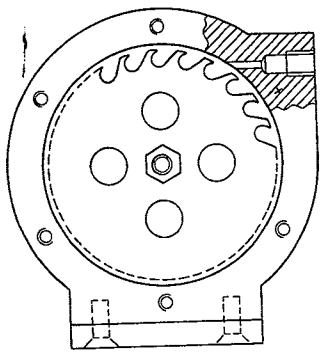
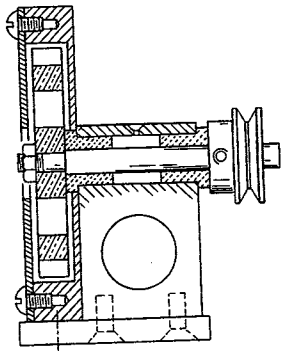
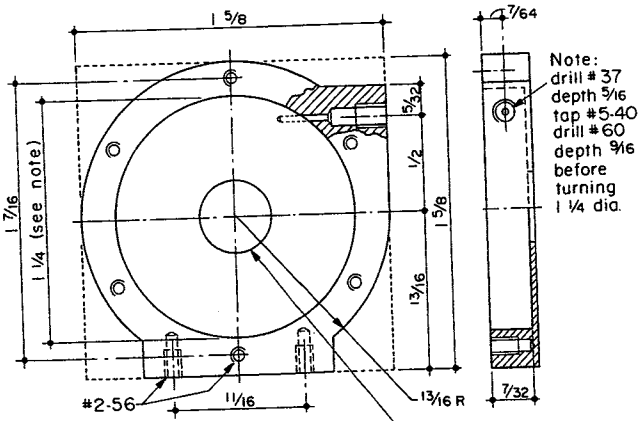
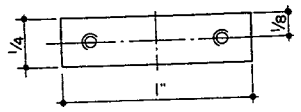


