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Horizontal Mill Engine

This simple horizontal double-acting engine uses a sliding block reverse. There are no complicated linkages or precision cut-off, lead, etc., so let's get right to the construction.

The **BASE** is a simple, straightforward piece so no comments are needed.

On an accurate block for the **CYLINDER**, apply layout dye and lay out the centers for the two 6-32 holes, the bore and the port openings. Mount in

a 4-jaw and use a center test indicator and make the 1/2" bore. Mill and drill the port openings, drill and tap the 6-32 holes and steam connections.

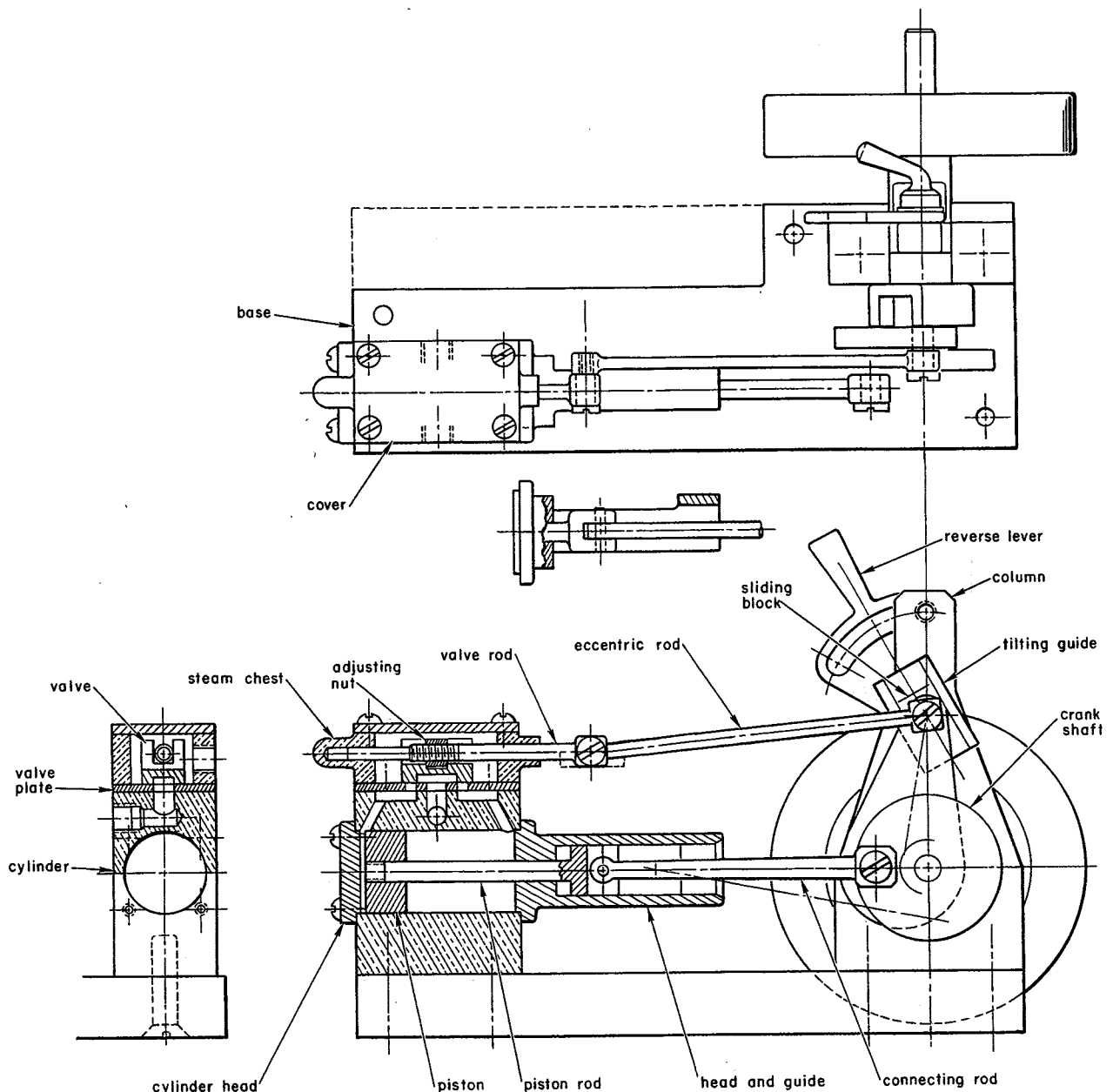
Make the **STEAM CHEST COVER** and **VALVE PLATE**. Lay out and drill the four screw holes in the cover and use it as a jig for the Valve Plate, Steam Chest and Cylinder Block.

