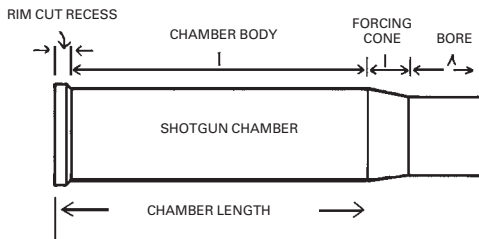


BY RALPH WALKER *Photos and Drawing By Author*

WARNING

Never attempt to disassemble or reassemble a firearm unless you are absolutely certain that it is empty and unloaded. Visually inspect the chamber, the magazine and firing mechanism to be absolutely certain that no ammunition remains in the firearm. Disassembly and reassembly should follow the manufacturer's instructions. If such instructions are not immediately available, contact the manufacturer to see if they are available. If they are not available at all, then you should consult other reference sources such as reference books or persons with sufficient knowledge. If such alternative sources are not available and you have a need to disassemble or reassemble the firearm, you should proceed basing your procedures on common sense and experience with similarly constructed firearms.

With regard to the use of these tools, the advice of Brownells Incorporated is general. If there is any question as to a specific application it would be best to seek out specific advice from other sources and not solely rely on the general advice and warnings given.



*Standard shotgun chamber with short forcing cone.*

**SHOTGUN CHAMBER LENGTHS**

The shotgun chamber consists of three sections. Starting at the rear is the recess cut for the rim of the shell. Next is the chamber body cut with a slight taper to assist inserting the shotgun shell and to provide for easy extraction after firing. Third is the forcing cone, beginning where the chamber body ends and tapering down to the bore section of the barrel.

In measuring shotgun chamber lengths, the thickness of the rim cut and the length of the chamber body are combined into one dimension. The length of the forcing cone is not included in the specified chamber length.

Prior to around 1900, shotgun chamber lengths varied considerably from manufacturer to manufacturer, often resulting in odd fractions. After 1900, shotguns have been produced in the following common chamber lengths:

GAUGE	CHAMBER LENGTH	GAUGE	CHAMBER LENGTH
10	2 <sup>7</sup> / <sub>8</sub> " , 3 <sup>1</sup> / <sub>2</sub> "	20	2 <sup>1</sup> / <sub>2</sub> " , 2 <sup>3</sup> / <sub>4</sub> " , 3"
12	2" , 2 <sup>1</sup> / <sub>2</sub> " , 2 <sup>5</sup> / <sub>8</sub> " , 2 <sup>3</sup> / <sub>4</sub> " , 3"	28	2 <sup>3</sup> / <sub>4</sub> " , 2 <sup>7</sup> / <sub>8</sub> "
16	2 <sup>9</sup> / <sub>16</sub> " , 2 <sup>3</sup> / <sub>4</sub> "	.410	2" , 2 <sup>1</sup> / <sub>2</sub> " , 3"

NOTE: Other gauges were produced or imported but not in any great quantity such as the 8 Gauge (3", 3<sup>1</sup>/<sub>8</sub>", 3<sup>1</sup>/<sub>4</sub>"), 14 Gauge (2<sup>9</sup>/<sub>16</sub>" , 24 Gauge (2<sup>1</sup>/<sub>2</sub>" ) , 32 Gauge (2<sup>1</sup>/<sub>2</sub>" ) and 9mm Gauge (1<sup>1</sup>/<sub>8</sub>" , 1<sup>3</sup>/<sub>16</sub>" ).

From 1920 to the mid 1930's the gauges were somewhat standardized to the following current chamber lengths:

GAUGE	CHAMBER LENGTH	GAUGE	CHAMBER LENGTH
10	3 <sup>1</sup> / <sub>2</sub> "	20	2 <sup>3</sup> / <sub>4</sub> " , 3"
12	2 <sup>3</sup> / <sub>4</sub> " , 3" , 2 <sup>1</sup> / <sub>2</sub> "	28	2 <sup>3</sup> / <sub>4</sub> "
16	2 <sup>3</sup> / <sub>4</sub> "	.410	3"

NOTE: Ammunition is still produced in the 10 Gauge 2<sup>7</sup>/<sub>8</sub>" length. The .410 Gauge 2<sup>1</sup>/<sub>2</sub>" shell is also still produced and a few special skeet guns are chambered in this length.

