

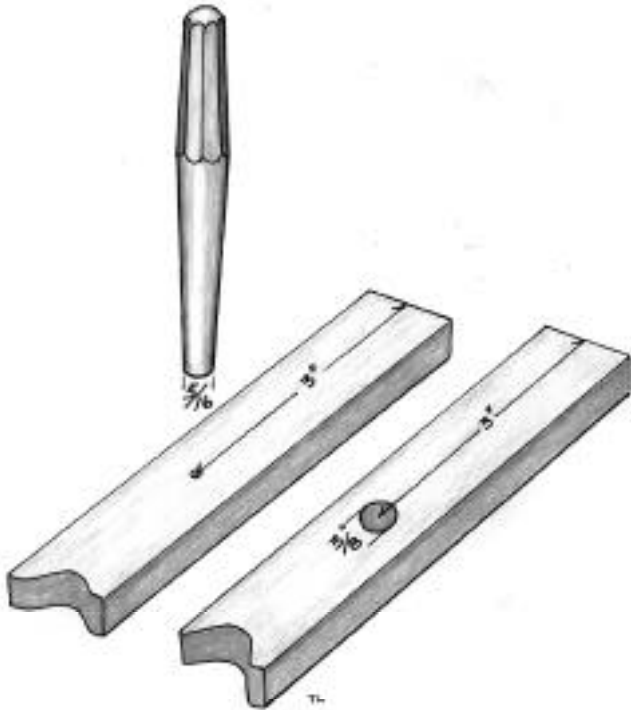
# Lesson Two: Hot Punching

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## Lesson Number Two-

Create holes or recesses in bars or plate by driving punches into or through hot material.



*Punching- layout and specifications*

(Holes or impressions can be made any shape you can make a punch.)

Punch a 3/8" round hole through the center of a 3/8" x 1" bar with the hole's center 3" from the end of the bar. Drift (stretch) the hole to finished size.

The finished hole should be 3/8" round, with clean sharp edges.

The hole should pass through the bar at 90 degrees.

The wide surfaces of the bar should be flat with no discernible hammer marks.

The bar should remain 3/8" thick.

The bar will bulge out slightly on either side of the hole.

The original edges of the bar should be straight in line on each side of the hole and without any twisting.

### *Intent:*

Students will learn to hot punch clean accurate holes and to check their results for accuracy.

### *Tools Needed:*

Forge, anvil, hammer, round punch, center punch, square and ruler.

### *Materials:*

24" of 3/8" x 1" hot rolled mild steel.

24" of 3/8" hot rolled round bar(to check final size of punched hole).

### *Method:*

When working to a specific hole size, start with a punch slightly smaller than the finished hole size. After the hole is made it can be enlarged to final size by drifting (stretching) with the punch.

### **The Punch**

The punch may be made of plain carbon tool steel at least 5/8" in cross section, forged to shape and normalized (air cooled until room temperature from a red heat). W1 or O1 drill rod, available at industrial supply shops, would be a good steel for this punch.

The business end of the punch should be a tapered round cross section 2 1/2" long, 9/32" to 5/16" round at its end and filed or ground flat with sharp edges after normalizing.

The top end should be tapered slightly to reduce mushrooming in use.

A hand held punch should be 10" to 11" long. A punch held in tongs should be 3 1/2" to 4" long.

### **Step One:**

Make a center punch mark in the center of the bar 3" from its end. Take a bright yellow heat where the bar is center punched. Place the bar flat across the face of the anvil, center punch mark up. Carefully place the punch over the center punch mark. Strike a single solid blow to sink the punch into the hot bar. Make sure the end of the punch is still where it is supposed to be. Continue striking solid blows until the punch is nearly through; another



*Some different styles of punches*

# CONTROLLED HAND FORGING



*Correct and incorrect alignment of the punch*

two or three blows. The punch will feel solid against the face of the anvil. If you have done this quickly the bar will still be at a bright orange heat.

### *Hints:*

Wear a glove on the hand that is holding the punch.

Quench your punch after every four or five blows. This will help to prevent the punch from deforming.

A few soapstone X-marks on the center punched side of the bar will help you get the punched side of the bar facing up when you first put it on the anvil.

Scraping the surface of the bar with your hammer will help you locate the punch mark. (Scale will fall into the punch mark leaving a small black spot.)

Learn to hit the punch directly and hard on the first blow. Avoid aiming blows.

The cold end of the bar can be supported on your thigh or on an adjustable stand set anvil high.

### **Step Two:**

Immediately turn the bar over on the anvil. Look for slight bulges on either side of the hole and a dark spot where the punch was driven into the first side of the bar. Position the end of the punch exactly over the dark spot. Strike several heavy blows. You will feel the punch solid against the anvil face again. Move the bar, with the punch in the hole, over the pritchell hole (the round hole in the heel of the anvil). Strike one or two more blows over the pritchell hole and a small slug will be driven out of the hole. Now, straighten and flatten the bar with light hammer blows on the anvil face. (The bar should still show color during this part of the process.)

At this point you will have a hole. It should be a bit smaller than the desired size.

### *Notes:*

If the punch doesn't clear the slug from the hole it is likely because the punch was misaligned when the bar was turned over or because the punch didn't have sharp edges on the business end.

The slug should be driven out from the second side of the bar. Avoid the temptation to turn the bar back over to the first side and try to drive the slug out.

Illustration of misaligned punch with slug hanging from one side of the hole.

### **Step Three:**

Now you need to drift (stretch) the hole to the desired size. Heat the bar to an orange heat again if necessary. Place the hole over the pritchell hole, insert the punch and drive it in a bit further. Remove the punch, turn the bar over and drive the punch from the second side. Continue this sequence until the hole is just large enough for the 3/8" round bar to fit through easily. The drifted hole should be just a bit larger than the 3/8" round bar so that when it is cool the 3/8" round will still fit through the hole.

### *Hints:*

When drifting, work a bit from one side of the bar and then from the other. This will make the hole more uniform in size. If you only drift from one side the hole would be wider on the top than on the bottom.

Finally, straighten and flatten the bar with light blows and a low heat.

### **Targets:**

Try to punch and drift the hole and straighten the bar in one heat.

(Beginners may need a second heat to accomplish this.)

Check your results using the 3/8" round bar, a square and a straight-edged rule. The 3/8" round bar should just fit through the hole you punched. The hole should pass through the bar at 90 degrees. The bar should be flat and uniform in thickness. The bar should be straight and without twist. The surfaces of the bar should be smooth with no discernable hammer marks.

### **Forging Dynamics:**

The flat bottom of the punch pushes the steel beneath it outward as it is driven into the hot bar. The sides of the bar bulge outward slightly.

When the bar is turned over and punched from the second side the sharp edges of the punch end shear out a small slug.

Driving the punch further into the hot bar stretches the hole larger, increasing the bulges on either side of the bar.

Steel expands when it is hot and shrinks as it cools. When hot, the drifted hole should be just a bit larger than the 3/8" round bar so that when it is cool the 3/8" round will still fit through the hole.