The off-center bosses on the

STEAM CHEST are laid out and centered in a 4-jaw using the center test indicator.

The **PISTON** and **ROD** need no mention except the importance of concentricity.

The **CYLINDER HEAD** and **CROSS SLIDE GUIDE** are used to spot the holes in the Cylinder. The Cross Slide Guide starts out with 5/8" square stock about 2" long. Lay out and prick punch the center of one end



and center in the 4-jaw. Then turn the 7/16" diameter and 5/16" bore. Next, cut off and leave approximately 1/16" for finishing the face and dowel. Chuck in the 4-jaw on the 7/16" diameter, leaving enough room to use an indicator for centering to .001" or less. Finish the face, dowel and hole for the Rod. File or mill the Guides to the 1/4" dimension.

Make the **VALVE, VALVE ROD** and **NUT** of brass. This Valve should float on the Valve Plate. The steam pressure holds it down; there should be a few thousandths freedom to rise off the Valve Plate with close clearance in the fit of the nut in the Valve and on the Rod threads. There should be no binding between the Valve and Valve Rod and a minimum of play at the nut. The Valve Rod and **CONNECTING ROD** are made from stock long enough to hold in the 4-jaw and a little extra for a tail center hole. On the Connecting Rod, before parting, mill to 3/32" thick at the small end, then lay out the 3/16" diameter end and file to the line. The only comment necessary on the **COLUMN** is importance of squareness on the bottom and the Shaft holes.

The **CRANKSHAFT** is simple and straight-forward with a press fit and peening at the joint.

The **TILTING GUIDE** is a turning job which can be speeded up by sawing out the corners instead of making them into chips. Make the 1/4" slot using the tool post milling attachment.

The **SLIDING BLOCK** can be "oilite" or bronze.

The **ECCENTRIC ROD** can be turned from the solid or soldered. The 2-1/32" dimension and the parallelism of the .125" and 3-48 holes are important here.

The **REVERSE LEVER** can be turned out of the solid or a hub can be soldered to 1/16" stock. This is a layout and a filing job. The curved slot can be a series of drilled holes filed out or milled by rotating the piece by hand around a 3/16" pin held in the milling vise.

The **ECCENTRIC** is first turned in the four-jaw to 3/4" diameter and the .625 x 1/8" is turned to a fine finish. Offset the piece in the four-jaw .156", using the crossfeed collar to measure the distance. As a final check, clamp a smooth square-ended piece of stock in the tool post and bring it up against the high point of the offset. Rotate the spindle 180 degrees. A .312" diameter piece of round stock should just pass between. Bore for the Shaft and turn the hub.

Add a set-screw at the low point.

The **ECCENTRIC STRAP** is first laid out and prick-punched. While in the rough, chuck the part in the 4-jaw and bore the .625" hole to a close fit on the Eccentric. If you are working close and the metal is already narrow at this bore, ease off the chuck jaws so the bore will not be distorted on the final cut.

