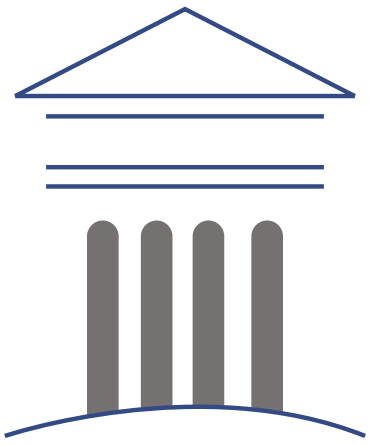
Troubleshooting Shotguns
Lesson: 2176

OBJECTIVES	3
INTRODUCTION	3
SINGLE-SHOT SHOTGUNS	4
Remedies	6
DOUBLE-BARREL SHOTGUNS	7
Operating Characteristics	7
Malfunctions	9
Self-Test Questions	10
SLIDE-ACTION SHOTGUNS	11
Malfunctions	11
Troubleshooting Slide-Action Shotguns	13
Self-Test Questions	16
SEMI-AUTOMATIC SHOTGUNS	18
Common Malfunctions	19
Troubleshooting Techniques	20
Self-Test Questions	23
ANSWERS TO SELF-TEST QUESTIONS	24
LESSON QUESTIONS	25





Objectives

After completing this lesson, you should

1. Understand how to check the headspacing in a single-shot shotgun.
2. Know the required minimum chamber length to hold modern plastic shotshells.
3. Be familiar with the part that causes forward and backward movement in the Prudy underbolt system.
4. Know what type of malfunction a dent in the magazine tube can cause.

Introduction

The modern scattergun is versatile. With the proper loads, it can be used for hunting all species of North American game, from fowl to bear.

Shotguns are used for hunting more than any other firearm in the United States. They are available in several types, including the inexpensive single-shot models, the repeaters, the semi-automatics, and the double-shot models. Troubleshooting techniques will vary with each type.

Since shotguns are widely used, you will have many requests for shotgun repairs and modifications.

Consequently, you should have a good knowledge of the basic types of shotguns: how they function, what to look for when

something goes wrong, and how to correct the problem once it is found.

This lesson is designed to review the operation of all types of shotguns. Furthermore, you will learn what to look for in various models when trouble does occur. Once the problem is found, all you need to do is follow the instructions in this lesson to correct it. Troubleshooting charts are provided to help you solve various shotgun problems quickly.



***Figure 1A**: Iver Johnson single-shot, break-open shotgun.*

Single-Shot Shotguns

Figure 1 shows a sectional view of an Iver Johnson single-barrel ejector shotgun. Many of the hammer single-shot shotguns of this century are similar to this model in design and operation.

Although most single-shot shotguns are relatively simple in design, all will have their share of problems — mainly due to wear and misuse. Many repairs to correct these problems, like replacing a broken trigger spring, only take a few minutes. Other repairs can be very time-consuming and costly, retiring many of these old-timers to the gun rack or scrap pile. However, a person with the knowledge can repair one of these shotguns in his spare time and have a good utility gun to knock around the farm or camp.

The two most frequent problems that occur with a single-shot shotgun are a broken trigger spring and a broken or weak locking bolt spring. A broken spring is easily detected by the action of the trigger, which will not spring back if pulled. Of course, if a gun looks dirty, clean it before starting your diagnosis.

The exact method of replacing the trigger spring might vary slightly with different brands. Using the Iver Johnson in Figure 1 as an example, remove the buttplate, and then with a long, heavy-duty screwdriver (½" shaft) remove the stock bolt. Be careful, since a wrong size screwdriver could slip and splinter the side of the stock.

Once the stock is removed, you will have a partial view of the inside of the receiver. Use a bore light to examine the inside of the receiver. You will be looking for a flathead screw on the bottom tang under the mainspring. The view is not too good on this particular model, since the receiver sidewalls will be blocking your direct view from the sides, and the mainspring assembly will be blocking your view from the top. You might have to remove the mainspring assembly to get at the screw head, but try to avoid this if at all possible.

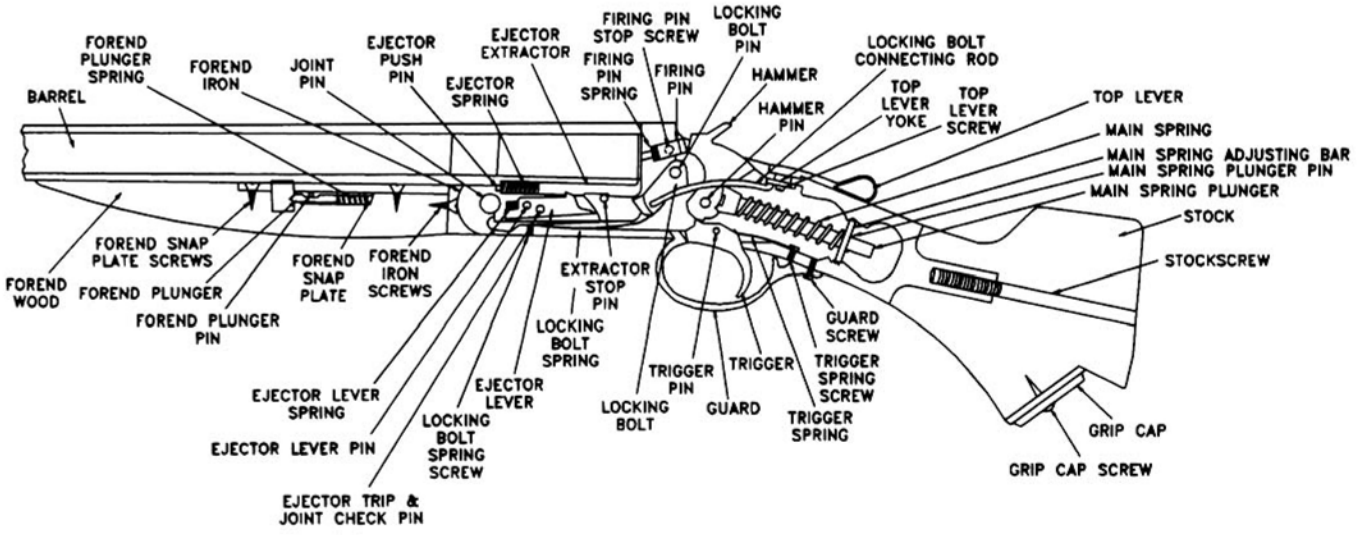


***Figure 1**: Sectional view of an Iver Johnson "Champion" single-shot, break-open shotgun. This design is similar to most break-open shotguns manufactured in the United States for the past 100 years.*

You may be able to get enough working room by sliding the mainspring adjusting bar in its notch slightly to the right or the left. Then use a ratchet screwdriver to loosen the trigger spring screw. Insert a new spring, with the curvature of the saddle toward the inside of the action, and retighten the screw. Replace the mainspring adjusting bar in its original position and then replace the stock and buttplate. The job should take about 15 minutes if you have a replacement spring on hand and if you do not have to remove the mainspring.

If the inside of the receiver is rusted, use a penetrating oil on the screw before extracting it. Otherwise, you will wrench the head off the screw and add to the original problem.

The locking bolt spring in most single-shot shotguns can be reached through the front of the receiver. Remove the fore-end, open the action, and remove the barrel to reach it. However, on some guns, you will have to remove some of the other parts of the receiver (the ejector lever and the ejector/extractor) to get at the locking bolt spring and its screw.

The symptoms of a loose or broken locking bolt spring include very loose top lever movement (one which does not align with the rear tang), play in the up-and- down barrel movement when the action is supposedly locked, and the barrel opening automatically firing without touching the top lever. A factory replacement spring is the best spring to use, but if the parts are not available, a spring can be made by conventional methods, which will be covered later.

A worn or broken firing pin is another common problem with many of the older shotguns. The pin is easily replaced by removing the firing pin stop screw and slipping the firing pin and spring out of its channel. Replace with a new pin in the reverse order, being careful not to let the remaining firing pin and spring fly out.

When a single-shot shotgun misfires, it is usually due to a broken or worn firing pin. However, sometimes misfires are caused by the firing pin spring. These coil springs in single-barrel shotguns are very tough and seldom break, but after years of use they can weaken. Most of the time, more tension can be added to the spring (enough to enable the hammer and firing pin to do their jobs) by moving the mainspring adjusting bar another notch or two closer to the hammer. If this does not add more tension, install a new firing pin spring.

The only other springs normally found in this type of gun are the ejector-lever spring and the ejector spring. Both seldom break, but when they do, replacement springs are easily made from coil-spring stock.

Any of the above repairs can be performed at very little expense. However, the problems that follow are a different matter. You will have to weigh each repair and decide if an inexpensive single-barrel shotgun is worth the time and expense to repair.

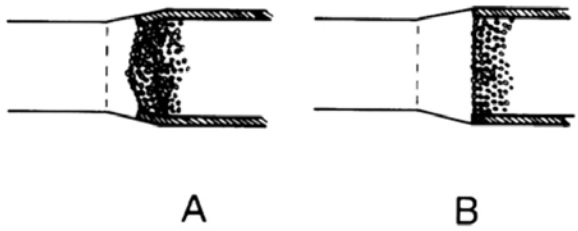


***Figure 2**: The effect of short chambers is depicted above. (A) In short chambers, the shotshell crimp bottlenecks when the gun is fired and enters the forcing cone, which squeezes and deforms the shot. (B) A correct chamber in which the fired shotshell case does not enter the forcing cone. The dotted line is the beginning of the bore and the end of the forcing cone.*

One of the most complicated problems that can occur with the older single-barrel shotguns is a loose action. To check for looseness, hold the gun with one hand on the fore-end and the other on the buttstock at the grip. By twisting your hands in opposite directions, you should be able to detect any play that might be present. Check all sides for any movement.

Headspace problems are also common in older single- shot guns. Hold the gun to a light source and look at the place where the barrel meets the standing receiver or breech. If you can see light through this gap with the action closed, the gun is probably too dangerous to fire. A feeler gauge can be used to measure the exact dimension of the gap.

