

Splitting



A coffee table by Doug Wilson using the techniques described

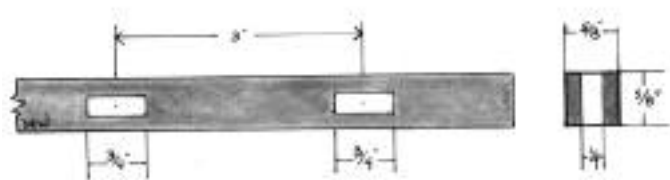
By Jay Close

Illustrations by Doug Wilson, photos by Jay Close

Lesson Number Eight—Splitting

Definition:

Cutting a bar by driving a sharp-edged chisel usually parallel to the length of the bar.



The finished practice piece with dimensions

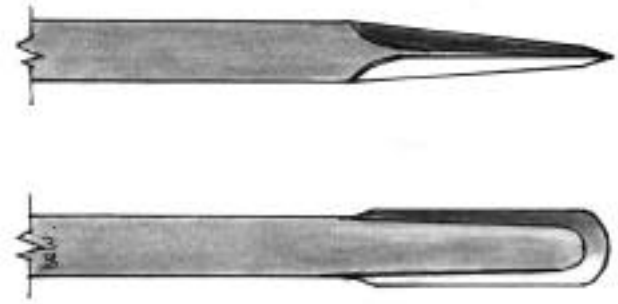
Lesson: slitting and drifting two mortises or slots in a square sectioned bar.

Intent:

The smith will learn the technique of slitting and drifting a narrow mortise to specified dimensions and how to anticipate the stretching of the bar to position mortises accurately.



Jay's tooling for this lesson



A slitting chisel

Materials:

24 inches of 5/8 inch square mild steel.

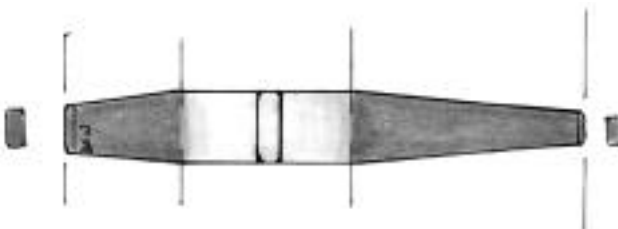
Tools:

In addition to the basic tools you will need a slitting chisel about 5/8-inch wide forged from W-1 or some other appropriate steel, and a drift 3/4-inch wide and 1/4-inch thick.

Make the drift of the same sort of steel as the chisel, although a drift of mild steel, carefully used, will work for a few repetitions of the lesson.

If the chisel is short, you will need chisel tongs to hold it. A pair of pick up tongs will be useful dealing with the drift.

Make the cutting edge of the chisel to approximate the drawing above. The edge is curved and thin. Keep it symmetrical—an off-center edge will be hard to drive straight. The length of the chisel edge should be about 75% of the length of the finished opening—in this case about 5/8-inch for an opening 3/4-inch long.



A drift

Make the drift to resemble the drawing. Provide a long, lead taper, a parallel section and a driving taper a bit longer than the bar thickness. To avoid sharp inside corners in the material, file or grind a slight chamfer on the edges of the drift. Round the top where the hammer hits to minimize mushrooming.

Method:

Overview of the Process: When a narrow slot or mortise is needed it is often slit and drifted rather than punched. This is particularly true when it is desirable to retain the full thickness of the bar stock around the opening.

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In the process taught here, a slit is cut then a drift inserted into the slit. This drift works like an internal anvil as the sides of the bar are progressively forged thinner on either side of the slit and the ends of the slit squared as the drift is driven in further.

Step One:

Measure the overall length of the bar you are starting with and record that measurement.

One inch from one end of the bar place a center punch mark deep enough that it will be readily observed on the heated bar. Center the punch mark in the middle of the bar.

