

How to make tailwheel shock rubber donuts and aluminum shims with formed flange

The following shows how to form a flange on the inner hole of aluminum shims to go between the rubber donuts for the tailwheel shock absorber.

The forming tool is made of a short piece of 1-1/4" electrical metal tubing, two pieces of 3/4" thick oak, and four bolts. Two steel ball bearings are pressed through the hole to form the flange.

Shim material:

.040" 2024-T3 alclad aluminum sheet, \$15.76 2'x2' sheet, Aircraft Spruce and Specialty

Forming tool materials:

(4) 1/4" x 2" bolts, nuts and washers

8" 1x4 oak, \$2.31/ft, Home Depot

6" 1-1/4" EMT, electrical metal tubing, \$10.29 per 10 ft, Home Depot

1.25" steel ball bearing, \$2.98, McMaster-Carr

1.3125" steel ball bearing, \$14.98 pkg of 4, McMaster-Carr

2016 prices

The rubber donuts are 70 durometer and can be made from 3/8 thick sheet material from MSC Direct. Order one foot, part # 64211261, 36 Inch Wide x 3/8 Inch Thick, Buna N Rubber Sheet 65-75 Durometer, Black, 2500 PSI Tensile Strength, -20 to 180 Degrees F, Plain Back, Cut to Length \$124.60 per ft.

The rubber donuts can be made similar to rough cutting the metal shims, with a bandsaw and a center pin to spin the rubber around (see photos below). Cut the rubber into 4" (or 3-3/4") squares and then drill a 1/4" hole 1-13/16" from one edge. Mount a 1/4" pin centered 1-13/16" from the blade. Cut out a 3-5/8" diameter piece of plastic sheet (from a milk container or similar) and add a 1/4" hole in the middle. Put the rubber on top of the plastic so that it is easier to spin it around while pressing it down flat while cutting. If your rubber sheet is curled because it came off of a roll, then place it concave side down while cutting so the edge that is being cut is flat against the work surface. A 1/4" wide coarse tooth wood blade works better than a fine tooth metal blade. The center hole can be drilled with a 1-3/8" hole saw rubbed with candle wax. When using the hole saw, place the rubber concave side up, so the edges need to get pushed down flat on the work surface. This helps to keep the rubber from pressing against the sides of the hole saw and binding up.

I rough cut the aluminum shims out using a bandsaw. I cut out 4" squares and then drilled a 1/4" hole 2" from one edge. Then drill a hole in a board 2" from the edge and clamp the board to the bandsaw. Now the aluminum squares can be spun around a 1/4" pin and cut to rough 4" diameter. Be sure to keep the protective plastic on the aluminum and cut them out with the plastic side down or else the aluminum will get very scratched. Cover the surface of the aluminum sheet with tape if there is no plastic on it.

The final size is approximately 3.85" diameter. That dimension is not critical, but minimum variation from one part to the other is important because they want to fit into the forming tool without free play in order to have the formed flange come out the same height all around. I ended up bolting them all together through the 1/4" hole and turning 27 of them down to 3.85" all together. A lathe is not required. They could be placed over a pin in another board, one at a time, and sanded to final diameter. The board can be slid up against stops clamped to a bench with a belt sander clamped to the bench at the correct distance. Only 23 or 24 are needed but I wanted some extras in case I messed some up.



I used a 1-1/8" hole saw to cut the center hole. Then deburr. This makes a shallow (about 3/32"-1/8" high) flange, similar to what was in my plane. A 1" hole will make a taller flange, but it might need to have the aluminum annealed with a torch around the