Another problem is a short chamber. Over the years, there have been a variety of standard chamber lengths for the shells that were manufactured when the gun was built. Most of them were less than 2.760" in overall length — the minimum dimension able to handle the overall length of modern plastic shells. Because of these obsolete chambers, an already weak action is further damaged by the higher pressures caused by these short chambers. The shell's crimp must have room to unfold to a completely flat position when the shot and wads go from the case to the bore. Any little bit of case forced into their path because of a short chamber will deform the shot, tear hulls, cause excessive recoil, and raise chamber pressures above normal (Figure 2).

One other problem is the choke. Many of the old single-shot guns had long 32"-36" barrels that were tightly choked. However, in an effort to modernize some of these guns, the barrels were cut to 26", leaving the barrel with no choke at all. These shotguns work well on rabbits and quail at close range, but beyond 30 yards, their shot pattern is very thin.

REMEDIES

Short Shotgun Chambers. Short shotgun chambers can be reamed by using a special reamer. This chambering reamer cuts short chambers to modern length and reams a new, long forcing cone at the same time without lengthening the chamber. Reamers are currently available from Brownells Inc. for 12, 16, 20, and .410-gauges. A later lesson will deal with chamber modification in detail.

Basically, the shotgun barrel is tightly secured in a vise with the muzzle pointing toward the floor and the chamber end slightly above the vise jaws. A cutting oil is used in the chamber for lubrication, and the chamber reamer is inserted lightly into the chamber. A T-handle wrench is used to turn the reamer one complete clockwise revolution in the chamber. The reamer is then removed while still turning clockwise (never pull a reamer out by turning it counterclockwise). The chamber is cleaned of all oil and metal shavings, and then measured. Continue this procedure, cleaning the chamber and reamer each time before continuing, until the desired chamber length or forcing cone is cut.

Chokes. A choke can be put back into a shotgun, but it takes some time, skill, and effort to do so. Many gunsmiths charge $45 to $100 to choke a shotgun barrel, which is expensive for a gun that is not in the collector's class.

Shotgun chokes are normally cut to the desired measurements with an angle-blade expanding choke reamer checked with barrel calipers, then honed smooth with

a shotgun barrel hone. Barrels on inexpensive single- shot shotguns are frequently choked with a barrel swage which reduces the inside muzzle diameter. A swage is constructed of heavy-duty steel, which transmits power to adjustable rollers in order to reduce the muzzle diameter. Integral choke tubes are quite popular and can often be installed for the same price as other chokes.

Loose Actions. The best remedy to correct a loose action is to replace a worn pivot pin. Since the strength and function of the action depend on this pin, care must be exercised during the replacement. Even then, it is a difficult and time-consuming operation on many types of single-shot guns.

With the pivot pin already in the action, it would be difficult to heat the outside of the hole and cool the pin at the same time. More than likely, the old pin will have to be drilled out using a bit slightly smaller than the pin. The remaining metal in the hole can be reamed, but be careful not to enlarge the original hole.

The new pin should be made of hard chrome-alloy steel, turned on a lathe to a diameter of 0.001" larger than the finished hole, and slightly tapered for a start at one end. The frame should be stripped of all parts that will be affected by the heat, then heated just to the point of changing color—about 400° Fahrenheit. While reaching this temperature, the new pin should be immersed in ice water to make it contract. When the frame changes color, the new pin should be removed from the ice water and quickly driven into the hole. When both parts have cooled, the result should be a very tight fit. If any metal protrudes on either side of the frame, it should be ground off, filed, and polished on the buffing wheel. This operation will probably damage the original finish, which may require refinishing (case-hardened or reblued) once the pin has been installed.

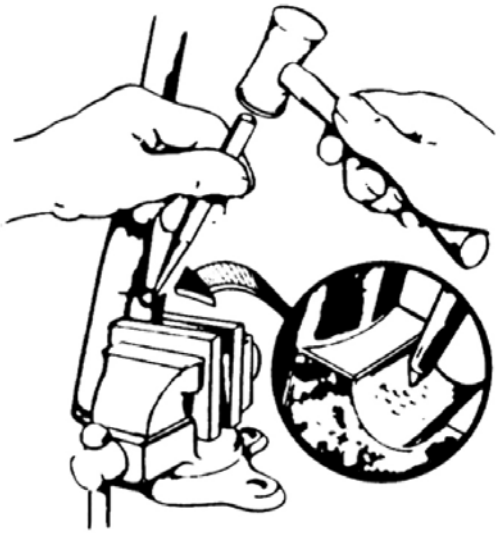


***Figure 3**: A center punch can be used to temporarily tighten inexpensive single-shot shotguns.*

If a professional gunsmith did the above operations, the costs would probably exceed $200. Therefore, such restoration work can only be justified on a single- shot shotgun with sentimental value.

On the other hand, an old single-shot shotgun might be a good candidate for the student or advanced hobbyist to practice on. The above operation will give the worker experience in lathe operations, metallurgy, and bluing or case-coloring.

If the action is not too loose, it can often be tightened by peening lightly around the semicircular cut-out on the barrel lug as shown in Figure 3. If done correctly, the metal will be displaced and moved slightly forward to close the gap. Peen both sides with a block of steel under the lug. When the pivot pin junction is tight, smooth the sides of the lug.

Double-Barrel Shotguns

Before the advent of repeating shotguns, the double- barrel, side-by-side shotguns were the most popular hunting firearm around the turn of the century. Then repeating shotguns and semi-automatics were used; they were more practical for hunting because of their ability to fire quickly several times. Today, more hunters use semi-automatic shotguns than any other shotgun.

Still, for upland game shooting, many hunters use a light double in either 12 or 20-gauge. Doubles handle well and point nicely, are not bulky, and weigh substantially less than their semi-automatic or pump counterparts.

Double-barrel shotguns include both the side-by-side and over/under guns. Drillings or three-barrel guns are essentially a double-barrel shotgun with the addition of a single rifle barrel centered under the shotgun barrels. Troubleshooting techniques for double-barrel shotguns also apply to drillings (Figure 4).

OPERATING CHARACTERISTICS

Most double-barrel shotguns have either a box lock or sidelock action. In general, the box lock contains all of its working parts within the lock or action, while a sidelock contains all of its working mechanism, except for the trigger, in a separate metal plate fitted into the side of the action body.

A double-barrel shotgun is similar to the single-shot, break-open shotgun except that there are two of every- thing: two barrels, two hammers, two mainsprings, and so on. On modern double-barrel shotguns, the hammers cock upon opening the barrels. When the barrels are dropped, the levers pivot, pressing the hammers back against the spring tension to the full-cock position.

The barrels pivot on a crossbolt or hinge pin similar to the single-shot shotgun. However, the locking mechanism varies widely in double-barrel shotguns. The Purdy underbolt system is characterized by a flush joint between the breech end of the barrels and the standing breech. The lock-up is accomplished by a sliding bolt, which is cammed forward and backward by



Figure: 4: *The three-barrel drilling consists of double shotgun barrels above a rifle barrel below. The shotgun barrels are usually 16-gauge, although other gauges are also available.*

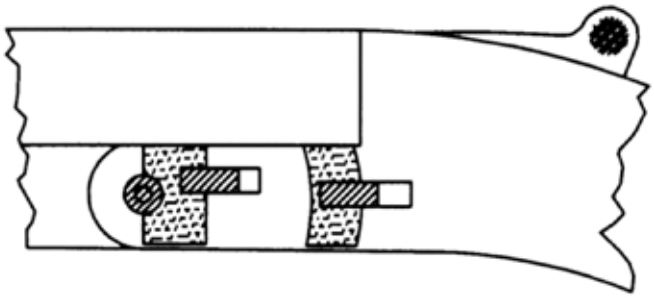


***Figure 5**: The Purdy underbolt locking system.*

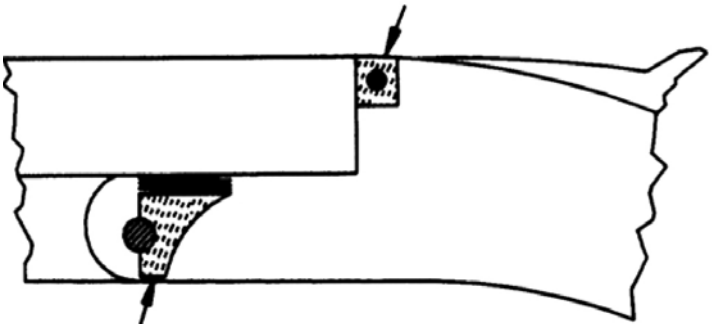


***Figure 6**: Sectional view of the Greener crossbolt system.*

the top or tang lever (Figure 5). When the lever is pressed to one side, the bolt slides out of the notches cut in the barrel lumps, permitting the action to open. When the action is closed, the lever automatically moves in the opposite direction, causing the bolt to slide forward and lock the barrels in the firing position.

The Greener crossbolt system uses an extension at the end of the barrels, which swings in and out of a recess in the receiver (Figure 6). When the gun is closed, a crossbolt enters the hole in the extension to lock the barrels firmly in place. When the top or tang lever is pressed to one side, the pin is released or cammed out the extension hole to free the barrels.

The doll's-head locking system utilizes a circular projection at the end of the barrels (Figure 7) which fits into a matching recess in the top of the receiver. Although no crosspin is necessary with this type of locking system, some doll's-head guns are reinforced with locking pins.

The rotary bolt system (Figure 8) is considered to be one of the finest shotgun locking systems in existence. With this system, a heavy-barrel extension with a rectangular cutout is engaged by a notched cylinder or bolt. The engaging surfaces are tapered to provide firm lock-up, even with progressive wear.

Some European gunmakers utilize a locking system known as a matching tapered dowel pin system. Spring-loaded tapered steel pins protrude at either side of the standing breech. When the action is closed, the pins retract and then engage matching recesses in the butt end of the barrels.

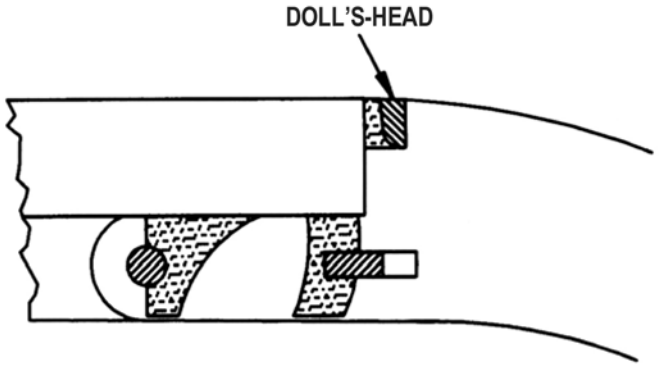


***Figure 7**: The doll's-head locking system utilizes a circular projection at the end of the barrel which fits into a matching recess at the top of the receiver.*

MALFUNCTIONS

Most of the malfunctions described for the single-shot, break-open shotgun also apply to double-barrel shotguns: a loose action, broken mainsprings, firing pins, and so on. The remedies are essentially the same as previously discussed.

