

***Hovarter Custom Vise***  
***X Link***  
***Assembly Instructions***

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## HISTORY

In the mid nineteenth century woodworkers began to outfit their leg vises with scissors mechanisms to eliminate the need to adjust a pin in the lower guide board. The mechanism consisted of two metal arms that were pivotally mounted to the bench leg and jaw at the top and connected to each other with a central pivot. The bottom ends of the arms would slide within mortises in the leg and jaw. As the jaw was moved in or out the scissors mechanism would not only maintain parallelism between the jaw and the leg but would also function as a lower fulcrum point to allow the vise to tighten against the work. This device would also fully support the weight of the jaw making it easier to screw the vise jaw in and out.

## ADVANTAGES

The Hovarter Custom Vise X Link is a modern adaptation of the nineteenth century original. We have used modern materials and added improvements to make it function better and ease installation. When used with the VX 20 vise you will have an extremely smooth, quick action pin-less leg vise.

The X Link mechanism is designed and precision CNC machined to provide exact parallelism between the vise jaw and the vise leg. In practice however the vise jaw should be angled slightly so the top of the jaw contacts the work piece first and clamping pressure deflects the mechanism slightly until the jaw is parallel to the leg. This is easily accomplished with the included shims which are added behind the wear plate in the vise jaw.

The X Link is also designed to occupy much less vertical space than the original nineteenth century version. This allow it to more easily fit shorter benches without interference with bench features like stretchers. The smaller mortise allows the leg and jaw to be much stronger.

One of the biggest advantages of the X Link is the use of a spherical bearing for the pivot in the jaw. The spherical bearing allows a very tight clearance between the pivot pin and the link while allowing the joint to pivot freely. This makes installation much easier because the drilled hole for the pivot pin does not have to be so precisely perpendicular. You could drill the hole at a 15 degree angle and it would still work! The other advantage is that it prevents binding and allows the jaw to pivot slightly to adjust to out of square work.

The center pivot bolt has a precision ground shoulder and is threaded into the jaw link to reduce play while making it easy to remove the jaw if needed.

Finally, an optional drill guide and long drill bit make drilling the pivot holes easy and precise. The drill guide aligns with the edge of the jaw or leg to automatically give you the proper setback. When clamped to the leg or jaw it allows you to precisely drill the pivot hole in stock up to 9" wide without a drill press!

#### ASSEMBLY NOTES

The jaw minimum thickness is 1-3/4". This may provide adequate stiffness if hardwood is used and the jaw is fairly wide. The jaw will be significantly stiffer if the thickness is increased to at least 2". A stiffer jaw will prevent deflection when clamping. The weight of the jaw is carried by the X Link so this should not be a consideration. It is acceptable to use laminations to create the desired thickness. The jaw width is a personal preference, but a practical minimum is 4". The Leg minimum width is 3" and the thickness minimum is 3".

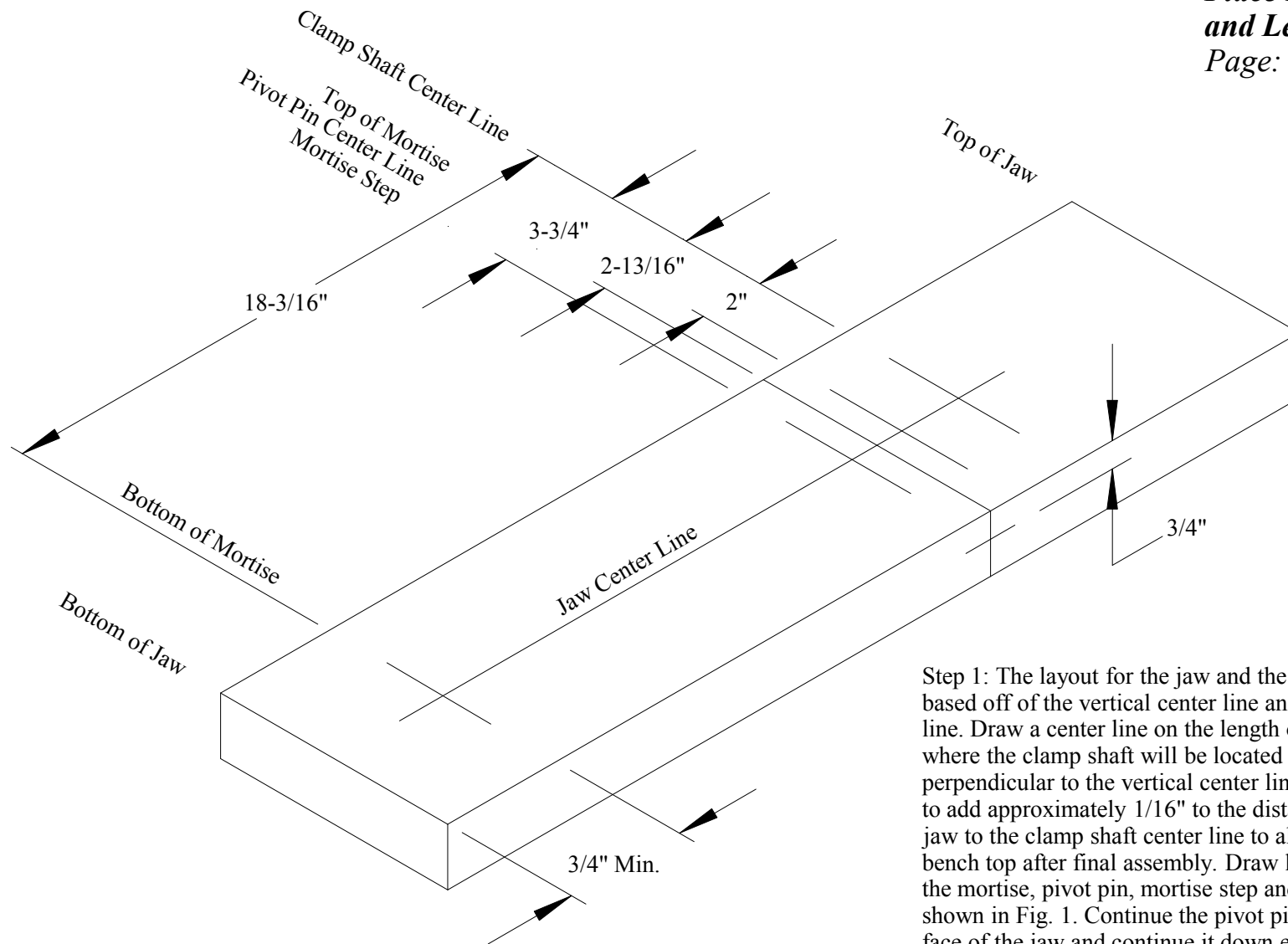
The mortise is centered on the leg and jaw and is 16-3/16" long and 1-1/16" wide. When the mortise is laid out on the leg ensure that it will not interfere with any stretcher mounting hardware. The mortise is most easily excavated using a plunge router but it may also be roughed out with a drill and finished with chisels. Whatever method is employed, make sure the bottom of the mortise where the wear strip mounts is flat and parallel to the face of the leg or jaw.