Roll the bar 180 degrees and place a corresponding center punch mark on the opposite side. These two marks will guide the placement of your chisel as you cut from both sides.

Step Two:

With tools ready at the anvil, heat the end of the bar to a full yellow. Make sure that the area around the center punch marks is hottest.

Place the heated end of the bar in the middle of the anvil with a center punch mark facing up.

Put the chisel edge centered over the punch mark aligned with the length of the bar.

Tip: If you have difficulty seeing the punch mark, rub the side of your hammer across the bar surface. This will scrape the surface free of scale, but scale will collect in the center punch mark and make it visible.

Steady the end of the bar you have been holding against your thigh. Pick up the hammer.

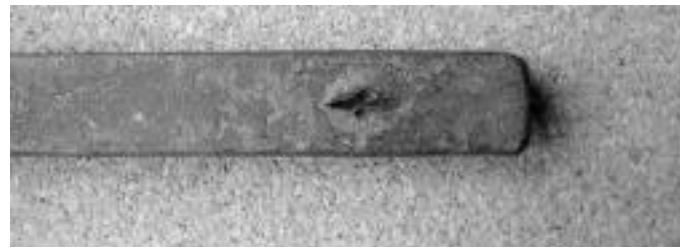
Hit the end of the chisel to leave a distinct but light witness mark to your chisel placement.

If necessary, correct the placement of the chisel and drive it hard into the bar a little more than half way.

Hold the chisel vertically. Hit the chisel vertically, and you will cut vertically.

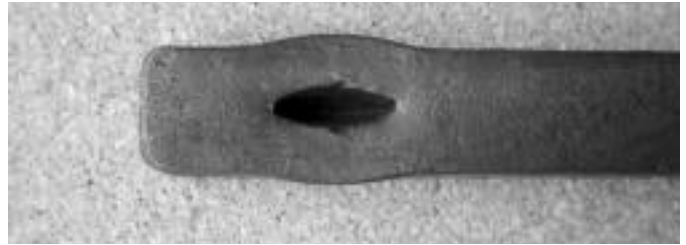


Jay Close steadies the bar against his thigh.



A "witness mark" centered on the centerpunch mark

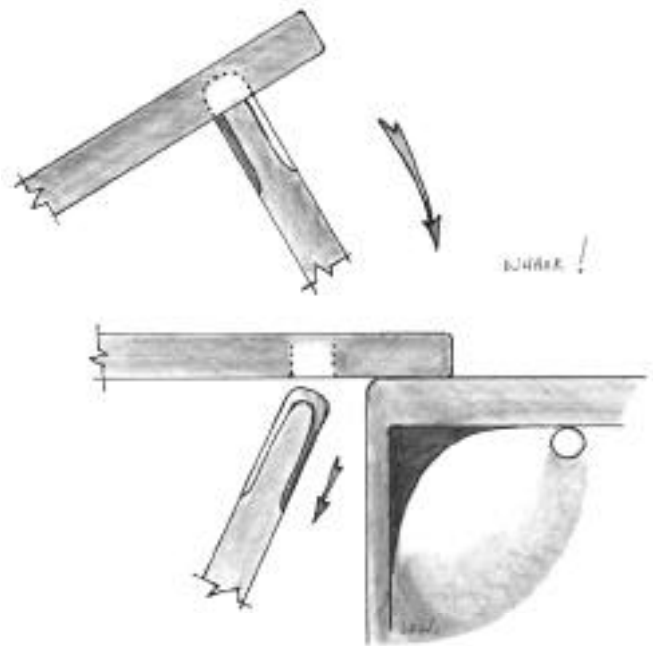
Do not allow the chisel to stay in the cut! If it softens in use, it stops cutting and begins to deform. As a starting point, three quick hammer blows to the chisel and then get it out of the cut.



The cut halfway through

Especially for a W-1 chisel, as soon as you notice it turning red, quench the edge. Residual heat in the rest of the tool will slightly draw the hardness, keeping the tool from becoming brittle.

