Streetsweeper

A Home Workshop Shotgun

Warning

Be advised that even though this is not a full automatic firearm, permission to own such a gun is required from the Federal and, in some cases, State Governments.

Also understand that I have applied for patents on certain portions of this gun. While I grant freely permission to build this design for your own use, no commerical use is permitted without permission.

Picture a time slightly in the future. The place can be anywhere or everywhere. Suddenly the people in charge decide that it isn't in their best interest for the general public to possess firearms anymore. So suddenly a law is passed banning the possession of firearms and requiring all that are already in existence to be surrendered.

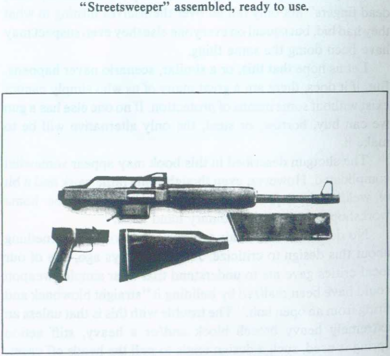
Even though most people sit snugly secure in the thought that no gun registration exists, the authorities simply seize the firearms transaction records from all the Federal Licensed Dealers, so they have a record of who owns a goodly percentage of the existing arms. Then, after they have all the weapons that will be surrendered voluntarily, they stand a couple of die hards they caught holding out up against a wall and shoot them and suddenly even the loud mouths who proclaim such absurdities as "They will only take my gun when they pry it from my cold, dead fingers" not only fall all over themselves turning in what they had hid, but squeal on everyone else they even suspect may have been doing the same thing.

Let us hope that this, or a similar, scenario never happens. But, if it does, there are a great many of us who simply cannot exist without some means of protection. If no one else has a gun we can buy, borrow, or steal, the only alternative will be to make it.

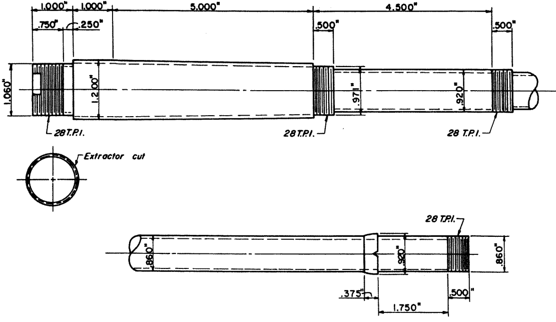
The shotgun described in this book may appear somewhat complicated. However, even though some lathe work and a bit of welding is required, the gun can be built in the home workshop using mostly ordinary hand tools.

No doubt the arm chair gun designers will find something about this design to criticize. Just a few days ago, one of our local critics gave me to understand that a far simpler weapon could have been realized by building it "straight blowback and firing from an open bolt." The trouble with this is that unless an extremely heavy breech block and/or a heavy, stiff action spring is used, such a design tends to pull the heads off cases,

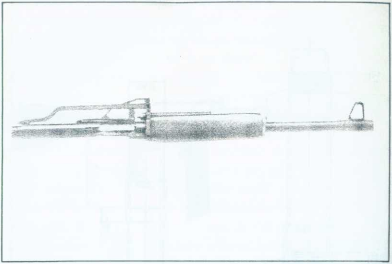
"Streetsweeper" assembled, ready to use.



Broken down in basic assemblies.


1.000"
1.000"
5.000"
4.500"
.750"
.250"
.500"
.500"
1.060"
1.200"
.971"
.920"
28 T.P.I.
28 T.P.I.
28 T.P.I.
Extractor cut
28 T.P.I.
.860"
.920"
.860"
.375"
1.750"
.500"

Barrel



Barrel, inner receiver assembly.

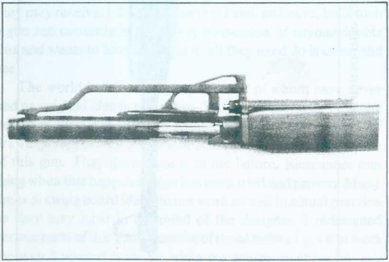
leaving the case body in the chamber, thereby jamming the gun as the next round tries to enter the already obstructed chamber. This is caused by the case body expanding and clinging to the chamber wall at the moment of firing while at the same time the breech block starts to open causing inadequate support for the case head. Since there is as much pressure pushing toward the rear as there is pushing the wad(s) and shot column up the bore, the case head is blown off.

As to the "firing from an open bolt," in a shotgun the breech block or bolt would be required to travel some three inches after the trigger was pulled. Hardly conducive to accuracy. But even more important, the primer rises during feeding to the center of the bore line before the bolt is closed. It is therefore, not only possible, but probable, that the firing pin would indent the primer with sufficient force to fire the shell before the action is completely closed. When this happens, chunks of shell case fly like shrapnel which is not only dangerous but, again, will cause the gun to jam.

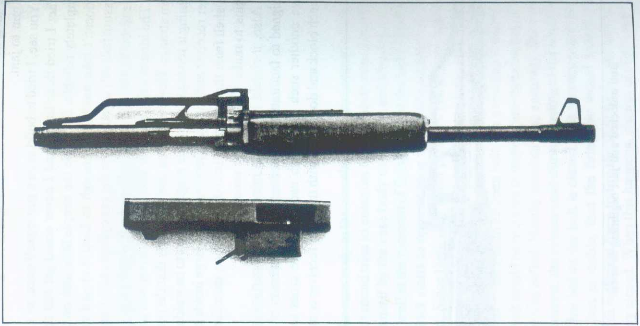
You see, I tried to build such a gun myself once, as a matter of fact I tried three times, and I never could get one that was completely reliable. So, while the simple little lock on the bolt (it doesn't take much, just enough to keep it closed until the pressure falls off) together with the gas cylinder take some extra time to build, the end result will make it worthwhile.

The idea of using an inner and outer receiver will probably seem strange. However, when one considers that the magazine opening is too big to allow the magazine box to be welded to the inner receiver and the outer receiver is too large inside to guide the shell from the magazine into the chamber, then the design begins to make slightly more sense.

Also, it should be kept in mind that this particular gun is designed to facilitate construction with a minimum of tools. I have another such gun which uses a square cross sectioned breech block and does away with the inner receiver completely.



Bolt unlocked and just beginning to open.



Barrel/inner receiver assembly, outer receiver removed.

However, this design requires several hours work with a milling machine, and while it appears simpler on paper, would be beyond the scope of the average home workshop.

Please keep in mind that prior approval is required from the BATF, or whoever takes their place, to construct this weapon even though it is not full automatic firearm.

Also, consider that since the action must open some three inches and close the same amount to load, extract, and eject, there is more than ample time to release the trigger and pull it again between shots. So while it is quite possible to make up a trigger assembly which would permit full automatic fire, the only thing gained except for a tendency to waste ammunition would be further legal complications.

Also, remember that since I have no control over the materials and workmanship which may go into a gun that someone else constructs, I cannot take any responsibility for whatever happens.

Neither do I guarantee that you can build this gun. Some people cannot build anything, regardless of what instructions they may receive. I do guarantee that I can, and have, built such a gun and currently have it in my possession. If anyone doubts this and wants to have a look at it, all they need do is come and see.

The world is full of "copycats" most of whom have never had an original idea in their lives. So, it probably won't be long before at least one of these people comes up with a book of drawings supposedly showing how to build an improved version of this gun. They have done it to me before. Remember one thing when this happens, mine has been tried and proven. Many times drawing board ideas do not work as well in actual practice as they may have in the mind of the designer. I redesigned certain parts of this gun a number of times before I got it to work the way I wanted it to. So when the others do show up, ask yourself, "Has it been tried?" Mine has. Take your choice.

MAGAZINE

As usual with home workshop firearms, it is a good idea to build a suitable magazine or "clip" first and then build the rest of the gun around it. A properly designed and constructed magazine is especially important in a shotgun such as this since feeding can be a problem.

In order for a shotgun such as this to function without jamming it is necessary that the front end of the shell travel up a slightly inclined ramp for ½" or more. The inner top surface of the receiver guides it into the chamber, and then, just as the front end enters the chamber, the rear, or rimmed end disengages from the magazine lips, allowing the rear end of the shell to move upward as the shell moves forward into the chamber. Since, obviously, the ejection port cannot be obstructed, the magazine top must set low in relation to the chamber end of the barrel.

If a large enough number of magazines is to be constructed, dies can be made to from the magazine body in one piece. If, however, only magazines for one gun are intended, it will be easier and simpler to make the magazine body in four pieces as shown.

The magazine sides and both ends are cut from 20 ga. sheet steel which normally measures .0359" thick or for all practical purposes .036" a full size template can be traced from the plan sheet. If smooth sides are used the material can be cut to exact size. If reinforcing ribs are pressed into the sides (This stiffens the assembly and prevents rippling or buckling.), the material must be cut oversize and trimmed to exact size after forming. The end pieces are bent to shape around a form block .813" wide leaving a 3/16" lip on either side. This will cause the inside opening to be .855" wide when the sides are fastened on by riveting, spotwelding, or silver solder. A small 1/16" wide flange is bent outward at the bottom of side forming flanges to hold the bottom plate in place.

Sharp right angle bends can be made quite easily on thin sheet metal such as this simply by clamping the material to be bent between two blocks of steel with the area to be bent protruding and placing another block of steel against the exposed portion then, using a hammer, driving it into the desired position.

Dies can be constructed to press the reinforcing ribs into the sides by milling corresponding male and female dies from ½" steel plate. Makeshift dies can be made up by soldering sheet metal strips to ½" steel plate as shown in the drawing and photograph. Remember to leave clearance between the slots in both male and female dies for the thickness of the material being formed. Building proper dies for operations such as this is described in more detail in my books "*Home Workshop Guns for Defense and Resistance,*" Volumes I and II.

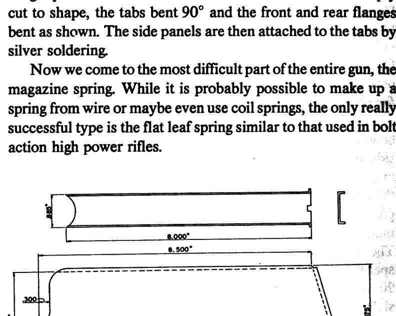
The bottom plate is formed from the same sheet metal, by bending lips on each side to slide over the flanges left on each side. A forming die can be made simply by milling a depression in a block of steel as wide as the magazine flanges plus two thicknesses of the sheet metal, in this case 1.082" plus .072" giving a total width of 1.154", and using a block 1.082" as a male die pressing the sheet metal plate into the depression. Then with the block removed and replaced with a sheet metal spacer of the same width, the sides which now extend upward 90° are folded over, and with a little filing or grinding fitted to slide over the magazine flanges.

A keeper is made as shown to keep the bottom plate located in place. This is simply a sheet metal plate with a short flange folded up on each end and a ⅛" diameter "tit" silver soldered as shown with a corresponding hole drilled in the bottom plate.

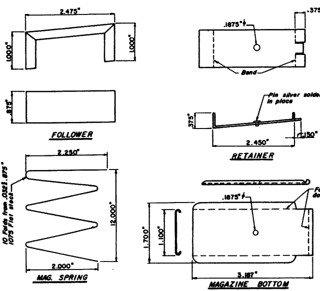
A back plate the full width of the magazine body and long enough to extend slightly below the magazine well is silver soldered in place at the upper rear of the magazine. With the tabs at the lower edge bent to the rear. This plate serves not only to reinforce and stiffen the magazine body but the tabs serve as a depth stop and the magazine latch engages the center of this plate, holding the magazine in position.

The magazine follower can be made from this same thickness of sheet metal which will require side panels silver soldered in place or thicker material of .075" to .125" thickness which can simply be bent to shape. A pattern is included in the drawing for the sheet metal type which makes up into a lighter weight part than the thicker material. The sheet metal is simply cut to shape, the tabs bent 90° and the front and rear flanges bent as shown. The side panels are then attached to the tabs by silver soldering.

