

Making an alt-az mount and tripod

I have made several tripods for antique telescopes, and hopefully others may benefit from my experiences. I made an alt-az mount along with one of the tripods, so it is included in this article. I took the features I liked best from several of the tripods for this article, so some of the pictures may not look exactly like the text describes them.

Part 1. THE ALT-AZ MOUNT

I searched the Internet for pictures of alt-az mounts. Some were too expensive to make for the client, and some had unwanted/unneeded features. I then took the rest and made a drawing of what I considered a combination of the best features, which was sent to the client. Then I started looking for brass – not as easy as you would think. I ended up having to order it from 3 sources. I laid out the patterns on cardstock, cut it out, and transferred to the ½” sheet brass. I cut it out on the bandsaw, and machined the straight edges, and sanded the curved edges with a drum sander. I machined a hole in the base for a large bolt. The tube measured 4”, so I bought round brass tube with 4” I.D. I cleaned it up in the lathe, turning the inside enough to leave room for felt lining. Then I put the tube in the vise on the milling machine and milled 6 slots for bolts, and drilled and tapped the holes. I turned the piece 90°, and milled two opposing holes in the middle, which were then tapped ½”-20. Then the tube was cut in half on the bandsaw. A light sanding and it was ready. I turned a piece of cedar to 4” O.D. and put it in the clamshell to keep everything in place. Then I made two large thumbscrews from brass and threaded the ends to match the holes in the side of the clamshell. Stainless steel hardware was used to put the mount together.