Tip: If the chisel sticks, twist it to slightly widen the slot and it should pull free. Sometimes tapping the sides of the slot will knock out a reluctant chisel. Or turn the work upside down and swat the end of the bar on the edge of the anvil to use momentum to pull the chisel free.



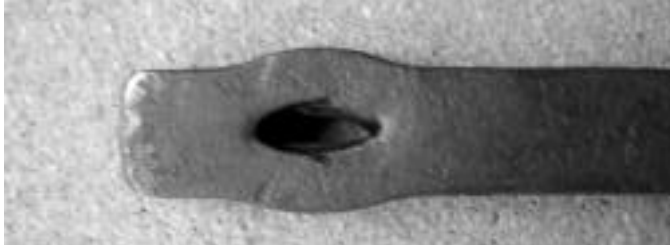
Removing a sticky chisel

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With the cut a little more than half way through, put the bar back in the fire.

Tip: Inspect the chisel. If it has deformed on the edge, correct and resharpen before continuing.

Unless you need to resharpen the chisel, resist the temptation to thoroughly cool the chisel. It will cool in the air as you reheat the bar and will have enough remaining heat to not overly cool the bar as you continue cutting.



The completed slit

Step Three:

Repeat step two chiseling through from the opposite side until the two cuts meet halfway through the bar. You should see a clean opening all the way through with the sides of the slit bulged out.

Step Four

Prepare your tools so that the drift and pick-up tongs are handy. Take a good yellow heat on the bar around the slit. Tap the drift into the slit until solid resistance is met, i.e., until you are beginning to reshape the ends of the opening just by driving in the drift.

The lead taper of the drift should extend through to the opposite side of the bar. Make sure you are hitting it in over the hardie hole, the pritchel hole, a bolster block or open vise jaws.

The trick is to support the work as closely around the slit as possible.

Tip: An unsupported bar can collapse into a wide pritchel or hardie hole, so hold the bar along the side of the hole where one edge at least will receive support. If you are hitting the drift a number of successive blows, move the bar left, right, front, back around the square hardie hole or around the circumference of a large pritchel hole.



Supporting the bar with the edges of the pritchel hole

Once you meet resistance, forge the bulge of the sides against the drift working both sides evenly. Knock the drift in further to continue squaring the ends and bulge the sides again.

Remember, you are shaping the sides of the slot with the hammer working against the drift, but the ends of the slot can only be cleaned up by driving the drift in against them.

The exact balance between forging the sides with the drift in place and driving the drift deeper to clean the ends of the slot is a matter of experiment. The variables include the width of your chisel, the taper of your drift and how aggressively you pursue each shaping option.

Repeat the forging of the sides and then remove the drift by tapping on the end of the lead taper or tapping the lead taper on the anvil surface.

The sides will stretch longer and thinner. This is good. But the wall around the slot will also stretch wider. This is bad. The undesirable stretch must be forged out with the drift knocked free of the slot.

Do this now. A couple of hammer blows on each side should suffice.

WARNING: the drift is now VERY HOT and can only be handled with tongs!

If the drift has taken on a red color, quench it quickly to black but not down to hand-holding temperature.

If the bar is still at least orange, put the drift in from the opposite side of the slot and repeat the forging in of the bulge and re-setting the drift.

Do not work below a clear orange to bright red heat. Do not allow the drift to get red and soften while in the slit. Get it out and keep it relatively cool. A soft internal anvil is of little use.

Resist the temptation to cool the drift to hand-holding temperature. This will rob heat from the workpiece and slow down the pace of the work. Handle the drift with tongs.

When the bar is red, remove the drift, forge in the unwanted stretch in width and get it back in the fire.

Step Five

Complete the drifting of the hole using the same procedure outlined in Step Four:

Tap in the drift until the drift squares the ends of the slot. Forge in the bulge on both sides evenly. Remove the drift and dress the top and bottom of the slot. Re-set the drift from the opposite direction and work the sides evenly again.