The X Link is designed to keep the jaw parallel to the leg up to the maximum opening which is slightly over 11" from leg to jaw. When clamping however the mechanism will deflect slightly from the clamping forces. To compensate for this the top of the jaw should angle in slightly so that the top of the jaw contacts the work first and then the bottom contacts last. To accomplish this shims are placed behind the wear plate in the jaw. You do not want to angle the jaw too aggressively because you may start to cause binding with the clamp shaft. Start with 2 shims which is about 3/64" and clamp a work piece normally and check to see if the jaw is parallel to the leg after clamping. Adjust the number of shims to achieve parallelism when clamped.

#### USE WITH VX 20 VISE MECHANISM OR VISE SCREWS

When the X Link is used with the VX 20 vise mechanism follow the VX 20 directions for mounting the vise and the bearing in the leg. Follow the X Link directions for the jaw counter-bore and through hole. Do not use the 1-3/4" diameter washer that is included with the VX 20 as this will cause binding. The X Link fully supports and guides the jaw so this washer is not required.

When the X Link is used with a vise screw the hole through the jaw will need to accommodate the particular flange or mounting system used by the vise screw. Ensure that the screw is centered in the corresponding nut to ensure that no binding occurs throughout the travel of the X Link.



**FIG. 1**

Step 1: The layout for the jaw and the leg are identical and are based off of the vertical center line and the clamp shaft center line. Draw a center line on the length of the part. Determine where the clamp shaft will be located and draw a line perpendicular to the vertical center line. NOTE: It is advisable to add approximately  $1/16''$  to the distance from the top of the jaw to the clamp shaft center line to allow for trimming to the bench top after final assembly. Draw layout lines for the top of the mortise, pivot pin, mortise step and bottom of the mortise as shown in Fig. 1. Continue the pivot pin layout line across the face of the jaw and continue it down each side. Draw a line on each side  $3/4''$  from the face to locate the pivot pin holes.

Step 2: Repeat this same layout procedure for the leg, basing all dimensions off of the center line of the leg and the clamp shaft center line. Refer to the leg mortise drawing.

