

Fabrication instructions:

Designed and prepared by Robert Saine. February, 2010.

Materials used:

Ordered from Mcmastercarr.com

6061 Aluminum bar ½" x 2" X 36" -- Part # 8975K743

Lowe's

Hillman Stainless Steel Machine Screws Flat Head Phillips 10-24 x 2 inches.

H# 8811977 – pack of 5, 4 used.

5/16-18 Stainless Steel Hex Head bolt, 1/12" long and 5/16 SS Locknut, 2 5/16 SS Flat washers.

Home Depot

3/16" x 1 ½" "Tension Pin" - Steel, Zinc plated (2)

You will need:

Band Saw with Metal cutting blade

Drill Press – Drill Press vise and clamps.

15/16" drill bit – Metal cutting

Various drill bits for 5/16 threaded holes, 10-24 threaded holes, and 3/16 Tension Pin.

Bench mounted Belt / Disk sander with 80 and 120 grit disks and belts.

Thread Taps for 5/16-24 and 10-24.

Bench mounted Metal Vise – At least 6" throat.

Electric Orbital or vibrating sander

220 Grit emery cloth or sand paper (for Electric sander)

320 and 600 Wet Sand paper

Mother's Aluminum polish (or equivalent)

Drill mounted polishing / buffing wheel.

RED Loctite

Nylon Bushing from your stock shifter

Shift Peg from your stock shifter plus one more purchased – Dealer or E-Bay. If you desire you may want to use aftermarket shift pegs from Kuryakyn or other supplier.

Note: When drilling aluminum use a SLOW speed. Aluminum will get hot and bond to the drill bit if drilled at high speed. I have my drill press set at the lowest speed, 260 RPM.

Clamp the work piece onto the drill press table. You don't want it to wiggle around or wallow out. This is ESPECIALLY important when drilling the 15/16" holes. Make SURE your drill press table is Square at 90 degrees to the drill bit. Check both front to rear and side to side.

After drilling holes, remove burrs from the edges. I use a sharp piece of metal to scrape the burrs off.

I suggest making a copy of the template and gluing it to a file folder or similar piece of thin, stiff paper.

Then cut out the Shift Peg Rail and Shift Lever Arm and use these to trace the shape onto the aluminum.

Be very careful when handling the Aluminum bar stock. Any scratches, dents, or nicks you put into the flat sides of the bar will have to be sanded smooth before polishing.

1. Start with a piece of ½" x 2" Aluminum bar cut to 8 ½" long. This will be the Foot Peg Rail. Line it up and CLAMP it to your drill press table so you can Drill a 15/16" hole centered end to end and 7/8" from the top. (See the Template). After drilling check to see that the Nylon bushing is a slip fit into the hole. Lay the Foot Peg Rail Template on it and trace the outline with a black Sharpie pen. Cut the bar to shape using a Band saw. Cut on the outside of the line: Leave the line visible. You will fine sand it to

shape later. You will need to make some “relief cuts” to be able to make the sharper curves. Drill holes at each end of the rail for the Shift Pegs to screw into. (See the Template) I use a ¼” drill bit. Thread the holes with a 5/16-24 Tap.

2. Use another piece of ½” x 2” Aluminum bar cut 4 7/8” long. This will be your Shift Lever Arm. Drill a 15/16” hole centered edge to edge and 7/8” from one end. Line it up and Clamp it to the drill press table. After drilling check the fit of the Nylon bushing. Lay the Shift Lever Arm Template on it. Trace and cut the outline as you did with the Shift Peg Rail. Drill a 5/16” hole in the end of the Lever Arm. (See the Template). This is where the Shift rod from the Transmission will attach. It attaches with the 5/16” SS bolt, flat washers, and Locknut.

3. Now slide the bushing into both the Shift Peg Rail and Shift Lever Arm. Make sure they fit flush against each other.

4. Next you need to make the Outside and Inside spacers. From the ½” x 2” bar cut two 2”x 2” squares and Drill a 15/16” hole in the center of each. Remember to CLAMP. You can then use the spacer templates to draw the circle shape and cut them to shape on the band saw.