Metric chamber lengths and chamber diameter specifications are not exact duplicates of the current American specifications

# BROWNELLS

## MEASURING & RECHAMBERING SHOTGUN CHAMBERS

#077-200-100



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since the accepted procedure is to carry the dimension to the nearest millimeter. The dimensions are usually stamped on the bottom of the barrel under the chamber. For example, 12-70. The 12 designates the gauge and the 70 designates the length of the chamber in millimeters. In this case the 70mm is the equivalent of the American 2<sup>3</sup>/<sub>4</sub>" chamber. Actually, 2<sup>3</sup>/<sub>4</sub>" is exactly 69.85mm but this small difference can be ignored for all practical purposes. The accepted conversion of metric chamber lengths to American standard chamber lengths is:

METRIC	INCHES	METRIC	INCHES
50	2"	73	2 <sup>7</sup> / <sub>8</sub> "
63-64	2 <sup>1</sup> / <sub>2</sub> "	76	.3"
65	2 <sup>9</sup> / <sub>16</sub> "	89	3 <sup>1</sup> / <sub>2</sub> "
70	2 <sup>3</sup> / <sub>4</sub> "		

**THE SHOTGUN SHELL IN RELATION TO CHAMBER LENGTH**

The unfired shotgun shell is considerably shorter than the chamber length. For example, the modern star crimped 20 gauge 2<sup>3</sup>/<sub>4</sub>" shell is 2.44" in length when loaded. When fired, the crimped end unfolds and the shell is then 2.75" in length. This usually matches the chamber length of 2.75". Therefore, the end of the fired shell case stops where the forcing cone begins tapering the chamber diameter down to the smaller bore diameter.

An unfired 20 gauge 3" shell measures 2.68" in length, which allows it to easily enter the 20 gauge 2<sup>3</sup>/<sub>4</sub>" chamber (2.75)". However, when the 3" shell is fired, the case unfolds to its full 3"

length. The extra .25" of case body enters the forcing cone creating a "bottle neck" effect through which the shot and wads must pass.



*"Bottle Neck" effect when the end of the fired shell case enters the forcing cone, thus squeezing and deforming the shot (left), as opposed to a correct length chamber (right) in which the fired case does not enter the forcing cone. Dotted line is beginning of bore and the end of the forcing cone.*

The amount and type of powder loaded in a shell is carefully selected to provide the correct burning rate which provides the pressure necessary to overcome the inertia of the shot: push it and the wads through the forcing cone, up the bore and through the choke. This balance is absolutely essential for good patterns and the overall correct function of the shotgun. Any time part of the fired shotgun case enters the forcing cone and creates the "bottle neck" effect, the balance is changed and several detrimental effects occur.

First, the momentary slowing of the shot charge by the "bottle neck" increases the rate of burning of the powder which results in increased chamber pressure. In some cases, it is about the same as firing a proof load shell. This excess pressure not only puts a strain on the gun's mechanism and barrel, but also increases the amount of recoil. Provided the mechanism is capable of safely withstanding the 10% to 25% increase in chamber pressure, the gun will slowly, but surely, be battered to pieces.

The second effect is that as the shot is forced through the "bottle neck", individual pellets become deformed and out of round. When the deformed pellets leave the barrel, they will not stay with the main charge as air pressure against the deformed pellets causes them to veer away from the mass of shot. The end result is a poorer pattern, both in percent and distribution of the pellets in the pattern circle. While this has been an extreme example, it illustrates the necessity of the chamber length correctly matching the length of the fired shotgun shell. Any time a portion of the fired shell case enters the forcing cone, it decreases the efficiency of the barrel and consequently, the efficiency of the shotgun's performance.

### USING YOUR CHAMBER DEPTH GAUGES

The chamber must be clean for accurate gauging. If normal cleaning procedures fail, make a special tool by using a brass bore brush and the forward section of a shotgun cleaning rod inserted in a ¼" electric hand drill. The rapid rotation of the bore brush will usually get the job done. If this fails, wrap a small amount of four aught (0000) steel wool around the bore brush and allow the drill to run for about a minute. Use both of these systems dry. They will remove the caked rust, powder residue, etc., and not damage the chamber. Wipe the chamber with a clean patch and use a strong light directed into the chamber to assure cleanliness before gauging.

Your gauges are machined to specifications of each shotgun gauge chamber dimension as established by the Sporting Arms and Ammunition Manufacturers' Institute (S.A.A.M.I.). The diameter of the front end is that of the chamber body where it meets the forcing cone. While a small bevel is cut on the front end to protect it, care should be exercised to prevent the edge from becoming nicked to avoid false gauging.

The forward edge of the circular cut around the gauge body is the point of the chamber length. This index edge should align with the rear of the chamber rim recess cut in the barrel if the chamber length is correct. Visual observation is easy but can be made more pronounced by filling the groove with a contrasting color. A simple method is to wipe the cut clean, then fill the groove with a white Lacquer-Stik® (Brownells #517-100-002). Another method is to use common fingernail polish.

The gauge body is not tapered as is the shotgun chamber to avoid false gauging on the side of the chamber. The rear end of the gauge is threaded ¼"-20 tpi to accept the #080-546-501



*Lathe cut grooves accurately indicate chamber length when placed in clean chamber. Forward groove measures 2¾" chambers, rearward groove measures 3" chambers.*

Chamber Gauge Handle. A common ¼"-20 bolt or threaded rod extension can also be used to allow easy insertion and extraction of the gauge in a chamber. The handle is almost a necessity on pump or autoloader barrels with long barrel extensions.

