

# Table

by Clay Spencer

(steel scribe points) construct a horizontal line through the center of the vertical line. Draw the vertical and horizontal lines with



This description covers making a small circular table with rings, slit, upset and drifted holes, forge welded split scrolls, four curved legs with upset square corners, upset feet, tenons and a tapered hoop.

## Layout

First make a full scale drawing on a table or piece of steel. Scribe a vertical center line. Center punch at the center. With a compass

silver pencil.

Mark ends of the line with center punch.

With a silver pencil in a compass, draw the outside ring and the inside ring, inside and outside lines of both. Draw the two cross bars and the scrolls on at least one end of one cross bar. The easiest way to draw the scrolls is to make a scroll first. Use an existing jig or make a jig to fit your scroll. Make a trial

scroll to be sure the length is right. To start the trial scroll, center punch a mark at each inch on the edge of the stock before you draw the taper. Then you can determine how long to cut the stock. Keep this trial scroll with the jig. Make sure the scrolls do not have kinks or flat spots and the jig does not have kinks or flat spots.

Make the outside frame parts first. Cut all similar parts at one time using a stop on the saw or shear. Cut longer parts first –you can't cut a long part from a short piece of stock. Lay all similar parts on a table and mark them all at once with a square to line them up and a square to mark across them.

## Outside Ring

1/2" square, 67 3/8" long

Measure the centerline diameter of the outside circle and multiply by 3.14 to get the length to cut the stock. Cut stock and break all 4 edges. Check to make sure length did not change due to breaking edges.

Heat and upset ends for scarfs. Make mating scarfs on opposite ends. For stock this long, upset by jamming down on a floor anvil or swage block-rotate each time you slam it down, straighten when it bends. Make the scarfs so that most hammering to weld will be flat. While ends are hot, start making the bend on each end.

Bend the ring cold on bending plate ( two



3/4" diameter steel pins, 3" long welded in two holes 1" apart, in a 3/8" plate). Mark off every 2" to help you make a smooth curve. Bend one third from one end then start at other end and bend a third. Finally bend the middle. Use a bending wrench as needed.

Check against the layout or a radius gage and correct. Start at one end and make corrections as you go to the other end-don't jump around. Get the circle as perfect as you can (both round and flat) before you weld-it is much, much more difficult to correct after the ring is complete and rigid.



Flatten and correct twists. Hammer on a flat anvil and bend across the hardy hole if necessary. The upset area cannot be made perfect before welding.

The bend will have to be made a little tight because the upsetting for the scarfs has shortened the stock. Make sure the scarfs overlap fully and have pressure against each other.

Heat, flux, reheat and weld. Forge back to the original stock thickness and width. Heat a long length on each side of the scarf. Correct the curve at the weld while it is still hot. Flatten the ring and remove any kinks or twists. Keep the weld very hot while hammering in the area.

Check the ring on the drawing and correct

any places where needed. You will have to heat a long length now that the circle is complete. A jig may have to be made if ring is too large for a cone. Some corrections can be made cold.

## Inner Ring

1/2" square, 40 3/8" long

Next make the inner ring. Measure the centerline diameter, multiply by 3.14 to get the length. Since this ring has slit, upset and drifted 1/2" square holes, you will have to determine if the holes will make the stock longer or shorter.

### Test Piece for Inner Ring

Make a test piece-measure and record. Use exactly the same process for the test piece as you will for the final part.

Mark the center where the hole will be. Use a square to transfer the center location to the opposite side of the stock. Scribe a line cross-



ways and use a center scribe or try square to mark the center of the stock. Make a heavy, deep center punch mark on both sides. Make two witness marks on either side of the center punch exactly 6" from the cp.

Use the slitter point to indent the stock cold over both center punch marks.



Heat at punch mark and slit half way through from each side, then go through over



a punch plate.

Heat and open up the slit with a small round



punch or an opener-oval pointed 1/4" round. Heat and upset the slit to round.

Heat and drift to 1/2" round (for 1/2" square



hole).

Heat and use square punch from both sides to open to near 1/2" square.

When punching with a water hardening tool, you can cool it in water and dip in coal dust for a lubricant. Be sure to keep the hole square with the stock. A handled punch can be torqued around to square up the hole with the stock.

Heat and drift with an oversized 1/2" square drift. Cut a 2" length of 1/2" square. Heat to



welding heat and upset center with several heavy blows. Taper the top for 1/2" and taper the other end to about 3/8" square. Grind smooth. Drifting is easier with a lubricant such as wax, graphite, molybdenum disulfide, or a high temperature antisieze compound.