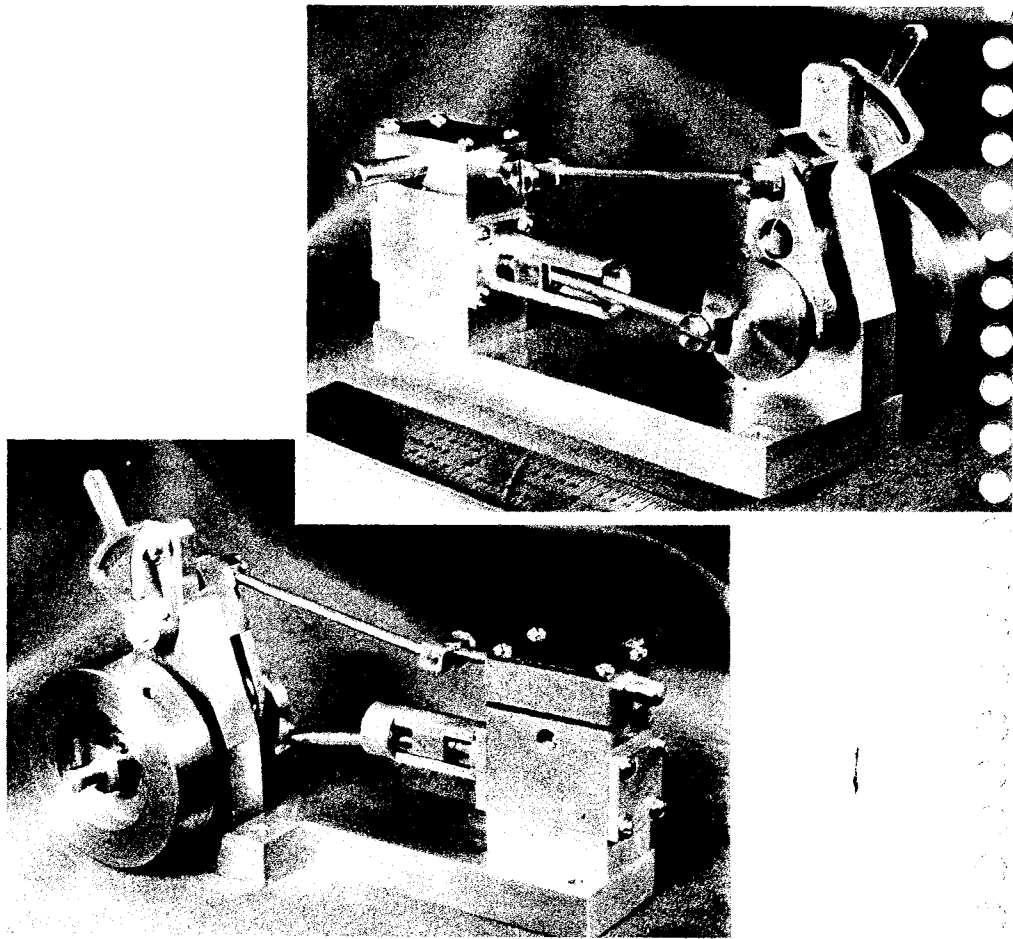
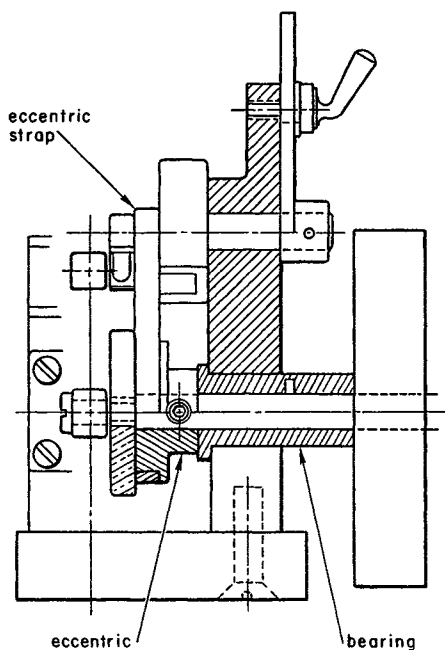
Make the **FLYWHEEL** next, about 1-3/4" diameter by 3/8" wide, fitted with a set-screw. The one shown is 1-1/2" and seems to be o.k.