5. After drilling and shaping the spacers, slip the bushing through all 4 pieces. The order should be: Outside Spacer, Shift Peg Rail, Shift Lever Arm, Inside Spacer. Make sure they all fit flush together. The outside edges will be rough and uneven at this time. Don’t worry, you will sand everything flush and smooth later. The total thickness will be a little more than the length of the bushing. The inside spacer will need thinning. You need to “Test Fit” as you thin the inside spacer. If you have not already done so, remove your stock shifter. Re-install the foot rest support bracket. Now slide the bushing loaded with all 4 pieces onto the foot rest, and then slide the foot rest into the bracket. Do not re-install the Spring-clip on the end of the footrest at this time. Just insert and snug the Allen Bolt that holds the Foot Peg in place. If the bolt will not go in, the inside spacer is indeed too thick. The new unit should rotate easily on the foot peg, but not have more than 1/16” side to side play. Remove the new unit and use the disk and/or belt sander to thin the Inside spacer. Push the bushing inside the unit about ¼” so you don’t sand it as well. Sand only the outside face of the Inside spacer. Use 80 grit to take material off faster. Dip the piece in water often to keep the heat down. You don’t want to melt the Nylon bushing! Then use 120 grit to finish sand. Take care to keep the face flat and not sanded at an angle. The face should remain 90 degrees to the line of the bushing. The thickness of the spacer should remain uniform on all sides. Continue to test fit and sand until the proper thickness is obtained.

6. Now comes the real TEDIOUS part. The pieces need to be aligned and clamped together. It is Imperative to get the Shift Lever Arm at the proper Angle to the Shift Peg Rail. Look at the drawing. Mine are lined up at 55 degrees. Yours may be a little different depending on how you rest your foot on the foot peg. Here is how you determine your angle.

You will need someone to help with this. With the new unit mounted on the foot rest sit on your bike. You may want to put a piece of wood under your jiffy stand to have the bike sitting more upright. Place your feet on both foot rests in your normal riding position. Have someone rotate the Shift Peg Rail until the holes where the shift pegs mount line up with the bottom of your foot. It may be helpful to have the shift pegs screwed in at this fitting. They should be equal distance below the Toe and Heel of your foot, but should not touch either. Hold the Rail in that position. Now rotate the Shift Lever Arm until the hole in the end aligns with the hole in the end of the shift rod from the transmission. Use a Sharpie to mark a line on the edge of the Shift Peg Rail and the face of the Shift Lever Arm so you can return them to this alignment after removing them from the Bike.

Remove the unit from the bike.

7. Now it gets even more tedious! With the bushing inserted, Clamp the 4 pieces together **assuring the marks on the Rail and Lever Arm maintain the alignment determined in the last step.** I use two pairs of long nose Vise Grips, one on each side. However you clamp them, you will need to leave enough flat surface so you can keep the faces at 90 degrees to the drill bit on your drill press. To prevent the vise grips from interfering, I use a piece of 1 ½” hardwood to raise the face off the drill table. Drill four 9/64” holes completely through all 4 pieces from Inside spacer to Outside spacer. For proper spacing of the holes, check the template. The holes should be centered between the edge of the 15/16” hole and the outside edge of the spacers. They should be fairly evenly spaced around the spacer. **GO SLOW ON THE DRILLING.** Aluminum shavings will quickly accumulate inside the drilled hole. Withdraw the bit often to clean the shavings out. Remove any shavings that have bonded to the drill bit. After drilling the first hole, I insert a spare 9/64” drill bit into it to help keep anything from moving while drilling the other holes. I insert more 9/64” spare bits after drilling each hole. After drilling all 4 holes, mark the pieces so you can return them to the same position. If you rotate any piece now, the holes will not line up. You can remove the clamps and remove the Outside spacer. You will now thread the 4 holes in the outside spacer with a 10-24 Tap. Thread them from the inside surface to the outside. Insure you keep the Tap at 90 degrees to the face of the spacer. Set the spacer to the side. Clamp the other 3 pieces back together with the bushing inserted. Make sure the holes are properly aligned according to the marks you just made. Again, inserting some spare 9/64” drill bits helps. Now you need to enlarge these 4 holes with a 3/16” drill bit. This will allow the 10-24 bolts to pass through to the threaded outside spacer. Finally, remove the inside spacer. On the inside face (faces the foot peg bracket, not the Shift Lever Arm) counter sink the 4 holes 3/16” deep with an 11/32” drill bit. This will allow the heads of the 10-24 bolts to be flush with outside face of the inside bushing.

8. Now for some sanding. The edges of all 4 pieces will be rough. Sand the outside edges of all 4 pieces individually using the Bench sander. You can use 80 grit to start, and then 120 grit. Do not be too aggressive. All you want to do is get the deep gouge marks made from the band saw blade to disappear. Do not sand the faces of the pieces at this time. Keep the pieces with the faces at 90 degrees to the sanding surface and keep the pieces moving. Do not sand flat spots into the edges. I use the roller end of the bench sander to slowly smooth out the curves. Continue until the deep scratches are no longer visible. The edges should have a smooth, uniform sanded look.

