CHAPTER

35 Steam Pump

This pump is a bit more novel, even, than most steam pumps and offers the Machine Shop fan another engine to add to his collection. The design was suggested by Ralph Jarvis of Fenton, Michigan and the Ball-End Crank sliding in the Flywheel actuates the Steam Valve through an Eccentric and Rock Shaft.

The model shown is mostly aluminum. The Shaft, Eccentric and Flywheel are steel. All the tiny hardware is brass. You can adapt your own stock material as needed.

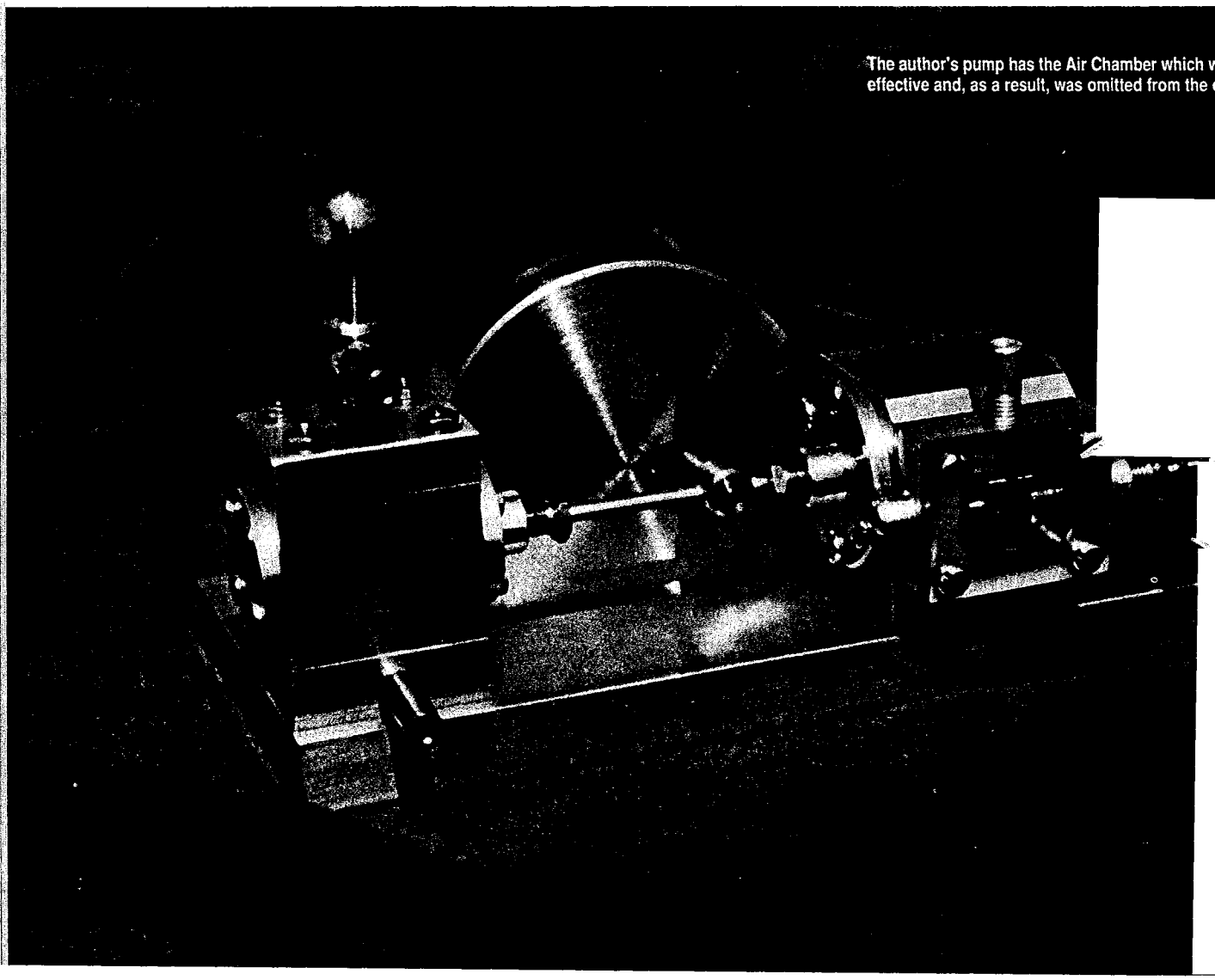
On the **STEAM CYLINDER**, the 3/4" height to the 5/8" bore must match the stack-up of the three pump parts.