Now we come to the most difficult part of the entire gun, the magazine spring. While it is probably possible to make up a spring from wire or maybe even use coil springs, the only really successful type is the flat leaf spring similar to that used in bolt action high power rifles.



MAGAZINE



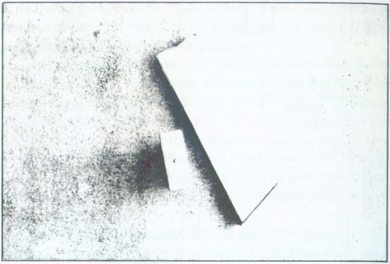
MAGAZINE PARTS

A strip of 1060, 1070, 1075 or 1080 sheet steel is obtained in what is referred to as the "dead soft annealed" state. The .025" thickness is preferred here and, if possible, a length of about 30". If only shorter sections are available, the spring will have to be made in more than one piece and clipped together.

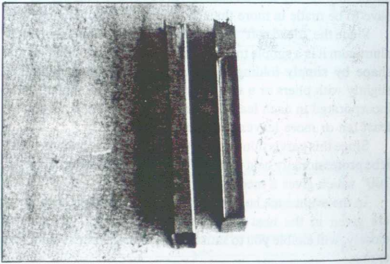
Since the "dead soft" material bends about as easily as soft aluminum it is a simple matter to bend each of the spring legs to shape by simply folding it around a ⅛" rod and squeezing slightly with pliers or a small clamp. Note that a slight bow is incorporated in each leaf. The entire spring should contain at least ten or more leaves or stages.

Since this part is thin and relatively fragile it is preferred that it be professionally heat treated if possible, specifying temper at 700° which gives a medium spring temper.

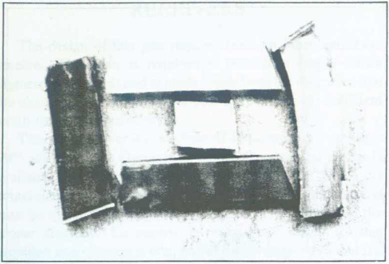
In the event such heat treatment is not available, directions are given in the heat treatment chapter which, if followed closely, will enable you to satisfactorily harden and temper this spring.



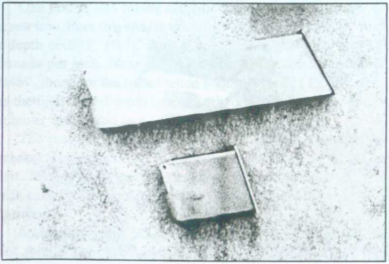
Bottom of magazine at left shows take down button which must be depressed before floorplate will slide forward.



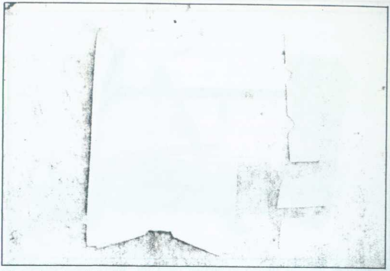
Folded corners make smoother magazine box than built up box at right.



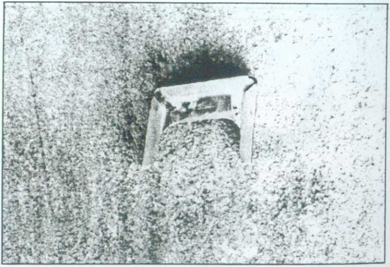
Magazines may be folded to shape, built up, short, long, curved or straight.



A ten shot magazine and a three shot magazine.



Magazine box blank, cut from sheet steel, with follower blank and gussets.



Folded sheet metal follower with reinforcing gussets silver soldered in place.

RECEIVERS

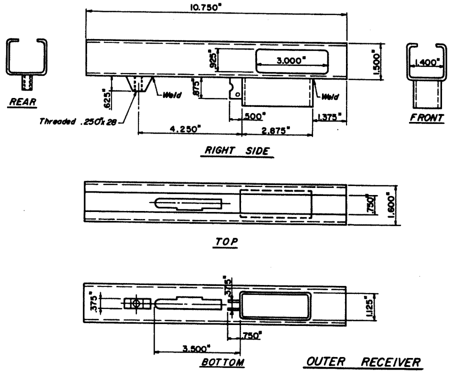
The design of this gun requires both an inner and outer receiver. The inner is required to provide a proper inside diameter for the bolt and to guide shells from the magazine into the chamber. The outer serves primarily to provide sufficient width for the magazine well.

The inner receiver is made from 4140 tubing, outer diameter 1¼" and an inside diameter of .900." Commerical tubing is available with an inside diameter of ⅞" or .875." Since the actual size of such tubing is, in many cases, slightly undersize, it must be reamed, or honed, or a combination of the two, to the proper diameter. An expansion reamer will suffice for this provided an extension is attached to the driving end so that the reamer will go all the way through. The reaming should be followed by honing since the inside surface should be smooth and free from tool marks. If no hone is available, progressively finer grits of emery cloth wrapped around a ⅞" wood dowel will do about the same job although it will take longer.

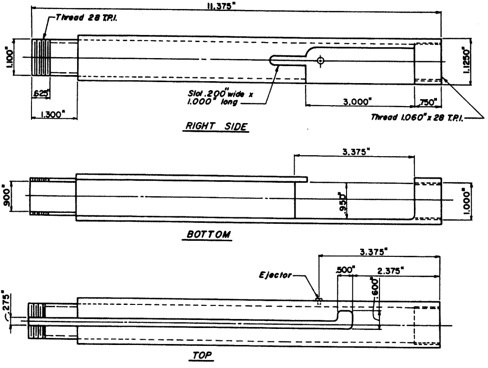
One end of this tubing must be threaded for the barrel to screw into. Bore this end (in the lathe) to a diameter of 1.0" and a depth of .625" (⅝"). This section is then threaded with 28 threads per inch. Note that the thread depth for this pitch is .046", therefore the barrel tenon should be left at 1.050" and, as the final thread depth is approached, tried frequently to the receiver and mated to a close snug fit.

The rear end is also threaded to accept a stock mounting bracket. Turn a section ⅞" long with a diameter of 1.100." The first .750" of this is threaded using the same 28 threads per inch with an ⅛" wide shoulder left at the forward part for a spacer to fit around.

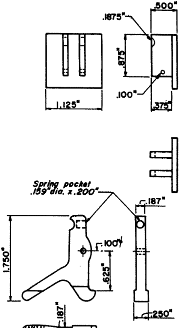
A lengthwise slot .300" wide is cut on the top center. This slot should begin 2⅜" behind the front face and extend the entire length of the receiver rearward. It is recommended that



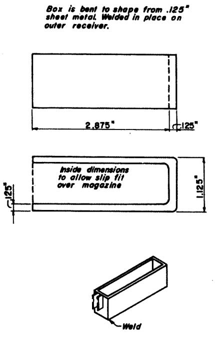
OUTER RECEIVER



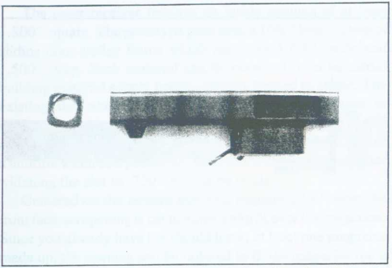
INNER RECEIVER



MAGAZINE LATCH



MAGAZINE BOX



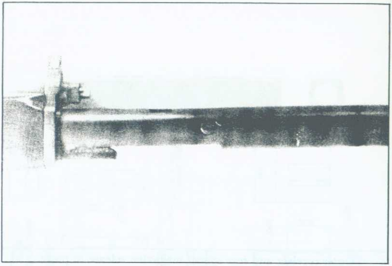
Outer receiver and rear spacer magazine release in place.

this slot be cut using a vertical milling machine with a ¼" cutter. After the slot is cut entirely through the tubing a light cut using the side of the cutter is made up one side of the slot and back down the other. The wider portion for the locking lug is also cut using the same set up.

Since this slot represents the top center of the receiver, a center line is now located on the exact opposite side, or 180 degrees away.

Using this bottom center line, an opening is cut to allow the magazine entrance into the receiver body. This opening is extended up the right hand side as shown in the drawings to form an ejection part.

The flat behind the magazine opening serves no purpose except a slight weight reduction. It can be incorporated, or not, as you see fit. The .300" x 1.500" slot shown in this flattened portion must be cut to provide clearance for the hammer.



Right side of inner receiver, ejector is visible (barely) above and at rear of magazine opening.

Bottom view, ejector location is clearer here.

The outer receiver requires an inside opening of at least 1.300" square. The prototype guns used a 10¾" long section of sliding door trolley frame which measures 1.400" wide and 1.500" deep. Such material can be obtained from industrial building material supply houses already formed to shape. The existing slot which was intended to be on the bottom as originally used is turned over and used on the top side in this application. The edges of the slot are probably rough and not of a uniform width so a pass down each side with the milling cutter widening the slot to .750" should be made.

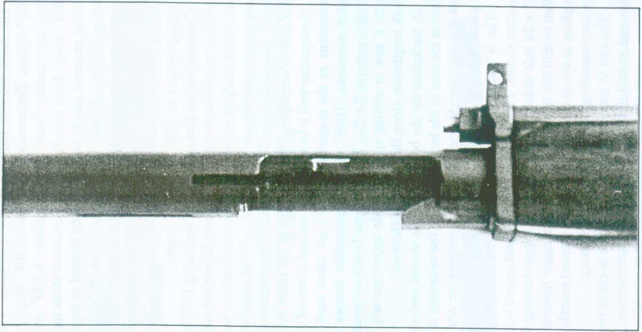
Centered on the bottom side and beginning 1⅜" from the front face, an opening is cut to allow a slip fit over the magazine. Since you already have (or should have) at least one magazine made up, the opening can be tailored to fit the magazine quite closely. An ejection port 1" deep and 3" long is cut on the right hand side to correspond with the port in the inner receiver.

A magazine well is bent to shape around a form of the same dimensions as the magazine. Use 12 ga. sheet steel for this which measures .1046". Some automobile frames contain suitable material for this. The 90 degree bends are much easier made if saw or milling cuts are made approximately ⅓ to ½ depth lengthwise along the inside of the bend.

A backplate for the box is made as shown and welded in place at the rear of the box after which the assembly is located and clamped over the opening in the outer receiver and welded in place preferably using the heli-arc process.

The ⅜" square block ⅝" long is welded in place in the location shown. This will later be drilled and tapped to receive a ¼" x 28 bolt which holds the grip and trigger housing in place. Wait to drill this hole until the grip and trigger housing is fitted in place at which time the hole can be located exactly through the corresponding hole in the trigger housing.

The slot to provide hammer clearance is cut in the bottom side and should match the slot in the inner receiver.



Inner receiver showing feed ramp mounted in place. May be held by screws or silver solder.

BOLT

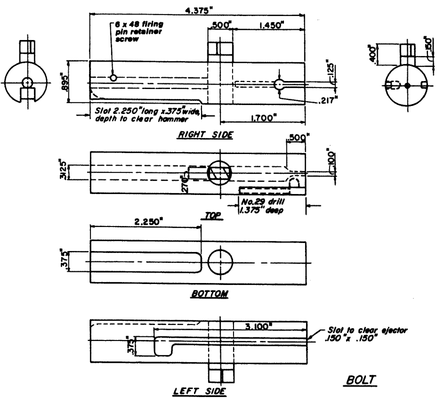
The bolt, or breech block, can be fashioned in two ways. Either with the locking lug and bolt machined in one piece which requires a considerably larger piece of material turned to size with enough material left in a band to mill the lug from, or a section of material for the bolt body of sufficient diameter to just fit inside the inner receiver with the locking lug made separately and fitted through the bolt. Since the latter method requires less work and material it is the one described here.