Figure 1 - Milling a hole in sheet brass



Figure 2 - Cleaning up the edges of the sheet brass

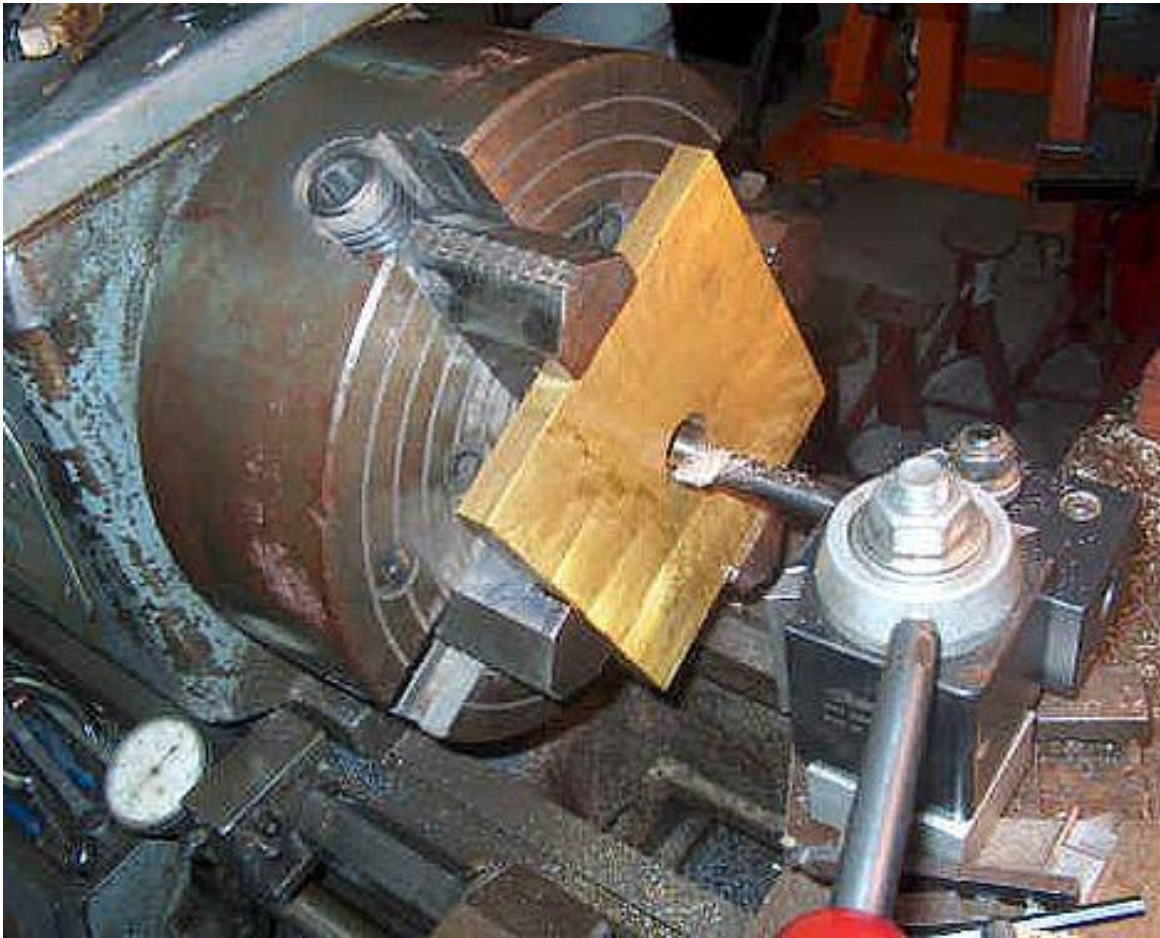


Figure 3 - Boring hole in center of base



Figure 4 - Pieces cut out, holes drilled, tapped, and countersunk for stainless steel capscrews



