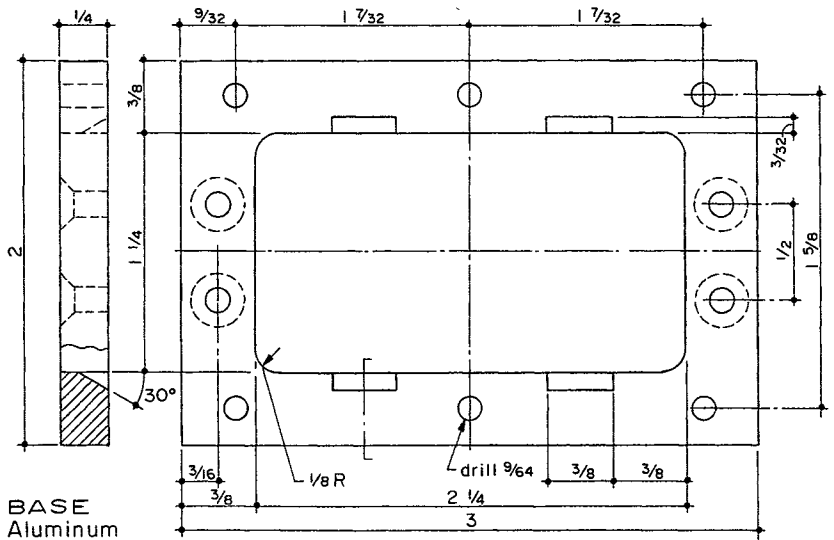
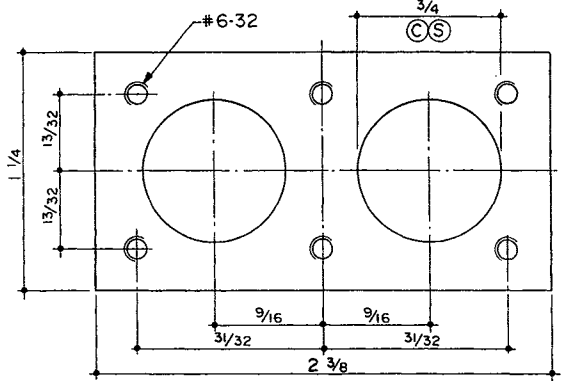
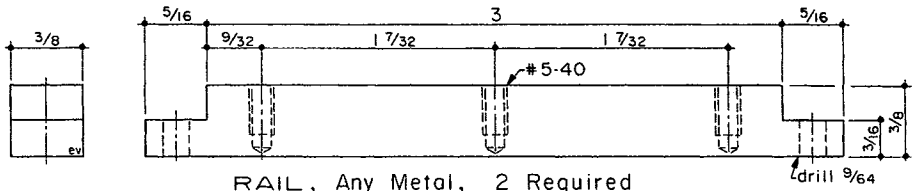


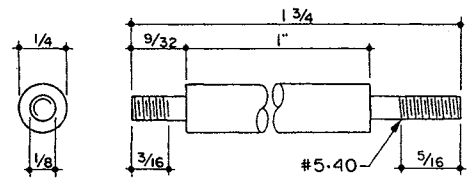
CYLINDER BLOCK
Cast Iron, Brass or Hard Aluminum