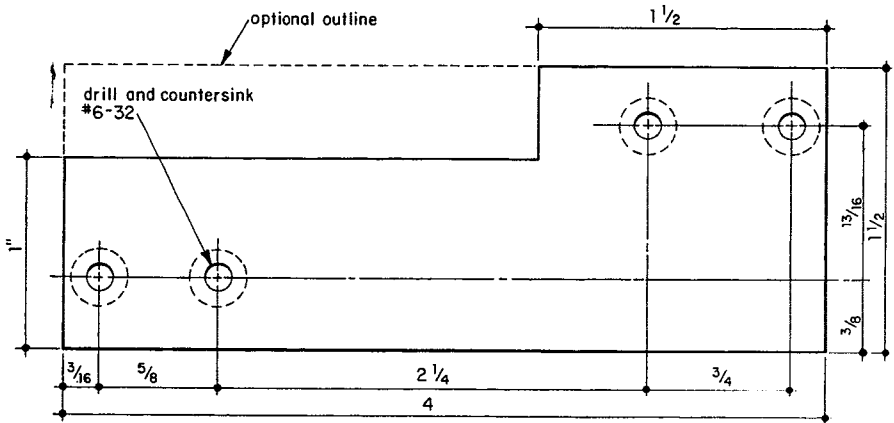
The **STEAM CONNECTIONS** are shown as 3/16" model taper pipe or 10-32 thread, but you can make them whatever is convenient.

The **ECCENTRIC OFFSET** must be on the centerline through the Crank Pin and Shaft and to either side of the Shaft.

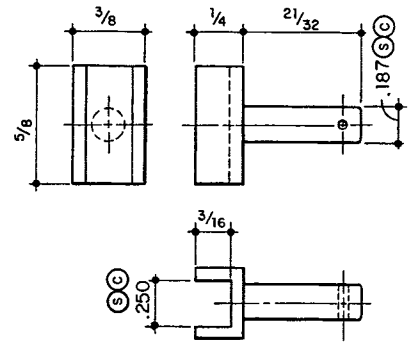
At final assembly, turn the Shaft until the Eccentric Rod is at one extreme and note (by looking through the steam connection hole) the position of the Valve nut. Turn to the other extreme. It should be equally opposite. Center the nut, if necessary, by removing the shoulder screw and rotating the valve rod.

So your Horizontal Mill Engine is now complete! It will make a good showing on as little as 5 to 10 psi air.

