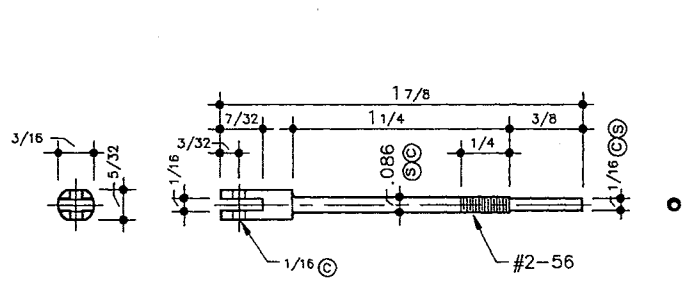
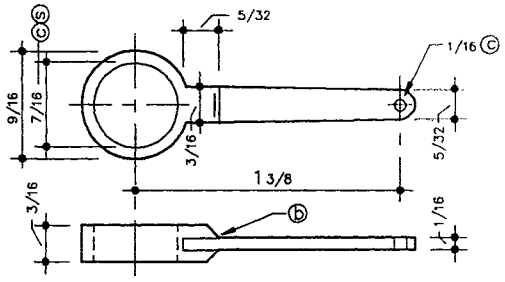
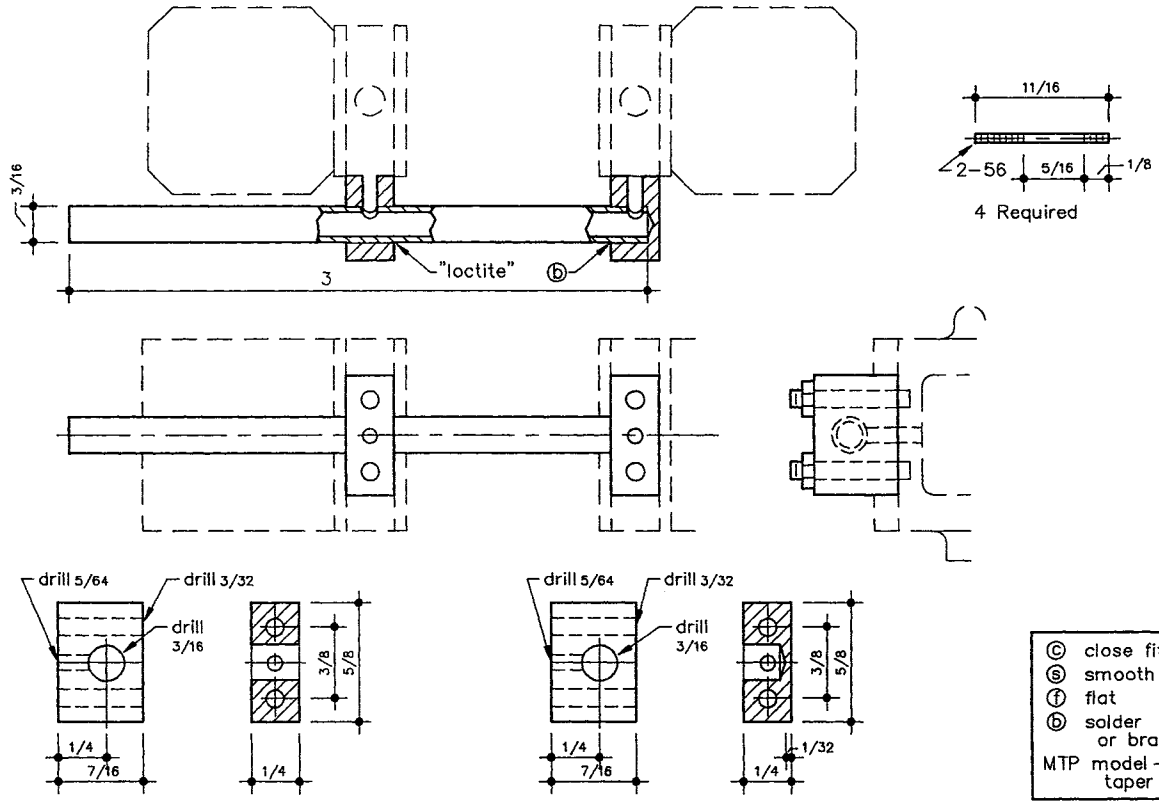


VALVE ROD
Brass
2 Required



ECCENTRIC STRAP
Brass
2 Required



STEAM INTAKE MANIFOLD
Brass

Packing to both Pumps. This takes a bit of patience, some tweezers and time. Perhaps you can add the Packing earlier and carefully withdraw the Plungers and reinsert when mounting the Table assembly. A radius or short taper on the ends of the Plungers will help.

Slide the Crank Shaft through the Bearing, one Eccentric, Eccentric Strap, Flywheel, the other Eccentric and Strap and the other Bearing. Leave all these parts loose for now.

Draw the Shaft flush with one Bearing face. Hold a Crank Arm in place and push the Shaft through it until the Shaft is flush with the other Bearing face. Hold the other Crank Arm in place and push the Shaft back through it. Spot the Crank setscrews on the Shaft flats and tighten. Make sure the Shaft turns free.

Insert pins through the Valve Rods and Straps. Snug up the Eccentric setscrew only enough to drive the Valve Rod. Adjust the Valve Rod until the Valve holes are equally exposed at each end of the stroke. Bits of fine copper wire can be inserted to retain the pins. Attach the Steam Chest covers.

Tighten the Flywheel midway on the shaft. Insert the two crank shoulder screws. Rotate the Flywheel until one Piston is at extreme dead-center and tighten its Eccentric 90 degrees from the crank. Do the same with the other Eccentric either to both lead or both follow its crank.

Ten to 15 pounds of air drives this engine easily. Clear, light mineral oil was chosen for pumpage. It prevents rust and lubricates. Actually, the engine runs too fast to depict the working of the large pumping units in the city waterworks. It is hard to slow down. A heavy Flywheel helps to reduce the speed a bit, so if you make a Flywheel, make it heavy. You may be able to add 1/4" to its diameter. See the detail photos on page 79.

CHAPTER

17 Pumping Engine

The general idea for this engine came from an old illustration sent in by Chuck Sleppy from Troy, Ohio. The yoke type of piston rod transmits the steam pressure directly to the pump. The connecting rods are light duty, mostly for the purpose of timing. This engine was first made in 1981 with double-acting pumps. The pumps were not satisfactory and the engine was set aside. Later, they were cut down to single action. There was no improvement until now with this design. The Pumps now are bare Cylinders with separate outside Valves piped to them. The passages and Valves are larger and they pump a good stream. Overall, this Pumping Engine resembles the old city waterworks pump with catwalk, railings and ladder. The parts are generally not difficult to make.

There are four **COLUMNS** that are related to five parts, the **FLOOR, BASE, CATWALK, BEARING BEAMS** and **TABLE**. The Columns should be as near alike as you can make them. Flathead screws are used top and bottom so the lower or upper section of the unit can be removed and serviced. There are hole patterns on all five parts that are related and can affect assembly and alignment.

The **FLOOR** is plain blue anodized aluminum on the model shown, with 1/2" squares scribed to resemble floor tile. You may use any material you wish.