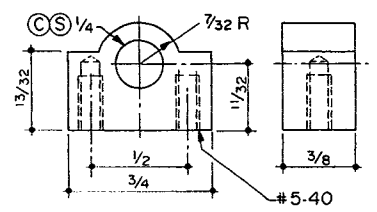
BASE
Aluminum



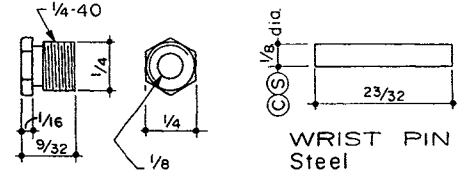
RAIL, Any Metal, 2 Required



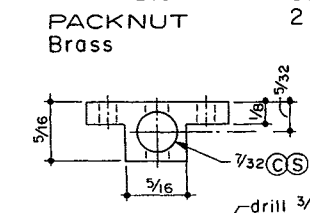
COLUMN
Steel
6 Required



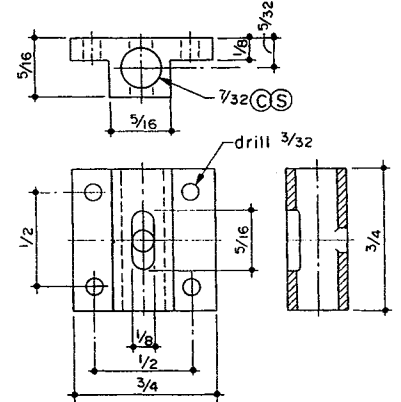
BEARING
Brass
2 Required



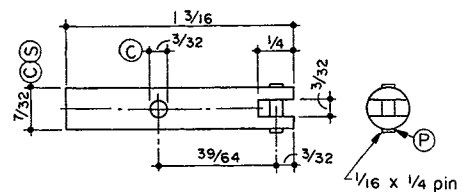
WRIST PIN
Steel
2 Required



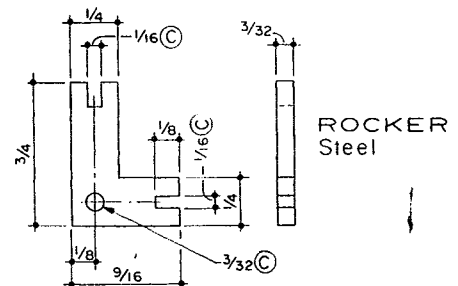
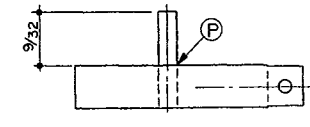
PACKNUT
Brass



SLIDE
Brass



SLIDE PIN
Steel



ROCKER
Steel

44

Open Column Twin

This is a 3/4" x 3/4" single-action vertical two-cylinder engine using the Open Column construction and a regular Steam Chest and Slide Valve. It is a stocky, compact engine and fairly strong. The small diameter Flywheel, as used on marine engines, is combined with the Crankshaft, though this wouldn't be done in a larger commercial engine. The lack of an open Flywheel makes it just a bit more difficult to start. A pulley or coupling has to be used as a thumb wheel to give it a start. Rotate the Shaft until it is on a power stroke and it will start the instant the pressure hits it.

This is a fairly heavy engine. The Cylinder was made of a block of steel. A fine-grained semi-steel or Meehanite would have been preferred. Brass or bronze could be used, but it is expensive these days.