The **CRANK ARM** shown was made by using a small ball-turning tool mounted on the lathe compound. The simplest method would be to purchase a ball from a supplier. Cole's Power Models lists bronze balls that can be attached to a rod as shown. Bore the Flywheel to a close fit on the ball.

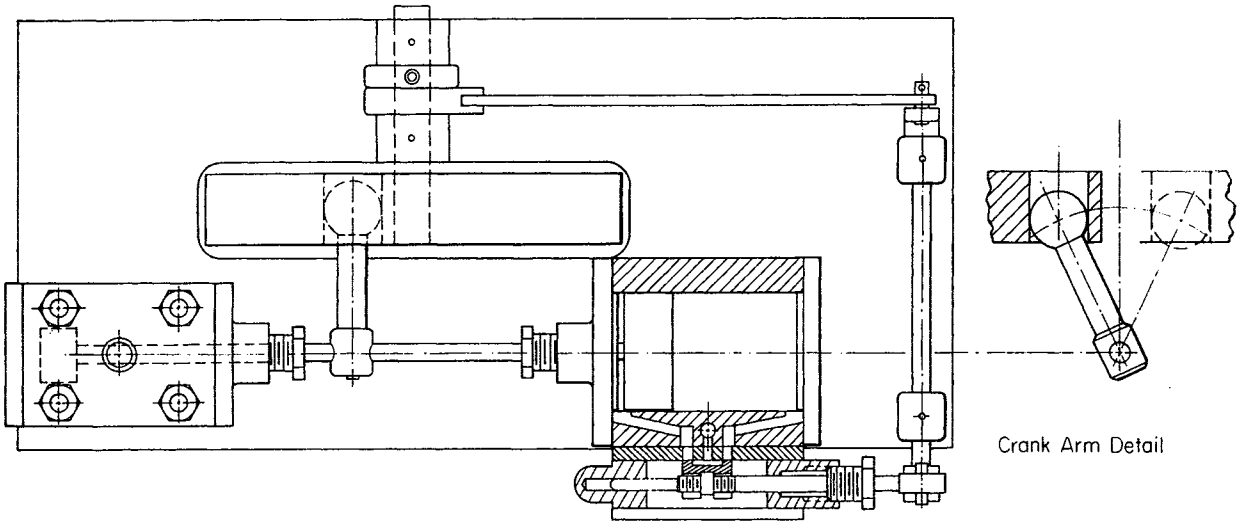
The **PISTONS** and **ROD** are simple. Quite a bit of thought was put into the Pump Piston. The model was to be run on compressed air, using 3/16" aquarium tubing, and it was to pump water. Then the problem of material and sealing suggested tiny cup rings and a two-piece Piston. All was put aside and a straight cylindrical Piston without rings or any fussing was used. The pumpage would be common medicinal mineral oil which is clean, a lubricant, non-corrosive, and odorless. It works fine! The oil used was labeled "heavy" but it would be better to use a lighter grade.

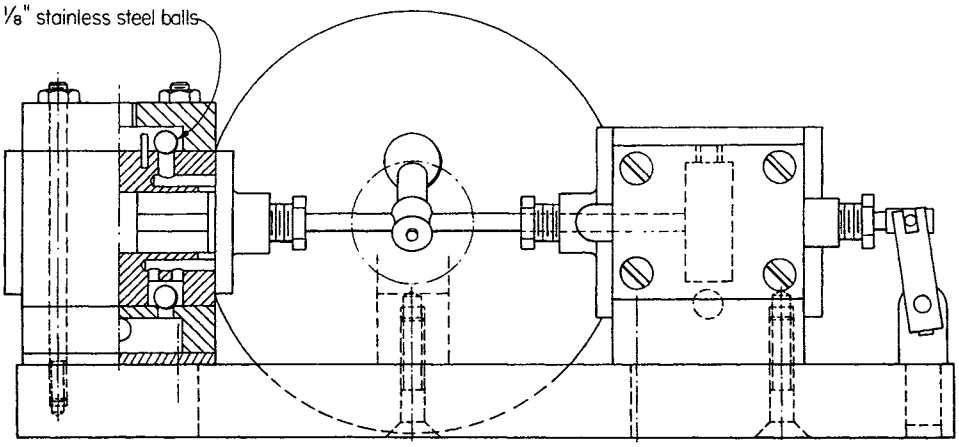
The **BEARING** is brass and the Eccentric is a close fit, acting as a collar to control the end-play in the Flywheel Shaft.