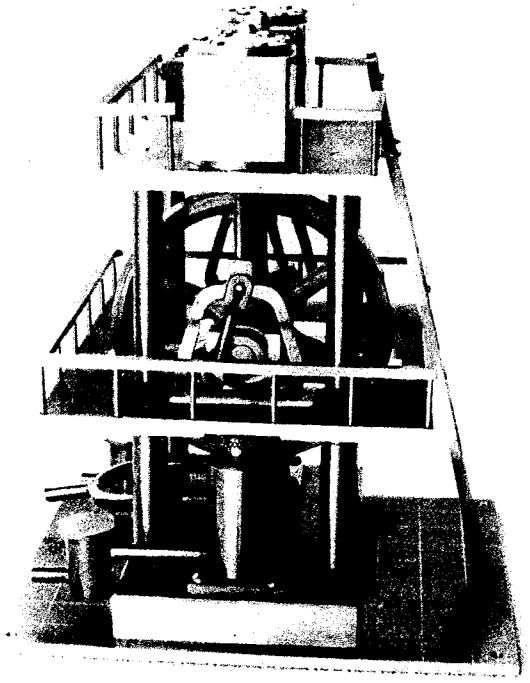
The **BASE, BEAMS, CATWALK** and **TABLE** require careful but not difficult layout, drilling and tapping. A series of drilled holes joined by straight saw cuts and filing form the center openings in the Catwalk.

On the Catwalk and Table a series of 1/16" holes are drilled for the **RAILING** (if you choose to add the Railing and Ladder). The Railing pieces are notched, bent and soldered, then the hole patterns in the Catwalk and table are duplicated on the Railing. On the model shown, all the 1/16" pins were set in the Railing with Loctite and set aside. At assembly, Loctite was used in the lower ends of the pins. 3/32" square brass was ordered from a supply house but it was out of stock so 1/8" stock on hand was cut into 3/32" strips. The 3/32" x 1/8" Rails look OK.

The **LADDER** construction is similar to the Railing. The method of mounting the Ladder with 1/16" pins permits the Ladder to be eased up and out for service or repair. The Railing and Ladder add quite a bit to the appearance though the proportions may be challenged. A miniature man of a size to match the Ladder may not match the Railing height. You will probably have some good ideas along this line.

The steam **CYLINDERS** are 1" cubes. Before making the 1/2" bore, mill the 1/16" x 3/16" ports and then drill the 1/16" holes at 11 degrees. The **HEADS** can be used as jigs for spotting the 12 bolt holes. Keep the bolt pattern parallel to the valve face for sake of the steam manifold and valve rod.

For the **STEAM CHEST**, lay out all lines and centers

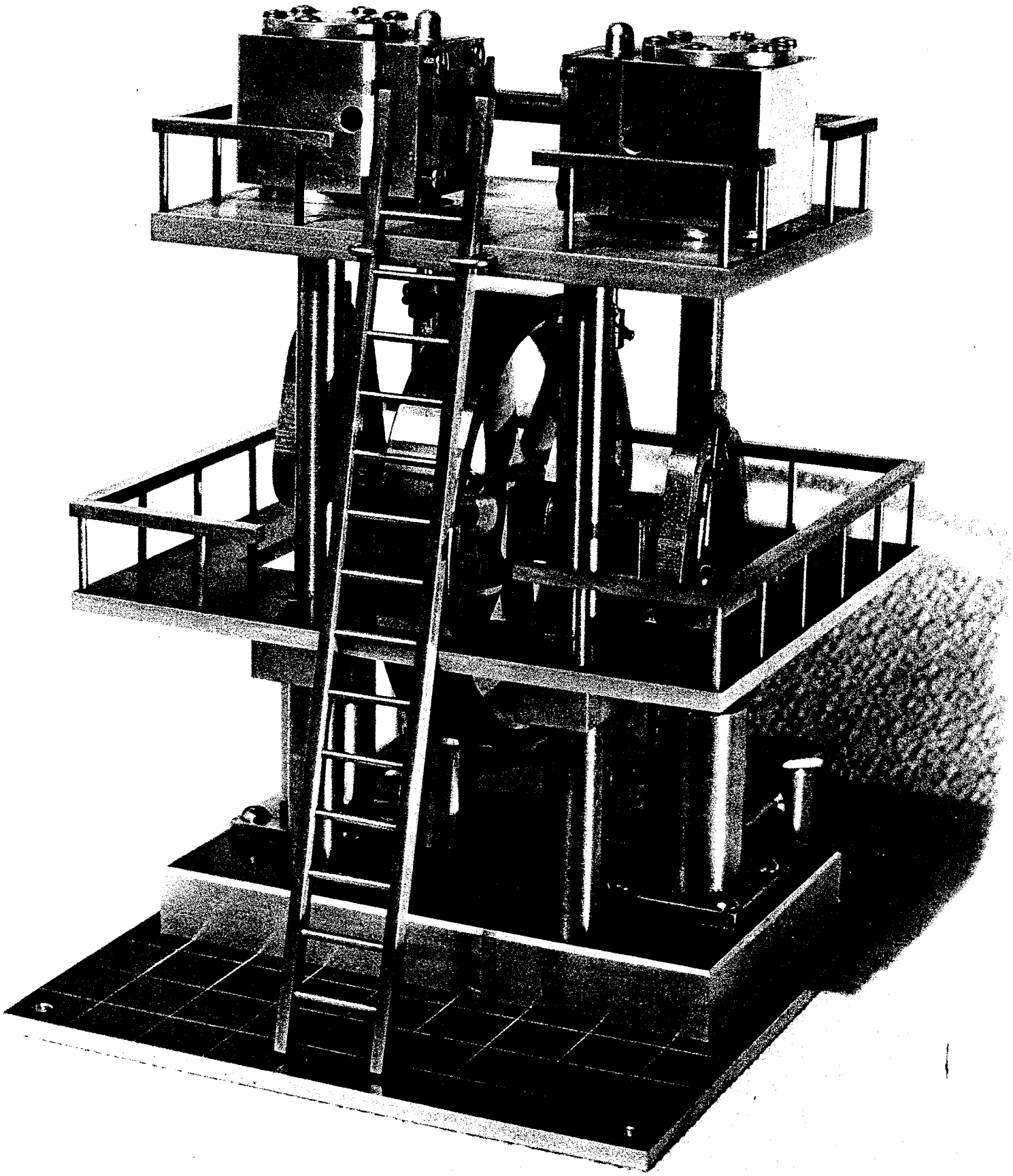


on a 1/4" x 13/16" x 1-3/8" block. Chuck in the 4-jaw and pick up the center of the blind 3/16" boss with a center test indicator and turn to shape. Repeat for the packing end, carefully drilling the deep 1/16" hole with a new drill to avoid drill wandering. Drill four holes, saw and file the 7/16" x 5/8" opening in the center. If the steam connection stud holes break through, just cement the studs in place. Make the two blocks for the **STEAM MANIFOLD**. Solder the blind block to the 3/16" tube. At final assembly, mount the blocks on the Steam Chests with Loctite in the other block. When cured, drill 5/64" through the tube.