After use, wipe the gauge clean and lightly oil. Store the gauges separately.



*Chamber Depth Gauge inserted in 12 gauge, 3" chamber, with pointer indicating that the gauge shows proper chamber depth, or length, for 3" chamber.*

### SHORT CHAMBERS

Starting around 1930 it became standard practice to stamp both the gauge and the chamber length on the barrel such as "12 Gauge 2¾"" or an abbreviation. While there are exceptions to the rule, a barrel stamped only with the gauge specifications should be checked with the chamber length gauge. Chances are that the chamber length is shorter than the current standard. It is good practice to also check metric marked chambers to assure correct dimensions for American shells.

**.410 Gauge:** The majority of pumps and semi-automatics will be chambered for the 3" shell as Winchester pioneered this field in the 1930's with their Model 42 pump. Prior to that time the .410 was chambered in the 2½" length or the earlier 2" length. The designation .410 is somewhat misleading as it is the bore diameter expressed in hundredths of an inch and not the "gauge" as measured for other shotguns. Some early single and double barrels were marked either 12mm or 67 gauge.

**28 Gauge:** The original 1903 version of this shell was in 2⅞" chamber length but was standardized in the 1920's to the current 2¾" chamber length. The longer 2⅞" chamber will present no problems with the current 2¾" shell but the condition of the gun should be carefully considered in shooting the 2¾" magnum shell with 1 ounce of shot, as the earlier guns were designed for a light load and ¾ oz. of shot. A few European doubles, although stamped for the 2¾" shell, will give extraction problems with American shells as the chambers are extremely tight, especially in the ultra light version guns. Any that do not accept the 2¾" gauge can be rechambered to eliminate the problem. NOTE: There were a few guns chambered for a special 2½" 28 gauge shell but these are extremely rare.

**20 Gauge:** Up until 1926 the standard chamber length was 2½" and a considerable number of guns will be found with this chamber length. Provided the barrel and the gun mechanism are in good condition, these guns can often be rechambered to current 2¾" length. Single and double barrels require only rechamber-

ing, but the pumps and semi-automatics will usually require alterations of the feed mechanism and ejection ports in the receiver. Prior to World War I a few double barrels and one pump were chambered for the 3" shell loaded with 1½ oz. of shot. It was not popular, but after World War II the 3" shell was increased to 1¼ oz. of shot and has rapidly gained in popularity. Conversion from the 2¾" chamber to the 3" chamber is usually safe in well built guns but under no circumstance should a 2½" chamber be converted to the 3" chamber.

**16 Gauge:** The 2⅞" chamber length was both the American and the European standard until 1929 when the American standard was changed to the current 2¾" length. The European standard did not change until after World War II and even today the 2⅞" (65mm) is still popular in some sections of Europe. The popularity of the gauge, the large number of guns manufactured in the U.S. prior to 1929, and the vast imports both before and after World War II has resulted in literally thousands of 16 gauge 2⅞" guns still in use. In fact, only in recent years have the ammunition manufacturers discontinued production of 2⅞" shells. Conversion of single and double barrels to the 2¾" chamber seldom requires more than rechambering. Pumps and semi-automatics will require alterations of the mechanism. While any sound gun will accept the conversion, the use of short magnum shells should be avoided.



*Chamber Gauge verifies that the chamber in this 12 gauge auto barrel is 2¾", as gauge seats to the forward, (or 2¾") ring in the gauge. Note the Chamber Gauge Handle on gauge.*

**12 Gauge:** This is, without a doubt, the most popular gauge in shotguns and also has been produced in the widest variety of chamber lengths. The British still make an ultra light upland game gun in the 2" chamber length and prefer the 2½" shell and chamber length for general use. The 2¾" chamber and shell is considered for heavy duty use. A considerable number of the 2½" chambered guns have been imported and the length was popular in the early 1930's with some American doubles being produced in this length.



*Classic example of short chamber. After thorough cleaning, chamber will not accept gauge to full 2¾" depth. This particular chamber measured 2⅝" prior to rechambering.*

The 2⅝" chamber length was standard in the U.S. until the mid 1920's when the 2¾" chamber was adopted. The 3" chamber length and shell began in the 1930's and has steadily gained popularity due to the availability of heavy 1⅞ oz. shot loading which almost matches the 10 Gauge 3½" 2 oz. load.

Rechambering of the 2" and 2½" chambers to the current 2¾" chamber length should be approached with caution due to the light weight of the guns.

The 2⅝" chamber length is more commonly encountered than realized as many manufacturers obviously did not make the change when the 2¾" chamber length was adopted. Any barrel that is not stamped 2¾" should be gauged. The conversion to 2¾" length should present no problems if the gun is in good condition and will increase the performance of the gun.

