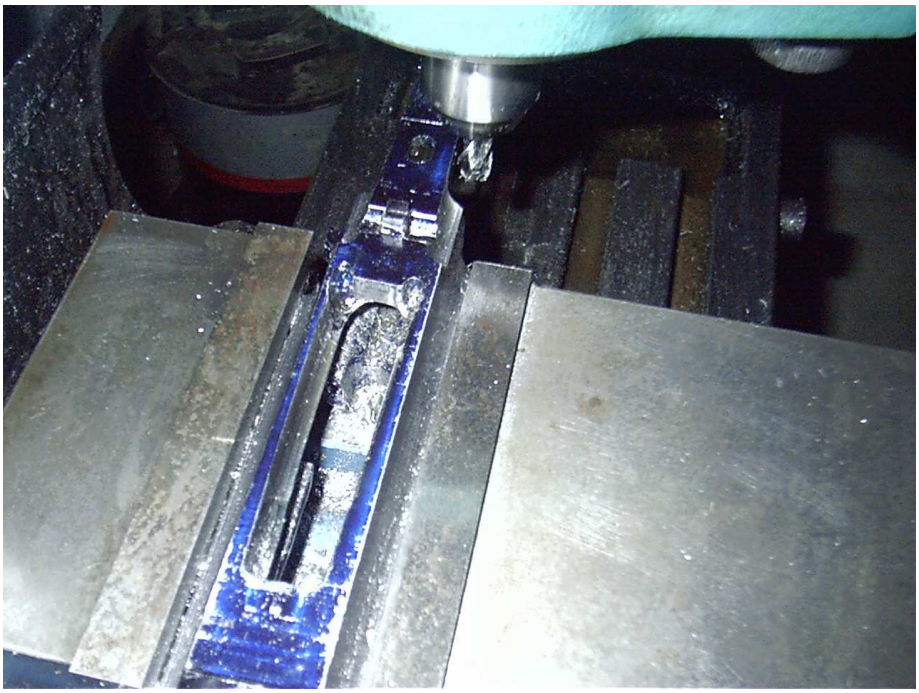
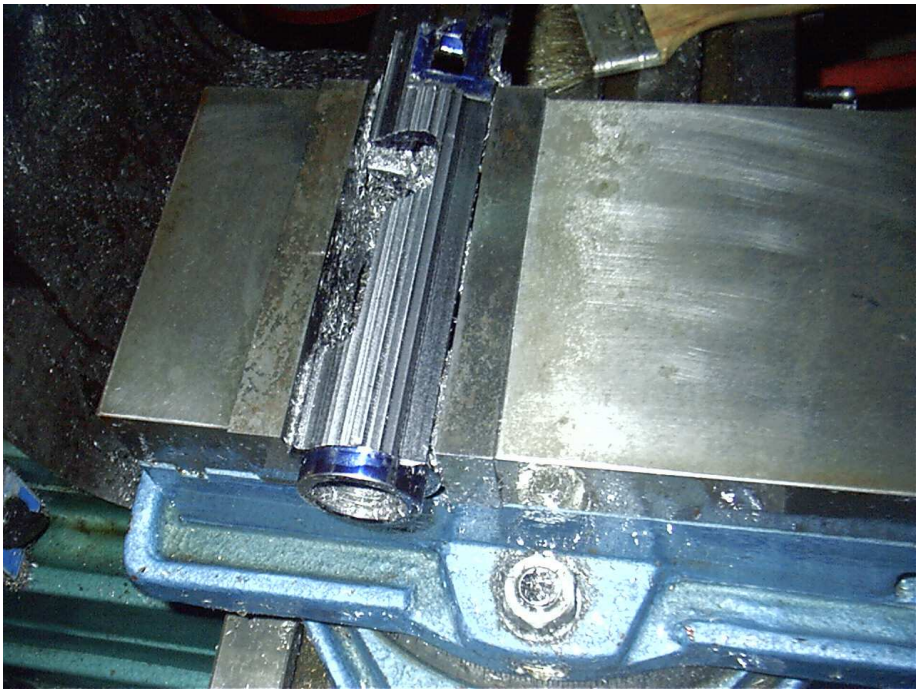
With the receiver still in the vise you can mill the two clearance cuts for the rear tang. I use a 3/8 inch ball end mill for this cut and mill at a depth of .190 inches, and a total length of 1.160 inches. I mill .185 inches into the receiver body.



Final Shaping of the Receiver

To cut the final shape of the receiver you are going to remove a lot of metal. I suggest you use only USA made cobalt, or carbide ball end mills. I use a very good 3/8 inch carbide Ball end mill. I only make conventional cuts and keep the leaf screws tight, any slop in your set up, means a broken end mill. The price of these end mills are not cheap, so take your time and prepare.

