



This is a picture of both the 3/8 inch and 1/4 inch broaches, the long thin sleeve is the sleeve I made from drill rod for the “C” type broaches to cut the bolt guide slot (1/4 inch broach) and start the raceways.

Starting the Receiver



I start the receiver by cutting a piece of 4140 pre-hard 1 ¾ inches in diameter and slightly over 8 ¾ inches long. I center the blank stock in a 4 jaw independent chuck in the lathe for boring. I begin by drilling a pilot hole in the center of the blank stock. I then drill a ½ inch hole at least 4 ½ inches long, using cutting oil. One thing that

I need to mention is that 4140 pre-hard is very hard steel, I use HSS USA made drill bits. If you crowd the drill bit while you are drilling you can easily break or dull the bit. You must use steady pressure and plenty of cutting oil. If you linger as you feed the bit you can actually work harden the already hardened 4140, if that happens you may be done with that piece of metal unless you use a carbide bit or carbide tipped boring bar.

After I drill the ½ inch hole, I switch to an 11/16 inch drill bit and repeat drilling the same 4 ½ inch hole. I then face off the receiver, so that I have a clean and trued edge. This is why I make the blank stock slightly longer than 8 ¾ inches long, before mounting in the chuck, just don't shorten the receiver blank to less than 8 ¾ inches long.

The next step is boring for the barrel shank. I use a special ground 1" inch counter bore to form both the barrel shank and form the square face that will be the receivers locking lugs. I suggest that you use carbide tipped boring bar to do this operation. The easy way to set the carbide tipped boring bar is to use the trued face of the receiver blank as a gauge. I bore this hole 1.350 inches deep. I use a dial gauge set on the lathes tailstock. You can also use a dial gauge set on the lathe bed.



This picture shows not only the front locking lugs, but the broached raceways. Notice how the locking lug is really just a shoulder in the barrel end of the receiver blank. It's absolutely necessary to get the front locking lug square to the barrel opening.

The depth of the bore must be 1.350 inches long for a Mauser. The diameter of the bore will depend on the diameter of the barrel shank. If you want to use a standard Mauser barrel do not exceed 1 inch for the barrel bore.

You should now have an 11/16 inch hole half way through the receiver blank, with a .980-1.00 inch diameter hole, 1.350 inches long in what will now be the barrel end of the receiver blank.

Next I loosen the chuck slightly and remove the receiver blank from the chuck. I then turn the receiver blank 180 degrees and then reinsert the blank into the lathe chuck. I then center the receiver blank in the chuck and drill a pilot hole. I then take my 1/2 inch, 6 inch long drill bit and drill a hole the remaining distance through the receiver stock using plenty of cutting oil. Next I enlarge the hole with my 11/16 inch, 6 inch long drill bit.

Now I change to a 13/16 inch counter bore or drill bit. Using a dial gauge mounted on the tail stock, I then bore a hole 2.375 inches deep into the bridge end of the receiver blank. This cut forms the arc needed to accommodate the raised area on the rear of a Mauser bolt and clearance for the bolt shroud.

Now don't forget this step, it can be done later but will have to be done with a boring bar. The 2.375 inch distance is for the full length large ring Mauser. If you are using a bolt other than a Mauser or are building a receiver for an intermediate Mauser bolt, you must change this cut accordingly.

Leaving the receiver blank in the chuck I now install a 45/64th reamer in the tailstock chuck and ream the receiver blank to accommodate the bolt diameter. Make sure you use plenty of oil here and don't let the metal chips bind the reamer. I ream from the bridge end intentionally, most tail stocks have a small amount of wear causing a slight taper at the start of the hole. Since Mauser receivers have this slight taper, we recreate it using this method.

I now hone the newly reamed hole using an 18mm fine grit silicon carbide flex hone. Use plenty of honing oil (transmission fluid) and do not over hone you are looking for a maximum diameter of no more than .705 inches. I have seen Mauser bolt bores as large as .707 inches but don't go that far we want a tighter bore for accuracy.