Figure 5 - Cleaning up brass tube



Figure 6 - Squaring up the end of the brass tubing

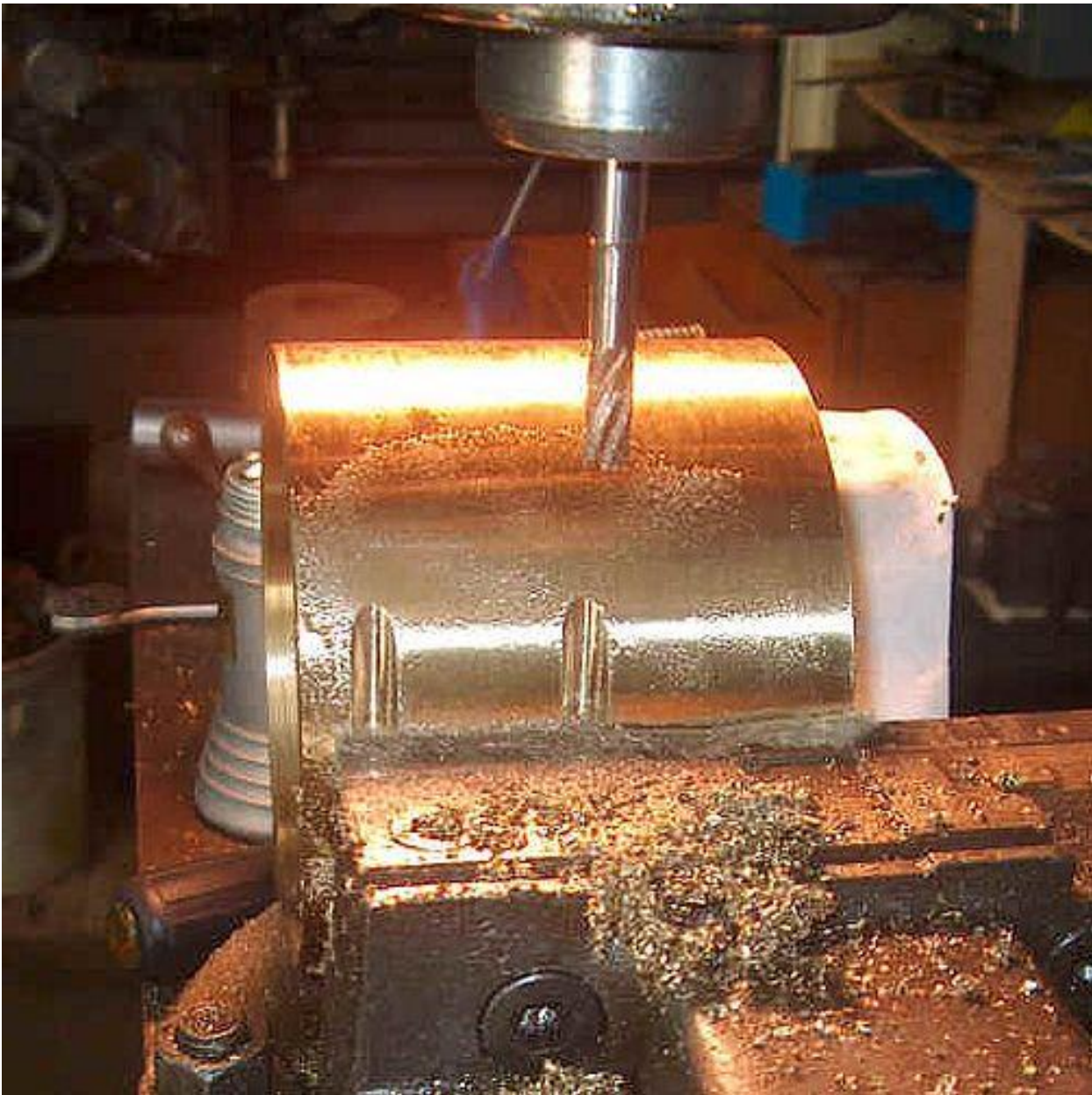


Figure 7 - Milling slots in clamshell



Figure 8 - Cutting the clamshell in half – Note holes in sides 90° from slots for Thumbscrews



Figure 9 - Machining the thumbscrews to hold clamshell to sides



Figure 10 - One thumbscrew made, cutting second.