After drifting, reheat, put drift in the hole and lightly hammer sides of hole flat.

After cooling, measure between the witness marks. If the length between witnesses is long then shorten the same amount for each hole. If the length between witnesses is short then add to the stock length for each hole. If the measurement is 1/4" long then add 1/4" for each hole to the total length.

Make corrections for stock length, cut stock and break edges.

Since there are 4 holes, divide the length by 4 to get hole spacing. The first hole will be 1/2 the spacing from the end, the second hole will be 1/2 the spacing plus one spacing, The third hole will be 1/2 the spacing plus 2 times the spacing and so on. Do not step off the spacing but add the dimensions and mark from one end. Error will be introduced if you step off the spacing. Make a heavy center punch at each hole location, both sides.

Make marks at: 5 1/8", 15 3/16", 25 1/4" and 35 5/16".

Upset both ends of the bar for the scarf but do not scarf yet.

Follow the above procedure used for the test piece to mark holes on both sides with the slitter after center punching.

It is essential that the marks be centered on the stock, held vertically, the slitter be sharpened symmetrically. If not you will spend considerable time correcting off center holes or making new pieces. If the hole is slightly off center then hammer the thin side in

slightly and cool it so the thick side will be stretched more to even it out. On a bick or horn you may be able to draw out the thick side slightly to even them up.

Punch and drift all 4 holes. Straighten and flatten the stock.

Scarf the ends and start the bending. Make the scarf so that it will weld on the flat-it is easier to weld on the flat of the ring rather than inside and outside of the ring. Continue the bend for about 1/3 of the ring. Bend in a swage or on a ramp on the anvil. When a hole is heated for the bend, place the drift partly in the hole to cool it. Knock out the drift and continue bending but be careful bending around the hole.

Start at the other end and bend to meet the first bend. Flatten the ring on the anvil with the punched holes in the hardy hole. Correct the bending until it is a flat circle and the



scarfs are touching with pressure against each other.

Heat, flux, reheat and weld. Forge stock back



to original size.

The drift may have to be run back through

the holes if they were distorted during the bending. File any burrs in the holes and make sure the stock will pass through both holes.

## Scrolls and Cross Bars

1/4" x 1/2", 17 1/2" long, 4 pieces

1/2" square, 12 1/2" long, 2 pieces

Cut the scroll stock and the cross bars. Lay all four scroll pieces side by side and mark the center across all at one time, then center punch at the center. Mark centers of cross



bars in same manner.

Taper the scroll ends for about 4" until they are one inch longer on both ends. Use a story



stick to check both tapers.

Check width of taper to make sure it is original stock width.

Flatten scroll taper and even out with flat dies in treadle hammer .



Lay all the tapered bars side by side, centers lined up and mark equal lengths on both sides of the center. Cut/grind to equal length on both sides of the center.

Nick the center of the scrolls about 1/2 through with a hardy or cold cut, heat and bend, hammer together.



Straighten, taper the sides slightly and scarf.



Upset before welding for better looking joint, then straighten. Open a space for flux at the bend. Heat, flux, weld lightly and scarf.

Upset the cross bars by heating 4" at the end, bend 2" about 75°.



Hammer the end with the bend on the anvil.

Weld the scroll stock to the cross bar on both ends.

Check length of both scroll/cross bars against each other. Adjust lengths so they are exactly the same by grinding/cutting. If necessary, remark the center of the bars.

Straighten the scrolls and line them up, one on top of the other. Mark at 2 1/2" from the end. Mark a center line from the tip to the mark. Saw the ends of the scrolls along the centerline to the mark.

Bend the cross bars in the center about 1/4" so they can pass each other when put through the inner ring.

Roll up the scrolls evenly on one end of both cross bars until they match the drawing. Pass the straight scroll through two opposite holes and roll up both scrolls.

Pass second bar through and roll up the scrolls on it.

Center both cross bars and lock in place with clamps. Heat centers of both cross bars evenly in fire or with rosebud. Make a half lap joint by flattening the bars in the center with



flat plates in the treadle hammer. After the stock cools, center punch and drill the center with a  $17/64$ " diameter bit.

### Collars

$1/8$ " x  $1/2$ ", a little over 2' required for 8

Groove the collars before you cut the collars to length.



The length of the collar stock is the perimeter around the pieces to be joined plus  $2 1/2$  times the thickness of the collar stock.