I start by placing the receiver on its right side in a vise. I use the front nose cut as reference guide to determine the maximum depth of cut for the 3/8 inch end mill. You will not be able to cut the maximum depth with one single pass. What I do is continue cutting until I get to the necessary depth. Now use plenty of cutting oil, and don't let the receiver get hot.



When cutting I raise and lower the cutter and use the table feeds to make the cuts, and do not turn or move the receiver, until I am finished with a side. Now this does leave the surface very rough.

I remove this roughness in another step with a tool post grinder. It would be possible to mount the receiver on a mandrel, and then place the receiver between a rotary table, and dead center. You would then rotate and move the receiver under a fixed ball end mill cutter. This would provide a smoother finish, and with a little spit, and polish, you could have a finished receiver.

Now I prefer my method because I believe I get a better finish and a more uniformed profile. The diameter of the bridge ring is smaller than the front ring by .100 inches. After I mill a side to the depth of the front ring, I then lower the ball end mill .040 inches, and mill the rest of the receiver behind the front ring.

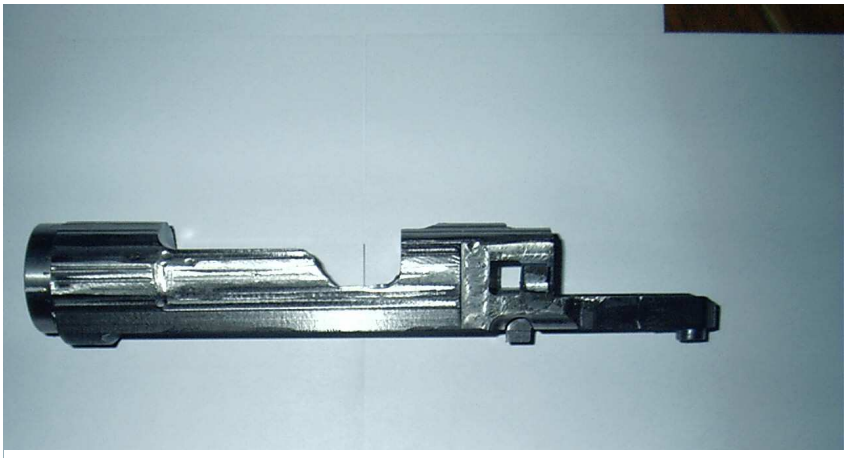
I prefer to only mill .040 inches and use a tool post grinder to clean up the rest. When you get to the very rear of the receiver next to the receivers base, the sides get very thin, so don’t over cut.

After completing the left side I rotate the receiver in the vise and mill the top in the same manner that I milled the left side.

After I finish the top I continue to the right side cutting as before, always making certain not to over cut and using the front nose cut as a guide.

Here is what my receivers look like after cutting with a ball end mill.

This is the right side of the receiver. The rear of the receiver has been milled down .040 inches more that the front ring. Other than final fitting and shaping, you now have a firearm.



This is the left side of the receiver. The area in front of the bolt stop flange must be shaped smooth for the bolt stop to rest properly against the side of the receiver.

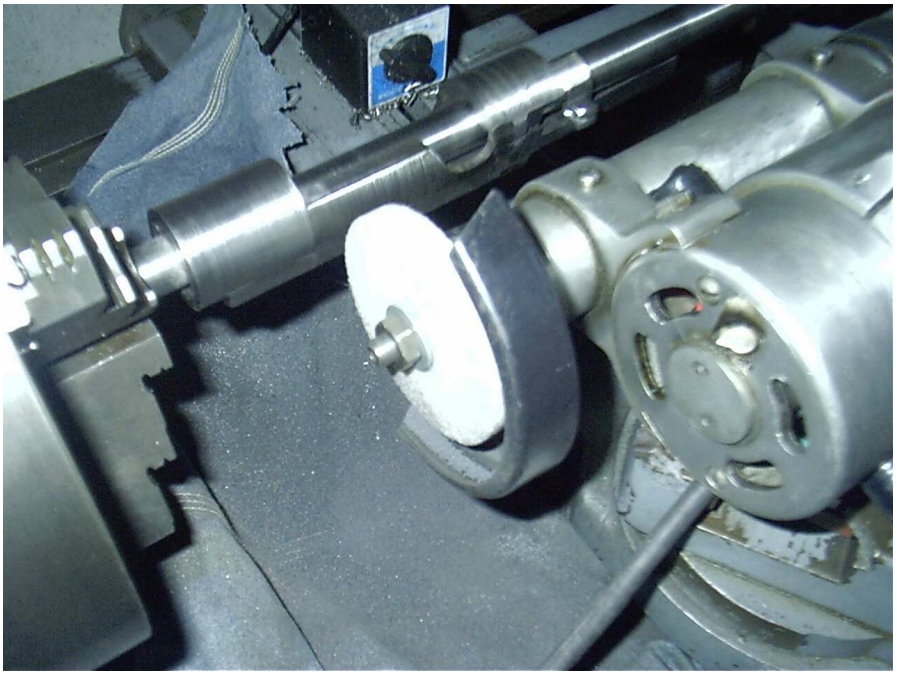
I now screw a holding fixture into the receiver. This holding fixture is nothing more than a 12 inch rod that has been threaded, and turned down on one end to fit into the bore of the receiver.