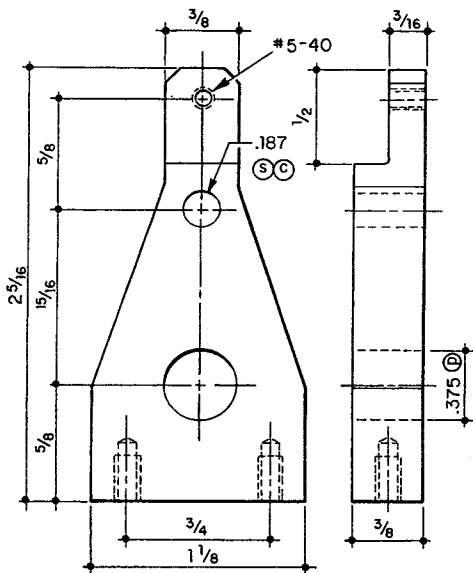




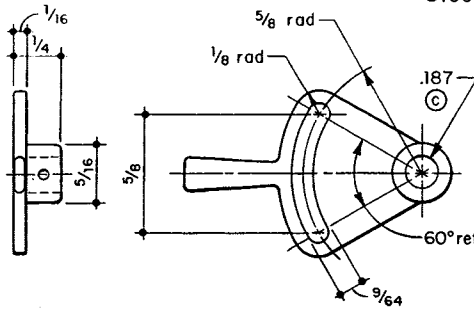
BASE - 3/8" thick
Aluminum or Steel



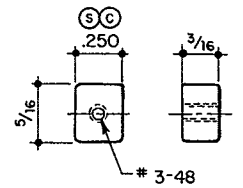
TILTING GUIDE
Steel



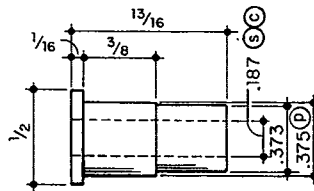
COLUMN
Aluminum or Steel



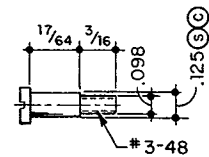
REVERSE LEVER
Aluminum or Steel



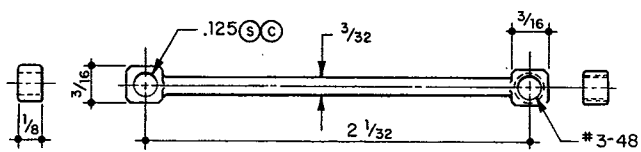
SLIDING BLOCK
Bronze



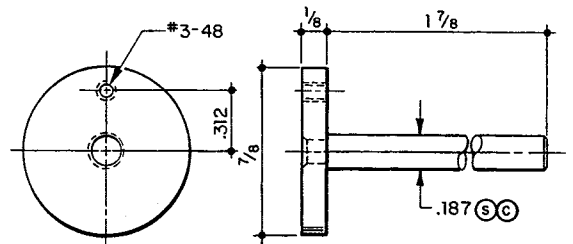
BEARING
Bronze



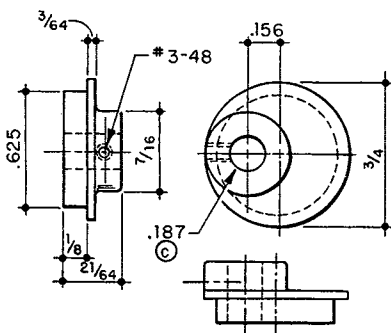
SLIDING BLOCK PIN



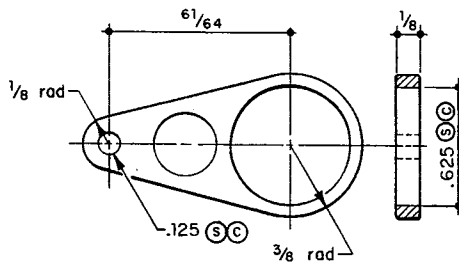
ECCENTRIC ROD
Brass



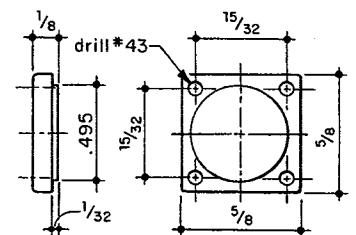
CRANK SHAFT
Steel



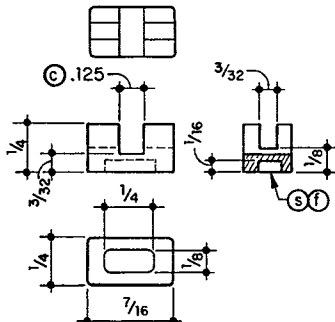
ECCENTRIC
Steel



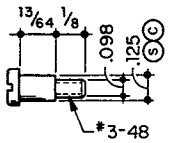
ECCENTRIC STRAP
Brass