One type of malfunction exclusive to double-barrel shotguns is the inadvertent firing of both barrels. This problem is especially prevalent in older European double-barrel guns where hammers and sears are made with soft steel. With age and wear, the trigger/sear contact becomes poor, and when one barrel is fired, the second barrel is jarred and fires at the same time.

The problem of both barrels inadvertently firing can sometimes be corrected by inspecting the sears with a magnifying glass and truing any rounded surfaces by light honing. Since shotgun sears ride in extremely shallow grooves, usually only minor polishing is required to smooth, lighten, or heavy-up the trigger pull. However, if the contact points are badly worn, they may need to be re-cut, polished, and heat treated. If this still does not solve the problem, the sear may have to be cut off, a new piece of heat-treated steel silver-soldered in its place, reshaped, and polished. The problem can also be corrected by welding.

Rough trigger pulls can also be corrected by lightly honing the sear/hammer contact points, but go easy. Never allow a shotgun to have a hair trigger—a trigger that lets the gunfire with a very slight pressure. Many guns have discharged from merely bumping the butt against the ground. Remember, too, that any time more than a very small amount of metal is removed from a sear surface, the case hardening probably has been removed. In this case, the part must be heat-treated.

The troubleshooting chart in Figure 9 lists malfunctions common to the single-shot and double-barrel shotguns. The probable causes of these malfunctions are listed along with the corrective actions.

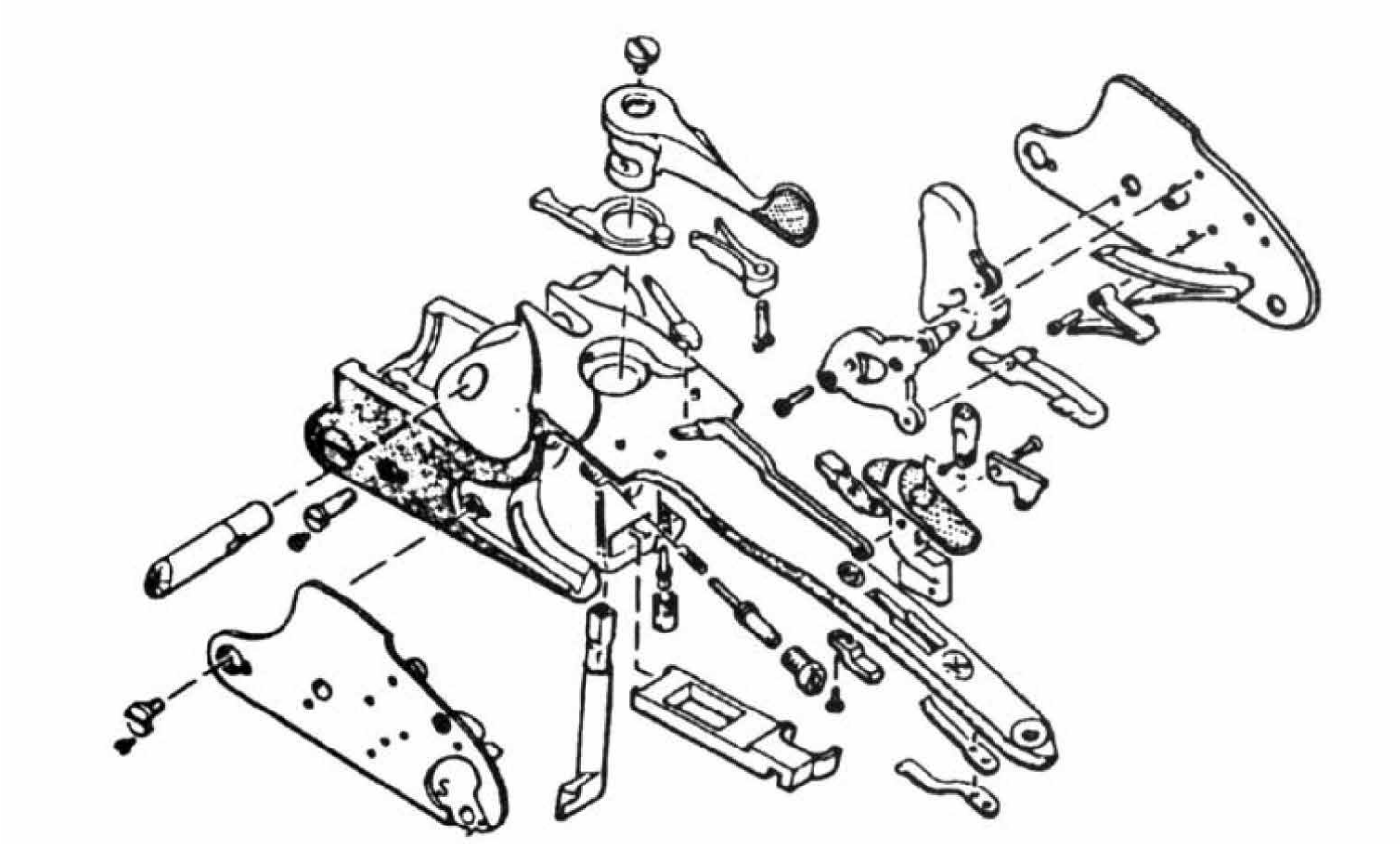


Figure 8 : *The rotary belt system is considered to be one of the finest shotgun locking systems in existence.*

Malfunction	Probable Cause	Corrective Action
Fails to eject	Broken or weak ejector spring	Replace spring
	Debris in extractor/ejector mechanism	Clean thoroughly
Loose fore-end	Fore-end plunger spring weak or broken	Replace spring
	Fore-end iron loose	Tighten
Trigger fails to reposition	Broken trigger spring	Replace
Fails to lock properly	Locking bolt spring broken or worn	Replace
	Bent or worn joint pin	Replace pin or peen humps to tighten around pin
Fails to fire	Worn or broken firing pin	Replace

Figure 9: Troubleshooting chart for single-shot and double-barrel shotguns

SELF-TEST QUESTIONS

Please check your answers on page 24.

1. **What name is given to the double-barrel shotgun that utilizes a circular projection at the end of the barrel, which fits into a matching recess in the top of the receiver to help lock the action?**
2. **What is the name of a three-barrel gun?**
3. ***True or False*. The Purdy locking system uses two underbolts to lock the shotgun action.**
4. **What is the probable cause of a loose single-shot break-action shotgun?**

Slide-Action Shotguns

In the late 1800s, the Winchester Repeating Arms Co. introduced the first successful repeating shotgun. The gun was designed by John Browning and was lever-activated. This was known as the Winchester Model

1887 repeating shotgun. With a magazine capacity of four shells plus one in the chamber, the shooter had a total of five shots, which could be fired as fast as the lever could be operated. However, this was its downfall: the lever action was too slow and the gun was heavy and bulky.

Winchester and Marlin then popularized slide-action or "pump" shotguns known as the Winchester Model 1893 (a later version was known as the Model 1897) and the Marlin Model 17.

The pump-action was faster than the lever action. Also, the movements involved in using the fore-end as a "pump" did not affect the sighting capabilities as drastically. The pump action was here to stay!

By the early twentieth century, Winchester had developed its Model 12, which is the oldest continuously-produced hammerless shotgun with a pump action. This shotgun has been produced in almost every shotgun configuration from a duck gun to a trap gun.

Remington also produced pump shotguns starting in 1907. The original Remington ejected used shells from the bottom of the receiver, and was known as the Remington Model 10. Many shooters believed that the Model 10 action was smoother and quieter than the Winchester. The present Remington Model 870 (Figure 10) has a very smooth action, even though it was designed as a labor-saving action.

The pump action in a shotgun, like the Model 870 Remington, is activated by the movement of the fore-end. When the fore-end is pulled back, a lever that attaches to the bolt moves rearward. The movement of this lever ejects the used shell and at the same time pushes the hammer back. The hammer engages a special sear that holds it in the cocked position. While the pump lever moves rearward, it also moves a new shell onto the carrier. The carrier is activated by the bolt, which in turn is moved by the lever attached to the fore-end. When the bolt is in its rearward position, a special cam, the *carrier dog*, allows the carrier to drop down to the level of the magazine. With the carrier in this position, the new shell that is moved into position by the pumping action can be picked up. As the bolt moves forward, the carrier dog is forced down, pushing the back end of the carrier down in a seesaw fashion and causing the front of the carrier to lift the new shell up to the breech. When the fore-end is moved forward the rest of the way, the bolt pushes the new shell into the chamber. When the bolt reaches its extreme forward position, a special locking-block closes into position and makes the action ready for firing.