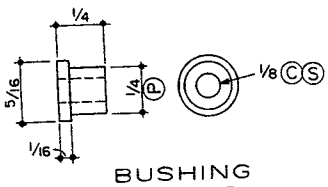


TURBINE

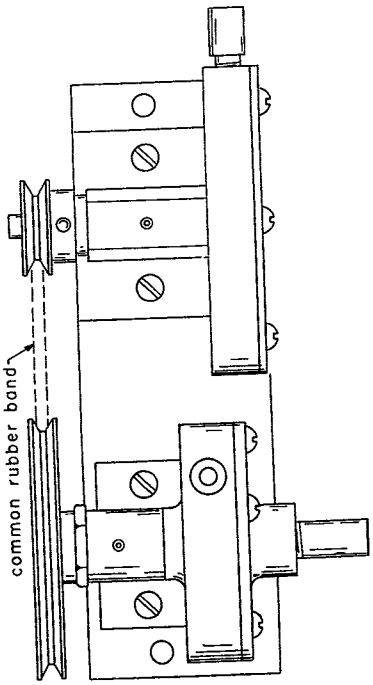


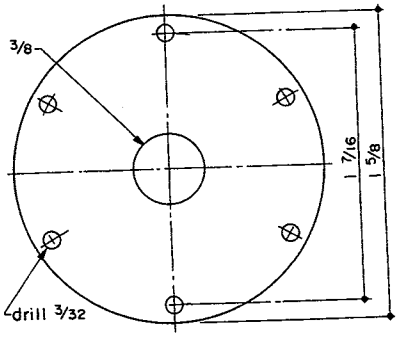


HOUSING
Aluminum

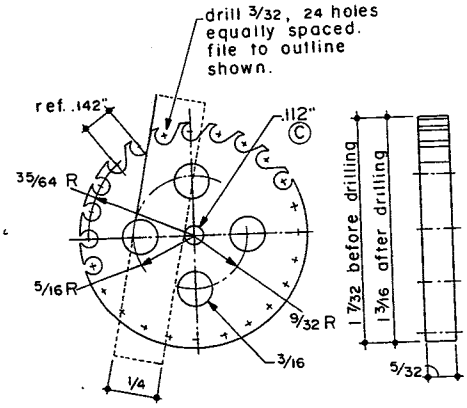


BUSHING
"Oilite" or Bronze
2 Required

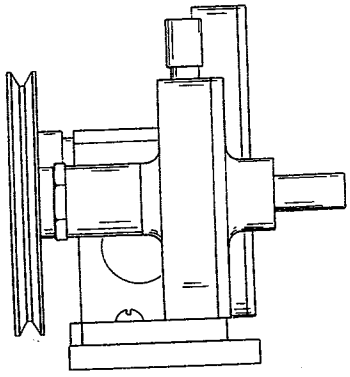




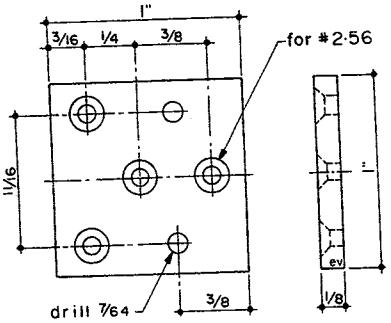
COVER
1/32" Brass



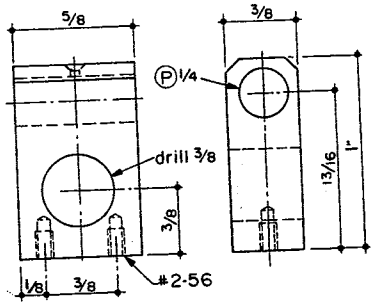
ROTOR
Aluminum



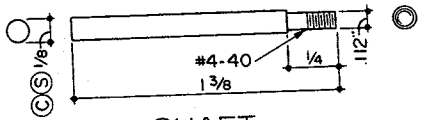
TURBINE AND
CENTRIFUGAL PUMP



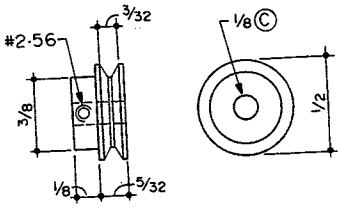
FOOT
Any Metal



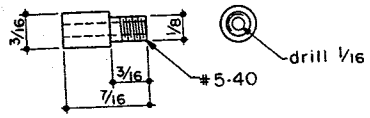
BEARING
Aluminum



SHAFT
Stainless Steel



PULLEY
Aluminum



STEAM CON.
Brass

CHAPTER

12 Turbine and Centrifugal Pump

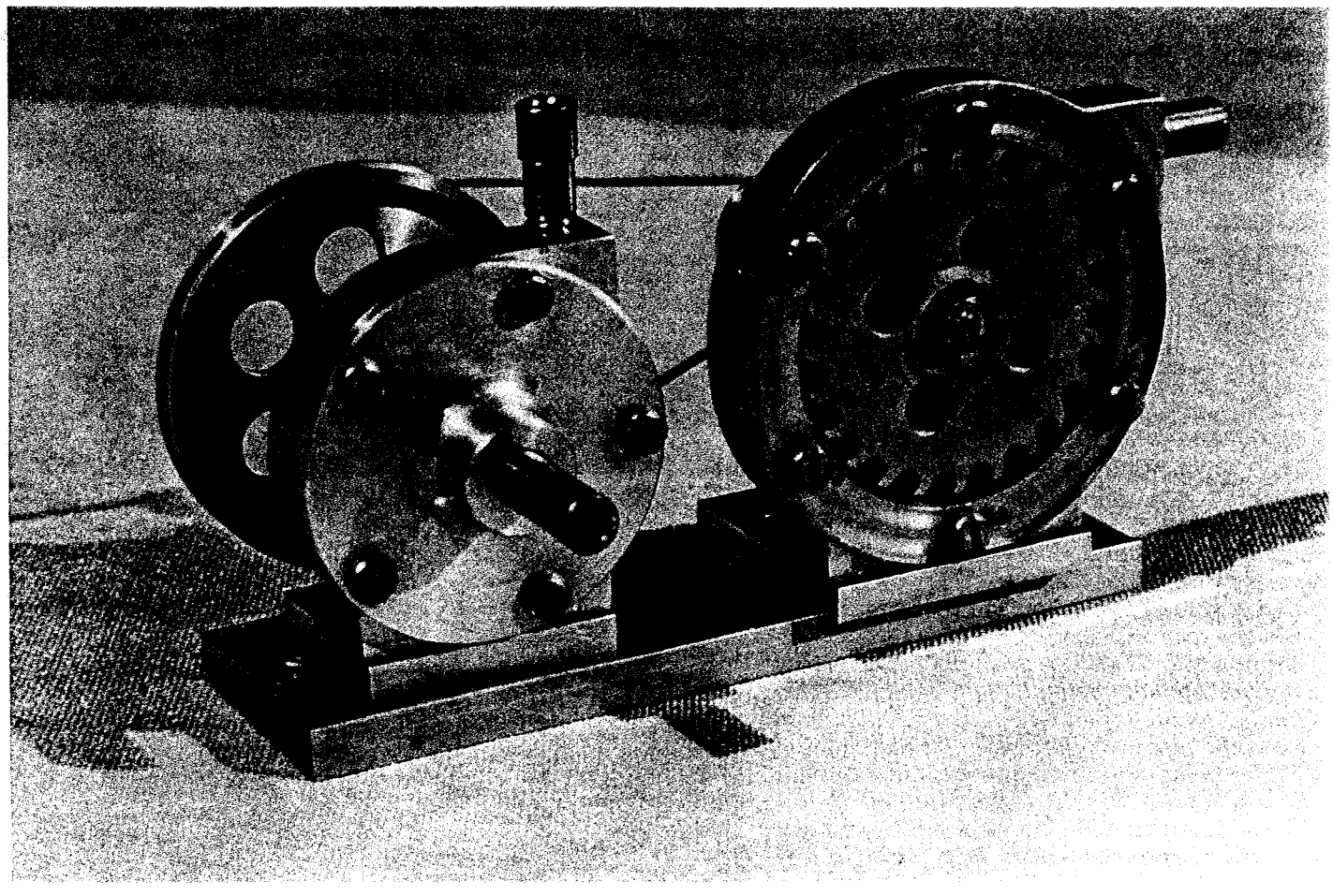
Turbine and centrifugal pump designs are quite deep subjects and will not be covered here. These are simplified designs based on dead reckoning and a smattering of experience, and will probably make experienced turbine and centrifugal pump engineers cringe. However, they do work and they show the principles.