For the **ECCENTRIC**, turn to 1/2" diameter and bore the shaft. Mount a square-ended bar in the tool post and squarely bring it up against the 1/2" diameter. "Zero" the cross-slide collar and rotate the chuck so two jaws are horizontal. Loosen the ver-



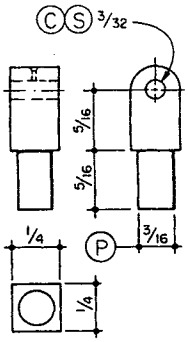
The author's pump has the Air Chamber which wasn't too effective and, as a result, was omitted from the drawings.



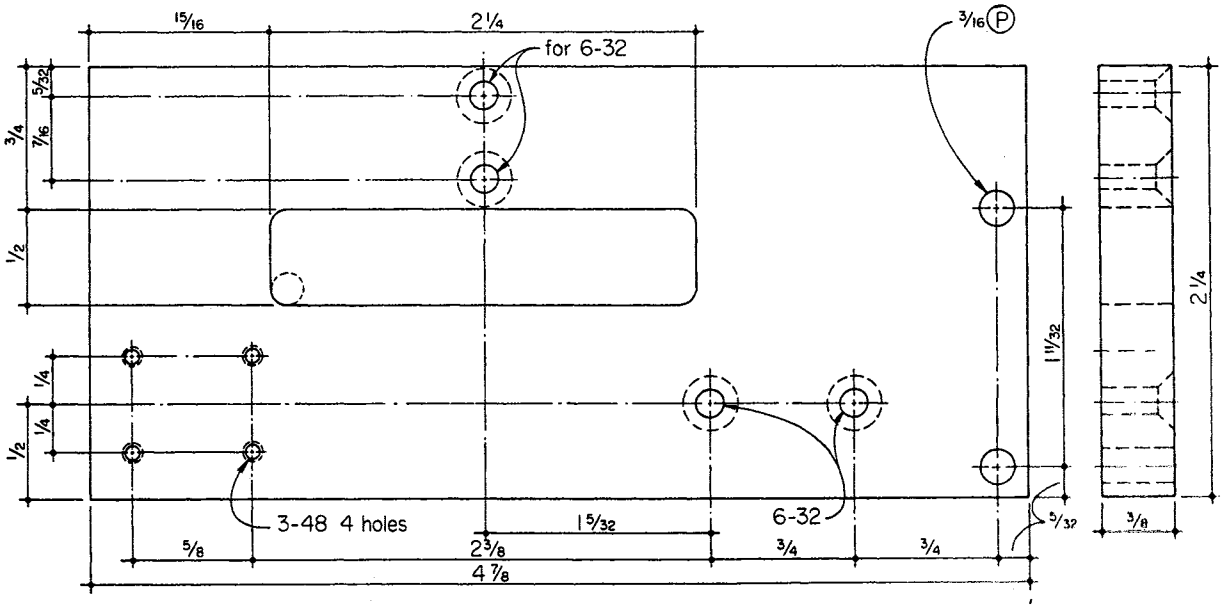


EV/jjw

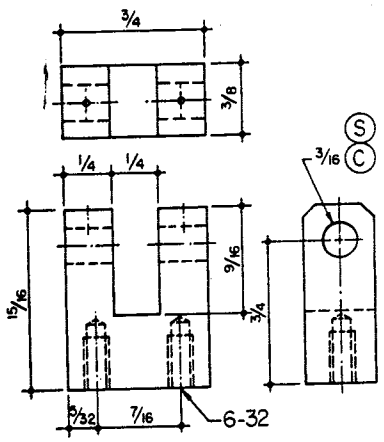
STEAM PUMP



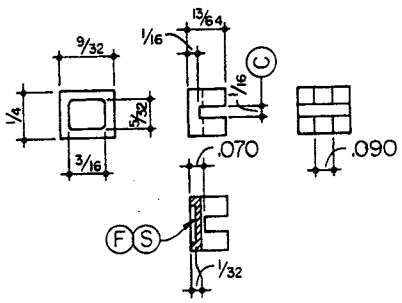
ROCKSHAFT BEARING
2 Required



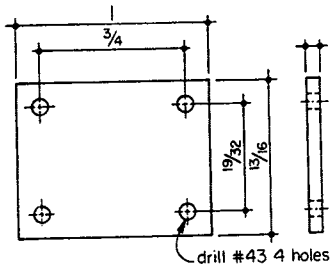
BASE



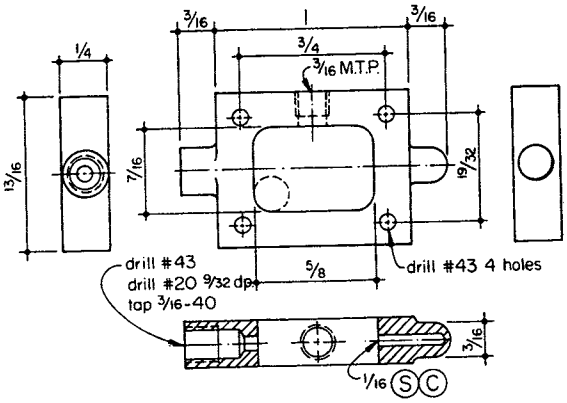
BEARING



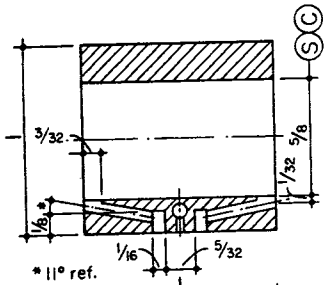
VALVE

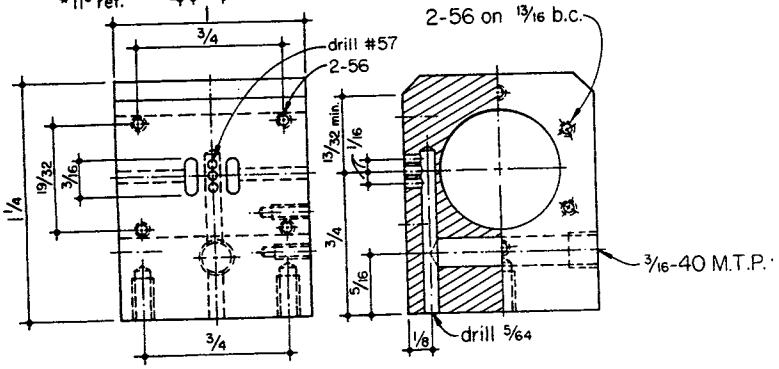


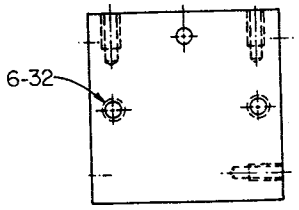
COVER



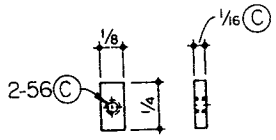
STEAM CHEST



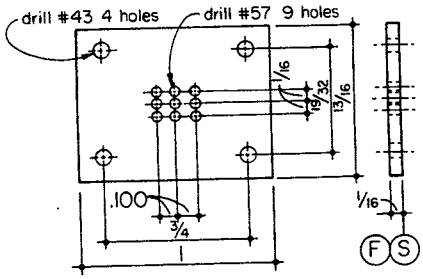




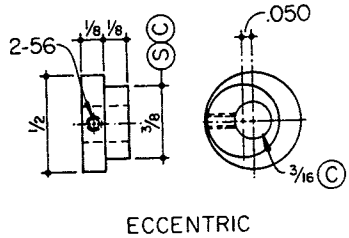