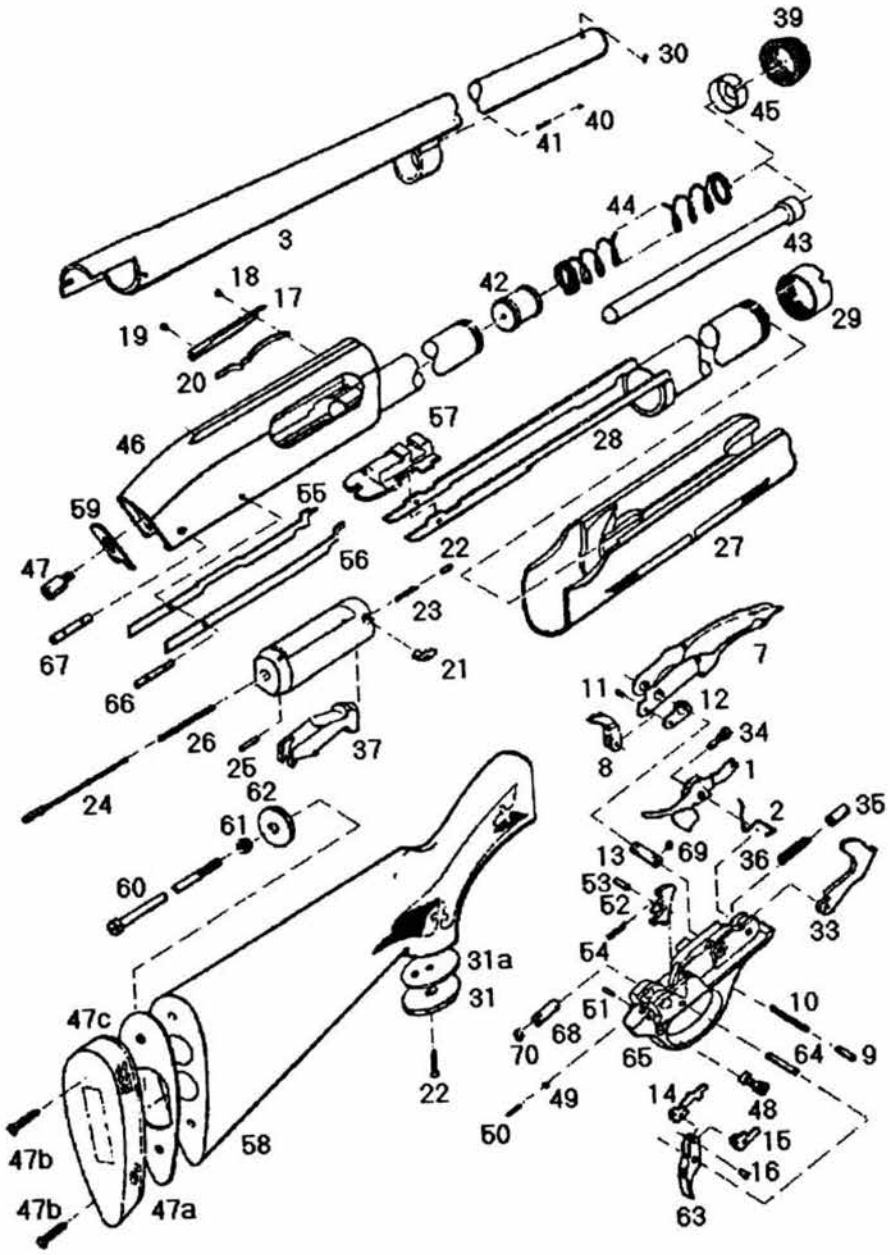
MALFUNCTIONS

The biggest cause of a malfunction in other repeating firearms is the same for pump shotguns: dirt, dust, and assorted debris when combined with gun oil and grease prevent the proper operation of the components. Other common malfunctions include failure to feed properly; double-feeding; magazine failure to retain shells; headspace problems; action jams; action failing to lock; failure to extract or eject; gun failing to fire; hammer failing to cock; gun firing on closing the action; safety sticking; and cracks or seams on the bolt face. Also, badly pitted chambers and barrels are relatively common on some of the older models which were used before the invention of noncorrosive primers.

Initial Inspection. When a pump shotgun is cleaned, the mechanism should be tested for proper functioning. However, during this initial test, live ammunition should not be used. When dummy rounds are not available, fired shells can often be used for testing by turning in the uncrimped end so that the length of the shell will be approximately that of a live shell. If hand- loading equipment is available, a dummy round can be produced by taking fired cases and leaving the fired primer intact. Fill the powder compartment of the shell with dry white sand, insert a wad over the sand, and load the remaining portion of the shell with shot as usual. This will make an excellent dummy round for testing shotguns. You should have five rounds each of the various gauges.

Parts List

Key No.	Part Name
1	Action-Bar Lock
2	Action-Bar Lock Spring
3	Barrel Assembly
4	Breechbolt. 12 Ga.
	Breechbolt. 16 Ga.
	Breechbolt. 20 Ga.
	Breechbolt Assembly. 12 Ga.
	Breechbolt Assembly. 16 Ga.
	Breechbolt Assembly. 20 Ga.
7	Carrier
	Carrier Assembly
8	Carrier Dog
9	Carrier-Dog Follower
10	Carrier-Dog Gollower Spring
11	Carrier-Dog Pin
12	Carrier-Dog Washer
13	Carrier-Pivot Tube
14	Connector. Left
15	Connector. Right
16	Connector Pin
17	Ejector. 12 Ga.
	Ejector. 16 Ga.
	Ejector. 20 Ga.
18	Ejector Rivet. Front
19	Ejector Rivet. Rear
20	Ejector Spring
21	Extractor
22	Extractor Plunger
23	Extractor Spring
24	Firing Pin
25	Firing-Pin Retaining Pin
26	Firing-Pin Retractor Spring
	Fore-end (Wood only) 12 Ga.
	Fore-end (Wood only) 16-20 Ga.
27	Fore-end Assembly. 12 Ga.
	Fore-end Assembly. 16. 20 Ga.
28	Fore-end Tube Assembly
29	Fore-end Tube Nut
30	Front Sight (Plain-Barrel)
31	Grip Cap
31a	Grip-Cap Spacer
32	Grip-Cap Screw
33	Hammer
34	Hammer Pin
	Hammer-Pin Washer
35	Hammer Plunger
36	Hammer Spring
37	Locking-Block Assembly
38	Locking Block Assembly (Oversize)
39	Magazine Cap
40	Magazine-Cap Detent
41	Magazine-Cap Detent Spring
42	Magazine Follower
43	Magazine Plug. 3-Shot. Wood
44	Magazine Spring
45	Magazine-Spring Retainer
46	Receiver Assembly. 12 Ga.
	Receiver Assembly. 16 Ga.
	Receiver Assembly. 20 Ga.
47	Receiver Stud
47A	Recoil Pad
47B	Recoil-Pad Screw



Key No.	Part Name
	Recoil-Pad Spacer
48	Safety Switch
49	Safety-Switch Detent Ball
50	Safety-Switch Spring
51	Safety-Switch Spring-Retaining Pin
52	Sear
53	Sear Pin
54	Sear Spring
55	Shell Latch. Left. 12 Ga.
	Shell Latch. Left. 16 Ga.
	Shell Latch. Left. 20 Ga.
56	Shell Latch. Right. 12 Ga.
	Shell Latch. Right. 16 Ga.
	Shell Latch. Right. 20 Ga.
57	Slide
58	Stock Assembly
59	Stock-Bearing Plate
60	Stock Bolt
61	Stock-Bolt Lock Washer
62	Stock-Bolt Washer
63	Trigger
	Trigger Assemblyl
64	Trigger Pin
65	Trigger Plate. Right
	Trigger Plate. Left
	Trigger-Plate Assembly. Right
	Trigger-Plate Assembly. Left
66	Trigger-Plate Pin. Front
67	Trigger-Plate Pin. Rear
68	Trigger-Plate Pin Bushing
69	Trigger-Plate Pin-Detent Spring. Front
70	Trigger-Plate Pin-Detent Spring. Rear

To test pump shotguns, operate the gun in the following manner:

- With the sliding breech locked and the hammer cocked, push the operating handle slightly forward, and press on the slide-lock release. On the Winchester Model 12 (Figure 11), the Stevens Model 620, and others, the slide-lock is on the left rear of the trigger guard. On Ithaca Model 37 shotguns, the slide-lock release latch is on the right side of the forward end of the trigger plate guard bow. Other models may have the latch located in other positions — on the side of the action, at the rear of the action near an exposed hammer, and so on — but the release will always be a spring-operated button that depresses inward. With the slide-lock release button depressed, pull the operating handle sharply to the rear and then push it sharply forward. Repeat this several times in the same manner to test for the smoothness of the action.

- Retract the operating handle again, release the slide-lock release, and push the operating handle sharply forward to lock the sliding breech. Then attempt to retract the operating handle. The operating handle should not retract.

- Pull the trigger, allowing the hammer to move forward to the fired position, and attempt to retract the operating handle. The operating handle should retract.

- Retract the operating handle fully and then push it forward until the sliding breech is fully forward, but not locked, and the locking block is not fully engaged. Then, pull the trigger to release the hammer. The hammer should not be released until the sliding breech is fully locked and the locking block is fully seated in its aperture.

- Place two or three dummy rounds in the magazine and work them through the action to test the gun for feeding, loading, extraction, and ejection of shells. The second shell should not leave the magazine until the first shell has been loaded into the chamber and the sliding breech is locked behind it.

- With the sliding breech locked and the hammer in the cocked position, slide the safety all the way to the right or on position and attempt to pull the trigger. The trigger should not pull, nor should the hammer release. Try bumping the butt stock on a solid surface to see if the hammer will release or if the safety will be bumped to the off (firing) position.

- Slide the trigger safety to the off position and pull the trigger. The trigger should pull and the hammer should be released to fire the gun.

If everything checks out during the preliminary inspection and the gun is in safe working condition, you may wish to test fire the gun with three rounds of live ammunition to ensure that the gun will fire during actual operation.

TROUBLESHOOTING SLIDE-ACTION SHOTGUNS

When the gun does not operate and function as it should during the preliminary inspection, damaged or improperly assembled parts are the most probable causes. Here are a few of the more common problems, causes, and solutions.

Operating Handle Sticks. When the fore-end cannot be moved forward or backward easily, the cause is often foreign matter in the receiver recesses. A bent or battered slide handle (the rear extension of the action slide) may be the cause. Check for burrs in the bar slot in the receiver or the barrelhead. A



***Figure 11**: Disengaging the action slide-lock and sliding the fore-end back and forth on a shotgun.*



Figure 12: Brownell's hydraulic dent remover.

magazine can sometimes be dented enough to jam the action by binding the slide.

Clean and degrease the operating mechanism thoroughly, then check the action bar for bends or marring. If the action bar is damaged, the careful use of a hammer and file will often correct it. Burrs in the bar slot in the receiver or barrelhead can be removed with a file or Arkansas stone. However, proceed with caution, as the stoning process must be exact with no change in the angle of the faces.

Dents. Dents in the magazine tube can cause a feeding problem. If you have a lot of dented shotgun barrels and magazine tubes, you may want to consider purchasing a hydraulic dent raiser like the one shown in Figure 12. This tool is actually a hydraulic jack of tremendous force with pressure controlled by the T-screw in the handle. Because of the pressure involved, the best of steels and heat-treating procedures have been used in its production to ensure ease of maintenance and years of trouble-free use.

Operating the dent raiser is quite simple. Hold the tool on the outside of the barrel so that the small anvil in the tool head is even with the center of the dent in the barrel. Slide the collar so that it touches the barrel breech or muzzle (depending upon which end of the barrel you intend to insert the tool). Then lock the collar in place with an Allen wrench.