When making the **VALVE, NUT** and **VALVE ROD**, try for a close fit of the Nut in the valve and the Rod thread in the Nut. These parts must be free so the Valve floats on its seat held by the steam pressure.

The **PISTON ROD/YOKE/PLUNGER** is the result of a near miss in design, intentional design and a gamble. The **CONNECTING ROD** will not drop into the opening in the Yoke. The Yoke is quite clumsy looking so effort was made to keep it narrow. By starting the Rod diagonally as shown and gently pressing it, the fork will spring enough to let the crank end enter the Yoke. A check showed no serious permanent set. It is easier to remove than insert. This was done several times. These parts were double-checked against the drawing, so if it is close to print it should work. If you have fears, the ends can be shortened slightly to reduce the springing. Assemble

Pumping Engine



rods and pins and run fine soft copper wire through the fork pins in such a way as to prevent turning in the fork, forcing the pin to rotate in the Yoke. A turn of the wire around the connecting rod shank and binding tight does the trick.

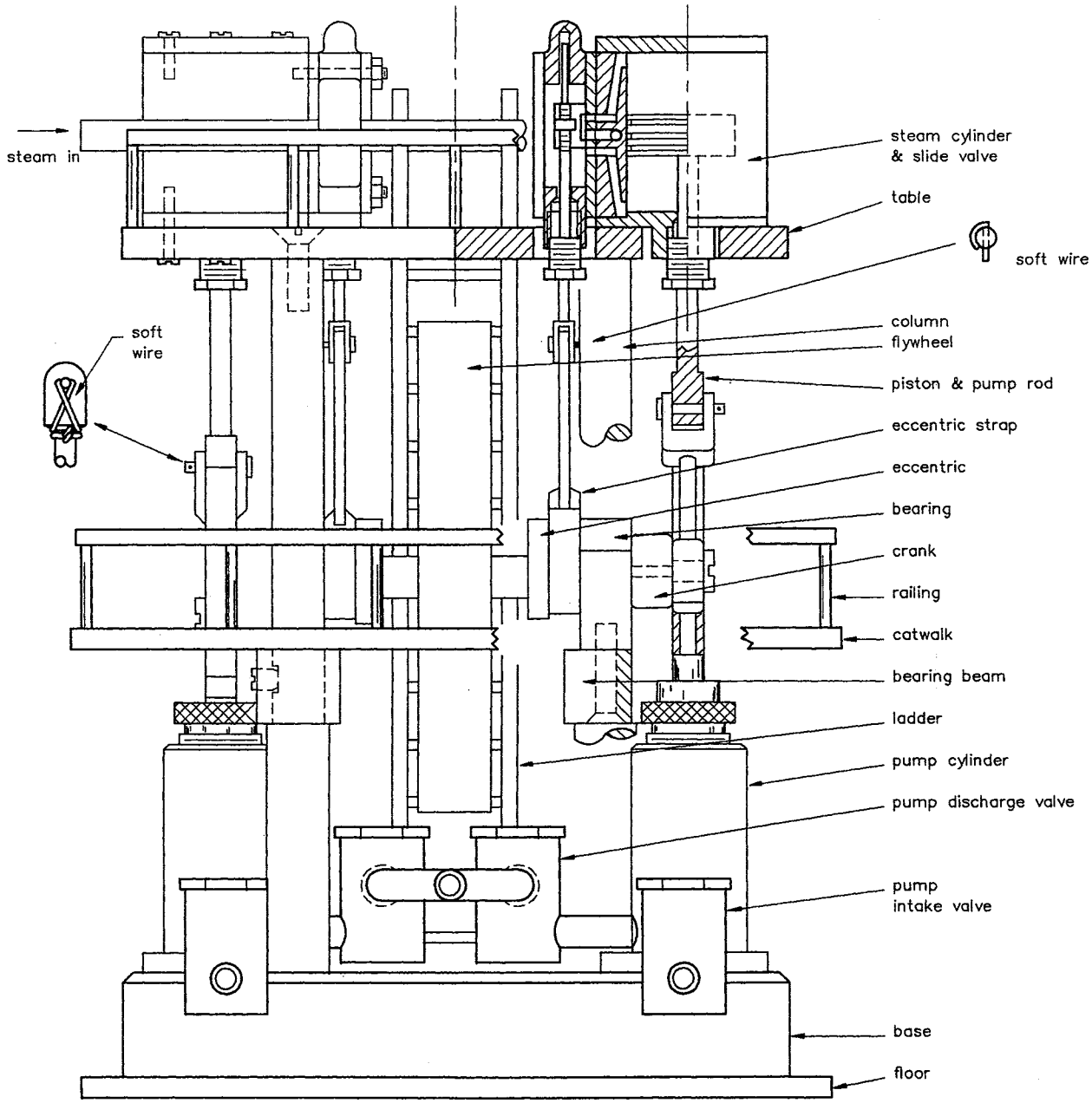
If you wish, spanner wrench holes can be drilled into the **PISTON** for easier assembly. You may have to make a forked tool for this. If the **PISTON ROD** is made about 1/32" long you will have a bit of adjustment in centering the Piston between the heads. Dress the Rod flush with the end of the Piston.

When making the **ECCENTRIC**, spot the setscrew on the centerline through the offset. It helps when timing the Valve.

Note the flats on the **CRANKSHAFT** are 180 degrees apart. This makes one pump discharge while the other is on the intake stroke. Here again, spot the setscrew in the **CRANK ARM** on the centerline through shaft and screw holes.

The **PUMP CYLINDERS** require no compl icated operations. The **PACKNUTS** can be drilled or notched for a spanner wrench. The **PACKING** in all cases on this model is 1/16" graphited asbestos. Use your favorite packing. Set the Packnuts very light.

On the **VALVE BODIES**, all the 3/16" tubing connections are soldered into the bodies. These tubes are all threaded in the lathe using a tailstock die holder before parting off to length. Note the **INTAKE** connections are in line while the **DISCHARGE** connections are at right angles to each other and made Right Hand and Left



PUMPING ENGINE

Hand. On all four Bodies, a 3/16" steel ball is used to make seats for the stainless steel balls. Drop the steel ball down into the Body and, using a brass rod and light hammer, give a sharp blow to form the seat. The **COVERS** are shallow and they have a 3/64" projection to limit the rise of the ball to about 1/32". These projections can be cut back if more rise is needed.

The **PUMP DISCHARGE MANIFOLD** is simple bent tubing. The short piece is scalloped to fit around the bend and soldered. This is cut-and-try filing until a couple of projections wrap around the tube. They can be spread apart on a 3/16" diameter rod and hammered and filed for a close fit and good soldering. Drill through after soldering.

When all the parts are made, assemble the Bearings to the Beams and slide the Beams on to the Columns.