Obtain and turn a piece of 4340 or similar steel to a diameter which will just push freely through the inner receiver. The finished length will be 4½". Automobile axle material is suitable for this.

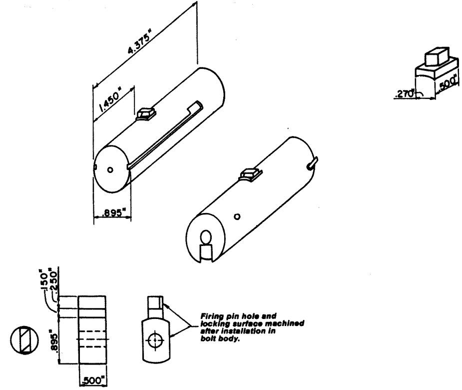
A firing pin hole is bored from the rear end with a .302" N drill to a depth of 4.0" then from the front end with first a no. 39 (.0995) drill followed by a no. 38 (.1015). Next a ½" hole is drilled at a right angle to the bolt body, centered and entirely through both sides and 1⅜" from the front face to the center of the hole.

Using the same 4340 (or similar) material a locking lug blank is turned as shown. The portion which fits through the bolt should be .005" larger than the hole through the bolt for a press fit. The portion which extends above the bolt is turned to ⅝" diameter to allow extra material for squaring the face of the locking lug, after it is pressed in place. The side opposite the locking lug can be silver soldered to prevent it from ever working loose. The firing pin hole must now be redrilled with the N drill since we have blocked the hole. This is followed by reaming to .3125" (5/16) and lapping the inside as slick and smooth as possible.

The locking lug is machined from the material extending from the bolt body to a width that will allow free travel in the receiver slot. The rear surface is squared and the actuating cam cut as shown.


4.375"
6 x 48 firing pin retainer screw
.500"
1.450"
.895"
.125"
.217"
Slot 2.250" long x.375" wide, depth to clear hammer
1.700"
RIGHT SIDE
.400"
.150"
.500"
.100"
.3125"
.276"
No.29 drill 1.375" deep
TOP
2.250"
.375"
BOTTOM
3.100"
.375"
Slot to clear ejector .150" x .150"
LEFT SIDE

BOLT


4.375"
1.450"
.895"
.270"
.500"
.150"
.250"
.895"
.500"
Firing pin hole and
locking surface machined
after installation in
bolt body.

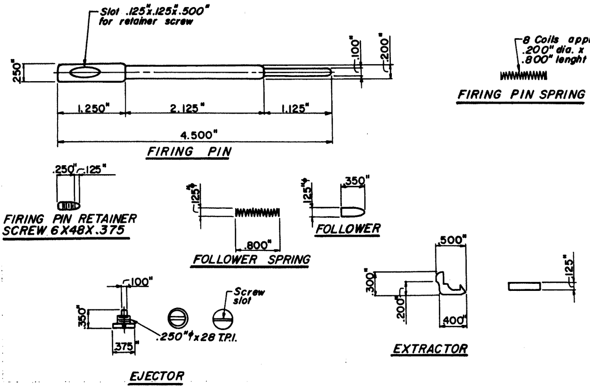
An opening for the extractor is made by first drilling a hole .213" in diameter and .375" deep with a no. 3 drill .220 from the hole center to the bolt face and in a 9 o'clock position when viewed from the bolt face (90° left from the locking lug. A ⅛" slot is cut from the hole forward to a depth of .160" and a lengthwise ⅛" hole drilled just inside, and parallel to, the bolt body. This hold should be .750" deep or 1.180" deep if measured from the bolt face. The extractor plunger and spring fit inside this hole.

Another slot, cut the entire length of the bolt body, .125" wide and .1875" deep must be cut in a four o'clock position when viewed from the bolt face or 120 degrees clockwise from the locking lug. This slot is to provide clearance for the ejector. The location of this slot plus the wider portion some three inches to the rear of the bolt face can be marked through the hole that the ejector screws into located in the inner receiver, thus locating it exactly.

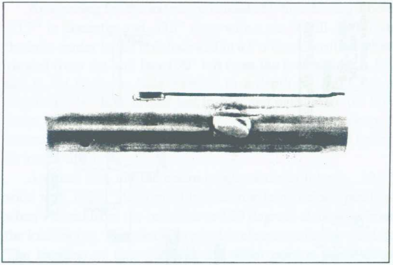
The ejector is simply a screw with the top, bottom and front sides machined flat to mate with the bolt slot. Care should be taken to assure that this ejector rides freely in the bolt slot without binding.

The extractor system is more or less a copy of the Remington 1100-870. In fact, you can save yourself a couple hours work by simply buying and using these parts which most gunsmiths keep in stock. For those who would rather do it themselves, dimensions are included in the drawings.

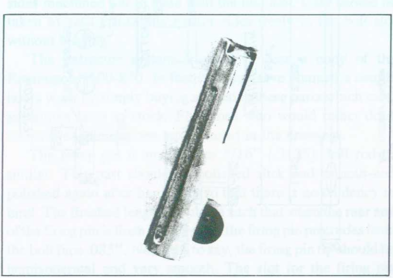
The firing pin is made from 5/16" (.3125) drill rod or similar. This part should be polished slick and smooth and polished again after hardening so that there is no tendency to bind. The finished length should be such that when the rear end of the firing pin is flush with the bolt the firing pin protrudes from the bolt face .085". Needless to say, the firing pin tip should be hemispherical and very smooth. The slot for the firing pin retainer screw must be properly positioned to permit the firing



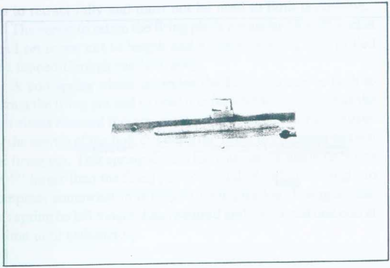
Slot .125"x.125"x.500" for retainer screw
.250"
1.250"
2.125"
1.125"
4.500"
.100"
.200"
FIRING PIN
8 Coils approx. .200" dia. x .800" lenght
FIRING PIN SPRING
.250" .125"
FIRING PIN RETAINER SCREW 6X48X.375
.125"φ
.800"
FOLLOWER SPRING
.125"φ
.350"
FOLLOWER
.500"
.300"
.200"
.400"
.125"
EXTRACTOR
.100"
.350"
.375"
.250"φx28 T.P.I.
Screw slot
EJECTOR



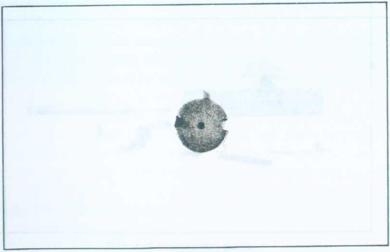
Bolt, top view showing locking lug and cam, ejector clearance slot also visible.



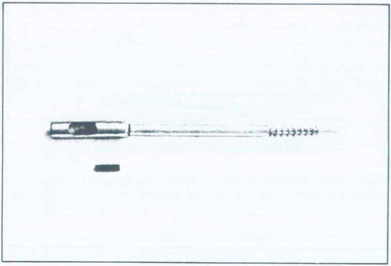
Bolt, bottom view, showing relieved area to reduce hammer friction.



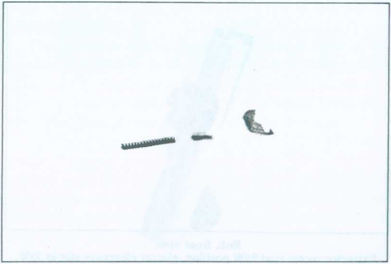
Bolt, left side.
Flutes are simply to reduce friction, serve no other purpose.



Bolt, front view.
Extractor recess is at 9:00 position, ejector clearance slot at 3:00.



Firing pin with retracting spring in place. Retainer screw engages slot in rear portion of firing pin body.

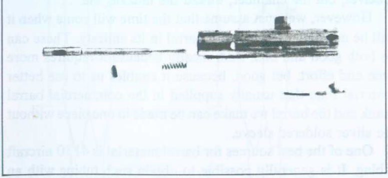


Extractor with follower and spring.

pin to retract fully and must not be used to limit protrusion.

The screw to retain the firing pin is a standard 6 x 40 socket head set screw cut to length and a corresponding hole drilled and tapped through the bolt body.

A coil spring which encircles the firing pin serves both to retract the firing pin and to hold it in its rearmost position as the bolt slams forward thereby preventing premature firing caused by the inertia of the bolt throwing the firing pin forward against the firing pin. This spring should have an inside diameter some .005" larger than the firing pin body and of sufficient length to compress somewhat in it longest configuration. I suggest that this spring be left longer than required and shortened one coil at a time until satisfactory.



Bolt and component parts.
Consists of firing pin, spring, retainer screw, bolt body, extractor, follower and spring.

BARREL

Shotgun barrels, simply by virture of being smooth bored and thus requiring no rifling are simpler to make than rifle or pistol barrels. Even so, as long as shotgun barrel blanks are available with finished (or nearly so) interiors from various suppliers, it is far simpler and cheaper to obtain one of these and rework it than it is to obtain material and tooling to make just one barrel.

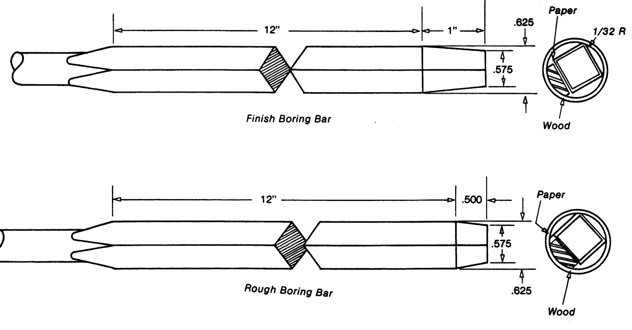
Since these barrel blanks usually come in lengths ranging from 26" to 36" it will be neccessary to cut the barrel to the desired length. This will usually be done by cutting back from the muzzle end since it is desirable to retain all the larger diameter possible at the breech end.

If the barrel blank is not of sufficient diameter to allow threading for the gas piston bracket and forend retainer nut then it will be necessary to turn a straight cylindrical section on the barrel and silver solder a sleeve of large enough diameter to thread properly in place. The proper dimensions and location are shown in the drawing.

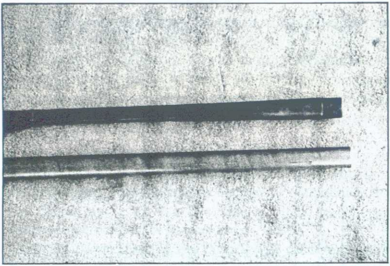
The barrel, then, is easy enough to come by. All that is required now is to thread the breech end to mate with the receiver, cut the chamber, thread the muzzle, etc. . .

However, we must assume that the time will come when it will be necessary to make the barrel in its entirety. These can be both good and bad. Bad, mostly because it requires more time and effort, but good, because it enables us to use better material than that usually supplied in the commercial barrel blank and the barrel we make can be made in one piece without the silver soldered sleeve.

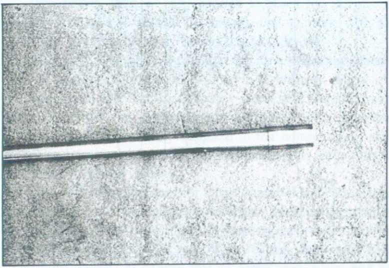
One of the best sources for barrel material is 4130 aircraft tubing. It is generally possible to obtain such tubing with an outside diameter of 1¼" (1.250"). The biggest drawback to this is that many times the supplier wants to sell such material in minimum lengths of twenty feet or sometimes more, and we



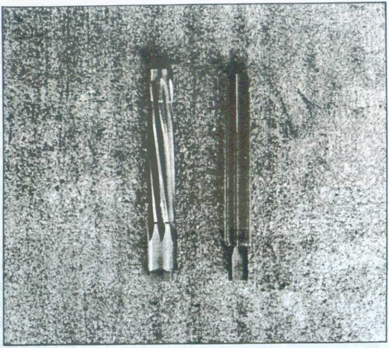
Barrel Boring Bars



Barrels can be made from 4130 seamless tubing as described in text.