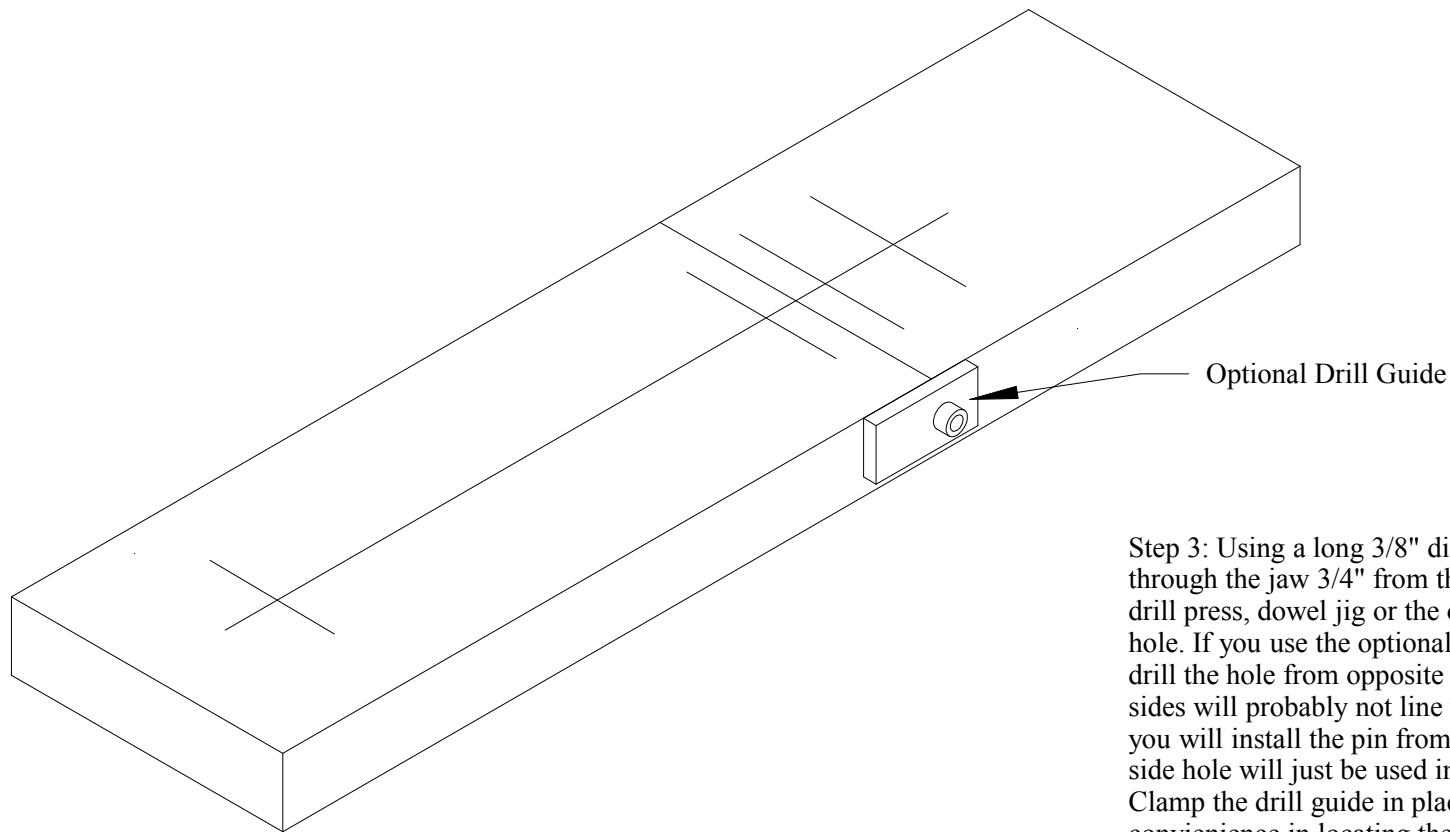


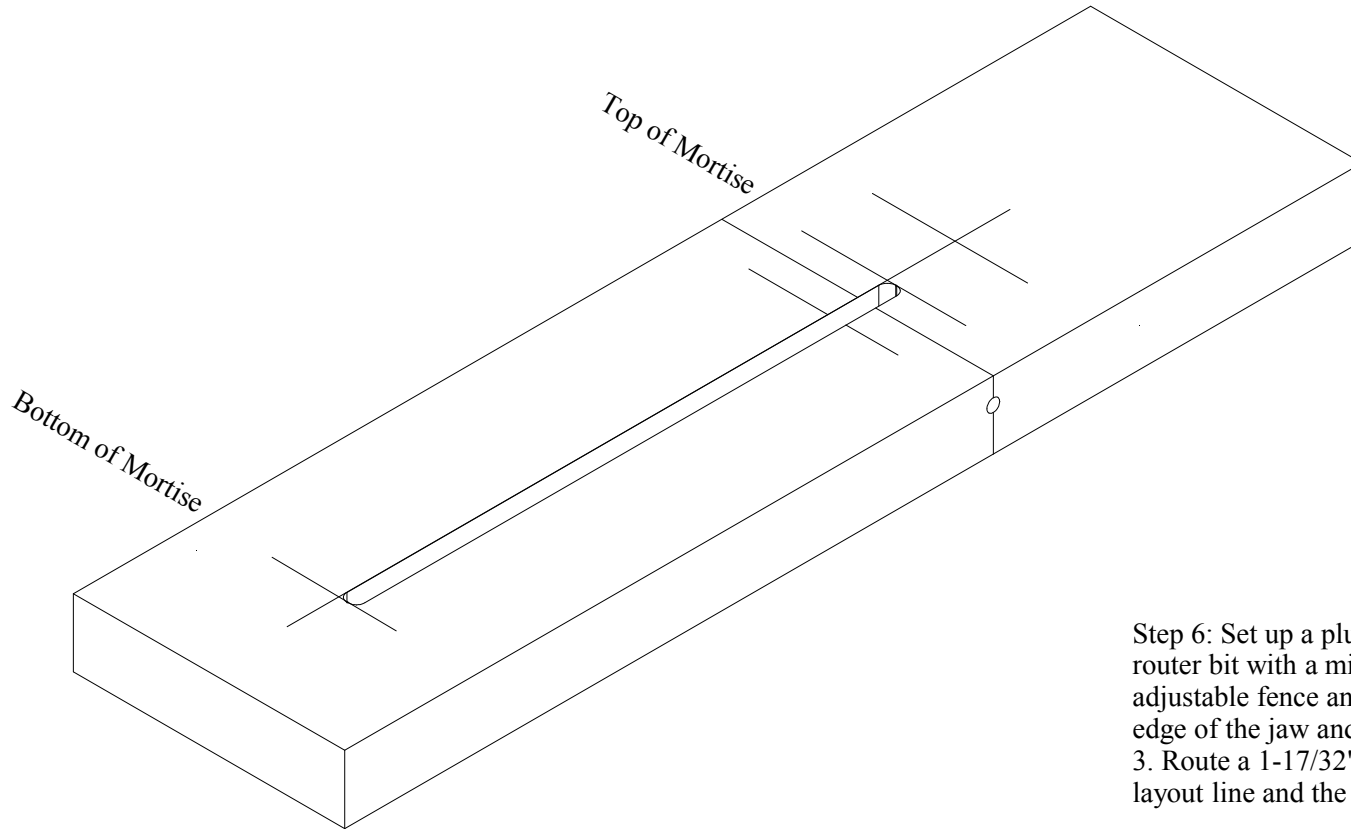
FIG. 2

Step 3: Using a long 3/8" diameter drill bit drill the pivot hole through the jaw 3/4" from the inside face. It is necessary to use a drill press, dowel jig or the optional drill guide to drill this long hole. If you use the optional drill guide it may be necessary to drill the hole from opposite sides. The holes drilled from opposite sides will probably not line up. This will be acceptable because you will install the pin from the first drilled side and the opposite side hole will just be used in case you need to remove the pin. Clamp the drill guide in place as shown in Fig. 2. For convenience in locating the drill guide, the center of the drill bushing is located 1" from the end of the guide and 3/4" from either side. Just place it flush with the inside face and 1" from your layout line.

When drilling, retract the drill bit often to clear chips. Drill as deep as you can until the drill chuck bottoms against the drill guide. Drill to a minimum depth of 1-1/2" past the center line of the jaw. Mark this side so you can make sure to install the pin from this side only. You may have to remove the drill guide and finish drilling free hand to get to this depth if you have a really wide jaw.

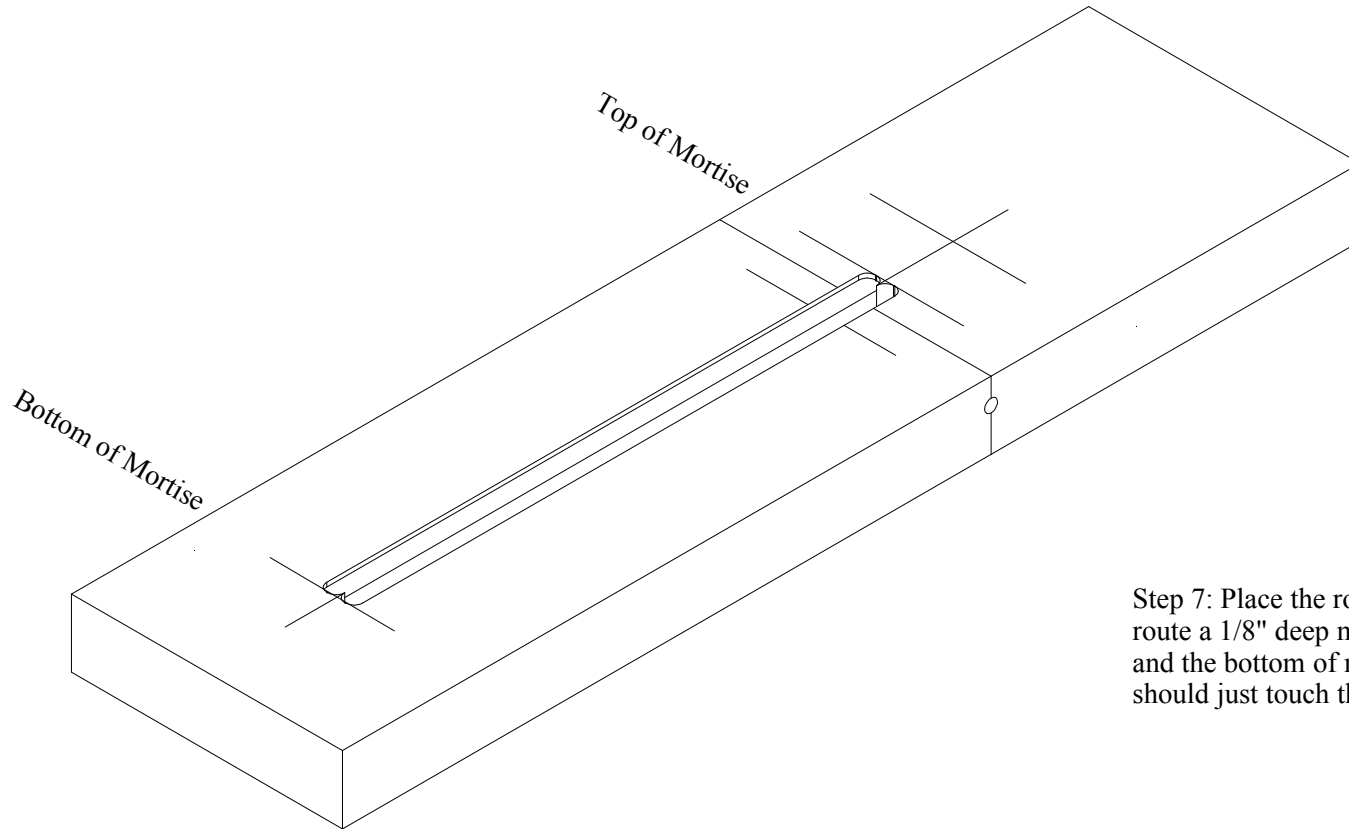
Step 4: If you can not drill all the way through from the first side, remove the drill guide and clamp it to the other side. Drill until you meet the hole from the other side.