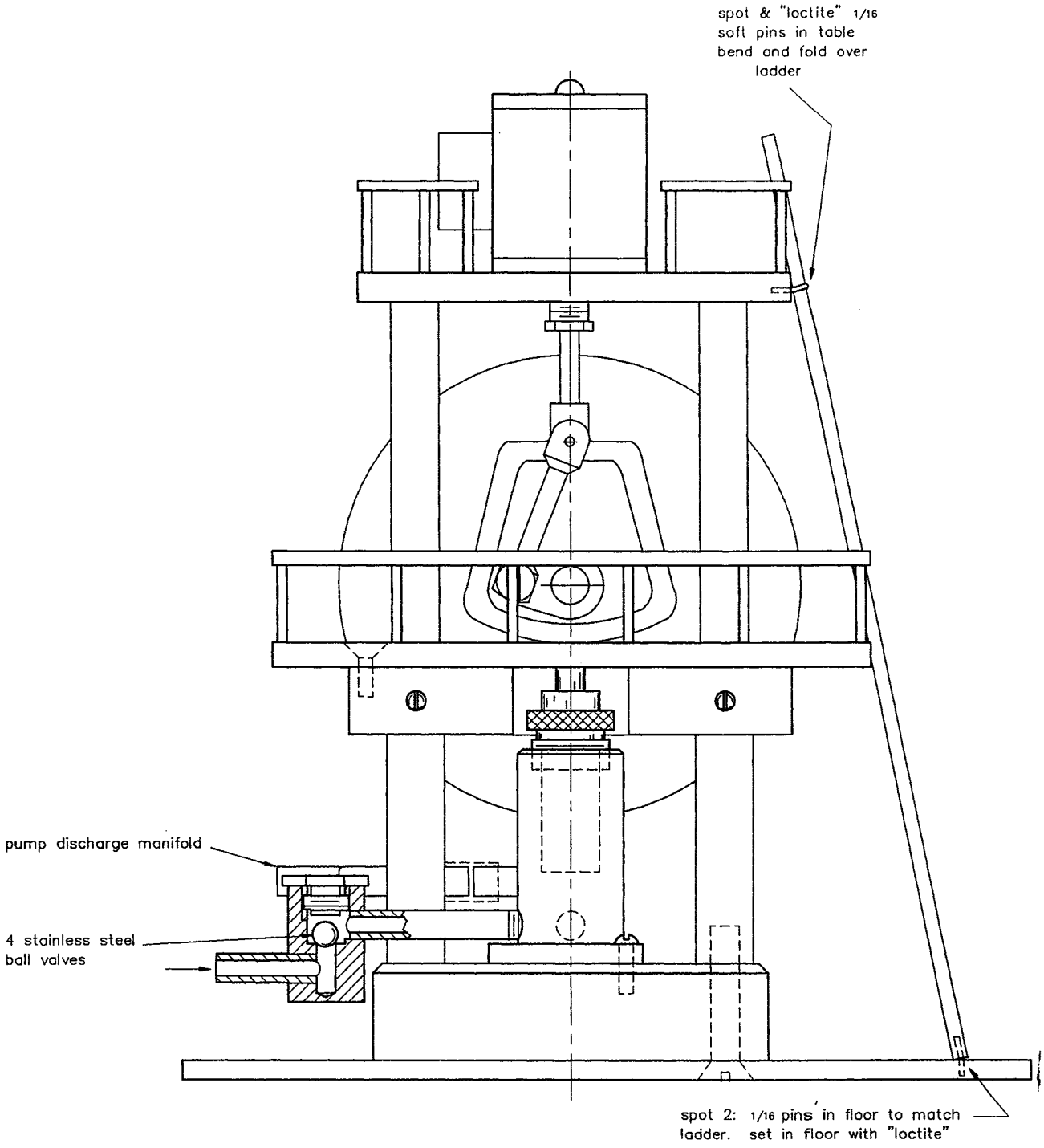
Assemble the Pumps and Valves on the Base.

Assemble the Floor/Base/Pump assembly to the Column/Beam assemblies using #10-32 flathead screws. Note the Ladder is opposite the Pump intake Valves. Adjust so the shaft turns free in the bearings.

Attach the Catwalk. Note the Ladder mounting.

Assemble the entire Steam Cylinder, Heads, Valving and Piston Rod/Yoke/Plunger to the Table. Attach the Steam Chest less Covers so Valves can be timed later. Add Packing to all stuffing boxes. Note the Ladder is opposite the Steam Intake Manifold. See photos page 79.

Lower the Table assembly down onto the Columns with the Pump Plungers entering the Pump Bodies. Set the flat head screws in the top of the Columns. Add



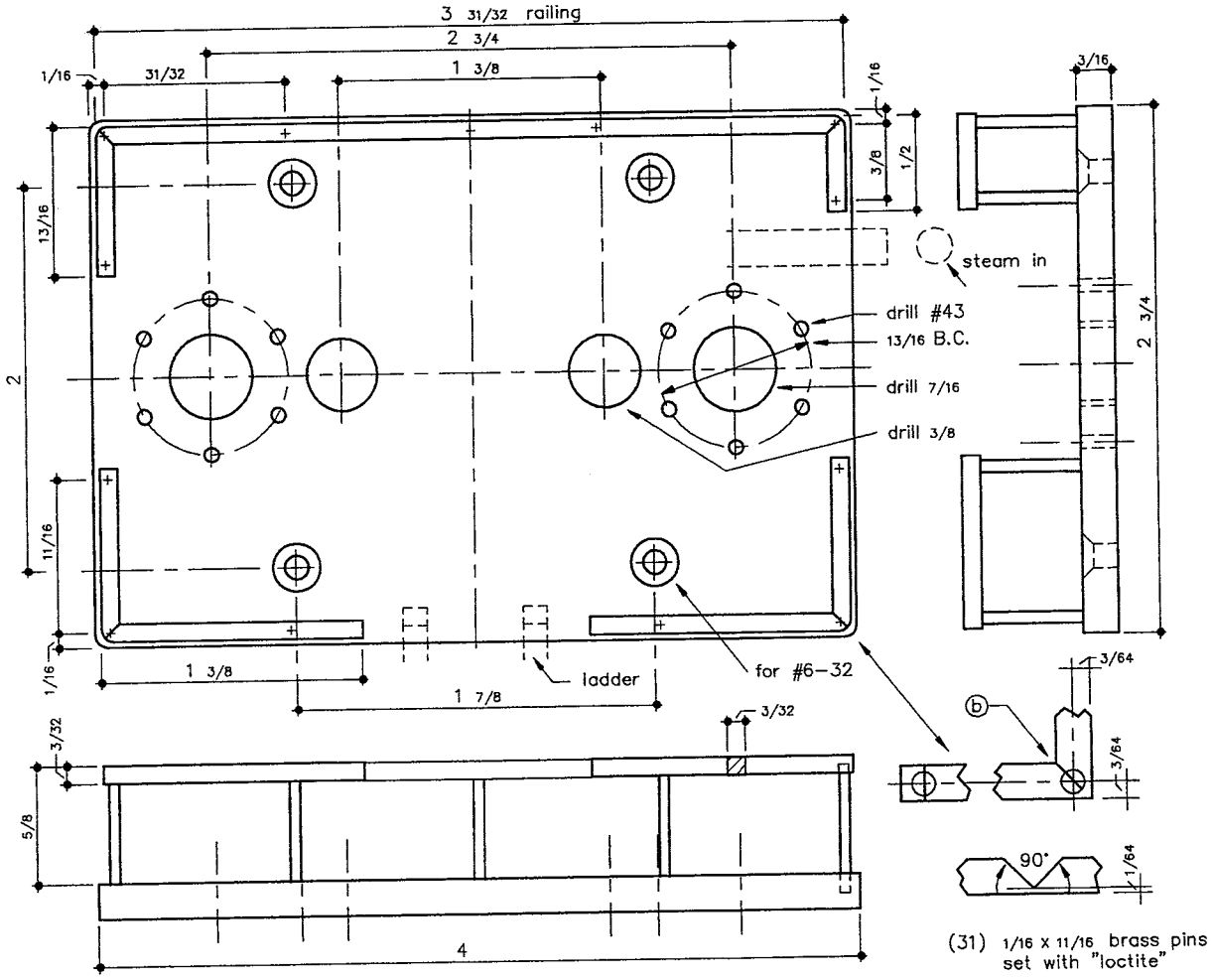
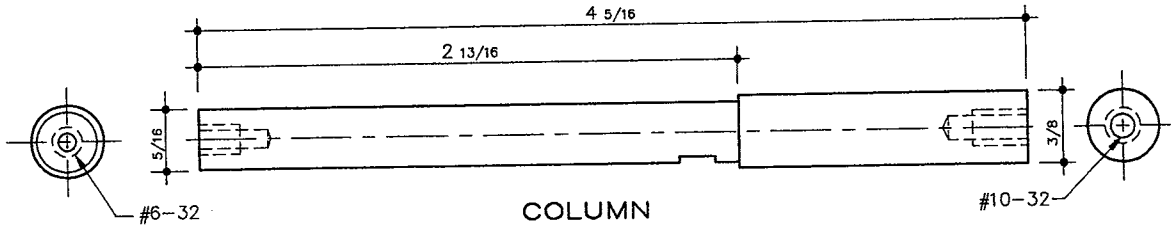
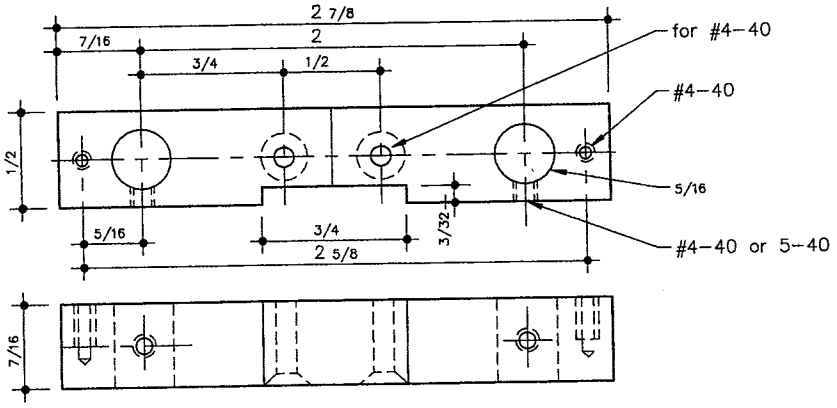