STEAM CYLINDER



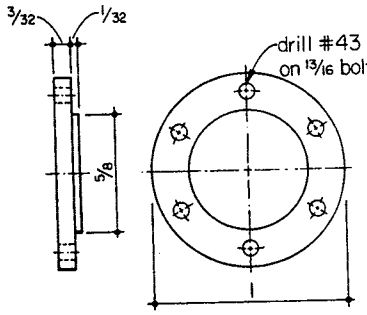
VALVE NUT



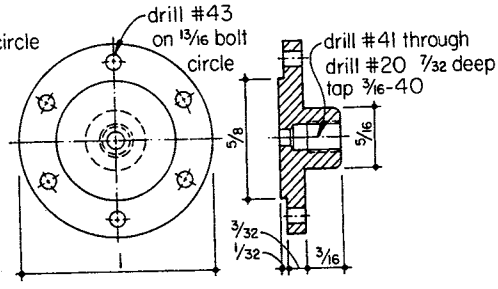
VALVE PLATE



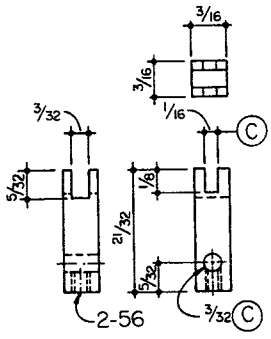
ECCENTRIC



OUTBOARD HEAD - STEAM

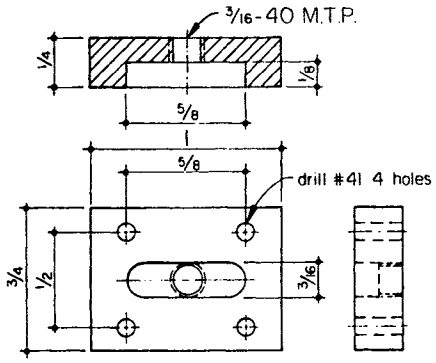


INBOARD HEAD - STEAM

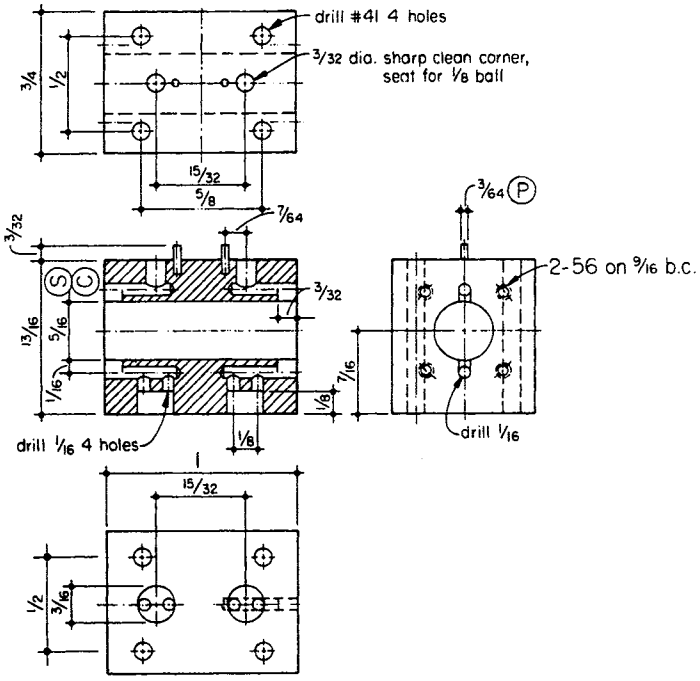


FORK

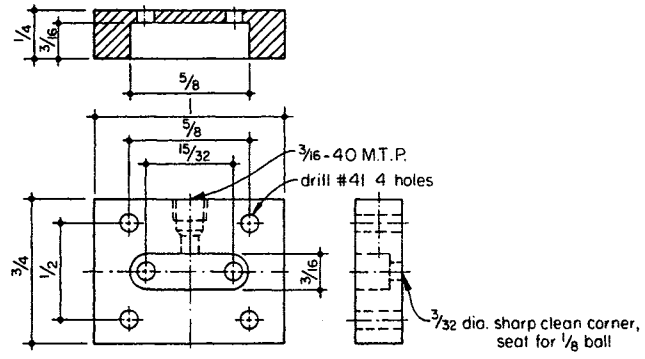
EW/jw



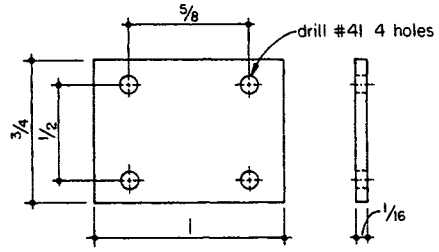
UPPER VALVE CHAMBER



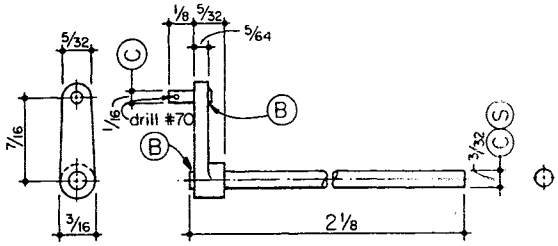
PUMP CYLINDER



LOWER VALVE BLOCK



EV/jw PUMP FOOT PLATE



ROCKER SHAFT

tical jaws slightly. Back up the rear jaw about 5/64" and feed the front jaw in, forcing the piece back about 1/16". Turn the cross-slide in .050" and ease the piece back against the bar, using the rear jaw. Now, when the high spot just kisses the bar and the chuck is rotated 180°, a .100" diameter rod should just pass between the bar and the stock in the chuck. Snug up all the jaws and turn the 3/8" diameter to a close fit in the Strap.