The **COVER** is 1/16" clear plastic, although any 1/32" metal will do. You may use any convenient material you may have for this model.

Start the **HOUSING** with an accurate 1/4" x 1-5/8" x 1-5/8" block and lay out the outline, foot holes, cover screw holes and the steam connection. Drill the #60 nozzle before boring the 1-1/4" x 7/32" chamber. Complete all the tapped holes. Saw and file to the outline at the 13/16" radius. This is a place where Bob Maynard's filing machine would be a most handy tool for this job.

The **ROTOR** shown is the fourth one tried in this design and worked the best. It is simple and not difficult to make. Try for uniformity and balance, as this will spin up in the thousands of revolutions per minute. Start with a 1-1/4" diameter x 3/16" disk. Chuck in a 3-jaw, gripping about 1/16" of the width. Next, turn to 1-7/32" diameter and face true with a skin cut. Drill the center hole in stages with the final pass a #34 drill. While in the lathe, scribe the 35/64" and 9/32" radius circles. Reverse in the chuck, true up and face to about .164" thick and turn the O.D. to match the first cut. If you have an indexing fixture, proceed to drill the twenty-four 3/32" holes and four 3/16" holes. A dividing head is great for this type of drilling. If not available, pace off 24 spaces and drill in the drill press. Do the same for the four holes. Chuck a piece of 1/4" diameter steel in the 3-jaw with about 1/2" projecting. Turn to .112" diameter for about 3/8" for a close fit in the Rotor and thread #4-40 for 1/4". You now have a stub arbor for dressing down the Rotor to 5/32" thick and 1-3/16" diameter. This operation must be done slowly and carefully with a finely-honed tool bit. Remove it from the arbor and insert the Turbine Shaft. Then lay an accurate 1/4" strip of metal on the Rotor against the 1/8" diameter Shaft and scribe lines tangent to each hole as shown. File each opening to this line.

As with all models in this series, the steam connections are for 3/16" plastic tubing. Your first test will be most interesting as you begin running it it on pressures all the way from 10 to 60 psi. A pulley or collar should be used in order to keep the



Rotor centered in the Housing.

This **PUMP** is very simple. The material can be anything you may have on hand. If you pump water, it is well to use material thatwill not rust.

