

# Drawing Out

Text and photos by Jay Close

Drawings by Tom Latané

## Lesson #18: Using the peen

*Definition:* Drawing down is the reduction of the cross sectional area of a bar.

*Intent:* This lesson will review the proper shape of a peen for the cross-peen forging hammer. Through two exercises the smith will learn to use the peen to gain increased directional control of the drawing-down technique.

*Overview:* The cross-peen hammer is the basic blacksmith's hammer. It offers two striking surfaces: the face and the peen. While smiths may disagree about the ideal shape of the peen, the peen illustrated in figure 1 is much too sharp for our work. It would create narrow, deep fissures in the bar surface that would be diffi-



Fig.1 Sharp peen on hammer as purchased.

cult to smooth and likely result in cold shuts. Figures 2 and 3 illustrate the same peen ground to a more useful shape, a shape that will leave behind a bar surface more easily refined, yet a shape that still demonstrates the special forging capabilities of the cross-peen hammer. The two essential features of this reshaped peen are its increased width (3/8 inch to 3/4 inch wide) and the well-rounded corners.

Peening introduces a wedging effect to the hammer blow. A blow with the face will tend to spread the work 360 degrees; a blow with the peen will spread the metal more perpendicular to the length of the peen. You will see some spread in all directions, but most shape change will occur as illustrated in figure 4. This allows a degree of directional control that is less evident in a flat blow with the hammer face.

*Tools:* Basic forging tools only.

*Material:* Mild steel 1/4 inch by 1 inch and about 24 inches long (or as convenient to hold).

### Exercise One- Step One

At a full yellow heat, lay one inch of the bar flat on the anvil face as in figure 5. Use a part of the front edge of the anvil that has a rounded corner when you do this. Imagine placing a square of



Figs.2 and 3. Reshaped peen ground wider with rounded corners.

the material on the anvil surface. Get used to making shape judgments by eye.

Hold the bar held horizontally and perpendicular to the front edge of the anvil. Reference figure 6.

Standing with your shoulders roughly perpendicular to the front edge of the anvil (see figure 7), strike with the peen in the middle of the square of material on the anvil face.

Hit with the peen parallel to the anvil surface but with about 75% to 80% of the peen length over the anvil face and the remainder off the face. This is a partial peen blow. ( Figure 8.)

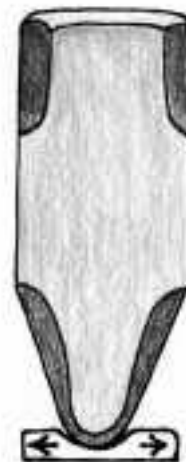


Fig. 4. Peen pushes metal to either side.

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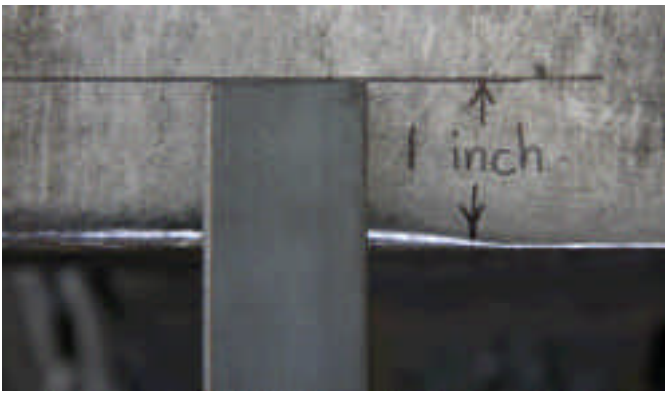


Fig. 5. One inch of the bar on the anvil face.

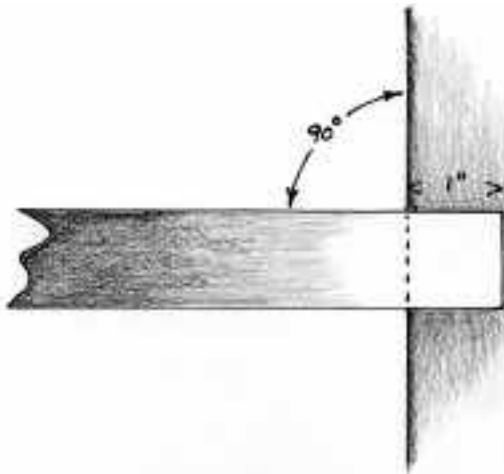


Fig. 6. Bar placed horizontally and perpendicular to the anvil edge.