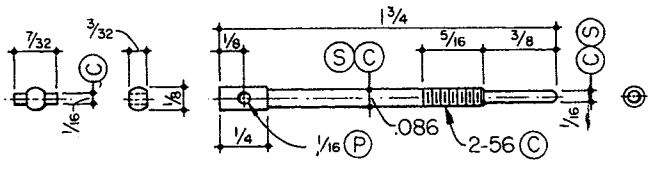
When making the **VALVE, VALVE ROD** and **NUT**, try for close but free fits. That is, the Valve should float on the seat, held there by steam pressure and not bind against the Rod. Try for a minimum of shake in the 2-56 threads.

On the **STEAM CHEST,** turn the gland end and, very carefully, drill the 1/16" hole — preferably with a new drill at a high spindle speed. Withdraw the drill very often and add a bit of "Liquid Wrench" each time. Counter-drill and tap 3/16-40. Carefully-drilled holes will have to serve unless you have reamers in these sizes.

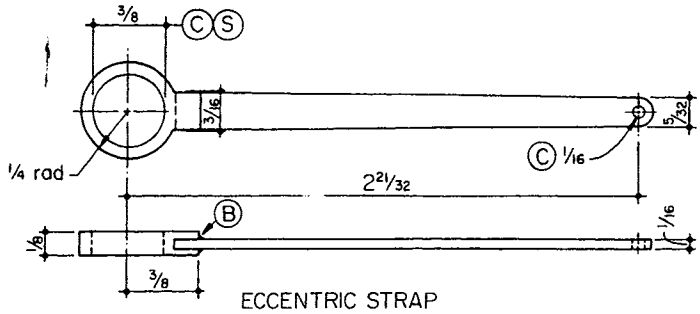
The **ECCENTRIC STRAP** is a brass end, bored and filed to shape and soldered to the flat bar. After soldering, dress the edges to a neat outline and locate the 1/16" hole 2-21/32" from the center of the 3/8" bore.