Commercial barrel blank.



Chamber reamers.
At left is 12 ga. spiral fluted finish reamer. Other reamer is long forcing cone reamer.

only need a section slightly over 18" long. I say slightly over because 18" is the minimum legal shotgun barrel length, and since there may possibly be a difference of opinion as to just where the barrel starts and stops, it is better to make it slightly long, say 18⅛" - 18¼" just to be on the safe side.

The inside diameter of the tubing obtained depends on what we want the finished bore diameter to be. Unlike rifled barrels, shotgun bore diameters vary by as much as .040", perhaps more, while standard bore diameter for a 12 gauge barrel is .729", it is not uncommon to find bores as small as .710" -

.712" and as large as .745" - .748". The smaller diameters are more often encountered in foreign made guns while the larger diameters are most often seen in custom built or reworked target shotgun barrels. The larger bore diameters tend to kick less than the tighter ones.

As long as one piece plastic shot cup type wads which expand and seal the bore are used exclusively, the larger bore diameter is the route to take. Since, usually, the ¾" inside diameter tubing is actually .008" — .010" undersize, this is ideal for our purpose since honing and/or lapping the inside surface will leave a smooth uniform interior measuring .740" -.745".

If, on the other hand, it is intended to ever use shells loaded with fiber wads, it will be necessary to use a smaller bore diameter of, preferably, .725" - .730". This means that smaller inside diameter tubing is required. Since the closest suitable standard diameter is 11/16" or .6875", (usually it will also be slightly smaller) this will have to be the size obtained, and we will ream, hone, and lap it to size. This size can also be used when a choked barrel is desired since the diameter is such that a full choke can be left in the muzzle end. I have been making trap gun barrels for several years using this same tubing.

In the event that you do decide to use the smaller bore diameter, it will be necessary to make up at least one, and preferably two, boring tools as shown in the drawings, one of these would be a roughing reamer and the other a finishing and burnishing reamer which removes only some .002" - .004" of metal.

Making such reamers is fairly easy if use of a surface grinder is available. The tool is first shaped square some .020" larger than the finished size, which leaves enough material for grinding. A shank approximately 1½" long is turned on one end and a length of drill rod, long enough to reach through the bore, welded on.

Note that the roughing reamer only cuts on the one side. The finish reamer is given a small radius and the opposite side is the cutting edge.

In use, the barrel blank is chucked in the lathe preferably using a chuck on each end of the spindle and the barrel blank extended through the headstock. Then the shank of the tool fastened to the carriage in some manner that will allow it to be pushed into the bore while retaining some lateral movement.

The tool is made to fit the bore by using a piece of hard wood shimmed with strips of paper. The tool should only remove some .002" - .004" with each pass of the tool into the barrel bore. Needless to say, a continuous supply of cutting oil used as a lubricant. And, of course, additional strips of paper are placed between the wood and the tool between cuts until the proper bore diameter is almost reached, at which time the finish reamer is used to bring it to the finished size.

This will produce a useable barrel, however, if we now cast a lead lap on the end of a cold rolled steel rod and turned to bore diameter, then substituted for the boring tool, and moved back and forth slowly through the bore with a coating of some sort of lapping compound, a mirror like finish free of tool marks can be achieved. After all tool marks are removed, another lead lap should be cast and this one used with rouge for a final finish.

The outside should now be turned to shape using the dimensions given in the drawing as a guide. The breech end threaded as shown to match the inner receiver threads, the two threaded portions for the gas cylinder ring and forend nut machined as shown and the muzzle end threaded.

The barrel can now be centered in the lathe headstock using a chuck on each end as was done during the boring operation, or the muzzle end chucked and the breech end centered in a steady rest. The chambering operation is accomplished by placing the dead center in the center of the reamer. Then the reamer is turned with a suitable wrench and gradually forced in with the tail stock screw. Here again, cutting oil is used liberally. Do not cut the chamber to its full depth at this point. Leave some .030" to be cut after the gun is assembled to assure that proper headspacing can be achieved.

If the other parts have been made in the sequence shown in the book, the barrel spacer is now placed on the breech end of the barrel and the inner receivers screwed tightly in place. The gas cylinder ring is now threaded on the barrel and metal removed either from the rear side of the ring or from the shoulder at the rear of the threaded barrel portion until the gas cylinder comes up exactly on top dead center with the ring tight. Then with the gas cylinder installed by inserting it through the hole in the barrel spacer and screwing it tightly into the ring, the gas port is drilled completely through the ring, cylinder, and top side of the barrel. This port can be anywhere between .100" and .120" so a number 31, 32, or 33 drill can be used with practically the same result. The hole in the upper wall of the gas cylinder and ring are tapped with a 6 x 48 tap to receive a plug screw which both prevents gas from escaping and allows cleaning of the gas port by removing the screw.

If the bolt is finished now (or later) the chamber should be cut to its finished depth allowing the bolt to close easily on a "go" guage or a factory shell with an .008" or .010" shim between. A self loading gun of this type requires slightly excessive headspace to insure successful operation since there is no camming action associated with the bolts closing to assist in locking the action over a slightly thicker case rim than standard.

With the bolt in place, the extractor's position should be marked on the barrel. Index marks should be made on the barrel, barrel spacer, and receiver to insure proper alignment on reassembly. The barrel should now be removed and the extractor slot cut with a file using the marks previously made as guides and limits.

While it is possible to make chamber reamers, and chamber dimensions are given in the drawings. Suitable reamers are available from sources listed in the back of this book that will cut the forcing cone, chamber, and rim counterbore simultaneously .

Therefore, as long as such reamers are available, I recommend they be purchased and used since a considerable amount of time and effort is required for their manufacture.

There are, and have been, a number of different opinions expressed regarding forcing cone length. The forcing cone, for those who do not know, is that portion of the bore immediately forward of the chamber which by tapering reduces the inner diameter from chamber size to bore size.

In certain applications a long forcing cone some 1½" long is desirable. However, in an application such as used here I doubt seriously that anything would be gained except perhaps a slight decrease in recoil. So, whatever forcing cone length that the manufacturer has incorporated in the reamer should prove satisfactory.

STOCK

The buttstock, forend, and grip for this shotgun can be made from hardwood, plastic, or fiberglass. As long as we are concerned with building only one gun, hardwood would seem to be the best choice. The use of plastic or fiberglass would require building molds and/or forms which would require more time and effort to complete.

While there are several types of hardwood available that are suitable for this purpose including maple, myrtle, gum, beech, etc., walnut is probably more readily available and as durable as any of the others. Since this gun is not necessarily meant to be a thing of beauty, I suggest that you seriously consider plain straight grained wood since it is usually stronger and weighs less than fancy figured wood. If possible, obtain wood of the type known as French, English, or Circassian Walnut. Even though it was probably grown and cut in California, it is not only denser and stronger but is also lighter in weight than the Black Walnut which is more common across the rest of this country. Several wood suppliers are listed in the back of this book from whom suitable wood is available.

The buttstock is inletted simply by drilling a ⅜" hole lengthwise down the center of the blank. While long drills are available which would reach completely through the stock blank, such drills are expensive and usually must be ordered from a specialty company. So it will probably be cheaper and faster to turn the shank of a standard twist drill to a smaller diameter, slip the end of a piece of tubing which is somewhat smaller in outside diameter than the drill body over it, and braze the two together. This long shanked drill is chucked in the lathe. Both ends of the stock blank are centerpunched and with the tailstock center resting in the punch mark on the other end, the drill is fed into the stock blank with pressure from the tailstock screw.

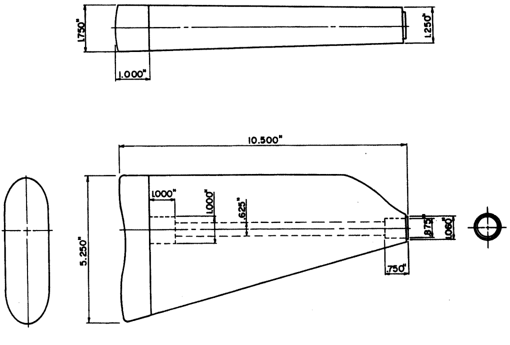
The through hole is enlarged to ¾" at the forward end deep enough to receive the enlarged portion of the stock mounting bracket and a lip cut to mate with the outer portion. Do not neglect this since it reinforces the front end of the stock against splitting. The through hole must also be enlarged at the rear or butt end to a diameter of ⅞" and a depth sufficient to allow the stock retaining nut to engage the threads on the stock retaining bracket. The depth of this hole will vary due to the fact that one builder may use a longer stock than another.

With the stock bolted tightly in place and cut to its finished length the end is faced off flat and square and a recoil pad mounted in place using the two screws provided, on my own gun, I used a Pachmayer "Presentation" pad with a white line incorporated in its design, I used this simply because it was available, and while certain "purists" insist that the white line pad has no business on a firearm of this type, I have not been able to tell any difference in the pads function. I have noticed that they kick about the same with, or without, the white line.

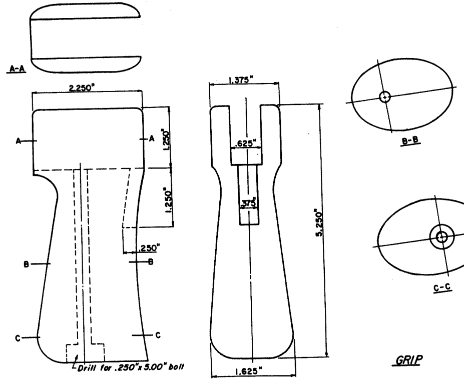
Anyway, with the pad mounted it is a simple matter to shape the stock to the same round contour as the metal at the forward end and the approximate contour of the recoil pad at the rear and removing all excess wood in between keeping the lines straight as possible for appearance sake. A fairly coarse grit disc or belt sander will remove this wood fairly rapidly.

The forend and grip are made in the same manner. The grip requiring only a ¼" hole drilled lengthwise and enlarged at the bottom end with a flat pointed drill or end mill to accept a reinforcing washer. It is then inletted to fit over the trigger housing. This can be done easily and quickly if a milling machine is available, If not, most of the wood can be removed by sawing and finished with a file and flat chisel. It is then shaped as desired in the same manner as the buttstock.

Make the forend by first drilling a lengthwise centered hole just like we did the buttstock. Since we already have a long ⅝"



BUTTSTOCK


A-A
2.250"
1.250"
A
A
1.250"
.250"
B
B
C
C
Drill for .250" x 5.00" bolt
1.375"
.625"
.375"
5.250"
1.625"
B-B
C-C

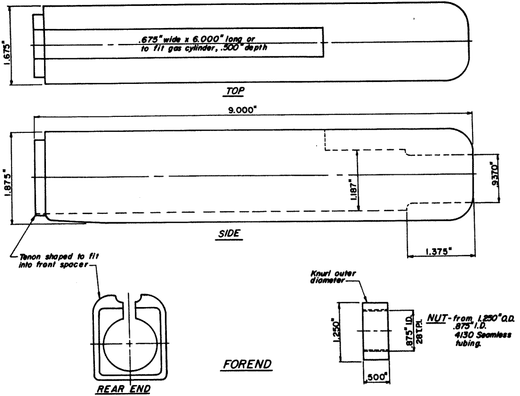
GRIP

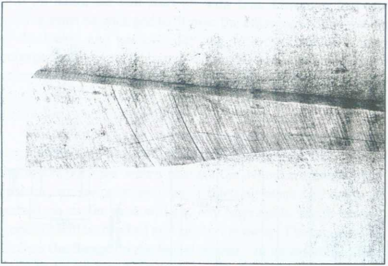
drill on hand, we will start off with that. However, the rear portion must be enlarged to fit over the enlarged breech section of the barrel and gas cylinder ring with the forward portion enlarged to fit over the barrel. Drills big enough to do this are expensive and hard to find, so it will probably be easier to make up a boring bar using ⅝" round stock and the cutter from an expansion bitt as shown in the picture.

