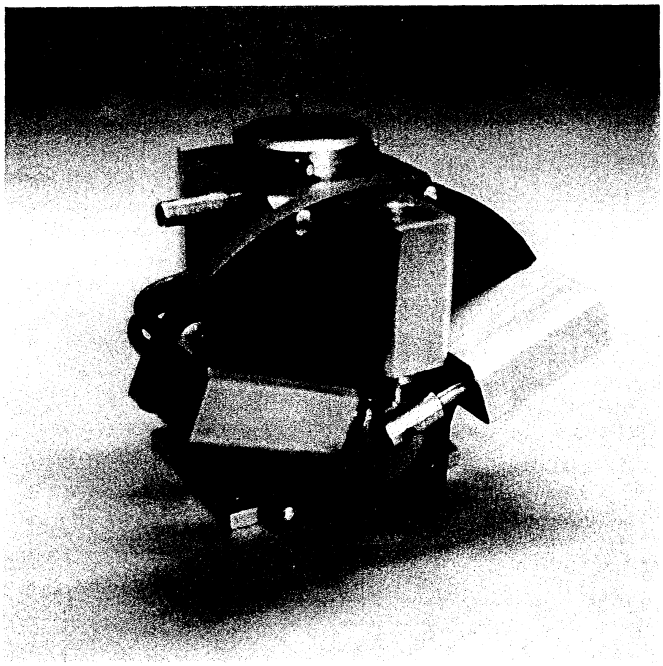
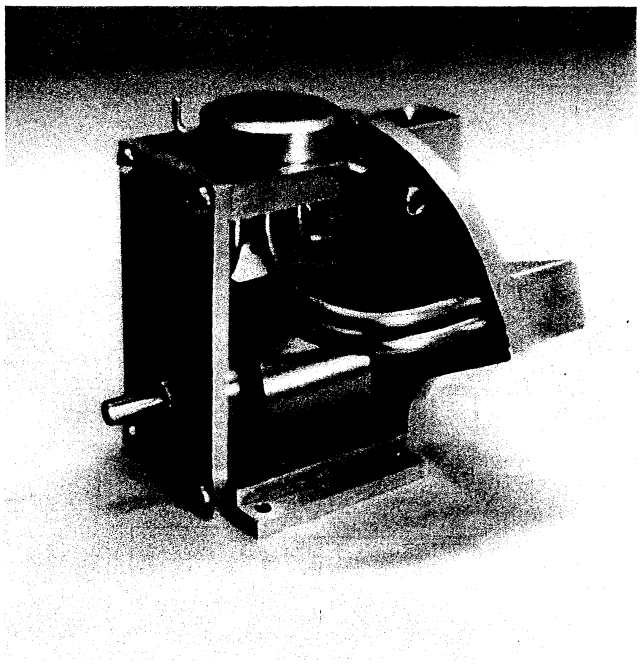
CHAPTER

51

V3R





Jason Smith in Hilliard, Ohio, sent in the sketches for this three-cylinder engine. It is a reversing, single-action wobbler, using a clever way to bring the three cylinders 60° apart instead of 120°. The center Cylinder applies pressure to the Piston and Crank in the same direction as a Cylinder at 120° would give. It is a good showoff conversation piece to run on compressed air.

The fitting of the Tubing will be a challenge. Since any dimension that might be shown would be hard to follow, it was decided that this was a cut-and-fit job. Perhaps pieces of 1/8" diameter solder is the best way to arrive at the length and bends for each Tube.

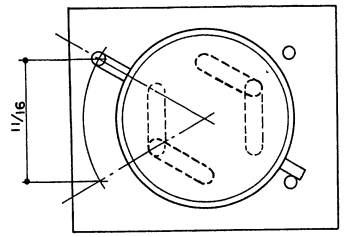
It is really a tiny, compact engine and some parts are quite small. We try to make projects for those with small machinery.