Now insert the dent raiser into the barrel to the depth of the locking collar so the anvil will be at the center of the dent. Gently turn the T-screw in and watch the dent come up. When the dent is completely up, relieve the hydraulic pressure against the anvil by loosening the T-screw. You must be careful not to bulge the barrel because the tool is so powerful. Reapply pressure until you feel a slight resistance and you can turn the tool handle back and forth without too much pressure. Turn the T-handle and twist and burnish. Repeat until the dent is completely removed. With this tool, no outside hammering or peening is required.

Sliding Breech Does Not Lock. This problem may be due to foreign matter on the face of the sliding breech, in the extractor grooves in the barrelhead, or in the locking block hole in the sliding breech. If cleaning and degreasing does not correct the problem, look for a broken firing pin or burrs on the edges of the locking block or locking hole in the receiver.

A broken firing pin should, of course, be replaced. If burrs are present, carefully hone these away with an Arkansas stone and plenty of honing oil.

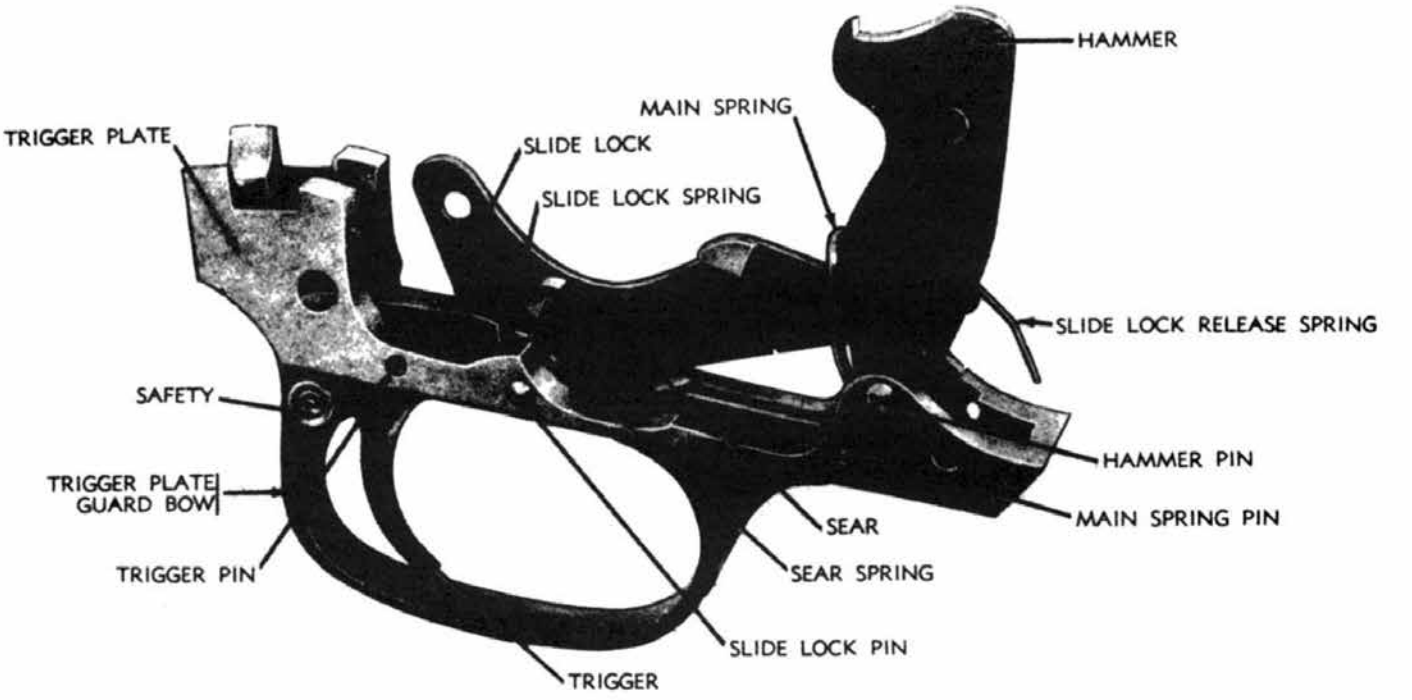
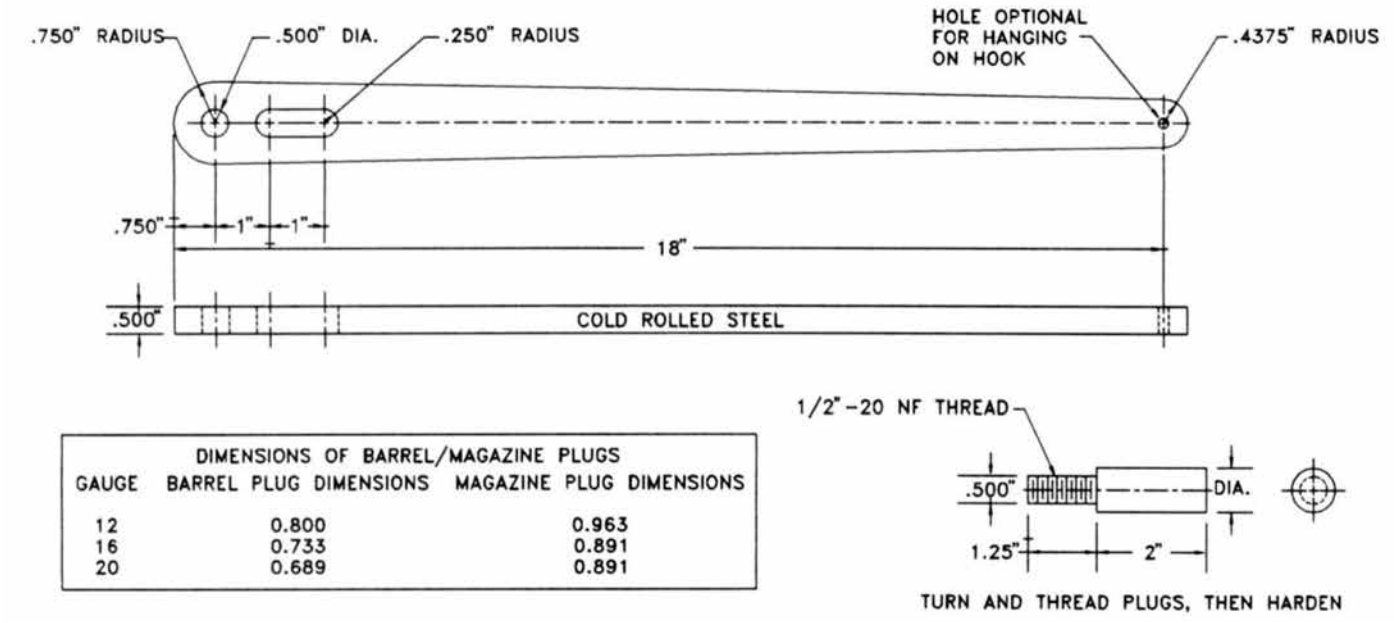


Figure 13: When the hammer does not cock properly on slide-action shotguns, check for burrs or foreign matter on the sear.



DIMENSIONS OF BARREL/MAGAZINE PLUGS

GAUGE	BARREL PLUG DIMENSIONS	MAGAZINE PLUG DIMENSIONS
12	0.800	0.963
16	0.733	0.891
20	0.689	0.891

***Figure 14**: The Winchester Model 12/97 barrel-removal tool.*

Hammer Does Not Cock Properly, or Slips. This condition can be the result of burrs or foreign matter on the sear hooks of the hammer or sear, worn or broken hooks, missing or improperly assembled parts in the trigger mechanism, or a broken main-spring. Figure 13, shows the trigger mechanism of a shotgun. Most guns use similar mechanisms.

If cleaning does not solve the problem, deepening the notches with a file may help. Otherwise the parts must be replaced. Check the assembly drawings to see if all trigger mechanism parts are assembled correctly. Replace any broken parts.

Firing Pin Does Not Retract into Sliding Breech. Check for a broken firing pin and burrs on the firing pin or locking block. Replace a broken firing pin. Remove burrs with emery cloth and honing stones.

Slide Does Not Go Fully Forward. Check for dirt in the slide groove. The slide may not move forward because of a jammed locking block or a jammed slide plunger. Less frequently, a broken firing pin may be causing the trouble.

Thoroughly clean and degrease the gun, then check to see that all parts of the mechanism are assembled properly. Look for worn or broken parts and replace any that are defective.

Slide-lock Does Not Function. This malfunction probably is caused by a bent slide-lock release spring. However, if this is not the cause, look for burrs on the rear of the slide and on the slide-lock. The slide-lock may also be bent.

Replace the slide-lock release spring if this is the cause of the trouble. Burrs can be removed with a file and Arkansas stone. Straighten the slide-lock with a hammer and file it if it is bent.

Slide Does Not Retract Fully. This malfunction may be due to a broken hammer, an improperly assembled mainspring, an improperly assembled stock tank, and in some cases, a broken firing pin.

Disassemble the gun and check for improperly assembled parts as well as worn and broken parts. Reassemble correctly, replacing any worn or broken parts.

Shells Are Not Extracted or Ejected. A rough or dirty chamber is most often the cause of extraction problems. However, if the problem persists after cleaning the chamber, look for a worn, broken, or burred extractor. Check the extractor spring and check for an improperly-assembled ejector. Both can cause problems in slide-action shotguns.

The chamber can be cleaned with a power drill and a brass chamber brush or bore-polishing rod. Remove any caked dirt in the extractor recesses. Burred parts should be smoothed

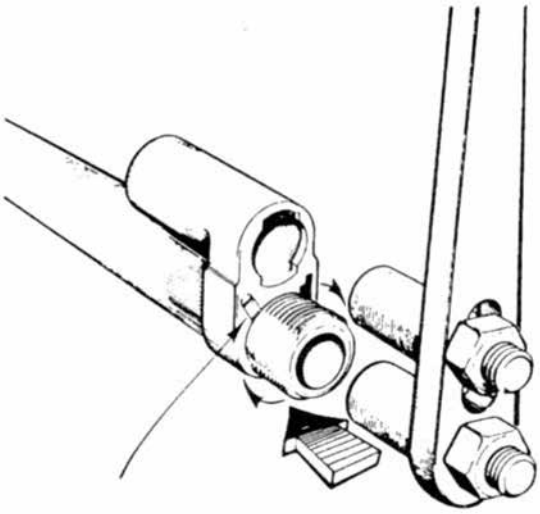


Figure 15: Operating principles of the model 12/97 barrel-removal tool. First remove the adjusting sleeve. Replace the adjustment lock and screw before inserting the wrench. This will afford additional support to prevent distortion if impact is required to initiate removal.

with a file and honing stone. Missing, broken, or worn parts should be replaced.