Wood must also be removed to clear the gas cylinder and ring. This is accomplished using a small gouge and flat chisel. If the metal portions which contact the wood are coated with lipstock, rouge, prussian blue or inletting black and the wood pushed on as far as it will go, any high spots which prevent proper fit will be marked and can be cut away. The tenon which fits into the flange on the barrel spacer can be located and the wood to be removed marked exactly by coating the forward edge of this flange as above and with the forend in place around the barrel and gas cylinder, pushing it to the rear against the coated flange. The wood is then cut away using a sharp flat chisel to the inside of the marked area and a depth of approximately ⅛".

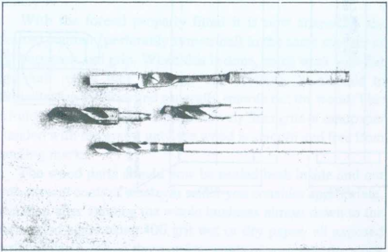
With the forend properly fitted it is now shaped to the desired contour (perferably symetrical) in the same manner as the buttstock and grip. When this is done, some work with flat and half round files or rasps will probably be needed to straighten up the lines and generally smooth out the wood. This is followed by sanding with progressively finer grits of sandpaper (sanded with the grain) until the wood is smooth and free from sanding marks.

The wood parts should now be sealed both inside and out with several coats of whatever sealer you consider appropriate, and then after sanding the whole business almost down to the bare wood again using 400 grit wet or dry paper, all exposed surfaces can be given three or four coats of your favorite stock finish.

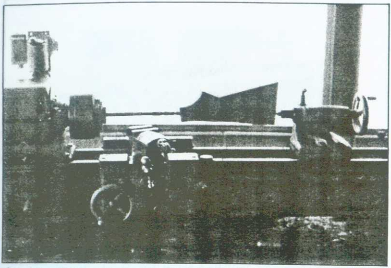

1.675"
.675" wide x 6.000" long or
to fit gas cylinder, .500" depth
TOP
9.000"
1.875"
1.187"
.9370"
SIDE
1.375"
Tenon shaped to fit
into front spacer
REAR END
FOREND
Knurl outer
diameter
1.250"
.875" I.D.
28 T.P.I.
NUT - from 1.250" O.D.
.875" I.D.
4130 Seamless
tubing.
.500"



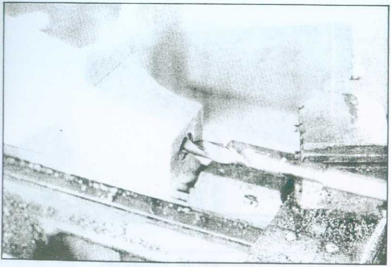
Rifle blank contains enough material for buttstock, forend and grip.



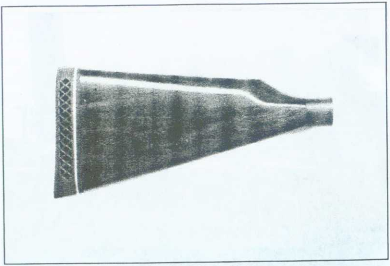
Long shank drills used to drill stock and forend holes. Drill at top has adjustable blade, pilot to follow hole made by smaller drill.



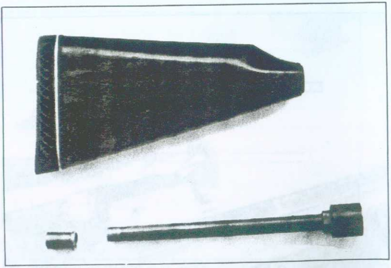
Stock is drilled with long shank drill in lathe chuck, centered on tail stock center. Fed into drill by tail stock pressure.



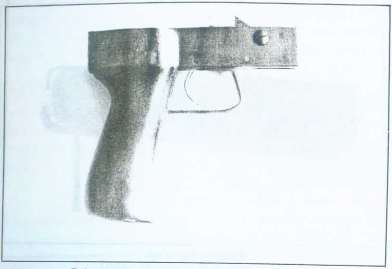
Close up of drilling operation.



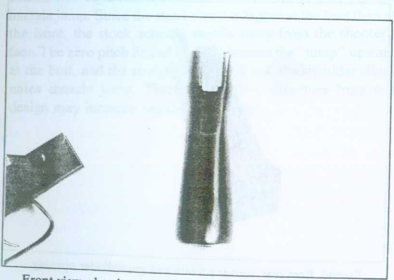
Buttstock assembly.



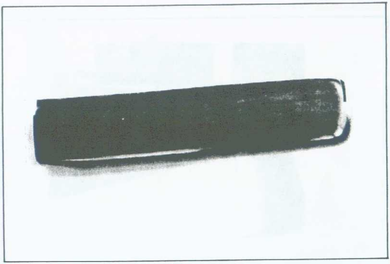
Buttstock, mounting bracket, nut.



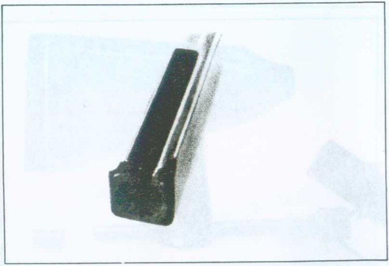
Grip, can be shaped to individual preference.



Front view, showing cut out for trigger housing, trigger guard.



Forend, side view.



Forend, from rear, showing tenon and gas cylinder opening.

Trigger assembly, grip, grip screw.

It should be noted here that the stock design of this gun contributes significantly to the reduced recoil and lack of muzzle jump. Since the stock comb is higher at the heel than at the front, the stock actually recoils away from the shooter's face. The zero pitch line of the butt lessens the "jump" upward at the butt, and the straight line recoil into the shoulder eliminates muzzle jump. Therefore, radical departure from this design may increase recoil appreciably.

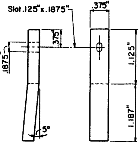
TRIGGER ASSEMBLY

The trigger assembly consists of a housing, trigger, hammer, sear, disconnector and safety, plus a hammer spring and guide, trigger and sear springs, plus appropriate pivot pins or screws.

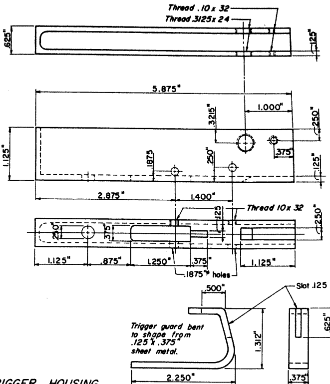
The trigger housing is made from rectangular bar stock ⅝" wide, 6" long and 1⅛" deep. Since little or no stress or shock is imposed on this part, it can be made from whatever steel is available. I prefer better material than cold rolled even for parts such as this, simply because it machines cleaner. I used, and will continue to use, 4140 for this part.

The inside is cut out using a ⅜" end mill leaving a wall thickness including both sides, one end, and the bottom of .100" to .120". The other end which will be the forward, or front, end is cut out entirely. By using the measurements shown or tracing an overlay from the plan sheet, the holes can be properly located and drilled. As usual these holes should be started with a center drill, then drilled with an undersized drill and finished with the proper diameter drill. Since the holes for both the trigger and sear axis pins are threaded 8 x 40 or 8 x 32 to accept axis pins which screw in place, the holes should be a finished diameter of .136" on the threaded side. A number 29 drill is correct for this. The opposite side is larger at .164" - .166" to accept the pin body. Use a number 19 drill for this. The hammer axis pin uses a threaded hole ⅜" x 24" on both sides. These are drilled with a "Q" drill of .332" diameter. The pin at the upper front edge is ¼" in diameter with one side tapped for a ¼" x 28 thread. Use a ¼" and a number 3 drill (.213) respectively. This pin is used only to wedge the forward end of the trigger housing in place.

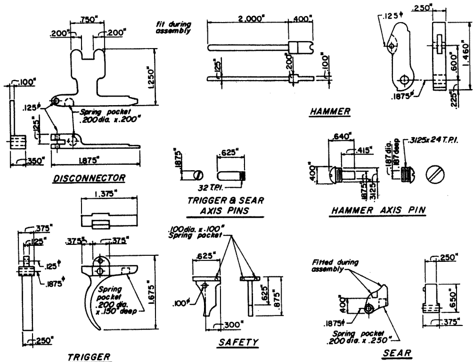
A slot ¼" wide and ½" long is cut in the bottom for the trigger to fit through and the trigger guard bent to shape from .100" - .125" sheet metal ½" wide. A ⅛" wide slot is cut in the trigger housing just forward of the trigger opening and a



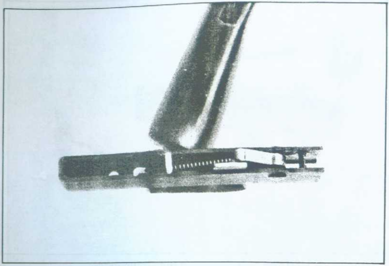
TRIGGER GUARD BRACKET



TRIGGER HOUSING



TRIGGER ASSEMBLY



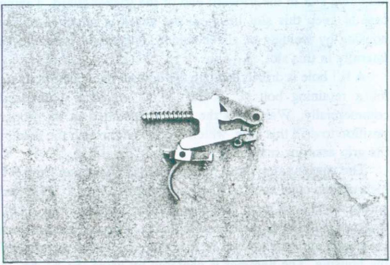
Top view of trigger assembly, showing hammer in cocked position.

matching slot in the forward end of the trigger guard. Taking care to keep this slot lined up the guard is attached to the housing by welding or silver solder. The safety lever works laterally in this slot.

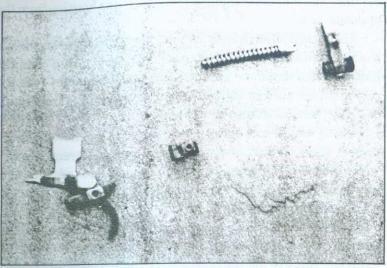
A ¼" hole is drilled through the bottom rear of the housing for a retaining bolt ¼" x 28" x 5" which is purchased commercially. Wait until the grip is installed in its proper position to drill this hole, which is marked through the hole in the grip assuring matching.

The trigger safety, and hammer are cut to shape from ¼" high carbon steel such as 4340. A section of automobile leaf spring works well here. The sear should be made from 5/16" material of the same quality, note that spacers are fitted to both the trigger and sear to keep them centered between the walls of the housing. The hammer is centered by using the ⅜" by 24 T.P.I. hammer screw with a small ¼" pin extending through the

Trigger assembly with magazine catch.



Trigger/hammer assembly in approximate assembled position.



Trigger with trigger bar, sear, hammer spring and guide, hammer with axis pin in place.

Hammer axis pin and boss.

hammer and into the bushing threaded into the housing from the opposite side.

The combination trigger bar and disconnector is also made from ¼" material with the forward portion thinned to clear the hammer and hammer spring. The upper "humps" on the disconnector portion should be left oversize to permit fitting after the rest of the gun is assembled.

Three small coil springs are required as shown for the trigger, sear and disconnector. No specific size is required here so long as they are strong enough to return these parts to their pre-fired position and hold them there. Drill "pockets" as shown for the springs to fit in.

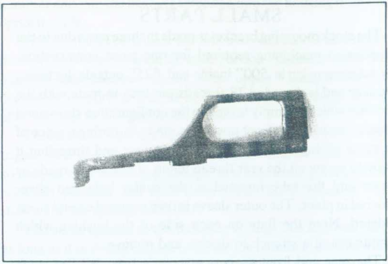
The same applies to the hammer spring. The size can vary as long as it is strong enough to throw the hammer forward with sufficient force to fire the shell consistently. The spring guide is made to match.