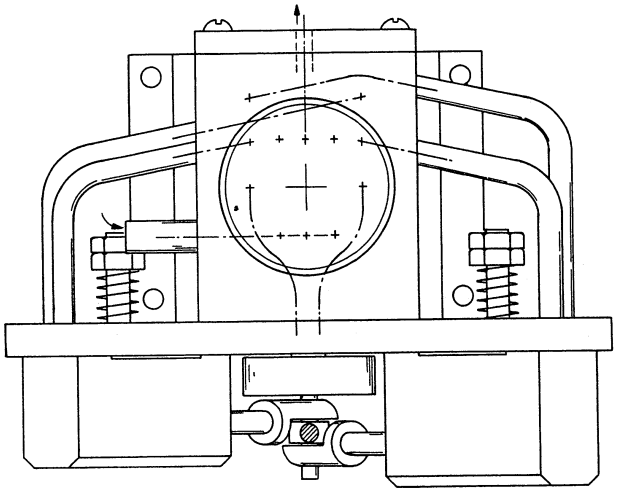
The **BASE** and the **BACK PLATE** are plain machine shop practice. The bore for the Bearing must match the bore in the Front Plate for good alignment with the Crankshaft.

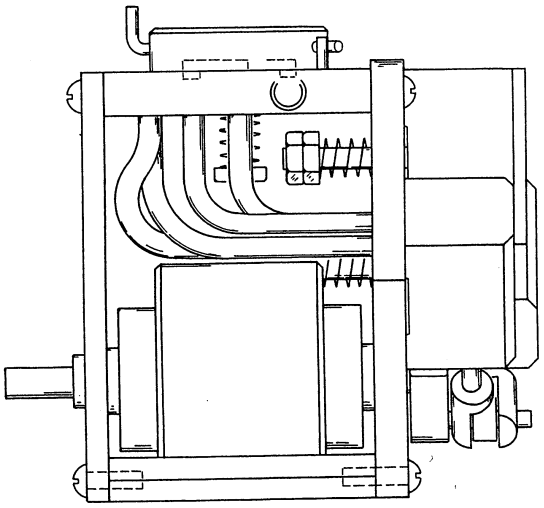
On the **FRONT PLATE**, lay out all the centers and outlines except the six 1/16" steam ports. Make all the remaining holes. This Plate must be smooth and flat at the Cylinder areas. Make the drill jig and jig pin. Drill the 1/16" steam ports as shown, using a close-fitting 1/8" pin in the pivot holes and holding the jig against the 1/8" diameter on the jig pin. Drill out these 1/16" port holes 1/8" diameter and 9/64" deep to take the 1/8" Tubing. This depth helps to hold the Tube in place while assembling with epoxy or soldering, in which case the Plate should be brass. Cut the Plate to fan shape. This is a spot where you can shape to suit your own ideas on appearance. Make and press-fit the Crankshaft Bearings into the Front and Back Plates. Note the shoulders are on the inside.

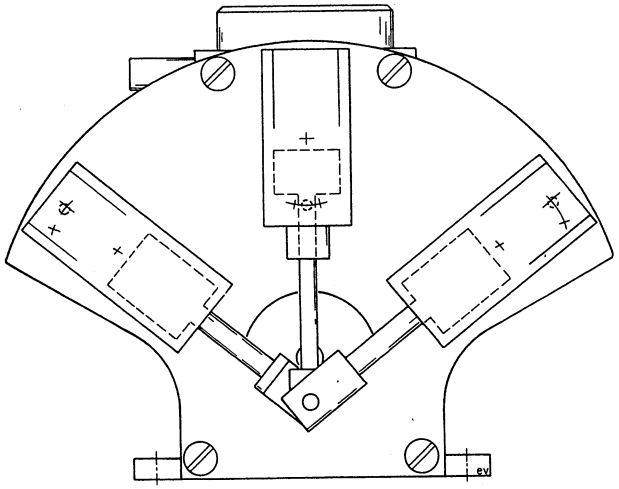
The **VALVE PLATE** requires careful layout and drilling. A 5/8" circle is scribed in the center and six spaces paced off using the 5/16" radius just used for the circle. Two of the 3/32" holes go down and meet the passage to the Tubing. The other four are drilled shallow, only about 1/32", indicating the ends of the 3/32" milled slots. After milling the slots, two holes are centered in the slots and drilled down to meet the intake and exhaust passages. It is important that this Plate be flat and smooth for a good metal-to-metal seal. Make sure there are no burrs or dirt at assembly. Determine the two extreme positions of the Valve movement and spot the two 1/16" pins.