9. Now slip all 4 pieces onto the bushing and bolt all 4 pieces together with the 10-24 bolts. Do not use Loctite yet, they will still have to come out before you finish. The bolts will stick out past the outside spacer. Again, don't worry; you will cut them off flush later. This is where it gets “creative” with the sanding. Using a 120 grit belt, sand the outside edges of the pieces until they are all flush with each other and the seams between them pretty much disappear. You only need to sand the areas where the edges are flush with each other. The areas where the Shift Peg Rail and Shift Lever Arm begin to extend past the spacers will not need sanding. Once you are satisfied everything is flush and smooth, it should look almost like a solid unit, not 4 individual pieces.

9. Now, take it all back apart. Time to sand the faces. You need to CAMBER sand the outside face of the Outside Spacer. See the template. I do this by rolling the edge at an angle on the disk sander, then the belt sander. There is no exact measurement or method to doing this, it is “by the seat of your pants” and visualizing. Do not get too aggressive on the angle. Just a little attractive rounding is all you want. Keep the spacer moving to avoid flat spots or obvious angles. Now sand the faces of the Peg Rail and Lever Arm. You do not need to sand the inside face of the outside spacer, or either face of the inside spacer. If you have DEEP scratches on the faces, you can lightly and CAREFULLY sand them on the flat bed of the belt sander using 120 grit, or finer if you have it. Don't sand ruts or gouges into the faces. After using the belt sander, finish sanding with 220 grit Emory paper. Or use 220 grit paper in an electric

Orbital or vibrating sander. Next sand everything with 320 grit Wet Sand, then 600 grit Wet Sand. All scratches should disappear.

10. Now insert the bushing and bolt everything back together. Use RED Loctite to secure the 10-24 bolts. Tighten them as tight as you can without stripping them. Use a Dremel with a Cut off wheel; or other suitable tool to cut the ends of the bolts flush with the outside spacer. Wipe any excess Loctite off. Finish sand the bolt ends flush with the Belt sander and 120 grit.

11. The face of the Outside spacer should still be mostly flat. It is time to insert the 3/16" Tension Pins. These provide lateral Sheer strength to the unit and lock everything solidly together. Place the unit on the Drill press table with the outside spacer down. Mark the location for the two 3/16" Tension pins (see the template). You will need to drill the 3/16" holes from the Inside spacer, at least 1 1/2" deep, but not completely through the outside spacer. Set the stop on your Drill press to prevent drilling too deep. The Tension Pins will barely penetrate the Outside spacer. This is OK; there is no shear force between the spacer and Shift Peg Rail. All the Sheer force is between the Shift Peg Rail and the Shift Lever arm. Drill one hole, and then insert the Tension Pin. I do this with a Vise. You can use a hammer, but a vise is much easier and drives the pin straighter. I pad one of the vise jaws with a piece of scrap aluminum and place the outside Spacer against this to keep from scratching it. Wit the Tension pin just sitting in the hole, start closing the vise so the other jaw is pushing the pin into the hole. Continue closing until the pin is completely inserted and flush with the inside spacer. Now drill the other hole and insert the second pin.

12. Getting close to being finished now. Actually, construction is done. The unit could be used as is. But it needs that finishing touch of polishing. The more work you do here, the better it will look. I have polished mine to the point it looks Chrome plated.

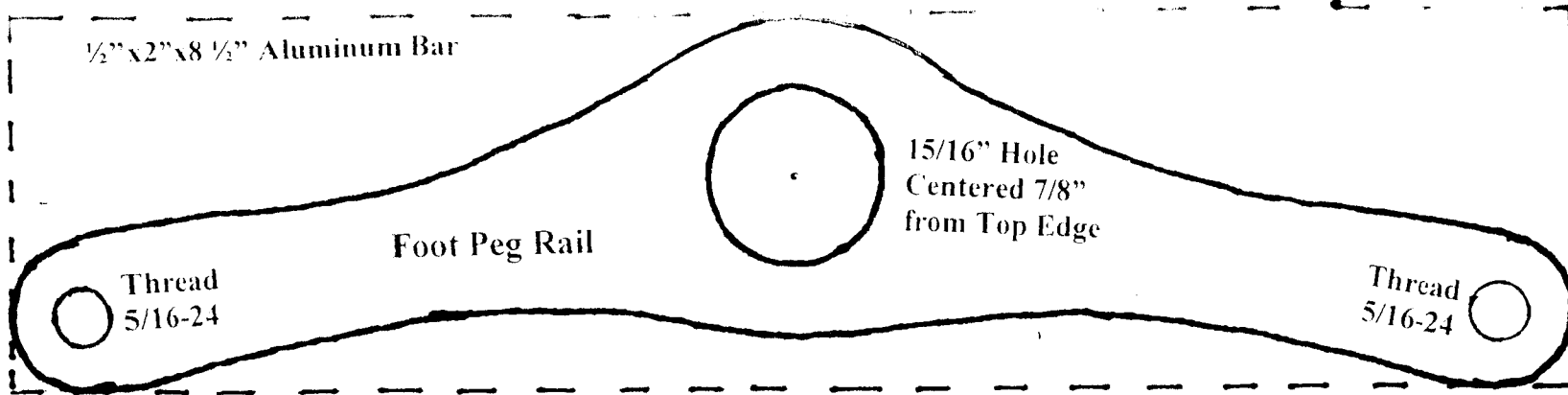
13. First step to getting that polished finish is to sand all the edges with 220 grit. Get ALL the scratches out. I use my electric sander for this. Next, wet sand the entire unit again with 320 Grit. Pay particular attention to any scratches or nicks. If you can see them now, they will really stick out when polished. Also, pay particular attention to the surfaces where all 4 pieces are flush with each other. If you sand enough, the joints between the pieces will disappear. Once you are satisfied with the smoothness of the surfaces, finish all surfaces with 600 grit Wet Sand.