For the **HOUSING**, make the layout on an accurate block 3/8" x 1-1/4" x 1-1/4". Saw and file to the 1-1/4" diameter. Here, again, a filing machine is handy. Mount in the 4-jaw and bore the 29/32" x 7/32" opening and 1/4" center hole. Reverse it in the chuck and turn to 9/32" thick down to 3/8" diameter. Drill and tap foot holes and the discharge hole. Later use the head as a jig.

Next, make the **OUTER BEARING, BEARING and WASHER** with 5/16-40 threads as shown, although you can adapt to 32 threads. The 40 series of thread is a big help in making tiny model parts. Set the Bearing in the Housing with Loctite. The packing is 1/16" strands unraveled from braided graphited asbestos packing. The Spring has a wide range and should be a cut-and-try operation from your odds-and-ends box.

The **HEAD, SHAFT, PIPE CONNECTION** and **FOOT** need no comment.

The **IMPELLOR** is a tiny part that may try your patience. The one shown in the assembly requires careful layout and filing. A filing machine is great here, too, although it is possible to do the job by hand. Two alternates are shown which can be straight milling cuts.

To make the curved bladed Impellor shown, start with an accurate 7/8" diameter x 1/8" disk. Scribe the exact center and prickpunch. Set the dividers at 21/64" and scribe a circle. Without changing the setting, pace off six points on the circle and prickpunch. Scribe the 7/32" circle. Draw three centerlines through the six points. Drill the six 1/8" holes. Using the intersection of the three centerlines and the 21/32" circle as centers, scribe tangents to each hole as shown. Chuck in the 3-jaw and bore 3/32" and turn the 7/32" and 7/16" diameters 1/16" deep. Round the 7/32" hub for an easier flow of the liquid to the vanes. Use a jewelers saw and file to the curves as shown. Attach to the Shaft with a press fit or Loctite.

Assemble and give a test run at a fairly fast speed. A Centrifugal Pump requires flooding or priming to start pumping. If your Pump is above the supply level, a foot valve will be needed to retain a prime.

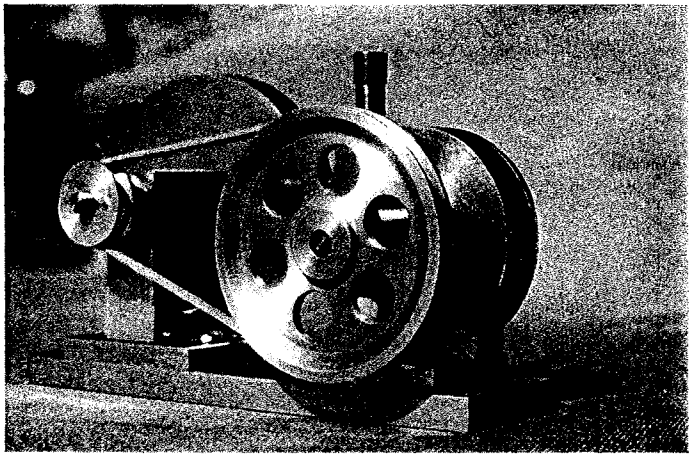
A pulley or collar should be used to keep the Impellor centered in the Housing.

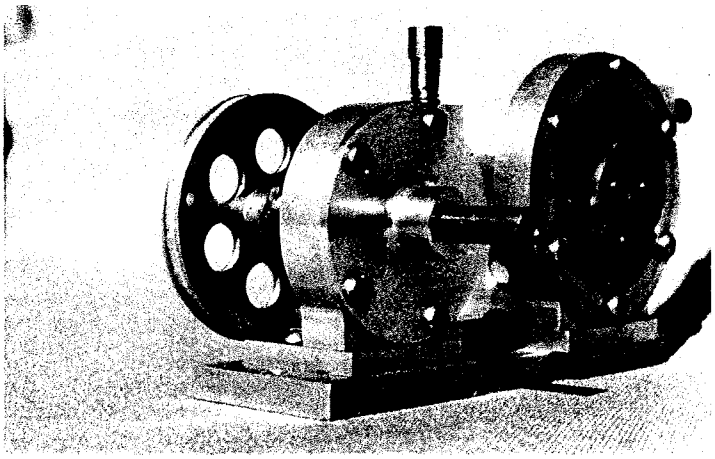
The Centrifugal Pump is mounted on a Base driven by the Turbine.

