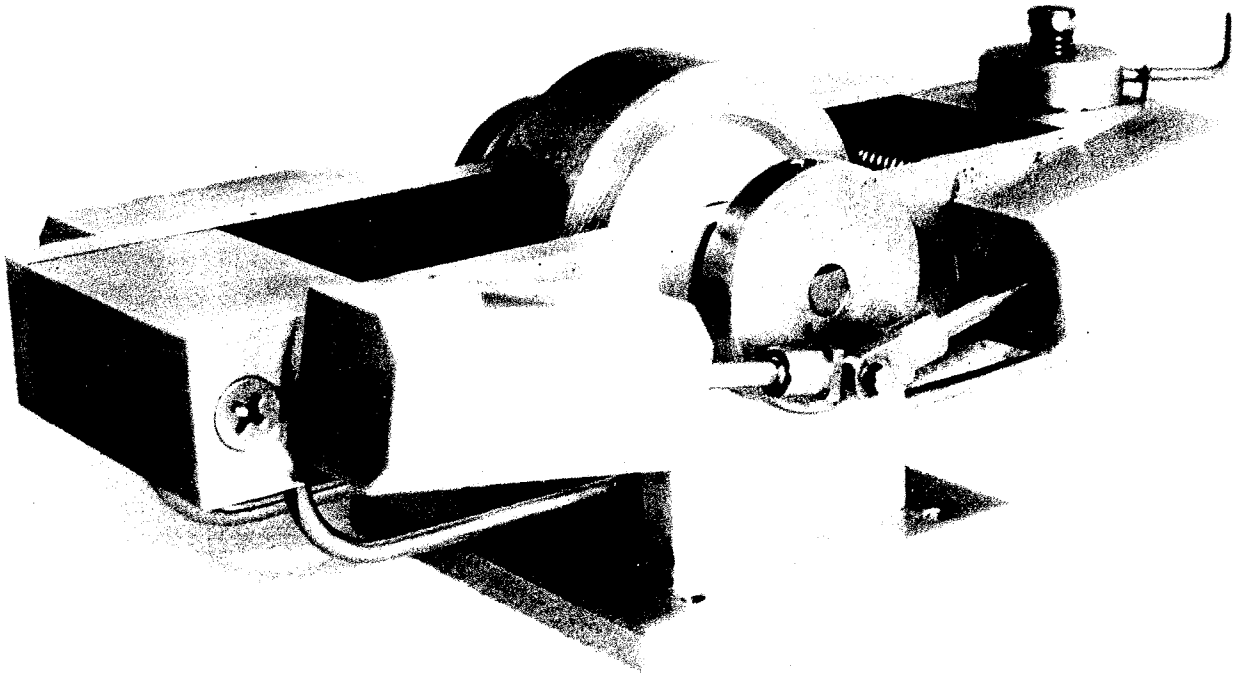
CHAPTER

28 H-Quad Engine



In 1981, this writer built a small twin wobbler engine and drawings were published. The overall length was about 2-1/4", the bore was 1/4" and it had a 1-1/4" flywheel. Ralph Weidman in Wooster, Ohio, didn't like to work to that small size so he doubled it and added two more cylinders and a reverse. His engine is shown below, next to the original H-Twin.

The drawings presented here cover his engine with a few slight variations since his engine is mostly brass while this one is mostly aluminum.

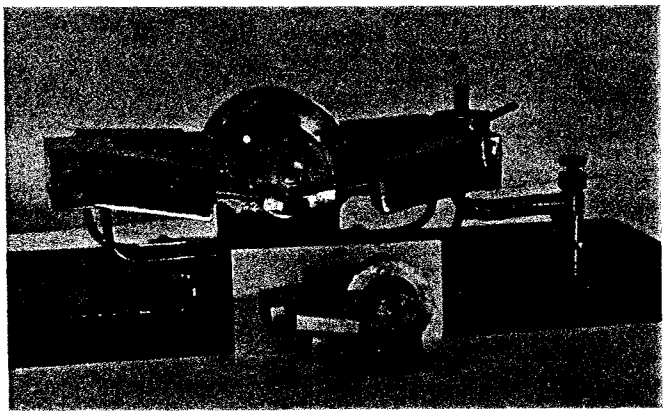
The Side Frames and End Blocks are worked up together in Steps 1 through 11.