Step 5: Repeat this same procedure for the pivot hole in the leg.



Step 6: Set up a plunge router with a 1/2" diameter spiral upcut router bit with a minimum flute length of 1-3/4". Install an adjustable fence and set it so the fence rides against the right edge of the jaw and the bit just touches the center line. See Fig. 3. Route a 1-17/32" deep mortise between the top of mortise layout line and the bottom of mortise line.

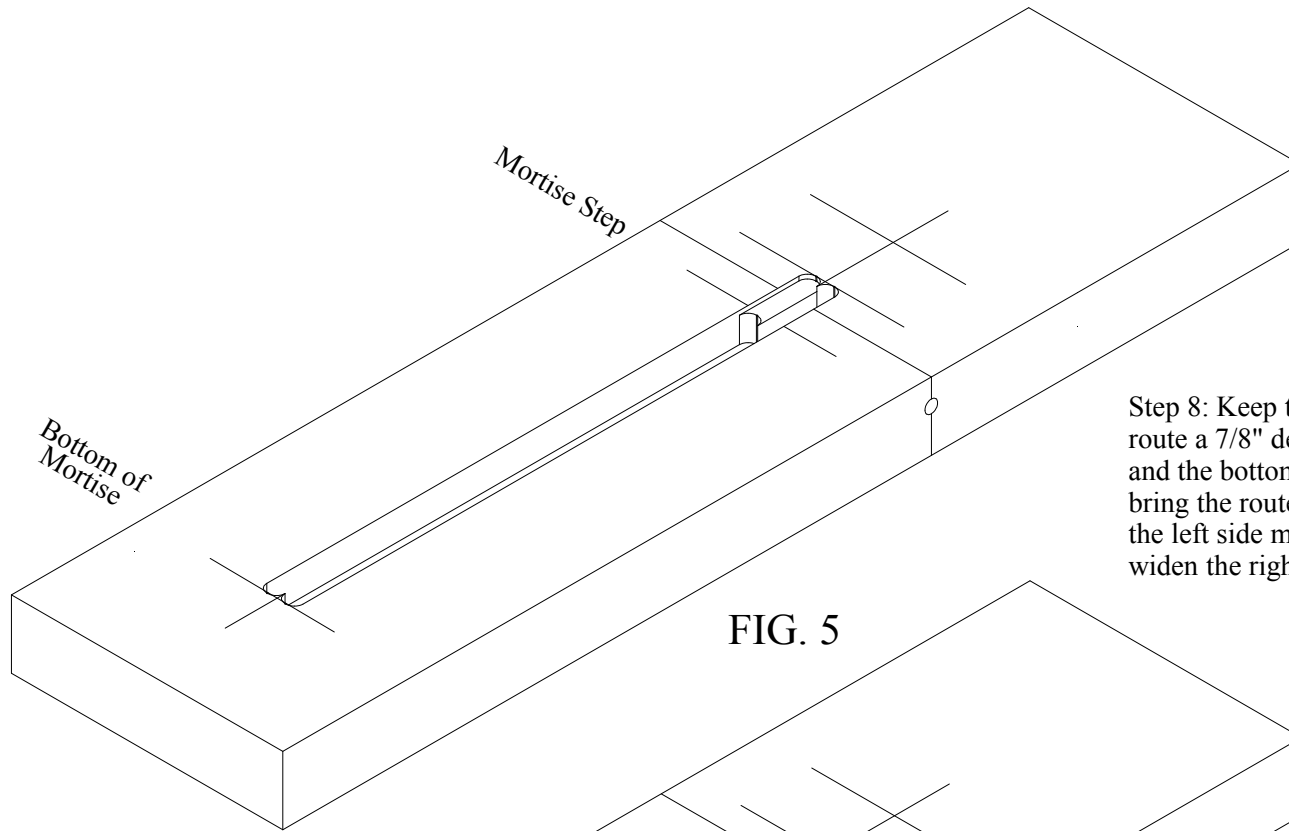
FIG. 3



Step 7: Place the router fence against the left edge of the jaw and route a 1/8" deep mortise between the top of mortise layout line and the bottom of mortise line. The right side of the router bit should just touch the center line as shown in Fig. 4.