Assemble the Base, Front, Rear and Valve Plates. Fitting the **TUBING** takes a bit of patience. Make and fit all the Tubes. To fit the shortest pieces, the screws through the Front Plate and into the Valve Plate will have to be loosened a bit. If you use the five-minute epoxy, you will have to be organized and work fast. You will be better off with the slower type. Apply the Epoxy very carefully so it will not get inside the Tubing. Apply to the shortest Tubes first and tighten the screws. For the rest of the Tubes, apply the cement and spring each Tube in place, one at a time. The ends of the Tubes at the Front Plate can be drilled out if the cement gets into the passage, BUT at the other end it is blind and you will have to take it apart and start over if









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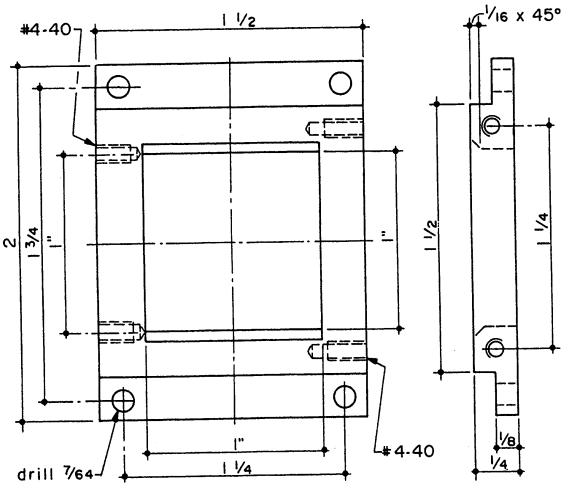
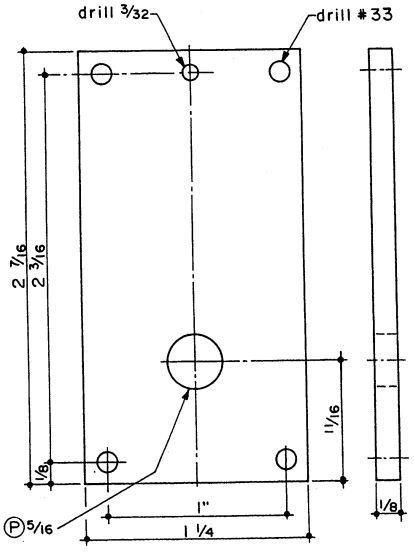
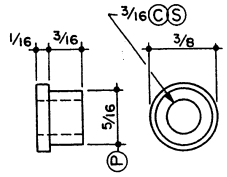