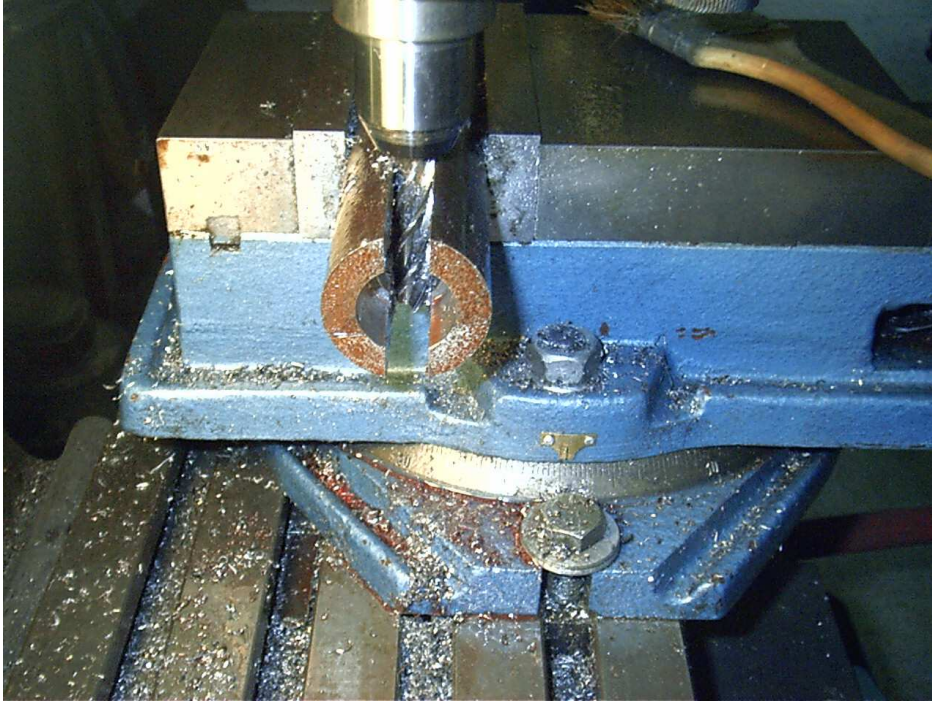


This is the 45/64th HSS reamer I use for reaming the receiver blank to accommodate the bolt.

The counter bore in the picture is a 1 inch counter bore that I ground down slightly undersize (.980) to bore the breech end of the receiver and form the square shoulder that becomes the receiver locking lugs.

The lower tool is a center finder that I use in the last step of finishing the receiver blank to find top dead center.

The counter bore is an interchangeable pilot style.



This is the secret to broaching a receiver in the home shop. The gullets of a standard broach will not handle the amount of material needed to cut the raceways of a receiver, but by changing the distance the broach must travel, the impossible, becomes possible.

I start by mounting a 5 inch milling quality vise on the table of the milling machine making certain the vise jaws are parallel to the cutter. I then place the receiver blank in the vise and secure.

Next I find absolute top dead center using a center finder. I then begin milling a slot 2.100 inches long, using a long $7/16^{\text{th}}$ of an inch wide center cutting end mill.

This is the first step in forming the tang end of the receiver; I will mill the tang to its proper length of 2.168 inches in a later step. This new flat area will also be used as an indexing area for future layout, so make sure you are milling at top dead center of the receiver blank.

Hint you may want to start using a shorter 7/16 inch carbide end mill to start the slot milling. After you complete the top of the slot you can then switch to the longer end mill.

Do not try to cut the slot in one pass, unless you have the equipment to do so.

If you are going to use a bolt other than a large ring Mauser, you must change the length of the slot to accommodate the bolt.

If you want to duplicate a 700 Remington bolt action receiver, I suggest you eliminate the slotting of the receiver all together.

The Remington receiver has a taper at the bridge end of the receiver that gives it, its unique profile.

I suggest that you bore the bolt sleeve end of the receiver with a 1 inch counter bore to the proper depth to accommodate the width of the bolts shroud. This should give you plenty of room for the broach to cut the raceways.

The only thing that will change is the height of the sleeve, it will set lower in the receiver. After broaching you can mill the Remington tang to profile.