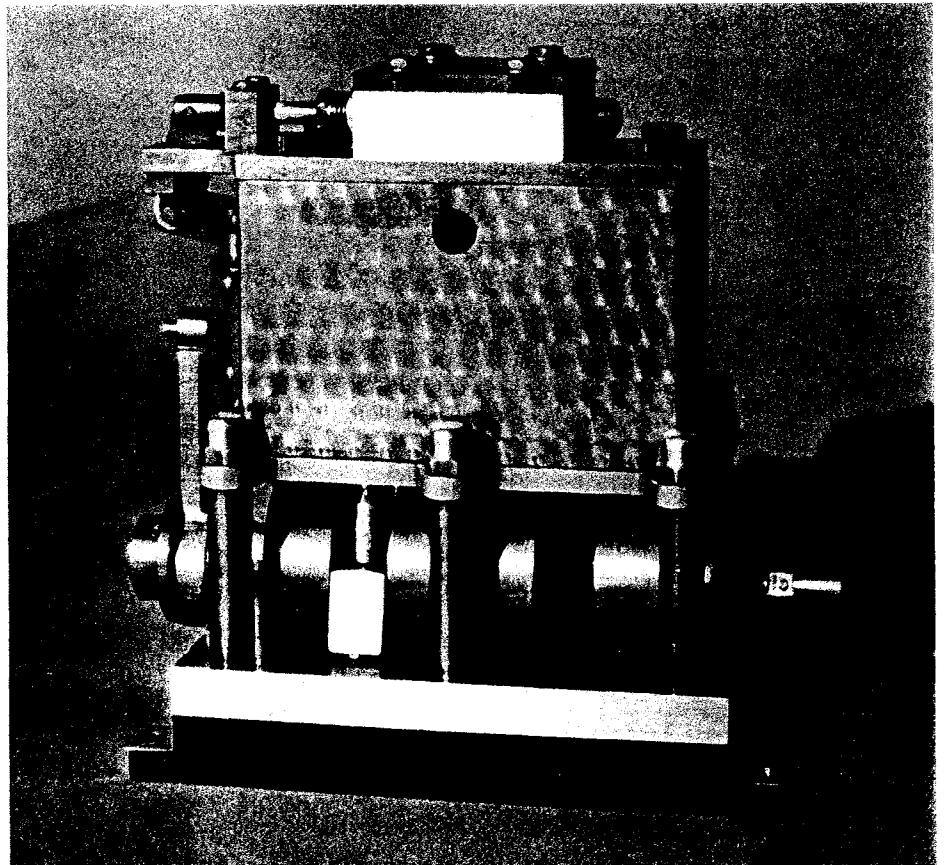
The Cylinder **TABLE** is a layout, filing and drilling job that must match the Crank frame and Cylinder drilling.

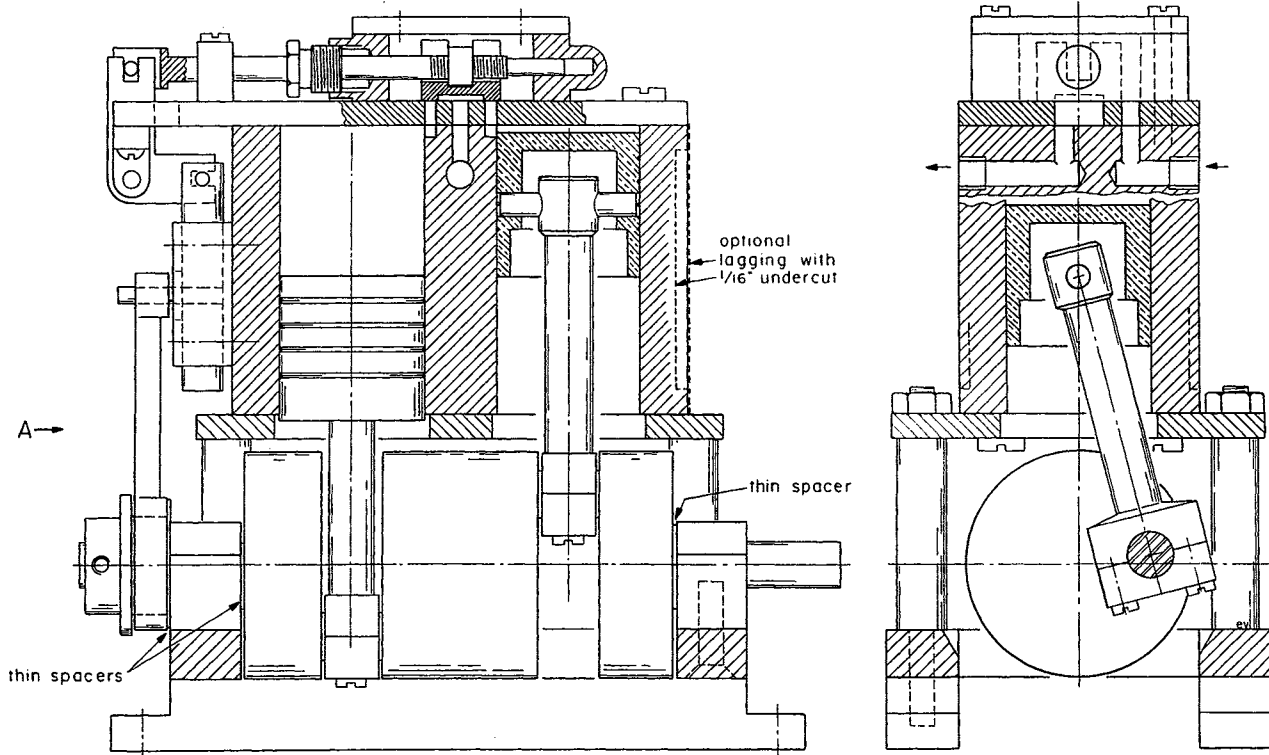
Steel disks and drill rod are used for the **CRANKSHAFT/FLYWHEEL**. Turn, and drill the center hole, for all three disks. Mount the disk in an indexing fixture and center so a 1/4" rod in the spindle chuck will enter the center hole. Read the crossfeed dial and move .375" off the center piece, rotate 180° for the opposite hole. Apply Loctite to the two Crank Pins and holes in the center piece **ONLY**. Assemble in place with the 4" center Shaft and the two outer Disks for alignment while the Loctite cures. When cured, apply Loctite to the two outer Disks and center Shaft, align and set aside to cure. When cured, add 1/16" spring pins and cut away the center shaft.