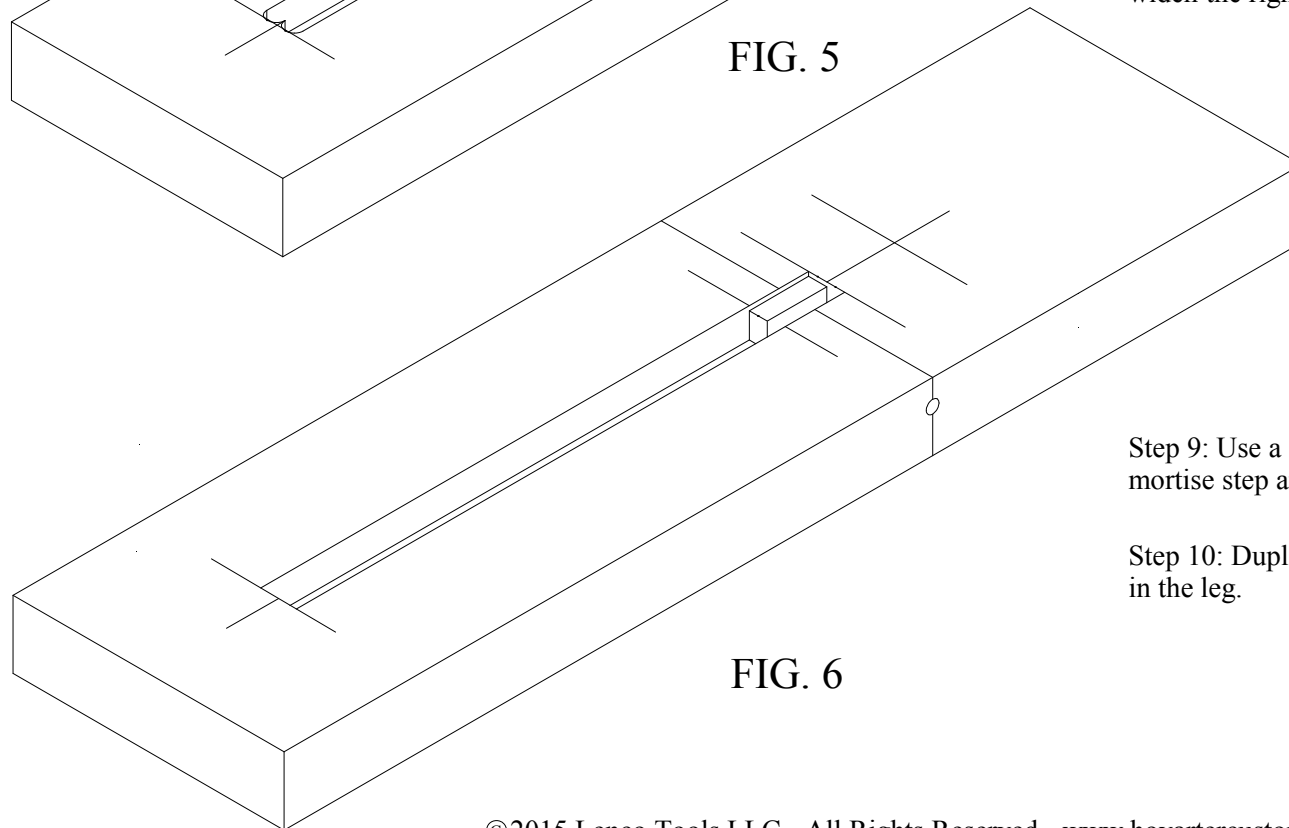
FIG. 4

***Finish Left Mortise, Widen  
and Square Up with Chisel  
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**FIG. 5**

Step 8: Keep the router fence against the left edge of the jaw and route a 7/8" deep mortise between the mortise step layout line and the bottom of mortise line. See Fig. 5. Adjust the fence to bring the router bit toward the outside edge by 1/32" and widen the left side mortises. Place the fence against the right edge and widen the right mortise.



**FIG. 6**

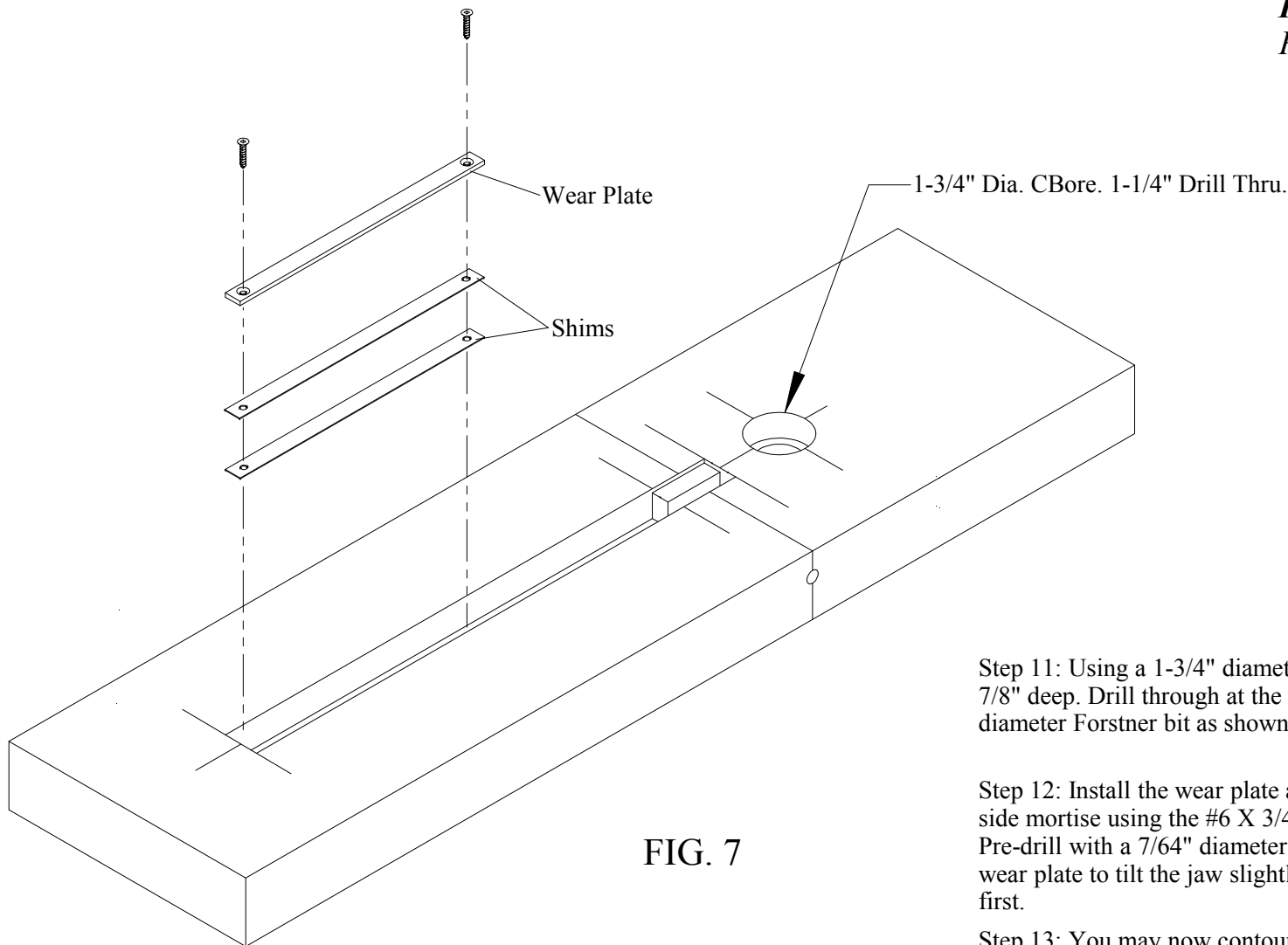
Step 9: Use a chisel to square up the bottom of the mortise, the mortise step and the top of the mortise as shown in Fig. 6.

Step 10: Duplicate the previous steps to route identical mortises in the leg.