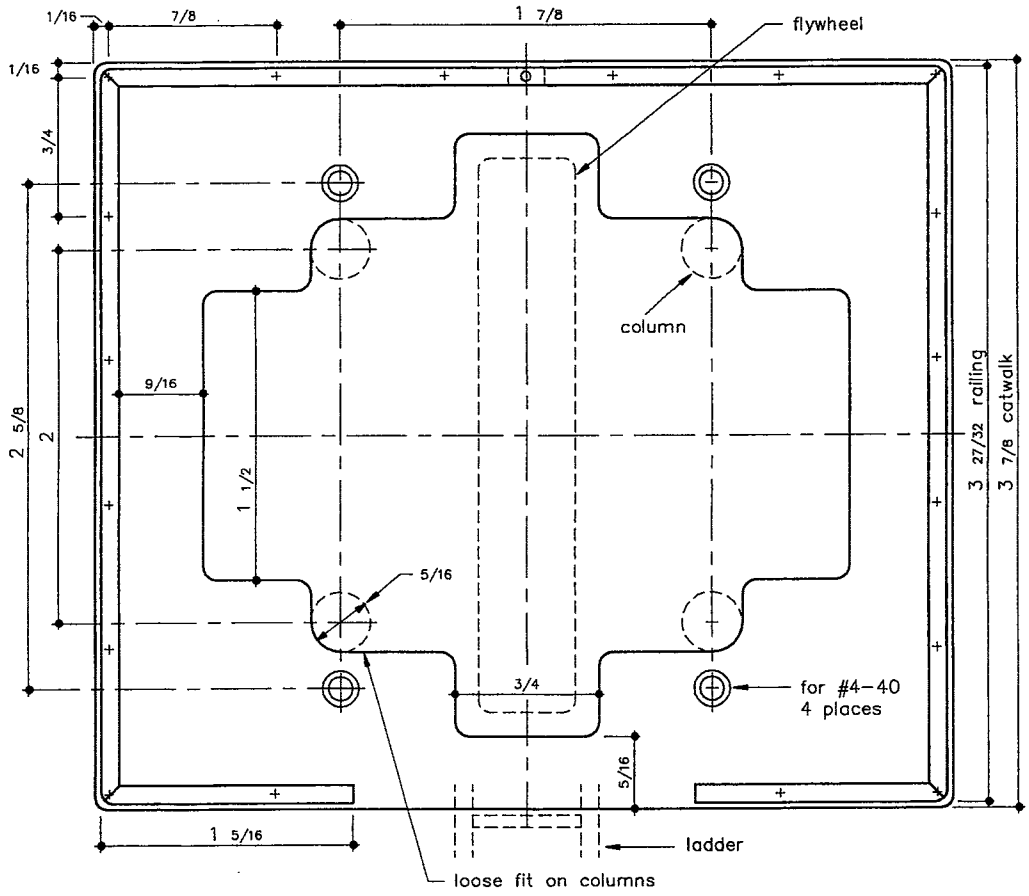
TABLE — RAILING
Aluminum — Brass

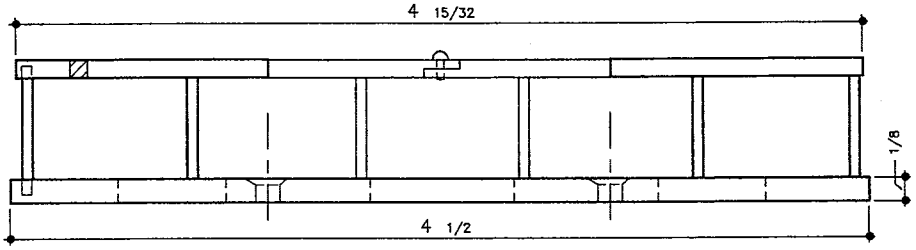


COLUMN
Steel
4 Required



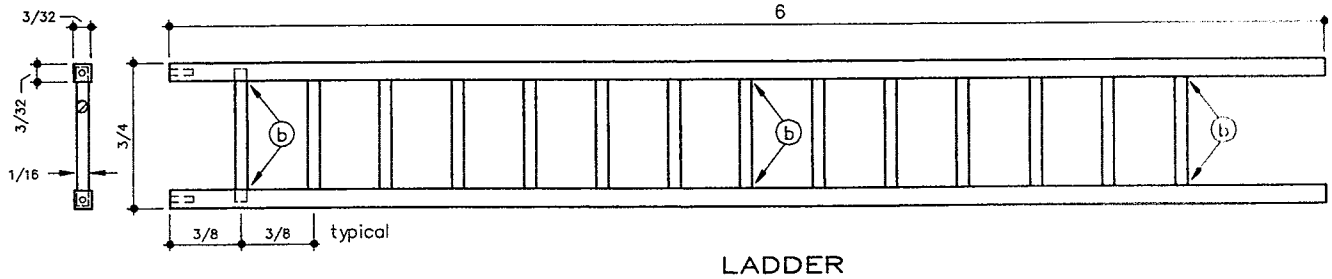
BEARING BEAM
Aluminum
2 Required





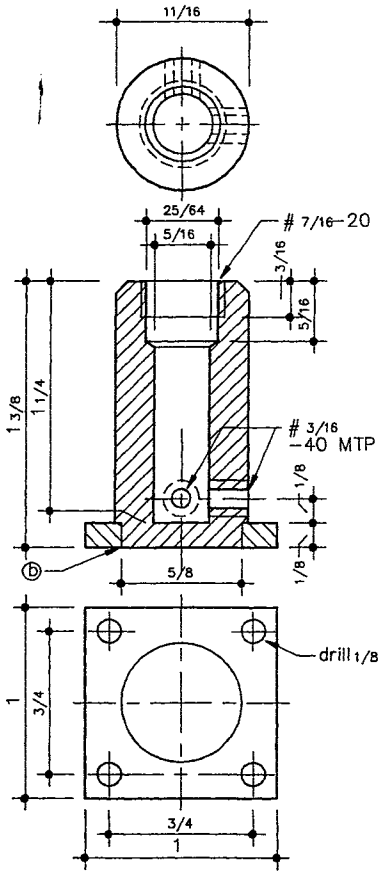
CATWALK — RAILING

Aluminum Brass

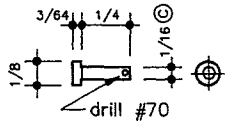


LADDER

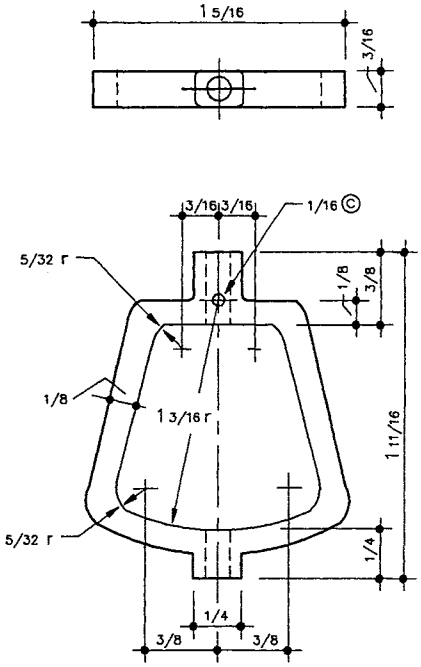
Brass



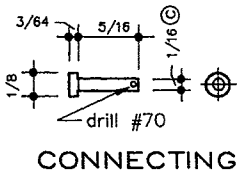
PUMP CYLINDER
Brass
2 Required



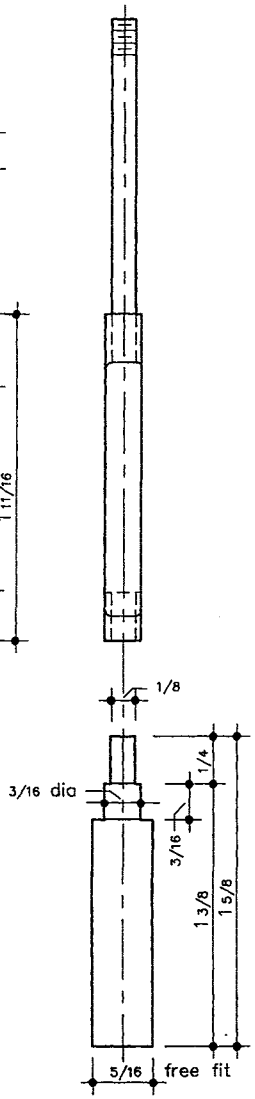
VALVE ROD PIN
Brass
2 Required



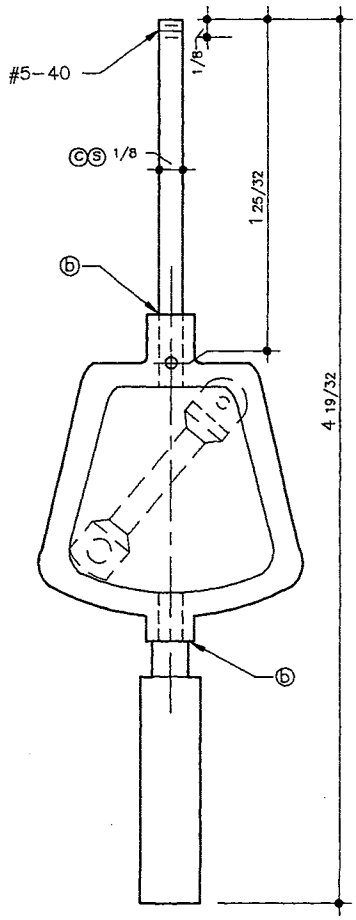