The **CYLINDER BLOCK** is formed from an accurate and square block 1-1/4" x 1-1/2" x 2-3/8". Apply layout dye to the top, bottom, one end and upper center of each side. Lay out the centers and prick punch for all the holes. The two 3/4" holes can be done in the 4-jaw, picking up each center with a center test indicator. Drill and tap all the holes. If lagging is desired, cut 1/16" deep paths on two sides and the end opposite the Eccentric as shown. Form the lagging from thin sheet metal and attach with four 2-56 screws.

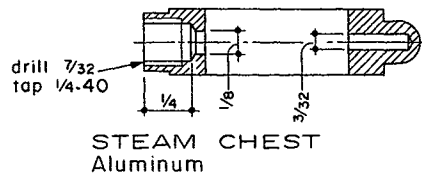
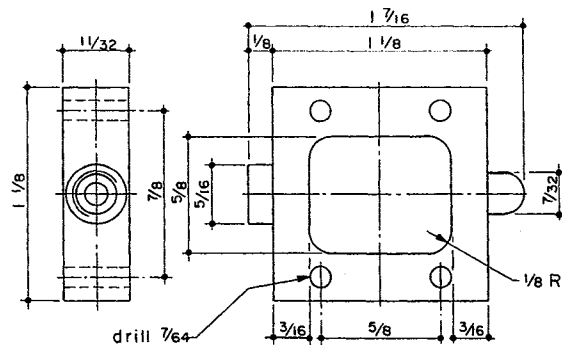
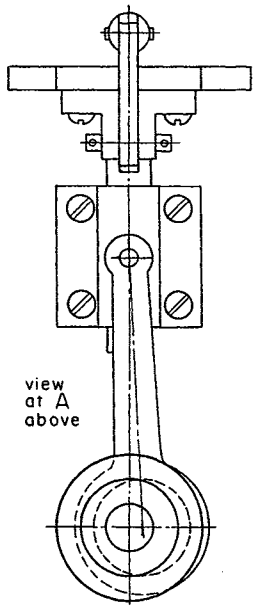
The **PISTONS** on the model shown are aluminum, but brass or bronze could be used. Mark each Piston so each stays with the bore it was fitted to.