SMALL PARTS

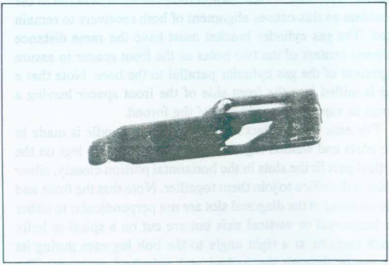
The stock mounting bracket is made in three parts due to the complicated machining required for one piece construction. The tubing portion is .500" inside and .625" outside diameter. The rear end is threaded 28 threads per inch to mate with the stock nut which is simply turned to the configuration shown and threaded inside. The front portion is made by boring a piece of the same tubing used for the inner receiver and threading it inside to screw on the rear thread tenon, a bushing is made as shown and the tube inserted in the center hole and silver soldered in place. The outer sleeve is then screwed on and silver soldered. Note the flats on each side of the bushing which permits use of a wrench to tighten and remove.

The rear and front spacers are made from ⅜" flat stock while the gas cylinder bracket is made from ½". Both spacers should have a shoulder ⅛" deep around the entire perimeter of each. The outside to the same width as the outer receiver and the smaller portion a snug fit inside the ends of the outer receiver. The hole in each should have the same relation to the shoulders as this causes alignment of both receivers to remain fixed. The gas cylinder bracket must have the same distance between centers of the two holes as the front spacer to assure alignment of the gas cylinder parallel to the bore. Note that a cup is milled into the front side of the front spacer leaving a flange to support the rear end of the forend.

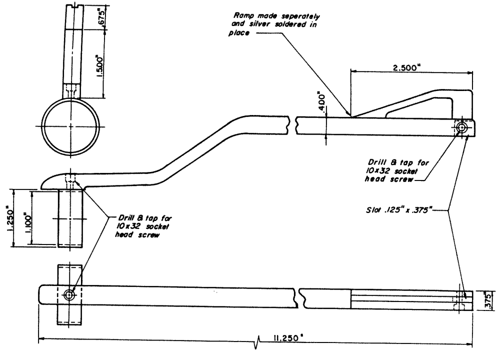
For ease of manufacture, the operating handle is made in two parts and welded together. As long as the two legs on the vertical part fit the slots in the horizontal portion closely, silver solder will suffice to join them together. Note that the front and rear surfaces of the diagonal slot are not perpendicular to either the horizontal or vertical axis but are cut on a spiral or helix which remains at a right angle to the bolt lug cam during its movement through the locked and unlocked positions. The flange at the top serves as a guide and should be .125" wide and



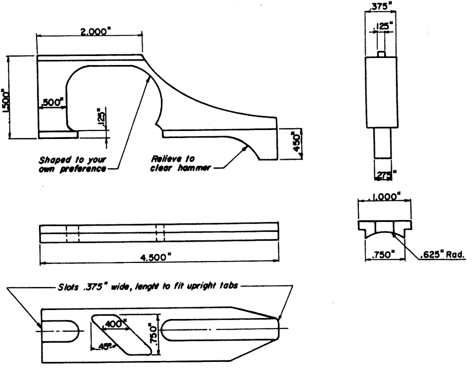
Operating handle, side view.



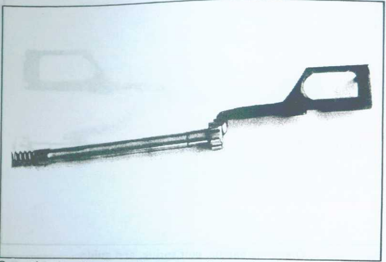
Operating handle, top view.



OPERATING HANDLE GUIDE



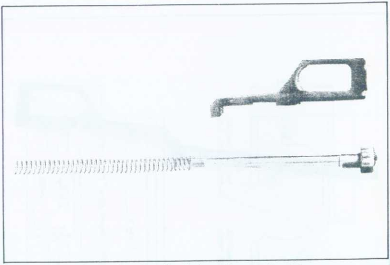
OPERATING HANDLE



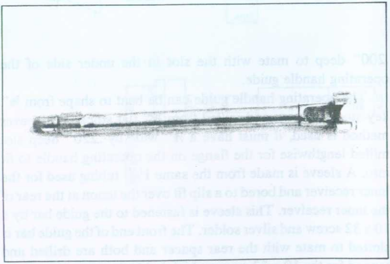
Operating handle shown in correct relationship with bolt spring and guide. Fluted portion of bolt spring guide is to reduce friction.

.200" deep to mate with the slot in the under side of the operating handle guide.

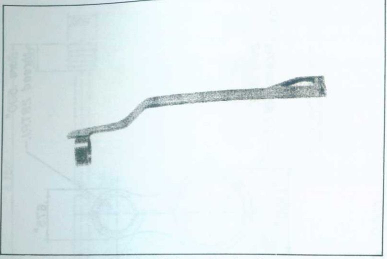
The operating handle guide can be bent to shape from ⅜" key stock or sawn and milled from ⅜" flat stock. Whichever method is used, it must have a ⅛" wide by .220" deep slot milled lengthwise for the flange on the operating handle to fit into. A sleeve is made from the same 1¼" tubing used for the inner receiver and bored to a slip fit over the tenon at the rear of the inner receiver. This sleeve is fastened to the guide bar by a 10 x 32 screw and silver solder. The front end of the guide bar is slotted to mate with the rear spacer and both are drilled and tapped for the 10 x 32 screw which holds them together at the front.



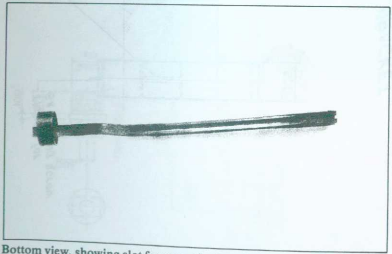
Operating handle, bolt spring, and guide.



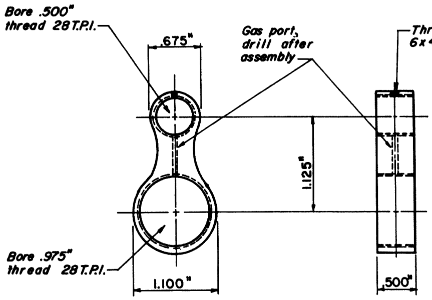
Bottom view of guide showing cut out portion for hammer clearance.



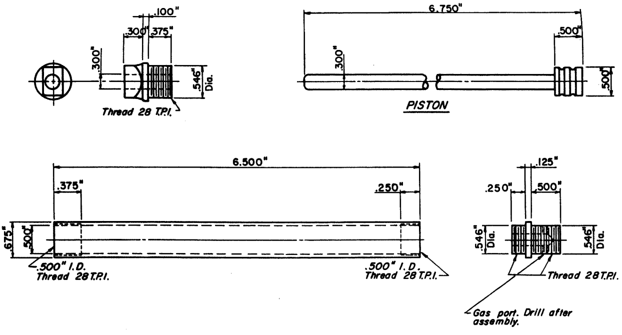
Combination carrying handle/operating handle guide, side view.



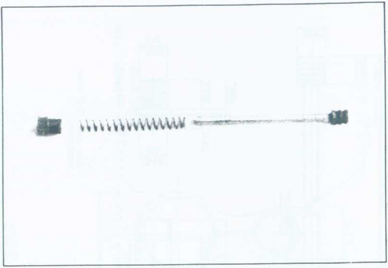
Bottom view, showing slot for operating handle which the "draftsperson conveniently left off the book drawing. It is shown on the large plan sheet.



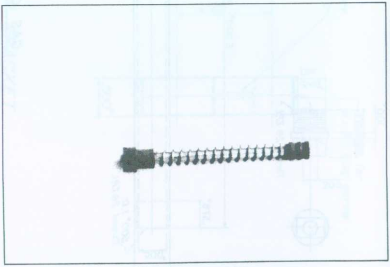
GAS CYLINDER BRACKET



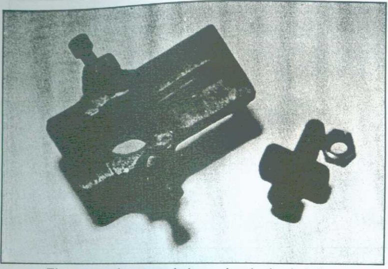
GAS CYLINDER



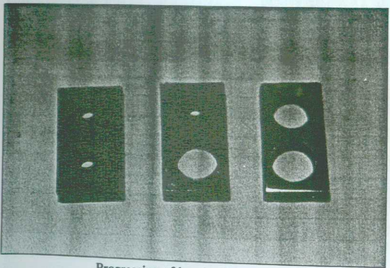
Gas piston, spring, retainer.



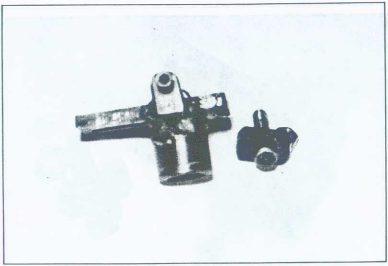
Gas piston assembly.



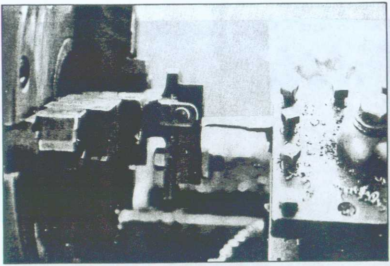
Fixture permits proper hole spacing, boring in lathe.



Progression of bracket fabrication.

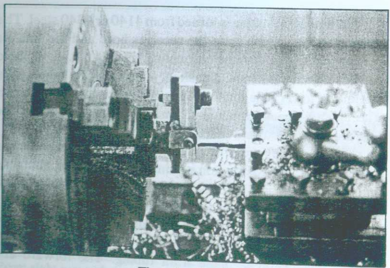


Side view of fixture.

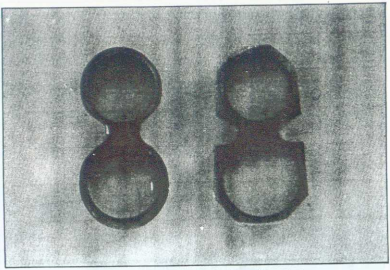


Boring front spacer.

Boring bracket to size.



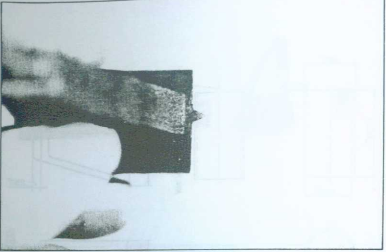
Threading bracket.


Outside contour progression of bracket.

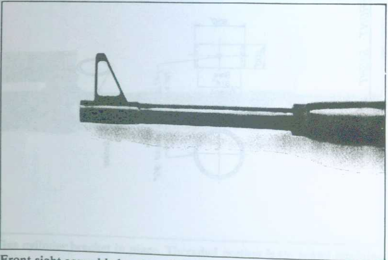
The bolt spring guide is turned from 4140 or 4340 steel. The larger portion a close fit to the receiver bore and the smaller portion just fitting the stock mounting bracket tub. A ¼" hole can be drilled lengthwise, if desired, just to make it lighter. The slot in the lower side is to provide clearance for the hammer. The slot on the upper side mates with the rear leg of the operating handle to prevent its turning.

As long as they are available, the use of bolt springs such as are used in 1100 Remington or similar autoloading shotguns will save a lot of time and trouble. If you do have to wind one it should be made from music wire with a diameter of .051" - .052", an uncompressed length of approximately 14" and contain some one hundred coils.

