.

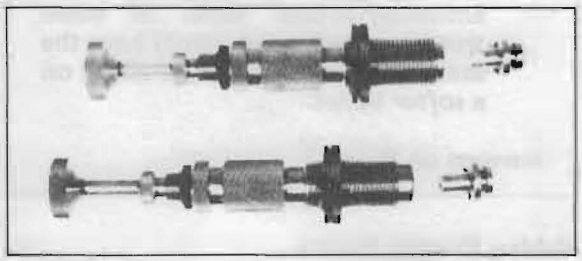


FIGURE 32 — CH two-die swaging set for making pistol bullets. Punches are shown to the left of the dies.

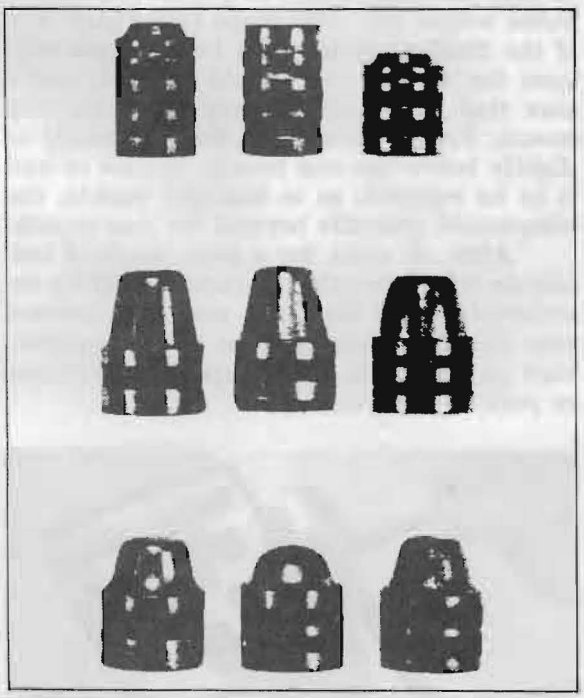


FIGURE 33 — Typical .38-caliber (.357) swaged bullets used for target shooting.

Before going on, please do Programmed Exercise 3. Make sure you write your answers on a separate sheet of paper before looking at the answers on the page specified.

PROGRAMMED EXERCISE

3

1. Why are bullet molds cast a bit oversize?

2. What do gas checks do?

3. True or false? An alternative to using gas checks, which help accuracy and prevent bullet deformation by reducing bullet/bore contact and preventing the bullet from melting, would be to use a bullet with a high antimony-to-lead ratio. In other words, a *hard* bullet would have the same effect as using a gas check on a *softer* bullet.

Answers on Page 17

Making Swaged Bullets

The first step, after ordering jackets (cups) of the proper length for a given bullet weight, is to experiment — by trial and error — to find the correct core length for the desired bullet weight and nose shape (see Figure 34). If the finished bullet is to be a spitzer soft-nose for a rifle, you would probably use a core that comes all the way up to the cup mouth. For a hollow point, the core would be slightly below the cup mouth. If a lot of lead is to be exposed, as in handgun bullets, the core would protrude beyond the case mouth.

After all cores for a given batch of bullets are cut to length, the cups are lightly exterior-lubed and the cores manually inserted into the cups. Take care not to get any lubricant on the inside of the cups or on the cores or poor bonding will result.

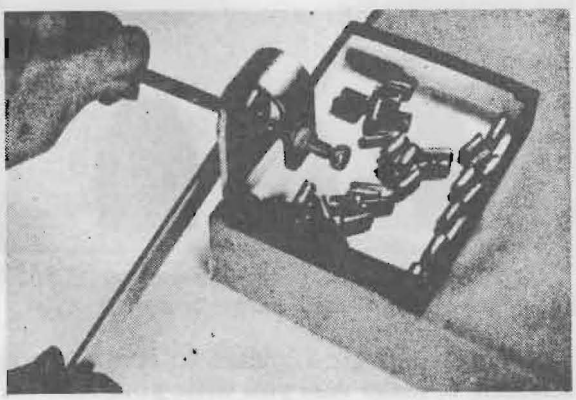


FIGURE 34 — Cutting lead wire to correct core length with simple hand shears.

Next, the core seating punch is snapped into place in the ram and the core seating die is threaded into the press. When the ram is raised and the punch extends about 1/4" into the bottom of the die, the lock ring is tightened, thus securing the die. A cup, with the core inside and in nose-down position, is then placed in the core seating punch and guided into the die as the ram is raised (see Figure 35). If no resistance is felt, the die must be threaded farther down; too much resistance and the die must be backed off. The idea is to set the die so that it positions the lead core *solidly* against the base of the cup. Normally, and if the bullet won't be a hollow-point, a bit of lead or "weep" will extrude through the bleed hole in the top of the die (see Figure 36). If no lead comes through, the core probably isn't seated deep enough and an off-balance bullet is in the making. Tighten down the die a bit farther.

FIGURE 35 — After the core seating punch is locked into the ram and the core seating die is threaded into the press, the jacket with core is placed nose down in the punch. When the ram is raised, the base of the bullet enters the die, thus seating the core in the jacket.

Following the core-seating operation, the core seating punch and die are removed from the press and the swaging punch and die are mounted. The swaging die is adjusted much like a bullet seating die. The semi-finished bullets are placed nose down into the swaging punch. The height of the swaging die is adjusted by trial and error until raising the ram shapes the bullet correctly (see Figure 37). In

some swaging dies, the distance the bullet runs up into the die (and the length of the core) determines whether the point will be of hollow or round-nose shape. In other instances the swaging punch alone decides the shape of the nose.

FIGURE 36 — The bullet, as it comes from the core seating die, should have no more than about 1/8" of "weep" extending from the tip. This is removed with a knife or pinched off with the fingers.

The bullets, because of the heavy pressure required, tend to remain in both the core seating and swaging dies. They can be dislodged by rapping the ejector knob at the top of the die with a plastic hammer (see Figure 38). A better solution is the die ejector tool (see Figure 39), offered by some manufacturers, which greatly speeds up the operation.

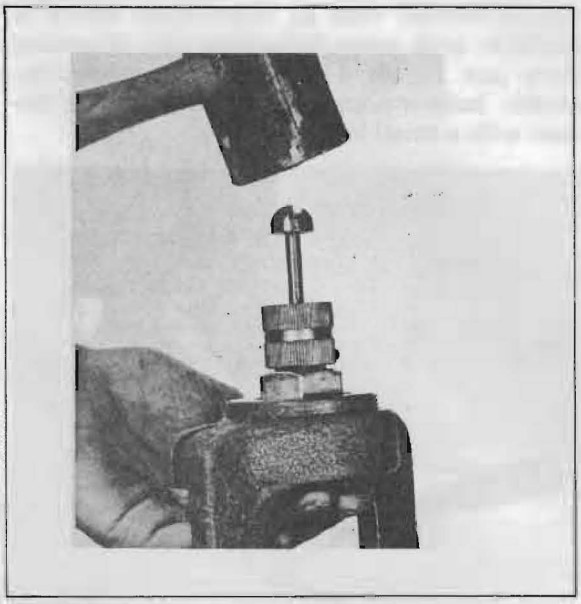


FIGURE 38 — With the ram lowered, the extractor knob is tapped with a plastic hammer and the bullet is caught in the hand.

Following the swaging process, the bullets, if of the handgun variety, must be cannelured. A special tool (see Figure 40) is required and it takes only a few moments to force-engrave the ring around each bullet. If you're working on handgun bullets and want hollow points that *can't* be provided by the die (some aren't designed for this function), the recesses

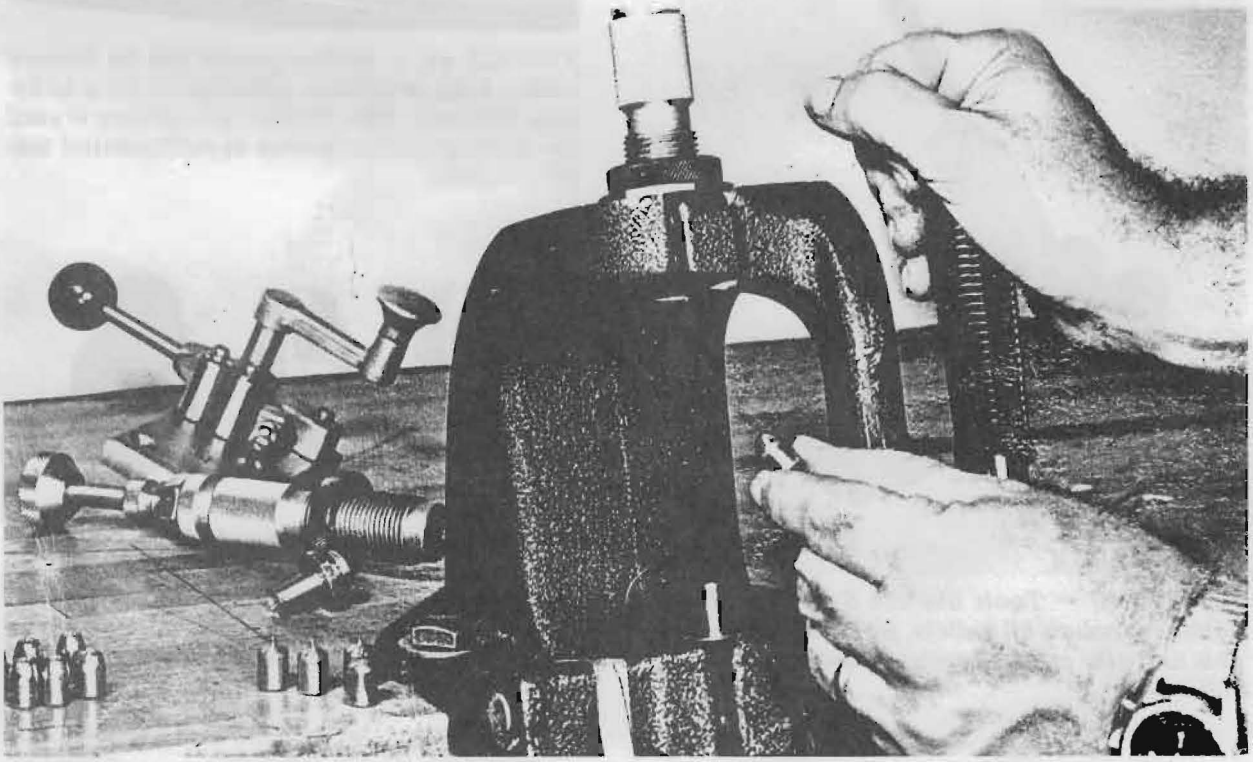


FIGURE 37 — After the core seating operation is completed, the bullets are swaged. Note the swaging punch in the ram and the finished bullets (except for cannelures) at left.

can be formed with an attachment which is available with some lathe-type case trimming tools (see Figure 41). Generally, more concentric hollow-points are formed with a die than with a small lathe cutter.

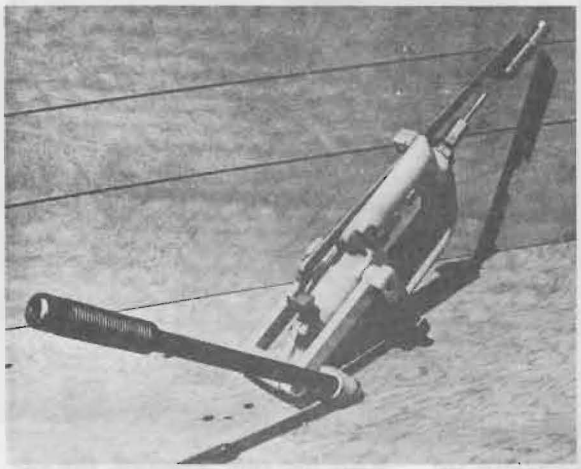


FIGURE 39 — Bullets tend to stick in the dies because of the pressures involved. A bullet ejector assembly, like the JD unit shown on the RCBS Rockchucker, simplifies the procedure.

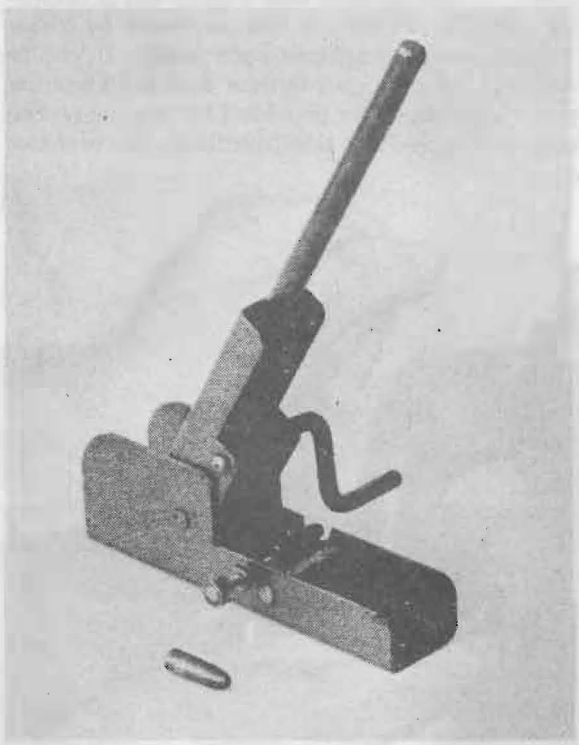


FIGURE 40 — Tools like the SAS unit illustrated cannelure all bullets, jacketed and lead. This unit also crimps handgun case necks after bullet seating.

Swaging Set-Up Costs

Once you have a proper-strength loading press, the cost of setting up for bullet swaging is minimal. The cost of swaging dies is comparable to that of conventional sizing dies, and core cutters run from about $8 to $15. For handgun bullets, a cannelure tool (which you can use on all bullets) is needed, which will set you back another $15 or so. Your cost per bullet will be less than half that of commercial bullets. Unfortunately, and in the case of rifle bullets in particular, few home-made products can even approach the better factory-mades in accuracy. Also, the cold-bonding you'll use isn't as good as the "hot-swaging" used by most manufacturers, and bullet expansion and "hold-together" aren't as predictable.

Okay, now that you know there's more to bullet building than *getting the lead out*, remember that it all comes with practice and experience. And now, before you begin trying your hand at it, you will want to go on to Part 3 of this study unit, which deals with shotshell reloading.

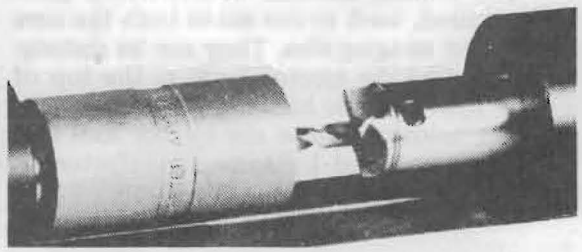


FIGURE 41 — Hollow-points can be formed within a die or with an attachment for a lathe-type trimmer. The Forster unit shown is used for making hollow points in full-jacketed military bullets.

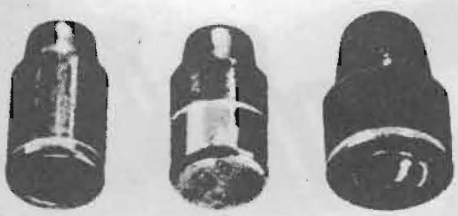


FIGURE 42 — Typical handgun bullets formed by swaging: the bullet at right has a gas check base; the center bullet has a half-jacket; the Harvey design at right has a zinc washer base which was swaged into place in the sizing die.

ANSWERS

3

1. Since it would be very difficult to cast them to specifications in the molding process alone, they are cast a bit bigger than specifications and are then sized down.

2. (1) Prevent bullets from melting; (2) minimize bullet/bore contact (which reduces leading).

3. True

NOTES

NOTES

NOTES

SHOTSHELL RELOADING

BRASS — FOR RELOADERS WITH A PAST

Shotshells, like ammunition for handguns and rifles, have been handloaded since the dawn of the breechloader/metallic cartridge era. Indeed, the first shotshells were made of brass (see Figure 1). As long as they were fired in the same gun after reloading, the cases didn't have to be resized. The loading procedure involved decapping (usually with a punch-type tool), priming, dropping in a measured charge of blackpowder, and glueing a cardboard or fiber wad over the top of the charge. This worked fine unless the shells got wet or were stored too long — in which case the shell (and often the shooter) became unglued.

Brass shotshells are still used and reloaded today, but infrequently, and mostly by octogenarians and nostalgia buffs. They are expensive and hard to come by, and sealing of the over-shot wad is still a pesky, time-consuming, and not very reliable procedure. Brass cases dent easily when dropped and don't feed well (if at all) through pumps and semiautos.

TODAY'S BRASS HEADS ARE "SHORTENED" CASES

The first commercial shotshells utilized a shortened full-length brass case for economy (the brass head), a paper tube hull, filler and overpowder wads to separate the powder from the shot and to provide the proper spacing within the hull, and a nitro overshot card. Over the years, and until plastics were invented, shotshells remained essentially the same (see Figure 2). Then changes and improvements came rapidly.

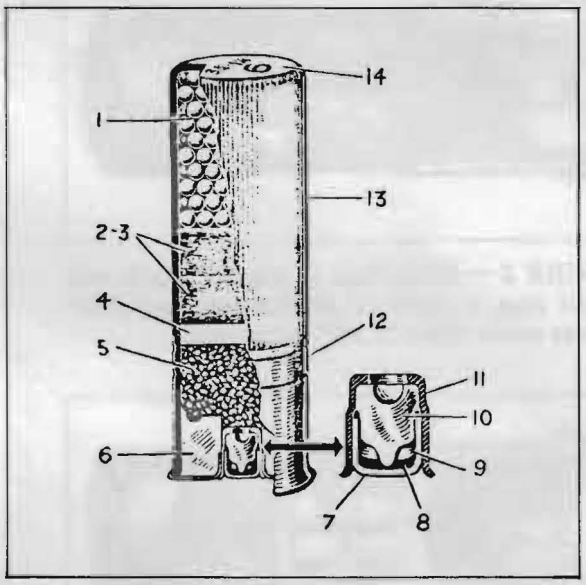


FIGURE 2 — Until a few years back, shotshells contained as many as 14 components, including a variety of wads (numbers 6, 2 and 3, and 14).

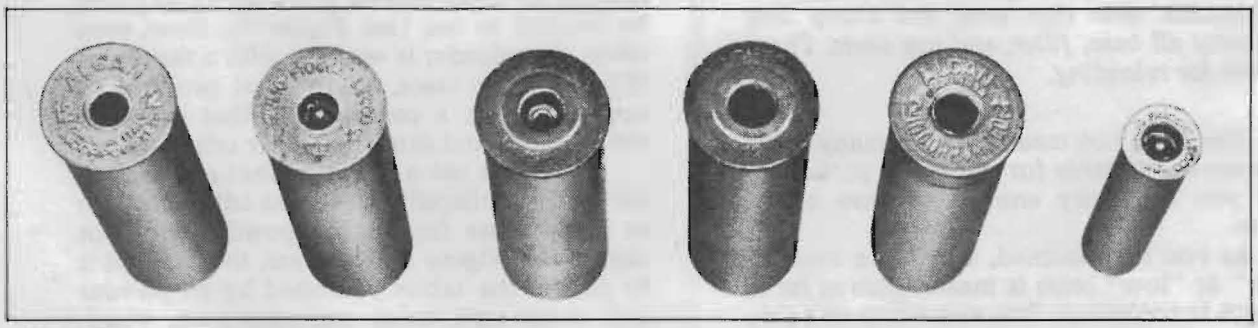


FIGURE 1 — Brass cases were the first type used in shotshell reloading and are still manufactured. Imported versions are usually Berdan-primed (second from left and far right). Some U.S. types require large pistol, rather than standard shotgun, primers.

The new plastic replaced the paper tube and made possible the now-familiar pie crimp. A plastic shot cup was added, which greatly improved the pattern and range (see Figure 3). Next, the shot cup sprouted a base or pedestal, which eliminated the felt wads between the powder charge and the shot. Finally the entire case was compression-formed of plastic, thus doing away with the base wad around the primer (see Figure 4). The brass head has been retained, but more for familiarity and tradition than out of any functional need. Experimental shotshells made entirely of plastic have been developed which functioned perfectly!

Experienced handloaders prefer the "low-base" Winchester AA and Remington-Peters RXP skeet and trap cases, which are of one-piece construction (see Figure 6).

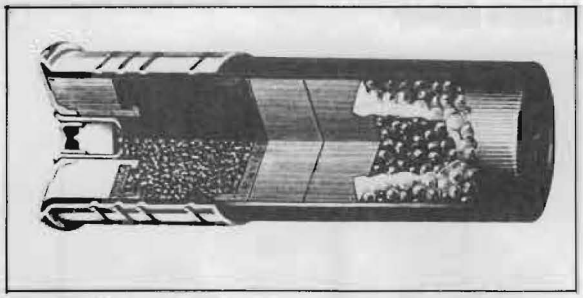


FIGURE 3 — Early "age of plastic" shells had a shot cup, a paper or plastic case, and filler or base wads. They're still being made.

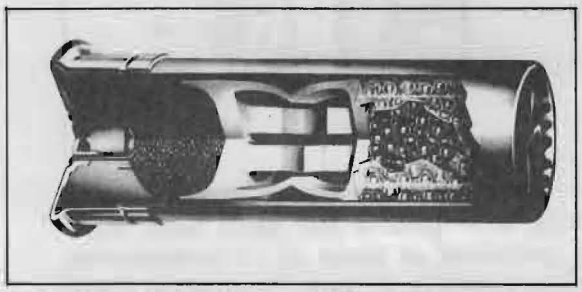


FIGURE 4 — Modern compression-formed cases are of one-piece plastic and employ a combination shot cup, wad, and crimp that eliminates all base, filler, and top wads. These are best for reloading.

This does not mean that the many other cases are not suitable for reloading, particularly if you are lucky enough to have a free source.

As you have learned, whether a case had "high" or "low" brass is meaningless as far as strength is concerned. The suitability of a case for a given charge is limited by its capacity, not by how far the brass extends up from the bottom.

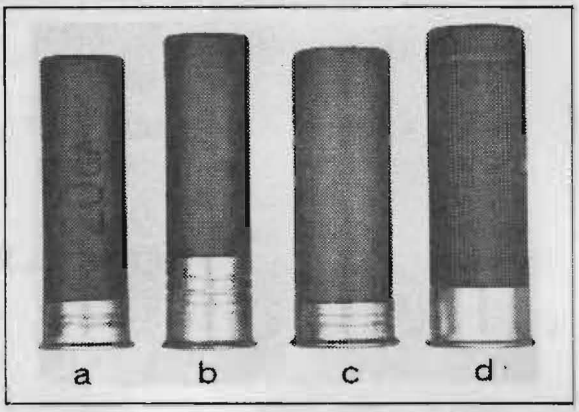


FIGURE 5 — The old-style rolled-crimp cases (b and d) were longer, with comparable charges, than modern pie-crimped cases (a and c). Overall length of the opened cases after firing was the same.

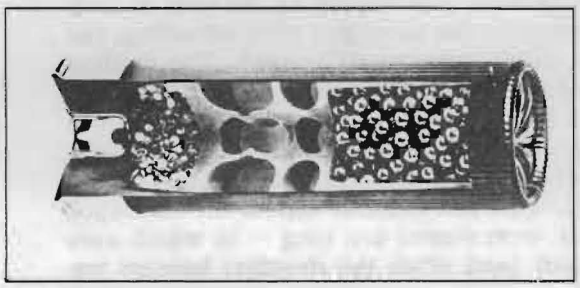


FIGURE 6 — A popular case with reloaders is the one-piece, compression-formed Remington RXP. Sectioned view shows the new W29930 Power Piston with integral shot cup.

PLASTICS MAKE COMPONENT SELECTION EASY

Shotshell reloading is a much simpler proposition today than it was 10 to 15 years ago, when all shells utilized a large number of wad components. Matching up wads and charges with different-type cases can be a real headache. In the past, the handloader kept a variety of different-thickness felt and cardboard wads on hand to "build up" the proper spacing between powder and shot for any case he wanted to use (see Figure 7). Now, even when the reloader is working with a variety of different-type cases, it's no real problem to come up with a combination that positions the shot cup and shot for proper crimping.

You can use a universal shot cup such as CCI with a collapsible base that adjusts to two or three cases for a given powder and shot charge (see Figure 8). However, the best bet is to follow the tables published by all powder and some equipment manufacturers, which list the proper "fixed-length" shot cups for the various case/powder/shot combinations. The trick, really, is to standardize — and work

with as few different-type cases, wads, and powders as possible. Generally, the experienced reloader can make ammo for everything from skeet to geese, with only one or two different cases, five or six assorted wad lengths, and from two to three shot and powder bushings and three types of powder.

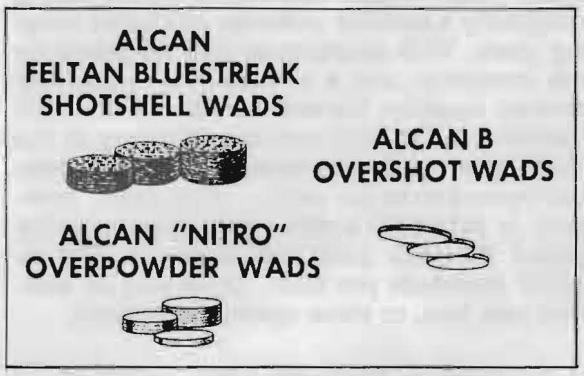


FIGURE 7 — An overshot wad, plus a spacer "sandwich" made up of two or three different-size overpowder wads, was necessary before the plastic wad cup came along. (Some reloaders still favor the old felt and cardboard wads.)

FIGURE 8 — Pacific wads. Versalite cup, left, has a collapsible base and adjusts to all length requirements. The "fixed-length" Green and Blue Verelite wads are for specific loads and cases.

For the shooter who enjoys trap or skeet, or who does a lot of informal clay bird powdering with his buddies, shotshell reloading is a must. By selecting good-quality cases that can be reloaded about ten times (like the Winchester AA5 and Remington-Peters All-American or RXP's), the cost per shell becomes half or less that of factory fodder. Shotshell reloading equipment is usually less costly than that needed for loading metallic cartridges (see Figure 9). It's true that the presses generally cost more, but you're probably never going to load over four gauges at best, usually only two. However, the myriad accessories required by the rifle and pistol loader have no counterparts on the shotshell loading workbench. Now let's talk about the equipment needed to get started.

FIGURE 9 — Little equipment is needed, and just a few components, for shotshell reloading.

SHOTSHELL LOADING PRESSES

You can turn out acceptable shotshell reloads on equipment costing as little as $7 to $12, or factory-quality ammo on presses priced from $70 or so on up into the hundreds. There are many in-between choices in all price brackets.

At the lower end of the spectrum are the Herter and Lee loading tools (see Figure 10), which rely on mallet impact and hand pressure to perform all basic loading operations *except* case resizing. Production is slow, about a box per hour, but these tools do the job. As long as the reloads will be used in the same gun, they generally perform satisfactorily. Because the cases aren't resized, reloads sometimes *won't* work through other shotguns — especially pumps and semi-autos with tight chambers. Such tools cannot be considered professional and do not warrant further discussion here.

Single-Stage Presses

The most widely used and economical type of loading press is the single-stage, where one shell at a time is moved manually through different stations on a base plate. If the stations are arranged in a circle on the base plate, the entire die and charge bar assembly usually drops *down* to meet the shell case

when the handle is actuated (see Figure 11). The station in which the shell is located when the assembly drops determines which operation will be performed.

FIGURE 10 — The Herter (left) and Lee loading systems turn out acceptable shotshells and constitute the lowest-priced "presses" available.

FIGURE 11 — The Pacific DL-105 is a good-quality single-stage press. The entire top assembly drops when the handle is operated.

When the stations are "in line" from left to right, the press is of the H type. In H-type presses, the stations rise when the handle is levered down; in others the die assembly drops down (see Figure 12). H presses are usually thought to be stronger and less apt to get out of alignment after heavy use than single-post presses. This isn't necessarily so. There are good, barely adequate, and perhaps even bad presses among both species.

An unusual single-stage press is the Hollywood Senior turret (see Figure 13), which is essentially a metallic cartridge and bullet swaging press. With appropriate dies furnished by the company, and a conventional adjustable powder measure, the unit handles all shotshell operations. The shell remains stationary in the shellholder while the turret is indexed from one operation to the next. This press, however, is primarily a rifle press. A comparably priced shotshell press will turn out 700 to 1,800 shotshells per hour, depending on whether one, two, or three operators are used.

Selecting a Single-Stage Press. Single-stage presses range in price from as little as $40 to $85 and up, and have a capacity of anywhere from 100 to 500 (claimed) completed shells per hour. A complete set of equipment for one gauge, and two "standard" bushings (one for powder, one for shot), are included. Most often the dies are adjustable for standard and magnum-length shells. Some are not. Change-over kits, enabling you to convert the press for another gauge, usually cost about $25 to $50.

Most presses come complete with two crimping dies — an 8-point crimper for most plastic shells, a 6-point crimper for most paper and some plastic cases. Sometimes the 6-point crimper is an extra-cost option.

A few good single-stage presses do not resize the case in the decapping operation, which is important if you'll be making shells for different guns or if they will be fired in pumps and semi-autos. A combination decapping/sizing die is available at extra cost.

A number of single-stage presses offer automatic priming devices as standard or optional equipment. Others are designed only for separate manual insertion of each primer. Capacity of the powder and shot hoppers, and whether larger hoppers are available and interchangeable, are other things to consider.

The chances are that your first shotshell press will be a single-stage unit. When the time comes to purchase, keep the above points (and questions) in mind.