Keep your bar-holding hand relaxed. Separate the action of the hand swinging the hammer from the other holding the work.

Having hit one blow in the middle of the bar, strike there repeatedly until a troughlike thin area develops, maybe 1/16 inch thick or less. When peening for width, always work the middle of the bar first, as this is the easiest time to spread that center section.



Fig. 7. Stand with shoulder of hammer hand facing the anvil.

At the time of impact of the peen with the workpiece, the hammer handle should be horizontal. This helps insure that the blow is not inadvertently pulling or pushing the material unevenly. Figure 9 illustrates the result of a blow in which the peen hits at an angle. The spread you witness should be even and the shape you create symmetrical.

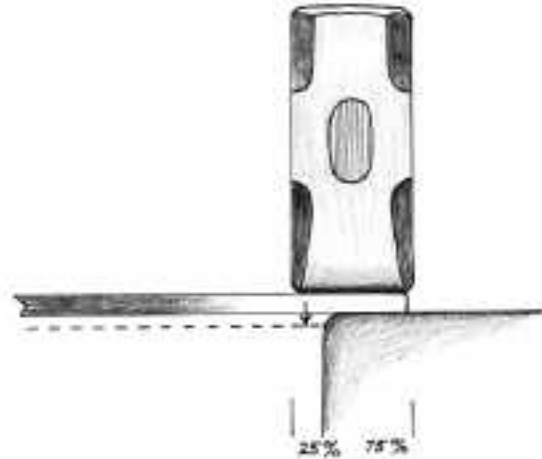


Fig. 8. Peen hits an overlapping blow— mostly on the anvil, but partially off.

The end of the bar should look like figure 10 on the top side and like figure 11 underneath. Note that the rounded corner of the anvil will have begun a defined transition on the bottom of the workpiece.

Also note that all peen marks are parallel to each other and parallel to the length of the bar.

### Step Two

Work each half of the peened section sequentially.

Forge the far half first as most people find peening away from themselves more awkward than peening toward themselves. It is always a good rule to do the hard or more awkward tasks first. Figure 12 illustrates the sequence of work: middle first, then the half farthest from you, finally the half nearest you.

Heat the bar on edge with the thick part you intend to work placed down in the fire and the part awaiting shaping uppermost. See figure 13. You should be able to get a full yellow heat

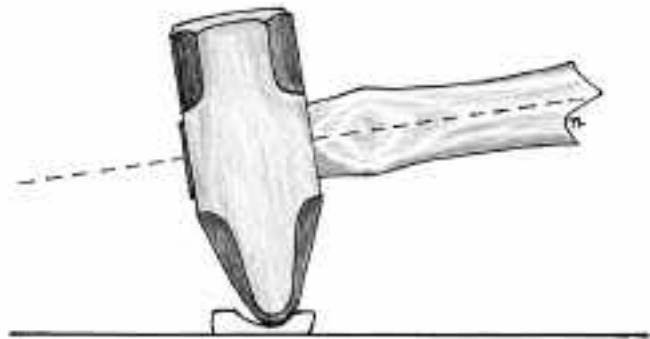


Fig. 9. Metal driven more in one direction by angled blow.



*Fig. 10. Top of the bar showing peened middle trough.*

on the edge without endangering either the thinned middle section or the thick opposite edge.

At a full yellow heat come back to the anvil as in Step One. Feel the slight shoulder you started rest against the rounded corner of the anvil.

Now hit just to the far edge of the central trough. The harder you hit and the higher the heat, the more smoothly the bar will move in front of your hammer blows. You want each hammer blow to be placed parallel to the one before and just slightly further into the thick bar. Keeping the hammer blows parallel to each other maximizes the sideways spread and (with practice) increases control of the final shape.

Try for a consistent pattern of parallel peen marks and a consistent average thickness in the bar. It will take time to develop the confidence and hammer control necessary to do this well, but



*Fig. 11. Bottom of bar showing transition made by rounded corner of the anvil.*

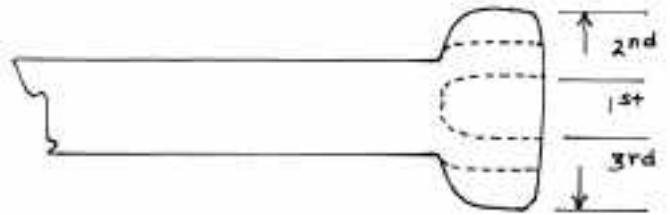
practice will make it second nature.