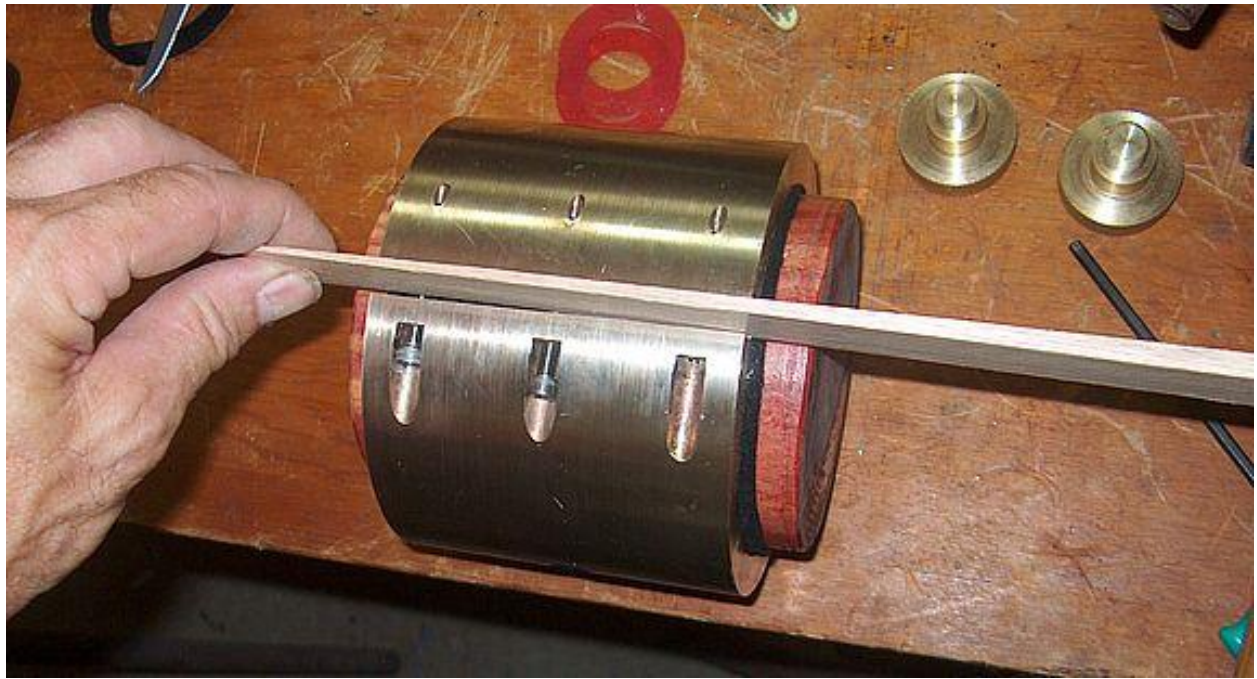


Figure 11 - Aligning the pieces – note thumbscrews for sides of clamshell



Figure 12 – Putting mount together, lining up for test fit



Figure 13 - Mount on tripod. You can barely see the steel tripod top piece with bolt that goes through the base to be held on by the nut. There is a large piece of Teflon® between the pieces which enables turning the mount in azimuth.

Part 2 – TRIPOD Metal Portion

Tripod top

I had a 6" F15 Brashear with a rare crescent mount, but the tripod was long gone, or it was mounted on a pier, I don't know. Either way, I needed a tripod. This is a large tripod, the legs are 80" long.

How to get 3 equally spaced and marked places to put the legs: I started with a piece of steel plate. I turned it to the same diameter as the base of the mount, roughly 6". To hold the legs, I used pieces of 1" x 2" rectangular thick wall steel tube. I cut the tubing to 2" long, and drilled a ½" hole in the middle of each. I took a pair of dividers and set one point in the middle of the circle and the other exactly on the edge. Then holding the point on the edge, move the other point to the edge, making a mark on both sides of where you started. Move the point to the

next mark and mark on both sides again. Continue on around, and you will end up with 6 exactly spaced x's on the edge of the circle. Then draw lines from every other point to the middle. In my case I used 1" wide tube, so I marked $\frac{1}{2}$ " on both sides of each of the 3 lines on the outside edge and inside. Draw lines to connect the dots, and now you have outlines to put three 1" wide tubes, equally spaced, on the edge of a circle, square with everything. I then used c-clamps to hold them in place and welded them to the steel circle. Turn a piece of steel to fit the space between the inside edges of the tubes 2" long, then bore a $\frac{3}{4}$ " hole in it and weld to the plate and inside of the 1" x 2" pieces. Beadblast, prime and paint three coats.