Progressive Presses

The per-hour production of a progressive press has a lot in common with its price — both normally run well into the hundreds (about $150 and up). The larger production

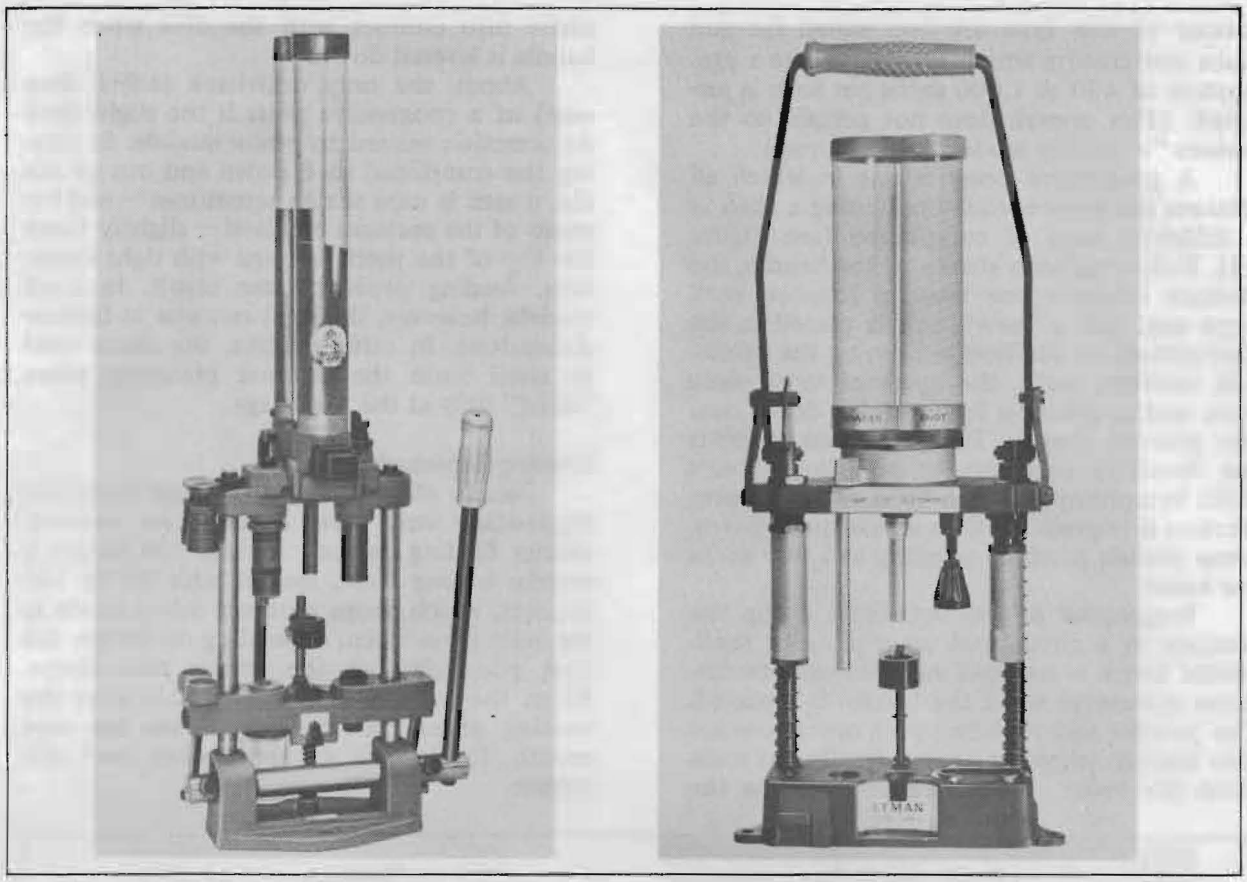


FIGURE 12 — Two in-line H-type presses. With the Bair unit (left), the stations rise when the handle is pulled; in the Lyman press, the top assembly drops down.

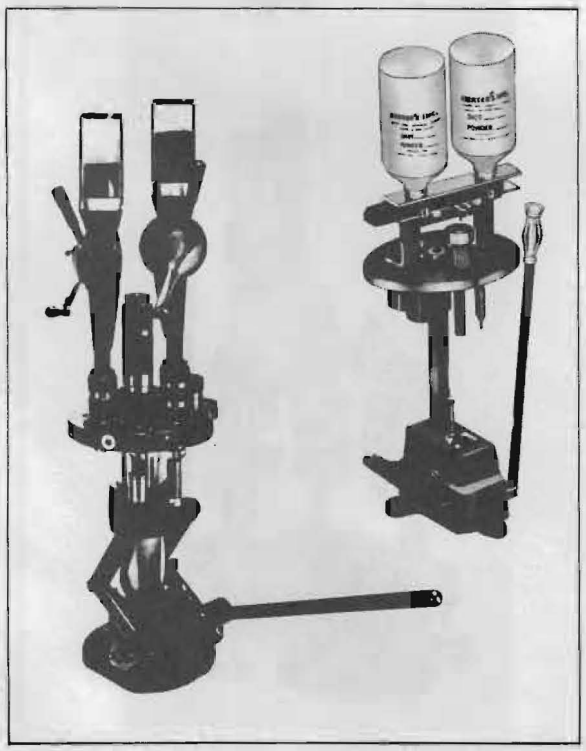


FIGURE 13 — Turret-type single-stage presses by Hollywood (left) and Herter.

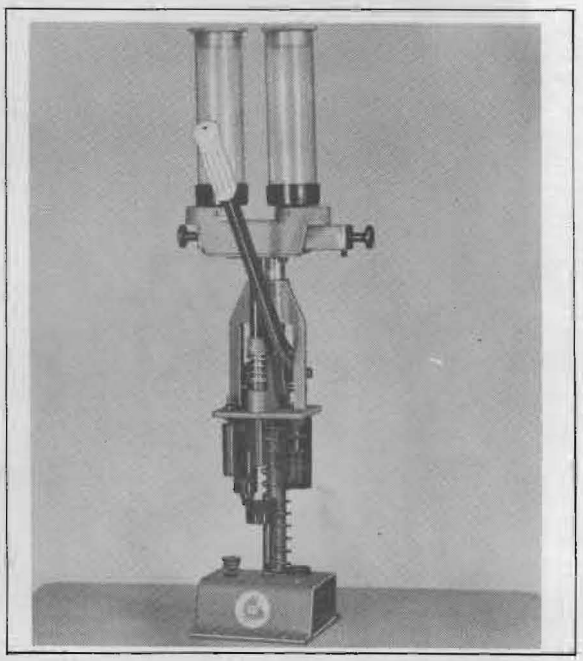


FIGURE 14 — Few single-stage presses have everything. The low-priced (about $45) Bair Cat shown resizes cases full-length and can be adjusted for standard and magnum shells. It does not, however, have a primer feed.

presses of this type are best suited for gun clubs and custom ammo-making, where a production of 400 to 1,000 shells per hour is justified. (This remark does not pertain to the various "economy model" progressives.)

A progressive press is one in which all stations are loaded, each containing a shell in a different stage of completion (see Figure 15). Following each stroke of the handle, the stations advance one step, a finished shell pops out, and a "new" hull is placed in the first station. In addition to levering the handle and inserting hulls, the operator must place each wad in position for ramming down over the powder charge. The procedure requires the dexterity necessary to play Beethoven's Fifth Symphony one-man band style, but production is impressive. With an assistant or two, some models produce as many as 1,000 shells per hour!

Progressive presses invariably group the stations in a circle, and on a plate or shell-holder which is indexed automatically (sometimes manually) when the handle is actuated. The powder and shot-dropping operations are also usually triggered automatically. In most cases the index plate is raised, bringing the shells into contact with the dies when the handle is levered down.

About the only drawback (other than cost) of a progressive press is the slight shell deformation caused by some models. In driving the completed shell down and out of the die, a ram is used which sometimes — and because of the pressure required — slightly flares the top of the shell. In guns with tight chambers, feeding problems can result. In most models, however, the shell remains at factory dimensions. In other presses, the shells tend to swell from the internal pressures when "sized" only at the first stage.

Priming Shotshells

Nearly all presses but the least expensive single-stage units have standard or optional primer feeding devices. Usually the device is merely a long tube, loaded with 50 to 100 primers, which drops a primer into a recess in the base plate when, depending on design, the base plate rises or the primer tube drops. When the unprimed case is placed over the waiting primer, a ram driven into the case mouth forces the primer pocket over the primer.

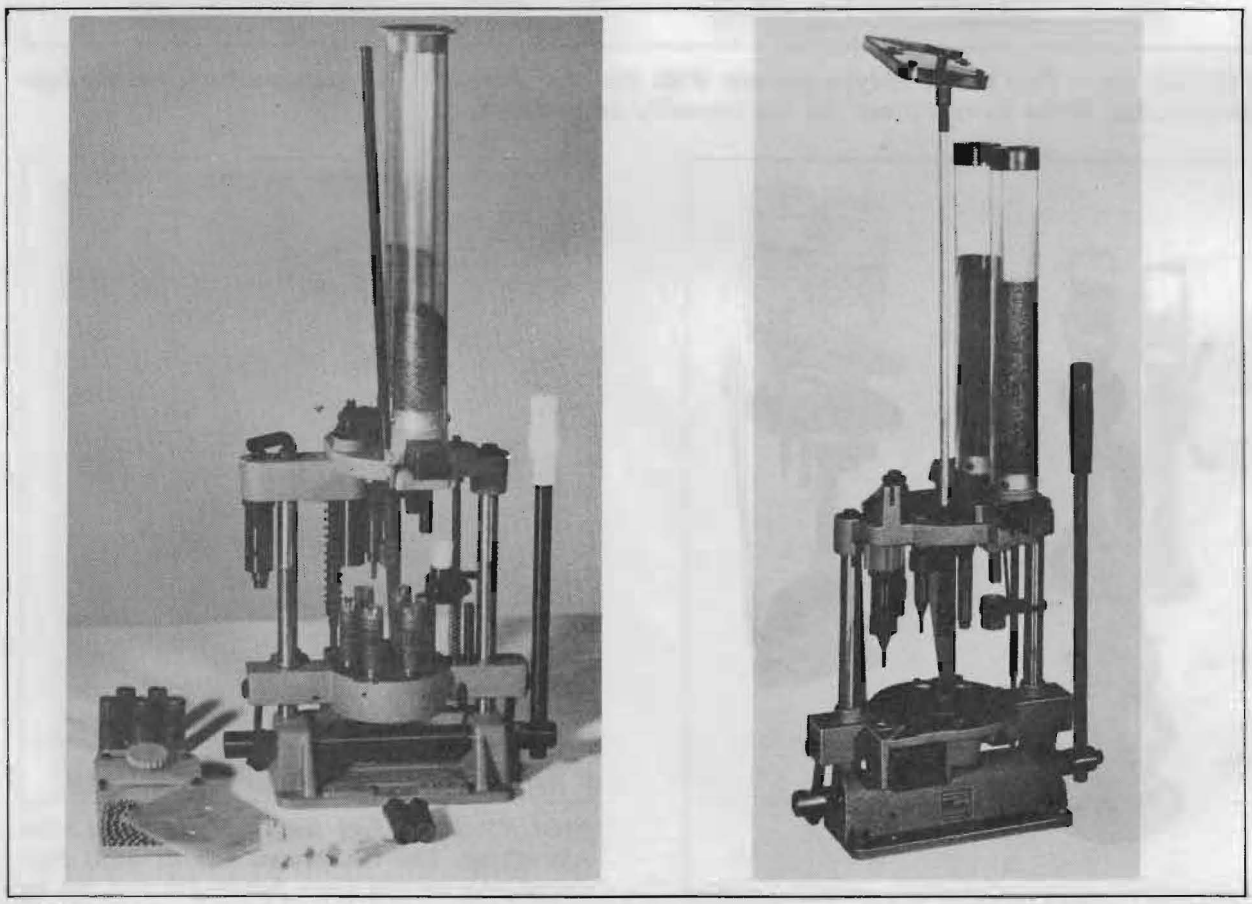


FIGURE 15 — Two popular, medium-priced, progressive presses — the Polar Bair 600 (left) and the Pacific DL-366. The Pacific press has a primer tray atop the primer tube.

On the more expensive progressive presses (see Figure 16), the primers are carried by a track under the base plate, where they are positioned under a shell's primer pocket. The priming ram, in its downward movement, forces the case over the primer. Primer trays, which eliminate the need for the long primer tube, are relatively new. When a box of primers is dumped into the tray, the primers are fed automatically and right-side-up into the feeder tube or track.

The few dollars extra you have to lay out for a standard or optional primer feeding device is a good investment if you will be

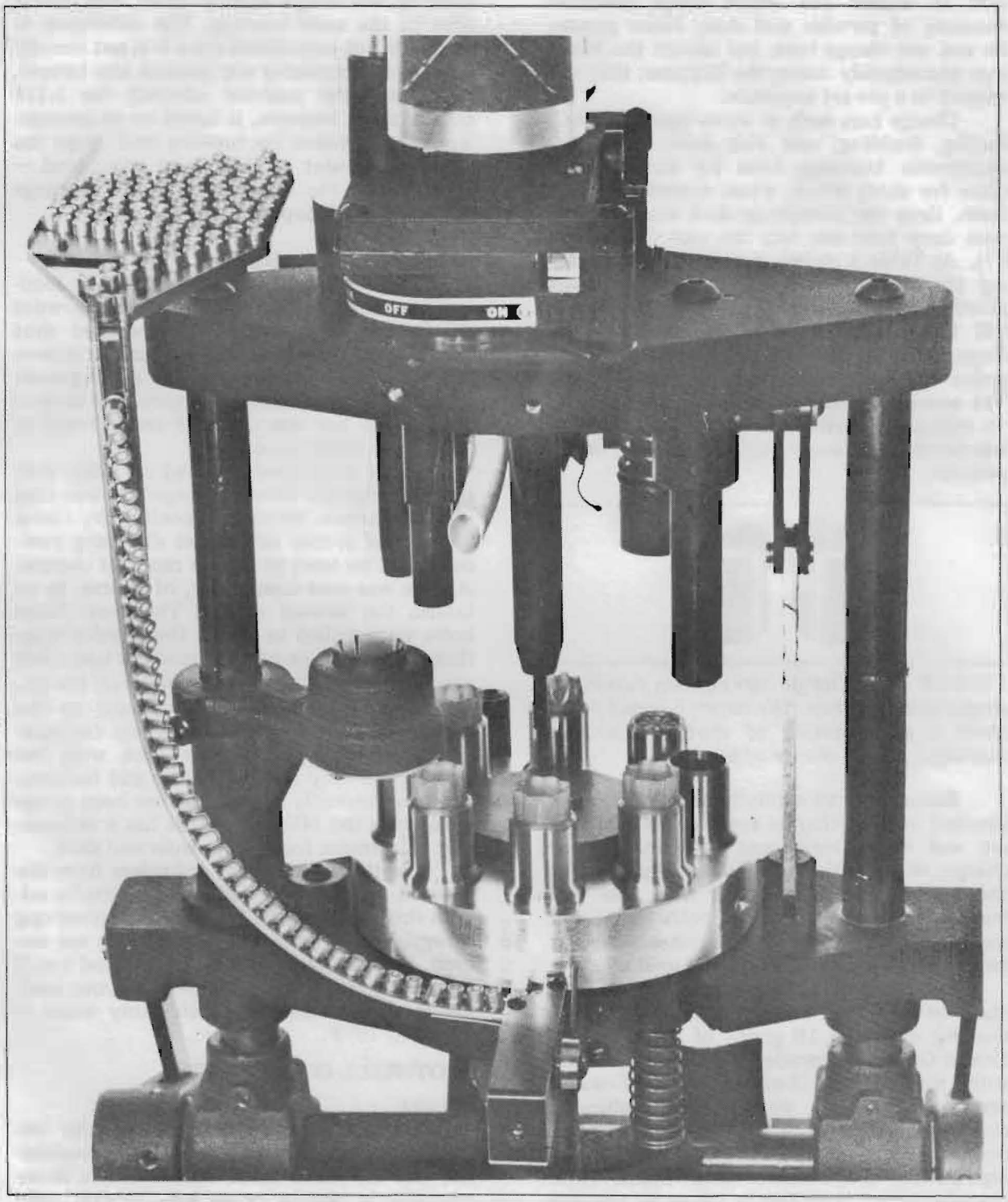


FIGURE 16 — The Ponsness 800-B progressive press is one of the best, also one of the most expensive (over $500).

making three or four boxes of shells at a time. A feeder, with or without the primer tray, can nearly double your production.

Charge Bars and Bushings

Nearly all shotshell presses, irrespective of design, incorporate a charge bar (readily seen in Figure 15) which drops specified amounts of powder and shot. Some presses do not use charge bars, but mount the bushings immediately under the hoppers; they are tripped in a pre-set sequence.

Charge bars such as those used by MEC, Pacific, Redding, and Bair hold two interchangeable bushings (one for powder, the other for shot) which, when moved back and forth, drop the powder or shot down a common drop tube and into the case (see Figure 17). As Table 1 shows, a given powder bushing throws different amounts of different powders. For example, P-W bushing size H will throw 17.9 grains of the rather bulky Dupont 700X powder, and a charge of 37 grains of the dense Hodgdon HS-5 powder. The reason is that a given bushing holds a given volume of powder, and dense powder has less volume and more weight than light, bulky powder.

FIGURE 17 — Charge bars contain two interchangeable bushings; the larger bushing (left) holds a given weight of shot, the smaller bushing a pre-set charge of powder.

Sometimes, by carefully checking recommended powder charges for the various medium and heavy loads and comparing those charges with the throws of a given bushing for the various powders, you'll find that one bushing will often serve for both heavy and medium loads, and in a few cases serve for two powders in the same general load area.

For example, find bushing L on the chart in Table 1. You'll note that this size bushing will drop 19 grains of Hercules Red Dot or Green Dot powder, which is often used with medium, 1-1/8-ounce loads. Reading across to the right, you see that bushing L also drops 31 grains of the denser AL-5 powder, which is commonly recommended for high-power, 1-1/4-ounce field loads. (The manufacturers' load/charge tables at the end of this study unit list a great many powder charges for all types of loads.)

Shot bushings involve no "match-up" calculations. All lead shot *is considered to weigh the same* per unit of volume. This consideration is made even though it is known that the shot charge thrown by a given bushing *will vary slightly* when different shot sizes are used. For example, No. 9 shot in a given bushing will weigh slightly more than No. 4 shot in the same bushing. The difference in weight is not considered since it is not enough to increase pressures nor present any hazard.

Thus, the bushing selected for 1-1/4 ounce, as an example, is based on an average. You simply select the bushing that drops the required amount of shot for a given load — 1-1/4, 1-1/8, etc. Standard P-W shot bushings are listed at the top of Table 1.

Adjustable Powder Bars

To eliminate the need for separate loading bars, each with a hole for a given powder charge and another for the specified shot charge, the adjustable powder bar was invented (see Figure 18). Prior to the development of bushings which have only come out recently, a single bar was used for each charge at about four times the cost!

Three sizes were designed by MEC, with only the powder charge changed by screwing in a bolt held at the desired position by a lock nut. It had several advantages since any powder could be used in a wide range of charges. A scale was near-mandatory, of course, to establish the desired weight. The shot charge holes were drilled to match the powder range (light, medium, or heavy), more or less. They were expensive, but served well, until the single non-adjustable bar was replaced by the simple expedient of using bushings for powder. Most shotshell loaders stick with the bushings as they are convenient and inexpensive. Just recently, a new bar has been developed with the MEC tools that has a micrometer adjustment for both powder and shot.

Another thing many reloaders have discovered is that, in a cold room, powder seldom drops uniformly. We're all for conserving energy, but if your powder charges are uneven, your shooting will be, too — and you'll be *wasting* energy (gunpowder). Do your loading in a room that is comfortably warm — 68°F. to 70°F.

SHOTSHELL COMPONENTS

Primers

Modern shotshell primers generate tremendous pressure and heat, are non-corrosive, and are much more sensitive than those produced a decade or so ago. Today, only two sizes of primers are used in all currently manufactured shotshells — the small .223"

SHOT BUSHINGS

1 – 1/2 oz.	4 – 7/8 oz.	7 – 1-1/4 oz.	10 – 1-5/8 oz.
2 – 5/8 oz.	5 – 1 oz.	8 – 1-3/8 oz.	11 – 1-3/4 oz.
3 – 3/4 oz.	6 – 1-1/8 oz.	9 – 1-1/2 oz.	12 – 1-7/8 oz.

(All shot bushings meet N.S.S.A. and A.T.A. requirements)

POWDER BUSHINGS

(UNITS SHOWN IN GRAINS)

THIS IS NOT A LOADING TABLE, but rather a powder charge table showing the approximate number of grains dropped by Ponsness-Warren, Inc. bushings.

	DU PONT					HERCULES						WINCHESTER					HOODGON			ALCAN			C-I-L	NORMA	
	700 X	PB	SR 7625	SR 4756	IMR 4227	RED DOT	GREEN DOT	BLUE DOT	HERCO	UNIQUE	2400	296	452AA	473AA	540	571	HS-5	HS-6	H-110	AL-5	AL-7	AL-8	C-300	2010	2020
1A					12.1						12.1	13.7							13.7						
2A					12.6						12.6	14.8							14.8						
3A					14.0						13.9	15.6			15.3				15.6						
A	8.8	9.3	10.0	10.5	15.9	8.0	8.0		10.0	11.3	15.8	17.5			16.8	17.1	18.2	16.8	17.5	13.2	13.2		8.5	8.3	9.6
B	9.5	9.7	11.0	11.0	16.8	8.5	8.5		10.6	12.1	16.7	18.8			17.6	18.2	19.5	17.7	18.8	14.1	14.1		9.6	8.6	10.5
C	10.0	10.3	11.5	12.0	17.8	9.3	9.3		11.3	12.7	17.7	20.0			18.5	18.8	20.7	18.8	20.0	14.6	14.6		10.1	9.3	11.1
C1	10.3	10.4	11.9	12.4	18.2	9.5	9.5		11.7	13.2	18.0				19.6	20.1	21.1	19.2	20.6	14.9	14.9		10.4	9.8	11.5
D	10.8	11.1	12.5	13.0	19.1	9.8	9.8		12.1	13.8	19.2				20.4	21.0	22.3	20.5	21.5	16.0	16.0		10.9	10.2	11.9
D1	11.4	12.3	13.1	13.7	19.9	10.7	10.7		13.2	14.5	20.0			15.5	21.3	22.4	23.4	21.9		16.8	16.8		11.5	10.9	12.5
E	12.4	13.1	14.5	15.0	22.6	11.5	11.5		14.6	16.2	22.5			16.8	23.5	24.2	25.5	24.2		18.7	18.7		12.4	11.8	13.9
E1	12.9	13.8	15.1	15.8	23.9	12.1	12.1	19.1	15.3	17.0	23.7			17.1	24.0	24.7	28.3	25.5		19.7	19.7		13.7	12.4	14.8
E2	13.6	14.5	15.8	16.6	25.2	12.8	12.8	21.7	16.0	17.9	25.3		15.0	18.0	26.1	26.5	28.9	26.8		20.8	20.8		14.5	13.1	15.6
F	14.5	15.3	16.5	17.5	26.5	13.5	13.5	22.0	16.7	18.8	26.3		15.6	19.6	27.5	28.5	30.4	28.0		21.9	21.9	17.8	15.0	13.8	16.4
F1	15.0	16.1	17.7	18.4	27.9	14.1	14.1	22.4	17.7	19.7	27.7		16.4	20.1	28.3	29.3	31.5	29.4		23.0	23.0	18.6	15.6	14.4	17.2
G	16.3	17.0	19.0	19.5	29.3	14.7	14.7	24.5	18.6	20.6	29.0		18.3	22.7	31.2	32.3	33.6	30.7		24.1	24.1	19.5	17.3	15.0	18.0
G1	17.0	18.4	20.2	21.1	31.5	15.9	15.9	26.2	19.9	22.6	31.4		19.0	23.0	32.7	33.4	36.4	33.1		26.1	26.1	21.4	18.0	16.6	19.7
H	17.9	18.8	20.5	21.5	32.1	16.5	16.5	27.0	20.2	23.1	32.1		19.9	24.1	34.0	34.8	37.0	33.6		26.7	26.7	21.9	18.2	17.0	20.2
I	18.5	19.2	21.0	22.0	33.0	17.0	17.0	27.8	20.7	23.5	33.0		20.3	24.7	34.4	36.5	38.3	35.0		27.3	27.3	22.4	19.0	17.3	20.7
J	19.0	19.7	21.5	22.5	34.0	17.2	17.2	28.2	21.5	24.4	34.0		21.5	25.4	35.5	37.1	39.5	36.2		28.2	28.2	23.2	19.7	17.7	21.0
J1	19.6	20.3	22.7	23.2	35.4	17.9	17.9	29.3	22.2	25.4	35.4		22.3	26.8	36.9	38.8	40.7	37.2		29.1	29.1	23.7	20.1	18.6	22.2
K	20.0	20.9	23.0	24.0	35.9	18.2	18.2	29.5	22.7	25.8	36.0		22.5	27.0	37.1	39.0	41.9	38.3		29.9	29.9	24.2	20.3	19.0	22.5
L	21.0	21.7	24.5	25.5	37.4	19.0	19.0	31.3	24.2	27.3	37.5		23.4		39.5		43.8	39.4		31.0	31.0	25.3	21.6	19.2	23.3
M	22.0	23.0	25.5	26.5	39.6	19.9	19.9	32.7	25.3	28.1	39.5		24.0				45.9	41.8		32.9	32.9	26.8	23.0	20.5	24.7
N	23.5	24.5	27.0	28.0	42.0	21.2	21.2	35.0	26.4	30.3	41.8		26.5				48.7	44.6		34.8	34.8	28.5	24.0	21.5	26.0
O	24.0	24.7	27.5	28.5	42.4	21.5	21.5	35.5	26.8	30.5	42.5						49.4	45.3		35.4	35.4	28.7	24.3	22.0	26.4
P	24.5	25.8	28.5	29.5	43.8	22.0	22.0	36.0	27.1	30.9	43.8						49.9	45.5		36.0	36.0	29.5	25.0	23.0	27.3
Q	25.0	26.2	29.0	30.0	44.8	22.8	22.8	37.5	28.1	32.2	45.0						52.4	47.6		37.4	37.4	30.3	26.5	23.3	27.6
R	25.5	26.6	29.5	30.5	45.4	23.3	23.3	38.5	29.3	32.8	45.5						53.0	49.5		38.3	38.3	31.0	27.2	23.5	28.2
S	26.5	27.7	31.0	32.0		23.8	23.8	39.2	29.9	33.8	47.2						54.7	49.9		38.9	38.9	32.2	28.1	24.8	29.5
T	28.0	29.2	32.0	33.5		25.2	25.2	42.0	31.6	36.1	49.9						57.8	52.6		41.7	41.7	33.8	29.6	25.8	31.1
U	29.5	30.9	34.5	35.5		26.7	26.7	45.1	32.7	38.1	52.8						61.4	56.9		43.8	43.8	35.8	30.7	27.5	32.9
V	30.5	31.9	35.0	36.5		27.5	27.5	46.3	33.7	38.9	54.5						63.0	57.4		45.0	45.0	37.1	32.3	28.5	34.1
W	32.5	33.7	37.5	39.0		28.9	28.9	48.1	35.9	41.8	57.5						66.8	61.2		47.8	47.8	39.3	33.7	30.0	36.2
X	33.0	34.1	38.0	39.5		29.4	29.4	48.7	36.4	42.1	58.1									48.5	48.5	39.6	33.9	30.4	36.5
Y	34.0	35.7	39.5	41.0		30.8	30.8	50.3	37.9	43.7	60.6									50.5	50.5	41.3	35.5	31.7	38.2
Z	38.0	39.3	44.0	45.5		33.9	33.9	56.3	42.8	48.2	67.2									55.5	55.5	46.1	39.5	35.2	41.8
AA	41.0	42.2	47.5	49.0		37.1	37.1	60.6	46.0	52.2	72.4									60.4	60.4	49.6	43.0	38.0	45.6

ALL PONSNESS-WARREN RELOADERS AND ADDITIONAL TOOLING SETS COME WITH ONE SET OF BUSHINGS INCLUDED. PLEASE SPECIFY FROM THE ABOVE TABLE WHICH BUSHINGS YOU DESIRE. IF YOU DESIRE TO VARY YOUR LOADS, ADDITIONAL BUSHINGS ARE $1.50 EACH.

ALL OF THE ABOVE BUSHINGS WILL THROW APPROXIMATELY 3/10 OF A GRAIN LESS WHEN UTILIZED IN A SIZE-O-MATIC 800B, BECAUSE OF ITS REDUCED VIBRATION.

TABLE 1 — Data sheet from the Ponsness-Warren catalog, showing how one powder bushing throws different amounts (weights) of different powders.

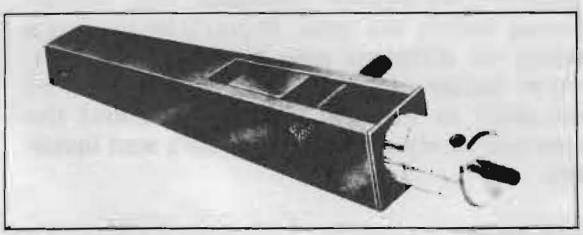


FIGURE 18 — Adjustable powder bars, like the Lyman unit shown, eliminate the need for interchangeable powder bushings.

primer for Remington-Peters "SP" plastic field loads and the larger .243" Winchester size for all other shotshells. (See Table 2 for manufacturers' size and number designations.)