The **WRIST PIN** is drill rod, held in at assembly by a light prickpunch mark flowing a bit of Piston metal

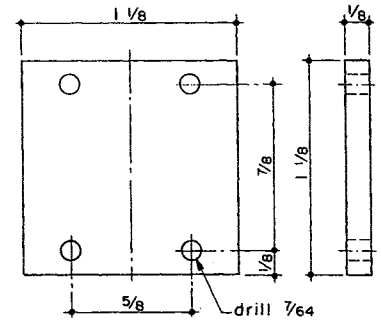




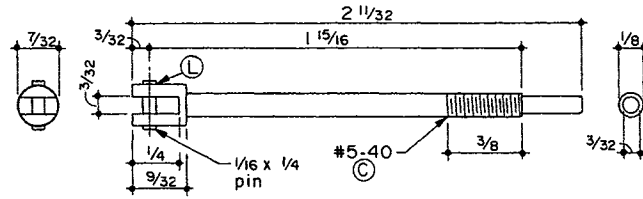
OPEN COLUMN TWIN



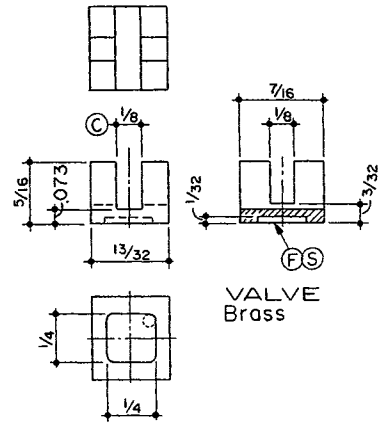
STEAM CHEST
Aluminum



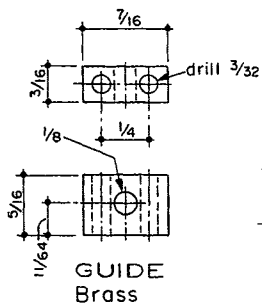
COVER
Aluminum



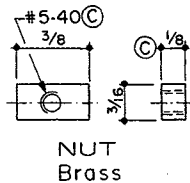
VALVE ROD
Brass



VALVE
Brass



GUIDE
Brass



NUT
Brass

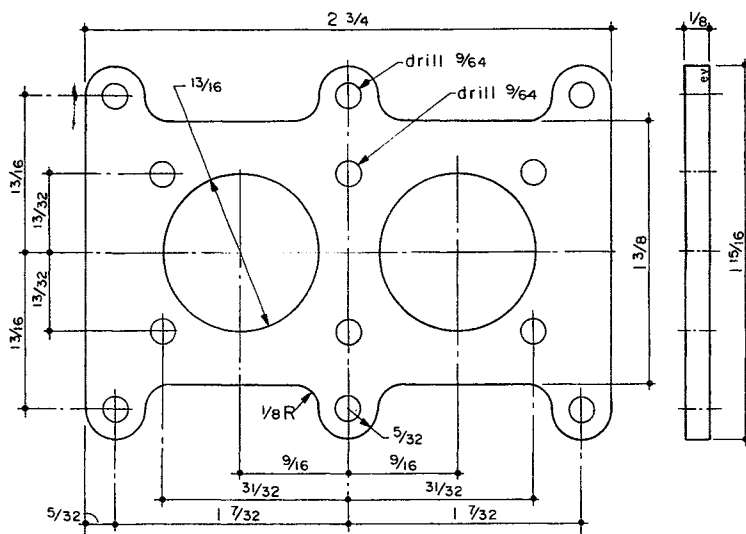
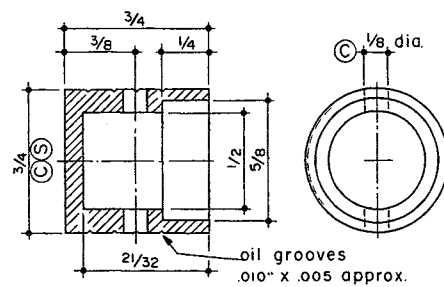
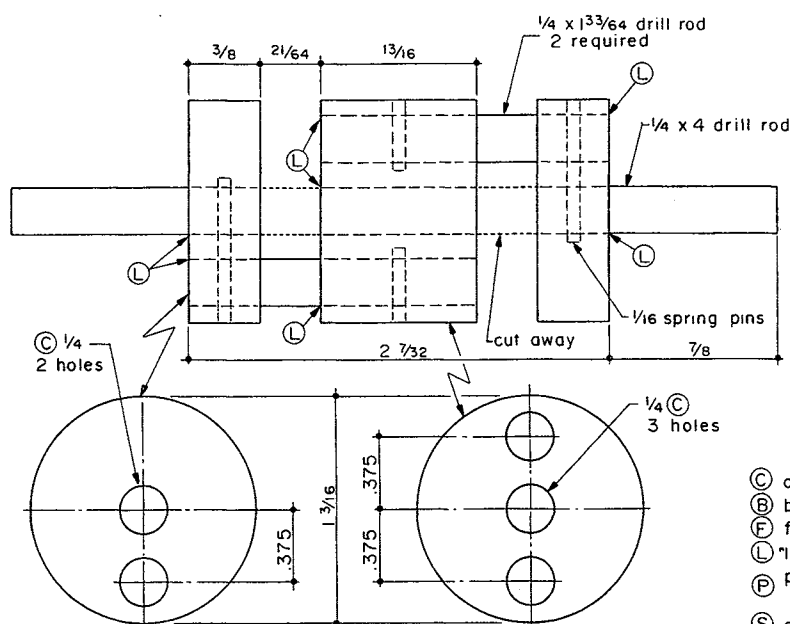