Broaching the Receiver

I expect this chapter to be read more than any chapter in my book. I have been a visitor to many gun smithing and gun building web sites since 1998.

When the discussion was about building a bolt action receiver and the difficulty involved, the problem was always the raceways. It's my sincere hope that this chapter answers a lot questions for many people in the homebuilding community.

Let's get started!

You will need a 20 ton shop press and an old 3 jaw lathe chuck. The shop press needs to be a good one, the cheap Chinese presses may work, but only if they are ridged. The old 3 jaw lathe chuck must have center hole large enough to allow the receiver blank to set flat on the press plates.

You will also need those two 7/16ths broaches and the 3/8ths broach that we ground down in the previous chapter, along with that thin sleeve. I also cut 4 shims .020 of an inch thick. I cut mine from a piece of 29gauge sheet metal.

Set the chuck in the press and insert the receiver blank barrel end first into the chuck with the slot opening facing toward the operator.

Now we are going to do something unconventional. We are pushing a square broach down a round hole. In this case the round hole is .705-.707 inches in diameter. What we want to do is remove a small amount of metal to help the nose of the broach travel down the receiver blank.

To do this I insert the 3/8 inch broach onto the hole of the receiver blank WITHOUT the sleeve, aligning it with the slot.

Yes you read correctly. Now make certain that the broach is aligned with the slot as seen in the next picture. Now press the broach down and through the receiver blank.

What you have done is cut two small grooves down the full length of the receiver blank. The broach should have pressed fairly easy down the hole, if it binds or stick's go back to the grinding the broach chapter and follow the instructions for removing approximately .015th of an inch off of the back of the broach.

If the broach was burred polish it on the 4x36 belt sander with the silicon carbide belt.



Now reinsert the broach 180 degrees in the receiver blank, align the broach as before and press it down through the receiver blank. The broach should practically fall through the hole leaving two small scratches the full length of the receiver blank. These two lines are still necessary for clearance so don't over look this step.

Now when you push the broach through the receiver it is going to require that you use a fixture or an adapter to make the transition through the receiver, DO NOT stick some damned little piece of scrap metal on top of the broach and continue, this is very dangerous, and could become a lethal projectile.

If you find it difficult to press the broach through the receiver once it becomes flush with the top, then I suggest you make a holding fixture. The fixture that I made fitted over the push rod of the press.

I took a piece of round metal stock about 3 inches long, that was larger than the push rod. I then bored a hole half way through. I then flipped it over and drilled and tapped in the center for a 3/8 inch grade 8 bolt.

What I now have is a piece of round stock with a hole half way through it and a 3/8 inch threaded hole in the center of the solid bottom. Next I drilled and tapped a hole in the middle of the top (bored) half for a set screw. This screw will be used to attach the fixture to the press.

After attaching fixture to the press, I now screw a short grade 8 bolt with the hex head cut off into the fixture and push the broach down until it becomes flush with the top of the receiver.

I then continue by screwing longer bolts into the fixture until I push the broach through.

The fixture that I described works for me on my press. I strongly suggest that you come up with a safe way to push the broach through the receiver before you begin broaching.

Normally A push type keyway broach is used for only a short distance and is designed to pass through the object being broached before it becomes flush.

We are pushing these broaches at their maximum cutting capacity and it will require a special fixture to assist in driving the broaches through the receiver.



I am now ready to begin broaching the raceway of the receiver. I place the thin sleeve in the receiver blank. I center the slot of the sleeve with the slot in the receiver. It's very important that you get the sleeve centered in the receiver, remember the slot in the sleeve is $\frac{3}{8}$ inches wide and the slot in the receiver is $\frac{7}{16}$ inches wide.

I insert the broach with no shims into the sleeve and press it through the receiver. To help the broach pass through the sleeve, I smear a small amount of white grease on the back of the broach.

I now reinsert the $\frac{3}{8}$ inch broach into the sleeve but this time with a .020 thousands shims. Again I press the broach through the receiver. I repeat this process adding .020 of an inch shims with each pass till the broach just cuts a clean groove through the receiver. The last pass with the broach should stop cutting just before it begins to cut into the area bored for the barrel.