Cases should always be inspected before and after the priming operation. If a primer fits loosely because of an oversize primer pocket, the case should be discarded. If the primer fails to seat with moderate pressure, either the pocket is dirty or you're trying to insert the wrong primer.

Manufacturer's Designation	All Winchester-Western, Federal, Alcan, Remington-Peters Plastic Target Load cases	Remington-Peters Paper cases and Plastic Field load cases
ALCAN G57F		X
ALCAN WW209F	X	
ALCAN 220	X	
CCI 109	X	
CCI 157		X
FEDERAL 209	X	
REMINGTON-PETERS 57*		X
REMINGTON-PETERS 97*	X	
SULLIVAN 209	X	
WINCHESTER-WESTERN 209	X	

All primers listed are non-mercuric and non-corrosive. Primers used with Ball powders should have covered flash holes to prevent the tiny powder kernels sifting into the battery cup.

TABLE 2 — Shotshell primer sizes.

Cases

Cases of different construction have different capacities, requiring different powder/wad/shot combinations. The worst and most confusing thing a novice reloader can do is start out with a batch of "assorted" cases of varying design (see Figure 19). Some won't crimp properly, others won't crimp at all — and a powder charge that might be right for one case could cause sky-high pressures in another case.

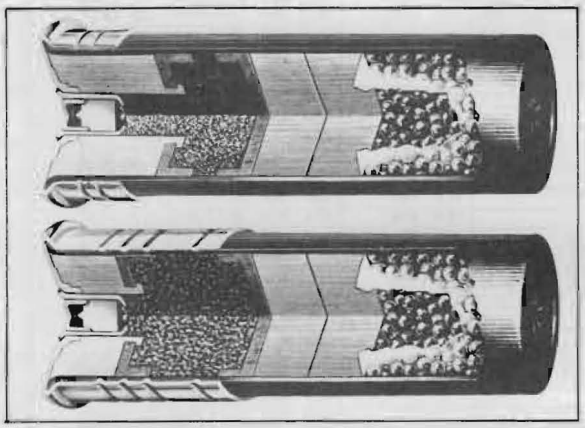


FIGURE 19 — Different cases have different capacities. Note the higher base wad in the low-base shell at top. Unless universal wad cups are used, the length of the correct wad cups will also differ.

The best idea is to start out with and stick with one kind of case — preferably the "AA" type of one-piece, compression-formed plastic construction. Such cases will last for 10 to 15 reloads, and you don't have to worry about a paper base wad coming loose and covering the primer — which causes the shot to "roll" out of the barrel.

Paper shells have a short reloading life — generally about five reloads — and unless you have the chance to pick up a large quantity of once-fired cases for "peanuts," stick with plastic. The secret of fast, economical reloading is standardization — and it starts with the hull.

Shotshell Powder

We have discussed powders at length previously. Suffice it to say that there are a great many excellent powders available today for the shotshell reloader (see Table 3). Light field, skeet, and trap loads use a fast-burning, often flake-type powder like Hercules Blue or Red Dot, or Dupont 700X; heavy field loads require denser, slower-burning propellants (often ball-type) such as Herco HS-5 or AL-5. As in all reloading, metallic cartridge or shotshell, the greater the resistance (weight) of the projectile or charge, the slower burning the powder; the lighter the resistance, the faster burning the powder.

A very real hazard in shotshell reloading is the double charge. Like pistol cases, shotshells provide plenty of room for a double charge. And it's impossible with most presses to look inside the case to check, and you can't tell by looking. Experienced reloaders can "feel" the extra resistance provided by the extra powder in the crimping die. Few case/powder/shot combinations will permit proper crimping with a double charge. Some others might. Keep your mind on what you're doing. A double charge of powder (under and over the shot) can only happen by getting out of sequence. Distractions and running conversations have no place at the loading bench!

Wads

Today there are a great many different types of plastic wads. All serve multiple purposes. The cup keeps the shot from touching the bore and results in better and tighter patterns. It also serves as a seal, preventing gases from escaping up the sides and around the shot. The base, set tightly over the powder, also acts as a seal. The pedestal or mid-section serves as a wad, spacing and correctly positioning the shot charge in relation to the case mouth. It also acts as a cushion, slowing down the movement of the shot to the rear at recoil, thus reducing the gun's kick (see Figure 20).

Plastic wad cups are made in a variety of sizes for specific case and load combinations. Universal cups adapt to several cases and charges, with the pedestal compressing or "folding" to permit crimping and correct spacing within the tube. If you'll be loading a variety of different case load combinations, you're better off with the universal type of wad such as the CCI. They cost about the same and surely cut down on one's wad inventory.

Shot Pellets

In selecting shot pellets, there are some important pros and cons to consider — whether to go larger or smaller, heavier or lighter.

The fastest burning smokeless powder available to handloaders is Hercules Bullseye. It is almost universally used for .38 Special target loads. Well adapted to light loads in all pistol cartridges.

Hodgdon Grey B and the new Winchester AA20S and AA12S spherical or ball powders are a new look in propellants. Designed for trap and skeet shotshell loads in plastic cases, they can be used in light handgun loads too.

Winchester Ball powder 450-LS has become popular with skeet and trap shooters who reload their own ammunition. This fine-grained powder also can be used in light handgun loads.

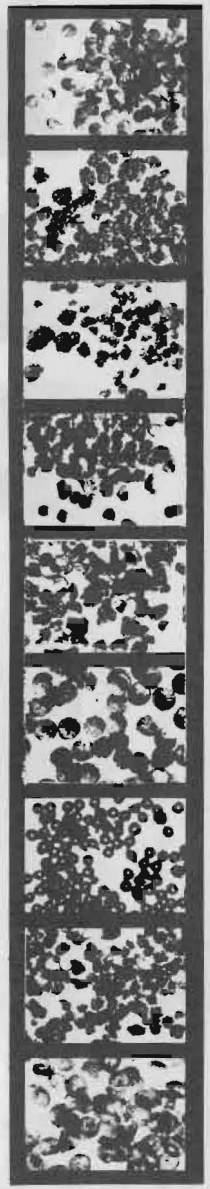
Winchester 230-P is a fast burning Ball powder for use in light loads in most pistol cartridges.

Norma 1010 is a new fast burning pistol powder and Norma 2010 is a similar fast burning shotshell powder designed for trap and skeet loads.

Alcan AL-120 is a fast burning shotshell powder intended primarily for trap and skeet loads.

Hodgdon Top Mark is useful both in trap and skeet shotshell loads and in target loads in handgun cartridges.

Hercules Red Dot is probably the most widely loaded shotshell powder. Primarily intended for light to medium loads in shotgun shells, it is also becoming popular for light target loads in pistol ammunition.



DuPont 700-X is meant primarily for use in 12 gauge trap and skeet loads and light to medium field loads. It is also a very good powder for target loads in handguns.

Hercules Green Dot is a slow version of Red Dot, usually used in light and medium shotshells but also can be used with good results in light pistol loads.

DuPont PB is an older medium shotshell powder that can be used in light to medium pistol cartridges.

Unique has been in the Hercules line for many years and remains one of the most versatile of all powders. It is an excellent powder for practically all handgun cartridges, used mostly for medium to heavy loads. Unique is also used for medium shotshell loadings and makes one of the best choices for greatly reduced loads in rifle cartridges.

DuPont SR7625 (SR stands for 'Sporting Rifle") is used in medium shotshell and pistol loading. Oddly enough, it is not even listed as a rifle powder in DuPont's latest Powder Guide.

Alcan AL-5 is intended for medium shotshells but is also of value in loading medium handgun cartridges.

Winchester 500-HS and Hodgdon HS-5 powders are very similar. Both are listed as medium shotshell propellants but make serviceable pistol loads as well.

Alcan AL-7 is much like AL-5, but slightly slower burning. It can be used in both medium and heavy shotshells and pistol cartridges.

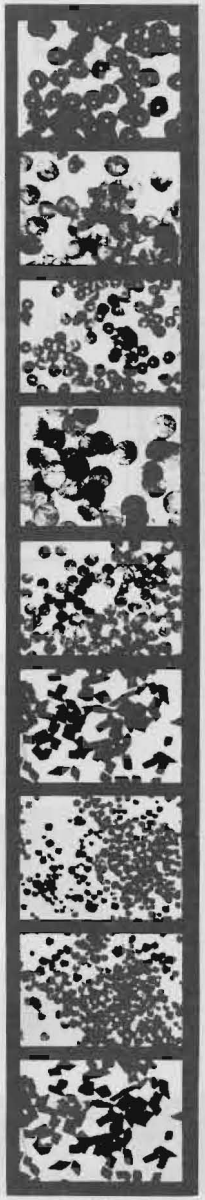


TABLE 3 — Illustrations and descriptions of the faster-burning shotshell powders. (Courtesy Speer, Inc.)

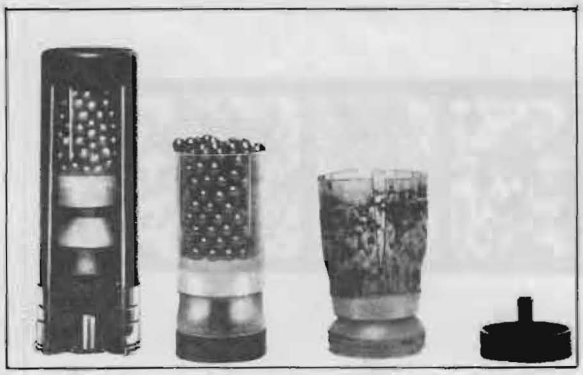


FIGURE 20 — The Federal "Champion" target load has a wad with a collapsible base that cushions recoil. Note the compression of the base in the fired and recovered wad. At right is the detachable overpowder cup.

First of all, remember, pattern density is a whale of a lot more important than velocity. Also, regardless of muzzle velocity, small and medium-size shot are moving at about the same speed when 40 to 50 yards from the gun. Therefore, you're better off with a heavier load of shot moving comparatively slow than with a lighter shot charge moving faster.

You probably have your own ideas as to which shot size is best for different-size game. We wish to point out, however, that the most common mistake made in selecting shot size is to use too large a pellet size. Four or five hits with No. 6 pellets have more stopping power than two or three No. 4 pellets, and so on.

Some of the deadliest duck shots use No. 7½ shot and improved-cylinder boring, and at up to 40 yards score twice the hits of fellows shooting No. 4's out of a full-choke tube. Also, standard 7½ or 8-shot target loads are splendid on upland game such as quail or doves. Too many shooters use No. 6's for this purpose, which are better suited to chukar, pheasants, and ducks over decoys.

Common Problems

When a reloader "standardizes" on one type of case (and one primer), and utilizes universal-type wads, 90% of his potential problems are solved in advance. He can then usually get by with two or three different types of powder and two or three sets of bushings for all his target and hunting requirements.

When a case won't crimp closed properly, and bulges at the top, you've either dropped a double charge of powder, too much shot (wrong bushings), or used an overly long wad cup. If the crimp is "hollow," you've either failed to drop the powder or have used too short a wad cup (see Figure 21).

LEAD SHOT

Uniform and round Winchester-Western lead shot of hardness tailored for the job is available in all popular sizes. The convenient tabulation below not only correlates shot size with diameter, but also indicates approximately how many pellets there are per unit of weight.

STANDARD SHOT CHART

No.	Diam. In Inches	Approx. Pellets In 1 oz.	No.	Diam. In Inches	Approx. Pellets In 1 lb.
12	.05	2385	4 Buck	.24	340
11	.06	1380			
10	.07	870	3 Buck	.25	300
9	.08	585			
8½	.085	485			
8	.09	410			
7½	.095	350	1 Buck	.30	175
6	.11	225			
5	.12	170	0 Buck	.32	145
4	.13	135			
2	.15	90	00 Buck	.33	130
BB	.18	50			

The following tabulation gives the approximate number of pellets per shotshell load for shot sizes 2 through 9. The exact number of pellets will vary, depending on exact alloy content: for example, chilled shot vs. soft shot. Slight variations in shot pellet diameter will also affect the exact number of pellets per load, when shot charge is thrown volumetrically (rather than weighed).

Shot Charge	Shot Size #2	#4	#5	#6	#7½	#8	#8½	#9
½ oz.	45	67	85	112	175	205	242	292
¾	67	101	127	168	262	308	363	439
⅞	79	118	149	197	306	359	425	512
1	90	135	170	225	350	410	485	585
1⅛	101	152	191	253	393	461	545	658
1¼	112	169	213	281	437	513	605	731
1⅜	124	186	234	309	481	564	665	804
1½	135	202	255	337	525	615	730	877
1⅝	146	220	276	366	569	666	790	951
1⅞	169	253	319	422	656	769	850	1097
2	180	270	340	450	700	820	910	1170

TABLE 4 (Courtesy Olin Industries — Winchester-Western)

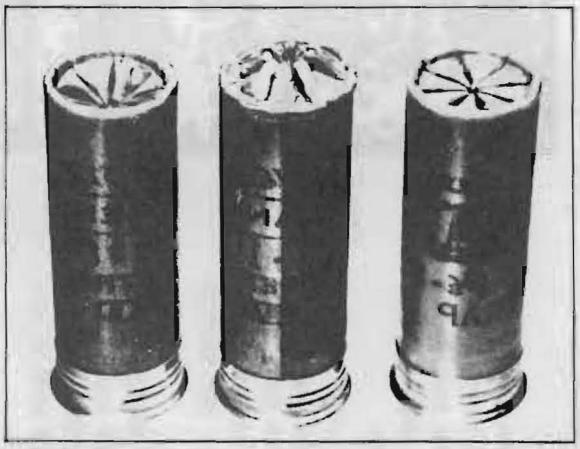


FIGURE 21 — Crimp is correct on the shell at the right. The center shell has too much of "something." The one at the left not enough. (See text)

Messed-up crimps can be caused by using the wrong crimper (8-point on paper, 6-point on plastic). A more likely possibility is that the case has just "done wore out" and is no longer capable of crimping properly. All cases should be checked frequently for incipient cracks (see Figure 22).

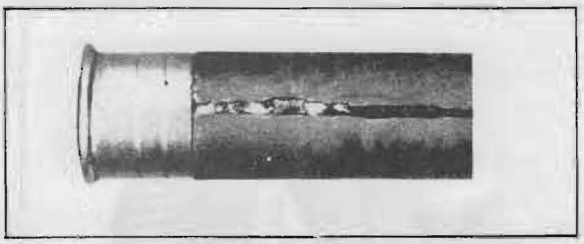


FIGURE 22 — This doesn't happen often with plastic cups. Felt wads, because of increased friction, sometimes crack the case after three or four loadings when pressure is applied to the wad.

Incorrect adjustment of the final crimping die can also create difficulties. If it's set too high, the crimp won't close and the shell may be overly long. Set the die down too far and you'll flare the front edges of the shell — causing feeding and chambering problems. Always read and understand the manufacturer's instructions before setting up your loader.

Some reloaders, when making up a batch of shells for duck or goose shooting, like to dip the heads in paraffin for extra moisture protection; too much paraffin, however, will affect operation.

Another thing — don't ever dry wet plastic shells in the oven. Why not? See Figure 23.

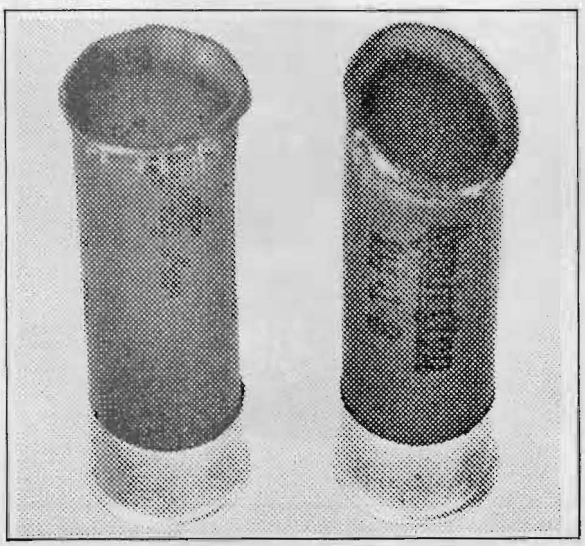


FIGURE 23 — Plastic cases, like some people, can't take heat. Keep them out of the oven!

Finally, always "go by the book" (manufacturers' listings) when reloading; never depend upon memory.

Shotguns are not designed to accept high pressures compared to rifles; about 11,000 psi is maximum for shotguns and up to 50,000 psi for modern rifles.

You will note that every loading manual lists certain combinations of case, primer, powder, wads, and shot charge. The manuals warn that changing any one of these will affect pressures. Even switching to a different primer can build up excess pressures. Study the variance in the pressure column figures.

Excess pressures are revealed in loose primers, leaking gas, and distorted bases.

A shotgun that is "blown up" is usually due to an obstruction in the bore — or a double charge. This is hard to do with modern loaders, and it invariably happens when the loading sequence is interrupted and the reloader fails to note that he already has a charge of powder in the case — although there is always the warning condition as the crimp will fail to close or will be badly distorted, very visible evidence that the wad and shot column has changed.

NEVER force this crimp and attempt to use the shell. Dump the shot and weigh the powder. It may only be a wrong wad or it could be the wrong shot load.

Do not pour out some shot in such an instance to secure a satisfactory crimp. You still don't know what caused the change. You may have a double charge, and the difference to the eye alone is hardly noticeable. It is a gamble you cannot afford to make.

Always observe all of your safety rules. They apply as much (or more so) to shotshell reloading as to reloading metallic cartridges.

Before going on, please do Programmed Exercise 1. Make sure you write your answers on a separate sheet of paper before looking at the answers on the page specified.

Operation of the Loading Press

Now let's see if we can apply the basics of shotshell reloading and carry a case through an entire loading sequence, using the popular Texan single-stage press. See Figures 24 through 30.

FINAL OBSERVATIONS

Most leading presses utilize five stations; some, with standard or optional primer feeds, require six stations. These stations shouldn't be confused with the die arrangements of presses like the Ponsness-Warren, which holds dies for two gauges, permitting rapid changeover.

MANUFACTURERS' LOADING TABLES

North American School of Firearms is indebted to the manufacturers whose recommended shotshell load listings follow in the appendices, and to Speer, Inc., who first organized and published much of this material in the Speer No. 8 Loading Manual.

PROGRAMMED EXERCISE

1

1. If you wanted to drop 27.0 grains of Winchester 473AA powder, what bushing would you use? (a) K. (b) N. (c) R. (d) Y.

2. What should you do with the case if a primer fits loosely because of an oversize primer pocket?

3. If the primer fails to seat with moderate pressure, what two conditions should you consider?

4. Why is it a good idea, when someone starts reloading shotshells, to stick with one kind of case?

5. True or false? The suitability of a shotshell case for a given charge is dependent on *how far up* the brass extends.

6. What are the likely problems if your case will not crimp-close properly?

7. If the crimp is hollow, what has possibly happened?

Answers on Page 18

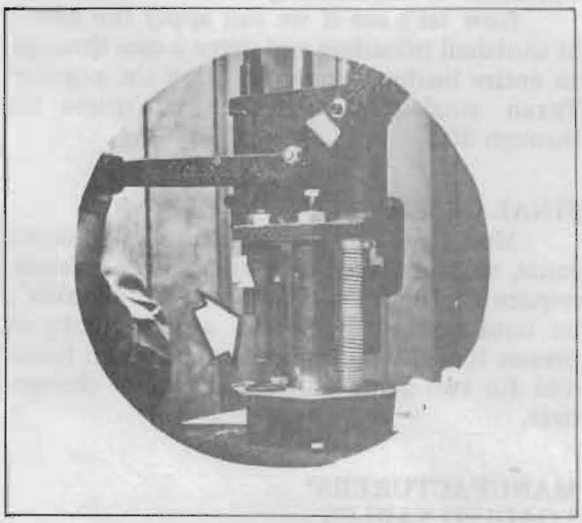


FIGURE 24 — The first step in reloading: the empty hull is placed in the first station and the die assembly is levered down. A decapping pin within the sizing die (this press sizes during the decapping procedure) forces the spent primer out the bottom of the base plate.

FIGURE 25 — The primer is placed into the recess in the seating die (Station 2). The hull is then placed over the primer and the circular ram or punch is levered down into the case mouth — thus forcing the primer pocket over the primer. (We're not using the optional primer feed which drops the primer into the die recess.)

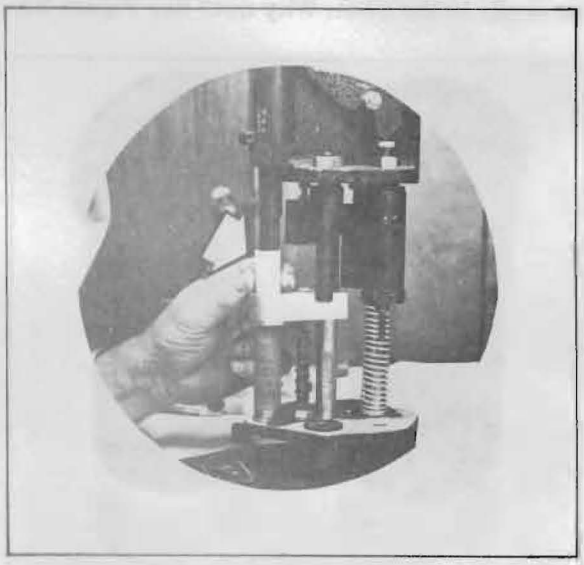


FIGURE 26 — Three separate operations are performed at the third station. First, the lever is pressed down, which guides the drop or loading tube into the hull. The charge bar is then pushed to one side, which brings the powder bushing (and charge) over the drop tube, thus dropping the powder charge. The handle is levered up and the wad cup placed over the drop tube (illustrated). By moving the handle down, the wad is pressed down over the powder. (The proper wad pressure, as specified in the loading table, has been preset on the press.)

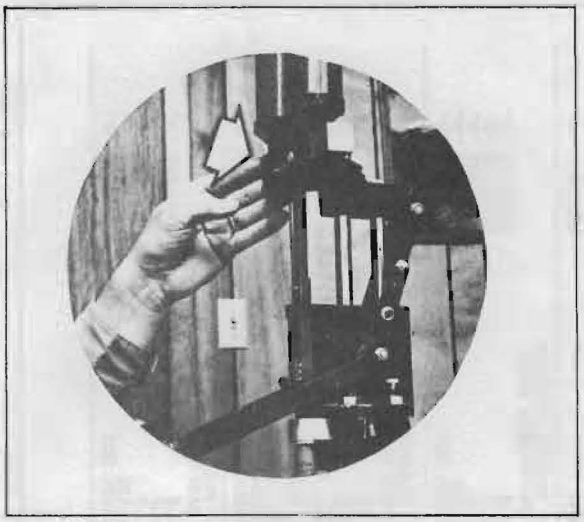


FIGURE 27 — We're still at Station 3. With the handle still down, the charge bar is shifted to bring the shot bushing over the drop tube and the shot is dropped into the case.

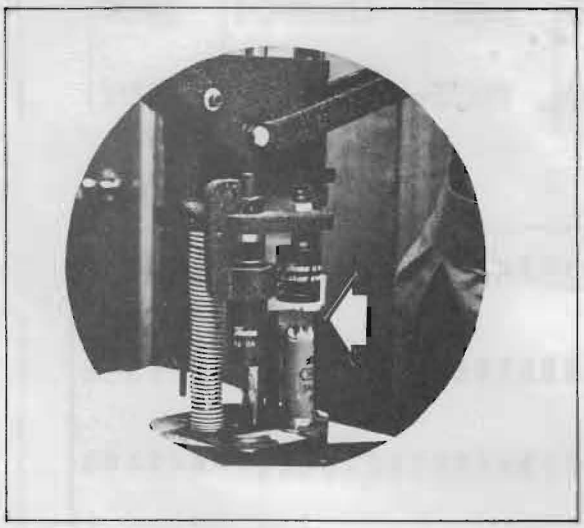


FIGURE 28 — The charged shell is now placed in Station 4, which starts the crimp. Don't hold onto the hull. If you keep your hands off, the hull will adjust or index by itself — lining up the new crimp with its previous crimp.

FIGURE 29 — The semi-crimped shell is then placed in the last (No. 5) station. Levering the handle finishes the crimp and the shell.

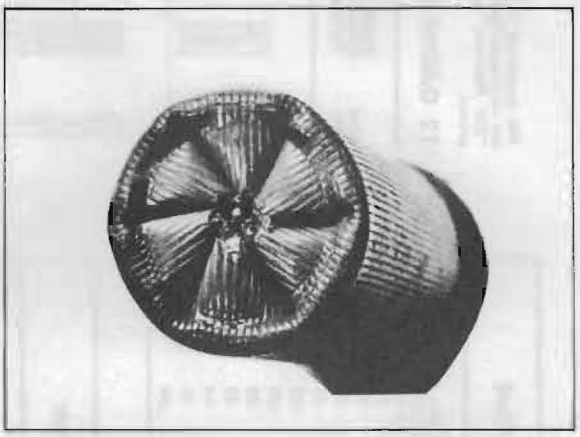


FIGURE 30 — The result is a shell that costs only about half that of its factory equivalent and will perform every bit as well. (Note: This plastic shell required a 6-point crimper. Most require an 8-point crimp.)

Standard Shot

Shot Size	Diameter	Approx. Number Per Oz.
Fine Dust	.03	
Dust	.04	4565
No. 12	.05	2330
11	.06	1350
10	.07	850
9	.08	570
8	.09	400
7½	.095	340
6	.11	220
5	.12	170
4	.13	135
3	.14	105
2	.15	85
1	.16	70
B	.17	60
Air Rifle	.175	55
BB	.18	50
BBB	.19	42

Buck Shot

Western	American Standard	Dia. In Inches	Approx. Number Per Lb.
	No. 4	.24	340
No. 9	3	.25	299
8		.26	263
7½	2	.27	238
7		.28	210
6		.29	186
5	1	.30	152
4	0	.32	144
3	00	.34	128
2	000	.36	112
1		.38	96

Shot

Oz. of Shot Per Shell	Grain Weight	Shells From 5 Lb.	Shells From 25 Lb.
⅜	164	213	1067
½	218	174	872
⅝	273	128	640
¾	328	106	533
⅞	382	91	457
1	437	80	400
1 1/16	464	75	376
1⅛	492	71	355
1 3/16	519	67	336
1¼	546	64	320
1⅜	601	58	291
1½	656	53	266
1⅝	710	49	246
1¾	765	45	228
1⅞	821	42	213
2	874	40	200
2¼	984	35	178

Powder

Grs. of Powder Per Shell	Shells From 8 Oz.	Shells From 1 Lb.	Shells From 3 Lb.
16	218	437	1311
18	194	388	1164
19	184	368	1104
21	166	333	999
22	159	318	954
23	152	304	912
24	145	291	873
25	140	280	840
26	132	265	795
27	129	259	777
28	125	250	750
29	120	241	723
30	116	233	699
32	109	218	654
33	106	212	636
34	102	205	615
37	94	189	567
38	92	184	552
39	89	179	537
50	70	140	420
52	68	136	409
54	64	129	388
56	62	125	375
58	60	121	362

The suggested loading data shown here are based on use of the components listed, and are maximum loads. Any change may result in a significant pressure change. Use the Alcan "220 Max-Fire" primer except in those Remington cases requiring the Remington size primer.