14. Now for the final polishing. I use Mother's Aluminum polish. It is a polishing paste. You may have another brand you like, but it needs to be a polishing paste. I use a 5" polishing wheel mounted in a variable speed electric drill. I clamp the drill in my bench vise so I can use both hands. Start by rubbing some polishing paste into the polishing wheel. A little dab will do you, too much will just sling off all over the place. I start the drill very slowly and begin working the polish over the unit. After the polish is pretty well dispersed I speed the drill up to full speed and lock the trigger on. Just work the polishing wheel all over the surfaces, you will see the shine begin to come out. Keep polishing. If the wheel gets too dry, add a little more paste. Keep polishing until you are happy with the looks. You can not "Over polish". You can also polish the heads of the shift peg bolts, they will shine like chrome. Also, sand and polish the head of the 5/16" SS bolt that attaches the shift rod. (sand to remove the grading markings).

15. That's it, you are now ready to install the Shifter and enjoy riding. Make sure to use RED Loctite when installing the Shift Pegs. I did not re-install the spring clip on the end of the Foot Peg shaft. I keep a pretty close eye on the nuts and bolts on my bike. I don't think I will have trouble with the Allen Bolt coming loose. If you don't do regular maintenance of this type, you do need to re-install the spring clip. You can also adjust the angle of the shifter some by loosening the lock nuts and screwing the shift rod into or out of the rod end caps.

Enjoy – Robert.

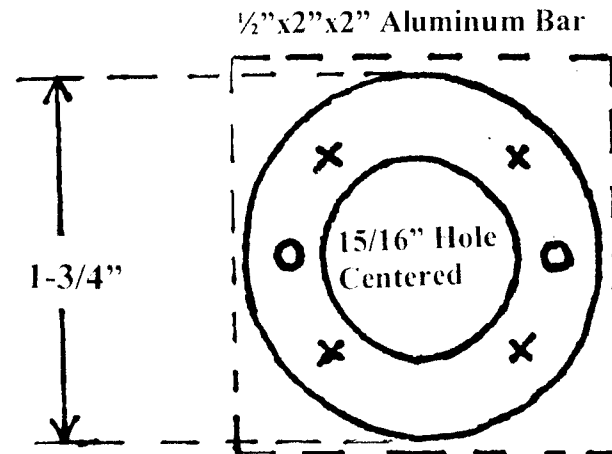
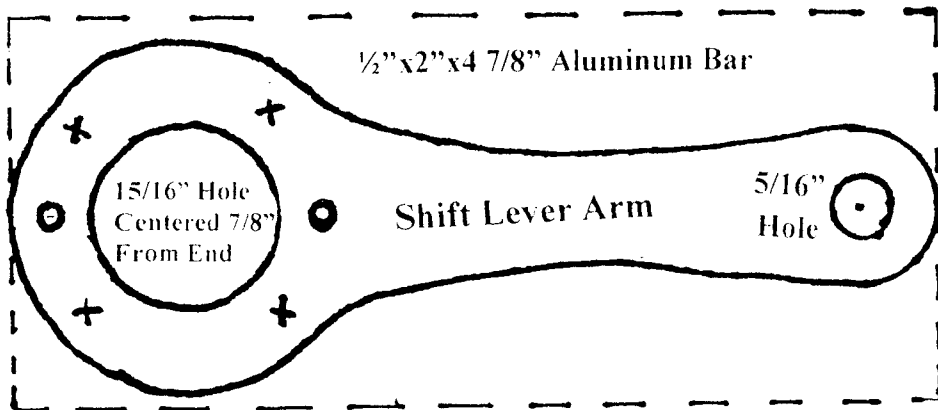
TOP



Harley Davidson Sportster
Heel/Toe Shifter

Designed and Drawn by:
Robert Saine
February, 2010

Inside & Outside
Spacers (make 2)



Note: X= approximate location for 10-24 Bolts
O= Approximate location for 3/16" Tension Pin



Outside Spacer
Camber Outside face