The rechambering of a current 2¾" chamber or the older 2⅝" chamber length to the 3" chamber length is of questionable safety, regardless of the condition of the barrel or gun mechanism. Even if successful, the heavy loaded 3" shell with 1⅞ oz. of shot will generally batter a gun mechanism to uselessness. Older guns should definitely not be rechambered to the new 3½" magnum.

**10 Gauge:** This has been made in two chamber lengths, 2⅞" and the current 3½". Under no circumstances should a 2⅞" chamber be converted to the 3½" chamber length.

#### NOTES ON CONVERSION

As stated, single and double barrel guns can normally be converted to the longer chambers with little effort other than rechambering. Some of the doubles with automatic ejectors may require retiming of the ejectors but generally no special technique is required. The Browning Five Shot Semi-Automatic in 16 gauge 2⅞" chamber length is quite common but requires the alteration of parts internally for proper operation with the 2¾" length shell. Malfunctions are usually the results of not making the full conversion as recommended by Browning. The step-by-step conversion in full detail can be found on pages 240-242 of Brownells Encyclopedia Of Modern Firearms. Follow the directions carefully and the gun should function perfectly. It is recommended that the short magnum 16 gauge shells not be used in converted Brownings as the gun was not designed for this heavy load. The conversion of pumps such as the Winchester Model 1912 in short chambers follows the same basic procedure.



*The same chamber as shown at left, still prior to rechambering, easily accepts an unfired 2¾" shell. However, when fired, this shell will protrude into the forcing cone area, causing excessive pressures, recoil and damage to the gun. Following these photos, this gun was rechambered to 2¾".*

#### THE LONG FORCING CONE

The example of firing a 3" shell in a 2¾" length chamber and the resulting effects are, in varying degrees, true with all short chambers. It is also true to a lesser degree with chambers of the correct length but with the forcing cone of the chamber cut to accommodate the old roll type crimped shells. These forcing cones are short and abrupt, with a length of ½" about average.

The old roll type crimped paper shotgun shells had a heavy piece of cardboard, commonly termed the nitro wad, directly over the powder charge in the shell. Next came the felt filler wads, then the shot charge, and finally the over shot wad with the shotgun case end rolled over to hold the wad in place.

When fired, the pressure from the powder pushed the roll crimp straight as the wad and shot column moved out of the shell. It was important that the powder gas not be allowed to pass around the wads and disrupt the shot. For this reason the forcing cone was short and abrupt to engage the over powder nitro wad immediately as it left the shell. It was compressed by the forcing cone and held the gas pressure behind the wad.

The invention of plastic, cup-shaped, over powder wads was a giant step forward. As gas pressure increased, it automatically pressed the cup edge firmly outward for a perfect gas seal. Its

superiority over the paper nitro wad can best be judged by the fact that reloading manuals recommended decreasing the powder charge 10% when the plastic cup wad was used instead of the nitro paper wad.

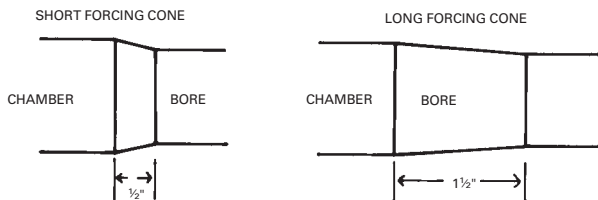
The plastic cup powder wad completely replaced the nitro wad. Next came the plastic shot protector and then the plastic filler wads. The final step was the joining of all three components into one unit. This unit perfectly seals the gas pressure, cushions the impact of getting the shot moving, and protects the shot from being rubbed against the sides of the bore and deformed. Replacement of the old waxed paper shell and one-piece wad, has resulted in a shotgun shell far superior in every way to the old shell.

### CONVERTING OLD FORCING CONES TO THE LONG FORCING CONE

Fired in a barrel from which all choke has been removed, the modern plastic shell will generally produce a 5% to 10% better pattern at a given distance than a similar loaded shell using the old wads, no shot protector, over shot wad, etc. In a choked barrel, the new shell has the effect of increasing pattern performance approximately a half to a full degree of choke. In other words, a barrel choked modified and intended for the old type shells will produce either an improved modified, or a full choke pattern with the new shell.

The 30" circle at 40 yards has always been the method of determining the efficiency of a full choked barrel. With a barrel chambered and choked for the old type shell, 70% is considered a good pattern. Yet, 30% of the shot is not in the circle and, consequently, has been lost for practical purposes. The new type shell will increase the percent to 75 or 80, thus utilizing more of the shot that was in the shell before it was fired. This is accomplished primarily by reducing pellet deformation as the pellets travel through the forcing cone and barrel.