12 GAUGE LOADS WITH "FLITE-MAX" AND "UNISLEVE" WADS

Shot Wt.	Muzzle Velocity Ft./Sec.	Powder Charge and Shell Type	Wad Column
		12 GA. 3" PLASTIC ALCAN & FEDERAL	
1⅞	1105	35.0 Grs. AL-8	FLITE-MAX #1
1¾	1180	39.0 Grs. AL-8	FLITE-MAX #3
1⅝	1215	39.0 Grs. AL-8	FLITE-MAX #3
1½	1250	35.0 Grs. AL-7	FLITE-MAX #4
1⅜	1335	36.0 Grs. AL-7	FLITE-MAX #5
1¼	1310	35.0 Grs. AL-5	FLITE-MAX #6
		12 GA. 2¾" PLASTIC ALCAN & FEDERAL (PAPER BASE WAD)	
1½	1235	38.0 Grs. AL-8	FLITE-MAX #1
1⅜	1300	39.0 Grs. AL-8	FLITE-MAX #2 or #3
1⅜	1225	30.0 Grs. AL-7	FLITE-MAX #4
1¼	1315	31.0 - 32.0 Grs. AL-7	FLITE-MAX #5
1¼	1280	29.0 - 30.0 Grs. AL-5	FLITE-MAX #5
1⅛	1210	22.0 Grs. AL-120	FLITE-MAX #6
1⅛	1155	18.5 Grs. RED DOT	FLITE-MAX #6
1⅛	1185	20.5 Grs. GREEN DOT	FLITE-MAX #6
1⅛	1235	21.5 Grs. GREEN DOT	FLITE-MAX #6
		12 GA. 3" PLASTIC ALCAN & FEDERAL	
1¾	1195	39.0 Grs. AL-8	UNISLEVE "A"
1⅝	1215	39.0 Grs. AL-8	UNISLEVE "A"
1⅜	1315	36.0 Grs. AL-7	UNISLEVE "B"
		12 GA. 2¾" PLASTIC ALCAN & FEDERAL (PAPER BASE WAD)	
1⅜	1275	39.5 Grs. AL-8	UNISLEVE "A"
1¼	1265	32.0 Grs. AL-7	UNISLEVE "B"
1¼	1240	31.0 Grs. AL-5	UNISLEVE "B"
1⅛	1210	22.0 Grs. AL-120	UNISLEVE "B"
1⅛	1200	21.0 Grs. GREEN DOT	UNISLEVE "B"
		12 GA. 2¾" PLASTIC FEDERAL (PLASTIC BASE WAD)	
1½	1220	37.5 Grs. AL-8	FLITE-MAX #1
1⅜	1290	38.5 Grs. AL-8	FLITE-MAX #1
1⅜	1215	29.5 Grs. AL-7	FLITE-MAX #3
1¼	1300	30.5 - 31.5 Grs. AL-7	FLITE-MAX #4
1¼	1265	28.5 - 29.5 Grs. AL-5	FLITE-MAX #4
1⅛	1200	21.0 Grs. AL-120	FLITE-MAX #5
1⅛	1145	18.0 Grs. RED DOT	FLITE-MAX #5
1⅛	1175	20.0 Grs. GREEN DOT	FLITE-MAX #5
1⅛	1225	21.0 Grs. GREEN DOT	FLITE-MAX #5
		12 GA. 2¾" PLASTIC FEDERAL (PLASTIC BASE WAD)	
1⅜	1265	39.0 Grs. AL-8	UNISLEVE "A"
1⅜	1228	30.0 Grs. AL-7	UNISLEVE "A"
1¼	1300	32.0 Grs. AL-7	UNISLEVE "A"
1⅛	1190	22.0 Grs. AL-120	UNISLEVE "B"
1⅛	1230	20.5 Grs. GREEN DOT	UNISLEVE "B"

12 GAUGE LOADS WITH "FLITE-MAX" AND "UNISLEVE" WADS

Shot Wt.	Muzzle Velocity Ft./Sec.	Powder Charge and Shell Type	Wad Column
		12 GA. 3" REMINGTON EXPRESS	
1 5/8	1200	32.0 Grs. AL-7	UNISLEVE "A"
1 1/4	1335	34.0 Grs. AL-5	UNISLEVE "B"
		12 GA. 2 3/4" REMINGTON EXPRESS & SHUR-SHOT	
1 3/8	1230	30.0 Grs. AL-7	UNISLEVE "A"
1 1/4	1300	32.0 Grs. AL-7	UNISLEVE "A"
1 1/4	1255	29.0 Grs. AL-5	UNISLEVE "A"
1 1/8	1275	30.0 Grs. AL-5	UNISLEVE "B"
1 1/8	1185	21.0 Grs. AL-120	UNISLEVE "B"
1	1315	24.0 Grs. AL-120	UNISLEVE "B"
		12 GA. 3" REMINGTON EXPRESS	
1 3/4	1135	36.0 Grs. AL-8	FLITE-MAX #1
1 5/8	1185	37.0 Grs. AL-8	FLITE-MAX #3
1 1/2	1230	37.0 Grs. AL-8	FLITE-MAX #4
1 3/8	1295	35.0 Grs. AL-7	FLITE-MAX #5
1 1/4	1320	34.0 Grs. AL-5	FLITE-MAX #6
		12 GA. 2 3/4" REMINGTON EXPRESS & SHUR-SHOT	
1 1/2	1110	32.0 Grs. AL-8	FLITE-MAX #1
1 3/8	1250	29.0 Grs. AL-7	FLITE-MAX #1 or #2
1 1/4	1320	32.0 Grs. AL-7	FLITE-MAX #3
1 1/4	1290	29.0 Grs. AL-5	FLITE-MAX #3
1 1/8	1330	30.0 Grs. AL-5	FLITE-MAX #4
1 1/8	1135	20.0 Grs. AL-120	FLITE-MAX #5
1	1320	24.0 Grs. AL-120	FLITE-MAX #6
		12 GA. 2 3/4" REMINGTON TARGET	
1 3/8	1205	27.5 Grs. AL-7	FLITE-MAX #1
1 1/4	1250	28.0 Grs. AL-7	FLITE-MAX #1
1 1/4	1260	27.0 Grs. AL-5	FLITE-MAX #2
1 1/8	1360	30.0 Grs. AL-5	FLITE-MAX #3
1 1/8	1180	19.0 Grs. AL-120	FLITE-MAX #3
1	1325	22.0 Grs. AL-120	FLITE-MAX #4
1	1275	21.0 Grs. AL-120	FLITE-MAX #4
		12 GA. 2 3/4" REMINGTON TARGET	
1 1/4	1215	28.0 Grs. AL-5	UNISLEVE "A"
1 1/8	1225	20.0 Grs. AL-120	UNISLEVE "A"
1 1/8	1215	20.0 Grs. GREEN DOT	UNISLEVE "A"
1 1/8	1200	18.0 Grs. RED DOT	UNISLEVE "A"
1 1/8	1205	18.0 Grs. 700-X	UNISLEVE "A"
1	1350	22.0 Grs. AL-120	UNISLEVE "A"
		12 GA. 2 3/4" REMINGTON ALL-AMERICAN	
1 3/8	1205	27.0 Grs. AL-7	FLITE-MAX #1
1 1/4	1240	27.5 Grs. AL-7	FLITE-MAX #1
1 1/4	1245	26.5 Grs. AL-5	FLITE-MAX #2
1 1/8	1350	29.5 Grs. AL-5	FLITE-MAX #3
1 1/8	1170	18.5 Grs. AL-120	FLITE-MAX #3
1	1315	21.5 Grs. AL-120	FLITE-MAX #4
1	1260	20.5 Grs. AL-120	FLITE-MAX #4

12 GAUGE LOADS WITH "FLITE-MAX" AND "UNISLEVE" WADS

Shot Wt.	Muzzle Velocity Ft./Sec.	Powder Charge and Shell Type	Wad Column
		12 GA. 2 3/4" REMINGTON ALL-AMERICAN	
1 1/4	1225	27.5 Grs. AL-5	UNISLEVE "A"
1 1/8	1215	19.5 Grs. AL-120	UNISLEVE "A"
1 1/8	1215	19.5 Grs. GREEN DOT	UNISLEVE "A"
1	1335	21.5 Grs. AL-120	UNISLEVE "A"
		12 GA. 3" WIN-WESTERN POLY FORMED	
1 7/8	1120	37.0 Grs. AL-8	FLITE-MAX #1
1 3/4	1135	39.0 Grs. AL-8	FLITE-MAX #2
1 5/8	1215	39.0 Grs. AL-8	FLITE-MAX #3
1 1/2	1250	35.0 Grs. AL-7	FLITE-MAX #4
1 3/8	1335	36.0 Grs. AL-7	FLITE-MAX #5
1 1/4	1310	35.0 Grs. AL-5	FLITE-MAX #6
		12 GA. 2 3/4" WIN-WEST. POLY FORMED	
1 1/4	1350	33.0 Grs. AL-7	FLITE-MAX #1
1 1/4	1320	31.0 Grs. AL-5	FLITE-MAX #1
1 1/8	1315	24.0 Grs. AL-120	FLITE-MAX #3
1	1330	25.0 Grs. AL-120	FLITE-MAX #4
		12 GA. 3" WIN-WEST. POLY FORMED	
1 3/4	1190	39.0 Grs. AL-8	UNISLEVE "A"
1 5/8	1205	39.0 Grs. AL-8	UNISLEVE "A"
1 3/8	1290	36.0 Grs. AL-7	UNISLEVE "B"
		12 GA. 2 3/4" WIN-WEST. POLY FORMED	
1 1/4	1290	33.0 Grs. AL-7	UNISLEVE "A"
1 1/4	1295	32.0 Grs. AL-5	UNISLEVE "A"
1 1/8	1265	24.0 Grs. AL-120	UNISLEVE "A"
1 1/8	1175	22.0 Grs. AL-120	UNISLEVE "A"
		12 GA. 2 3/4" WIN-WEST. AA & (*SUPER-X SUPER-SPEED PLASTIC)	
1 3/8	1240	38.0 Grs. AL-8	FLITE-MAX #1
1 3/8	1210	29.0 Grs. AL-7	FLITE-MAX #3
1 1/4	1310	40.0 Grs. AL-8	FLITE-MAX #1
1 1/4	1325	31.0 Grs. AL-7	FLITE-MAX #4
1 1/4	1195	28.0 Grs. AL-5	FLITE-MAX #4
1 1/8	1245	29.0 Grs. AL-5	FLITE-MAX #5
1 1/8	1205	21.0 Grs. AL-120	FLITE-MAX #5
1 1/8	1145	20.0 Grs. AL-120	FLITE-MAX #5
1	1280	22.0 Grs. AL-120	FLITE-MAX #5
		12 GA. 2 3/4" WIN-WEST. AA & (*SUPER-X—SUPER-SPEED PLASTIC)	
1 3/8	1275	30.0 Grs. AL-7	UNISLEVE "A"
1 1/4	1215	28.0 Grs. AL-5	UNISLEVE "B"
1 1/8	1245	22.0 Grs. AL-120	UNISLEVE "B"
1 1/8	1145	20.0 Grs. AL-120	UNISLEVE "B"
1 1/8	1215	20.0 Grs. GREEN DOT	UNISLEVE "B"
1 1/8	1195	18.0 Grs. RED DOT	UNISLEVE "B"
1 1/8	1205	18.0 Grs. 700-X	UNISLEVE "B"
1	1320	23.0 Grs. AL-120	UNISLEVE "B"

*Shells of current manufaoture with reduced internal wall taper.

ALCAN 12 GAUGE BUCKSHOT RECOMMENDATIONS

Shell: 2¾" ALCAN—FEDERAL PLASTIC (Paper Base Wad)
Crimp Type: As Shown Roll with .040" Over Shot Wad

Load	Powder & Charge Weight		Wad Column	Pellets Per Layer	Crimp	Muzzle Velocity (Ft/Sec)
10 Pellets #000	AL-7	37 Grs.	PGS+⅝" FBS	2	R	1315
8 Pellets #000	AL-5	39 Grs.	AW+5/16" FBS	2	R	1485
12 Pellets #00	AL-7	36 Grs.	PGS+½" FBS	3	R	1300
12 Pellets #00	AL-7	34 Grs.	PGS+½" FBS	3	F	1280
12 Pellets #00	AL-7	35 Grs.	FLITE-MAX E w/ 16 Ga. .070"	2	R	1260
10 Pellets #00	AL-7	37 Grs.	FLITE MAX #2	2	R	1400
9 Pellets #00	AL-5	34 Grs.	AW+½" FBS	3	F	1400
9 Pellets #00	AL-5	36 Grs.	AW+5/16"+5/16" FBS	3	R	1420
9 Pellets #00	AL-120	29 Grs.	AW+½" FBS	3	R	1410
15 Pellets #0	AL-7	37 Grs.	PGS+5/16" FBS	3	R	1270
15 Pellets #0	AL-8	40 Grs.	FLITE-MAX E w/ 16 Ga. .070"	3	R	1275
12 Pellets #0	AL-5	32 Grs.	FLITE-MAX #3	3	F	1340
12 Pellets #0	AL-5	33 Grs.	FLITE-MAX #4	3	R	1300
12 Pellets #0	AL-5	34 Grs.	AW+5/16" FBS	3	F	1315
12 Pellets #0	AL-5	35 Grs.	AW+⅜" FBS	3	R	1325
16 Pellets #1	AL-7	35 Grs.	PGS+½" FBS	4	R	1265
16 Pellets #1	AL-7	33 Grs.	PGS+5/16" FBS	4	F	1230
15 Pellets #1	AL-5	35 Grs.	FLITE-MAX #2	3	R	1340
12 Pellets #1	AL-120	30 Grs.	FLITE-MAX #3	3	R	1455
41 Pellets #4	AL-8	41 Grs.	PGS+5/16" FBS	*	R	1200
34 Pellets #4	AL-7	35 Grs.	FLITE-MAX #1	**	R	1300
34 Pellets #4	AL-7	33 Grs.	AW+5/16" FBS	*	F	1245
34 Pellets #4	AL-7	34 Grs.	AW+½" FBS	*	R	1230
27 Pellets #4	AL-5	34 Grs.	PGS+5/16"+5/16" FBS	*	F	1350
27 Pellets #4	AL-5	34 Grs.	AW+⅜" FBS	*	F	1365
27 Pellets #4	AL-5	36 Grs.	PGS+⅜"+⅜" FBS	*	R	1370
29 Pellets #4	AL-7	39 Grs.	FLITE-MAX #3	**	R	1430

*7 per layer, except top layer with 6.
**Nest Pellets in Layers as Shown.
For 29: 6, 6, 6, 5, 6
For 34: 6, 6, 6, 5, 6, 5

APPENDIX 1 (cont'd)

ANSWERS

1

1. A
2. Discard the case.
3. Either the primer pocket has dirt in it or you're using the wrong primer.
4. Various brands and styles of cases have varying capacities. A powder charge that might be right for one case may be far too high for another.
5. False
6. You've either dropped too much shot, a double charge of powder, or used too long a wad cup.
7. You've either failed to drop powder or have used too short a wad cup.

SHOTSHELL-TARGET

12 GAUGE TRAP AND SKEET RELOADING DATA that complies with A.T.A. and N.S.S.A. Ammunition Regulations

Nominal 12 Gauge Skeet Loads–1145 F/S and 1200 F/S–1⅛ oz. No. 8 or 9 Shot
Nominal 12 Gauge Trap Loads–1145 F/S and 1200 F/S–1⅛ oz. No. 7½ or 8 Shot

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Target (Plastic Covered Base Wad)-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	17.0	REM	"Power Piston"* W29924	1150	9500
REMINGTON	97★	"HI-SKOR" 700-X	17.0	REM	"Power Piston" W29928	1145	8800
REMINGTON	97★	"HI-SKOR" 700-X	18.5	REM	"Power Piston" W29928	1215	9700
REMINGTON	97★	"HI-SKOR" 700-X	17.5	REM	"Power Piston" W23694	1150	8700
REMINGTON	97★	"HI-SKOR" 700-X	18.5	REM	"Power Piston" W23694	1205	9600
REMINGTON	97★	"HI-SKOR" 700-X	18.5	REM	"Power Piston" W23676	1215	9600
REMINGTON	97★	"HI-SKOR" 700-X	17.5	REM	Post Wad W23618	1155	8800
REMINGTON	97★	"HI-SKOR" 700-X	18.5	REM	Post Wad W23618	1205	9700
WINCHESTER	209	PB	20.5	REM	"Power Piston" W29928	1140	7200
WINCHESTER	209	PB	21.0	REM	"Power Piston" W23694	1155	6800
WINCHESTER	209	PB	22.0	REM	"Power Piston" W23694	1200	7700
WINCHESTER	209	PB	21.0	REM	"Power Piston" W23676	1145	6800
WINCHESTER	209	PB	22.0	REM	"Power Piston" W23676	1195	7400
WINCHESTER	209	PB	21.0	REM	"Power Piston" W29926	1155	7000
WINCHESTER	209	PB	22.0	REM	"Power Piston" W29926	1205	7600
WINCHESTER	209	PB	20.5	REM	Post Wad W23618	1140	7200
WINCHESTER	209	SR 7625	22.5	REM	"Power Piston" W29928	1140	6500
WINCHESTER	209	SR 7625	24.0	REM	"Power Piston" W29928	1195	7000
WINCHESTER	209	SR 7625	22.5	REM	"Power Piston" W23694	1135	6500
WINCHESTER	209	SR 7625	24.0	REM	"Power Piston" W23694	1200	7100
WINCHESTER	209	SR 7625	24.0	REM	"Power Piston" W23676	1200	6800
WINCHESTER	209	SR 7625	22.5	REM	Post Wad W23618	1135	6700
WINCHESTER	209	SR 7625	23.5	REM	Post Wad W23618	1190	7400
REGISTERED TRADEMARK OF REM ARMS CO., BPT., CONN							
SHELL: REMINGTON-PETERS 2¾ in. "All American" (Solid Plastic Base Wad)-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	16.5	REM	"Power Piston" W29924	1140	9400
REMINGTON	97★	"HI-SKOR" 700-X	16.5	REM	"Power Piston" W29928	1140	9000
REMINGTON	97★	"HI-SKOR" 700-X	18.0	REM	"Power Piston" W29928	1200	9800
REMINGTON	97★	"HI-SKOR" 700-X	17.0	REM	"Power Piston" W23694	1150	9100
REMINGTON	97★	"HI-SKOR" 700-X	18.0	REM	"Power Piston" W23694	1195	9700
REMINGTON	97★	"HI-SKOR" 700-X	18.0	REM	"Power Piston" W23676	1205	9900
REMINGTON	97★	"HI-SKOR" 700-X	16.5	REM	Post Wad W23618	1160	9500
REMINGTON	97★	"HI-SKOR" 700-X	18.0	REM	Post Wad W23618	1200	10300
WINCHESTER	209	PB	20.0	REM	"Power Piston" W29928	1135	7100
WINCHESTER	209	PB	20.5	REM	"Power Piston" W23694	1150	7300
WINCHESTER	209	PB	21.5	REM	"Power Piston" W23694	1200	8000
WINCHESTER	209	PB	20.5	REM	"Power Piston" W23676	1155	7500
WINCHESTER	209	PB	21.5	REM	"Power Piston" W23676	1205	8000
WINCHESTER	209	PB	20.5	REM	"Power Piston" W29926	1150	7000
WINCHESTER	209	PB	21.5	REM	"Power Piston" W29926	1195	7800
WINCHESTER	209	PB	20.0	REM	Post Wad W23618	1135	7100
WINCHESTER	209	SR 7625	21.5	REM	"Power Piston" W29928	1145	7000
WINCHESTER	209	SR 7625	23.0	REM	"Power Piston" W29928	1210	7700
WINCHESTER	209	SR 7625	22.0	REM	"Power Piston" W23694	1155	6800
WINCHESTER	209	SR 7625	23.0	REM	"Power Piston" W23694	1195	7500
WINCHESTER	209	SR 7625	23.5	REM	"Power Piston" W23676	1210	7700
WINCHESTER	209	SR 7625	21.5	REM	Post Wad W23618	1150	7300
WINCHESTER	209	SR 7625	22.5	REM	Post Wad W23618	1195	7800

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12 GAUGE TRAP AND SKEET RELOADING DATA that complies with A.T.A. and N.S.S.A. Ammunition Regulations (Cont'd.)

Nominal 12 Gauge Skeet Loads–1145 F S and 1200 F S–1⅛ oz. No. 8 or 9 Shot
Nominal 12 Gauge Trap Loads–1145 F S and 1200 F S–1⅛ oz. No. 7½ or 8 Shot

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: ALCAN 2¾ in. Paper Target-Fold Crimp							
ALCAN	220 "Max Fire"	"HI-SKOR" 700-X	18.0	ALCAN	"Flite Max" No. 5	1150	8800
ALCAN	220 "Max Fire"	"HI-SKOR" 700-X	19.5	ALCAN	"Flite Max" No. 5	1210	9900
ALCAN	220 "Max Fire"	PB	21.5	ALCAN	"Flite Max" No. 5	1150	7800
ALCAN	220 "Max Fire"	PB	23.0	ALCAN	"Flite Max" No. 5	1200	8600
ALCAN	220 "Max Fire"	SR 7625	24.0	ALCAN	"Flite Max" No. 5	1145	6400
ALCAN	220 "Max Fire"	SR 7625	25.0	ALCAN	"Flite Max" No. 5	1200	7000
REGISTERED TRADEMARKS OF ALCAN COMPANY, INC., ALTON, ILL.							
SHELL: FEDERAL 2¾ in. Paper Target-Fold Crimp							
FEDERAL	209	"HI-SKOR" 700-X	18.0	FED	⅞ in. "Pellet Protector"	1150	9000
FEDERAL	209	"HI-SKOR" 700-X	19.0	FED	⅞ in. "Pellet Protector"	1190	9700
FEDERAL	209	PB	22.0	FED	⅞ in. "Pellet Protector"	1145	6900
FEDERAL	209	PB	23.5	FED	⅞ in. "Pellet Protector"	1200	7600
FEDERAL	209	SR 7625	24.5	FED	⅞ in. "Pellet Protector"	1155	5600
FEDERAL	209	SR 7625	25.5	FED	⅞ in. "Pellet Protector"	1200	6200
REGISTERED TRADEMARK OF FEDERAL CARTRIDGE CORP., MINN., MINN.							
SHELL: WINCHESTER-WESTERN 2¾ in. Plastic Double A Target-Fold Crimp							
WINCHESTER	209	"HI-SKOR" 700-X	17.0	WIN	"WAA" 12	1140	9600
WINCHESTER	209	"HI-SKOR" 700-X	18.5	WIN	"WAA" 12	1195	10300
WINCHESTER	209	PB	21.0	WIN	"WAA" 12	1140	7400
WINCHESTER	209	PB	22.5	WIN	"WAA" 12R	1205	8600
WINCHESTER	209	SR 7625	22.5	WIN	"WAA" 12	1155	7600
WINCHESTER	209	SR 7625	23.5	WIN	"WAA" 12	1205	8400
REGISTERED TRADEMARK OF OLIN MATHIESON CHEMICAL CORP., EAST ALTON, ILL.							

12 GAUGE INTERNATIONAL TRAP RELOADING DATA that complies with A.T.A. Modified Clay Pigeon Ammunition Regulations

Nominal Load–1220 F S–1¼ oz. No. 7, 7½ or No. 8 Shot

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Target (Plastic Covered Base Wad)-Fold Crimp							
WINCHESTER	209	PB	23.5	REM	Power Piston W29926	1220	10100
WINCHESTER	209	SR 7625	24.5	REM	Power Piston W29926	1220	8900

(Cont'd next page)

Data shown were obtained under controlled conditions; to be assured of the ballistic *results* as listed in this 1968–1969 Guide, you must comply, exactly, with each and every listed *condition* that produced these results. In effect, these data as presented in the shotshell section are a "recipe", to be followed without deviation to achieve the stated ballistic level. The values shown may vary substantially if different component combinations and/or techniques are employed.

APPENDIX 2 (cont'd)

12 GAUGE INTERNATIONAL TRAP RELOADING DATA that complies with A.T.A. Modified Clay Pigeon Ammunition Regulations (Cont'd.)

Nominal Load–1220 F/S–1¼ oz. No. 7, 7½ or No. 8 Shot

PRIMER MFR.	PRIMER NO.	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. "All American" (Solid Plastic Base Wad)-Fold Crimp							
WINCHESTER	209	PB	22.5	REM.	"Power Piston" W29926	1220	10000
WINCHESTER	209	SR 7625	24.0	REM.	"Power Piston" W29926	1215	9000
SHELL: REMINGTON-PETERS 2¾ in. Plastic Field (Both High and Low Brass)-Fold Crimp							
ALCAN	G57F	PB	24.0	REM.	"Power Piston" W29928	1210	9600
ALCAN	G57F	PB	24.0	REM.	"Power Piston" W23694	1210	9500
ALCAN	G57F	PB	24.0	REM.	"Power Piston" W23676	1210	9400
ALCAN	G57F	PB	23.5	REM.	Post Wad W23618	1205	9900
ALCAN	G57F	SR 7625	25.0	REM.	"Power Piston" W29928	1210	8500
ALCAN	G57F	SR 7625	25.5	REM.	"Power Piston" W23694	1220	9000
ALCAN	G57F	SR 7625	25.0	REM.	"Power Piston" W23676	1215	8600
ALCAN	G57F	SR 7625	24.5	REM.	Post Wad W23618	1205	9200
SHELL: ALCAN 2¾ in. Paper Target-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	21.0	REM.	"Power Piston" W23694	1215	10200
ALCAN	220 "Max-Fire"	PB	25.0	ALCAN	"Flite-Max" No 4	1225	10200
ALCAN	220 "Max-Fire"	SR 7625	26.5	ALCAN	"Flite-Max" No 4	1225	8400
SHELL: FEDERAL 2¾ in. Paper Target-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	21.0	FED.	⅞ in. "Pellet Protector"	1220	10500
FEDERAL	209	PB	25.5	ALCAN	"Flite-Max" No 4	1225	9900
FEDERAL	209	SR 7625	27.0	ALCAN	"Flite-Max" No 4	1220	7800
SHELL: FEDERAL 2¾ in. Plastic Field (Both High and Low Brass–Paper Base Wad)-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	21.0	FED.	⅞ in. "Pellet Protector"	1215	10100
FEDERAL	209	PB	25.5	ALCAN	"Flite-Max" No 4	1230	9600
FEDERAL	209	SR 7625	27.0	ALCAN	"Flite-Max" No 4	1230	8200
SHELL: WINCHESTER-WESTERN 2¾ in. Plastic Double A Target-Fold Crimp							
WINCHESTER	209	PB	24.0	REM.	"Power Piston" W23694	1225	9800
WINCHESTER	209	SR 7625	24.0	WIN	"WAA" 12R	1210	9900

20 GAUGE SKEET RELOADING DATA that complies with N.S.S.A. Ammunition Regulations

Nominal 20 Gauge Skeet Load–1200 F/S–⅞ oz. No. 9 Shot

PRIMER MFR.	PRIMER NO.	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Target (Solid Plastic Base Wad)-Fold Crimp							
*REMINGTON	97★	"HI-SKOR" 700-X	14.5	REM. S.A.C.	H & 28 Ga., 7/16 in. Sacork	1180	10400
WINCHESTER	209	PB	16.5	S.A.C.	Sacdome & ⅜ in. Sacork	1190	9800
WINCHESTER	209	SR 7625	16.0	REM.	"Power Piston" W23678	1195	10200
REMINGTON	97★	SR 4756	21.5	REM.	H & 5/16 in. Felt	1205	9600

*REM. .050 in. Card Wad over shot. Roll Crimp to 2.5 in. overall length

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20 GAUGE SKEET RELOADING DATA that complies with N.S.S.A. Ammunition Regulations (Cont'd.)

Nominal 20 Gauge Skeet Load–1200 F/S–⅞ oz. No. 9 Shot

PRIMER MFR.	PRIMER NO.	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: FEDERAL 2¾ in. Paper Target-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	15.0	REM.	"Power Piston" W29942	1210	10500
FEDERAL	209	PB	17.0	REM.	"Power Piston" W29942	1195	9600
FEDERAL	209	SR 7625	18.0	REM.	"Power Piston" W29942	1190	8300
FEDERAL	209	SR 4756	22.0	REM.	"Power Piston" W29942	1190	7800
SHELL: WINCHESTER-WESTERN 2¾ in. Plastic Double A Target-Fold Crimp							
REMINGTON	97★	"HI-SKOR" 700-X	15.0	REM. S.A.C.	H & .050 Card & 28 Ga., ½ in. Sacork	1185	10200
WINCHESTER	209	PB	16.5	REM.	"Power Piston" W29942	1210	10500
WINCHESTER	209	SR 7625	17.5	REM.	"Power Piston" W29942	1205	8800
WINCHESTER	209	SR 4756	21.5	REM.	"Power Piston" W29944	1220	8700

28 GAUGE SKEET RELOADING DATA that complies with N.S.S.A. Ammunition Regulations

Nominal 28 Gauge Skeet Load–1200 F/S–¾ oz. No. 9 Shot

PRIMER MFR.	PRIMER NO.	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Target-Fold Crimp							
REMINGTON	69	"HI-SKOR" 700-X	16.0	REM. S.A.C.	.135 in. Card & 5/16 in. & 3/16 in. Sacork	1195	9700
REMINGTON	69	PB	15.0	REM.	"Power Piston" W23680	1200	9500
REMINGTON	69	SR 7625	16.0	REM.	"Power Piston" W23680	1195	8300
REMINGTON	57★	SR 4756	20.0	REM.	.135 in. Card & REM. ¼ in. & 3/16 in. Felt	1215	8300
SHELL: FEDERAL 2¾ in. Paper Target-Fold Crimp							
WINCHESTER	209	PB	15.5	REM. S.A.C.	.050 in. Card & 5/16 in. & ⅜ in. Sacork	1190	9700
WINCHESTER	209	SR 7625	15.5	REM. S.A.C.	.135 in. Card & 5/16 in. & 5/16 in. Sacork	1195	9200
FEDERAL	209	SR 4756	19.0	REM.	.135 in. Card & 3/16 in. & 3/16 in. Felt	1215	9200
SHELL: WINCHESTER-WESTERN 2¾ in. Paper Target-Fold Crimp							
CASCADE	109	PB	15.5	REM. S.A.C.	.050 in. Card & 5/16 in. & ½ in. Sacork	1190	10000
WINCHESTER	209	SR 7625	16.5	REM. S.A.C.	.135 in. Card & ½ in. Sacork	1205	10300
WINCHESTER	209	SR 4756	19.0	REM.	.135 in. Card & 3/16 in. & 3/16 in. Felt	1215	9200

Du Pont registered trademark

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.410 BORE SKEET RELOADING DATA that complies with N.S.S.A. Ammunition Regulations

Nominal 410 Bore Skeet Load–1200 F/S–½ oz No 9 Shot

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR	WAD COLUMN TYPE	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2½ in. Plastic Target-Fold Crimp							
REMINGTON	69	IMR 4227	18.0	REM	1/16 in. & 1/8 in. Felt	1205	8400(A)
REMINGTON	69	IMR 4227	19.0.	REM	1/16 in. & 1/8 in. Felt	1200	9300(B)
SHELL: FEDERAL 2½ in. Paper Target-Fold Crimp							
FEDERAL	209	IMR 4198	23.0	REM	1/8 in. Felt	1205	9400(A)
FEDERAL	209	IMR 4198	23.0	REM	1/8 in. Felt	1190	9300(B)
SHELL: WINCHESTER-WESTERN 2½ in. Paper Target-Fold Crimp							
WINCHESTER	209	IMR 4227	18.5	S.A.C. REM	1/8 in. Sacork & .050 in. Card	1200	10500(A)
WINCHESTER	209	IMR 4227	19.0	S.A.C.	3/16 in. Sacork	1220	10500(B)

(A) For 2½ in. chamber (B) For 3 in. chamber

SHOTSHELL-FIELD

10 GAUGE FIELD RELOADING DATA

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR	WAD COLUMN TYPE	SHOT (OZ.)	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON 2⅞ in. Plastic–.050 in. Card Wad Over Shot Roll Crimp to 2.675 in. Overall Length								
REMINGTON	57★	"HI-SKOR" 700-X	24.5	ALCAN REM.	"PGS"* & .135 in. Card & 3/8 in. & 3/8 in. Felt	1¼	1195	8300
ALCAN	G57F	PB	33.0	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. Felt	1¼	1295	7100
ALCAN	G57F	PB	37.0	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. Felt	1¼	1425	9300
REMINGTON	57★	"HI-SKOR" 700-X	25.5	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. Felt	1⅜	1200	9500
ALCAN	G57F	PB	34.0	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. Felt	1⅜	1305	9200
ALCAN	G57F	SR 7625	40.0	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. Felt	1⅜	1410	9400
ALCAN	G57F	PB	31.0	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. Felt	1½	1190	9000
ALCAN	G57F	SR 7625	37.0	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. Felt	1½	1305	9400
ALCAN	G57F	SR 7625	42.0	REM	.135 in. Card & 3/8 in. Felt & .050 in. Card	1½	1425	10200

REGISTERED TRADEMARK OF ALCAN COMPANY INC., ALTON, ILL.