As a final sizing step, as the bar cools to red, drive the drift through all the way from one direction. The sides should not bulge.



The drifted slit

Then, drive the drift through from the opposite direction as the bar loses forging heat. If necessary, do some low heat dressing of the bar surfaces and tap the drift through one final time.

Step Six

Now that you have slit and drifted a mortise, measure its overall length with the bar at room temperature.

Compare that to the overall length of the bar before the mortise. The difference will tell you how much the bar stretched to create a mortise of that size.

Knowing this stretch factor, mark the center point for another mortise that will end up 3 inches from the center of the first one.

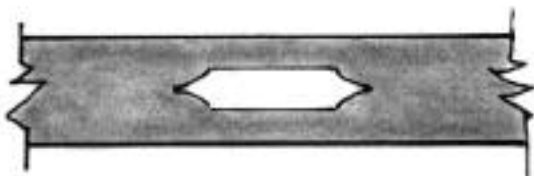
For example, say you started with 10 inches of bar. After you made the first mortise the bar grew to 10 and 1/2 inches. From the mortise center, the mortise pushed the bar 1/4 inch forward and another 1/4 inch back. If you want a second mortise a specified distance from the first, you must anticipate this 1/4 inch stretch center to center.

Mark the center of the second slot half the overall stretch of the material closer to the first slot than the needed final dimension.

Slit and drift the second mortise just as the first.

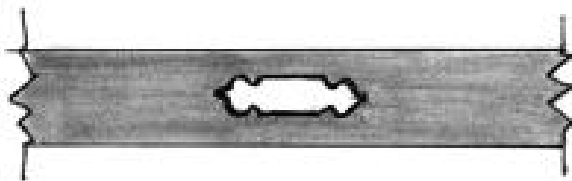
Troubleshooting:

Your mortise should look like a rectangle reflecting the cross-section of your drift. If it looks like the drawing below, the drift never had a chance to square the ends of the slit. This came about because either (1) the length of the chisel cutting edge was too long compared to the width of the drift, or (2) you did not drive the drift in far enough before stretching the sides of the slot.



Results of a chisel too long for the drift

If your mortise looks like this, you have over-stretched the sides of the slot so that on the final forging the drift was not completely filling the mortise.



Results of overstretched sides

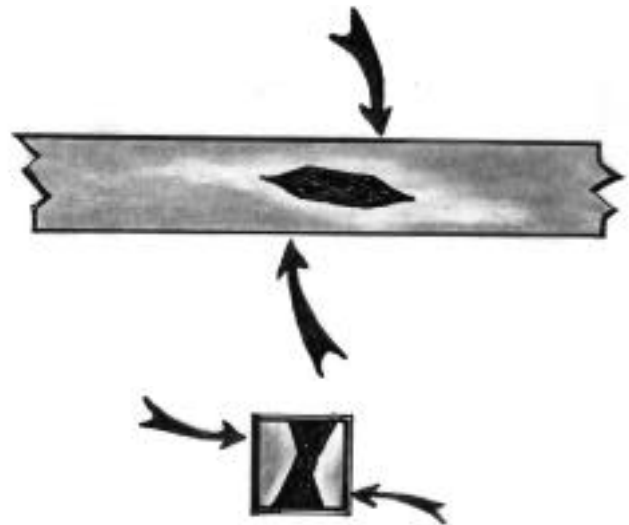
You can also create a mortise that is fairly rectangular but too long. This comes from over-stretching the sides of the slot. With a careful heat localized around the slot you can upset the slot shorter and then re-forged and drift. Remember to adjust the balance between stretching the sides and driving the drift on the

next mortise. If this does not help, you probably need a narrower chisel.