For  $1/2$ " square +  $1/4$ " x  $1/2$ ", the perimeter is  $2 1/2$ ". If the collar stock is  $1/8$ " thick add

$5/16$ " for a total of  $2 13/16$ ". Cut one collar and make a trial fit. Correct the length if it is too short or too long. Set a stop on the saw and cut all collars at once.

Mark the location for the first bend-it is half the length of the collar plus  $1/2$  the width of



the two pieces ( $1 13/32$ " +  $3/8$ " =  $1 25/32$ "). Center punch the stock at that location.

Heat the end of the collar stock and forge a very short taper on each end.



Taper the width slightly first.



Forge a short taper on each end.

Second end should be opposite the first end.

Make a sharp 90° bend at the mark in a V-block on treadle hammer.



Use a set and heavy hammer to drive stock into bottom of the collar.



Use a 3/4" collar block to make the second 90° bend. Clamp the collar to the block with vise grips. After clamping, remove the vise grips.

With a torch heat the outside bottom corner of the collar and use strong tongs to bend the collar side to the stock.



Bend the collar tight to the collar block with a hammer.



After bending the collar, it should be a very tight fit on the pieces to be collared. If not use a slightly smaller collar block to make a smaller collar bend.

Heat the inside bottom corner of the collar and use tongs to bend the collar to the stock.

Place the parts to be collared in correct position and upside down on a heavy table (or anvil with stands to support the off side). Use four or more 1/2" thick blocks to support collars.



Put all collars in place supported by the spacers to keep slit, upset drifted holes off the table. Make sure the collars located at the tangent point of the curves and positioned so that the last part of the collar to close bends to the center of the grill.

Heat the inside of the collar and quickly hammer the collar flat to the stock.



## Legs

1/2" square, cut 45" long

Set the stop on saw or shear and cut 4 legs. Cut legs 10" longer than drawing so the square corner may be made in the vise with 2 hammers.

Lay 4 legs side by side and mark location for the square corner. Make a heavy center punch mark on both sides.



Heat the outside of the collar and quickly hammer and close the collar. Be careful to



bend the second end of the collar directly over the first end.

Heat the bottom 4" and upset on a floor plate or anvil. Shorten stock about 1/2".

Round the bottom of the upset. Upset all 4 legs and adjust to the same length.

Straighten the upset section.



Heat and make a 90° bend exactly at the mark.



Use hot cut to run the groove where it was hammered. The two bends should be made very quickly and with few hammer blows.

Set the remaining collars. The collars may be put on either before or after the legs are connected to the outer ring



Put aluminum jaws on the vise. Take a high heat and clamp the legs very tight in the vise. Use two medium heavy hammers. After 6



blows, move to the opposite side of the vise and take another 6 blows. Keep hammering and switching as long as stock is hot. Try to hammer evenly and keep center punch centered. One heat should finish the corner.

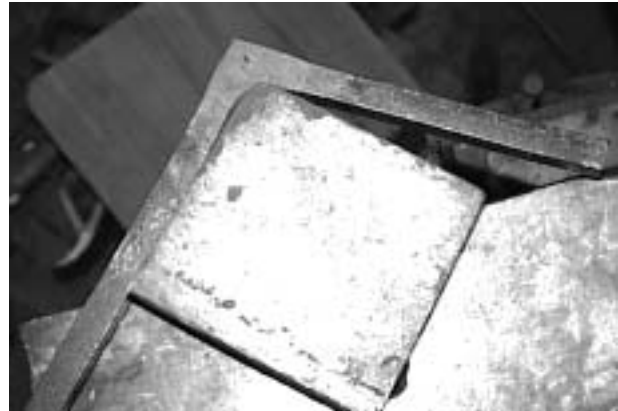
Flatten stock back to 1/2" in both planes. Check with the gap gage. Straighten any bends in both legs. Use a large V-block and V-tool in a treadle hammer to