*Du Pont registered trademark

Data shown were obtained under controlled conditions: to be assured of the ballistic results as listed in this 1968–1969 Guide, you must comply, exactly, with each and every listed condition that produced these results. In effect, these data as presented in the shotshell section are a "recipe", to be followed without deviation to achieve the stated ballistic level. The values shown may vary substantially if different component combinations and or techniques are employed.

10 GAUGE FIELD RELOADING DATA (Cont'd.)

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR	WAD COLUMN TYPE	SHOT (OZ.)	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON 2⅞ in. Plastic–.050 in. Card Wad Over Shot Roll Crimp to 2.675 in. Overall Length								
ALCAN	G57F	PB	32.5	ALCAN REM.	"PGS" & 1/8 in. & 3/16 in. Felt	1⅜	1210	10100
ALCAN	G57F	SR 7625	37.5	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. Felt	1⅜	1295	10200
CASCADE	157	SR 7625	42.0	ALCAN REM.	"PGS" & 12 Ga., ½ in. Mold-Tite	1⅜	1390	10400
ALCAN	G57F	SR 7625	35.0	ALCAN REM.	"PGS" & .050 in. Card & 3/8 in. Felt	1⅜	1210	9900
CASCADE	157	SR 7625	38.5	ALCAN REM.	"PGS" & 12 Ga., ½ in. Mold-Tite	1⅜	1290	10400
REM.	57★	SR 4756	41.0	ALCAN REM.	"PGS" & .135 in. Card & ¼ in. Felt	1⅞	1215	9700
REM.	57★	SR 4756	41.0	ALCAN REM.	"PGS" & 3/8 in. Felt	2	1200	10000
SHELL: REMINGTON 3½ in. Plastic–.050 in. Card Wad Over Shot Roll Crimp to 3.25 in. Overall Length								
REM.	57★	"HI-SKOR" 700-X	30.0	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. & 1/4 in. & 1/4 in. Felt	1½	1210	10000
ALCAN	G57F	PB	38.5	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. & 3/8 in. Felt	1½	1300	10000
ALCAN	G57F	SR 7625	45.5	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. & 3/8 in. Felt	1½	1395	9300
ALCAN	G57F	PB	36.0	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. & 1/4 in. Felt	1⅝	1195	8800
ALCAN	G57F	SR 7625	43.0	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. & 1/4 in. Felt	1⅝	1310	8900
ALCAN	G57F	SR 7625	47.0	ALCAN REM.	"PGS" & 3/8 in. & 3/8 in. & 1/4 in. Felt	1⅝	1390	10300
ALCAN	G57F	PB	37.5	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. & 1/4 in. Felt	1¾	1205	10200
ALCAN	G57F	SR 7625	44.5	ALCAN REM.	"PGS" & 3/8 in. & 1/4 in. & 1/4 in. Felt	1¾	1310	10300
ALCAN	G57F	SR 7625	49.0	ALCAN REM.	"PGS" & 12 Ga., ½ in. Mold-Tite & 10 Ga. 3/8 in. Felt	1¾	1385	10200
ALCAN	G57F	SR 7625	41.0	ALCAN REM.	"PGS" & 1/4 in. & 1/4 in. & 1/4 in. Felt	1⅞	1220	9900
ALCAN	G57F	SR 7625	47.0	ALCAN REM.	"PGS" & 12 Ga. ½ in. Mold-Tite & 10 Ga. 3/8 in. Felt	1⅞	1320	10100
ALCAN	G57F	SR 7625	42.0	ALCAN REM.	"PGS" & 12 Ga. ½ in. Mold-Tite & 10 Ga. 3/8 in. Felt	2	1210	9800
ALCAN	G57F	SR 7625	46.0	ALCAN REM.	"PGS" & 12 Ga. ½ in. & 1/4 in. Mold-Tite	2	1285	10100
ALCAN	G57F	SR 7625	43.5	ALCAN REM.	"PGS" & 12 Ga. ½ in. & 1/4 in. Mold-Tite	2⅛	1210	10100

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APPENDIX 2 (cont'd)

12 GAUGE FIELD RELOADING DATA

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR	WAD COLUMN TYPE	SHOT (OZ.)	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Target (Plastic Covered Base Wad)-Fold Crimp								
REMINGTON	97★	"HI-SKOR" 700-X	16.0	REM	Power Piston W29922	1	1105	6800
REMINGTON	97★	"HI-SKOR" 700-X	15.5	REM	Power Piston W29924	1	1100	7800
WINCHESTER	209	PB	19.0	REM	Power Piston W29922	1	1085	5200
WINCHESTER	209	PB	19.0	REM	Power Piston W29924	1	1105	5700
WINCHESTER	209	PB	20.0	REM	Power Piston W29928	1	1105	4900
WINCHESTER	209	PB	20.0	REM	Power Piston W23694	1	1095	4800
WINCHESTER	209	PB	20.0	REM	Post Wad W23618	1	1105	5500
WINCHESTER	209	SR 7625	21.5	REM	Power Piston W29922	1	1095	5100
WINCHESTER	209	SR 7625	21.5	REM	Power Piston W29924	1	1100	5400
WINCHESTER	209	SR 7625	21.5	REM	Post Wad W23618	1	1095	5400
REMINGTON	97★	"HI-SKOR" 700-X	18.0	REM	Power Piston W29922	1	1200	7800
REMINGTON	97★	"HI-SKOR" 700-X	17.5	REM	Power Piston W29924	1	1200	8500
REMINGTON	97★	"HI-SKOR" 700-X	18.0	REM	Post Wad W23618	1	1205	8300
WINCHESTER	209	PB	21.0	REM	Power Piston W29924	1	1200	6800
WINCHESTER	209	PB	22.0	REM	Power Piston W29928	1	1190	5600
WINCHESTER	209	PB	22.0	REM	Power Piston W23694	1	1195	5700
WINCHESTER	209	PB	22.0	REM	Post Wad W23618	1	1205	6300
WINCHESTER	209	SR 7625	23.5	REM	Power Piston W29924	1	1205	6600
WINCHESTER	209	SR 7625	23.5	REM	Power Piston W29928	1	1200	5800
WINCHESTER	209	SR 7625	23.5	REM	Power Piston W23694	1	1190	5800
WINCHESTER	209	SR 7625	24.0	REM	Post Wad W23618	1	1200	6100
REMINGTON	97★	"HI-SKOR" 700-X	20.0	REM	Power Piston W29922	1	1305	9100
REMINGTON	97★	"HI-SKOR" 700-X	19.5	REM	Power Piston W29924	1	1295	9500
REMINGTON	97★	"HI-SKOR" 700-X	20.0	REM	Post Wad W23618	1	1295	9500
WINCHESTER	209	PB	23.5	REM	Power Piston W29924	1	1300	8100
WINCHESTER	209	PB	24.5	REM	Power Piston W23694	1	1305	7000
WINCHESTER	209	PB	24.5	REM	Power Piston W23676	1	1300	7000
WINCHESTER	209	PB	24.5	REM	Post Wad W23618	1	1300	7300
WINCHESTER	209	SR 7625	25.5	REM	Power Piston W29924	1	1305	7500
WINCHESTER	209	SR 7625	26.5	REM	Power Piston W29928	1	1290	6500
WINCHESTER	209	SR 7625	26.5	REM	Power Piston W23694	1	1300	6800
WINCHESTER	209	SR 7625	26.5	REM	Power Piston W23676	1	1295	6700
WINCHESTER	209	SR 7625	26.5	REM	Post Wad W23618	1	1290	7000
REMINGTON	97★	"HI-SKOR" 700-X	22.0	REM	Power Piston W29928	1	1385	10500
REMINGTON	97★	"HI-SKOR" 700-X	22.0	REM	Power Piston W23694	1	1390	10400
WINCHESTER	209	PB	26.0	REM	Power Piston W29924	1	1410	10000
WINCHESTER	209	PB	27.0	REM	Power Piston W23694	1	1400	8300
WINCHESTER	209	PB	27.0	REM	Power Piston W23676	1	1400	8200
WINCHESTER	209	SR 7625	29.5	REM	Power Piston W23694	1	1415	8000
WINCHESTER	209	SR 7625	29.5	REM	Power Piston W23676	1	1405	7700
WINCHESTER	209	SR 7625	28.5	REM	Post Wad W23618	1	1400	8200
REMINGTON	97★	"HI-SKOR" 700-X	16.0	REM	Power Piston W29924	1⅛	1105	8600
REMINGTON	97★	"HI-SKOR" 700-X	16.0	REM	Power Piston W29928	1⅛	1100	8200
REMINGTON	97★	"HI-SKOR" 700-X	16.5	REM	Power Piston W23694	1⅛	1110	8200
REMINGTON	97★	"HI-SKOR" 700-X	16.5	REM	Post Wad W23618	1⅛	1115	8200
WINCHESTER	209	PB	19.5	REM	Power Piston W29924	1⅛	1105	7100
WINCHESTER	209	PB	20.0	REM	Power Piston W29928	1⅛	1110	6600
WINCHESTER	209	PB	20.0	REM	Power Piston W23694	1⅛	1095	5900
WINCHESTER	209	PB	20.0	REM	Power Piston W23676	1⅛	1105	6400
WINCHESTER	209	PB	19.5	REM	Post Wad W23618	1⅛	1090	6400
WINCHESTER	209	SR 7625	21.5	REM	Power Piston W29924	1⅛	1090	6400
WINCHESTER	209	SR 7625	21.5	REM	Power Piston W29928	1⅛	1110	6200
WINCHESTER	209	SR 7625	21.5	REM	Power Piston W23694	1⅛	1100	6100

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12 GAUGE FIELD RELOADING DATA (Cont'd.)

PRIMER MFR.	PRIMER NO.	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	SHOT (OZ.)	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Target (Plastic Covered Base Wad)-Fold Crimp								
WINCHESTER	209	SR 7625	21.5	REM.	Post Wad W23618	1⅛	1090	6200
WINCHESTER	209	PB	24.5	REM.	"Power Piston" W23694	1⅛	1290	9500
WINCHESTER	209	PB	24.5	REM.	"Power Piston" W29926	1⅛	1300	9000
WINCHESTER	209	SR 7625	26.5	REM.	"Power Piston" W29928	1⅛	1300	8200
WINCHESTER	209	SR 7625	26.5	REM.	"Power Piston" W23694	1⅛	1295	8500
WINCHESTER	209	SR 7625	27.0	REM.	"Power Piston" W23676	1⅛	1300	7800
WINCHESTER	209	SR 7625	29.5	REM.	"Power Piston" W23676	1⅛	1400	9200
WINCHESTER	209	SR 7625	29.5	REM.	"Power Piston" W29926	1⅛	1410	9600
WINCHESTER	209	SR 7625	27.0	REM.	"Power Piston" W29926	1¼	1305	10500
WINCHESTER	209	SR 4756	37.0	REM.	H & 3/16 in. Felt	1¼	1400	10500
WINCHESTER	209	SR 7625	25.5	REM.	"Power Piston" W29926	1⅜	1205	9500
WINCHESTER	209	SR 4756	32.0	REM.	H & 3/16 in. Felt	1⅜	1205	9000
WINCHESTER	209	SR 4756	35.5	REM.	H & ⅛ in. Felt	1⅜	1310	10300
WINCHESTER	209	SR 4756	33.0	REM.	H & ⅛ in. Felt	1½	1215	10000
SHELL: REMINGTON-PETERS 2¾ in. "All American" (Solid Plastic Base Wad)-Fold Crimp								
REMINGTON	97★	"HI-SKOR" 700-X	15.5	REM.	"Power Piston" W29922	1	1100	7400
REMINGTON	97★	"HI-SKOR" 700-X	15.0	REM.	"Power Piston" W29924	1	1090	7400
WINCHESTER	209	PB	19.0	REM.	"Power Piston" W29922	1	1095	5600
WINCHESTER	209	PB	19.0	REM.	"Power Piston" W29924	1	1110	6200
WINCHESTER	209	PB	19.0	REM.	"Power Piston" W29928	1	1115	5900
WINCHESTER	209	PB	19.0	REM.	"Power Piston" W23694	1	1105	5700
WINCHESTER	209	PB	19.0	REM.	Post Wad W23618	1	1120	6200
WINCHESTER	209	SR 7625	21.0	REM.	"Power Piston" W29922	1	1110	5800
WINCHESTER	209	SR 7625	20.5	REM.	"Power Piston" W29924	1	1110	6000
WINCHESTER	209	SR 7625	20.5	REM.	Post Wad W23618	1	1095	5600
REMINGTON	97★	"HI-SKOR" 700-X	17.5	REM.	"Power Piston" W29922	1	1215	8700
REMINGTON	97★	"HI-SKOR" 700-X	17.0	REM.	"Power Piston" W29924	1	1190	8600
REMINGTON	97★	"HI-SKOR" 700-X	17.5	REM.	Post Wad W23618	1	1215	8400
WINCHESTER	209	PB	21.0	REM.	"Power Piston" W29924	1	1210	7300
WINCHESTER	209	PB	21.0	REM.	"Power Piston" W29928	1	1195	6500
WINCHESTER	209	PB	21.5	REM.	"Power Piston" W23694	1	1205	6500
WINCHESTER	209	PB	21.0	REM.	Post Wad W23618	1	1215	7200
WINCHESTER	209	SR 7625	22.5	REM.	"Power Piston" W29924	1	1195	6700
WINCHESTER	209	SR 7625	23.0	REM.	"Power Piston" W29928	1	1200	6500
WINCHESTER	209	SR 7625	23.0	REM.	"Power Piston" W23694	1	1200	6500
WINCHESTER	209	SR 7625	22.5	REM.	Post Wad W23618	1	1210	6200
REMINGTON	97★	"HI-SKOR" 700-X	19.5	REM.	"Power Piston" W29922	1	1300	9900
REMINGTON	97★	"HI-SKOR" 700-X	19.0	REM.	"Power Piston" W29924	1	1290	9900
REMINGTON	97★	"HI-SKOR" 700-X	19.5	REM.	Post Wad W23618	1	1300	10000
WINCHESTER	209	PB	23.0	REM.	"Power Piston" W29924	1	1300	8200
WINCHESTER	209	PB	24.0	REM.	"Power Piston" W23694	1	1300	7800
WINCHESTER	209	PB	24.0	REM.	"Power Piston" W23676	1	1305	7400
WINCHESTER	209	PB	23.5	REM.	Post Wad W23618	1	1310	8300
WINCHESTER	209	SR 7625	24.5	REM.	"Power Piston" W29924	1	1295	7800
WINCHESTER	209	SR 7625	25.0	REM.	"Power Piston" W29928	1	1290	7300

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(Cont'd. next page)

Data shown were obtained under controlled conditions. to be assured of the ballistic results as listed in this 1968-1969 Guide you must comply, exactly, with each and every listed condition that produced these results. In effect, these data as presented in the shotshell section are a "recipe", to be followed without deviation to achieve the stated ballistic level. The values shown may vary substantially if different component combinations and or techniques are employed

12 GAUGE FIELD RELOADING DATA (Cont'd.)

PRIMER MFR	PRIMER NO	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	SHOT (OZ.)	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. "All American" (Solid Plastic Base Wad)-Fold Crimp								
WINCHESTER	209	SR 7625	25.0	REM	"Power Piston" W23694	1	1300	7400
WINCHESTER	209	SR 7625	25.0	REM	"Power Piston" W23676	1	1285	7300
WINCHESTER	209	SR 7625	25.0	REM	Post Wad W23618	1	1305	7600
WINCHESTER	209	PB	25.5	REM	"Power Piston" W29924	1	1410	10100
WINCHESTER	209	PB	26.5	REM	"Power Piston" W23694	1	1415	9100
WINCHESTER	209	PB	26.5	REM	"Power Piston" W23676	1	1410	8900
WINCHESTER	209	SR 7625	28.5	REM	"Power Piston" W23694	1	1425	8900
WINCHESTER	209	SR 7625	28.5	REM	"Power Piston" W23676	1	1405	8100
WINCHESTER	209	SR 7625	27.5	REM	Post Wad W23618	1	1410	8900
REMINGTON	97★	"HI-SKOR" 700-X	15.5	REM	"Power Piston" W29924	1⅛	1090	8700
REMINGTON	97★	"HI-SKOR" 700-X	15.5	REM	"Power Piston" W29928	1⅛	1085	8100
REMINGTON	97★	"HI-SKOR" 700-X	16.0	REM	"Power Piston" W23694	1⅛	1105	8300
REMINGTON	97★	"HI-SKOR" 700-X	16.0	REM	Post Wad W23618	1⅛	1110	8700
WINCHESTER	209	PB	19.0	REM	"Power Piston" W29924	1¼	1110	7400
WINCHESTER	209	PB	19.0	REM	"Power Piston" W29928	1¼	1090	6700
WINCHESTER	209	PB	19.5	REM	"Power Piston" W23694	1¼	1110	6700
WINCHESTER	209	PB	19.5	REM	"Power Piston" W23676	1¼	1115	7000
WINCHESTER	209	PB	19.0	REM	Post Wad W23618	1¼	1110	7200
WINCHESTER	209	SR 7625	20.5	REM	"Power Piston" W29924	1¼	1115	7200
WINCHESTER	209	SR 7625	20.5	REM	"Power Piston" W29928	1¼	1110	6500
WINCHESTER	209	SR 7625	21.0	REM	"Power Piston" W23694	1¼	1095	6600
WINCHESTER	209	SR 7625	20.5	REM	Post Wad W23618	1¼	1100	6800
WINCHESTER	209	PB	24.0	REM	"Power Piston" W23694	1⅛	1305	10000
WINCHESTER	209	PB	24.0	REM	"Power Piston" W29926	1⅛	1305	9900
WINCHESTER	209	SR 7625	26.0	REM	"Power Piston" W29928	1⅛	1300	8800
WINCHESTER	209	SR 7625	25.5	REM	"Power Piston" W23694	1⅛	1305	8800
WINCHESTER	209	SR 7625	26.0	REM	"Power Piston" W23676	1⅛	1300	8600
WINCHESTER	209	SR 7625	28.5	REM	"Power Piston" W23676	1⅛	1400	10300
WINCHESTER	209	SR 7625	28.0	REM	"Power Piston" W29926	1⅛	1405	10400
WINCHESTER	209	SR 7625	26.0	REM	"Power Piston" W29926	1¼	1280	10300
WINCHESTER	209	SR 7625	24.0	REM	"Power Piston" W29926	1⅜	1195	10400
SHELL: REMINGTON-PETERS 2¾ in. Plastic Field. (Both High and Low Brass)-Fold Crimp								
ALCAN	G57F	PB	19.0	REM	"Power Piston" W29922	1	1100	5000
ALCAN	G57F	SR 7625	22.0	REM	"Power Piston" W29922	1	1095	5000
ALCAN	G57F	PB	22.0	REM	"Power Piston" W29922	1	1205	6200
ALCAN	G57F	SR 7625	24.0	REM	"Power Piston" W29922	1	1200	5900
ALCAN	G57F	PB	24.5	REM	"Power Piston" W29922	1	1300	7500
ALCAN	G57F	PB	24.5	REM	"Power Piston" W29924	1	1305	7800
ALCAN	G57F	SR 7625	26.5	REM	"Power Piston" W29922	1	1305	6800
ALCAN	G57F	PB	27.5	REM	"Power Piston" W29922	1	1405	9100
ALCAN	G57F	PB	27.0	REM	"Power Piston" W29924	1	1400	9500
ALCAN	G57F	PB	27.5	REM	Post Wad W23618	1	1405	9200
ALCAN	G57F	SR 7625	29.5	REM	"Power Piston" W29922	1	1405	8000
ALCAN	G57F	SR 7625	29.5	REM	"Power Piston" W29924	1	1400	8000
REMINGTON	57★	"HI-SKOR" 700-X	16.5	REM	"Power Piston" W29922	1⅛	1110	8000
ALCAN	G57F	PB	20.0	REM	"Power Piston" W29922	1⅛	1105	6500
ALCAN	G57F	PB	19.5	REM	"Power Piston" W29924	1⅛	1100	6800
ALCAN	G57F	SR 7625	22.0	REM	"Power Piston" W29922	1⅛	1100	6000
REMINGTON	57★	"HI-SKOR" 700-X	18.5	REM	"Power Piston" W29922	1⅛	1195	9400
REMINGTON	57★	"HI-SKOR" 700-X	18.5	REM	"Power Piston" W29924	1⅛	1195	9600
ALCAN	G57F	PB	22.5	REM	"Power Piston" W29922	1¼	1195	7600
ALCAN	G57F	PB	22.5	REM	"Power Piston" W29924	1¼	1205	8100
ALCAN	G57F	PB	22.5	REM	Post Wad W23618	1¼	1200	7600

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12 GAUGE FIELD RELOADING DATA (Cont'd.)

PRIMER MFR.	PRIMER NO.	DU PONT POWDER DESIGNATION	DU PONT POWDER GRAINS	WAD COLUMN MFR.	WAD COLUMN TYPE	SHOT (OZ.)	MUZZLE VELOCITY (FT/SEC)	CHAMBER PRESSURE (PSI)
SHELL: REMINGTON-PETERS 2¾ in. Plastic Field. (Both High and Low Brass)-Fold Crimp								
ALCAN	G57F	SR 7625	25.0	REM.	"Power Piston" W29922	1⅛	1210	7000
ALCAN	G57F	SR 7625	24.0	REM.	"Power Piston" W29924	1⅛	1200	7200
ALCAN	G57F	SR 7625	24.0	REM.	Post Wad W23618	1⅛	1205	6900
ALCAN	G57F	PB	25.0	REM.	"Power Piston" W29924	1⅛	1300	9700
ALCAN	G57F	PB	25.0	REM.	"Power Piston" W29928	1⅛	1300	9000
ALCAN	G57F	PB	25.5	REM.	Post Wad W23618	1⅛	1300	9300
ALCAN	G57F	SR 7625	28.0	REM.	"Power Piston" W29922	1⅛	1305	7800
ALCAN	G57F	SR 7625	27.0	REM.	"Power Piston" W29924	1⅛	1310	8800
ALCAN	G57F	SR 7625	27.0	REM.	Post Wad W23618	1⅛	1300	8000
ALCAN	G57F	PB	28.5	REM.	"Power Piston" W23694	1⅛	1400	10400
ALCAN	G57F	SR 7625	30.0	REM.	"Power Piston" W29928	1⅛	1415	10500
ALCAN	G57F	SR 7625	30.5	REM.	"Power Piston" W23694	1⅛	1410	9500
ALCAN	G57F	SR 7625	30.0	REM.	Post Wad W23618	1⅛	1400	9700
ALCAN	G57F	SR 7625	27.5	REM.	"Power Piston" W29928	1¼	1295	10200
ALCAN	G57F	SR 7625	27.5	REM.	"Power Piston" W23694	1¼	1295	10400
ALCAN	G57F	SR 7625	27.5	REM.	"Power Piston" W23676	1¼	1290	9700
REMINGTON	57★	SR 4756	38.5	REM.	H & ⅜ in. Felt	1¼	1410	10500
ALCAN	G57F	SR 7625	26.0	REM.	"Power Piston" W23676	1⅜	1200	9400
ALCAN	G57F	SR 7625	26.0	REM.	"Power Piston" W29926	1⅜	1210	9500
REMINGTON	57★	SR 4756	36.0	REM.	H & ¼ in. Felt	1⅜	1300	9900
REMINGTON	57★	SR 4756	33.0	REM.	H & $^{3}/_{16}$ in. Felt	1½	1210	10000
SHELL: REMINGTON-PETERS 3 in. Plastic—Fold Crimp								
ALCAN	G57F	SR 7625	33.5	REM.	"Power Piston" W29922	1¼	1415	10100
ALCAN	G57F	SR 7625	27.0	REM.	"Power Piston" W29922	1⅜	1200	8000
ALCAN	G57F	SR 7625	30.5	REM.	"Power Piston" W29922	1⅜	1300	10100
REMINGTON	57★	SR 4756	41.0	REM.	H & ¼ in. & $^{3}/_{16}$ in. Felt	1⅜	1395	10300
ALCAN	G57F	SR 7625	28.0	REM.	"Power Piston" W29922	1½	1200	9400
ALCAN	G57F	SR 7625	28.0	REM.	"Power Piston" W29924	1½	1210	10400
REMINGTON	57★	SR 4756	38.0	REM.	H & $^{3}/_{16}$ in. & $^{3}/_{16}$ in. Felt	1½	1300	10100
REMINGTON	57★	SR 4756	34.5	REM.	"Power Piston" W29928	1⅝	1205	9100
REMINGTON	57★	SR 4756	34.0	REM.	"Power Piston" W23694	1⅝	1205	9400
REMINGTON	57★	SR 4756	34.5	REM.	Post Wad W23618	1⅝	1210	9700
REMINGTON	57★	SR 4756	35.5	REM.	"Power Piston" W23676	1¾	1215	10400
REMINGTON	57★	SR 4756	35.5	REM.	"Power Piston" W29926	1¾	1215	10500

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Data shown were obtained under controlled conditions. To be assured of the ballistic results as listed in this 1968-1969 Guide, you must comply exactly with each and every listed condition that produced these results. In effect, these data as presented in the shotshell section are a "recipe" to be followed without deviation to achieve the stated ballistic level. The values shown may vary substantially if different component combinations and/or techniques are employed.