BASE
Any Metal

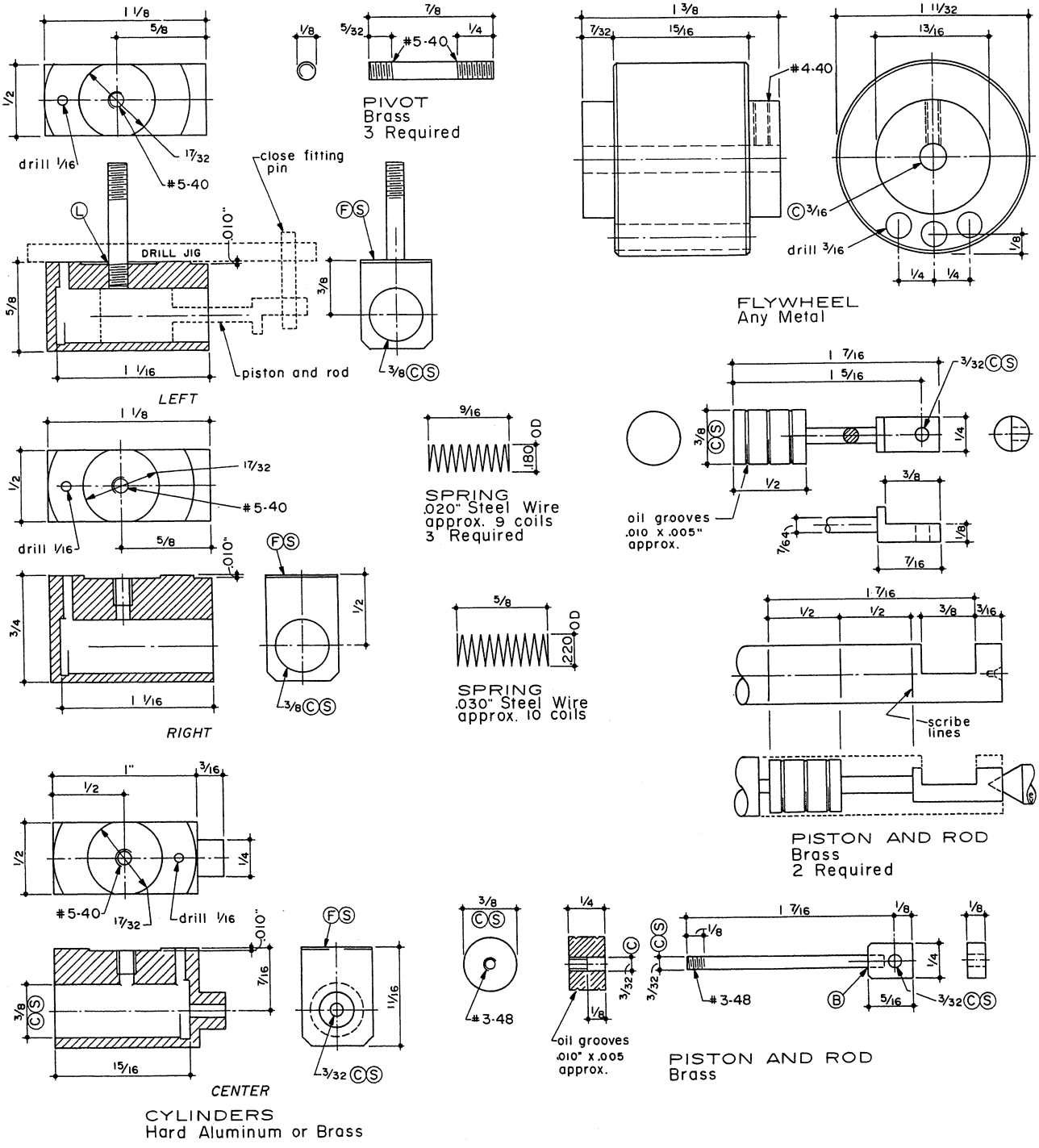


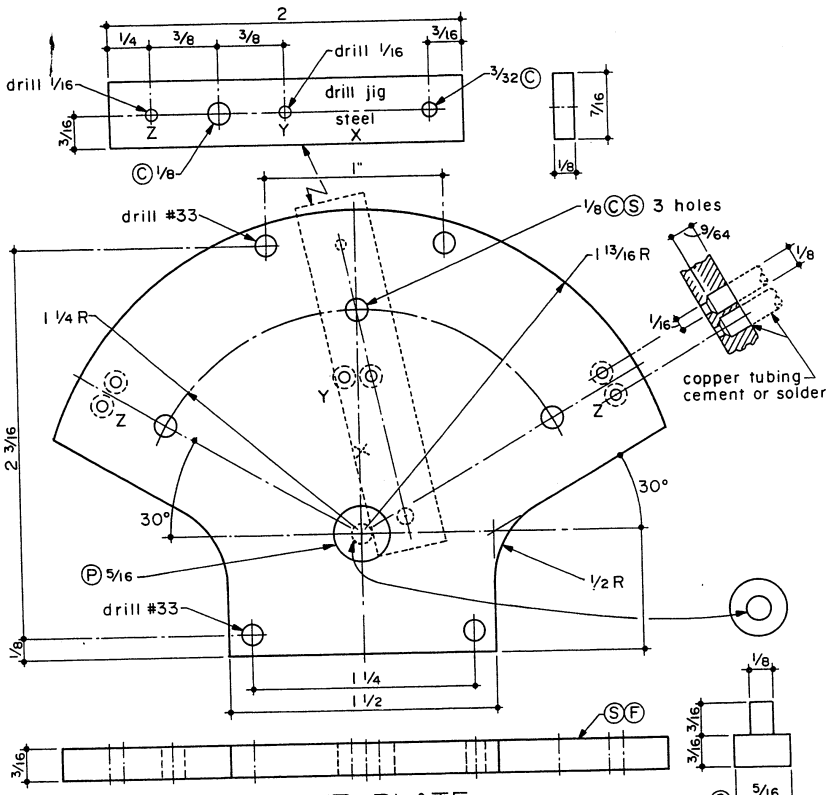
BACK PLATE
Any Metal



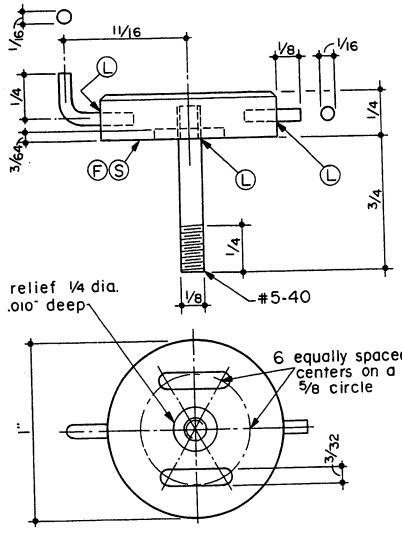
BUSHING
Brass

Ⓒ close fit
Ⓢ smooth
Ⓟ press fit or "Loctite"
Ⓑ braze or solder
Ⓕ flat
Ⓛ "Loctite"
MTP model taper pipe

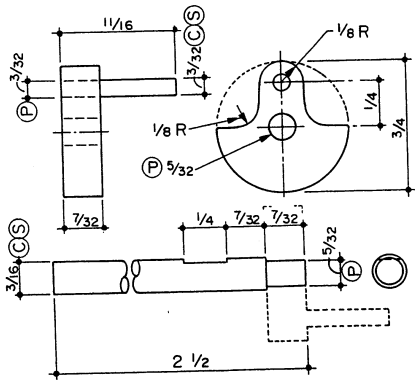

PIVOT
Brass
3 Required
drill 1/16
#5-40
close fitting pin
DRILL JIG
piston and rod
LEFT
RIGHT
SPRING
.020" Steel Wire
approx. 9 coils
3 Required
SPRING
.030" Steel Wire
approx. 10 coils
FLYWHEEL
Any Metal
drill 3/16
oil grooves
.010 x .005"
approx.
PISTON AND ROD
Brass
2 Required
scribe lines
#3-48
CENTER
CYLINDERS
Hard Aluminum or Brass
PISTON AND ROD
Brass