***Drill Clamp Shaft Hole and Counter-Bore, Install Wear Plate***

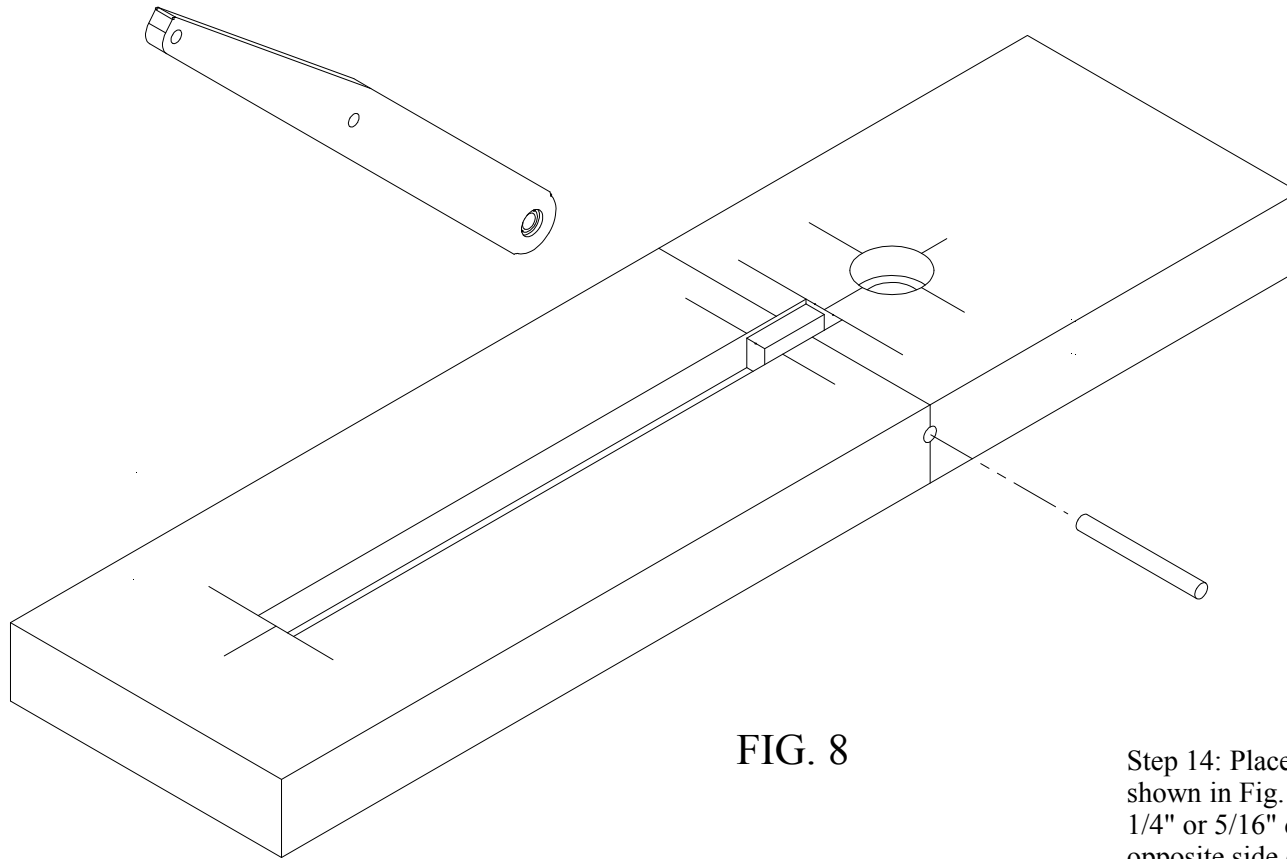
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Step 11: Using a 1-3/4" diameter Forstner bit, drill a counter-bore 7/8" deep. Drill through at the counter-bore center with a 1-1/4" diameter Forstner bit as shown in Fig. 7.

Step 12: Install the wear plate at the bottom of the 7/8" deep left side mortise using the #6 X 3/4" wood screws as shown in Fig. 7. Pre-drill with a 7/64" diameter drill bit. Add shims under this wear plate to tilt the jaw slightly so the top of the jaw contacts first.

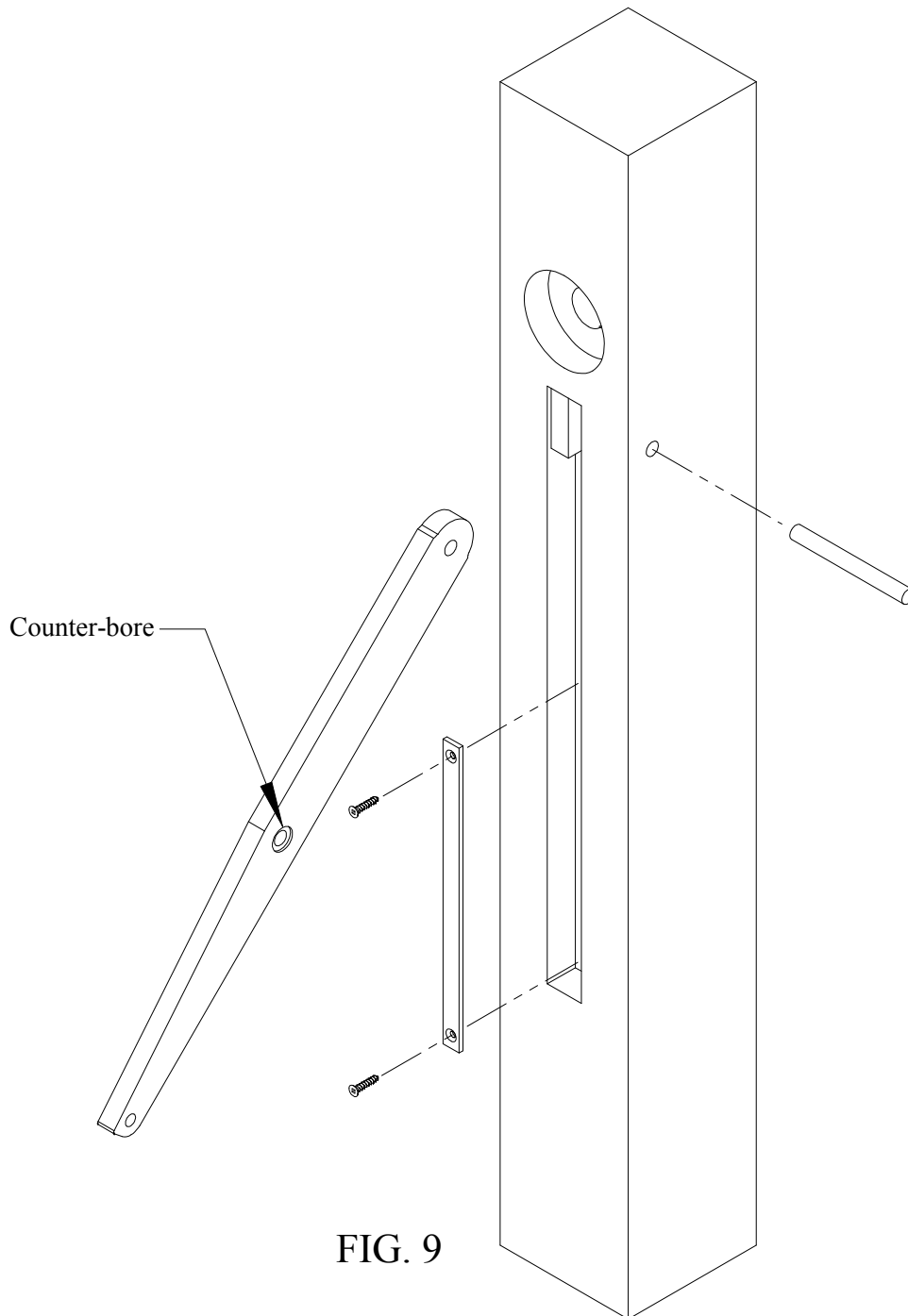
Step 13: You may now contour the exterior shape of the jaw as desired.



**FIG. 8**

Step 14: Place the jaw link into the right mortise oriented as shown in Fig. 8. The jaw link has the spherical bearing. Use a 1/4" or 5/16" diameter wood dowel rod inserted from the opposite side of the pivot pin to help orient the spherical bearing. Install the pivot pin into the hole and tap until it is through the spherical bearing. Use care when tapping the pivot pin through the bearing to make sure you don't knock it out of its bore. Make sure the pin is inserted at least 1" past the spherical bearing. It may be necessary to use a 1/4" diameter pin punch or rod to fully insert the pivot pin. When you are totally finished you can plug the holes if you wish. If you ever need to remove the pin you can drill the plugs out and remove.