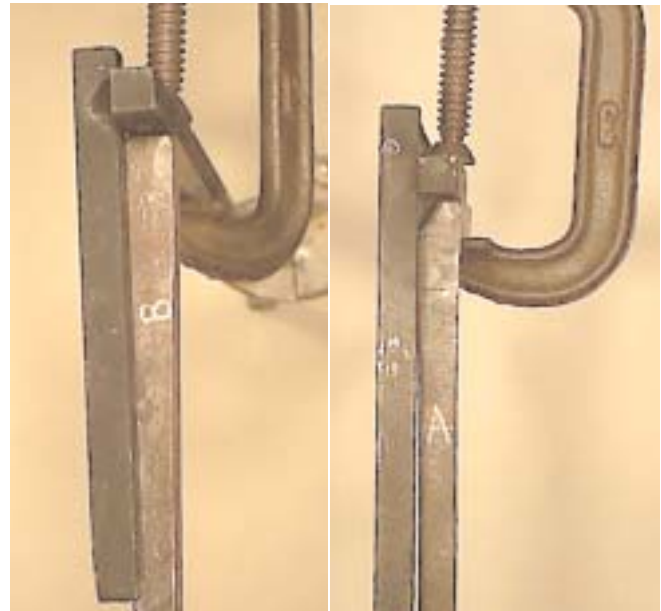
straighten legs and make bend 90°. Use the 90° block to make the corner 90° and straighten the legs.

Check the corner with a square. Make correc-

tions. Look for bends about an inch from the corner on both legs and correct. Check and correct square again.



Clamp the square to leg A and see if leg B is square or goes off to one side. Correct.



Leg B angles to left

Leg A goes right

Clamp the square to leg B and see if leg A is square or goes off to one side. Correct.

Mark short leg for cut and cut off. Be sure to leave enough stock to make a tenon.

Clamp the leg bending jig in a vise. Take a long heat below the corner and clamp the corner in the bending jig. Bend a couple of inches and add a clamp, bend and clamp. Don't go past the heat or it will pull the stock away from the jig. Unclamp.



Take another heat lower on the stock. Clamp the corner and every 3". Bend and clamp. Keep leg down tight against the jig base.



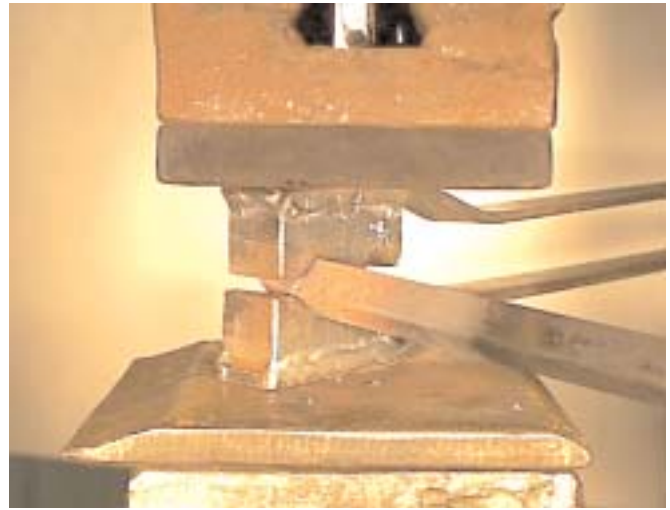
Heat and bend until leg is in contact with the jig down to holes for rivets. Let stock cool while clamped in jig.

Use a long drill bit to mark for rivet holes. Be sure leg is down against the jig base.

Remove from jig. Center punch for rivets. Move center punch to center if necessary. Drill  $9/64$ " for rivets.

Mark for cutting tenon with jig all around the stock. Cut off  $1/2$ " past tenon mark. Use a sharp hot cut and cut around stock. Cut deeper on the corners.

Forge a  $5/16$ " tenon using a spring swage or guillotine tool.



Heat and use a monkey tool to square up the shoulder.

Make the lengths exactly the same on all four legs. If a leg is too short, draw it out, if too long upset using the monkey tool.

Make sure the short



section is straight, square shouldered and the 90° corner has not been changed.

Cut the tenon to length. The length is thickness of stock it goes through plus 1 1/2 times the tenon diameter. For a 5/16" diameter tenon going through 1/2" stock, cut at 15/32" above shoulder.

Check all 4 legs against each other using an adjustable gage to make sure all the lengths are the same. Upset, draw out or grind the bottom to get the legs even.

### Tapered Hoop

1/8" x 1 1/4", cut 48" long

Mark stock 2 1/4" from one end and make second mark 42 3/4" from first mark.

Edge bend the stock to 23" inside radius in bending jig on treadle hammer. Mark every



2" and run through the jig using light blows. Flatten any kinks on anvil. Run back through jig to complete bending until jig bottoms out.

Check bend radius against a drawn radius or radius gage. Mark tight bends with chalk on



inside of bend and mark loose bend areas with chalk on outside of bend. Lay stock flat on an anvil and hammer on chalk marks. Check with radius gage and correct until radius is correct.