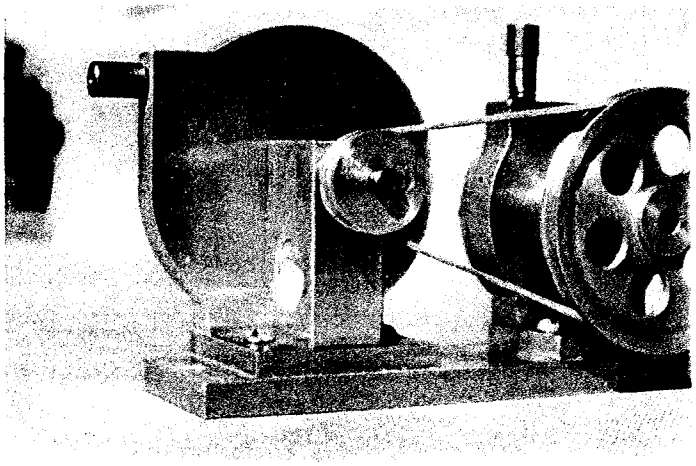
A common rubber band of about 1/16" square (cross section) runs in the V-pulleys. Try several to get one that will drive the Pump freely without too much pressure on the Bearings. The Turbine doesn't have much power until it is running at a fairly high speed.

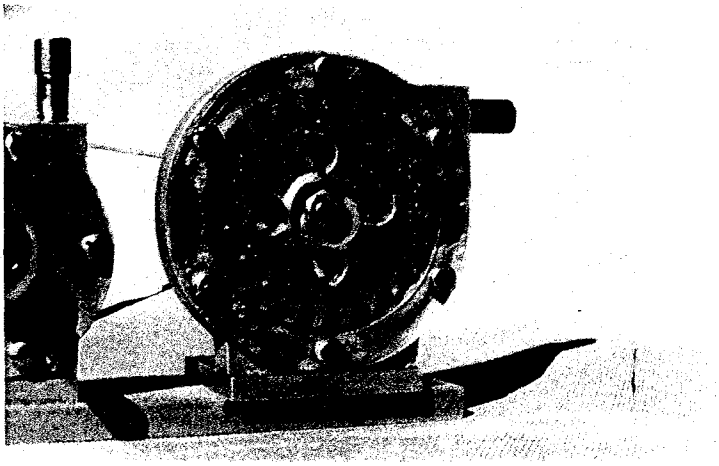
The parts shown require little comment. You may have Erector pulleys or such that can beadapted. The **BASE** and **PULLEYS** are aluminum, though any odds and ends can be used. It is well to consider rusting when selecting material if water is to be used. This model was tested on water and then drained to prevent rust on the Shaft. It should have been made of stainless steel. Pumping light oil will lube the Inner Bearing. It showed a nice stream at high speed with the turbine running on about 60 psi air.

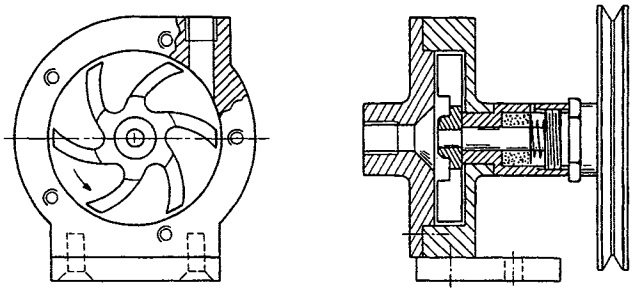
This is a cute little unit and it is fun to run and show off.