Patterning a shotgun at the range where it will be used will tell you much more about the performance your customer wants than sticking to the old, standard 40-yard system. The performance of an improved cylinder barrel at 40-yards is not a guarantee of performance at the shorter ranges for which the improved cylinder is intended. The ultimate barrel will produce the desired pattern, completely without open spaces or "free holes", at the distance for which the degree of choke was intended.



*This illustrates, in proportion, the difference between the two types of forcing cones. While there are variations, of course, the dimensions shown are average.*

The short and abrupt forcing cone always deformed some of the shot as it was pushed through the short cone but this was a necessity with the old type shell. It is not a necessity with the modern wad unit and folded crimp plastic shell. In fact, it actually decreases the efficiency of the new shell! With modern shells, a longer forcing cone allows the shot to pass from the chamber to the smaller bore diameter with less shot being deformed, and without the gas leak problem.

Forcing cones from 1" to 3" in length have been tested and the results indicate that generally a forcing cone of approximately 1 1/2" in length will provide the best results with the widest variety of loads. A short forcing cone barrel recut to the long forcing cone may give a 5% to 10% pattern increase both in density and pellet distribution. The actual pattern percent gain will vary with individual barrels, gauges, pellet sizes and shell loads used. However, the combination of the long forcing cone and the modern shell will invariably produce a more efficient pattern.

An additional advantage of the long forcing cone is that the plastic shell body sometimes unfolds and stretches to a length longer than specified. In a 2 3/4" chamber the length can be as much as 2.9" instead of the correct 2 3/4". The stretching varies with the quality of the shell and the load. Cheap, short magnum shells will stretch more than a quality skeet or trap load shell. In

the short and abrupt forcing cone, this stretching allows the end of the shell to enter the forcing cone and create the "bottle neck" effect similar to a short chamber, and with similar results.

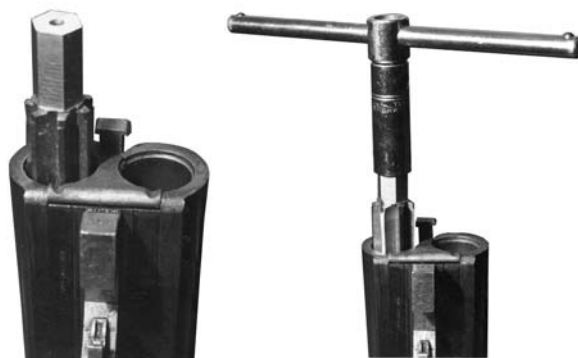
### RECUTTING FORCING CONES AND CHAMBERS

Brownells Long Forcing Cone Reamers can be used to extend the forcing cone from the original short configuration, and under some conditions, may also be used to lengthen early short chambers to accept modern standard and low velocity loaded shells. As a general rule we encourage the use of a good quality chamber reamer for actual cutting of the chamber. Safety should always be given first priority when rechambering any firearm. The acceptable conversions should never be attempted without a thorough examination of the condition of the gun and its components. A gun in good condition, with all components locking and functioning correctly can normally be safely converted. Yet similar models in poor condition with parts and components worn and loose should not be converted. Always remember that with older model guns the magnum load of its day is probably the accepted field load of today. For this reason, caution should be exercised to select only field or target loads and avoid the current heavy short magnum shell loads. If in doubt about the safety of rechambering a particular gun...**DON'T!**

The Brownells Long Forcing Cone Reamers are available in two different forms; the traditional straight flute and the more modern helical or spiral flute. Spiral flute reamers function with a shearing cut which under some conditions can be much more efficient than the cutting action of a straight fluted reamer. Both can be used in the same manner and both, when used properly, will normally leave a very smooth surface. They are exclusively manufactured for us by one of the country's oldest reamer suppliers. Be sure the reamer cutting edges are kept sharp by careful stoning with a hard Arkansas stone. When in use, the metal chips from the removed metal should be equal in front of every cutting edge to assure that the reamer is cutting evenly on all sides. If the chip build-up is in front of only one or two flutes, the other flutes are not cutting. Stone the face of these flutes lightly until the metal removal is equalized. **DO NOT** stone the tops of flutes.

**NOTES:** On some guns, the original chamber diameter will not match the modern SAAMI specifications of the reamer. If it is smaller than the reamer, the reamer will open up the forward end of the chamber to the nominal chamber mouth dimension used in modern chambers. If the original chamber is larger in diameter than today's specifications show, the reamer will leave a slight step. This step normally will not cause functioning problems. A little extra time spent honing the chamber and forcing cone will "blend" the step into the chamber, but is only needed for cosmetic reasons.

We have observed that barrel steels used on shotguns vary greatly in hardness. Some steels will cut easily with little effort, while others require much greater force and will try to start "chattering" with any cutter used. Even, down-pressure on the reamer, and plenty of cutting oil, will



*LEFT: Barrel in vise, chamber end up, with chamber reamer in position to begin cutting new chamber.  
RIGHT: T-handle wrench gives control for accurate reaming.*

usually minimize or eliminate, this chatter. If it persists into the finished forcing cone length, you have no choice but to spend extra time with the barrel hone to clean up the chatter marks.