Cut ends at the marks.

Upset both ends for welds in a vise. Make scarf with hot cut and set on treadle hammer.

Flat bend the stock to a ring. Check against a



circle on the layout. Correct kinks and flats. Bend so scarfs line up and bear against each other.

Heat, flux, reheat and weld. Frequently flip hoop side to side while heating to even out the heat. Let weld area widen out as you weld and grind wide area back to size.



Straighten area around weld to even out the circle. Lay flat on anvil and stretch an area to straighten out a dip in the edge.



Divide the circular hoop into quarters with the 4 leg square.



At each mark use jig to transfer punch marks for rivet holes. Drill  $9/64$ " holes for rivets.

### Assembly

$3/16$ " rivets,  $15/16$ " long, 8 required  
Screws, 10-24, 1" long and nuts, 4 required

Use the 4 leg square to mark locations for holes for leg tenons. Center the holes between the scrolls. Center punch exactly on the centerline.

Heat with a torch and punch on the treadle hammer with a  $1/4$ " round punch. Drift with  $5/16$ " drift.

Lay top face down on a table, supported by blocks. Loosen screws of leg clamp and put on the top. Stick legs through the clamp and put tenons through the holes. Put hoop in place over the legs and use screws to hold hoop and legs in place. Tighten clamp screws to line up the legs. If necessary, use bungee to hold legs and clamp to the ring.



Turn table right side up and support one of the square corners on an anvil. Use a stand to support other side of the table.



Be sure ring is down flush to tenon base. Heat tenon where it comes through the ring.

Use a heavy hammer to upset the tenon in the hole for several blows. Be careful to upset



straight down. The tendency is to pull the tenon toward you. Move to opposite side if tenon is moving to one side.

Reheat and finish heading tenon with a ball peen.

Lay table horizontal over the tail of the anvil. Remove screws and replace with rivets. Put a rivet back up plate on the anvil. Upset the rivet with several sharp blows then use a header to finish it. Rivets under 1/4" may be headed cold. Head all the rivets. Run a drill through the holes if necessary to align.

Clean with wire brush. A small wire brush or flap sanding wheel may be used in a drill or die grinder to clean inside the scrolls. If there are any shiny spots from wire brushing or sanding and a clear finish is to be used then heat those spots with a torch to achieve a more even color.

### Center Decoration

Make a decorative element for the center. Make a flower or other decoration. It must be thin and have a hole in the center for a 1/4"

bolt. The bolt head must be low or it will be higher than the tenon heads. If necessary, bend the cross bars down slightly in the center.

Clean the decoration very clean with sandpaper, sandblast or power wire brush.

Coat top side with Klyr-Fire using a small



brush.

Sift on a heavy coat of medium clear fusing



flux, number 2030. Using the 2030 helps get a much smoother surface with the colored enamels. Rub fingernail along the twist to apply the powder.

Let dry or warm slowly with a torch from 6" or more away.

Patience is required here or a very low heat.



After all liquid is dry, start heating slowly with a low heat. A propane torch with a good burner usually will have enough heat to get the metal to a red heat, 1500°F.

Heat until the flux melts and makes a smooth surface. Heat one section at a time then move to next section. A soft flame is better than a very hot one.



Apply a coat of colored enamel with the sifter. Hold a clean sheet of paper under the sifting to catch any powder falling off. If the surface is rounded, let cool, paint on another coat of Klyr-Fire, then sift the color on. If the surface is flat, you can sift another coat or dif-



ferent colored enamel high lights on hot and heat until it melts and flows smooth. If the coating is thin, you can sift some more enamel on while piece is hot and heat until it melts.



Do not apply the flame to the top and keep all dirt and dust off the enamel. Bubbles usually mean there was liquid that didn't dry. The enamel is very brittle and will crack or flake off if hit, bent or dropped. Some enamels or some colors do not work well with steel and torch. Use opaque, unleaded medium expansion enamels.



All enamels and supplies are available from Thompson Enamels, P O Box 310, Newport, KY 41072, phone 606-291-3800, FAX 606-291-1849. A workbook and a sample of all their colors is available. Tell them Clay sent you.

## Finish

For inside use a wax, acrylic or polyurethane finish may be used. Outside will require a couple coats of primer (different colors to be sure of complete coverage) and couple coats of finish paint. The enamel surface does not require any finish but the underside should be protected.

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