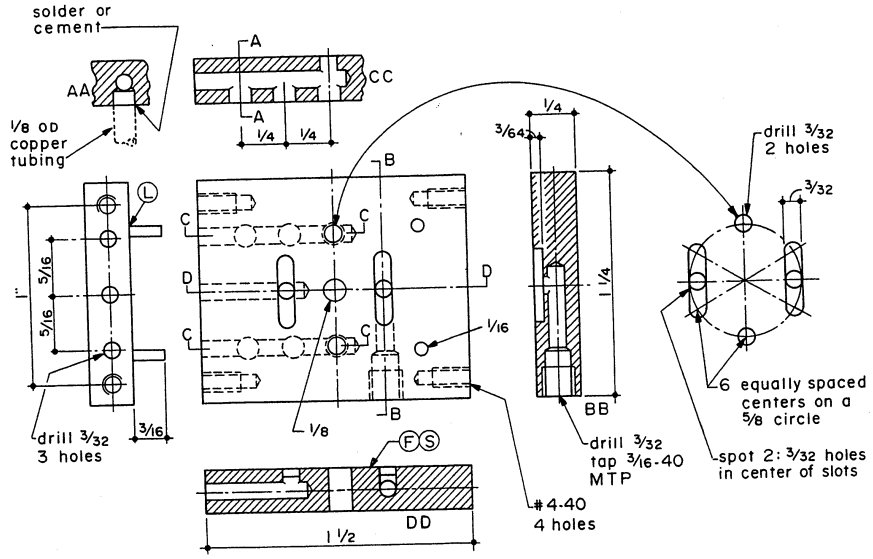
FRONT PLATE
Hard Aluminum *(cement)*
Brass *(cement or solder)*



VALVE
Brass



CRANKSHAFT
Steel



VALVE PLATE
Brass

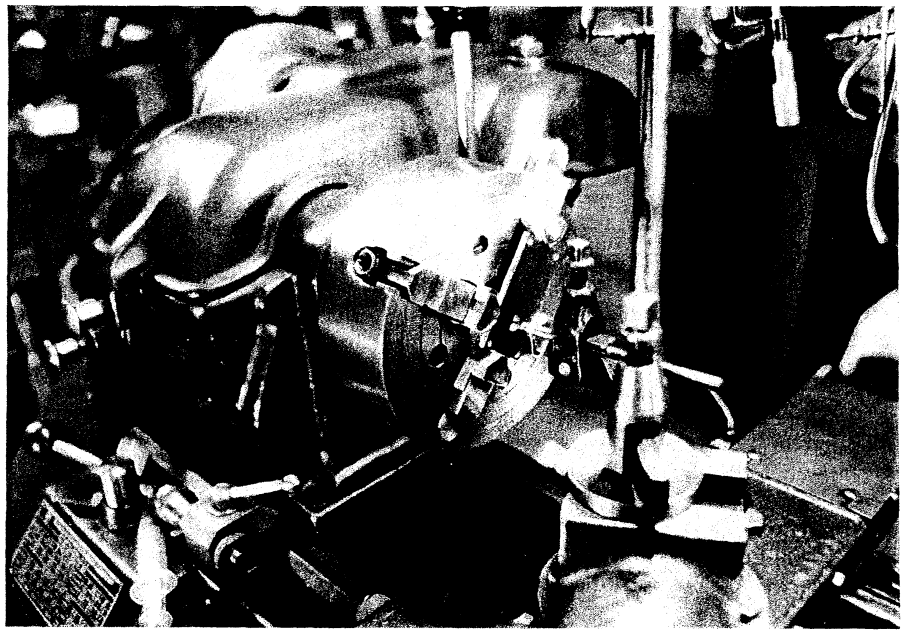
the passage gets stopped up by the cement. There is less chance of clogging the passages if brass parts are used. Fit and insert all the Tubes and melt tiny pellets of solder around each Tube end.