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0-20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Grams)	Shot Container	Charge Weight in Grains For: Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
12 Gauge Federal Paper Target 2¾" Length	Federal No. 209	2¼	1⅛	Federal Champion	17.0	19.0	—	—	1150
				Winchester-Western White AA	17.0	19.0	—	—	
				Alcan Unisleeve B	17.0	19.5	—	—	
				Alcan Flite Max 5	17.0	19.0	—	—	
				Alcan Flite Max 6	17.0	19.0	—	—	
				Pacific Verelite Red	17.0	19.0	—	—	
				Fordwad Yelo	17.0	19.0	—	—	
				Sullivan Variwad (L)	17.5	19.5	—	—	
				R&K Plastic Ind. T	17.0	19.0	—	—	
		3	1⅛	Federal Champion	18.0	20.0	20.0	—	1200
				Remington Power Piston W23694	18.0	20.0	—	—	
				Remington Power Piston W29924	—	20.0	—	—	
				Winchester-Western White AA	18.0	20.0	20.0	—	
				Alcan Unisleeve B	18.0	20.5	20.0	—	
				Alcan Flite Max 6	18.5	20.0	20.5	—	
				Pacific Verelite Red	18.0	20.0	20.0	—	
				Fordwad Yelo	18.0	20.0	20.0	—	
				Sullivan Variwad (L)	19.0	21.0	20.0	—	
				R & K Plastic Ind. T	18.0	20.0	—	—	
		3¼	1¼	Federal Champion	—	21.5	22.0	—	1220
				Winchester-Western White AA	—	—	22.0	—	
				Alcan Unisleeve B	—	21.5	22.0	—	
				Pacific Verelite Red	—	21.5	22.0	—	
				Fordwad Yelo	—	21.5	22.0	—	
		3	1	Remington Power Piston W29922	20.0	22.0	—	—	1300
				Alcan Flite Max 5	20.0	22.0	—	—	
		3	1¼	Federal Champion	19.0	21.0	21.5	—	1165
				Remington Power Piston W23694	—	21.0	—	—	
				Remington Power Piston W29924	—	—	21.5	—	
				Alcan Unisleeve B	—	—	21.5	—	
				Alcan Flite Max 3	—	21.0	—	—	
				Alcan Flite Max 4	—	—	21.5	—	
				Winchester-Western White AA	—	—	21.5	—	
				Pacific Verelite Red	—	—	21.5	—	
				Pacific Verelite Blue	—	21.0	—	—	
				Fordwad Yelo	—	—	21.5	—	
		3¼	1⅛	Federal Champion	20.0	22.0	—	—	1255
				Remington Power Piston W29924	—	22.0	—	—	
				Winchester-Western White AA	—	22.0	—	—	
				Alcan Unisleeve B	—	22.0	—	—	
				Alcan Flite Max 5	—	22.0	23.5	—	
				Pacific Verelite Red	—	22.0	—	—	
				Fordwad Yelo	20.0	—	23.5	—	
				Sullivan Variwad (L)	20.0	23.0	24.0	—	
		3¼	1¼	Federal Champion	—	—	25.5	—	1330
				Remington Power Piston W23676	—	—	—	30.0	
				Remington Power Piston W23694	—	—	25.5	—	
				Remington Power Piston W29924	—	—	25.5	—	
				Remington Power Piston W29926	—	—	—	31.0	
				Alcan Unisleeve A	—	—	—	29.5	
				Winchester-Western Red AA	—	—	—	31.0	
				Pacific Verelite Green	—	—	—	30.0	
				Pacific Verelite Blue	—	—	—	29.5	
12 Gauge Federal Plastic Game 2¾" Length	Federal No. 209	2¼	1⅛	Winchester-Western White AA	—	19.5	—	—	1150
				Alcan Unisleeve B	—	19.5	—	—	
				Alcan Flite Max 5	18.0	20.0	—	—	
				Alcan Flite Max 6	—	—	21.0	—	
				Fordwad Yelo	18.0	20.0	—	—	
				Sullivan Variwad (L)	18.0	19.5	—	—	
		3	1⅛	Federal Champion	—	21.0	—	—	1200
				Winchester-Western White AA	19.0	21.0	—	—	
				Alcan Unisleeve B	—	21.0	—	—	
				Alcan Flite Max 5	19.0	21.0	—	—	
				Alcan Flite Max 6	—	—	21.5	—	
				Pacific Verelite Red	—	21.0	—	—	
				Fordwad Yelo	19.0	21.0	21.5	—	
				Sullivan Variwad (L)	19.0	21.0	—	—	
		3¼	1¼	Federal Champion	—	22.5	22.5	—	1220
				Remington Power Piston W29924	—	22.5	—	—	
				Remington Power Piston W29928	—	22.5	—	—	

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0-20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Grams)	Shot Container	Charge Weight in Grains For: Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
12 Gauge Federal Plastic Game 2¾" Length	Federal No. 209	3¼	1¼	Winchester-Western White AA	—	22.5	22.5	—	1220
				Alcan Unisleeve B	—	22.5	22.5	—	
				Alcan Flite Max 5	—	22.5	22.5	—	
				Alcan Flite Max 6	—	—	22.5	—	
				Pacific Verelite Red	—	22.5	22.5	—	
				Fordwad Yelo	—	—	22.5	—	
		3	1	Alcan Flite Max 5	21.0	23.0	—	—	1300
		3	1¼	Federal Champion	19.0	21.5	—	—	1165
				Remington Power Piston W29924	19.0	—	—	—	
				Winchester-Western White AA	—	21.5	22.0	—	
				Alcan Unisleeve B	19.0	21.5	22.0	—	
				Pacific Verelite Red	19.0	21.5	—	—	
				Fordwad Yelo	—	—	22.0	—	
				Sullivan Variwad (L)	19.5	22.0	23.0	—	
		3¼	1⅛	Federal Champion	21.0	23.0	—	—	1255
				Winchester-Western White AA	20.5	23.0	—	—	
				Alcan Unisleeve B	20.5	23.0	—	—	
				Alcan Flite Max 5	—	23.0	24.0	—	
				Pacific Verelite Red	20.5	23.0	—	—	
				Fordwad Yelo	20.5	—	24.0	—	
				Sullivan Variwad (L)	20.5	23.0	24.0	—	
		3¾	1¼	Pacific Verelite Red	—	—	—	30.0	1330
				Pacific Verelite Green	—	—	—	30.5	
12 Gauge Federal Plastic Game 3" Length	Federal No. 209	4	1⅜	Remington Power Piston W23694	—	—	—	33.0	1315
				Winchester-Western Red AA	—	—	—	33.0	
		4	1½	Winchester-Western Red AA	—	—	—	37.0	1315
12 Gauge Remington-Peters Plastic All American Target 2¾" Length	Remington No. 97★	2¼	1⅛	Remington Power Piston W23694	17.0	19.0	—	—	1150
				Remington Power Piston W29924	17.0	19.0	—	—	
				Remington Power Piston W29926	17.0	19.0	—	—	
				Winchester-Western Red AA	17.0	19.0	—	—	
				Alcan Unisleeve A	17.0	—	—	—	
				Alcan Flite Max 2	—	18.5	—	—	
				Alcan Flite Max 3	—	19.0	—	—	
				Pacific Verelite Green	17.0	19.0	—	—	
				Sullivan Variwad (M)	17.0	18.5	—	—	
		3●	1⅛	Remington Power Piston W23694	18.0	20.0	—	—	1200
				Remington Power Piston W29924	—	20.0	20.0	—	
				Remington Power Piston W29926	18.5	20.0	—	—	
				Federal Champion	—	—	20.0	—	
				Winchester-Western Red AA	18.0	20.0	—	—	
				Alcan Flite Max 1	—	20.0	—	—	
				Alcan Flite Max 4	—	—	20.0	—	
				Pacific Verelite Green	18.5	20.0	—	—	
				Sullivan Variwad (M)	18.0	20.0	—	—	
		3¼	1¼	Remington Power Piston W29926	—	20.5	21.0	—	1220
				Sullivan Variwad (M)	—	20.5	—	—	
		3	1	Remington Power Piston W29922	20.0	21.0	23.0	—	1300
				Sullivan Variwad (M)	19.0	21.0	—	—	
		3	1¼	Remington Power Piston W23694	18.0	20.0	21.0	—	1165
				Remington Power Piston W29926	18.0	21.5	—	—	
				Winchester-Western Red AA	18.0	20.0	21.0	—	
				Alcan Unisleeve A	—	20.0	21.0	—	
				Alcan Flite Max 1	—	21.0	—	—	
				Alcan Flite Max 2	—	—	20.0	—	
				Pacific Verelite Green	—	20.0	21.0	—	
				Pacific Verelite Blue	—	—	21.0	—	
		3¼	1⅛	Remington Power Piston W23694	—	22.0	23.0	—	1255
				Winchester-Western Red AA	—	22.0	23.0	—	
				Alcan Unisleeve A	—	22.0	23.0	—	
				Alcan Flite Max 3	—	—	23.0	—	
				Pacific Verelite Green	—	22.0	23.0	—	
				Sullivan Variwad (M)	—	22.0	—	—	
12 Gauge Remington Plastic Shur Shot Peters Plastic Victor 2¾" Length	Remington No. 57★	2¾	1⅛	Remington Power Piston W23694	—	20.0	—	—	1150
				Remington Power Piston W29924	18.0	20.0	—	—	
				Federal Champion	18.0	20.0	—	—	
				Winchester-Western White AA	18.0	20.0	—	—	
				Alcan Unisleeve B	18.0	20.0	—	—	
				Alcan Flite Max 5	18.0	—	—	—	
				Pacific Verelite Red	18.0	20.0	—	—	
				Sullivan Variwad (L)	18.0	20.0	—	—	

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0 20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Ounces)	Shot Container	Charge Weight in Grains For: Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
12 Gauge Remington Plastic Shur Shot Peters Plastic Victor 2¾ Length	Remington No. 57★	3	1⅛	Remington Power Piston W29924	19.5	22.0	21.0	–	1200
				Federal Champion	19.5	22.0	21.0	–	
				Winchester-Western White AA	19.5	21.5	21.0	–	
				Alcan Unisleeve B	19.5	–	21.0	–	
				Alcan Flite Max 5	19.5	–	–	–	
				Pacific Verelite Red	19.5	22.0	21.0	–	
				Fordwad Telo	–	–	21.0	–	
		3¼	1¼	Remington Power Piston W23676	20.5	23.0	–	–	1220
				Remington Power Piston W23694	–	23.0	22.5	–	
				Remington Power Piston W29924	20.5	23.0	22.0	–	
				Remington Power Piston W29926	21.0	23.0	–	–	
				Winchester-Western Red AA	20.5	23.0	22.5	–	
				Alcan Unisleeve A	–	23.0	–	–	
				Pacific Verelite Blue	–	23.0	22.0	–	
				Pacific Verelite Green	–	23.0	–	–	
				Sullivan Variwad (S)	–	–	22.5	–	
				Sullivan Variwad (M)	–	23.0	–	–	
		3	1	Remington Power Piston W29922	21.0	23.5	24.0	–	1300
				Remington Power Piston W29924	21.0	–	24.0	–	
				Remington Power Piston W29928	21.0	–	–	–	
				Federal Champion	21.0	–	–	–	
				Winchester-Western White AA	21.0	–	–	–	
				Alcan Unisleeve B	21.0	–	–	–	
				Alcan Flite Max 4	21.0	–	–	–	
				Alcan Flite Max 5	21.0	23.0	24.0	–	
				Alcan Flite Max 6	21.0	–	–	–	
		3	1⅛	Remington Power Piston W23694	19.0	21.5	22.0	–	1165
				Remington Power Piston W29922	19.5	–	22.0	–	
				Winchester-Western Red AA	19.0	21.5	–	–	
				Alcan Unisleeve A	19.0	21.5	22.0	–	
				Alcan Flite Max 2	–	21.0	–	–	
				Alcan Flite Max 4	–	–	22.0	–	
				Pacific Verelite Blue	19.0	21.5	–	–	
				Pacific Verelite Green	–	–	22.0	–	
				Sullivan Variwad (M)	19.0	–	22.0	–	
		3¼	1¼	Remington Power Piston W23694	21.5	24.0	23.5	–	1255
				Remington Power Piston W29924	–	–	23.5	–	
				Federal Champion	21.0	23.5	23.5	–	
				Winchester-Western White AA	–	–	23.5	–	
				Pacific Verelite Red	21.0	24.0	–	–	
				Sullivan Variwad (M)	21.5	–	–	–	
12 Gauge Remington Plastic Express Peters Plastic High Velocity 2¾ Length	Remington No. 57★	3	1	Remington Power Piston W29922	21.5	–	–	–	1300
				Alcan Flite Max 4	21.5	23.5	24.0	–	
		3	1⅛	Remington Power Piston W23694	19.5	–	–	–	1165
				Remington Power Piston W29924	–	–	22.0	–	
				Remington Power Piston W29926	–	21.5	–	–	
				Winchester-Western Red AA	19.5	21.5	–	–	
				Alcan Flite Max 2	–	21.5	–	–	
				Alcan Flite Max 3	19.5	–	–	–	
				Alcan Flite Max 4	–	–	22.0	–	
				Pacific Verelite Blue	19.5	21.5	–	–	
				Pacific Verelite Green	–	–	22.0	–	
				Sullivan Variwad(L)	19.5	–	22.0	–	
		3¼	1⅛	Remington Power Piston W23694	21.5	24.0	–	–	1255
				Remington Power Piston W29924	–	–	24.0	–	
				Federal Champion	–	–	24.0	–	
				Winchester-Western White AA	–	–	24.0	–	
				Winchester-Western Red AA	21.5	24.0	–	–	
				Alcan Unisleeve B	21.0	–	24.0	–	
				Alcan Flite Max 2	–	–	–	–	
				Alcan Flite Max 3	–	24.0	–	–	
				Alcan Flite Max 5	–	–	24.0	–	
				Pacific Verelite Red	–	–	24.0	–	
				Pacific Verelite Green	21.5	–	–	–	
				Sullivan Variwad(L)	21.5	–	–	–	
		3½	1⅛	Remington Power Piston W29926	–	–	26.0	32.0	1330
				Winchester-Western Red AA	–	–	26.0	32.5	

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0.20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Ounces)	Shot Container	Charge Weight in Grains For: Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
12 Gauge Remington Plastic Express Peters Plastic High Velocity 3 Length	Remington No. 57★	4	1⅛	Remington Power Piston W23694	–	–	–	33.0	1315
				Winchester-Western Red AA	–	–	–	33.0	
12 Gauge Winchester-Western Plastic AA Target 2¾ Length	Winchester No. 209	2¾	1⅛	Winchester-Western White AA	18.5	21.5	–	–	1150
				Alcan Unisleeve B	18.5	21.5	–	–	
				Pacific Verelite Red	18.5	22.5	–	–	
				Sullivan Variwad (L)	18.5	–	–	–	
		3	1⅛	Winchester-Western White AA	20.0	22.5	23.5	–	1200
				Alcan Unisleeve B	19.5	22.5	22.0	–	
				Pacific Verelite Red	20.0	–	23.5	–	
				Fordwad Yelo	19.5	–	–	–	
				Sullivan Variwad (L)	19.5	–	–	–	
		3¼	1¼	Winchester-Western White AA	21.5	–	–	–	1220
				Winchester-Western Red AA	–	–	23.5	–	
				Federal Champion	21.5	–	–	–	
				Remington Power Piston W29926	22.0	–	–	–	
				Remington Power Piston W23694	–	24.0	–	–	
				Alcan Unisleeve A	–	23.5	–	–	
				Pacific Verelite Blue	–	23.5	–	–	
				Pacific Verelite Green	–	24.0	–	–	
				Sullivan Variwad (S)	–	–	23.0	–	
12 Gauge Winchester Paper Ranger Western Paper Xpert 2¾ Length	Winchester No. 209	2¾	1⅛	Winchester-Western Red AA	17.5	20.0	–	–	1150
				Federal Champion	17.5	–	–	–	
				Remington Power Piston W23694	17.5	19.5	–	–	
				Remington Power Piston W29924	17.5	–	–	–	
				Alcan Flite Max 1	17.0	19.0	–	–	
				Pacific Verelite Green	18.0	19.0	–	–	
				R & K Plastic Ind. T	18.0	19.0	–	–	
		3	1⅛	Winchester-Western Red AA	19.0	21.0	–	–	1200
				Remington Power Piston W23676	19.0	21.0	–	–	
				Remington Power Piston W23694	19.0	21.0	–	–	
				Remington Power Piston W29924	19.0	–	–	–	
				Alcan Flite Max 1	18.0	20.0	–	–	
				Pacific Verelite Green	19.0	21.0	–	–	
12 Gauge Winchester Plastic Ranger Western Plastic Xpert 2¾ Length	Winchester No. 209	2¾	1⅛	Winchester-Western Red AA	18.0	21.5	–	–	1150
				Alcan Unisleeve A	–	21.5	–	–	
				Alcan Flite Max 3	–	21.5	–	–	
				Alcan Flite Max 4	18.0	21.5	–	–	
				Pacific Verelite Green	18.0	21.5	–	–	
				Sullivan Variwad (M)	18.5	21.5	–	–	
		3	1⅛	Winchester-Western Red AA	20.0	23.0	–	–	1200
				Remington Power Piston W23694	20.0	–	–	–	
				Alcan Unisleeve A	20.0	23.0	–	–	
				Alcan Flite Max 3	–	23.0	–	–	
				Alcan Flite Max 4	20.0	23.0	–	–	
				Pacific Verelite Green	20.0	23.0	–	–	
				Sullivan Variwad (M)	20.0	–	–	–	
		3¼	1¼	Remington Power Piston W29926	21.5	–	–	–	1220
				Alcan Unisleeve A	22.0	–	–	–	
		3	1¼	Winchester-Western Red AA	20.0	–	23.0	–	1165
				Remington Power Piston W29926	–	–	23.0	–	
				Alcan Unisleeve A	20.0	–	23.0	–	
				Alcan Flite Max 2	–	–	23.0	–	
				Pacific Verelite Blue	–	–	23.0	–	
		3¼	1⅛	Winchester-Western Red AA	22.0	–	26.0	–	1255
				Remington Power Piston W23694	–	–	26.0	–	
				Alcan Flite Max 2	22.0	–	–	–	
				Pacific Verelite Green	22.0	–	25.0	–	
				Sullivan Variwad (M)	22.0	–	–	–	
12 Gauge Winchester Plastic Super Speed Western Plastic Super X 2¾ Length	Winchester No. 209	3½	1⅛	Winchester-Western White AA	20.0	–	23.0	–	1255
				Federal Champion	20.5	–	23.0	–	
				Alcan Unisleeve B	20.0	–	23.0	–	
				Alcan Flite Max 4	–	–	23.0	–	
				Pacific Verelite Red	20.0	–	23.5	–	
				Sullivan Variwad (M)	–	–	23.0	–	

APPENDIX 3 (cont'd)

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0-20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Grams)	Shot Container	Charge Weight in Grains For: Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
12 Gauge Winchester Plastic Super Speed Western Plastic Super X 2¾" Length	Winchester No. 209	3¾	1¼	Winchester-Western White AA	–	–	26.0	–	1330
				Federal Champion	–	–	25.5	–	
				Alcan Unisleeve B	–	–	26.0	–	
				Pacific Verelite Red	–	–	26.0	–	
		4	1⅛	Winchester-Western Red AA	–	–	27.0	–	1300
12 Gauge CIL Paper Canuck 2¾" Length	CIL No. 4BP	2¾	1⅛	Federal Champion	18.0	20.0	–	–	1150
				Remington Power Piston W29924	–	20.0	–	–	
				Winchester-Western White AA	18.0	20.0	–	–	
				Alcan Unisleeve B	18.0	20.0	–	–	
				Alcan Flite Max 5	–	20.0	21.5	–	
				Alcan Flite Max 6	18.0	–	21.5	–	
				Pacific Verelite Red	18.0	20.0	–	–	
				Fordwad Yelo	18.0	–	–	–	
				Sullivan Variwad (L)	18.0	20.0	21.5	–	
		3	1⅛	Federal Champion	19.5	22.0	–	–	1200
				Remington Power Piston W29924	19.0	22.0	–	–	
				Winchester-Western White AA	19.0	22.0	–	–	
				Alcan Unisleeve B	19.0	22.0	–	–	
				Alcan Flite Max 5	–	22.0	–	–	
				Alcan Flite Max 6	19.0	–	–	–	
				Pacific Verelite Red	19.0	22.0	–	–	
				Fordwad Yelo	19.5	–	–	–	
				Sullivan Variwad (L)	19.5	22.0	–	–	
		3¼	1¼	Remington Power Piston W23694	–	22.0	–	–	1220
				Remington Power Piston W29924	–	22.5	–	–	
				Pacific Verelite Blue	–	22.0	–	–	
				Sullivan Variwad (M)	–	22.0	–	–	
		3	1	Remington Power Piston W29922	–	24.0	–	–	1300
				Alcan Flite Max 5	21.0	–	–	–	
		3	1¼	Federal Champion	20.0	22.0	–	–	1165
				Remington Power Piston W29924	–	22.0	–	–	
				Winchester-Western White AA	–	22.0	22.0	–	
				Alcan Unisleeve B	20.0	22.0	22.0	–	
				Pacific Verelite Red	20.0	22.0	–	–	
				Fordwad Yelo	–	–	22.0	–	
				Sullivan Variwad (L)	20.0	22.0	22.0	–	
		3¼	1⅛	Federal Champion	–	23.5	–	–	1255
				Remington Power Piston W29924	–	23.5	–	–	
				Winchester-Western White AA	–	23.5	–	–	
				Alcan Unisleeve B	–	23.5	–	–	
				Alcan Flite Max 5	–	23.5	24.0	–	
				Pacific Verelite Red	–	23.5	–	–	
				Fordwad Yelo	–	–	24.0	–	
				Sullivan Variwad (L)	–	23.5	24.0	–	
		3¼	1¼	Alcan Unisleeve B	–	–	26.0	–	1330
12 Gauge CIL Plastic Canuck 2¾" Length	CIL No. 4BP	2¾	1⅛	Federal Champion	18.0	20.0	–	–	1150
				Remington Power Piston W29924	–	20.0	–	–	
				Winchester-Western White AA	18.0	20.0	–	–	
				Alcan Unisleeve B	18.0	20.0	–	–	
				Alcan Flite Max 5	18.0	20.0	–	–	
				Alcan Flite Max 6	–	–	20.0	–	
				Pacific Verelite Red	18.0	20.0	–	–	
				Fordwad Yelo	18.0	20.0	–	–	
				Sullivan Variwad (L)	18.0	20.0	–	–	
		3	1⅛	Federal Champion	19.0	21.0	–	–	1200
				Remington Power Piston W29924	–	21.0	–	–	
				Winchester-Western White AA	19.0	21.0	–	–	
				Alcan Unisleeve B	19.0	21.0	–	–	
				Alcan Flite Max 5	19.0	21.0	21.0	–	
				Alcan Flite Max 6	–	–	21.0	–	
				Pacific Verelite Red	19.0	21.0	–	–	
				Fordwad Yelo	19.0	–	–	–	
				Sullivan Variwad (L)	19.0	21.0	21.0	–	
		3¼	1¼	Remington Power Piston W23694	–	22.0	–	–	1220
				Remington Power Piston W29924	–	22.0	–	–	
				Alcan Flite Max 5	–	–	22.0	–	
				Sullivan Variwad (L)	–	–	22.0	–	

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0-20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Grams)	Shot Container	Charge Weight in Grains For: Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
12 Gauge CIL Plastic Canuck 2¾ Length	CIL No. 4BP	3	1	Remington Power Piston W29922	–	23.0	–	–	1300
				Alcan Flite Max 5	21.0	23.0	–	–	
		3	1¼	Federal Champion	19.5	21.5	–	–	1165
				Winchester-Western White AA	–	21.5	22.0	–	
				Alcan Unisleeve B	19.5	21.5	22.0	–	
				Pacific Verelite Red	19.5	21.5	–	–	
				Fordwad Yelo	–	–	22.0	–	
				Sullivan Variwad (L)	19.5	21.5	22.0	–	
		3¼	1⅛	Federal Champion	–	23.0	–	–	1255
				Winchester-Western White AA	–	23.0	–	–	
				Alcan Unisleeve B	–	23.0	–	–	
				Alcan Flite Max 5	–	23.0	24.0	–	
				Pacific Verelite Red	–	23.0	–	–	
				Fordwad Yelo	–	–	24.0	–	
				Sullivan Variwad (L)	–	23.0	24.0	–	
		3¼	1¼	Alcan Unisleeve B	–	–	26.0	30.0	1330
				Alcan Flite Max 3	–	–	–	30.0	
12 Gauge Alcan Paper Target 2¾ Length	Alcan No. 220	2¾	1⅛	Alcan Unisleeve B	18.0	20.0	–	–	1150
				Federal Champion	18.0	20.0	–	–	
				Winchester-Western White AA	18.0	20.0	–	–	
				Pacific Verelite Red	18.0	20.0	–	–	
				Sullivan Variwad (L)	18.5	20.0	–	–	
		3	1⅛	Alcan Unisleeve B	19.0	21.0	–	–	1200
				Federal Champion	19.5	21.0	–	–	
				Winchester-Western White AA	19.0	21.0	–	–	
				Pacific Verelite Red	19.0	21.0	–	–	
				Sullivan Variwad (L)	–	21.0	–	–	
		3¼	1¼	Remington Power Piston W23694	–	22.0	–	–	1220
				Remington Power Piston W29924	–	22.0	–	–	
				Winchester-Western White AA	–	22.0	–	–	
				Pacific Verelite Red	–	22.0	–	–	
				Pacific Verelite Blue	–	22.0	–	–	
				Sullivan Variwad (L)	–	22.0	–	–	
12 Gauge Alcan Plastic 2¾ Length	Alcan No. 220	2¾	1⅛	Alcan Unisleeve B	17.5	19.5	–	–	1150
				Federal Champion	17.5	19.5	–	–	
				Winchester-Western White AA	17.5	19.5	–	–	
				Pacific Verelite Red	17.5	19.5	–	–	
				Fordwad Yelo	17.5	19.0	–	–	
				Sullivan Variwad (L)	17.5	19.5	–	–	
		3	1⅛	Alcan Unisleeve B	19.0	21.0	–	–	1200
				Federal Champion	19.0	20.5	–	–	
				Winchester-Western White AA	19.0	21.0	20.5	–	
				Pacific Verelite Red	19.0	21.0	–	–	
				Fordwad Yelo	19.0	20.5	21.0	–	
				Sullivan Variwad (L)	19.0	21.0	20.5	–	
		3¼	1¼	Alcan Unisleeve B	–	22.5	22.5	–	1220
				Remington Power Piston W23694	–	22.5	–	–	
				Winchester-Western White AA	–	–	22.5	–	
				Pacific Verelite Red	–	22.5	22.5	–	
				Fordwad Yelo	–	–	22.5	–	
		3	1	Alcan Flite Max 5	21.0	22.5	–	–	1300
				Remington Power Piston W29922	–	22.5	–	–	
		3	1¼	Alcan Unisleeve B	18.0	21.0	22.0	–	1165
				Alcan Flite Max 4	–	21.0	–	–	
				Alcan Flite Max 5	18.5	–	–	–	
				Federal Champion	18.0	21.0	–	–	
				Remington Power Piston W29924	–	21.0	–	–	
				Winchester-Western White AA	18.0	–	–	–	
				Pacific Verelite Red	18.0	21.0	–	–	
				Fordwad Yelo	18.0	–	22.0	–	
				Sullivan Variwad (L)	18.5	–	22.0	–	
		3¼	1⅛	Alcan Unisleeve B	20.5	23.0	–	–	1255
				Alcan Flite Max 4	–	22.0	–	–	
				Alcan Flite Max 6	–	–	23.5	–	
				Federal Champion	–	23.0	–	–	
				Remington Power Piston W29924	–	23.0	–	–	
				Winchester-Western White AA	20.5	23.0	–	–	
				Pacific Verelite Red	–	23.0	–	–	
				Fordwad Yelo	21.0	23.0	23.5	–	
				Sullivan Variwad (L)	21.0	23.0	23.5	–	

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad Seating Pressure—0-20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Ounces)	Shot Container	Charge Weight in Grains For				Approx. Velocity (Ft./Sec.)
					Red Dot	Green Dot	Unique	Herco	
12 Gauge Alcan Plastic 2¾" Length	Alcan No. 220	3⅛	1⅛	Alcan Unisleeve B Alcan Flite Max 3 Pacific Verelite Green	– – –	– – –	26.0 – –	– 29.0 30.0	1330
16 Gauge Federal Paper Target 2¾" Length	Federal No. 209	2½	1	Remington Power Piston W29932	14.5	16.5	–	–	1165
		2¾	1⅛	Remington Power Piston W29934	–	17.5	18.0	–	1185
		3	1⅛	Remington Power Piston W29934	–	–	–	22.0	1240
16 Gauge Federal Plastic Game 2¾" Length	Federal No. 209	2⅝	1⅛	Remington Power Piston W29932 Remington Power Piston W29934	– –	18.0 18.0	– 18.5	– –	1185
		3	1⅛	Remington Power Piston W29932 Remington Power Piston W29934	– –	– –	– –	23.0 22.0	1240
		3⅛	1⅛	Remington Power Piston W29934	–	–	–	24.0	1295
16 Gauge Remington Plastic Shur Shot Peters Plastic Victor 2¾" Length	Remington No. 57★	2½	1	Remington Power Piston W29932	15.0	16.5	–	–	1165
		2¾	1⅛	Remington Power Piston W29932 Remington Power Piston W29934	– –	– –	18.0 18.0	– –	1185
		3	1⅛	Remington Power Piston W29934	–	–	–	22.0	1240
16 Gauge Remington Plastic Express Peters Plastic High Velocity 2¾" Length	Remington No. 57★	2¾	1⅛	Remington Power Piston W29932 Remington Power Piston W29934	– –	– –	18.0 18.0	– –	1185
		3	1⅛	Remington Power Piston W29934	–	–	–	22.0	1240
16 Gauge Winchester Plastic Super Speed Western Plastic Super X 2¾" Length	Winchester No. 209	3	1⅛	Remington Power Piston W29932 Remington Power Piston W29934	– –	– –	– –	22.0 22.0	1240
16 Gauge Winchester Plastic Ranger Western Plastic Xpert 2¾" Length	Winchester No. 209	2½	1	Remington Power Piston W29932	–	–	18.0	–	1165
20 Gauge Federal Paper Target 2¾" Length	Federal No. 209	2¾	⅞	Federal Pellet Protector Remington Power Piston W23678 Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – 14.0 – –	– 15.5 – 15.0 15.5	15.5 – 15.0 15.5 –	17.0 – 17.0 17.0 17.0	1155
		Skeet	⅞	Federal Pellet Protector Remington Power Piston W23678 Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – – – –	– 16.0 16.0 16.0 16.0	15.5 – 16.0 16.0 16.0	– – – – –	1200
		2½	1	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – – –	– – – –	16.0 16.0 16.0 16.5	– – – –	1165
		2¾	1	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – – –	– – – –	17.0 17.0 17.0 17.0	– – – –	1220
New 20 Gauge Federal Plastic Target 2¾" Length	Federal No. 209	2¾	⅞	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – 14.0 –	– – 15.0 –	15.5 15.5 15.5 15.5	18.0 18.0 18.0 18.0	1155
		Skeet	⅞	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – – 15.0	– 16.5 16.5 16.5	16.5 16.5 16.5 16.5	19.0 19.0 19.0 19.0	1200
		2½	1	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA	– – –	– – –	16.5 16.5 16.5	– – –	1165
		2¾	1	Remington Power Piston W29944	–	–	–	20.0	1220

SHOTSHELL LOADS
USING SHOT CONTAINERS

Recommended Wad-Seating Pressure—0-20 lbs. Folded Crimp.