I attach the holding fixture between the lathes centers; I also attach a tool post grinder to the compound rest of the lathe. I install a white grinding wheel onto the grinder, and then square the wheel to the receiver.

Making certain the power is off on the lathe, I feed the grinding wheel up to the receiver using the compound rest on the lathe.

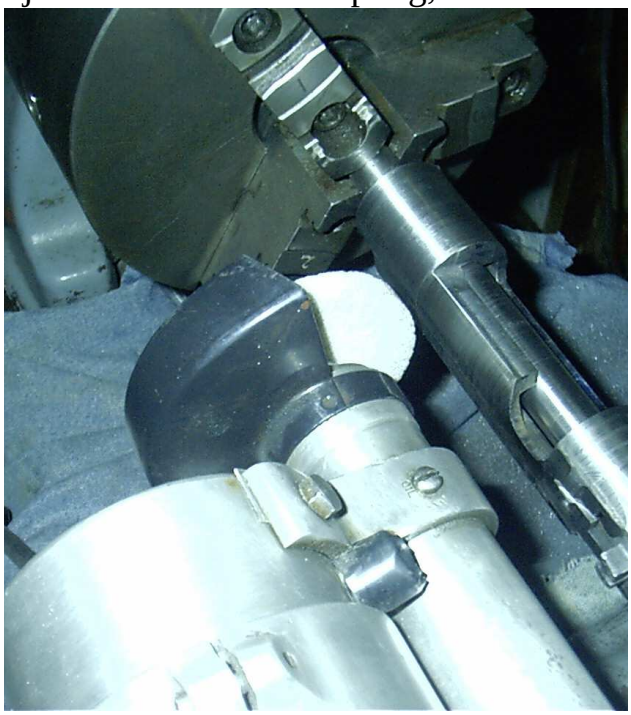
I roll the receiver by hand into the wheel, only removing a few thousandths at a time. Other than the very first pass at the very nose of the receiver, you can not roll the receiver a full circle. You must take care and stop rotating the receiver, before you hit the bottom edge or the wheel will dig into the receiver body.

I make my first pass with the grinding wheel and then move the tool post grinder over half the width of the wheel and roll the receiver again. I do this over the full length of the receiver and continue until I achieve the desired profile.



After shaping the profile of the main receiver body the last pass I make with the tool post grinder is the contour at the bottom of the receiver. I have found it matches the diameter of the 3 inch grinding wheel I use to profile the receiver body.

The tool post grinder can shape the receiver every where, except for a small section just above the bolt stop lug, I finish that with files and a rotary tool.



With the grinding done, I had a finished receiver, but it still looked rough. All of the ridges were gone, the shape was there, but it still didn't look right. I tried to polish the receiver with emery cloth; it helped, but the emery cloth left scratch marks, which required more polishing and elbow grease.

I began looking for a way to make final polishing easier. What I decided on worked like charm, it may not be perfect, but it saved a lot of hand work. I reinstalled the receiver back on the mandrel and attached to the lathe.

Once again I mounted the tool post grinder on the compound rest, the only difference instead of a grinding wheel I attached a rubber abrasive wheel, what a difference.