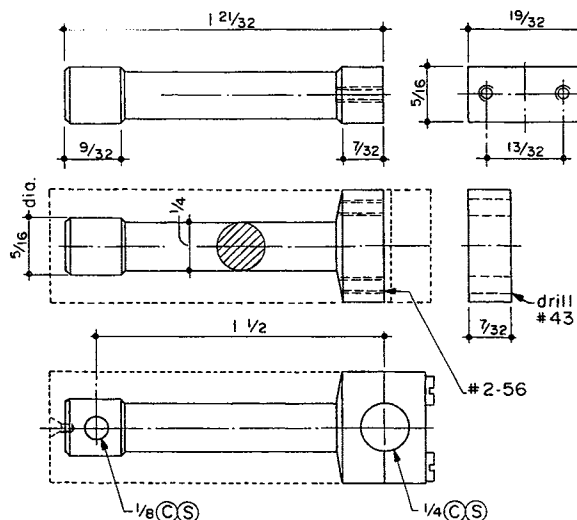
TABLE
Aluminum



PISTON
Brass
2 Required

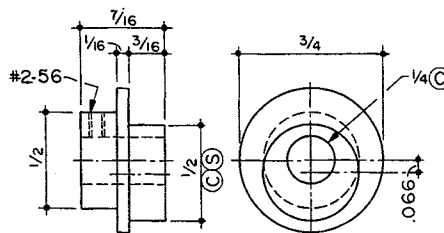


Steel
2 Required
CRANKSHAFT

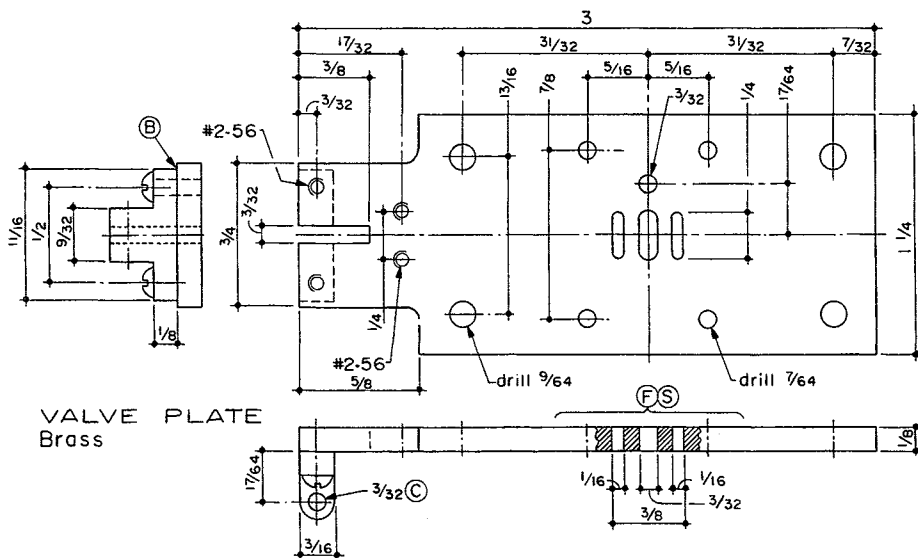


CONNECTING ROD
Hard Aluminum
2 Required

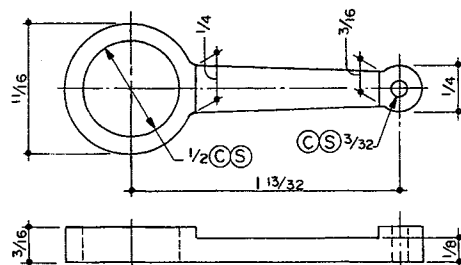
- (C) close fit
 - (B) braze or solder
 - (F) flat
 - (L) "loctite"
 - (P) press fit or loctite
 - (S) smooth
- MTP model taper pipe thread



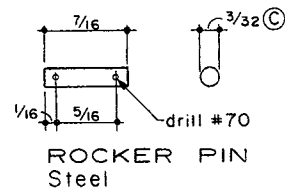
ECCENTRIC
Steel



VALVE PLATE
Brass



ECCENTRIC STRAP
Brass



ROCKER PIN
Steel

over each end of the Pin. Dress any metal raised on the Piston O.D. with an oil stone.

The **CONNECTING RODS** start out as two accurate pieces of aluminum (used on the model shown) or brass 5/16" x 19/32" x 2" long. Layout and tap-drill the two screw holes in one end of each piece. Using a thin slitting saw in the mill, cut a 7/32" piece off the end of each. Keep the related parts together. Tap the two holes in the "Rod" 2-56 and drill the "Cap" #43. Bolt the Cap in place and scribe a center line the full length of each assembly and around the end. Prick punch on this centerline at the Cap joint and 1-1/2" from that point for the 1/8" hole. Drill and ream these two holes in each. Prick punch the center of the Piston end of the Rod and center in the 4-jaw with only 1/8" projecting, using a center test indicator. Center drill with a tiny center drill (the one used here had a pilot drill diameter of .025"). Mark two adjacent jaws with chalk. Loosen these two jaws and move the piece out approximately 1-9/16" and hold against the tail stock center while tightening the two chalked jaws. Turn the 1/4" and 5/16" diameters. Next, on the end, make a parting cut at 1-21/32" until it almost touches the tail center. Remove and file off the small projection on the end.

The **ECCENTRIC** starts out as a piece of steel 3/4" diameter by approximately 1-1/2" centered in the 4-jaw chuck. Starting 1/4" from the end, turn the 1/2" hub for the set screw about 3/8" wide. Turn the O.D. smooth just under 3/4" to true it up. Bore and ream 1/4" for the Shaft. Mount a square-ended bar in the toolpost and bring it up against the finished O.D. and set the cross slide collar at zero. With two of the jaws horizontal, loosen the vertical jaws slightly. Back up the rear jaw about 3/32". Force the workpiece back about 5/64" using the front jaw. Turn the cross feed in .066". Ease the workpiece back against the bar using the rear jaw. Snug up all the jaws. Now, when the high spot just kisses the bar and the chuck is then rotated 180°, a .130" diameter rod should just pass between. Turn the 1/2" diameter eccentric and part off at 7/16". Add a setscrew located on the center-

line through the bore and offset. This helps when timing the Valve.