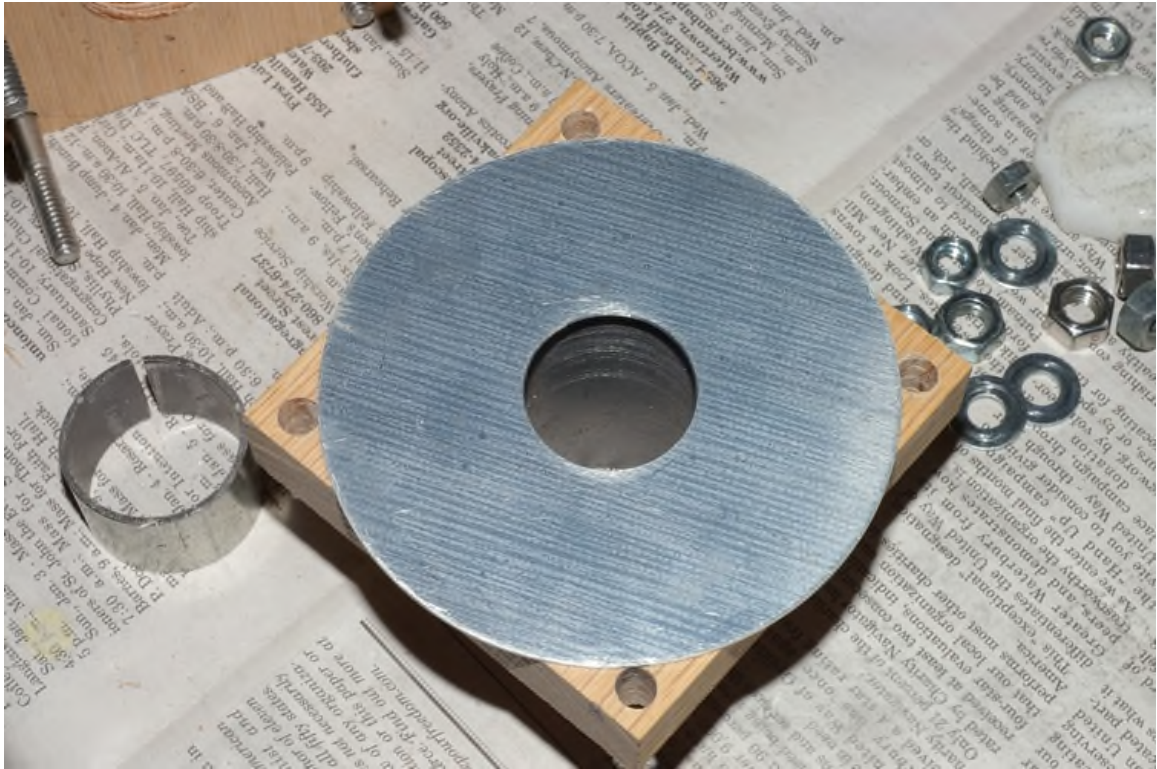
inner hole diameter in order to form the taller flange without cracking. I press formed four shims with a 1" hole and two of them cracked. I didn't try annealing, I just went with the larger hole and shallower flange for the rest of them.