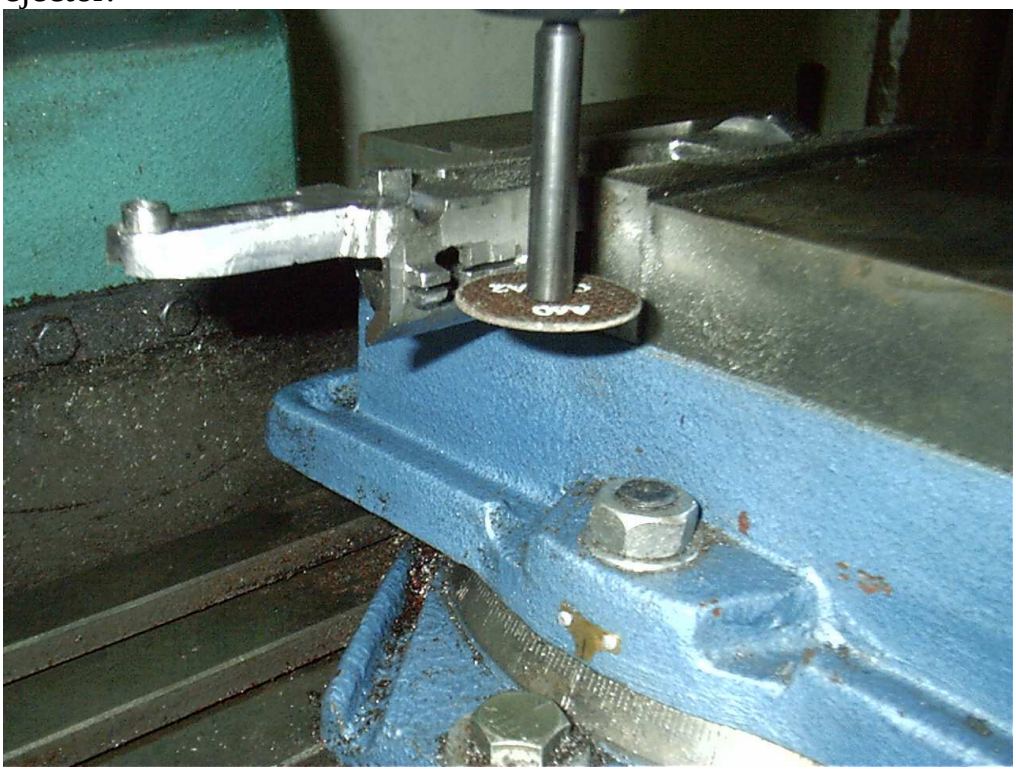
This is a picture of a receiver after grinding. It has the shape but is rough overall. Notice the marks on the lower section of the receiver below the thumb slot, the rubber abrasive wheel all but completely removed those marks.

After I finished the section on grinding the receiver to profile, I realized the need to provide a warning to all those wanting to grind their receivers; you must keep the receiver from getting too hot. I use white grinding wheels, the white wheels do not cause heat build-up like the pink wheels, but they can still over heat the receiver.

The way I counter the heat is by making shallow passes. I don't like to run water over the receiver, fortunately the mandrel acts as a heat sink. So heed the warning, over heating the receiver may cause a dangerous condition

Odds and Ends and Finishing Touches

To cut the ejector slot, I first tried a small HSS keyway cutter, only to dull the cutting edges, practically on contact. I thought about a rotary tool but those small wheels were to narrow, and they broke easily. The third thing that I tried not only worked, but worked so well I suggest you don't waste money trying anything else. I installed a 2 inch reinforced cut off wheel 1/16 inches thick in the mill, and was able to cut the lug and the slot with ease. Before cutting the slot I inserted the bolt, to the bolt stop hole, and used the slot in the bolt lug as a reference to determine proper placement for the ejector.



Mounting the bolt stop/ejector box is fairly straight forward. I use a 3mm drill bit to drill the hole. I found out the hard way that you must drill the hole straight.

I placed the receiver bottom up in the vise on the mill, and squared the receiver with a level in both directions and then drilled the hole.

When I drill the sear pivot hole, I first install the bolt into the receiver in a cocked position with safety on, bolt handle down as though it's ready to fire.

I place a 1/4 inch steel dowel .440 inches long in the sears spring cup, I then place the sear over the pivot lug with trigger installed. I butt the sear, using no pressure against the cocking piece and secure with a "C" clamp. (The dowel rod is used as a gage only and is replaced with the sear spring for final fitting after drilling)

I check the clearance at the edge of the sears spring cup with a feelers gauge set at .070 inches and correct the length of the dowel as necessary with shims to obtain a clearance of .070 inches.

I then place the receiver in a vise and square with a level in both directions and secure. I then drill the hole with a 3mm bit, making certain that the sears contact area is held firmly against the bottom of the receiver.

Just like the ejector/bolt stop lug hole the sear pivot hole must be drilled straight. I all most ruined one receiver because I drilled the sear pivot hole by hand and got the thing crooked.

I was able to salvage the receiver only because I was able to mill the lug and sear hole to .125 inches. Unfortunately you can't do that with ejector/bolt stop lug, so don't screw up.

Notice the position of the sear and how it is contacting the receiver toward the rear of the tang.

It's very important to mount the sear properly, not just for firing but for safety. The area of a sear that contacts the cocking piece has a slight angle; this angle allows the sear to reengage the contact area of the cocking piece if the trigger is pulled slightly, but not to full firing position.

The trigger that I use is a standard Mauser two stage military trigger, that allows for a slight pull of the trigger without firing, if these angles are not laid out properly the sear will not return to full contact with the cocking piece.

Even if you use an after market trigger the sear pivot hole must still be drilled straight, and in a position that allows for proper sear contact.

Another safety check that must be made before installing a barrel or test firing is determining whether your gun will fire on its own.

I start by installing a complete bolt, trigger, and sear on the receiver. Move the bolt into a cocked position and engage the safety. After the safety has been engaged, pull the trigger and release.