Barrel Removal. When barrels must be changed on repeating shotguns like the Winchester Model 12/97, and so on, the barrel-removal tool shown in Figure 14 helps easily remove worn or broken barrels. Figure 15 shows how the tool operates to remove a barrel from the barrel extension.

Two Shells Fed Into the Receiver at Once. Double-feeding is usually due to a bent, sticking, or broken shell stop, or a loose shell stop screw. Caked debris in the shell stop seating grooves can be the cause of the problem.

If the problem persists after thoroughly cleaning the gun, straighten a bent shell stop by hammering it against a flat steel block, or anvil. Replace the shell stop if it is broken or badly worn. If replacement parts are not available, sometimes the part can be repaired by brazing. Check the shell stop screw and tighten it if necessary.

Shells Stick in Magazine. A corroded or bent magazine follower is the most likely cause of this malfunction. A dented tube, broken or weak magazine spring, or dirt in the magazine also can cause shells to stick in the magazine.

Clean any corrosion from the magazine and remove any dents. The magazine can usually be straightened by driving a slightly undersized dowel into the magazine tube. Dents are removed with a file and honing stone, and worn or broken parts must be replaced.

Trigger Safety Sticks. If the problem is not caused by gummy residue in the safety slots, it is usually caused by a worn or burred carrier plunger spring or a jammed or rusted trigger spring.

After cleaning the safety and related parts, check the areas for burrs. Replace any missing, worn, or broken parts.

Refer to the troubleshooting chart in Figure 16 on the next page for several problems that develop in slide-action shotguns.

SELF-TEST QUESTIONS

Please check your answers on page 24.

5. **What problem usually develops in a slide-action shotgun when the shell stop is bent or broken?**
6. **What is probably the cause of shells sticking in the tubular magazine of a slide-action shotgun?**
7. ***True or False*. When the slide-lock does not function correctly in a slide-action shotgun the probable cause is the safety.**
8. **What problem usually develops in a slide-action shotgun when the chamber is dirty or corroded?**

Malfunction	Probable Cause	Corrective Action
Action-slide lock does not funtion	Bent or broken action-slide lock spring	Replace
	Hammer pin driven in too far (protrudes)	Adjust hammer pin
	Bent cartridge cutoff	Straighten cartridge cutoff
Breechbold jars down while in process of takedown	Weak breechbold retaining lever	Replace retaining level
	Breechbolt retaining level cut in receiver worn or upset	Return to factory for inspection
	End of action slide which trips retaining lever worn	Replace action slide
Loose takedown	Engagement between receiver and receiver extension worn	Turn adjusting sleeve one or more notches counterclockwise to tighten draw
Breechbolt does not lock or closes hard	Extractors enter chamber	Replace extractors
	Shallow counterbore in chamber ring	Counterbore chamber ring
	Bent ejector	Bend slightly or replace ejector
Firing pin does not retract in breechbolt; also misfires	Foreign matter in breechbolt (usually heavy oil or grease)	Clean
	Burred or broken retractor	Replace retractor
	Broken firing pin	Replace firing pin
	Weak, bent, or broken retractor spring	Replace spring
	Top of retractor worn too much	Replace extractor
	Hammer spring weak	Replace hammer spring
Shell fails to extract and eject	Worn, burred, or broken extractors	Replace extractors
	Weak or broken ejector	Replace ejector
	Weak or broken extractor springs	Replace extractor springs
	Excessive headspace	Replace barrel
Shell sticks in magazine	Cartridge cutoff out of position	Adjust cartridge cutoff
	Corroded or bent follower	Repair or replace follower
	Dented magazine tube	Remove dent or replace magazine tube
	Magazine tube out of round	Replace magazine tube

Figure 16: *Troubleshooting chart for slide-action shotguns*

Semi-Automatic Shotguns

John M. Browning invented the first successful semi-automatic shotgun. He sold the rights to the Remington Company to market the gun in the United States as the Remington Model 11. However, Browning retained the rights to sell the shotgun throughout the rest of the world as the Browning automatic. With a few modifications, this semi-automatic shotgun is still sold today by the Browning Arms Company. Nearly all semi-automatic shotguns operate on the same principle as the initial Browning: recoil action is operated by the energy generated by the recoil.

Basically, the recoil method can be separated into two groups: long-recoil and short-recoil. The original Remington Model 11 used a long-recoil system, while the Browning double automatic and the Winchester Model 50 are a few of the shotguns that use the short-recoil system.

In a long-recoil shotgun, the barrel and the breech are pushed back together until they reach the rear of the shotgun. At the rear, the breech and the barrel separate as the barrel pulls itself forward. When the barrel moves forward, it pulls away from the expended shell case which is held in contact with the breech by a set of double extractors. As the barrel reaches its original position, the shell is ejected by a special spring that is attached to the barrel. When the barrel is moving forward, it trips a spring in the stock which is compressed when the breech and barrel move rearward and the breech moves forward. When the breech moves forward, it picks up a new shell and pushes it into the chamber. The gun is then ready to fire (Figure 17).

Since the long-recoil shotgun has a two-part recoil, many shooters complain of the double-kick effect. When the shell is fired, the shooter feels the kick, but there is a second kick when the barrel and the breech slam back. Since movement of the gun is controlled by the adjustments on the various springs, maladjustment can cause some rather jolting recoils. If the adjustment rings are in the wrong position when firing high-powered shells, the kick effect is even worse.

To lessen the effects of the double-recoil, Browning and Winchester use a short-recoil system. With the Browning double automatic, the barrel only recoils about $^{5}/_{8}$", which is enough to start the action moving. Winchester, on the other hand, has a fixed barrel and a floating chamber in its Model 50. It also has an inertia rod that runs into the shoulder stock. When a shell is fired, the chamber moves back approximately $^{1}/_{10}$", causing a special pin in the bolt to kick the inertia rod against a spring in the shoulder stock. The hammer is cocked as the inertia rod moves rearward. At the extreme rearward position of the inertia rod, the bolt is opened and the shell is ejected. When the spent shell ejects, a new shell is allowed to enter the carrier. While the spring pushes the inertia rod forward, the bolt moves forward, picks up the shell on the carrier, and pushes it into the chamber. This ends the cycle and the shotgun is ready to fire.

In recent years, another method for powering semi- automatic shotguns has been developed. Just like semi-automatic rifles, gas-operated semi-automatic shotguns are using the gas power from the expanded shell to operate the action. The gas is taken from a port in the barrel, which minimizes the amount of recoil the shooter has to withstand. Because of this, the gas-operated semi-automatic shotgun is a very smooth-operating gun.

Gas-operated shotguns include the Beretta A-301 (Figure 18), the Browning B/2000, the Franchi Mode1 500, the Manufrance auto shotgun, the Remington Model 1100, the SKB autoloaders, the Smith & Wesson Model 1000, the Weatherby Centurion Auto, and the Winchester Models 1, 1400, and 1500.

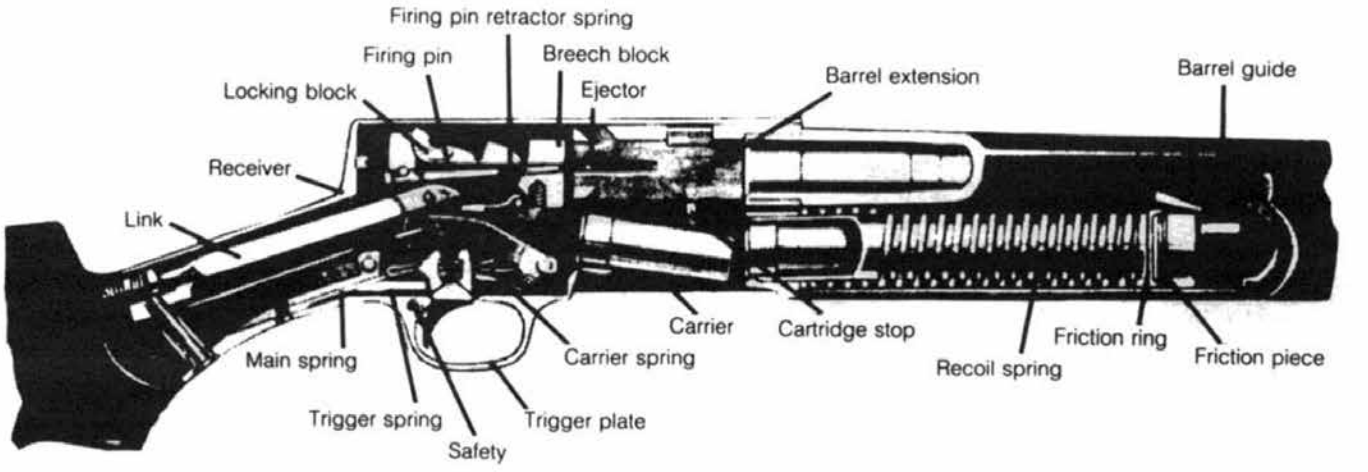


***Figure 17**: The John M. Browning long-recoil system for semi-automatic shotguns has been the basic system for all semi-automatic shotguns and is still used today.*



Figure 18: *The Beretta A-301 is one model of a gas-powered semi-automatic shotgun.*

COMMON MALFUNCTIONS

Malfunctions in autoloading shotguns might be caused by broken, damaged, or incorrectly assembled parts, faulty ammunition, incorrect operation, or debris in the mechanism. Since the receivers of autoloading shotguns are comparatively open, foreign matter can enter easily and clog the mechanisms. Therefore, a clean, properly lubricated gun inspected at frequent intervals is the best insurance against malfunctions.

Malfunctions of autoloading shotguns sometimes occur from conditions that would have no effect on a pump or any other manually-operated repeater. Most manufacturers put their guns through severe tests before they leave the factory to ensure that the gun will function properly in the field. However, there may be potential malfunctions undetectable at the factory, which will only appear when used under varying conditions.