Shell	Primer	Dram Equiv.	Shot Wt. (Ounces)	Shot Container	Charge Weight in Grains For				Approx. Velocity (Ft./Sec.)
					Red Dot	Green Dot	Unique	Herco	
20 Gauge Federal Paper Game 2¾" Length	Federal No. 209	2½	⅞	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– 13.5 – 13.5	14.5 14.5 14.5 14.5	15.0 – 15.0 15.0	17.5 – 17.5 17.5	1155
		Skeet	⅞	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – – –	– – 15.5 15.5	16.0 – 16.0 16.0	18.5 18.5 18.5 18.5	1200
		2½	1	Remington Power Piston W23678 Remington Power Piston W29944 Sullivan Variwad (S)	– – –	15.5 – 15.5	16.0 16.0 15.5	18.5 – –	1165
		2¾	1	Remington Power Piston W23678 Sullivan Variwad (S)	– –	– –	– 16.5	19.5 –	1220
20 Gauge Federal Plastic Game 2¾" Length	Federal No. 209	2⅝	⅞	Federal Pellet Protector Winchester-Western AA Sullivan Variwad (L)	– – –	15.5 15.5 15.5	16.0 – –	18.0 18.0 18.0	1155
		Skeet	⅞	Federal Pellet Protector Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – – 13.5	16.5 16.5 16.5 16.5	– – 16.5 16.5	19.0 19.0 19.0 19.0	1200
		2½	1	Federal Pellet Protector Remington Power Piston W29944 Winchester-Western AA Sullivan Variwad (S) Sullivan Variwad (L)	– – – – –	– – – – –	17.0 – 17.0 – 17.0	19.0 19.0 19.0 19.0 –	1165
		2¾	1	Federal Pellet Protector Remington Power Piston W29944 Winchester-Western AA Sullivan Variwad (S) Sullivan Variwad (L)	– – – – –	– – – – –	18.0 – 18.0 – 18.0	20.0 20.0 20.0 20.0 –	1220
20 Gauge Remington-Peters Plastic Target 2¾" Length	Remington No. 97★	2¾	⅞	Remington Power Piston W23678	–	14.0	14.5	–	1155
		Skeet	⅞	Remington Power Piston W23678 Sullivan Variwad (S)	– –	– –	15.5 15.5	– –	1200
20 Gauge Remington Plastic Shur Shot Peters Plastic Victor 2¾" Length	Remington No. 57★	2⅝	⅞	Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– 13.5 –	15.0 15.0 15.0	– 15.0 15.0	– – 17.5	1155
		Skeet	⅞	Remington Power Piston W29942 Winchester-Western AA Sullivan Variwad (L)	– – –	16.0 16.0 16.0	16.0 16.0 16.0	18.0 18.0 18.5	1200
		2½	1	Remington Power Piston W29942	–	–	16.0	–	1165
		2¾	1	Remington Power Piston W23678	–	–	17.0	19.5	1220
20 Gauge Remington Plastic Express Peters Plastic High Velocity 2¾" Length	Remington No. 57★	2½	1	Remington Power Piston W23678 Remington Power Piston W29944 Sullivan Variwad (S)	– – –	15.5 – 15.5	16.0 16.0 15.5	18.5 – –	1165
		2¾	1	Remington Power Piston W23678 Remington Power Piston W29944 Sullivan Variwad (S)	– – –	– – –	– – 16.5	19.5 19.0 –	1220
20 Gauge Winchester-Western Plastic AA Target 2¾" Length	Winchester No. 209	2¾	⅞	Winchester-Western AA Federal Pellet Protector Remington Power Piston W23678 Remington Power Piston W29942 Sullivan Variwad (L)	– – – – 13.5	14.5 14.5 – 15.0 15.0	15.0 – 15.0 – 15.0	17.0 17.0 – – –	1155
		Skeet	⅞	Winchester-Western AA Federal Pellet Protector Remington Power Piston W23678 Remington Power Piston W29942 Sullivan Variwad (S) Sullivan Variwad (L)	– – – 14.0 14.0 –	15.0 15.0 15.5 15.5 – 15.5	16.0 16.0 16.0 16.0 16.0 –	18.0 18.0 – – – –	1200
		2½	1	Sullivan Variwad (S)	–	–	15.5	–	1165
		2¾	1	Sullivan Variwad (S)	–	–	16.0	–	1220
20 Gauge Winchester Plastic Ranger Western Plastic Xpert 2¾" Length	Winchester No. 209	2⅝	⅞	Remington Power Piston W23678	–	15.5	16.0	–	1155
		Skeet	⅞	Remington Power Piston W23678	14.5	16.5	17.0	19.0	1200
		2½	1	Remington Power Piston W23678	–	–	17.0	–	1165
		2¾	1	Winchester-Western AA Remington Power Piston W23678	– –	– 16.5	17.0 18.0	– –	1220

SHOTSHELL LOADS USING SHOT CONTAINERS

Recommended Wad Seating Pressure—0-20 lbs. Folded Crimp

Shell	Primer	Dram Equiv.	Shot Wt. (Ounces)	Shot Container	Charge Weight in Grains For Red Dot	Green Dot	Unique	Herco	Approx. Velocity (Ft./Sec.)
20 Gauge Winchester Plastic Super Speed	Winchester No. 209	2 3/4	1	Remington Power Piston W23678 Remington Power Piston W29942	—	—	18.0 —	— 19.5	1220
Western Plastic Super X 2 3/4" Length		3	1 1/8	Remington Power Piston W23678	—	—	—	20.5	1220
28 Gauge Remington-Peters Plastic 2 3/4" Length	Remington 57*	Skeet	3/4	Remington Power Piston W23680	—	—	15.0	18.0	1200
		2 3/4	3/4	Remington Power Piston W23680	—	—	16.0	—	1295
28 Gauge Winchester-Western Paper 2 3/4" Length	Winchester No. 209	Skeet	3/4	Remington Power Piston W23680	—	—	13.0	—	1200
		2 3/4	3/4	Remington Power Piston W23680	—	—	14.0	—	1295

12-GAUGE BUCKSHOT LOADS USING HERCO POWDER

Recommended Wad Seating Pressure—100 Lbs.

	Shell Length (Inches)	Wadding	Crimp	Charge Weight (Grains)	Approximate Velocity (Feet/Sec.)
#4 BUCK, 27 Pellets					
Federal Plastic Game	2 3/4	H-FELT 1/8 & [illegible]	Rolled	32.0	1350
		H-FELT 1/8	Folded	32.0	1360
Remington Express Plastic	2 3/4	H-FELT 1/8 & 1/4	Rolled	34.0	1340
		H-FELT [illegible]	Folded	34.0	1355
Western SX Paper	2 3/4	H-FELT 1/8	Rolled	34.0	1360
		H-FELT 1/4	Folded	34.0	1375
Western SX Plastic	2 3/4	H-FELT 1/8	Rolled	34.0	1360
		H-FELT 1/4	Folded	32.0	1375
#1 BUCK, 16 Pellets					
Federal Plastic Game	2 3/4	H-FELT 1/8	Rolled	30.0	1260
		H-FELT 1/4	Folded	29.0	1270
Remington Express Plastic	2 3/4	H-FELT 1/4	Rolled	34.0	1295
		H-FELT 1/8	Folded	33.0	1300
Western SX Paper	2 3/4	H-FELT 1/4	Rolled	31.0	1260
Western SX Plastic	2 3/4	H-FELT [illegible]	Rolled	31.0	1290
		H-FELT 1/4	Folded	29.0	1260
0 BUCK, 12 Pellets					
Federal Plastic Game	2 3/4	H-FELT 1/8	Rolled	32.0	1320
		H-FELT 1/4	Folded	31.0	1320
Remington Express Plastic	2 3/4	H-FELT 1/4	Rolled	34.0	1310
Western SX Paper	2 3/4	H-FELT [illegible]	Rolled	33.0	1320
		H-FELT 1/8	Folded	33.0	1330
Western SX Plastic	2 3/4	H-FELT 1/4	Rolled	33.0	1325
		H-FELT 1/8	Folded	32.0	1330
00 BUCK, 9 Pellets					
Federal Plastic Game	2 3/4	H-FELT 1/8 & 1/4 & [illegible]	Rolled	34.0	1370
		H-FELT 1/8 & 1/4	Folded	32.0	1380
Western SX Paper	2 3/4	H-FELT 1/8 & 1/4	Rolled	35.0	1350
		H-FELT 1/4	Folded	33.0	1380
Western SX Plastic	2 3/4	H-FELT 1/8	Rolled	34.0	1380
		H-FELT 1/8	Folded	33.0	1375
Remington Express Plastic	2 3/4	H-FELT 1/8 & 1/4	Rolled	35.0	1370
		H-FELT [illegible]	Folded	35.0	1370
00 BUCK, 12 Pellets					
Federal Plastic Game	2 3/4	H-FELT 1/4	Rolled	34.0	1320
Western SX Paper	2 3/4	H-FELT 1/4	Rolled	35.0	1320
		H-FELT 1/8	Folded	32.0	1290
Western SX Plastic	2 3/4	H-FELT 1/4	Rolled	34.0	1320
Remington Express Plastic	2 3/4	H-FELT 1/8	Rolled	36.0	1350

SHOTSHELL LOADS USING No. 2400

with Fiber or Felt Cushion Wads and Over Powder Wads or Shot Containers as noted. Recommended Wad Seating Pressure—50 lbs. Folded Crimp.

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Ounces)	Wad	Charge Weight (Grains)	Approx. Velocity (Ft./Sec.)
20	Federal 209	3	Federal Plastic Game	Mag.	1 1/8	Over-Powder Plastic and Fiber	41.0	1300
				Mag.	1		42.0	1300
				Mag.	1 1/4		40.0	1250
20	Remington 57*	3	Remington-Peters Plastic Game	Mag.	1 1/8	Over-Powder Plastic and Fiber	39.0	1300
20	Winchester 209	3	Winchester-Western Plastic Game	Mag.	1 1/4	Over-Powder Plastic and Fiber	41.0	1300
				Mag.	1 1/8		42.0	1300
				Mag.	1 1/4		40.0	1250
410	Federal 410	2 1/2	Federal Paper	Skeet	1/2	Over-Powder Card and Fiber Sullivan Solo Wad	16.0 16.5	1200
410	Federal 410	2 1/2	Federal Plastic	Skeet	1/2	Federal Pellet Protector Sullivan Solo Wad	14.5 16.5	1200
410	Remington 97-4	2 1/2	New Remington-Peters Plastic with Solid Plastic Base Wad	Skeet	1/2	Over-Powder Card and Fiber Sullivan Solo Wad Remington Power Piston W23668	17.5 17.5 15.0	1200
410	Winchester 209	2 1/2	Winchester-Western Paper	Skeet	1/2	Sullivan Solo Wad Remington Power Piston W23668	16.0 15.0	1200

SHOTSHELL LOADS USING RED DOT

with Fiber or Felt Cushion Wads and Over Powder Wads as Noted. Recommended Wad Seating Pressure—50 lbs. 10 Gauge—Rolled Crimp & 12 Gauge—Folded Crimp.

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Ounces)	Charge Weight in Grains When Using: Card Wad Over Powder	Charge Weight in Grains When Using: Plastic Wad Over Powder	Approx. Velocity (Ft./Sec.)
10	Winchester 209 Remington 57*	3	Winchester Paper Super Speed Western Paper Super X Remington Plastic Express Peters Plastic High Velocity	4 1/2	1 1/2	31.0 31.0	29.0 29.0	1360
12	Federal 209 Remington 57* CIL 4BP Winchester 209	2 3/4	Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity CIL Imperial Winchester Plastic Super Speed Western Plastic Super X	3	1	23.0 24.0 24.0 24.0	22.0 22.0 23.0 22.0	1300
12	Federal 209 Remington 97* Winchester 209 CIL 4BP Alcan 220	2 3/4	Federal Paper Target Remington Peters Plastic All American Target Winchester-Western Plastic AA Target CIL Paper Canuck CIL Plastic Canuck Alcan Plastic	2 1/2	1 1/8	20.0 20.0 21.5 21.0 21.0 20.0	19.0 18.0 20.0 20.0 20.0 19.0	1150

SHOTSHELL LOADS • RIFLED SLUGS

Rolled Crimp—No Top Wad

Gauge	Slug (Ounces)	Powder	Charge (Grains)	Wad-Seating Pressure (Pounds)	Approximate Velocity (Ft./Sec.)
12	1/8	Unique	27.0	50	1550
12	1	Unique	29.0	50	1550
16	1/8	Herco	28.0	100	1550
20	5/8	Herco	26.0	100	1550

SHOTSHELL LOADS
USING GREEN DOT with Fiber or Felt Cushion Wads and Over-Powder Wads as Noted. Recommended Wad Seating Pressure—50 lbs. 10 Gauge—Rolled Crimp—all others—Folded Crimp.

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Ounces)	Charge Weight in Grains When Using		Approx. Velocity (Ft./Sec.)
						Card Wad Over Powder	Plastic Wad Over Powder	
10	Winchester 209 Remington 57★	3	Winchester Paper Super Speed Western Paper Super X Remington Plastic Express Peters Plastic High Velocity	4 1/2	1 1/4	33.0 33.0	31.0 31.0	1360
10	Winchester 209	3	Winchester Paper Super Speed Western Paper Super X Remington Plastic Express Peters Plastic High Velocity	4 1/2	1 1/8	32.0 32.0	30.0 30.0	1330
12	Federal 209 Federal 209 Remington 57★ Winchester 209 CIL 4BP	2 1/2	Federal Paper Target Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity Winchester Plastic Super Speed Western Plastic Super X CIL Imperial	3	1	24.0 24.5 25.0 26.5 25.0	23.0 24.0 24.0 25.0 24.0	1300
12	Federal 209 Remington 97★ CIL 4BP CIL 4BP Alcan 220	2 1/2	Federal Paper Target Remington-Peters Plastic All American Target CIL Paper Canuck CIL Plastic Canuck Alcan Plastic	2 3/4	1 1/8	21.5 21.0 22.0 22.5 21.5	20.5 20.0 21.5 21.5 20.5	1150
12	Federal 209 Federal 209 Remington 97★ Remington 57★ Winchester 209 CIL 4BP CIL 4BP Alcan 220	2 1/4	Federal Paper Target Federal Plastic Game Remington-Peters Plastic All American Target Remington Plastic Express Peters Plastic High Velocity Winchester-Western Plastic AA Target CIL Paper Canuck CIL Plastic Canuck Alcan Plastic	3	1 1/8	23.0 23.0 22.5 23.0 25.0 23.0 23.5 23.5	22.0 22.0 21.0 22.0 23.0 22.0 22.5 22.0	1200
12	Federal 209 Federal 209 Remington 57★ Remington 57★ Winchester 209 CIL 4BP CIL 4BP Alcan 220	2 1/4	Federal Paper Target Federal Plastic Game Remington Plastic Shur Shot Peters Plastic Victor Remington Plastic Express Peters Plastic High Velocity Winchester-Western Plastic AA Target CIL Paper Canuck CIL Plastic Canuck Alcan Plastic	3 1/4	1 1/8	25.0 25.0 24.0 24.5 26.0 24.0 24.5 24.5	24.0 24.0 23.0 23.5 24.0 23.0 23.5 23.0	1250
12	Federal 209 Remington 57★ Winchester 209 CIL 4BP CIL 4BP Alcan 220	2 1/4	Federal Plastic Game Remington-Peters Plastic Game Winchester Plastic Ranger Western Plastic Xpert CIL Paper Canuck CIL Plastic Canuck Alcan Plastic	3 1/4	1 1/8	27.0 27.0 29.0 27.0 26.0 26.0	26.0 26.0 28.0 26.0 25.0 25.0	1310
12	Federal 209 Federal 209	2 1/2	Federal Paper Target Federal Plastic Game	3	1 1/8	23.0 24.0	22.5 22.5	1165

SHOTSHELL LOADS
USING GREEN DOT—Continued

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Ounces)	Charge Weight in Grains When Using		Approx. Velocity (Ft./Sec.)
						Card Wad Over Powder	Plastic Wad Over Powder	
12	Remington 57★ Remington 57★ Winchester 209	2 1/2	Remington Plastic Express Peters Plastic High Velocity Remington Plastic Shur Shot Peters Plastic Victor Winchester-Western Plastic AA Target	3	1 1/8	23.5 23.0 24.5	22.5 22.0 22.5	1165
12	CIL 4BP CIL 4BP CIL 4BP	2 1/2	CIL Paper Canuck CIL Plastic Canuck CIL Imperial	3	1 1/8	23.5 24.0 24.0	23.0 22.5 22.5	1165
12	Federal 209 Federal 209 Remington 57★ Winchester 209 CIL 4BP CIL 4BP CIL 4BP	2 1/2	Federal Paper Target Federal Plastic Game Remington-Peters Plastic Game Winchester-Western Plastic AA Target CIL Paper Canuck CIL Plastic Canuck CIL Imperial	3 1/4	1 1/4	24.0 25.0 24.0 25.5 24.5 25.0 25.0	23.5 23.5 22.5 23.5 24.0 23.5 23.5	1220
16	Federal 209 Federal 209 Remington 57★ Winchester 209	2 1/2	Federal Paper Target Federal Plastic Game Remington-Peters Plastic Winchester-Western Plastic	2 1/2	1	18.0 19.0 18.5 19.0	17.0 18.0 17.5 18.0	1165
20	Federal 209 Remington 97★ Winchester 209	2 1/2	Federal Plastic Remington-Peters Plastic All American Target Winchester-Western Plastic AA Target	2 1/4	7/8	17.0 16.5 17.0	16.0 15.0 16.0	1155
20	Federal 209 Winchester 209 Remington 97★	2 1/2	Federal Plastic Winchester-Western Plastic AA Target Remington-Peters Plastic All American Target	Skeet	7/8	18.0 18.0 17.0	17.5 17.0 16.0	1200

SHOTSHELL LOADS USING UNIQUE with Fiber or Felt Cushion Wads and Over-Powder Wads as Noted. Recommended Wad Seating Pressure—50 Lbs. 10 Gauge—Rolled Crimp—All Others Folded Crimp

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Ounces)	Charge Weight in Grains When Using		Approx. Velocity (Ft./Sec.)
						Card Wad Over Powder	Plastic Wad Over Powder	
10	Remington 57★ Winchester 209	3	Remington Plastic Express Peters Plastic High Velocity Winchester Paper Super Speed Western Paper Super X	4 1/2	1 1/4	31.0 31.0	29.0 29.0	1360
10	Remington 57★ Winchester 209	3	Remington Plastic Express Peters Plastic High Velocity Winchester Paper Super Speed Western Paper Super X	4 1/2	1 1/8	32.0 32.0	30.0 30.0	1330
12	Federal 209 Remington 57★ Winchester 209 CIL 4BP	2 1/2	Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity Winchester Plastic Super Speed Western Plastic Super X CIL Imperial	3	1	26.0 26.5 27.0 26.0	25.0 25.0 25.0 25.0	1300

APPENDIX 3 (cont'd)

SHOTSHELL LOADS USING UNIQUE—Continued

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Grams)	Charge Weight in Grains When Using		Approx. Velocity (Ft./Sec.)
						Card Wad Over Powder	Plastic Wad Over Powder	
12	Federal 209	2¾	Federal Paper Target	2¾	1⅛	23.0	22.0	1150
	Federal 209		Federal Plastic Game			23.0	22.0	
	Remington 97★		Remington-Peters Plastic All American Target			23.0	21.0	
	Remington 57★		Remington Plastic Shur Shot Peters Plastic Victor			23.0	22.0	
	Winchester 209		Winchester-Western Plastic AA Target			24.0	22.5	
	Winchester 209		Winchester Plastic Ranger Western Plastic Xpert			23.0	22.0	
	CIL 4BP		CIL Paper Canuck			23.0	22.5	
	CIL 4BP		CIL Plastic Canuck			23.5	23.0	
	Alcan 220		Alcan Plastic			23.0	22.0	
12	Federal 209	2¾	Federal Paper Target	3	1⅛	24.0	23.0	1200
	Federal 209		Federal Plastic Game			24.0	23.0	
	Remington 97★		Remington-Peters Plastic All American Target			24.0	22.0	
	Remington 57★		Remington Plastic Shur Shot Peters Plastic Victor			24.0	23.0	
	Winchester 209		Winchester-Western Plastic AA Target			25.0	23.5	
	Winchester 209		Winchester Plastic Super Speed Western Plastic Super X			25.0	23.5	
	CIL 4BP		CIL Paper Canuck			24.0	23.5	
	CIL 4BP		CIL Plastic Canuck			25.0	24.0	
	Alcan 220		Alcan Plastic			24.0	23.0	
12	Federal 209	2¾	Federal Paper Target	3¼	1⅛	26.0	25.0	1250
	Federal 209		Federal Plastic Game			26.0	25.0	
	Remington 97★		Remington-Peters Plastic All American Target			26.0	25.0	
	Remington 57★		Remington Plastic Express Peters Plastic High Velocity			26.0	25.0	
	Winchester 209		Winchester-Western Plastic AA Target			27.5	26.5	
	CIL 4BP		CIL Imperial			27.0	26.0	
	Alcan 220		Alcan Plastic			26.0	25.0	
12	Federal 209	2¾	Federal Paper Target	3½	1⅛	27.0	26.0	1310
	Federal 209		Federal Plastic Game			27.0	26.0	
	Remington 97★		Remington-Peters Plastic All American Target			27.0	26.0	
	Remington 57★		Remington Plastic Express Peters Plastic High Velocity			27.0	26.0	
	Winchester 209		Winchester-Western Plastic AA Target			28.5	27.5	
	CIL 4BP		CIL Imperial			28.0	27.0	
12	Federal 209	2¾	Federal Paper Target	3	1¼	24.0	23.0	1165
	Federal 209		Federal Plastic Game			24.5	23.0	
	Remington 97★		Remington-Peters Plastic All American Target			24.0	22.0	
	Remington 57★		Remington-Peters Plastic Game			24.0	22.0	
	Winchester 209		Winchester-Western Plastic AA Target			25.0	23.0	
	CIL 4BP		CIL Paper Canuck			24.0	23.0	
	CIL 4BP		CIL Plastic			24.0	23.0	
	Alcan 220		Alcan Plastic			23.5	22.5	

SHOTSHELL LOADS USING UNIQUE—Continued

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Grams)	Charge Weight in Grains When Using		Approx. Velocity (Ft./Sec.)
						Card Wad Over Powder	Plastic Wad Over Powder	
12	Federal 209	2¾	Federal Paper Target	3¼	1¼	25.0	24.0	1220
	Federal 209		Federal Plastic Game			25.5	24.5	
	Remington 97★		Remington-Peters Plastic All American Target			24.5	22.5	
	Remington 57★		Remington-Peters Plastic Game			25.0	24.0	
	Winchester 209		Winchester-Western Plastic AA Target			26.5	24.0	
	CIL 4BP		CIL Paper Canuck			25.0	25.0	
	CIL 4BP		CIL Plastic			25.0	24.0	
	Alcan 220		Alcan Plastic			26.5	24.0	
16	Federal 209	2¾	Federal Paper Target	2¾	1	19.5	19.0	1220
	Federal 209		Federal Plastic Game			20.5	20.0	
	Remington 57★		Remington-Peters Plastic			19.5	18.5	
	Winchester 209		Winchester Plastic Ranger Western Plastic Xpert			21.5	20.0	
	Winchester 209		Winchester Plastic Super Speed Western Plastic Super X			20.5	19.0	
16	Federal 209	2¾	Federal Paper Target	2¾	1⅛	19.5	19.0	1185
	Federal 209		Federal Plastic Game			20.5	19.5	
	Remington 57★		Remington-Peters Plastic			19.5	18.5	
	Winchester 209		Winchester Plastic Super Speed Western Plastic Super X			20.5	19.0	
20	Federal 209	2¾	Federal Plastic	2¼	⅞	17.5	17.0	1155
	Remington 97★		Remington-Peters Plastic All American Target			16.5	15.5	
	Remington 57★		Remington Plastic Shur Shot Peters Plastic Victor			17.5	16.0	
	Winchester 209		Winchester-Western Plastic AA Target			18.5	17.5	
	Winchester 209		Winchester Plastic Ranger Western Plastic Xpert			18.0	17.5	
20	Federal 209	2¾	Federal Plastic	Skeet	⅞	18.0	17.5	1200
	Remington 97★		Remington-Peters Plastic All American Target			17.0	16.0	
	Remington 57★		Remington Plastic Shur Shot Peters Plastic Victor			18.0	16.5	
	Winchester 209		Winchester-Western Plastic			19.0	18.0	
20	Federal 209	2¾	Federal Plastic	2½	1	18.0	17.5	1165
	Remington 57★		Remington-Peters Plastic Game			17.5	16.5	
	Remington 97★		Remington-Peters Plastic All American Target			17.5	16.5	
	Winchester 209		Winchester Plastic Ranger Western Plastic Xpert			18.0	17.5	
	Winchester 209		Winchester Plastic Super Speed Western Plastic Super X			19.0	17.5	
28	Federal 209	2¾	Federal Plastic	1¼	¾	13.5	—	1160
	Remington 57★		Remington-Peters Plastic			13.5	—	
	Winchester 209		Winchester-Western Paper			13.5	—	
28	Federal 209	2¾	Federal Plastic	Skeet	¾	14.5	—	1200
	Remington 57★		Remington-Peters Plastic			14.5	—	
	Winchester 209		Winchester-Western Paper			14.5	—	

SHOTSHELL LOADS USING HERCO with Fiber or Felt Cushion Wads and Over-Powder Wads as Noted. Recommended Wad Seating Pressure—100 Lbs. 10 Gauge—Rolled Crimp—All Others Folded Crimp

Gauge	Primer	Shell Length (Inches)	Shell	Dram Equiv.	Shot Weight (Ounces)	Charge Weight in Grains When Using		Approx. Velocity (Ft./Sec.)
						Card Wad Over Powder	Plastic Wad Over Powder	
10	Winchester 209 Remington 57★	3	Winchester Paper Super Speed Western Paper Super X Remington Plastic Express Peters Plastic High Velocity	4¼	1¼	44.0 44.0	42.0 42.0	1360
10	Winchester 209 Remington 57★	3	Winchester Paper Super Speed Western Paper Super X Remington Plastic Express Peters Plastic High Velocity	4¼	1⅛	45.0 45.0	43.0 43.0	1330
12	Federal 209 Federal 209 Remington 57★ Winchester 209 CIL 4BP	2¾	Federal Paper Target Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity Winchester Plastic Super Speed Western Plastic Super X CIL Imperial	3½	1⅛	30.5 31.5 31.5 34.0 33.0	29.0 30.0 30.5 32.0 31.5	1310
12	Federal 209 Federal 209 Remington 57★ Winchester 209 CIL 4BP CIL 4BP	2¾	Federal Paper Target Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity Winchester Plastic Super Speed Western Plastic Super X CIL Paper Canuck CIL Plastic Canuck	3¼	1⅛	28.5 29.0 29.0 32.5 29.0 29.5	27.5 28.0 28.5 29.0 28.0 28.5	1220
12	Federal 209 Remington 57★ Winchester 209 CIL 4BP	2¾	Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity Winchester Plastic Super Speed Western Plastic Super X CIL Imperial	3¼	1¼	33.0 34.0 37.0 34.0	32.0 33.0 33.5 33.0	1330
16	Federal 209 Federal 209 Remington 57★ Winchester 209	2¾	Federal Paper Target Federal Plastic Game Remington-Peters Plastic Winchester Plastic Super Speed Western Plastic Super X	2¾	1⅛	21.5 22.5 22.5 24.0	21.0 22.0 21.0 22.0	1185
20	Federal 209 Remington 57★ Winchester 209	2¾	Federal Plastic Game Remington Plastic Express Peters Plastic High Velocity Winchester Plastic Super Speed Western Plastic Super X	2½	1	20.5 20.0 22.0	20.0 19.0 20.0	1165
20	Federal 209 Winchester 209	2¾	Federal Plastic Game Winchester Plastic Super Speed Western Plastic Super X	2¾	1	21.0 22.5	20.5 20.5	1220
28	Federal 209 Remington 57★ Winchester 209	2¾	Federal Paper Remington-Peters Plastic Winchester-Western Paper	Skeet	¾	16.5 17.5 15.5	– – –	1200
28	Remington 57★	2¾	Remington-Peters Plastic	2¾	¾	19.5	–	1295

APPENDIX 3 (cont'd)

Ball Powder smokeless propellant is the product of an exclusive manufacturing process carried on commercially by Olin Corporation since 1933. Although it is made from conventional propellant materials, plus other compounds which control ignition and rates of burning, its method of manufacture makes it entirely different in appearance and performance.

A graining process forms the nitrocellulose into spheres in carefully controlled size ranges. Further processing impregnates materials to change potential and adds deterrents to modify burning rates. Rolling flattens the grains to make final adjustment for powder speed.

Ball Powder offers many unique advantages for the reloader. Because it burns cooler, barrel life is lengthened. Due to its basic physical shape, Ball Powder will meter far more uniformly through powder measures than the older style powders.

To help familiarize you with the new line of Ball Powders we offer the following brief descriptions:

1. **230** (formerly 230P) an excellent pistol and revolver powder with quick clean burning. Available in 12 oz., 3 lb., 8 lb. and 12 lb. containers.
2. **296** (replaces AA665S) specifically designed for the 410, 28 gauge, 30M1 carbine and magnum pistol loads. Available in 1 lb., 3 lb. and 8 lb. containers.
3. **452AA** (replaces AA12S.) It is the same powder as used in the world famous Double A, 12 gauge factory loads. Available in 8 oz., 3 lb., 6 lb. and 10 lb. containers.
4. **473AA** (replaces AA20S and 500HS.) It is the same powder as used in the world famous Double A, 20 gauge factory loads. It has a wide range of applications from 12 to 20 gauge. Available in 8 oz., 3 lb., 6 lb. and 10 lb. containers.
5. **540** (formerly 540MS) is a magnum and high velocity shotshell powder. It is also a favorite in 28 gauge. Available in 1 lb., 3 lb., 8 lb. and 12 lb. containers.
6. **571** a new magnum powder for the heaviest shot charges. Available in 1 lb., 3 lb., 8 lb. and 12 lb. containers.
7. **630** (formerly 630P) is a high velocity pistol powder also useful in 30M1 carbine. Available in 1 lb. cans.
8. **680** (formerly 680BR) is excellent fast burning rifle powder for small capacity cases such as the 22 Hornet. Available in 1 lb. containers.
9. **748** (formerly 748BR) is very popular with the bench rest shooters. It has wide applications in many rifle calibers. Available in 1 lb. containers.
10. **760** (formerly 760BR) a wide application rifle powder. Available in 1 lb. containers.