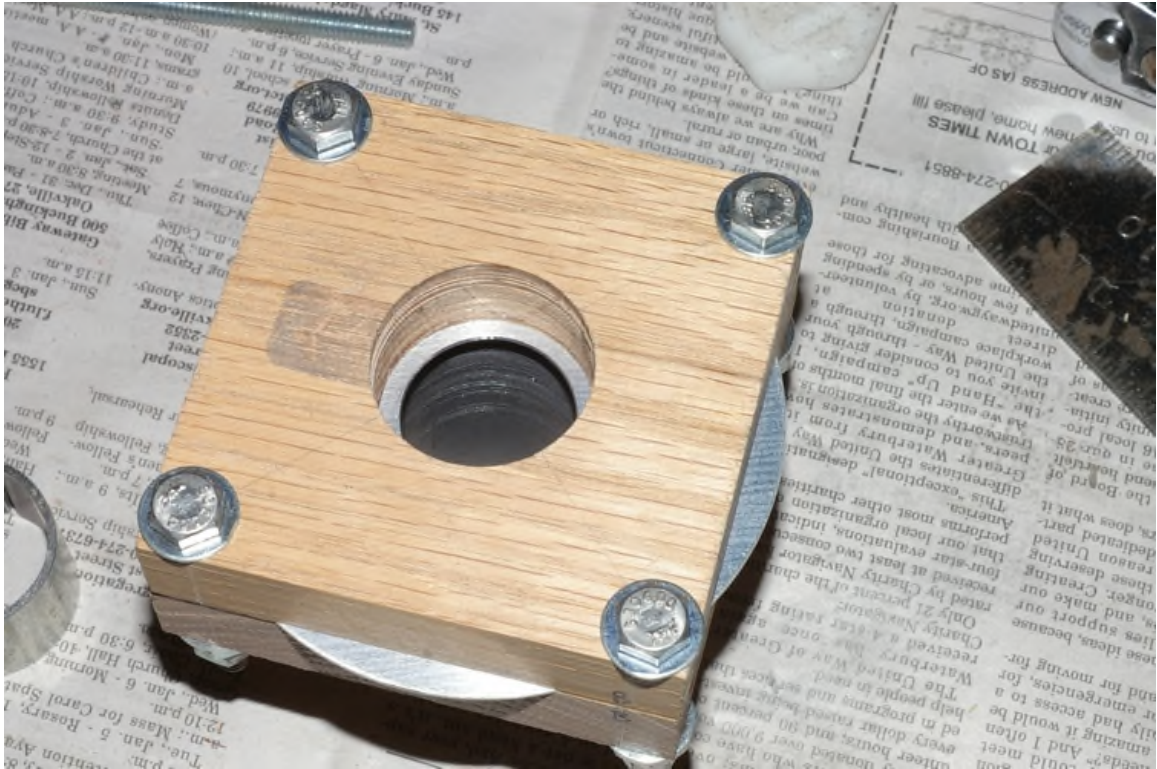
Disks ready for forming

A piece of 1-1/4" EMT tubing a few inches long is inserted into an oak board to make the forming tool. A 1-1/2" hole in the board made with a hole saw allows the EMT to be pushed in flush with the opposite face. The dimensions of 1-1/4" EMT are a little over 1-1/2" OD and a little over 1-3/8" ID. The inner edge of the EMT is quarter-round radiused across the full thickness of the tube to provide the bend radius for the aluminum shims. The other clamping board has a 1-3/8" hole. A short metal spacer is inserted in the 1-3/8" hole to keep the 1-1/4" ball bearing centered. The spacer is made from a short piece of the 1-1/4" EMT tube with a 3/8" wide slit cut out of it so it can be bent to fit in the 1-3/8" hole.





Clamp the aluminum shim between the oak blocks. When drilling the holes for the 1/4" bolts in the blocks, begin with them slightly offset toward the center and then carefully file or otherwise enlarge them so that the aluminum shims are centered on the large holes and with no play between the bolts and the aluminum.