The actual length of the finished long forcing cone will vary due to the actual bore diameter of the barrel. The same reamer used in a barrel with a .725" diameter bore will give a longer forcing cone than if it is used in a barrel with a .740" bore. This is important to remember: The angle of the forcing cone is the same in both barrels, and it is the longer, more gentle angle that reduces shot deformation in the forcing cone!

Place the barrel in a padded vise, chamber toward the ceiling, and the breech end as low as possible for observation and ease of cutting. Squirt cutting oil into the chamber and onto the flutes of the reamer as the oil will help achieve a smooth cut. While the wrench used to turn the reamer should be secure to the reamer, it is necessary to exert pressure equally, allowing the tapered reamer to "feel" its own way and keep centered. Side pressure on the handle can result in an oval chamber.

After about two or three complete revolutions of the reamer, remove it straight up and out of the chamber. Wipe away all metal chips and cutting oil from the reamer. An old toothbrush and mineral spirits work fine for this job. Next, run a dry patch through the bore to remove any lingering chips and cutting oil. Check with your chamber depth gauge. Regardless of the number of times, it is important that the rechambering be done slowly, the reamer and barrel cleaned each time, and the depth constantly checked with the gauge. A strong light directed into the chamber will help you see the progress of the rechambering and you can quickly note if you are not turning the reamer with even strokes.

If initial gauging has indicated correct chamber length but the chamber has the short, abrupt forcing cone and you want to rechamber for the long forcing cone, the procedure is identical, with two exceptions. First, all traces of the old forcing cone must be removed. Second, to achieve this, the chamber must be cut slightly longer than standard, as many of the old forcing cones are pitted. The front edge of the circular cut grooves around the gauge body is the index point for correct chamber length. However, it will generally be necessary to use the **REAR** edge of the circular cut on the gauge as the index point for chamber depth, in order to remove all of the old forcing cone. This extra length will not effect the barrel performance as 2¾" shells are commonly fired in 3" chamber length 20 and 12 gauge shotguns.

Finish the rechambering job by polishing the chamber and new forcing cone with 500 grit aluminum oxide cloth. The Brownell **CHOKER HONE** tool will do the job faster and with more even results. Use this rotating tool dry for about one minute of revolution in an electric hand drill to remove any roughness, then squirt cutting oil up into the chamber and use the tool for about two minutes. The result will be a highly polished forcing cone.

## CONCLUSION

The ultimate goal is to achieve as close to 100 percent of the pellets as possible, striking within the 30" pattern circle, with the pellets evenly distributed. The ammunition manufacturers have provided one giant step forward toward this goal with modern shotgun shells. Using these shells in chambers of correct depth is another step forward. The long forcing cone is still another step toward that goal. There is a fourth step available; reworking the choke to achieve the maximum percent of pellets evenly distributed in the 30" circle at the desired range.

Brownells Choke Set was introduced many years ago and thousands of gun shops across the country will testify to its effectiveness in improving shotgun patterns. By combining the modern shotgun shell, correct chamber length, long forcing cone and correct choke dimensions, you can achieve the maximum efficiency of any barrel regardless of age or model of gun.

## CATALOG SECTION

The following items have been selected to help you in your chambering work. *The prices shown are correct at the time of printing but are subject to change without notice. Items will be billed at the price in effect at the time of shipment.*

## BROWNELLS STRAIGHT FLUTE LONG FORCING CONE REAMER



### Lengthen Forcing Cones To Improve Patterns, Reduce Recoil

Double-duty reamers lengthen short chambers to modern standard or magnum lengths and cut the new long forcing cone at the same time - OR - will cut a long forcing cone without lengthening the chamber for the gunsmith seeking improved shooting performance for his customer. Flute placement, relief and angle are designed to give the best possible results on all types of barrel steel (except on chrome lined barrels, of course!). The 1½" long (approximately) forcing cone created is performance proven to give optimum results in any length chamber. (For complete instructions see our detailed, illustrated booklet, *Measuring and Rechambering Shotgun Chambers*.)

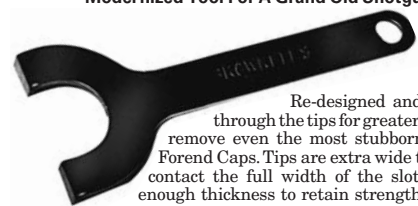
Reamers are ground exclusively for us from special, select tool steel by one of the oldest and most respected manufacturers of reamers in the United States. Quality and performance is 100% guaranteed. Plus, the hex-drive permits use of a socket and T-handle when tap handles will not operate. Lathe setup not required.