POWDER STORAGE

The following information has been extracted from a pamphlet entitled "Properties and Storage of Smokeless Powder" issued by the Sporting Arms and Ammunition Manufacturers Institute at 420 Lexington Avenue, New York, New York 10017. For a free copy of the complete pamphlet send a self-addressed, stamped envelope to the above address and request the pamphlet by title.

CONSIDERATIONS FOR STORAGE OF SMOKELESS POWDER

Smokeless powder is intended to function by burning, so it must be protected against accidental exposure to flame, sparks or high temperatures.

For these reasons, it is desirable that storage enclosures be made of insulating materials to protect the powder from external heat sources.

Once smokeless powder begins to burn, it will normally continue to burn (and generate gas pressure) until it is consumed.

D.O.T. approved containers are constructed to open up at low internal pressures to avoid the effects normally produced by the rupture or bursting of a strong container.

Storage enclosures for smokeless powder should be constructed in a similar manner:

1. *Of fire-resistant and heat insulating materials to protect contents from external heat.*
2. *Sufficiently large to satisfactorily vent the gaseous products of combustion which would result if the quantity of smokeless powder within the enclosure accidentally ignited.*

If a small, tightly enclosed storage enclosure is loaded to capacity with containers of smokeless powder, the walls of the enclosure will expand or move outwards to release the gas pressure — if the powder in storage is accidentally ignited.

Under such conditions, the effects of the release of gas pressure are similar or identical to the effects produced by an explosion.

Hence only the smallest practical quantities of smokeless powder should be kept in storage, and then in strict compliance with all applicable regulations and recommendations of the National Fire Protection Association (reprinted at end of leaflet).

RECOMMENDATIONS FOR STORAGE OF SMOKELESS POWDER

STORE IN A COOL, DRY PLACE. Be sure the storage area selected is free from any possible sources of excess heat and is isolated from open flame, furnaces, hot water heaters, etc. Do not store smokeless powder where it will be exposed to the sun's rays. Avoid storage in areas where mechanical or electrical equipment is in operation. Restrict from the storage areas heat or sparks which may result from improper, defective or overloaded electrical circuits.

DO NOT STORE SMOKELESS POWDER IN THE SAME AREA WITH SOLVENTS, FLAMMABLE GASES OR HIGHLY COMBUSTIBLE MATERIALS.

STORE ONLY IN DEPARTMENT OF TRANSPORTATION APPROVED CONTAINERS. Do not transfer the powder from an approved container into one which is not approved.

DO NOT SMOKE IN AREAS WHERE POWDER IS STORED OR USED. Place appropriate "No Smoking" signs in these areas.

DO NOT SUBJECT THE STORAGE CABINETS TO CLOSE CONFINEMENT.

STORAGE CABINETS SHOULD BE CONSTRUCTED OF INSULATING MATERIALS AND WITH A WEAK WALL, SEAMS OR JOINTS TO PROVIDE AN EASY MEANS OF SELF-VENTING.

DO NOT KEEP OLD OR SALVAGED POWDERS. Check old powders for deterioration regularly. Destroy deteriorated powders immediately.

OBEY ALL REGULATIONS REGARDING QUANTITY AND METHODS OF STORING. Do not store all your powders in one place. If you can, maintain separate storage locations. Many small containers are safer than one or more large containers.

KEEP YOUR STORAGE AND USE AREA CLEAN. Clean up spilled powder promptly. Make sure the surrounding area is free of trash or other readily combustible materials.

Winchester-Western Shot Shell Loading Data

Do not substitute components.

Use only combinations as listed in the data.

The data herein supercedes all previous W-W tabulations. All data was obtained in once fired cases.

CAUTION: Shotshell Ball Powder should always be used with Primers having covered flash holes.

Loads are listed for the following Shot Shell cases —

Winchester-Western compression-formed
Winchester-Western polyformed
Sears brand polyformed
Remington-Peters SP
Remington-Peters RXP
Federal Champion II (12 ga.)
S & W plastic (12 ga.)
Federal plastic field (20 ga.)
Browning polyformed

Wads used in various loads —

Winchester-Western	WAA12 WAA12XW WAA20 WAA28	WAA41 W12UP Molded Fiber
Remington-Peters	29922 29930 29924 23694	29928 29926 29932 29942 29944
Federal	Champion Champion II Pushin Cushin 410	
Pacific	Blue Verelite Red Verelite	
Alcan	Flite Max #6 Flite Max #5 Flite Max #4 Flite Max #2 "D" Kwiksert	

APPENDIX 4 (cont'd)

16 gauge

2¾" shells

2½ drams, equivalent 1 ounce shot	= 1165 FPS
2¾ drams, equivalent 1⅛ ounce shot	= 1185 FPS
3¼ drams, equivalent 1⅛ ounce shot	= 1295 FPS
3¼ drams, equivalent 1¼ ounce shot	= 1260 FPS

20 gauge

2¾" shells

2½ drams, equivalent ⅞ ounce shot	= 1210 FPS
2½ drams, equivalent 1 ounce shot	= 1165 FPS
2¾ drams, equivalent 1 ounce shot	= 1220 FPS
2¾ drams, equivalent 1⅛ ounce shot	= 1175 FPS

3" shells

3½ drams, equivalent 1-3/16 ounce shot	= 1295 FPS
3 drams, equivalent 1¼ ounce shot	= 1185 FPS

28 gauge

2¾" shells

2¼ drams, equivalent ¾ ounce shot	= 1295 FPS

410 bore

2½" shells

max., ½ ounce shot	= 1135 FPS

3" shells

max., 11/16 ounce shot	= 1135 FPS

12 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Double A, Double A Handicap, Upland, and Super-X

1 oz. shot: Field Loads
Nominal Velocity = 1290 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	22.0	WAA12	9900
WW209	452AA	22.0	Rem. 29922	9900
WW209	452AA	22.0	Pushin Cushin	10100
Fed.209	452AA	22.0	WAA12	10100
Fed.209	452AA	22.0	Flite Max #6	9900
Fed.209	452AA	22.0	Pushin Cushin	9500
CCI109	452AA	21.5	WAA12	9900
CCI109	452AA	21.5	Pushin Cushin	10100

1⅛ oz. shot: Trap, Skeet & Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	19.5	WAA12	9400
WW209	452AA	19.5	Rem. 29930	9300
WW209	452AA	19.5	Fed. Champion	9000
WW209	452AA	19.5	Pushin Cushin	9300
WW209	452AA	19.5	Red Verelite	9400
WW209	452AA	20.0	Flite Max #5	9000
WW209	452AA	20.0	Alcan "D"	9000
CCI109	452AA	19.0	WAA12	9600
CCI109	452AA	19.5	Fed. Champion	9600
CCI109	452AA	19.5	Pushin Cushin	9700
CCI109	452AA	19.5	Red Verelite	10000
CCI109	452AA	19.0	Rem. 29930	9600
CCI109	452AA	19.5	Flite Max #5	9700
CCI109	452AA	19.5	Alcan "D"	9000
Fed.209	452AA	19.5	WAA12	9200
Fed.209	452AA	19.5	Red Verelite	9500
Fed.209	452AA	19.5	Rem. 29930	8700
Fed.209	452AA	19.5	Pushin Cushin	9000
Fed.209	452AA	20.0	Fed. Champion	9200
Fed.209	452AA	20.0	Flite Max #5	9200
Fed.209	452AA	20.0	Alcan "D"	9300

12 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Double A, Double A Handicap, Upland, and Super-X

1⅛ oz. shot: Trap, Skeet & Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
Fed.399	452AA	20.0	WAA12	9100
Fed.399	452AA	20.0	Flite Max #5	9000
Fed.399	452AA	20.0	Alcan "D"	9500
Fed.399	452AA	20.0	Fed. Champion	9600
Fed.399	452AA	20.0	Red Verelite	9500
Fed.399	452AA	20.0	Rem. 29930	8800

1⅛ oz. shot: Trap, Skeet & Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	20.5	WAA12	10100
WW209	452AA	20.5	WAA12XW	10500
WW209	452AA	20.5	Pushin Cushin	10200
WW209	452AA	21.0	Fed. Champion	10000
WW209	452AA	21.0	Red Verelite	9900
WW209	452AA	21.0	Rem. 29930	9900
WW209	452AA	21.0	Flite Max #5	10200
WW209	452AA	21.0	Alcan "D"	10000
CCI109	452AA	20.5	WAA12	10500
CCI109	452AA	20.5	Fed. Champion	10400
CCI109	452AA	20.5	Pushin Cushin	10400
CCI109	452AA	20.5	Rem. 29930	10400
CCI109	452AA	20.5	Flite Max #5	10500
CCI109	452AA	20.5	Alcan "D"	10300
CCI109	452AA	20.5	Red Verelite	10500
Fed.209	452AA	20.5	WAA12	10000
Fed.209	452AA	20.5	WAA12XW	10300
Fed.209	452AA	20.5	Pushin Cushin	9900
Fed.209	452AA	21.0	Fed. Champion	9900
Fed.209	452AA	21.0	Alcan "D"	9900
Fed.209	452AA	21.0	Red Verelite	10000
Fed.399	452AA	20.5	WAA12	10000
Fed.399	452AA	21.0	WAA12XW	10500
Fed.399	452AA	21.0	Fed. Champion	10100
Fed.399	452AA	21.0	Pushin Cushin	10200
Fed.399	452AA	21.0	Alcan "D"	10200
Fed.399	452AA	21.5	Flite Max #5	9900
Fed.399	452AA	21.5	Rem. 29930	9900
Fed.399	452AA	21.5	Red Verelite	9700

12 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Double A, Double A Handicap, Upland, and Super-X

1⅛ oz. shot: Trap, Skeet & Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	23.5	WAA12	8500
WW209	473AA	23.5	WAA12XW	8300
WW209	473AA	24.0	Rem. 29930	8200
WW209	473AA	24.0	Fed. Champion	8300
WW209	473AA	24.0	Pushin Cushin	8300
WW209	473AA	24.0	Red Verelite	8300
CCI109	473AA	23.5	WAA12	8900
CCI109	473AA	23.5	Red Verelite	8800
CCI109	473AA	23.5	Rem. 29930	8400
CCI109	473AA	23.5	Pushin Cushin	8700
CCI109	473AA	24.0	Fed. Champion	8500
Fed.209	473AA	23.5	WAA12	9200
Fed.209	473AA	23.5	WAA12XW	8900
Fed.209	473AA	23.5	Fed. Champion	8700
Fed.209	473AA	23.5	Pushin Cushin	8600
Fed.209	473AA	23.5	Red Verelite	8800
Fed.209	473AA	23.5	Rem. 29930	8500

1⅛ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	25.0	WAA12	9500
WW209	473AA	25.0	WAA12XW	9300
WW209	473AA	25.0	Rem. 29930	8500
WW209	473AA	25.0	Pushin Cushin	9100
CCI109	473AA	24.5	WAA12	9400
CCI109	473AA	24.5	WAA12XW	10000
CCI109	473AA	25.0	Pushin Cushin	9900
CCI109	473AA	25.0	Rem. 29930	9400
Fed. 209	473AA	24.5	WAA12	9900
Fed. 209	473AA	24.5	WAA12XW	9700
Fed. 209	473AA	25.0	Rem. 29930	9300
Fed. 209	473AA	25.0	Pushin Cushin	9600
Fed. 209	473AA	25.0	Red Verelite	9500

APPENDIX 4 (cont'd)

12 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Double A, Double A Handicap, Upland, and Super-X

1⅛ oz. shot: Field Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	28.0	WAA12	10100
WW209	473AA	28.0	Rem. 29930	10100
WW209	473AA	28.0	Pushin Cushin	10400
CCI109	473AA	27.0	WAA12	10400
CCI109	473AA	27.0	Pushin Cushin	10500
CCI109	473AA	27.0	Rem. 29930	10100

1¼ oz. shot: Field Loads
Nominal Velocity = 1150 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	23.5	WAA12	9400
WW209	473AA	23.5	Rem. 29930	8900

1¼ oz. shot: Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	25.0	WAA12	10300
WW209	473AA	25.0	Rem. 29930	10100
Fed.209	473AA	25.0	WAA12	10500
CCI109	473AA	24.5	WAA12	9800
WW209	540	31.5	WAA12	9000
WW209	540	31.5	WAA12XW	8500
WW209	540	31.5	Rem. 29924	8900
WW209	540	31.5	Flite Max #4	8700
WW209	540	32.0	Fed. Champion	8800

12 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Double A, Double A Handicap, Upland, and Super-X

1¼ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	33.0	WAA12	9100
WW209	540	32.5	WAA12XW	9200
WW209	540	32.5	Red Verelite	9100
WW209	540	32.5	Alcan "D"	9300
WW209	540	33.0	Flite Max. #4	9000
WW209	540	33.0	Fed. Champion	9100
WW209	540	33.0	Rem. 29924	9000

1¼ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	34.5	WAA12	10100
WW209	540	35.0	WAA12XW	10200
WW209	540	35.0	Red Verelite	10300
WW209	540	35.0	Fed. Champion	10200
WW209	540	35.0	Rem. 29924	10300
WW209	540	35.0	Flite Max #4	10300
WW209	540	34.5	Alcan "D"	10500
CCI109	540	34.5	WAA12	10500
CCI109	540	34.5	WAA12XW	10300

1½ oz. shot: Magnum Loads
Nominal Velocity = 1240 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	36.5	WAA12R	10300
WW209	571	36.5	Blue Verelite	10500
WW209	571	36.5	Flite Max #2	10100
WW209	571	36.5	Rem. 29926	9800
CCI109	571	36.0	Flite Max #2	10500
CCI109	571	35.5	WAA12R	10500

12 Gauge 2¾" Winchester-Western, Sears and Browning Polyformed Plastic Tubes, Low Brass Head — High Paper Base Wad

1 oz. shot: Field Loads
Nominal Velocity = 1290 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	25.0	Rem. 29922	8100
WW209	452AA	25.0	Flite Max #4	9000

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	21.5	WAA12R	7800
WW209	452AA	21.5	Rem. 23694	7600

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	23.0	WAA12R	8700
WW209	452AA	23.0	Rem. 23694	8900

12 Gauge 2¾" Winchester-Western, Sears and Browning Polyformed Tubes High Brass Head — Low Paper Base Wad

1¼ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	37.5	WAA12R	7900
WW209	540	37.5	Rem. 29928	7900

1½ oz. shot: Magnum Loads
Nominal Velocity = 1260 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	36.5	WAA12R	9500
WW209	540	36.5	Rem. 29928	9400

12 Gauge 2¾" Remington-Peters SP Tubes

1 oz. shot: Field Loads
Nominal Velocity = 1290 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	452AA	23.5	WAA12	9800
CCI157	452AA	23.5	Rem. 29922	9700
CCI157	452AA	23.5	Pushin Cushin	10200

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	452AA	19.5	WAA12	9200
CCI157	452AA	19.5	Rem. 29924	9100
CCI157	452AA	20.0	Blue Verelite	8900
CCI157	452AA	19.5	Pushin Cushin	9600

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	452AA	21.5	WAA12	10200
CCI157	452AA	21.5	Rem. 29924	10300
CCI157	452AA	21.5	Blue Verelite	9600
CCI157	452AA	21.0	Pushin Cushin	10400
CCI157	473AA	24.5	Rem. 29924	7700
CCI157	473AA	25.0	Flite Max #5	7800

1⅛ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	473AA	26.0	Rem. 29924	8800
CCI157	473AA	26.5	Flite Max #5	8400

APPENDIX 4 (cont'd)

12 Gauge 2¾" Remington-Peters SP Tubes

1⅛ oz. shot: Field Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	473AA	28.5	Rem. 29924	9400

1¼ oz. shot: Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	540	32.0	Flite Max #4	7900
CCI157	540	32.0	Rem. 29924	7800

1¼ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	540	33.0	Rem. 29924	8100
CCI157	540	33.5	Blue Verelite	8000

1¼ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	540	36.0	Rem. 29924	8800
CCI157	540	36.0	Blue Verelite	9200

1½ oz. shot: Magnum Loads
Nominal Velocity = 1260 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	540	35.0	WAA12R	10300
CCI157	540	35.0	Rem. 29926	10100

12 Gauge 2¾" Remington-Peters RXP Tubes

1 oz. shot: Field Loads
Nominal Velocity = 1290 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	22.5	WAA12	10300
WW209	452AA	22.5	Rem. 29922	10100
WW209	452AA	22.5	Pushin Cushin	10300

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	19.5	WAA12	9700
WW209	452AA	19.5	WAA12XW	10000
WW209	452AA	19.5	Rem. 29930	9600
WW209	452AA	19.5	Alcan "D"	9600
WW209	452AA	19.5	Pushin Cushin	9900

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	21.0	WAA12	10500
WW209	452AA	21.0	Rem. 29930	10400
WW209	473AA	23.5	WAA12	8600
WW209	473AA	23.5	WAA12XW	8600
WW209	473AA	23.5	Pushin Cushin	8500
WW209	473AA	24.0	Rem. 29930	8400
CCI109	473AA	23.0	WAA12	9000
CCI109	473AA	23.0	WAA12XW	9600
CCI109	473AA	23.0	Pushin Cushin	8700
CCI109	473AA	23.5	Rem. 29930	8300

12 Gauge 2¾" Remington-Peters RXP Tubes

1⅛ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	25.0	WAA12	9600
WW209	473AA	25.5	Rem. 29930	9700
WW209	540	33.0	Rem. 29930	8500

1⅛ oz. shot: Field Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	27.5	WAA12	9900
WW209	473AA	27.5	Rem. 29930	10500

1¼ oz. shot: Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	25.0	WAA12	10300
WW209	473AA	25.0	Rem. 29930	10400
WW209	473AA	25.0	Fed. Champion	10300

1¼ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	33.5	WAA12	10300
WW209	540	34.5	Rem. 29930	9700
WW209	540	33.5	Pushin Cushin	10000

1½ oz. shot: Magnum Loads
Nominal Velocity = 1240 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	36.5	Rem. 29926	10400

12 Gauge 2¾" Federal Champion II Tubes

1 oz. shot: Field Loads
Nominal Velocity = 1290 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	23.5	WAA12	9300
WW209	452AA	23.5	Pushin Cushin	9600

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	19.5	Fed. Champion II	10000
Fed.209	452AA	19.5	WAA12	10100
Fed.209	452AA	19.5	WAA12XW	10300
Fed.209	452AA	19.5	Fed. Champion II	9500
Fed.209	452AA	19.5	Fed. Champion	9800

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
Fed.209	452AA	21.0	Fed. Champion II	10500
WW209	473AA	23.5	WAA12	9400
WW209	473AA	23.5	Fed. Champion II	8600
WW209	473AA	23.5	Pushin Cushin	8600
Fed.209	473AA	23.5	WAA12	9800
Fed.209	473AA	23.5	Fed. Champion II	8900
Fed.209	473AA	23.5	Pushin Cushin	9400

1⅛ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	25.0	WAA12	10200
WW209	473AA	25.0	Fed. Champion II	9500
WW209	473AA	25.0	Pushin Cushin	10000
Fed.209	473AA	24.5	WAA12	10500
Fed.209	473AA	25.0	Fed. Champion II	9500
Fed.209	473AA	24.5	Pushin Cushin	10300

APPENDIX 4 (cont'd)

12 Gauge 2¾" Federal Champion II Tubes

1¼ oz. shot: Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	24.5	Rem. 29930	10500

12 Gauge 2¾" Federal Champion Plastic Tubes

1¼ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	34.0	Fed. Champion II	7500

1¼ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	36.0	Blue Verelite	8400
WW209	540	36.5	Rem. 29924	8100
WW209	540	36.5	Flite Max #4	8200

1½ oz. shot: Magnum Loads
Nominal Velocity = 1260 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	34.5	WAA12R	10400
WW209	540	34.5	Rem. 29926	10300

12 Gauge 2¾" S & W Plastic Tubes

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1145 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	20.5	WAA12	8600
WW209	452AA	21.5	Flite Max #5	7800
WW209	452AA	21.0	Pushin Cushin	8500

12 Gauge 2¾" S & W Plastic Tubes

1⅛ oz. shot: Trap, Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	22.0	WAA12	9200
WW209	452AA	22.5	Flite Max #5	9200
WW209	452AA	22.0	Pushin Cushin	9300
WW209	452AA	22.0	Rem. 29930	9100

1⅛ oz. shot: Field Loads
Nominal Velocity = 1255 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	23.5	WAA12	10200
WW209	452AA	23.5	Rem. 29930	10100

1¼ oz. shot: Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	26.5	WAA12	9100
WW209	473AA	27.0	Flite Max #5	9000

1¼ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1330 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	37.5	WAA12	8100
WW209	540	37.5	Rem. 29930	8100
WW209	540	37.0	Pushin Cushin	8200

1½ oz. shot: Magnum Loads
Nominal Velocity = 1260 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	36.5	WAA12R	10000
WW209	540	36.5	Rem. 29926	9600

12 Gauge 3" Winchester-Western Compression-Formed Tubes

1⅜ oz. shot: 3" Magnum Loads
Nominal Velocity = 1295 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	35.0	WAA12	9500
WW209	540	35.5	Flite Max #5	9300
WW209	540	35.5	Rem. 29922	9500

1⅝ oz. shot: 3" Magnum Loads
Nominal Velocity = 1205 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	36.0	WAA12	10500
WW209	571	36.0	Flite Max #4	10100
WW209	571	36.0	Rem. 29924	10100
WW209	571	36.0	Blue Verelite	9700
WW209	571	36.0	W12UP + two ¼ MF + Kwiksert	10300
CCI109	571	35.5	W12UP + two ¼ MF + Kwiksert	10500

1⅞ oz. shot: 3" Magnum Loads
Nominal Velocity = 1100 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	33.0	WAA12R	10500
WW209	571	33.5	Flite Max #2	10400
WW209	571	34.0	Rem. 29926	10100

16 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Upland and Super-X

1 oz. shot: Skeet, Trap and Field Loads
Nominal Velocity = 1165 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	452AA	17.5	Rem. 29932	10300
CCI109	452AA	17.5	Rem. 29932	10500
WW209	473AA	20.5	Rem. 29932	8300
CCI109	473AA	20.0	Rem. 29932	8700

16 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Upland and Super-X

1 oz. shot: Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	21.5	Rem. 29932	8800
CCI109	473AA	21.0	Rem. 29932	9000

1⅛ oz. shot: Skeet, Trap and Field Loads
Nominal Velocity = 1185 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	26.5	Rem. 29932	8800
CCI109	540	26.5	Rem. 29932	8500

1⅛ oz. shot: Field Loads
Nominal Velocity = 1240 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	27.5	Rem. 29932	9400
CCI109	540	27.5	Rem. 29932	9200

1⅛ oz. shot: Heavy Field and Duck Loads
Nominal Velocity = 1290 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	28.5	Rem. 29932	10300
CCI109	540	28.5	Rem. 29932	9600

1¼ oz. shot: Magnum Loads
Nominal Velocity = 1230 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	30.5	Rem. 29934	10500

APPENDIX 4 (cont'd)

20 Gauge 2¾" Winchester-Western Compression-Formed Tubes, Double A, Upland, and Super-X

⅞ oz. shot: Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	18.0	WAA20	10900
WW209	473AA	18.0	Rem. 29942	10900
CCI109	473AA	17.5	WAA20	10900
Fed.399	473AA	18.0	WAA20	11100
Fed.399	473AA	18.0	Rem. 29942	10700

1 oz. shot: Field Loads
Nominal Velocity = 1165 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	23.0	Rem. 29944	10000
WW209	571	23.5	WAA20	9700
WW209	571	23.5	Rem. 29944	9800
CCI109	571	23.5	WAA20	9700

1 oz. shot: Heavy Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	24.0	Rem. 29944	10700
WW209	571	24.5	Rem. 29944	10300
WW209	571	25.0	WAA20	10000
CCI109	571	25.0	WAA20	10000

1⅛ oz. shot: Magnum Loads
Nominal Velocity = 1175 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	24.5	Rem. 23678	10200
Fed.209	571	24.0	Rem. 23678	11000
CCI109	571	24.5	Rem. 23678	10500

20 Gauge 2¾" Remington-Peters SP Tubes

⅞ oz. shot: Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	473AA	17.5	WAA20	10000
CCI157	473AA	17.5	Rem. 29942	10200

1 oz. shot: Field Loads
Nominal Velocity = 1165 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	540	22.5	Rem. 29942	9100

1 oz. shot: Heavy Field Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	540	23.5	Rem. 29942	9700

1⅛ oz. shot: Magnum Loads
Nominal Velocity = 1175 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
CCI157	571	25.0	Rem. 23678	10200

20 Gauge 2¾" Federal Plastic Field Tubes

⅞ oz. shot: Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	473AA	19.0	WAA20	9100
WW209	473AA	19.0	Rem. 29942	8900
WW209	473AA	19.0	Pushin Cushin	9600
Fed.209	473AA	19.0	WAA20	9300
Fed.209	473AA	19.0	Rem. 29942	8900
Fed.209	473AA	19.0	Pushin Cushin	9900

20 Gauge 3" Winchester-Western Compression-Formed Tubes

1⅛ oz. shot: 3" Magnum Loads
Nominal Velocity = 1220 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	27.0	WAA20	11000
WW209	571	28.0	Rem. 29942	10300
WW209	571	27.0	Alcan PGS + two ⅜ MF + Kwiksert	11100
CCI109	571	27.0	WAA20	11100
CCI109	571	27.5	Rem. 29942	10300
CCI109	571	26.0	Alcan PGS + two ⅜ MF + Kwiksert	11000

1³⁄₁₆ oz. shot: 3" Magnum Loads
Nominal Velocity = 1195 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	27.5	Rem. 29942	10600

1¼ oz. shot: 3" Magnum Loads
Nominal Velocity = 1135 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	24.0	WAA20	10800
WW209	571	25.5	Alcan PGS + two ¼ MF + Kwiksert	10900
CCI109	571	24.0	WAA20	11000
CCI109	571	25.0	Alcan PGS + two ¼ MF + Kwiksert	10800

28 Gauge 2¾" Winchester-Western Compression-Formed Tubes

¾ oz. shot: Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	540	17.5	WAA28	9900
CCI109	540	17.5	WAA28	10200
Fed.209	540	17.5	WAA28	10200
WW209	571	19.0	WAA28	10200
CCI109	571	19.0	WAA28	10300

28 Gauge 2¾" Winchester-Western Compression-Formed Tubes

¾ oz. shot: Field Loads
Nominal Velocity = 1260 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	571	20.5	WAA28	11000
CCI109	571	20.5	WAA28	11100

410 Bore 2½" Winchester-Western Compression-Formed Tubes

½ oz. shot: Skeet and Field Loads
Nominal Velocity = 1150 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	296	13.5	WAA41	9100
CCI109	296	13.5	WAA41	8500

½ oz. shot: Skeet and Field Loads
Nominal Velocity = 1200 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	296	14.0	WAA41	9800
WW209	296	14.0	Fed. 410	10300
CCI109	296	14.0	WAA41	9100
CCI109	296	14.0	Fed. 410	9900

410 Bore 3" Winchester-Western Compression-Formed Tubes

1¹⁄₁₆ oz. shot: Field Loads
Nominal Velocity = 1135 fps.

Primer	Powder	Charge (grs.)	Wad	Pressure (LUPs)
WW209	296	13.5	WAA41	10800
WW209	296	13.5	Fed. 410	11200
Fed.410	296	14.0	WAA41	10000
Fed.410	296	14.0	Fed. 410	10600

RELOADING PRECAUTIONS

Follow these precautions to help assure maximum enjoyment and safety in reloading and to assure uniform performance of your reloads. Remember that you can be badly injured or suffer severe burns if the strictest safety precautions and housekeeping rules are not enforced.

1. Exercise care at all times and wear safety glasses while reloading.
2. Never load in haste and avoid distractions.
3. Never smoke while handling powder or primers or during any reloading operation.
4. Handle primers carefully; they are the most hazardous of all components used for smokeless powder loads.
5. Keep powder and primers away from heat, sparks and open flames.
6. Store powder in a cool, dry place at all times.
7. Never use a powder unless you are certain of its identity.
8. Do not mix powders.
9. Devote full attention to reloading operations — avoid distractions.
10. Keep powder and primers out of reach of children.
11. Use components as recommended; don't take shortcuts.
12. Never exceed maximum recommended loads.
13. Develop a loading routine to guard against mistakes.
14. Examine every shell or cartridge before loading to insure good condition.
15. Double check every operation for safety and uniformity.
16. Check powder charge level in shells to avoid double charges.
17. On new center fire loads, start with charge weights 10% below recommended maximum loads, except as noted in data.
18. Always watch for indications of excessive pressure.
19. Do not decap live primers; it is safer to destroy them by firing the empty shell or cartridge in a firearm.
20. Do not substitute components; it will result in a significant change in ballistics, and could result in an unsatisfactory or even dangerous load.
21. Do not allow children to play in the vicinity of handloading operations.
22. Observe all local fire regulations and codes with respect to quantities of powders and primers stored and conditions of storage.
23. Store powder only in its original container. Never transfer it from one storage container to another since this increases the possibility that it may become mislabeled.
24. Keep these "Reloading Precautions" posted at the place where you do your reloading. Reread these precautions periodically.

APPENDIX 5 – RELOADING PRECAUTIONS