The **ECCENTRIC STRAP** is laid out on a piece of 3/16" flat brass. Prick punch the two hole centers and make the 3/32" hole. Saw and file to the outline. True up in the 4-jaw, centering with a center test indicator for the 1/2" hole. Do not tighten the jaws so much that the hole will be distorted when removed from the chuck. Carefully bore to a close fit on the Eccentric.

The **SLIDE PIN** is drill rod. Mill the 3/32" slot as near parallel with the 3/32" pin as you can make it. The 3/32" pin must be square with the 7/32" pin.

The **ROCKER** is steel and, here, accuracy is also important. This engine has a fault like the linkage in a locomotive valve. The accumulated tolerance at all the joints can total up to quite a lot of clearance. There are eight joints. If each has 1/2 of a thousandths clearance, the total is .004". If each wears another half, the total is .008". That means from .004" to .008" of the Eccentric rise is used up taking out the slack in the line. So try to make all the joints close fitting.

The **SLIDE** is a brass block milled or shaped and bored for a close fit on the Slide Pin. Just simple machining.

The **VALVE PLATE** and **ROCKER PIVOT** are combined here. This is made of brass, and drilling has to match the Cylinder block. Make up the Pivot block in one piece. Coat the surface of the block with solder. Coat the Valve Plate at this spot with soldering flux. Assemble, tightening down the screws. Apply heat with a torch. When the solder melts and flows all around the joint, quickly tighten the screws. Mill the slot for the Rocker. Flatness and smoothness are important at the center Valve area.

The **STEAM CHEST** is aluminum on the model shown. Start with an accurate block of aluminum 11/32" x 1-1/8" x 1-7/16". Lay out the outline and all the hole centers, including the centers of the 1/8" radius inside. Chuck in the 4-jaw, centering on the 1/4-40 hole. Drill 3/32" to about 1/32" from breaking through. Enlarge this to 1/8" about half way through. Drill 7/32" depth 1/4" and tap 1/4-40.

Reverse and turn the blind end. Drill the four 7/64" holes and four 7/32" holes at the 1/8" radius centers. If necessary, enlarge the 7/32" holes to 15/64" or 1/4", if the hole doesn't quite reach the layout lines. Saw and file the center opening.

The **VALVE** is a simple block with two milled slots and a recess in the bottom. When assembled, this block should seat exactly on the Plate when steam pressure is on it. It should float and not be held against the Plate by the Valve Rod. It should be able to rise a few thousandths off the Plate.

The **VALVE ROD** is made by chucking a 1/4" diameter x 3" brass rod in the 3-jaw with about 2-5/8" projecting, supported by the tailstock center. Use a tiny center drill. Start back a bit so the center can finally be cut away and turn to size and thread 5-40. Make a parting cut 9/32" from the shoulder. Mount in the cross slide mill and make the 3/32" slot. Fit a 1/16" pin squarely across the fork.

The model shown has a clear plastic cover so the Valve position and action can be seen. If live steam is to be used, it should be metal. At 30 pounds of air, it is hard to stop this engine with the fingers pinching the Shaft. Molykote lube was used at assembly to fill the surface pores and provide longer lasting lubrication.

At assembly, add a couple of turns of 1/16" strands of unraveled, braided, graphited asbestos packing to the Steam Chest Gland. Do not turn it up tight; just snug it up with the fingers.

With the Cranks at horizontal, the Valve should fully expose one slot. One half turn of the Crank should fully expose the other Valve slot. Set the Eccentric so it is at 90° to the centerline through the Cranks. Take half turns of the Valve Rod, adjusting the Valve so it exposes the Valve slots equally at both ends of the Valve travel.

An option on the model shown was hex nuts above the Valve Plate and acorn nuts on the Columns. The metal lagging option was used and the metal stock given the damascening finish before it was formed.

This is an interesting engine and it ran fine on as little as five pounds of air pressure.

SAFETY FIRST — AND ALWAYS!