Figure 14 - Tripod top - Note the parts meet in the middle for added strength



Figure 15 - Third coat of paint applied; drying in the sun



Figure 16 - Machining top of tripod



Figure 17 - Machining piece for tripod top

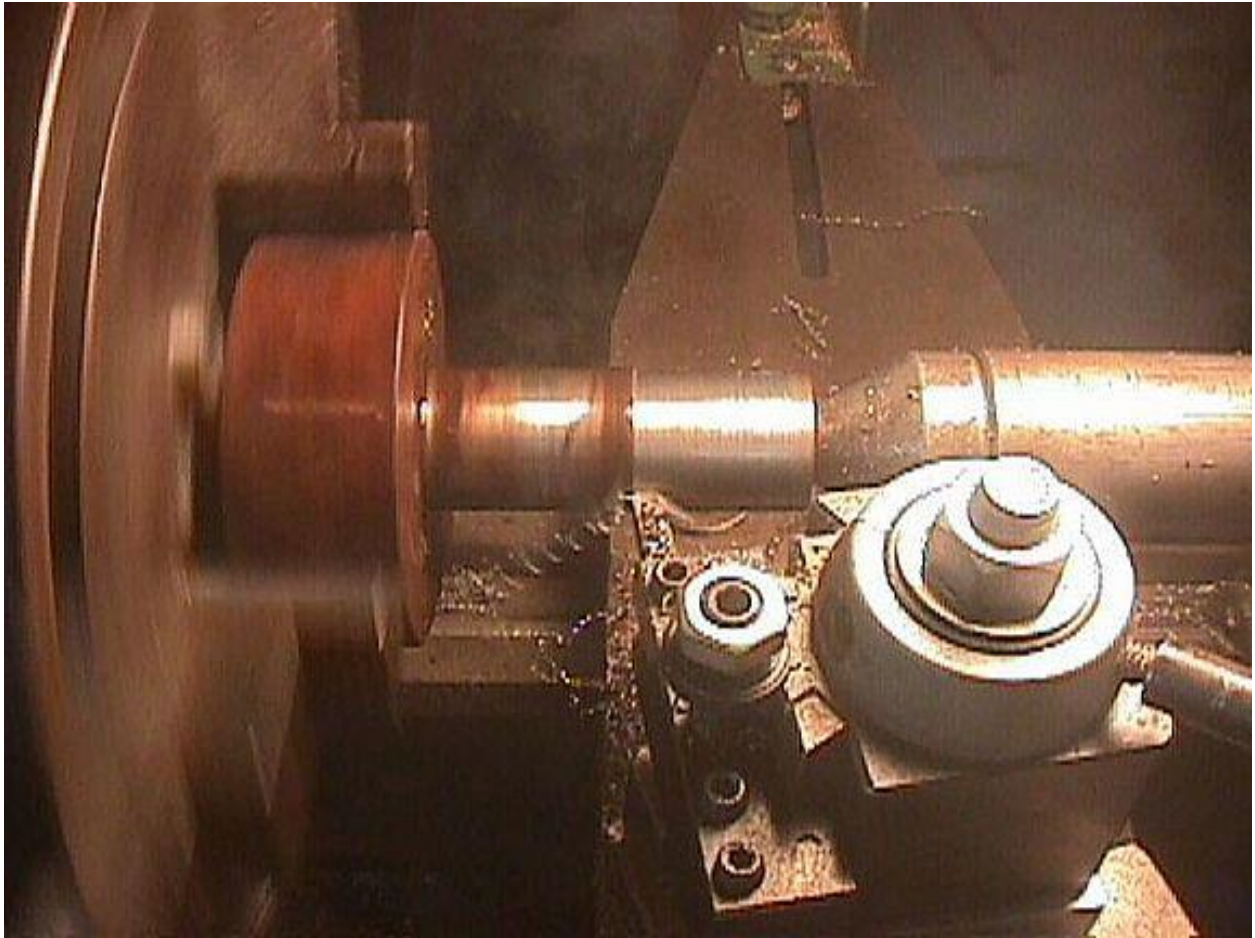


Figure 18 - Turning tripod top bolt to O.D. for threading



Figure 19 - Threading tripod top bolt



Figure 20 - Checking fit of locknut

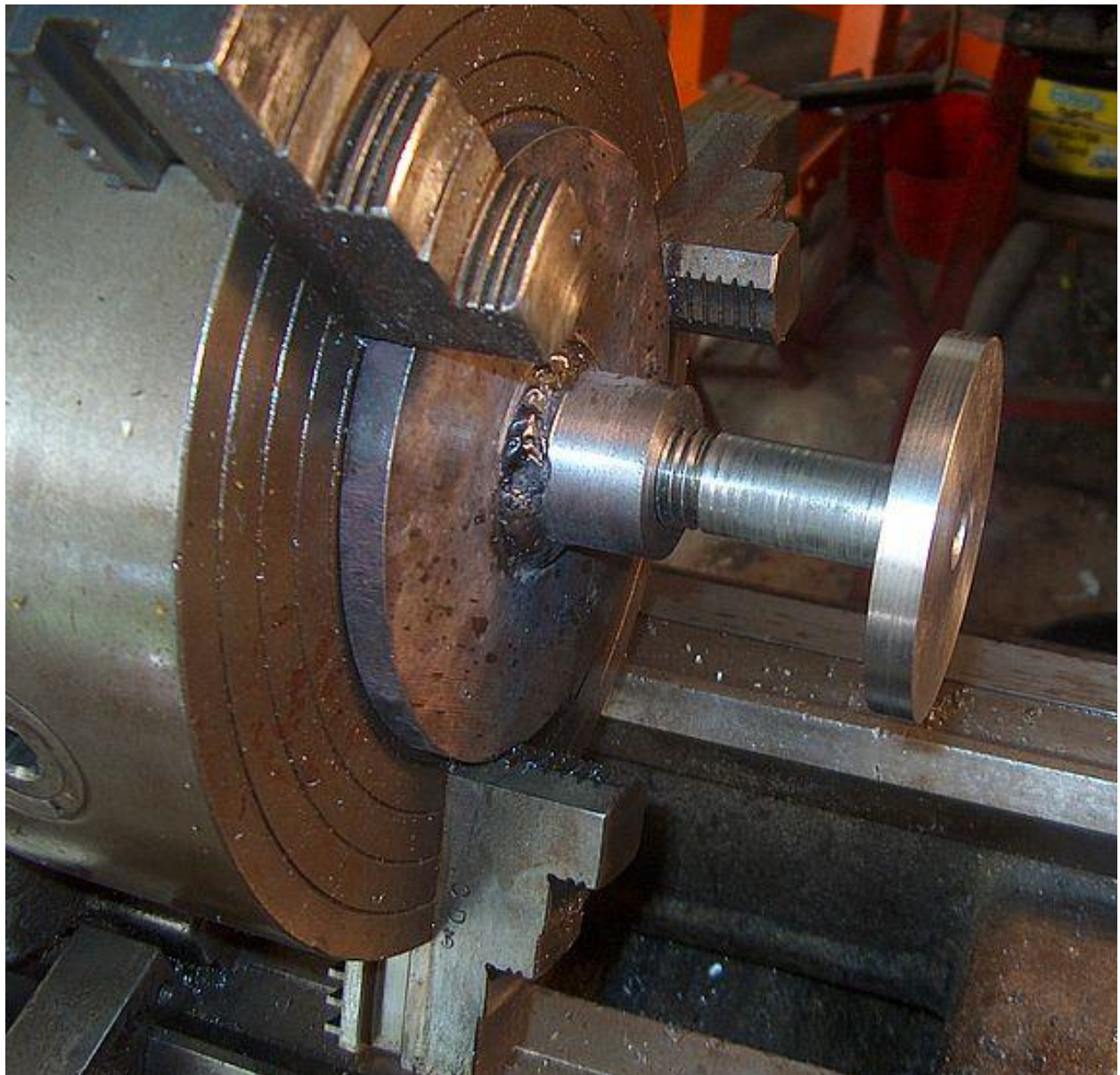


Figure 21 - Checking fit of tripod top with base bolt



Figure 22 - Bottom of tripod legs



Figure 23 - Looking at bottom of alt-az mount



Figure 24 - Completed tripod and alt-az mount with Cedar block to keep clamshell in place



Figure 25 - Closeup of alt-az mount on tripod



Figure 26 - Tripod with Alt-az mount and 4" refractor

Part 3 - Making The Tripod Wood Legs

I am making a set of Oak tripod legs for someone. I measured the legs on the 6" and the 4" Clark tripods. The Oak legs I am making were in between the two sets, so I used a 6" leg as a model, but shortened it. I cut the oak slightly longer and larger than necessary to allow for sanding and final adjustments. I cut it 1-3/8" x 2" x 70". Then I made a taper jig for the tablesaw. (Internet has many ways to make them.) The method I used was to lay out a full size pattern on a piece of scrap wood. I cut another board 3" wide – in this section it is called "the 2nd board". To keep the grain running straight, you need to have the middle of the pattern in line with the grain. I marked the distance – in my case, 1-1/4" from the edge. I used a long straight edge and marked the middle. (You only need to mark 2 or 3 inches on each end.) The 6" Clark legs are tapered just a bit on top. I measured down 10" and made that the widest point. The tops are tapered so all the wood will fit in the circle just below the top. I set the fence on the table saw at 3" from the blade. (Arbitrary.) I measured 3" from the edge of the 2nd board to the outside taper line on the bottom of the leg. Then go to the top and do the same, measure 3" from the outside edge of the 2nd board to the outside line on the top of the leg. (If you need to center your pattern with the grain, this is the time to do it.) I clamped it in place, then pilot drilled holes and screwed the two together. If you don't use pilot holes, it is easy for a screw to bind in the Oak and break off when you're trying to remove it. Do the same