The remaining causes of malfunctions can usually be traced to worn parts caused by excessive use and, in some cases, mistreatment. For example, Franchi auto-loading shotguns often develop feeding problems after several years of use. This problem is usually due to a worn carrier latch. The carrier latch, made of sheet steel, has edges turned to form a loop of flanges, which contain holes for the pivot pin. Since this latch is under considerable stress and the outside loop of the pivot holes is fairly thin, the holes will eventually begin to enlarge until the bridge of the loop breaks, causing the gun to misfeed.

To correct this problem, raise a bead of steel weld at the pivot holes, leaving the walls of the latch thicker at that point, then redrill the holes to the proper size. Be sure to leave room for the latch spring. This extra thickness gives the latch additional strength.

Another part that usually becomes worn is on the Remington Model 1100 shotgun. This model utilizes a small ring of special rubber (Part 73 in Figure 19) that fits into a groove on the magazine tube in front of the piston and the piston seal ring. After many years, the rubber ring can become worn and lose some of its sealing qualities. Every gun shop should keep a few of these seals on hand at all times. They may be purchased from Remington Arms Company Inc. (www.remington.com)

Autoloading shotguns also develop feeding problems from worn magazine springs. During the firing and feeding cycle, the carrier latch (Figure 20) is activated by being struck by the head of the next unfired shell from the magazine. If the magazine spring is weak, the fed shell might not have adequate energy when propelled against the latch and may fail

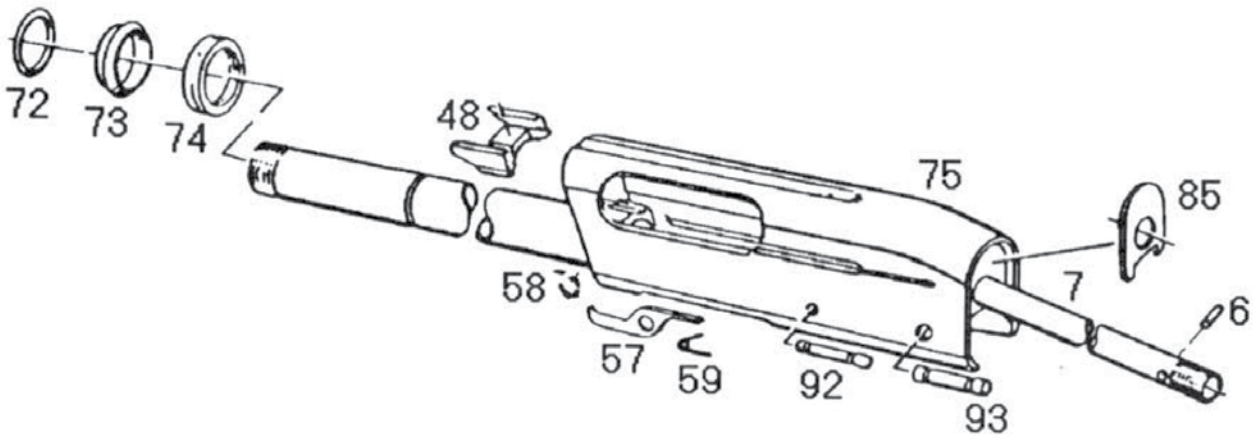


Figure 19: *Proper arrangement of the gas-system components*

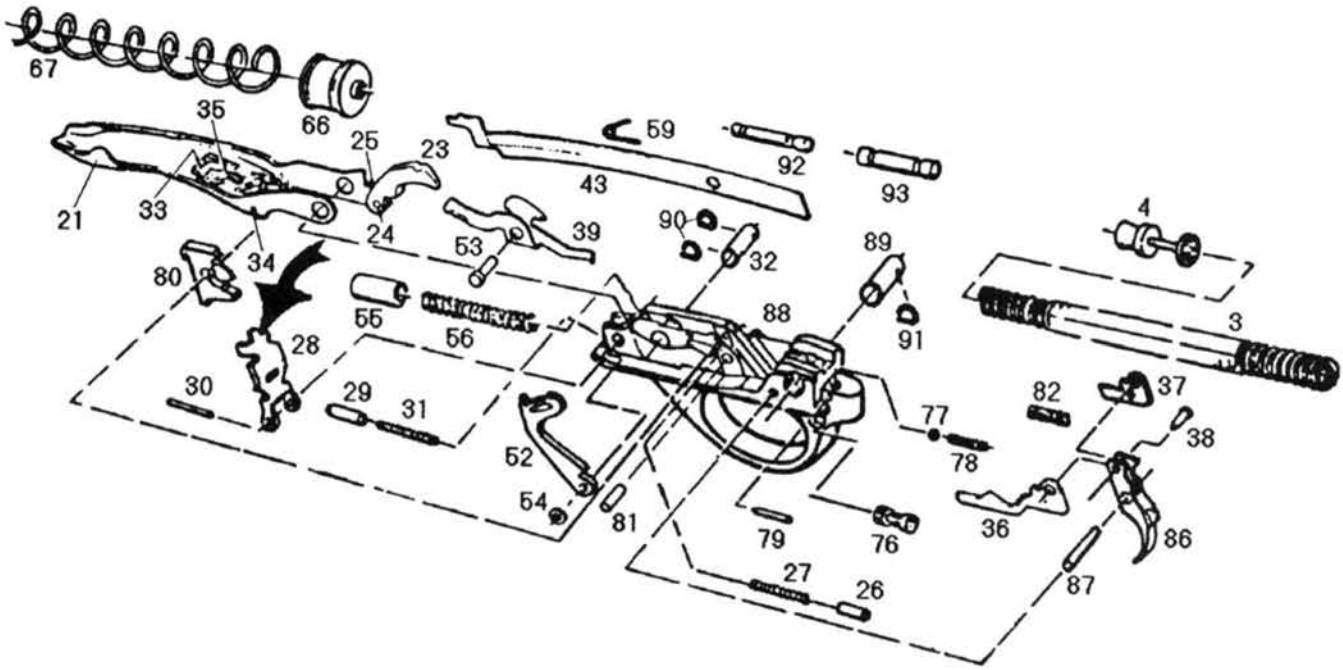


Figure 20: *The carrier latch is activated by the head of the shell as it leaves the magazine. A weak magazine spring will cause feeding problems.*

to disengage it. The simplest way to correct this problem is to replace the magazine spring with a full-strength one. A temporary solution is to stretch the magazine spring or to adjust the carrier latch by bending it slightly forward.

The best way to troubleshoot these problems is to learn to recognize worn parts when inspecting firearms. When cleaning the gun, examine every part closely. Look for bright spots, dull corners that should be sharp, out-of-round holes, and broken parts. Also check an exploded view of the gun to make certain that no parts are missing. This inspection alone should uncover any worn, missing, or broken parts. If all parts are working and in good condition, the malfunction probably was caused by dirt or debris in the action, which is remedied by cleaning the gun.

TROUBLESHOOTING TECHNIQUES

The autoloading guns covered in this section are generally similar in basic design, operation, and function. However, certain parts naturally vary. Malfunctions are covered as a guide to be applied only to the specific gun. The main concern is to learn how the guns function.

A malfunctioning gun should be cleaned before inspecting the firearm or before any repairs are made. This is especially true of any semi-automatic weapon. In climates where the temperature and humidity are high, were salt air is present, or during a rainy season, the shotgun should be inspected frequently and kept lightly oiled when not in use. In extreme climates, the shotgun should be disassembled for drying and oiling parts.

Unexposed parts and surfaces should be kept clean and oiled, such as the underside of the barrel, the magazine tube, the inner surface of the slide handle tube, the interior of the magazine tube, the slide handle bar, the interior of the receiver, the operating parts, the trigger group, the spring wells, and similar parts and surfaces. A light oil should be used for lubrication. All wood surfaces should also be inspected frequently to see that swelling due to moisture does not bind any working parts. If linseed oil is used on the gunstock, be careful not to let any of the oil seep into the working mechanism or it will gum the parts when it dries.

Failure to Fire. As with other types of guns, when a semi-automatic shotgun fails to fire, the cause is most often gummy residue in the bolt, which prevents the firing pin from moving forward the proper distance at the proper speed. In shotguns using the short-recoil system, a light pull on the trigger can tip the sear against the second notch on the hammer, destroying its inertia. An improper adjustment between the hammer catch and hammer can also cause misfires.

Firing pin length is especially critical in an autoloader. At the first sign of a misfire, the bolt assembly should be disassembled and thoroughly cleaned and inspected. If the pin is impeded in its travel to the rear for any reason, the gun can fire automatically, slamming the bolt back and forth until the magazine is empty.

A broken firing pin or firing pin spring should be obvious upon inspecting the disassembled bolt assembly. Replace these with new factory parts if at all possible. If this is not practical,

new ones can be made or the broken one can be repaired by welding, but be sure you can obtain the original dimensions. To ensure that the firing pin is not too long, tape a piece of electrical tape over the primer hole of a fired shell. Insert the empty shell with the tape into the chamber and let the bolt assembly slam home as if operating during actual firing. If the piece of tape is indented at all, the firing pin is too long and must be shortened.

Bolt Fails to Close Fully. This problem can be caused by a lack of lubricant on mating surfaces, but the fault probably is caused by burrs or foreign matter in the locking recesses in the receiver raceways. Stone all burrs and sharp edges on the hammerhead contacting link and check for sharp corners on the rear of the chamber. Should the chamber rotate slightly, the slides can hang up on the sharp edges.

Sometimes a broken, rusted, or improperly engaged recoil spring may not allow the action to lock up properly, as can a damaged carrier or carrier latch.

When the reason for a bolt's failure to close fully is not readily apparent, remove the appropriate parts from the gun. Then clean, inspect, and test them, in that order. Old shells might be the cause of the problem, so do not overlook this. Also, inspect the shell seat in the barrel.

Failure to Feed. The problem of improper feeding in autoloading shotguns is probably the one most often encountered. In general, feeding problems are due to a faulty magazine and magazine components, a faulty carrier, malfunction of shell stop(s), or a dirty action. Of course, if the fired shell fails to eject, a new shell cannot be fed into the chamber.