**SPECS:** 5¾" (14.6cm) long overall. 1" (2.5cm) long hex section: ½" (12.7mm) across on 10, 12, and 16 ga.; 7/16" (11.1mm) across on 20 ga.; 3/8" (9.5mm) across on .410 (10.4mm). 1½" (3.8cm) long forcing cone cutting section. 7 flutes, straight cut. 10 ga.: use on 10 Gauge Magnum Shotgun Chambers ONLY. **Do Not Use in 2½" (7.3cm) or other 10 Gauge chambers.**

#080-661-010	10 Ga. 3½" Mag L.F.C. Reamer, SK00TPU	\$ 65.88
#080-661-012	12 Ga. L.F.C. Reamer, SK00VBX	63.38
#080-661-016	16 Ga. L.F.C. Reamer, SK00HDZ	60.97
#080-661-020	20 Ga. L.F.C. Reamer, SK00YTP	60.97
#080-661-410	.410 Bore. L.F.C. Reamer, SK00AVB	50.78
#077-200-100	Measuring & Rechambering Shotgun Chambers Instruction Booklet	.N/C

## BROWNELLS WINCHESTER MODEL 12 FOREND WRENCH

Modernized Tool For A Grand Old Shotgun



Re-designed and beefed up through the tips for greater strength to remove even the most stubborn Model 12 Forend Caps. Tips are extra wide to give solid contact the full width of the slot, and have enough thickness to retain strength even after being reground to fit any extra narrow slots that you may come across. Designed by working gunsmiths for working gunsmiths, and shop-proven over a lot of years. Flat enough to go into your pocket for emergency field repairs. Fits 12 ga. only.

**SPECS:** 2" (5.10cm.) wide x 5" (12.7cm) long overall.  
#080-548-012 Model 12 Forend Wrench, SK00VBX

\$ 15.55

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# SHOTGUN CHOKE ALTERATIONS

One job that practically every gunsmith and hobbyist is asked to do is, "Can you open up the choke on my gun just a bit to adjust the pattern?" In most instances, the job had to be passed up, or the gun sent to an "expert", because tool costs were too high, and/or fully-illustrated, well-written instructions were not available. The impression left with your customer does not tend to build much confidence in your abilities! Or, make any money for you! Thanks to the clever ingenuity of the late Ralph Walker, an easy, simplified method of choke adjustment using Angle Blade Reamers, our Calipers and Barrel Hones is now available to the gunsmith. Costs are well within reach of anyone interested in doing the work. Instruction booklet has all the information with complete illustrations and data needed to do the job correctly and to your customer's most demanding satisfaction. Combine with a Long Forcing Cone job (listed elsewhere) and watch your customers really smile.

## ANGLE BLADE EXPANDING CHOKE REAMER



Smooth Cutting - Fully Adjustable -  
Gives Professional Choke Alteration

For 10, 12, 16, 20 and 28 gauge, plus .410 choke reaming. Blade angle eliminates chatter; each cut is clean and controlled. Tightly choked 12 gauge barrels may require use of the "D" reamer before using the 10/12 gauge "E" reamer. Barrel Hone and Caliper below are integral parts of the process and should be included in your equipment. "A" and "B" reamers are especially useful in fitting 1911 Auto barrel bushings.

**SPECS:** Overall dimensions and expansion range as follows: **108** - 4 1/2" long, .178" sq. shank. .375"-.406". **109** - 4 3/4" long, .178" sq. shank. .406"-.437". **A** - 5 5/8" (14.2mm) long, .218" (5.5mm) square shank, .468"-.531". **B** - 5 3/4" long, .282" sq. shank. .531"-.593". **C** - 6 5/8" long, .282" sq. shank. .593"-.656". **D** - 6 5/8" long, .282" sq. shank. .656"-.718". **E** - 7 1/8" long, .332" sq. shank. .718"-.781". 1" = 25.4mm.

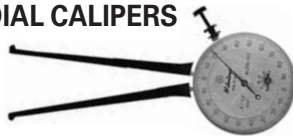
STOCK #	DESCRIPTION	FITS	PRICE
#170-375-008	108 Reamer (complete)	.410	\$ 38.61
#170-406-009	109 Reamer (complete)	.410	\$ 40.34
#170-531-001	A Reamer (complete)	28	\$ 42.14
#170-531-002	B Reamer (complete)	28	\$ 42.14
#170-593-003	C Reamer (complete)	20/16	\$ 44.57
#170-656-004	D Reamer (complete)	16/12	\$ 44.57
#170-718-005	E Reamer (complete)	12/10	\$ 48.38
#170-375-108	108 Blade Set	-	\$ 22.99
#170-406-109	109 Blade Set	-	\$ 24.01
#170-531-101	A Blade Set	-	\$ 25.09
#170-531-102	B Blade Set	-	\$ 25.09
#170-593-103	C Blade Set	-	\$ 26.54
#170-656-104	D Blade Set	-	\$ 26.54
#170-718-105	E Blade Set	-	\$ 28.80
#170-375-208	108 Nut	-	\$ 3.30
#170-406-209	109 Nut	-	\$ 3.60
#170-531-201	A Nut	-	\$ 3.60
#170-531-202	B Nut	-	\$ 3.60
#170-593-203	C Nut	-	\$ 4.15
#170-656-204	D Nut	-	\$ 3.60
#170-718-205	E Nut	-	\$ 3.95