Sometimes the chisel cuts are centered in the bar but misaligned along the bar length. Often this problem will sort itself out in the drifting. You can also put the drift in—it will enter at an angle—and tap it more upright as you forge in the sides. Do a little at a time from both sides taking advantage of the stiffness of the drift “on edge.”

Chisel cuts not centered in the bar will leave uneven material in the mortise walls. You can help the problem by concentrating your hammer blows on the thicker sections and avoiding the thinner ones. In the drawing below with two off-center chisel cuts, hit where the arrows point.

A similar correction can assist if the slit is angled away from the axis of the bar. Work the areas shown below more.



Correcting off center chisel cuts

Tip: A poorly shaped chisel edge can cause much frustration. Even if centered on the bar and struck vertically, an asymmetrical edge will lead the chisel at an angle causing poorly centered cuts. Inspect the cutting edge of the chisel often.

If your mortises are not 3 inches apart, you will need to adjust them—hopefully, just slightly. For greatest accuracy, remember to make your assessment when the bar is at room temperature. For your own interest, record the measurement both while the bar is red and when it is at room temperature and note the difference.

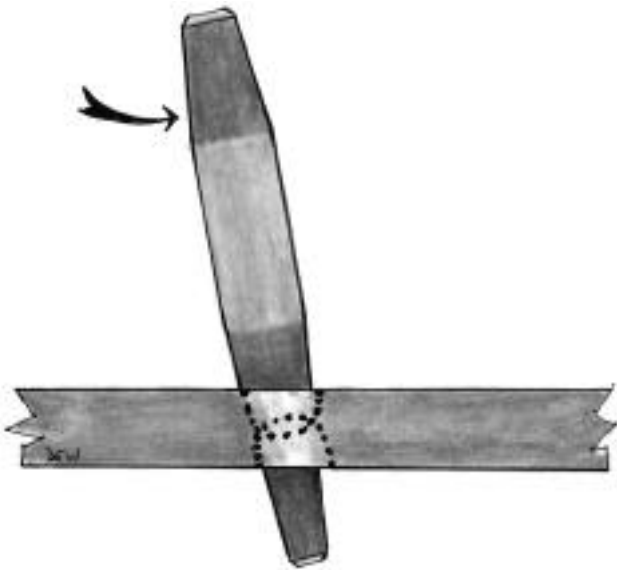
If the holes are a little far apart, take a long heat in the middle. Make certain the two slots are cool and carefully shorten the bar by upsetting. With care this can be done without producing an obvious bloating of the middle of the bar.

If the distance between the slots is short, you'll have to draw out the middle to lengthen the bar. Again, take a long heat and distribute your efforts over a long section of the bar so as not to produce an obvious thinning.

TARGETS

Time Targets: With experience and confidence you will be able

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Chisel cuts angled away from the axis of the bar

to cut the slit in one heat and drift it in perhaps two or three more. For your first efforts, cut half way in one heat and take a second heat to complete the slit from the opposite side. Then

allow four or even five heats to complete the drifting and a final one for clean up.

Shape and Dimension Targets: The dimensions of the slot will be largely determined by the size and shape of your drift, i.e., 1/4-inch by 3/4-inch. This should be “on the money,” no more than a 1/16-inch longer than the drift is wide.

The bar should remain the same dimensions through the slot as the rest of the bar. A straight edge laid along the flats of the bar should show no particular swelling or cavity around the mortise.

Tip: Hot-rolled bar often has slightly rounded corners. The area around the two mortises has been bulged, stretched and reforged enough that the corners are likely quite square. The contrast of square corner areas and round corner areas can often fool the eye into “seeing” a change of dimension where none exists, so observe carefully when testing the sides for straightness.

The slots should be centered in the bar with even wall thicknesses. The distance between the two slots should be 3 inches plus or minus 1/16-inch.

If you upset or drew out the bar between the slots to achieve the proper dimension, any dimensional change in the bar should be spread over as wide an area as possible and not be immediately obvious. The bar should be straight along its axis.

Skipjack

Striker