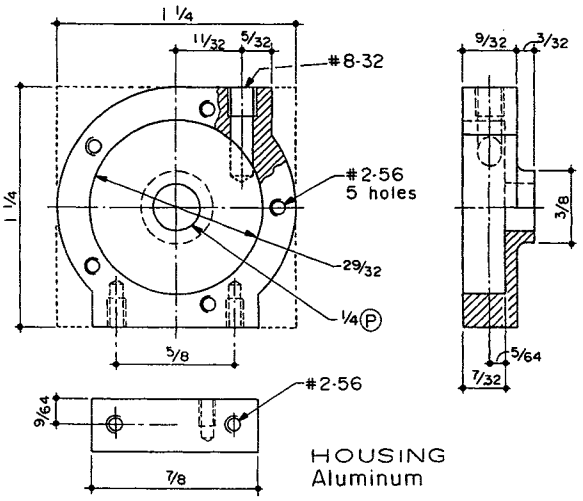




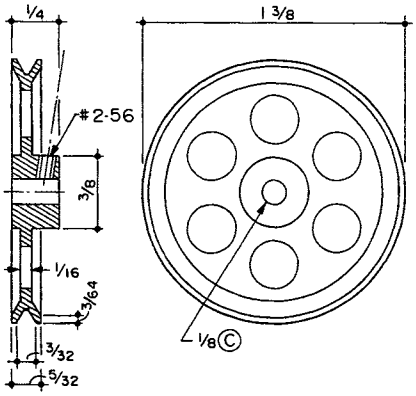




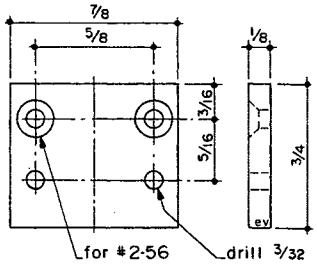
CENTRIFUGAL PUMP



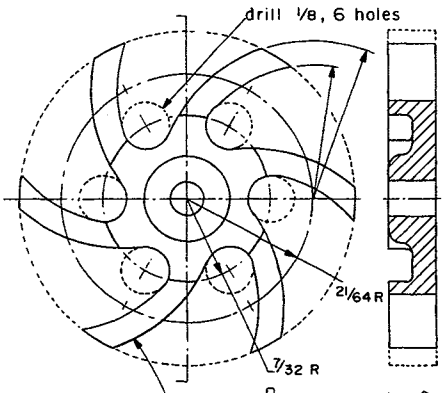
HOUSING
Aluminum

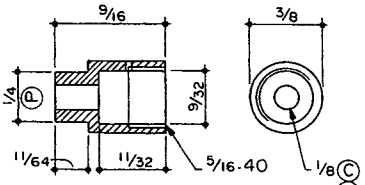


PULLEY
Aluminum

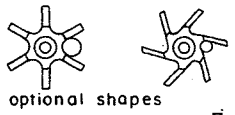


FOOT
Any Metal





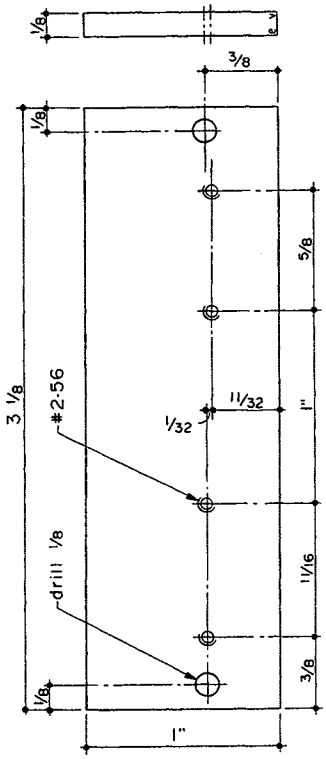
BEARING
Brass



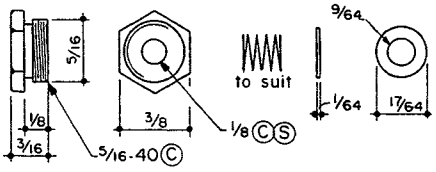
optional shapes

IMPELLER
Brass

SHAFT
St. Steel

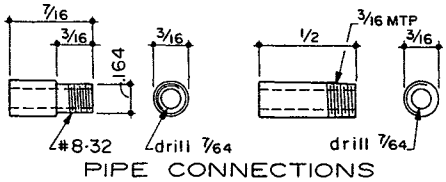


BASE
Any Metal

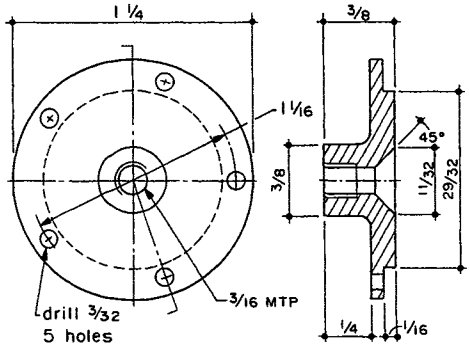


BEARING
Brass

SPRING WASHER
St. Steel Brass



PIPE CONNECTIONS
Brass



HEAD
Aluminum