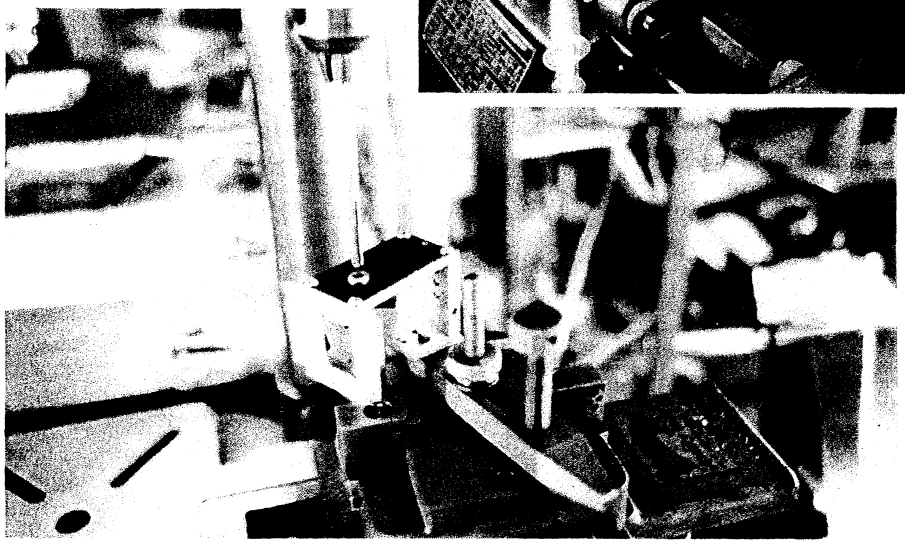
The **VALVE** is a disk, laid out with six spaces on a 5/8" circle just like the Valve Plate. Here, four of the centers are picked up and grooves milled as on the Valve Plate. The face must be smooth and flat for a good seal. While truing up the face, make an accurate 5-40 center hole for the Pivot Pin, perpendicular to the face. Turn the .010" x 1/4" relief.

Note the relationship of the **CRANKSHAFT** and **FLYWHEEL**. A 1/32" flat is made on the Shaft opposite the Crank throw. The set screw in the Flywheel is opposite the three counterbalancing holes. This puts the weight opposite the Piston and Connecting Rod, reducing a big share of the vibration.

Two of the **CYLINDERS** are the usual wobbler type. The center Cylinder has a Head on the end towards the Crank. This applies pressure to the Piston upward like a Cylinder down at 120° would give. One fault on this engine is the three different dimensions from the Piston centerline to the rubbing face. This turned out to be more of a problem than was anticipated. This was required to accomodate the Bearings at the Crank. The model made to these dimensions ran good at low pressure. Higher pressures lifted the tall Cylinder off its seat, though it did run. It

Boring the Back Plate for the Bushing





Reaming the Bearing holes.

is hard to reduce this dimension. Quite a bit of time was spent trying to solve this problem. Three different steps on the Front Plate would have been about as complicated. Decidedly offset Connecting Rods would apply an angling pressure to the outside Pistons. So, for a simple design that runs, this is what we have. Slightly more spring tension on the tall Cylinder helped reduce some of the trouble. Don't hesitate to try some of your own ideas here. In making the Cylinders, lay out the bore centerline on the end of a finished block and prick punch. Center in the 4-jaw, using a center test indicator and bore to a fine finish. Lay out the Pivot center and squarely chuck in the 4-jaw, using a protector over the bore end. Make a skin cut to a fine flat finish. Drill and tap for the Pivot and make the .010" undercut. The 1/16" port hole is made by using the Piston as shown with a close-fitting pin through the jig and Crankpin holes. All of these holes and pins must be close-fitting for accurately matching the holes in the Front Plate when the Cylinder rocks to each side.

The **PISTON** for the center Cylinder is quite plain and not unusual. Hold the 1-7/16" dimension from the Crankpin hole to the end.

The outside **PISTONS** start out with stock large enough to turn the O.D. to a close fit in the Cylinders. Mill the 3/8" wide cut to one-half the stock diameter. Center in the 3-jaw and add a center hole for tailstock support. Turn the Piston and Rod to shape and make the parting cuts. Center the 3/32" Crankpin hole in the width of the Bearing end. Use each Cylinder as a gauge and fit each Piston to its own Cylinder and keep them together. At assembly, check these Crank ends for rubbing against each other. You should see daylight between the three ends. In other words, they should float past each other and not apply any pressure that will add friction in the bore and tend to tilt the Cylinders.

The **SPRINGS** are from the odds-and-ends collection and seem about right for this job. Try some from your collection. The tighter you set these Springs, the more pressure it will take to run the engine. For showoff and a conversation piece, set them as loose as you can with the least leakage so it will start and run easily.

It may take a bit of filing and fitting to make it run free. It is an interesting model and a fair showpiece. At 15 to 20 pounds of air, it ran at a good speed.