The **VALVE ROD** is made from 1/8" rod, chucked in the 3-jaw and supported by the tailstock center. Plan enough stock length for chucking and to cut away the tailstock center hole later. Mill the flats, drill and fit the 1/16" x 7/32" Pin.

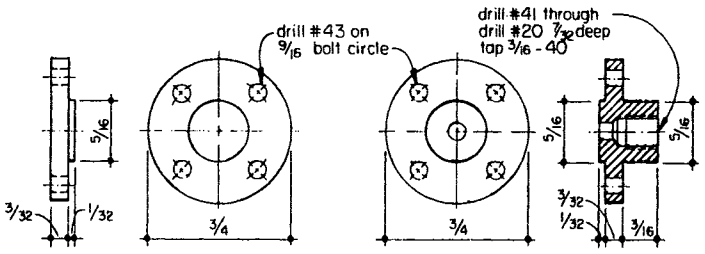
On the **PUMP CYLINDER**, the 3/16" diameter x 1/8" deep holes require a square-ended drill, **D** bit or an end mill. Try to hold the 1/8" depth, as it controls the amount the Ball Valves can rise. All the remaining holes are simple operations



VALVE ROD

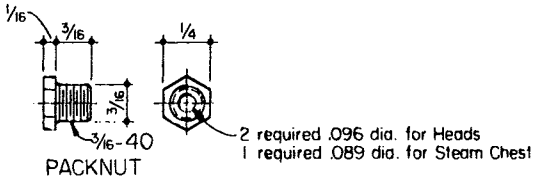


ECCENTRIC STRAP



OUTBOARD HEAD - PUMP

INBOARD HEAD - PUMP



PACKNUT

except the holes for the head screw. Take them very easy as they break into the tiebolt holes. You may have to file about 1/64" off the head screws. Stainless steel balls are used as Valves. The seats were made by using a hard steel ball, a bit of brass rod and tapped a light hammer blow. The 3/64" pins are required to keep the balls in the Valve area so they will always fall back onto the seat.