YOKE
Brass
2 Required



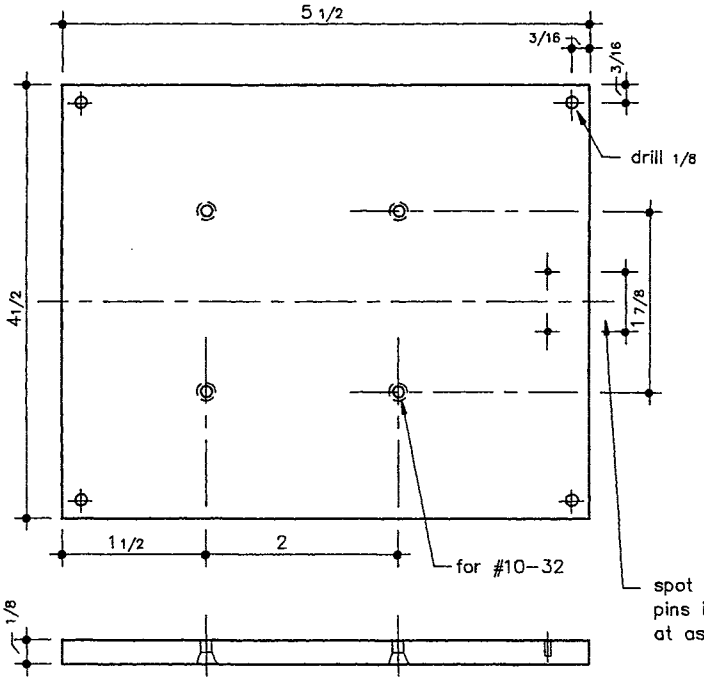
CONNECTING ROD PIN
Brass
2 Required



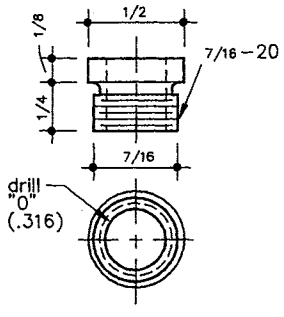
PLUNGER
Brass
2 Required



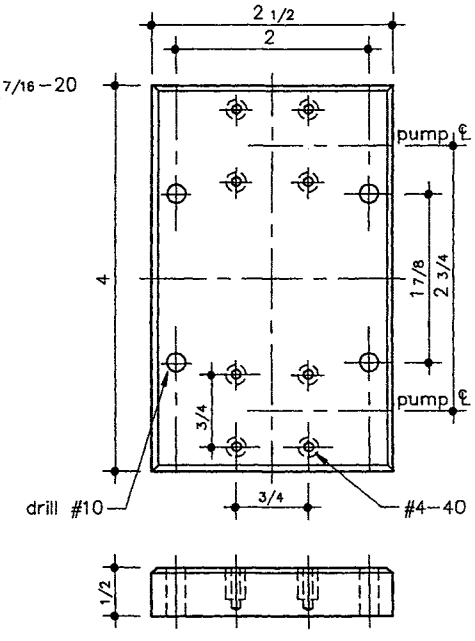
PISTON ROD–PUMP PLUNGER ASSEMBLY
Brass
2 Required



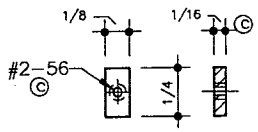
FLOOR
Aluminum or Steel



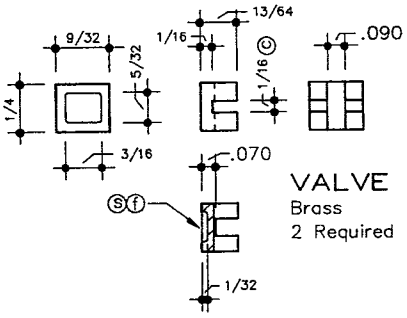
PUMP PACKNUT
Brass
2 Required



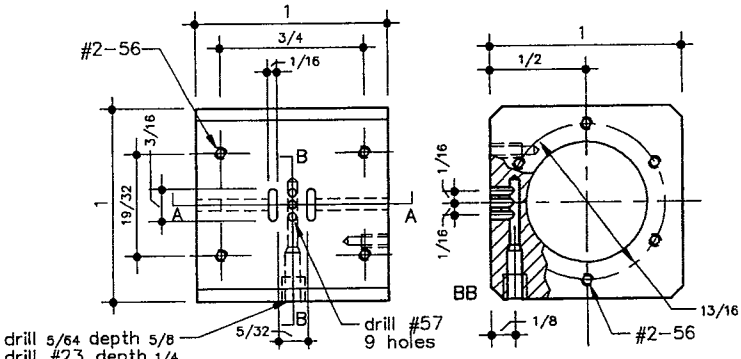
BASE
Aluminum or Steel

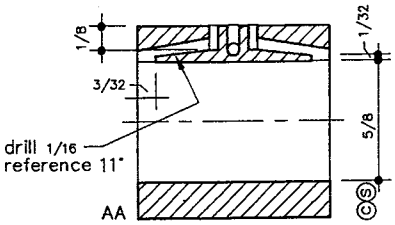


VALVE NUT
Brass
2 Required

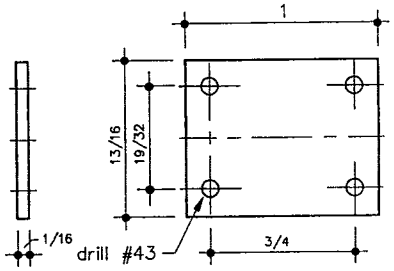