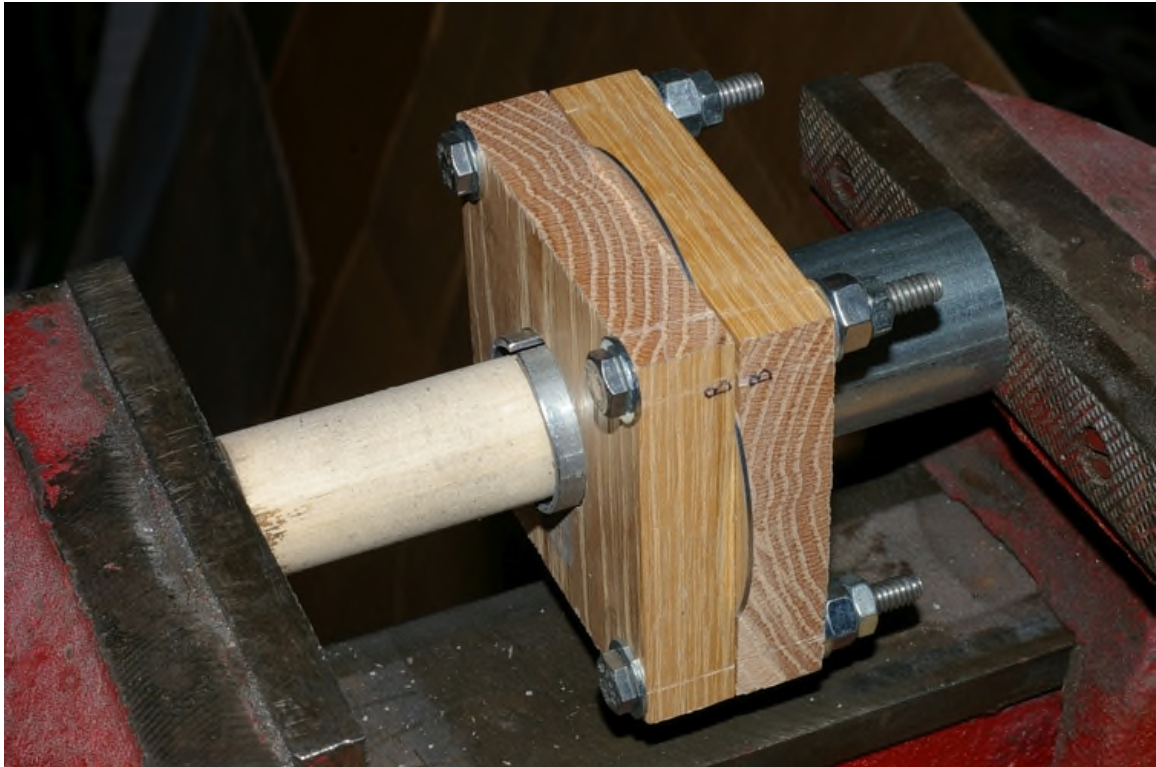


Install the slit EMT spacer in the 1-3/8" hole and apply wax to the 1-1/4" steel ball and insert into the hole for the first forming operation.



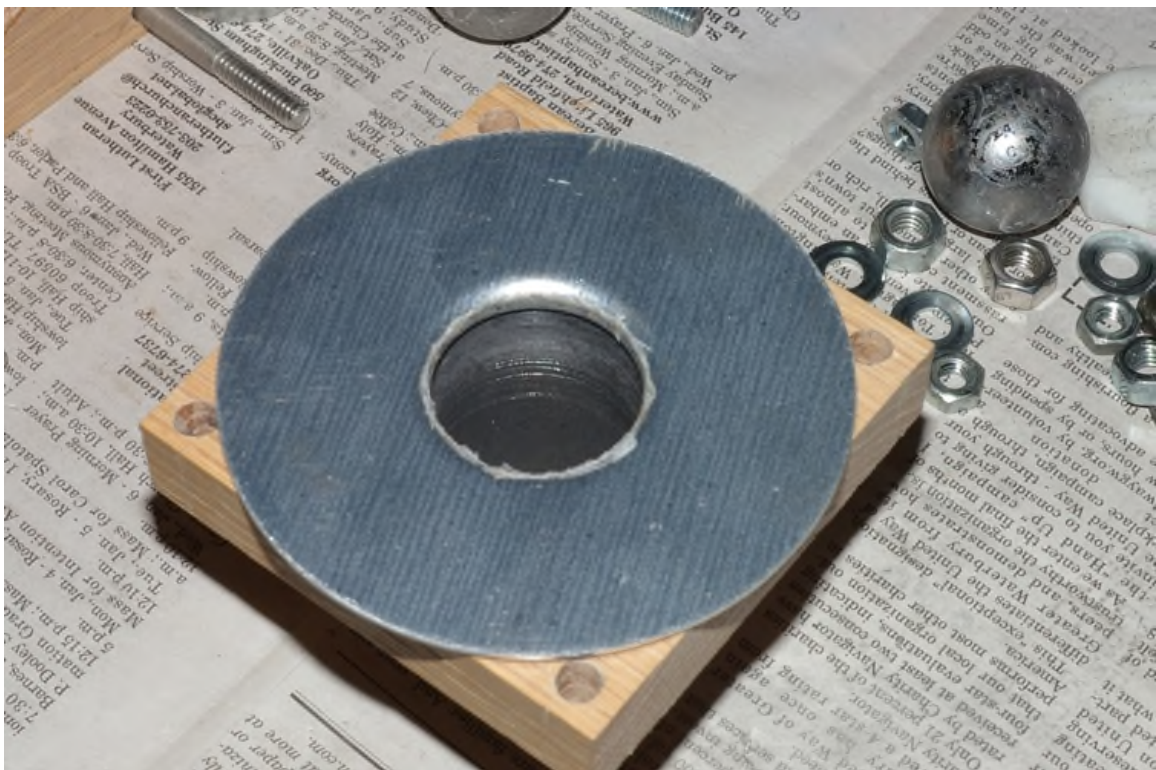


Cut a hollowed out depression in the center of a wood block or dowel to use as a pusher. Press the steel ball through the hole in the aluminum using a vise or heavy hammer.





Remove the slit EMT spacer and press the waxed 1-5/16" steel ball through. The formed shim will have a slight dish shape that can be flattened by putting a steel plate over top of the hole and squeezing the shim between the EMT and the plate in a vise or with a hammer.





Finished shims