Note: The shoulder bolt in the bottom of the link keeps the jaw link aligned with the wear plate in the leg.

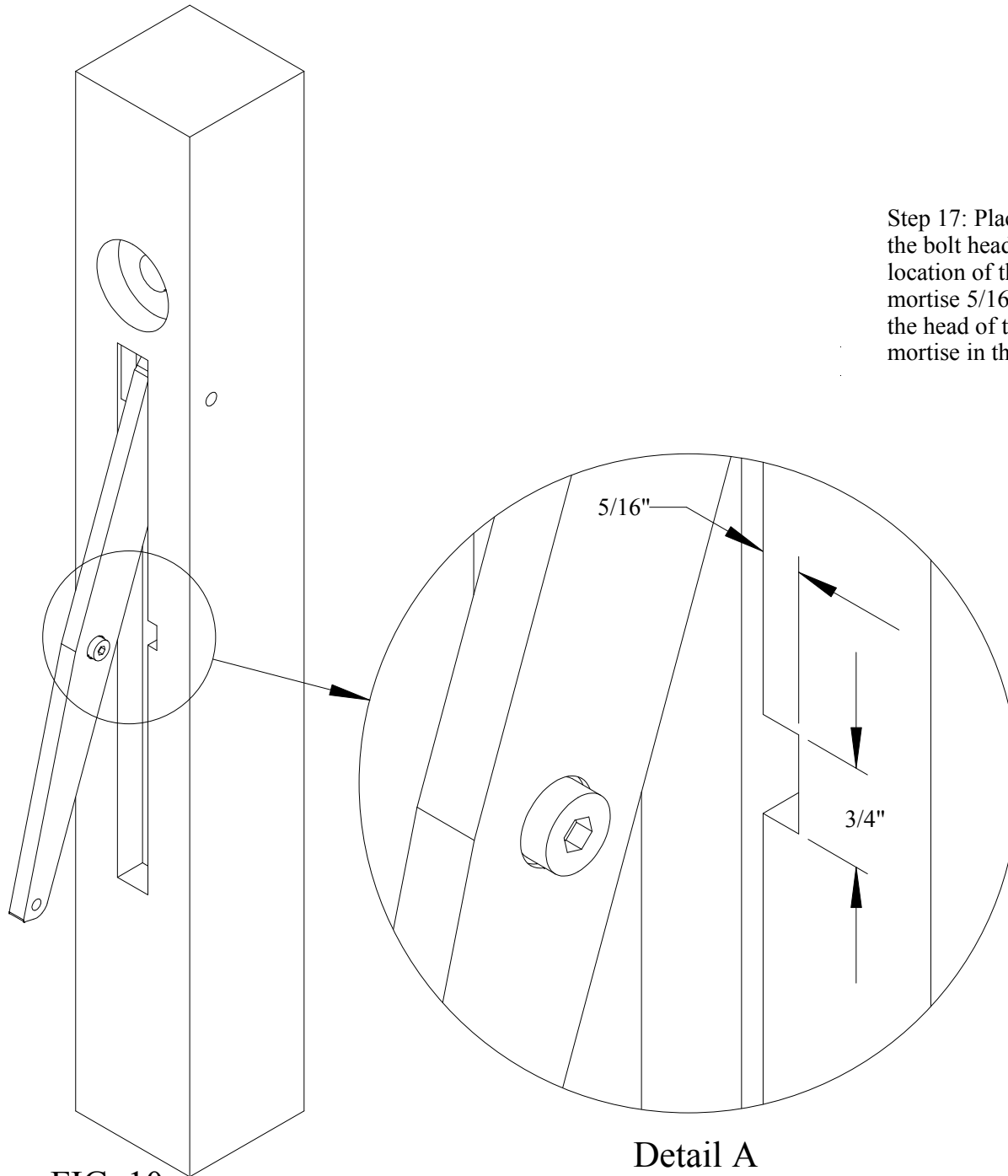


**FIG. 9**

Step 15: Install the wear plate at the bottom of the 7/8" deep left side mortise using the #6 X 3/4" wood screws. Pre-drill with a 7/64" diameter drill bit. See Fig. 9.

Step 16: Place the leg link into the right mortise oriented as shown in Fig. 9. Make sure the the pivot counter-bore is oriented as shown. Install the pivot pin into the hole and tap until it is through the pivot hole in the leg link. Make sure the pin is inserted at least 1" past the link. It may be necessary to use a 1/4" diameter pin punch or rod to fully insert the pivot pin. When you are totally finished you can plug the holes if you wish. If you ever need to remove the pin you can drill the plugs out and remove.

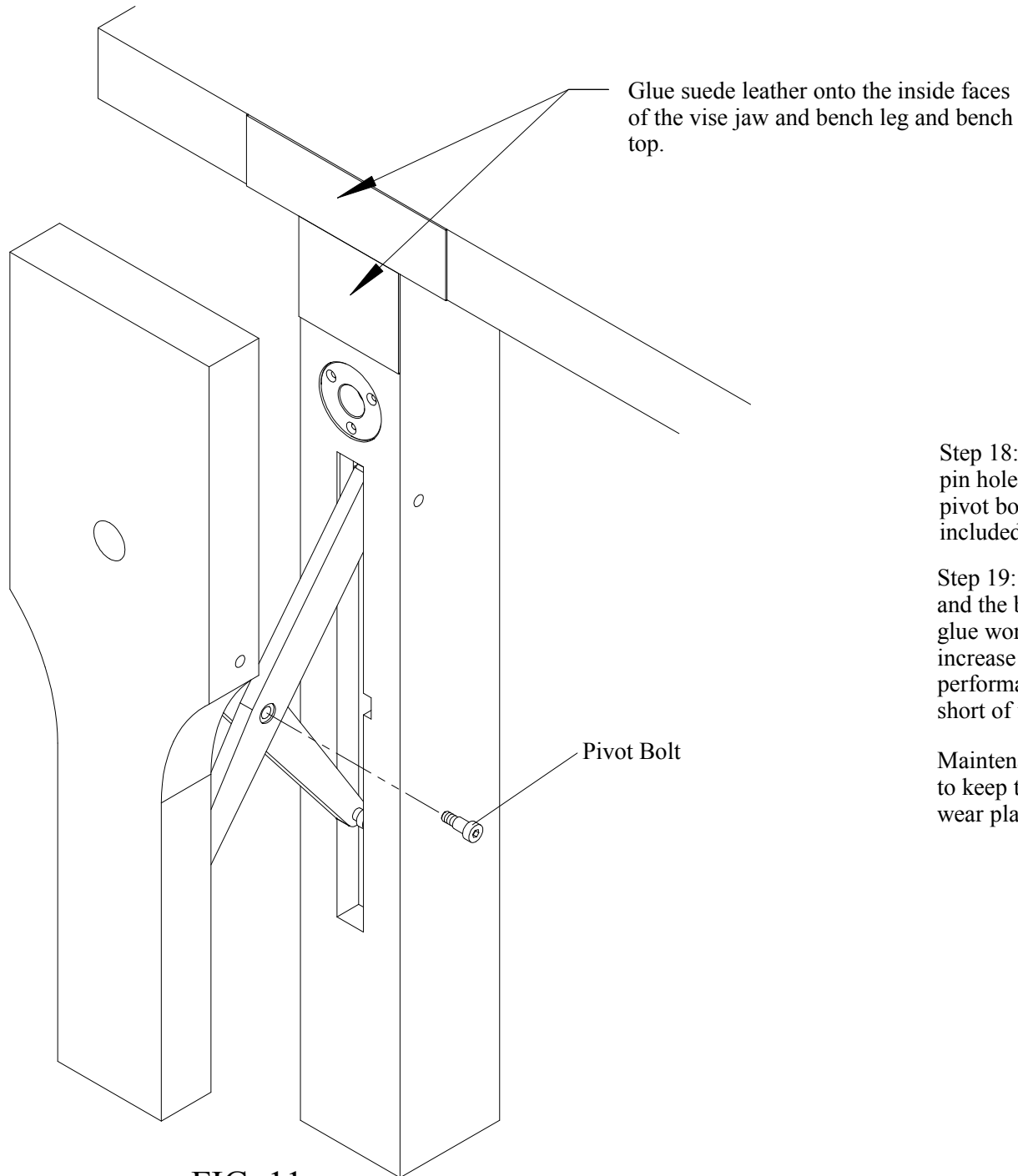
Note: The shoulder bolt in the bottom of the link keeps the jaw link aligned with the wear plate in the jaw.