Note that near the edge of the bar, as the path of resistance is lessened the metal moves more dramatically. It is, therefore, easy to get the edges much thinner than the middle. A consistent thickness is the goal.

At the end of this second heat the end of the bar should look something like figure 14.

## Step Three

The bar goes back in the fire but this time with the opposite, still-thick side down and the thinned edge uppermost. Once more you should be able to get a good yellow heat on the thick section without endangering the already thinned areas. See figure 15.



*Fig. 12. Work the middle, then the side furthest from you, then the side nearest you.*



*Fig. 13. Half to be worked placed edge down in the fire.*

Proceed just as in Step Two, but instead of working your peening blows away from you, bring the hammer blows slowly toward you.

Hit hard and with confidence. If the bar is hot and you hit hard the shape will bloom before your eyes. It is actually better to hit hard and sacrifice (initially) some accuracy than to hit timidly.

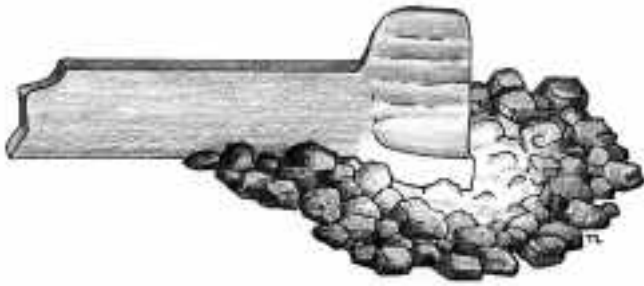
Your result should resemble figure 16. This is an exaggerated shape designed to show the potential of peen work. Observe these points:

- (1) the peen marks are parallel to each other
- (2) the peen marks are aligned along the length of the bar



*Fig. 14. Top view of the bar with one half spread.*

## CONTROLLED HAND FORGING



*Fig. 15. Bar heating on edge with thinned area upper most and portion to be worked down.*

- (3) the peen marks are even and the bar a consistent average thickness
- (4) the shape is symmetrical
- (5) on the opposite side of the bar there is a clean and definite shoulder.

You started with a 1 inch by 1 inch square of material on the anvil face that was 1/4 inch thick. The bar grew a little in length, but you ended with a wide oblong form that was much thinner. The mass of material was redistributed mostly to the sides, perpendicular to the run of the bar.

As an experiment you may want to try the same exercise but hitting only with the flat face of the hammer. You will end with a very different form, perhaps like figure 17.

### Step Four

As a final step, take an overall light orange heat on the thinned part of the bar and come back to the anvil. Place the bar as



*Fig. 16. Finished peening.*

before, feeling for the shoulder underneath against the anvil corner. Using the face of the hammer, smooth the peened part the bar, allowing the anvil face to planish the opposite side to a near-burnished finish. See figure 18.

Watch the rate at which the bar cools. Thicker areas will hold heat longer and show where more forging is needed. Areas that cool quickly are thin and you should stay away from these.

To test for how even you have forged the end of the bar, cool the bar and then use your fingers as a gauge to test for thick and

thins. Commonly, the middle is thick and the edges thin. Re-heat the bar—being thin, this will be fast—and address any unevenness you find. If you have left the center heavy, it will thin with reluctance.



*Fig. 17. Flattened bar using the face of the hammer.*



*Fig. 18. The smoothed shape.*

### Exercise Two

#### Step One

The shape you achieve when you peen a bar in width is a thinner and sideways stretched version of the shape you started with. Exercise One started with a thick square and ended with a thin, oblong and roughly rectangular form.



*Figs. 19 & 20. A triangle-shaped set up.*

Starting with a different initial shape we can create different, thinned expressions of it. These initial shapes are called “set ups.” Exercise Two introduces a different set up.

At a yellow heat, forge the end of your bar on edge to an even taper. Work at a high heat and hit hard to avoid or minimize the chance of a cold shut on the very tip.

Keep the taper short and retain the original 1/4-inch thickness of the bar. Figures 19 and 20 show what you are after. This triangular shape on the bar end is the set up for a different peened shape.

## Step Two

Start peening as in Exercise One.

At a yellow heat, place the base of the triangle that you created flat on the rounded edge of the anvil with the entire taper lying on the anvil surface. See figure 21. The bar must be horizontal and perpendicular to the anvil front. Stand as you did in the first exercise: roughly perpendicular to the anvil with the shoulder of your hammer arm facing the anvil.