The **UPPER VALVE CHAMBER** is straight work with no problems. A 3/16" end mill is required. Again, hold the 1/8" depth.

The **LOWER VALVE BLOCK** requires seating as on the Cylinders.

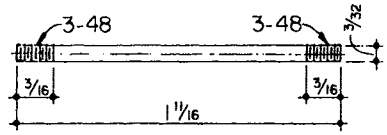
The **AIR CHAMBER** was an after-thought since Piston Pumps have a pulsating flow ... but it wasn't much of an improvement.

When setting the Eccentric, spot the Flywheel ball socket on the vertical centerline. Tighten the Eccentric with the centerline through the throw, 90° from the Flywheel socket centerline. That is, with the Piston at midstroke, the Valve should be at one end, completely exposing one set of Valve holes. For fine adjustment, turn the Valve Rod 1/2 turn and rotate the Flywheel each time until the Valve holes are equally exposed at each end of the stroke. A final tiny bit can be adjusted by rotating the fork on the Rock Shaft.

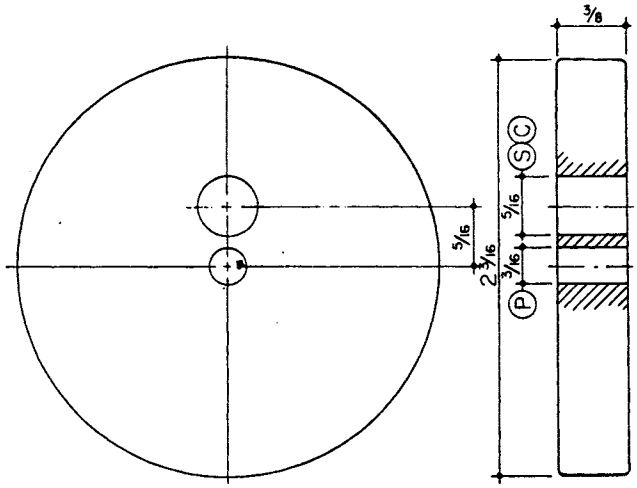
The 5/8" Steam Piston has four times the area of the 5/16" Pump Piston, resulting in 1 psi of steam exerting between 3 and 4 psi on the Pump.

On trial, about 5 psi of air ran the Pump with a fair flow of oil.

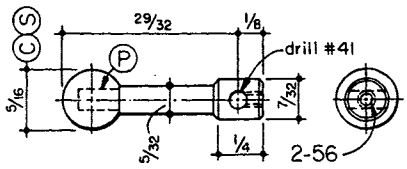
Here's another project to keep you busy for a few evenings ... and it will fascinate you and your friends for hour after hour in the years to come.



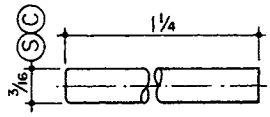
TIEBOLT - 4 required



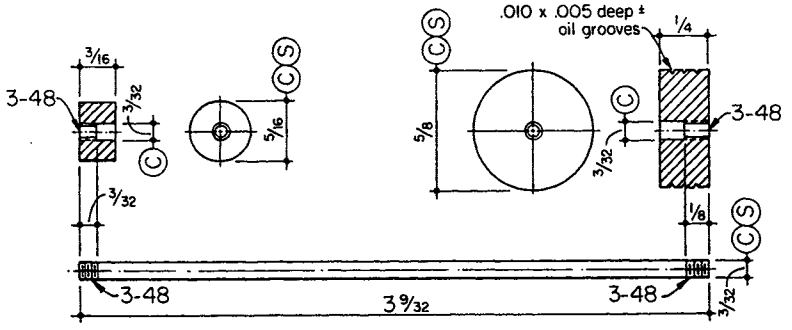
FLYWHEEL



CRANK ARM



SHAFT



PISTONS AND ROD

EV/JJW