**CHOKE SET G** - A complete kit with everything you need to modify chokes on shotguns from 28 gauge, all the way up to 10 gauge. **SPECS:** Includes B, C, D and E Reamers, Barrel Hone, Barrel Caliper and illustrated instructions.  
**#080-667-000 Choke Set G 8K00AVB** ..... \$ 221.03  
**#076-200-104 Illustrated Choking Instructions**, only, 6G00ICI ..... **FREE**

## INSIDE DIAL CALIPERS



Measures Bore-To-  
Choke Constriction



Measuring holes with varying inside diameters are of utmost importance to the gunsmith, technician, serious hobbyist and shooter. Quickly gives you the exact I.D. of shotgun chokes and chambers as well as chambers and throats in large caliber revolvers, pistols and rifles to a depth of 3/4". (Deep enough for practically all calibers and gauges.) Hole diameter range is from .375" to 1.357", plus. Comes with fitted carrying case. **SPECS:** 5 3/8" (13.6cm) overall length, 2" (5.1cm) dial.  
**#606-209-111 Inside Dial Caliper 6K00ZAY** ..... \$ 234.00

# BROWNELLS SHOTGUN CHAMBER GAUGE



Before adjusting the choke on a customer's gun with our choke reamers and hones, check the gun's chamber with the proper Walker Chamber Gauge. Do this while the customer is present. Explain what you are doing and why it is of great value. Also point out the advantages of the long forcing cone - it will enhance you, in his eyes, as an authority on the subject.

If your customer understands (and most will) and orders the chamber/long forcing cone job along with the choke adjustment, correct the chamber *first* and pattern the gun *before* doing the choke adjustment. The results you will get by following this technique can best be described as phenomenal. You will have picked up two jobs instead of one and made your customer mighty happy. In a nutshell: an excellent and profitable service you should be offering immediately.

Gauges are machined and blued steel. Depth lines are readily seen. Each gauge is drilled and tapped 1/4" x 20" so you can use the optional handle listed, if desired. Sold individually or in Set of 6 (.410, 28, 20, 16, 12 and 10 gauge) with the Handle.

**SPECS:** 10, 12, 16, 20, .410 ga. Overall lengths vary from 3.75" (9.5cm) to 4.5" (11.4cm). Blued steel.

STOCK #	GA/CHAMBER	STOCK #	GA/CHAMBER
#080-546-010	10 / 2 7/8", 3 1/2"	#080-546-020	20 / 2 3/4", 3"
#080-546-012	12 / 2 3/4", 3" / 3 1/2"	#080-546-028	28 / 2 3/4"
#080-546-016	16 / 2 3/8", 2 3/4"	#080-546-410	.410 / 2 1/2", 3"

— Advise # — **Brownell/Walker Chamber Gauge**, each, 8K00YTP ..... \$ 13.84  
**#077-200-100 Measuring & Rechambering Shotgun Chambers Instructions**, please request. N/C  
**#080-546-000 Brownell/Walker Chamber Gauges**, set of 6 w/handle 8K00HDZ ..... **62.28**  
**#080-546-501 Chamber Gauge Handle**, 8K00ZAY ..... **9.46**

## LISLE SHOTGUN BARREL HONE

Brings Bores & Chokes  
Back to New-Or-Better Polish



Ample range for 28 ga. to 12 ga. Flex-drive eliminates chatter, gouging. For 1/4" or larger electric drill. Included in choke set. **SPECS:** 1/4" (6.3mm) shaft, 8 1/2" (21.6cm) long. No. 37-S stones fit the old style No. 37 barrel hone and will **not** fit the No. 2.

**#531-108-002 No. 2 Barrel Hone 1C00VBX** ..... \$ 12.20  
**#531-107-602 No. 2-S Stones**, only 1C00DZA ..... **3.95**  
**#037-004-037 No. 37-S Stones**, 4 sets 7C00ZAY ..... **26.40**

**BARREL HONE EXTENSION SHAFT** - Piloted shaft attaches to your electric hand drill motor and accepts Brownells Barrel Hones. Keeps the hone in the center of the bore; prevents expensive damage; lets the hone do all the work for faster, better looking results. Includes abrasive paper holder and a threaded adapter that accepts all 3/16"-27 tpi shotgun brushes and mops.  
**#080-915-000 Barrel Hone Extension Shaft**, 8K00UAV ..... \$ 57.62



# BROWNELLS

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