Begin peening in the middle as you did before until you have a central trough like figure 22. Hit flat with the peen parallel to the anvil face and the hammer handle horizontal at the time of impact. Keep the length of the peen aligned with the length of the bar.

## Step Three

Put what will be the far half of the shape down in the fire, but be careful of the tip as it is vulnerable to burning.



*Fig. 21. Place just the set-up flat on the anvil face.*

At a yellow heat, peen the material working away from you. Keep an even average thickness and symmetrical shape. Concentrate on keeping the peening blows parallel to each other and the hammer handle horizontal at the time of impact.

## Step Four

Reheat with the bar on edge in the fire. The thick part of the shape should be down while heating and the thinned area uppermost. This is just as you did in Exercise One.

From a yellow heat peen the metal toward you in this step. Figure 23 shows the final shape.

See the previous exercise for points to watch.

## Step Five

Take an overall light orange heat to smooth the shape with the face of your hammer.

The results should look something like figure 24.



*Fig. 22. Central trough on triangle set-up.*



*Fig. 23. Final peened triangle set-up.*

To check for even thickness, cool the bar and use your fingers as a thickness gauge. If you find heavy areas, the thin shape will reheat quickly in the fire for additional attention.

## Troubleshooting

One of the biggest issues to overcome is inaccurate hammer blows. A misplaced blow with the broad face of the hammer is often of little consequence and easily obscured or corrected.



*Fig. 24. The smoothed shape.*

## CONTROLLED HAND FORGING



*Figs. 25 and 26. Corrections to alignment.*

When you are attempting to push material in front of the peen, especially as the material is getting thinner with each blow, a misplaced blow is sometimes hard to correct. The beginner will often become timid in the use of the peen, taking short pecking blows, and multiple heats to achieve the shape. This should be avoided. High heats and hard hammer blows are the key to successfully thinning a set up. The only way to achieve the accuracy needed is to force yourself to forge with confidence and hit with purpose.

Sometimes a significant asymmetry emerges as the peening progresses. If you are certain that the peening was accurate and even, then that asymmetry may have existed in the original set up. Even a slight unevenness in the set up will be magnified many times as the bar gets thinner. Just make the set up as even and symmetrical as possible and deal with emerging asymmetry as you work. Sometimes this involves leaving half the flattened area a bit thicker than the other. Some selective peening to spread one area more than another may also be needed.

In making these in-process corrections, there is no “step by step” or easily followed formulations. Forging with confidence helps. Keeping the peen marks parallel to each other even when making corrections also seems to help. Practice is the most important aid.

Frequently the peened shape will be even but slightly canted from the center line of the bar. With the shape already thinned, it is not advisable to correct the shape by a simple straightening

blow on the edge of the thin shape. Rather, slightly thin (with peen or face of the hammer) the base of the shape to stretch material and move the thinned form in the needed direction. For example, stretch the base of the thinned triangle on the left side to swing the form to the right; stretch the base of the triangle on the right side to swing the form to the left (figures 25 and 26).

### *Forging Dynamics*

In drawing down, the mass of a piece of iron is retained but the distribution of that mass is altered by often dramatic reduction of the cross-sectional area. By creating different prepared shapes called “set ups” and by use of the hammer peen, you can control the final shape of a thinned section with economical use of material.

The center section of a bar being peened is most resistant to shape change. This is because the hammer blow must push against material in all directions to make a change in thickness. The edges are easiest to thin as they have little resistance to their spread.

As the bar gets wider, even if thinner, this resistance of the middle to shape change only increases. The hammer blow must now push against stiff edges that are being forced to move through their thickest dimension. This is why in thinning a bar we try to work the center of the bar first. This is also why it is so easy to get a thinned section that is relatively thick in the middle and thin on the edges.

### **Targets:**

- The peened shape should be even thickness and symmetrical.
- The peened shape should be in alignment with the length of the bar.
- The surface texture on both sides of thinned area should be smooth without obvious hammer marks.
- Take one or two heats for more complex set ups like the triangle taper.
- Take three heats to peen these shapes and a single heat to smooth them.

Remember, these are targets or goals. It will take much practice to achieve these results.

### *Author's Note:*

All forging for this lesson was done with the inexpensive hammer shown in figures 2 and 3. You do not need esoteric or expensive equipment to practice and improve your forge work.

Thanks to Bob Ouellette who posed for figure 7. Bob is a student of mine in the American College of the Building Arts bachelors' degree program in forged architectural metals.