for all 6 legs. Then I drilled 1-1/4" diameter holes 1/4" deep on one side of each leg in the middle, 2/3 of the way up from the bottom, then turned a 1-1/4" dowel from the Oak, and cut it into three 1-1/4" long pieces. Then I put the dowels in the holes and temporarily used a clamp to hold the pieces in place. (When using clamps, use a thin piece of wood on each side to keep the clamp from making marks on your project.) I used a long bolt/nut through the top holes and 1-1/2" spacer between the top pieces to hold the legs together side by side. I clamped the bottoms of the legs together and centered a 1" wide board to mark from bottom to where the board no longer touched the legs, and cut that portion of each leg off using another jig on the tablesaw. I used stainless and/or brass bolts, nuts, and woodscrews keep from rusting. I made special bolts for the tripod top. Take it apart, round the tops, round all the edges, stain if necessary, sand again, and polyurethane the legs and dowel. Sand again and recoat.

I made 3 pieces of 1/2" steel, 5-1/2" long. I turned one end to a point in the lathe. Then I drilled holes in the bottom of the legs, maybe 4" deep. Put a pin in each hole, drill a hole through the pin and use one of the 1/4"-20 bolts to bolt it in. On one tripod, I put threaded inserts in the bottom so the owner could change and use either sharp points outside, or furniture tips inside on the floor. One tripod ended up with brass barrel nuts and 1/4" x 20 stainless steel threaded rod to hold the bottom legs together. This gave a clean look, and the bottom bolt goes through the 1/2" steel rod to hold it in place.

For a new twist, the person getting the tripod just let me know they wanted a wood tray. I normally use leather belts, so I had to design a tray. I tried triangle and round, round worked out better. I used 3 pieces of 1" x 6" with shiplap joints to make the 12" tray. I then glued a plywood circle under the wood to make it stronger. I went through several design phases before settling on pieces that hook over the 1-1/4" piece between the legs. I made an aluminum circle piece and spaced 6 holes – three up and down, three sideways. I threaded the holes 1/4" -20 and used threaded rod to go to the legs. I used 8-32 bolts to hold the piece to the bottom of the tray.

There was some talk recently about making/buying appropriate tools to work on telescopes. I have drawers full of screwdrivers, but even the largest one was too small to screw in the inserts in the bottom of the tripod legs. I made what I needed.



Figure 27 Threaded inserts for bottom of tripod legs



Figure 28 Front view of custom made screwdriver blade



Figure 29 Side view of special made screwdriver blade



Figure 30 Custom made screwdriver blade in insert



Figure 31 Drilling holes prior to tapping



Figure 322 Tapping holes in ring



Figure 33 Eyepiece tray - bottom view showing how ring attaches



Figure 34 - Turning the 1-1/4" dowel



Figure 35 - Tops of the 6 legs before sanding



Figure 36 - Legs stained and with one coat of Polyurethane. Note the 1-1/4" recess for the dowel.



Figure 37 – The three 1-1/4" Oak dowels



Figure 38 Temporary set up to make sure everything fits



Figure 39 Eyepiece tray for 2" eyepieces



Figure 39 Pieces to keep eyepiece holder in place, as well as to use as stretcher



Figure 40 Close-up of piece to hold eyepiece tray



Figure 41 Brushing Polyurethane on legs



Figure 42 Bottom of legs, showing one with rubber tips, one with tapered metal for outside



Figure 43 Belts I had made to keep tripod legs from spreading apart. I also made the brass triangle to hold the belts in the middle.



Figure - 44 Finished tripod with Brashear crescent mount and tube assembly



Figure 45 Completed tripod