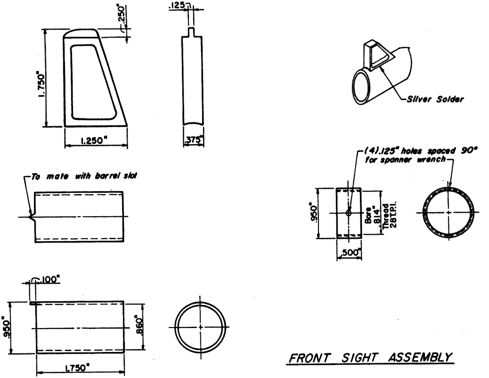
The gas piston is made from tubing. The forward end



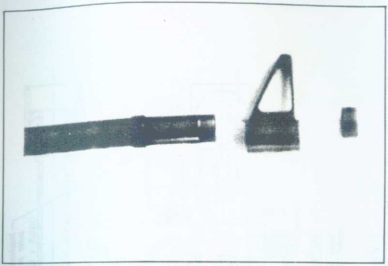
Projection on front sight band mates with notch in barrel band, prevents movement.



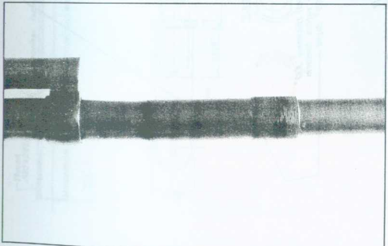
Front sight assembled on barrel, forend retainer nut as shown on plan.



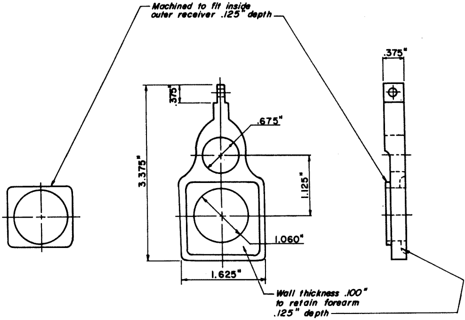
FRONT SIGHT ASSEMBLY



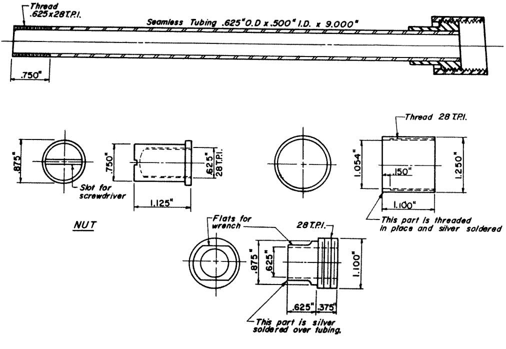
Front sight assembly.



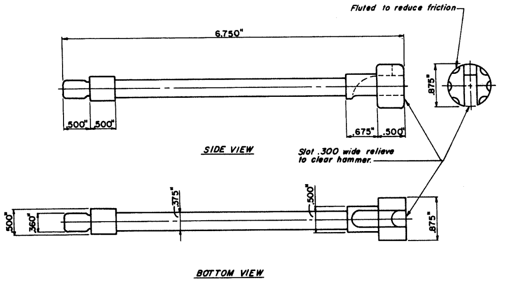
Gas cylinder bracket in place. Threaded portion is for barrel retaining nut.



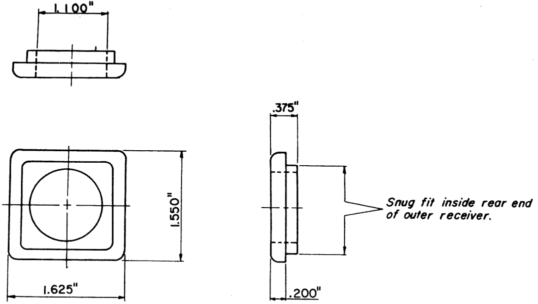
FRONT SPACER



STOCK MOUNTING BRACKET AND NUT



BOLT SPRING GUIDE


1.100"
.375"
1.550"
Snug fit inside rear end
of outer receiver.
1.625"
.200"

REAR SPACER

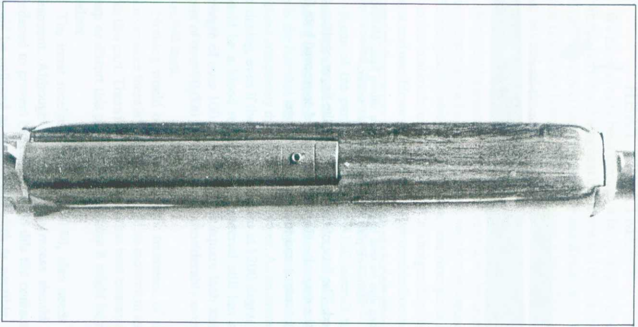
threaded to receive a plug which, in turn, screws into the gas cylinder bracket. The rear end is also threaded to accept a bushing which encircles the gas piston rod and holds the return spring in place. A Colt M 1911.45 auto recoil spring works well as a return spring.

The gas piston should be turned and lapped to a close fit. The piston and rod can be made seperately and screwed together, or turned in one piece from round stock. It may also be desirable to fit one or more piston rings as shown in the drawing to attain a tighter seal.

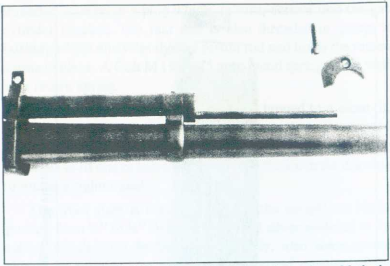
The front sight is made by shaping the upright, or blade, portion from ¼" to ⅜" flat stock which is silver soldered to the tubing which must fit the barrel closely, also some means should be provided to maintain the vertical position of the blade. One way of doing this is, as shown, cutting one or more notches in the barrel collar and corresponding projections on the sight sleeve which mate together preventing the sight from turning.

Both the forend nut and front sight nut are turned from round stock, bored to diameter and threaded to fit the barrel threads. Some means should be provided to tighten and to remove these nuts. This can be done by cutting opposing flats on each nut so that a wrench can be used or drilling one or more holes around the rim to permit the use of a proper spanner wrench. Such wrenches can be made by forging a curve in a short length of flat stock and installing a stud either by drilling and tapping or silver soldering.

The magazine release is made from ⅜" flat stock, the sides thinned to fit inside the slot at the rear of the magazine box. The upper end has a pocket drilled to accept a small coil spring and the hole drilled for a ⅛" diameter pivot pin. The hook portion which engages the rear side of the magazine and latches it in place should be left oversize for final fitting when the gun is



Socket screw plugs hole made during gas port drilling, permits cleaning of office.



Forend can also be held in place using system shown here. Method shown on plan is stronger, simpler, neater.

assembled. The face of the lever which the finger contacts to release the magazine should be checkered or grooved both for cosmetic reasons and to minimize slippage.

HEAT TREATMENT

We have already been through a fairly lengthy description of what takes place during heat treatment and the reason for it in *"Home Workshop Guns for Defense and Resistance"* Volumes I and II so there is no point in repeating it here. Suffice to say that several of the component parts described here require hardening and tempering mostly to prevent battering and/or rapid wear.

It should be pointed out, for the benefit of the uninformed, that pressures in a 12 ga. shotgun are very low in comparison to rifle and pistol cartridges. Therefore, less strength is required from the materials used to produce a shotgun that is safe to shoot and use. However, since far longer trouble free use can be expected from a gun built from quality materials and properly heat treated, the end result is worth the extra effort.

Some of the parts, if built from 4130 aircraft tubing as described, are satisfactory "as is." In fact, the primary purpose in using this material aside from desirable dimension availability is the fact that it is intended to be subjected to welding heats without completely drawing all the temper. As an example after hardening, even if the temper is drawn at 1200 degrees, which would be a blood red color, the material still has a tensile strength of over 100,000 pounds per square inch and a yield point of over 90,000 P.S.I. which is considerably more than is required here.

Nothing would be gained by heat treatment of the outer receiver since there is little pressure and no movement associated with this part. There is a good chance that heat treatment would warp or distort this part to a point where it might be rendered useless.

The inner receiver, built from 4140, also needs no heat treatment. Although the locking lug recess should be case hardened to prevent battering. To do this the contact surface should be polished as smooth and slick as possible, then the contact surface and immediate area around it is heated cherry red with the acetylene torch and dipped in a hardening compound such as "Kasenit." The Kasenit powder sticks to the metal, melting and forming a coating. The steel is then again heated to a bright red and quenched in water. This system is capable of imparting a deep surface hardening and can be repeated on the same material with some increase in hardness.

The other parts requiring heat treatment are the hammer, sear, disconnector/trigger bar, safety, magazine release, firing pin, and gas piston. While it is desirable and advisable to properly harden and temper these parts, preferably through the use of a proper oven, the "Kasenit" treatment described above will suffice if properly done. In fact, this treatment will probably work out better in a home workshop operation since it is not only almost foolproof but imparts a deep surface hardness while retaining a softer core thus creating shock and wear resistance without brittleness.

The locking lug on the breech bolt should be given the same treatment. If automobile axle material is used to make the breech block, as suggested, then no heat treatment is required or even desireable.

The magazine spring is the only part which actually presents a problem. This thin and relatively fragile part is difficult to heat and cool evenly. Therefore, if at all possible, professional heat treatment is desirable. In the event that this is not possible, some means must be found to evenly heat the part to 1475° - 1525° F. and quench in oil. The part must then be tempered at 700° which, if 1075 steel is used will produce a medium spring temper having a hardness of RC 47 and a tensile strength of 230,000 P.S.I. Probably the most foolproof way to accomplish this is to build a steel box for slightly larger than the formed spring from ¼" or thicker steel plate. The box doesn't need to be air or water tight so simply tack welding the sides and ends to the bottom plate will suffice. The sides should be deeper than the spring width.

In use the formed spring is placed inside the box and the whole business evenly heated until its color is just beginning to change from red to orange. A forge is desirable for this if no oven or furnace is available. Then without being allowed to cool the box, spring, and all is quenched in warm S.A.E. 10 motor oil. Then, just as a precaution against cracking or breaking it, the spring is placed on a piece of aluminum foil in a kitchen oven and held at the highest temperature the oven will attain for a period of at least an hour. The spring must now be polished as much as possible so that smooth bright metal can be seen. Then the part is put back in the box and heated until the steel progresses through the straw colors, followed by brown, purple, dark blue and finally a light pale blue, at which time the heat is removed and the spring allowed to cool. If all this was properly done, you now have a functional spring, if not you start over and keep trying until it does work.

It should be noted that it is better that component parts be on the soft side rather than too hard. Excessively hard parts are prone to break whereas the too soft part will usually only batter, bend, or wear excessively, conditions that will probably be noticed and corrected as the gun is inspected from time to time.

As a convenience the following table contains a type of steel suitable for each part of this gun together with suggested heat information which is optional to the "Kasenit" treatment previously recommended. Please note that, as stated before, since I have no control over the materials or procedures that you use, I cannot accept any responsibility whatsoever for the results obtained.

Part	Material	Harden	Temper	Hardness	Tensile Strength P.S.I.
Outer Receiver			None Necessary		
Inner Receiver	4140		None Necessary		
Barrel	4140		None Necessary		
Breech Block	4340	1475°-1550°	1000°	Rc38	178,000
Hammer	4340	1475°-1550°	800°	Rc44	210,000
Sear	4340	1475°-1550°	800°	Rc44	210,000
Trigger	4340	1475°-1550°	1100°	Rc35	160,000
Trigger Bar	4340	1475°-1550°	800°	Rc44	210,000
Safety	4340	1475°-1550°	1000°	Rc38	178,000
Gas Piston	4340	1475°-1550°	1000°	Rc38	178,000
Gas Cylinder	4140	1525°-1625°	1100°	Rc31	142,000
Operating Handle	4140	1525°-1625°	1100°	Rc31	142,000
Spacers	4140		None Necessary		
Magazine Spring	1075	1475°-1550°	700°	Rc47	230,000
Stock Mounting					
Bracket	4140		None Necessary		
Carrying Handle					
Bolt Guide	4140		None Necessary		
Sights	4140		None Necessary		
Firing Pin	4340	1475°-1550°	1000°	Rc38	178,000

FINISHING

With the component parts fitted and heat treated, it is desirable to smooth the exposed surfaces and color them in a manner that will hopefully contribute to rust prevention, prevent light reflection and be pleasing to the eye. In previous volumes I have given detailed descriptions including formulas for both nitrate blueing or "blacking" and rust blue methods. In this volume I shall try to describe a method sometimes referred to as "fume" blueing or "fuming." This method is probably the simplest and most foolproof and requires less equipment than most.