VALVE
Brass
2 Required

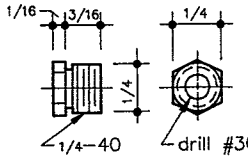




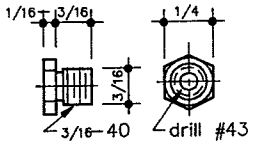
STEAM CYLINDER
Aluminum or Brass
2 Required



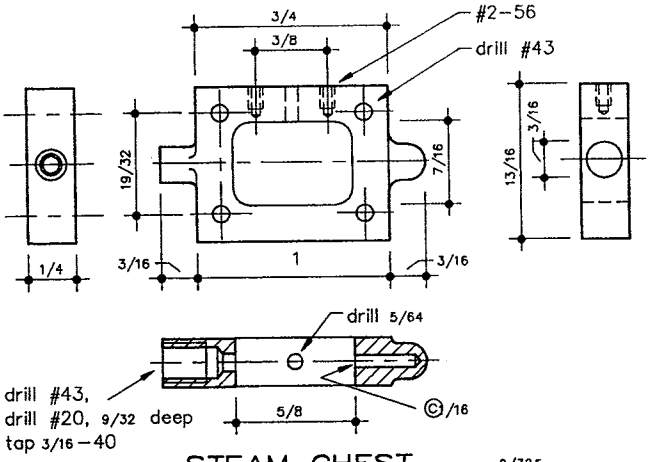
STEAM CHEST COVER
Aluminum or Brass
2 Required



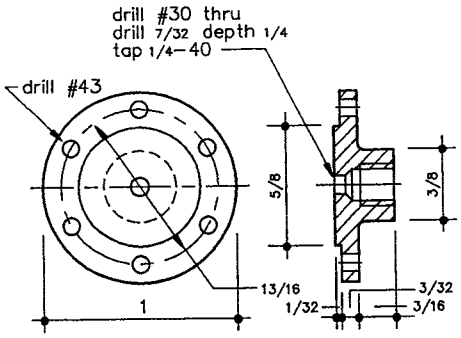
CYLINDER PACKNUT
Brass
2 Required



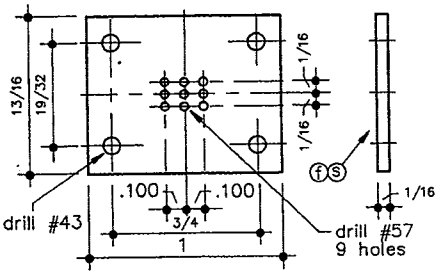
STEAM CHEST PACKNUT
Brass
2 Required



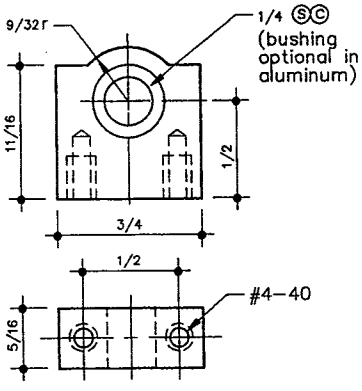
STEAM CHEST
Aluminum or Brass
2 Required



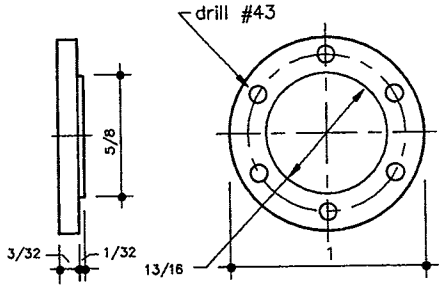
INBOARD HEAD
Aluminum or Brass
2 Required