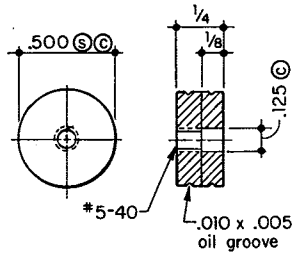
CYLINDER HEAD
Aluminum



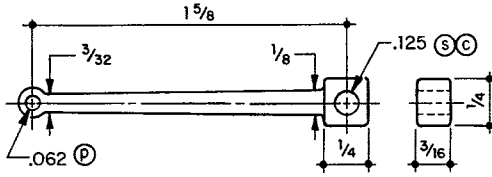
VALVE
Brass



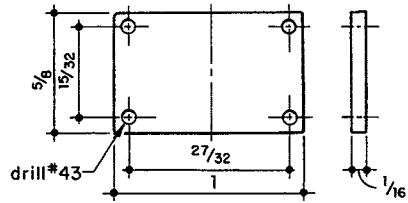
CRANK PIN
Steel-2 required



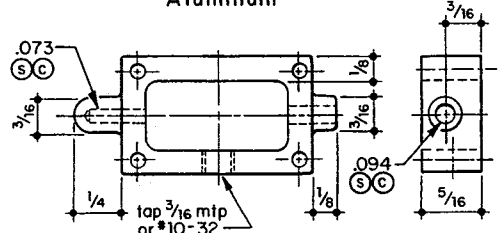
PISTON
Brass



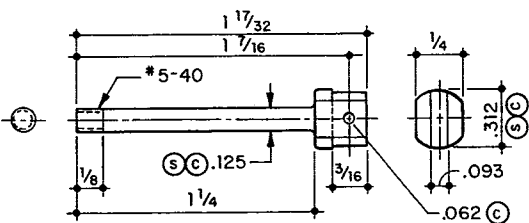
CONNECTING ROD
Brass



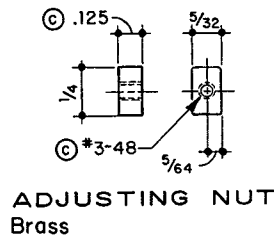
COVER
Aluminum



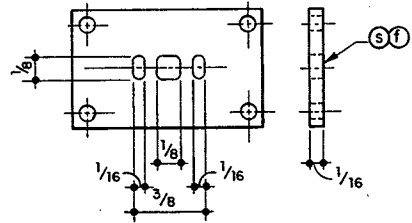
STEAM CHEST
Aluminum or Brass



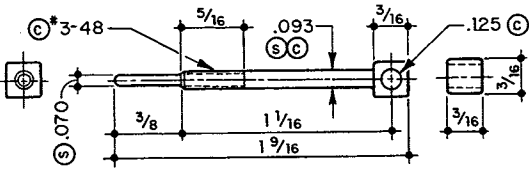
PISTON ROD
Brass



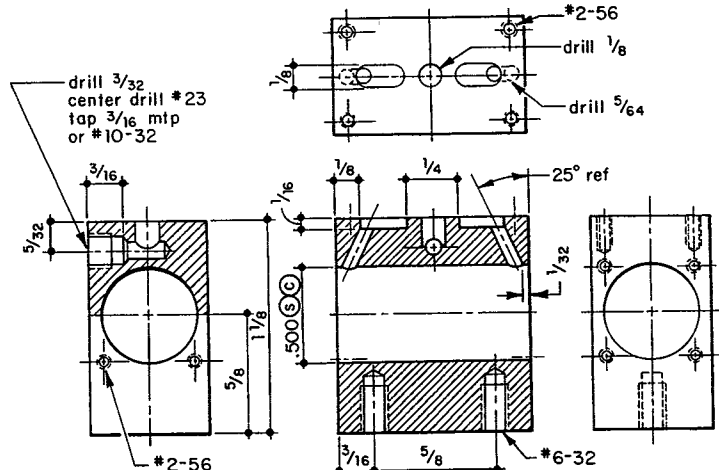
ADJUSTING NUT
Brass



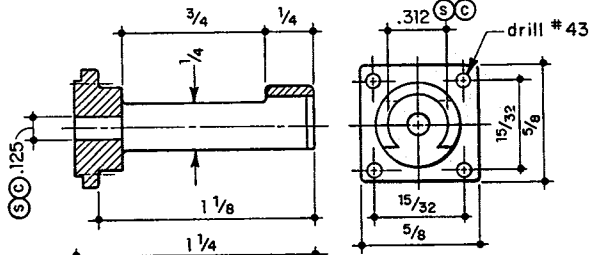
VALVE PLATE
Brass



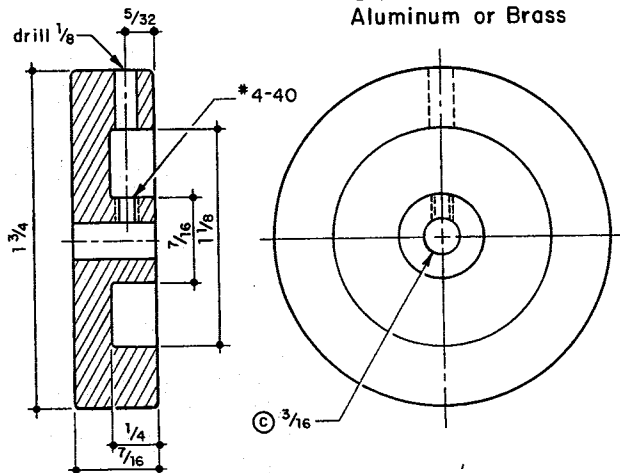
VALVE ROD
Brass



CYLINDER
Aluminum or Brass



HEAD AND GUIDE
Aluminum or Brass



FLYWHEEL
Any Metal