Regardless of the method used to impart the color, all methods have one common requirement. Polishing. The end result will be directly proportionate to the quality of the polish job.

As a final finish for a firearm of this type it is many times desirous to obtain a "satin" finish or a dull non-reflective finish. This is obtained by first removing all rough spots, blemishes, and tool marks in the same manner used in any other finish. While it is possible to save time and labor through the use of power polishing equipment, an equal or better job can be done with files and progressively finer grades or grits of abrasive cloth.

The files are used to smooth up the metal surfaces, removing tool marks, dents, and other blemishes. The curved surfaces are then cross polished by using strips of cloth in a shoe shining motion. These parts are then polished along with the flat surfaces in a lengthwise motion with strips of cloth wrapped around a flat file or block of wood. This process is repeated using progressively finer grits of abrasive cloth until a smooth mar free surface is obtained.

The parts which are to receive the dull finish are now given a "bead blast" finish through use of a glass bead machine. Such a rig utilizes compressed air to drive a uniform size of fine glass beads against the surface of the metal at high velocity creating a dull or frosted appearing surface. Many automobile body shops as well as aircraft engine shops have such machines and usually will do this for a nominal fee.

The parts are now degreased by the same method used with the other blueing processes. This can be done by boiling in clean water using a couple of tablespoonsful of lye per gallon or using one of the commercial solutions produced for this purpose.

Along with a tank to boil the parts in, plus a suitable heat source, it is also necessary to have at least one, preferably two, plastic boxes, both as airtight as possible to place the parts in while the actual fuming takes place. One box must be of sufficient size to accept the barreled receiver. The other needs only to be large enough for the remaining parts.

Sign shops often have scrap plastic sheets or discarded signs made from ⅛" to ¼" thick plastic from which a top, bottom, sides and ends can be sawn and, using plastic cement, built into a satisfactory receptacle.

You will also need a small quantity of both concentrated nitric and hydrochloric acids, as well as several (4 to 6) plastic glasses to hold the acids.

Then with the parts degreased by boiling in the degreasing solution, rubber plugs or corks are placed in each end of the barrel and the open end of the gas cylinder. Any areas which you don't want blued can be masked off or coated with shellac, varnish, lacquer, etc. The parts are next placed inside the plastic boxes. Six or eight drops of each acid are placed in each cup (don't mix them) and two cups of each acid placed in the long box and one or two of each in the smaller box and the covers put in place. The actual rusting takes place in, usually, one to three hours. Therefore, the work should be observed frequently after the first hour and removed when the desired color is obtained. Making the box lids from clear plastic can be an aid to easy inspection.

When finished the parts are boiled in clean water to stop any further action and oiled in the same manner used with other methods.

It is possible to achieve about any degree of luster desired by varying the acid quantities, since the nitric acid does the actual blueing while the hydrochloric fumes simply etch the surface. So, a bit of experimenting is necessary to achieve the finish desired.

Please note that this method of blueing did not originate with me. As far as I know a chemist and top gunsmith by the name of Philip Pilkington developed this system. I have described it here simply as an alternative to the methods presented in my other books.

ASSEMBLY AND TEST FIRING

Assuming that you have all the component parts built to the specified sizes and shapes, it stands to reason that you should surely be able to assemble them in the proper order without instruction. Let's run through it once anyway just in case some one or two doesn't completely understand.

The front spacer is installed in place over the barrel thread tenon and the inner receiver screwed on as tight as you can get it. The spaced vertical center line should be in line with the bolt slot centerline. The gas cylinder bracket is then threaded onto the barrel hoping all the time that it lines up vertically. If it does not, metal must be removed from the rear face of the bracket or the front of the barrel shoulder until it does. The gas cylinder is now inserted through the hole in the front spacer and screwed tightly in place. Then the gas port is drilled through the bracket, gas cylinder and upper wall of the barrel and the hole through the upper side of the bracket and cylinder enlarged with a No. 31 drill and tapped to receive a 6 x 48 plug screw.

The bolt is now pushed in place through the open rear end of the inner receiver and the chamber cut to its finished depth. This is done using an extension on the chamber reamer which extends past the rear of the receiver allowing it to be turned with the barrel and receiver assembled.

Index marks are made with a sharp punch or chisel on the receiver, spacer, and barrel to insure realignment after they are disassembled. And with the extractor position marked with the bolt both in the locked and unlocked positions the barrel is removed and clearance for the extractor cut both in the barrel and receiver. Final assembly of these parts can now be made. The gas piston is inserted in the cylinder and the operating handle and operating handle guide installed.

The bolt assembly should now slide, fore and aft, in the receiver with no roughness or tendency to bind. If such is encountered, coating the contact surfaces of the parts with fine lapping compound and working the action a number of times will usually remove the rough spots. All traces of the lapping compound must be removed after use to prevent continued metal removal. Several careful washings in gasoline or solvent may be necessary to accomplish this.

The forend can now be slipped over the barrel and secured in place with the forend nut. The front sight installs in the same fashion simply by slipping the sleeve over the barrel and installing the retaining nut.

The magazine latch together with the corresponding spring is inserted in its slot at the rear of the magazine well and pinned in place. The lower sleeve portion of the operating handle guide is placed over the rear end of the inner receiver and the screw installed which holds it to the front spacer. Then, the entire inner receiver assembly is inserted into the outer receiver, the rear spacer installed over the threaded shank and the bolt spring guide inserted into the rear end of the inner receiver. The stock mounting bracket is now threaded in place and tightened thereby drawing both front and rear spacers securely against both ends of the outer receiver, the flanges on both spacers maintaining proper alignment, the butt stock is pushed in place over the spring inserted in the tube, and the stock nut installed. The recoil pad is now installed using the two screws which hold it in place.

The trigger assembly is assembled by first installing the safety in the slot provided, next the sear and sear spring are installed followed by the trigger and trigger bar. The hammer is next put in place by first screwing the bushing into the left side of the housing, then with the hammer in position, the hammer pin is screwed in from the right side. The bushing and oversize screw portion on the hammer pin serve a twofold purpose of centering the hammer between the housing walls and reinforcing the comparatively thin housing walls. The hammer spring and guide are now put in place, the hammer placed in the cocked position and the safety engaged. The assembly is now installed on the gun by engaging the cross-pin at the front of the housing with the corresponding slot at the upper rear of the magazine well, the grip placed in position and the bolt installed through the hole in the grip and tightened. The gun should now be a relatively solid assembly depending mainly on proper tolerances in the mating parts.

The magazine is assembled by installing the follower through the lower end followed by the magazine spring, bottom plate retainer and bottom plate.

Disassembly of the weapon is accomplished in reverse order.

Now that the gun is assembled, several steps must be taken before test firing to assure proper function and safe operation. Since the disconnector legs on the trigger bar were purposely left oversize during manufacture, it should be necessary to remove metal from the front side of both of these legs until the trigger will push the sear out of engagement with the hammer only when the bolt is closed. Properly fitted, the hammer will fall only when the operating handle is within 3/16" to ¼" of its extreme forward, or closed position. Further rearward movement of the handle must push the trigger bar downward, out of engagement with the sear preventing firing.

There are people who would foolishly leave this disconnector portion of the trigger bar off the gun hoping to achieve full automatic operation. This should not be attempted since such condition will permit the gun to fire before the bolt is locked which not only places unnecessary strain and shock on parts of the gun, but many times causes the bolt to open while high enough gas pressures are present in the barrel to blow the case apart.

The safety should block the sear completely when engaged preventing any sear movement whatever, at the same time the trigger bar must have a slight clearance as it engages the sear enabling it to snap upward when the trigger is released and the bolt is locked.

With the disconnector and safety fitted as described and the chamber cut to the proper depth the magazine is fitted for proper feeding. This is done by engaging the safety and with a single round in the magazine, inserting the magazine in the gun, pulling the operating handle to the rear and allowing it to snap forward. Properly fitted, the shell head will move forward just enough to free it from the magazine lips just as the front end of the shell enters the chamber. Since the guide ramp between the magazine and barrel guides the forward end into the chamber and the top side of the inner receiver also serves to guide it in by limiting the shell's upward movement, if the magazine lips turn the shell loose at the proper time as described above, the gun will feed properly. It may be necessary to cut the magazine lips back somewhat to achieve this.

With proper feeding accomplished, the gun can be test fired. While shotgun pressures are comparatively low, it is still a good idea to wear shooting glasses and hold the gun with something solid between it and you when firing for the first time.

The gun should be fired only enough to determine that it does function and fire. Heat treatment of the required parts must be done before they are distorted or broken through any more use than absolutely necessary in the soft state.

It may very well happen that the action does not open completely during this phase of testing. No effort should be made to correct this until after heat treatment and final polishing and even then several rounds should be fired before corrective action is taken since slight "wearing in" will many times correct the problem. If the condition remains it will be necessary to either drill the gas port slightly larger, reduce the stiffness of the bolt spring, or both.

COMPONENT SOURCES

The following is by no means a complete list of sources from whom certain parts or materials can be obtained.

BARRELS

Numrich Arms Co., West Hurley, N.Y. 12491
Sarco Inc., 323 Union St., Stirling N.J. 07980
E. R. Shaw Inc., Prestly & Thomas Run Rd., Bridgeville, PA 15017
P&S Sales, P.O. Box 45095, Tulsa, OK 74145
Federal Ordnance, Inc. 1443 Potrero Ave., El Monte, CA 91733

STOCK WOOD

Don Allen, Rt. 4, Northfield, MN 55057
E. C. Bishop & Son, Box 7, Warsaw, MO 65355
Jack Burres, 10333 San Fernando Rd., Pacoima, CA 91331
Calico Hardwoods, Inc. 1648 Airport Rd., Windsor, CA 95492
Reinhart Fajen, Box 338, Warsaw, MO 65355
Flaigs Lodge, Millvale, PA 15209
Johnson Wood Products, Rt. 1, Strawberry Point, IA 52706
Oakley & Merkley, Box 2446, Sacremento, CA 95811
Roy Schaefer, 965 W. Hilliard Lane, Eugene, OR 97404

CHAMBER REAMERS

Clymer Mfg. Co., 14241 W. Eleven Mile Rd., Oak Park, MI 48237
F. K. Eliot, Box 785, Ramona, CA 92055
Keith Francis, Inc., 1020 Catching Slough Rd., Coos Bay, OR 97420
Bob Brownells, Main & Third, Montezuma, IA 50171

SPRINGS, SPRING MATERIAL

W. C. Wolf Co., Box 232, Ardmore PA 19003
Frank Mittermier, 3577 E. Tremont, New York, N.Y. 10465
Brownells, Main & Third, Montezuma, IA 50171

OTHER

Kasenit Inc., 3 King St., Mahwah NJ 07430 (Surface Hardening Compound)
Clover Mfg. Co., 139 Woodward Ave., Norwald, CT 06856 (Abrasive, lapping compound)
Twin City Steel Treating Co., 114 S. 3rd, Minneapolis, MN 55414 (Heat Treating)
Wholesale Tool Co., 12155 Stephens Dr., Warren MI 48090
Wholesale Tool Co., 4200 Barringer Dr., Charlotte N.C. 28210
Wholesale Tool Co., 7240 E. 46th St., Tulsa, OK 74145 (above four stores have machine tools, cutting tools, reamers, taps, bolts, nuts, screws, drill rods, and almost anything else you might need, usually for immediate delivery and at a good price.)