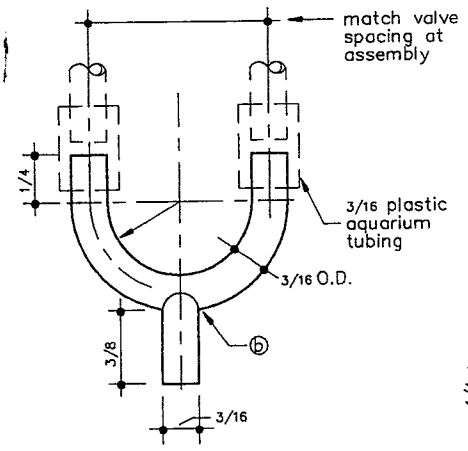
VALVE PLATE
Brass
2 Required



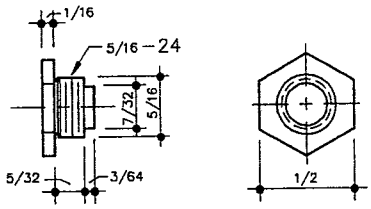
BEARING
Aluminum or Brass
2 Required



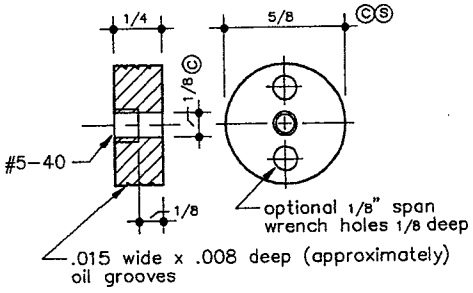
OUTBOARD HEAD
Aluminum or Brass
2 Required



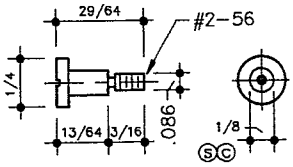
PUMP DISCHARGE MANIFOLD
Brass Tubing



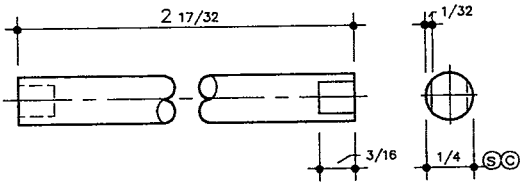
VALVE COVER
Brass
4 Required



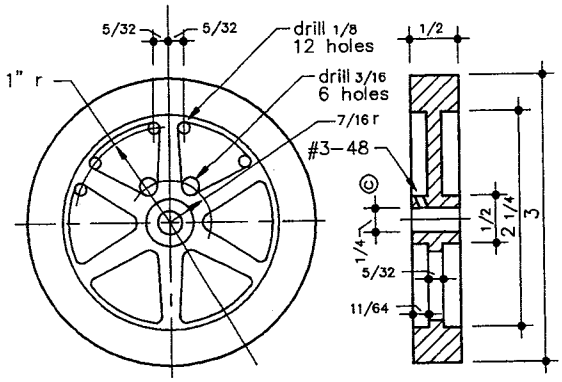
STEAM PISTON
Brass
2 Required



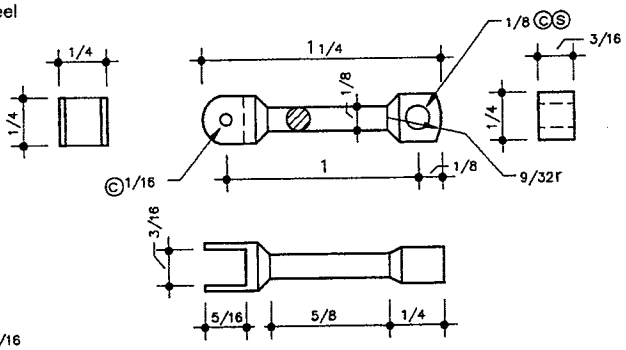
CRANK SCREW
Steel
2 Required



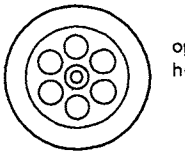
CRANKSHAFT
Steel

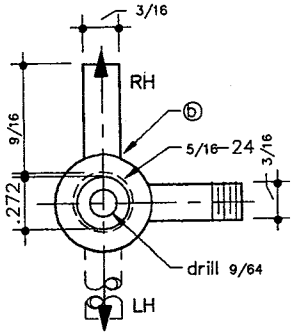


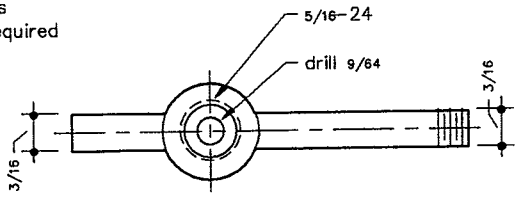
FLYWHEEL
Any metal

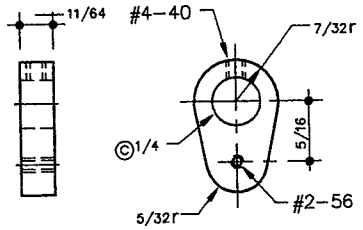


CONNECTOR ROD
Brass
2 Required

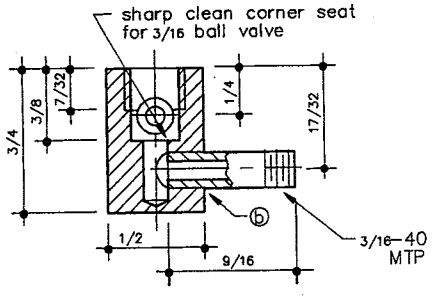




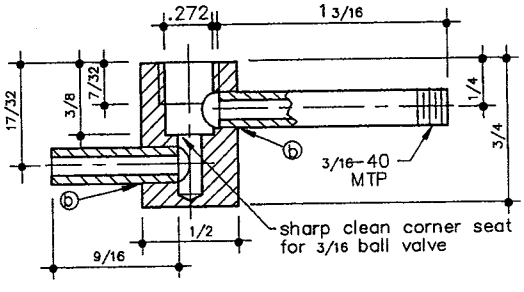




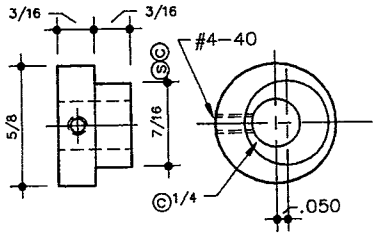
CRANK
Steel
2 Required



PUMP DISCHARGE VALVE
Brass body & tubing
Tubing wall .035"
2 Required (1: RH 1: LH)



PUMP INTAKE VALVE
Brass body & tubing
Tubing wall .035"
2 Required



ECCENTRIC
Steel
2 Required

The Pump Discharge Manifold is shown in the upper photo of the Pumping Engine while the two Steam Cylinders, Table and Railing are in the photo at the right. The Ladder shows clearly in the direct frontal view below and the Yoke and Pump Plunger Assembly are illustrated in the lower right picture.