Step 17: Place the pivot bolt into the leg link and pivot the link so the bolt head contacts the leg as shown in Fig. 10. Mark the location of the bolt head on the leg and chop a 3/4" X 5/16" inch mortise 5/16" deep as shown in Detail A. This mortise will house the head of the pivot bolt when the vise is closed. Duplicate this mortise in the jaw.

**FIG. 10**

**Detail A**

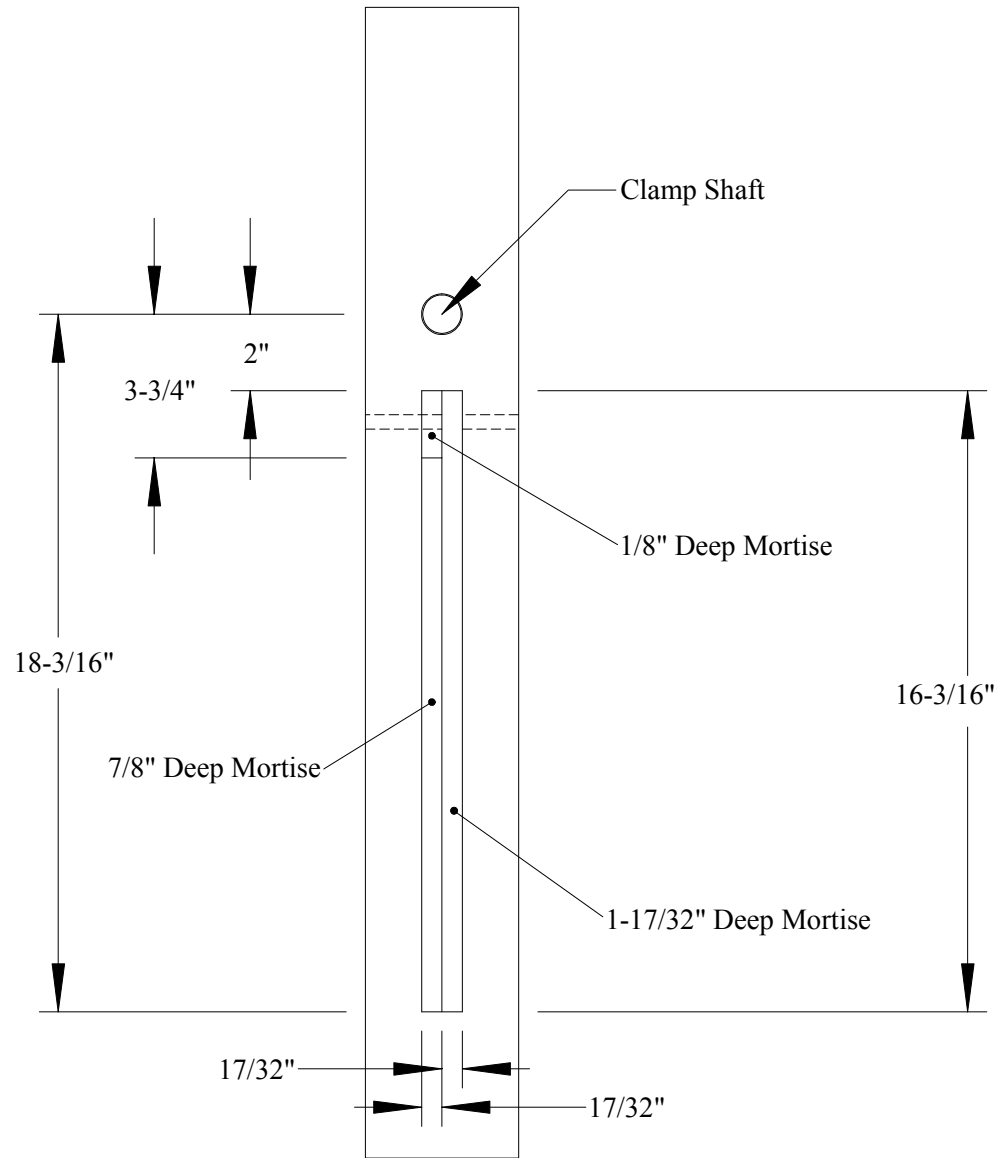


Step 18: Place the jaw into position and align the jaw link pivot pin hole with the leg link pivot hole. Put a drop of oil on the pivot bolt and insert it into the leg link hole and tighten using the included hex key wrench. See Fig. 11.

Step 19: Glue suede leather onto the inside face of the vise jaw and the bench leg and bench top. Contact cement or regular wood glue works well. The suede leather is necessary with a leg vise to increase friction and provide a little bit of compliance. For best performance the leather should continue down the leg to just short of the delrin bearing of the VX 20 vise as shown in Fig. 11.

Maintenance: Apply a drop of oil to the pivot points periodically to keep them free moving. Apply a small amount of grease to the wear plates in the leg and jaw mortises when needed.

**FIG. 11**



<b>Hovarter Custom Vise</b> www.hovartercustomvise.com © 2015 Lenco Tools LLC	Title: <b>Leg Mortise Dimensions</b>	P/N: <b>N/A</b>
	Vise Model: <b>X Link</b>	Revision:
	File Name: <b>X Link Mortise</b>	Date: <b>3/30/2015</b>