Magazine tubes under the barrel of a shotgun are located in an ideal place to get banged against all sorts of objects. When dents, gashes, and bends occur, feeding problems almost always arise from binding of the magazine spring of crimping the shells within the tube. In most cases, dented magazine tubes can be repaired by inserting an expanding dent plug, shown in Figure 21. Most expanding dent plugs are made of bronze to prevent jamming or marring the surfaces. To use, expand the dent plug until it fits tightly under the dent and then use a brass hammer to tap around the edge of the dent to force the dented metal up as shown in Figure 22. Keep hammering until the dent is up or the plug comes loose. If the plug comes loose before the dent is up, repeat the process of expanding the dent plug, pushing it under the dent and hammering around the edge until the dent is completely up. This same procedure can also be used to remove dents from shotgun barrels.

All autoloading shotguns use two shell stops positioned on each side of the receiver wall. The primary shell stop delays the shell at the mouth of the magazine until the lifter or carrier accepts it. The second shell stop holds back the other shell while the first shell is being lifted by the carrier. Once the first shell is chambered, the second shell stop releases the next shell, which is then held in position by the first shell stop. Should this second shell stop miss or release too soon, the shell in the magazine ends up on the ground. In some guns, this can be caused by a low carrier-lock head, which causes the rim of the shell to pass through the cutoff. Of course, the problem can be solved by installing a new carrier lock. But usually the repair can be made by inserting the carrier lock in a vise with the button and head protruding and then striking the button lightly with a hammer to bend the carrier lock in slightly. Assemble and check your work carefully to see that the shell head does not pass through the carrier lock. Finish by feeding a shell from the magazine tube and adjusting the carrier lock. To do this, remove the trigger guard and slide a shell in and out of the magazine tube. If the front end of the carrier lock scrapes the shell, it should be stoned until it just clears the shell case.

The second shell stop rarely causes problems except for occasional burring at the edges after heavy use over a period of years. To correct this, stone the burrs.

Shell lifters are another source of trouble when feeding is a problem. If a shell lifter is badly worn or bent, it will not fully lift the shell. The only way to fix a worn shell lifter is to replace it.

Defective Safeties. Most autoloading shotguns use trigger-block safeties which have a spring-loaded plunger that works in two notches. When the safety button is pushed from safe to fire, the plunger is depressed and rides over a hill that separates the two notches. This hill, after years of use, can become rounded, allowing the plunger to slip easily from one notch to the other, and rendering the safety feature worthless. Sometimes the safety can be corrected by grinding the notches deeper, but a replacement is recommended. Also, if the plunger or its spring becomes worn, a replacement must be made.

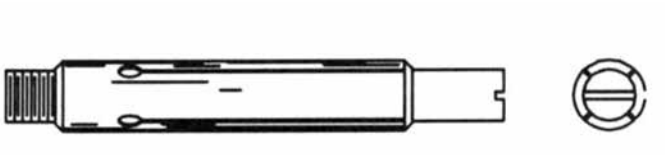


***Figure 21**: An expanding dent plug used to remove dents from magazine tubes and shotgun barrels.*

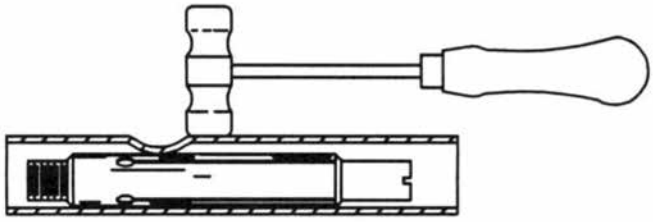


***Figure 22**: Expand the dent plug until it fits tightly under the dent, and then use a brass hammer to tap around the edge of the dent to raise the metal.*

Miscellaneous Malfunctions. The problems of extracting, ejecting, rough trigger pulls, and so on are essentially the same for autoloading shotguns as for other types of shotguns and rifles. The troubleshooting chart in Figure 23, on this page and the next page, summarizes the most common malfunctions of autoloading shotguns along with their corrective actions. A study of this chart gives you a starting place when troubleshooting semi-automatic guns. Again, to troubleshoot any firearm adequately, you must first understand how it functions, and exactly how each part is used to make the gun work properly. Once you learn this, you will have little difficulty troubleshooting the weapon. Once you have the problem isolated, it is simply a matter of repairing worn parts or installing new ones.

Malfunction	Probable Cause	Corrective Action
Fails to extract	Faulty extractor	Replace
	Extractor slot loose on shell rim	File or replace
	Extractor slot in barrel damaged	File slot to proper fitting of extractor
	Extractor spring defective	Replace
	Rough chamber	Repolish chamber
Fails to fire	Damaged firing pin	Replace
	Connector not seating to sear	Clean assembly or replace sear or connector
	Disconnector binds connector	Free up or replace
	Hammer fails to cock	Refit hammer and sear notch
	Trigger binds	Free up trigger or replace
Fails to feed	Carrier latch defective	Replace
	Carrier release defective	Replace or adjust
	Carrier jams	Adjust shell latch
	Tight extractor	Replace extractor or hone claw to ease tension
	Shell-latch doesn't slip off shell properly	Adjust shell latch
	Shell latch stop surface rough	Hone notch or replace
	Carrier lays too high	Adjust or replace
	Magazine spring damaged	Replace
	Magazine double-feeds	Replace shell latch
	Dented magazine tube	Remove dents
Fails to load	Follower latch defective	Replace
	Follower latch drops too far in magazine tube	Replace
	Rough follower-latch slot	Deburr or hone smooth
	Magazine follower, spring, or tube defective	Replace
	Carrier release fails to release carrier	Replace or adjust

***Figure 23**: Troubleshooting chart for semi-automatic shotguns. (Continued on next page)*

Malfunction	Probable Cause	Corrective Action
Fails to close	Crooked action bar	Straighten or replace
	Carrier movement defective	Replace carrier
	Action spring defective	Replace
	Piston assembly defective	Clear
	Action bar stud defective	Replace action bar assembly or repair damage
Fails to lock open	Incorrect head space	Adjust head space
	Locking block binds	Free up
	Action binds	Free up
	Rough barrel chamber	Polish chamber
	Damaged extractor or extractor slot	Replace extractor or repair slot
Fails to open	Action binds	Free up action bars
	Piston assembly defective	Clean and/or replace
	Gas holes mutilated	Check for proper size opening
	Gas holes mutilated	Check for proper size opening

***Figure 23**: Troubleshooting chart for semi-automatic shotguns.*

SELF-TEST QUESTIONS

Please check your answers on page 24.

9. **The recoil method of operating semi-automatic shotguns can be divided into two separate groups; what are they?**
10. **What type of operating system do the most recently manufactured semi-automatic shotguns utilize?**
11. ***True or False*. The original John M. Browning semi-automatic shotgun used the long-recoil system.**
12. **When a semi-automatic shotgun malfunctions, what should be done before starting the trouble-shooting procedure?**

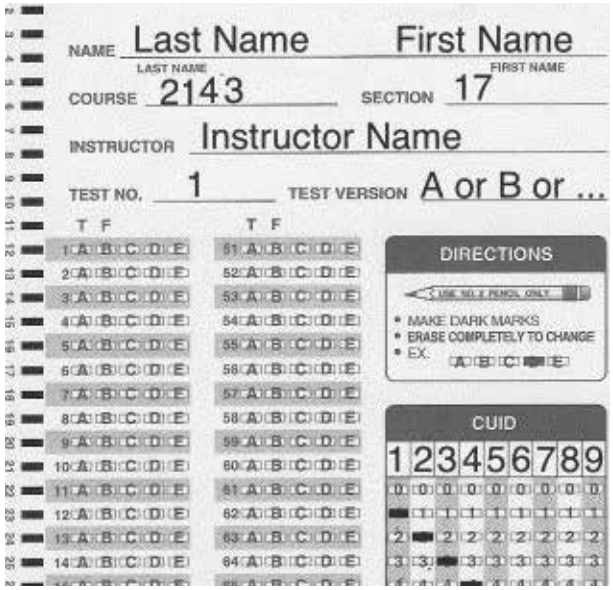
Answers to Self-Test Questions

1. Doll's-head.
2. Drilling.
3. True.
4. Worn parts, especially the main pivot pin.
5. Double-feeding usually results.
6. A corroded or bent magazine follower.
7. False.
8. The shells will not extract or eject.
9. Short-recoil and long-recoil systems.
10. Gas-operated system.
11. True.
12. The gun should be thoroughly cleaned.

Lesson Questions

THIS IS LESSON NUMBER 2176

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



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

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1. **The ability to determine the cause of any gun problem and correct it is known as**
   a. Firearm design.
   b. Maintenance.
   c. Inletting.
   d. Troubleshooting.

2. **Which of the following is one symptom of a loose locking bolt spring on a single-shot, break-open shotgun?**
   a. Loose top lever movement.
   b. Very tight top lever movement.
   c. Tight up-and-down barrel movement.
   d. Loose fore-end.

3. **What is one simple way to check for excessive headspace in a single-shot, break-open shotgun?**
   a. Fire a test round.
   b. Hold the action up to the light to check the barrel/breech gap.
   c. Completely disassemble the gun and use a headspace gauge.
   d. Check for any up-and-down movement of the barrel.

4. **What is the minimum chamber length to hold modern plastic shotshells?**
   a. 2.5 inches.
   b. 2.760 inches.
   c. 2.875 inches.
   d. 2.960 inches.

5. **Which of the following tools can be used temporarily to tighten inexpensive single-shot shotguns?**
   a. Channellock pliers.
   b. Mainspring vise.
   c. Dent remover.
   d. Center punch.

6. **Which part accounts for forward and backward movement in the Purdy underbolt locking system?**
   a. Standing breech.
   b. Top or tang lever.
   c. Trigger guard.
   d. Buttstock bolt.

7. **What is probably the cause when a trigger fails to reposition on either a single or double-barrel shotgun?**
   a. Broken trigger spring.
   b. Broken sear.
   c. Worn mainspring.
   d. Incorrect headspace.

8. **Dents in the magazine tube of repeating shotguns can cause**
   a. Misfires.
   b. Misfeeding.
   c. Excessive recoil.
   d. Short chambers.

9. **Which of the following conditions can cause a hammer not to cock or slip in a slide-action shotgun?**
    a. The ejector is not free in the receiver cut or else the ejector spring binds and does not function.
    b. Loose extractor.
    c. Very loose headspace condition.
    d. Broken mainspring.
10. **Who is credited with inventing the first successful semi-automatic shotgun?**
    a. Marlin.
    b. Winchester.
    c. Colt.
    d. Browning.