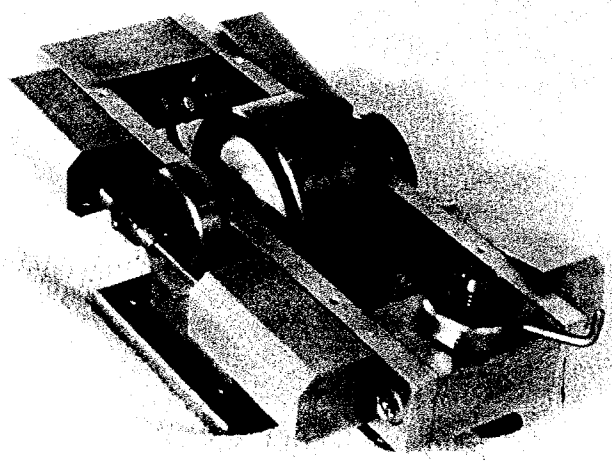
STEP 1. Make the two **SIDE FRAMES** alike. One side has 1/16" dowels to keep the End Blocks from rotation. Lay out the one Frame, clamp the two Frames together and drill and countersink for #8-32 screws. Bolt the two together with flat head screws so one side will lie flat while drilling and reaming the 5/16" Crankshaft hole and 3/16" Pivot holes.

STEP 2. Make the two **END BLOCKS,** tapped for the #8-32 screws.

STEP 3. The **DRILL JIG** is a simple steel strip drilled

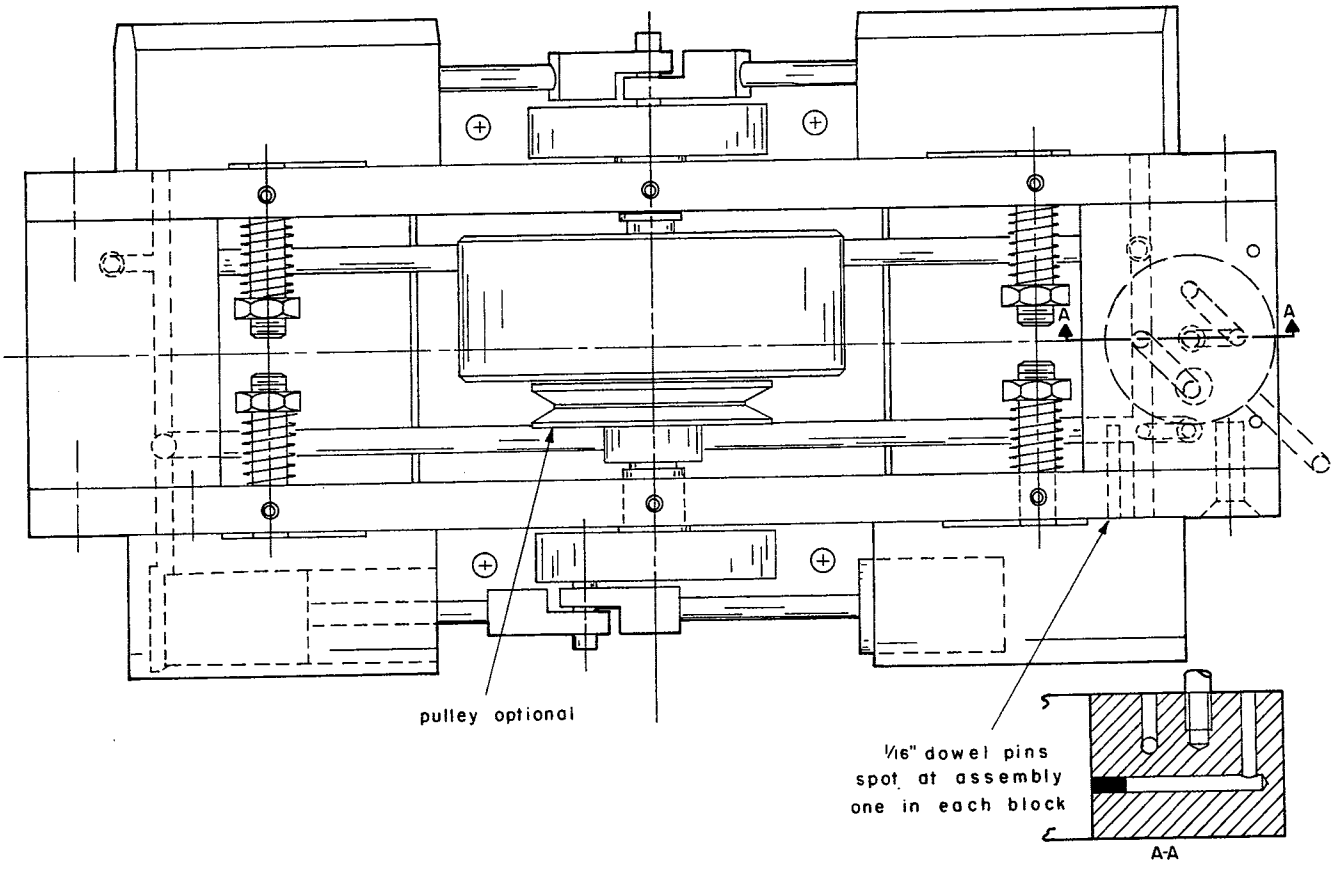
Below: Ralph Weldman's 4-cylinder wobbler alongside the original H-Twin.
Right: The H-Quad is an interesting engine which shows a lot of action.

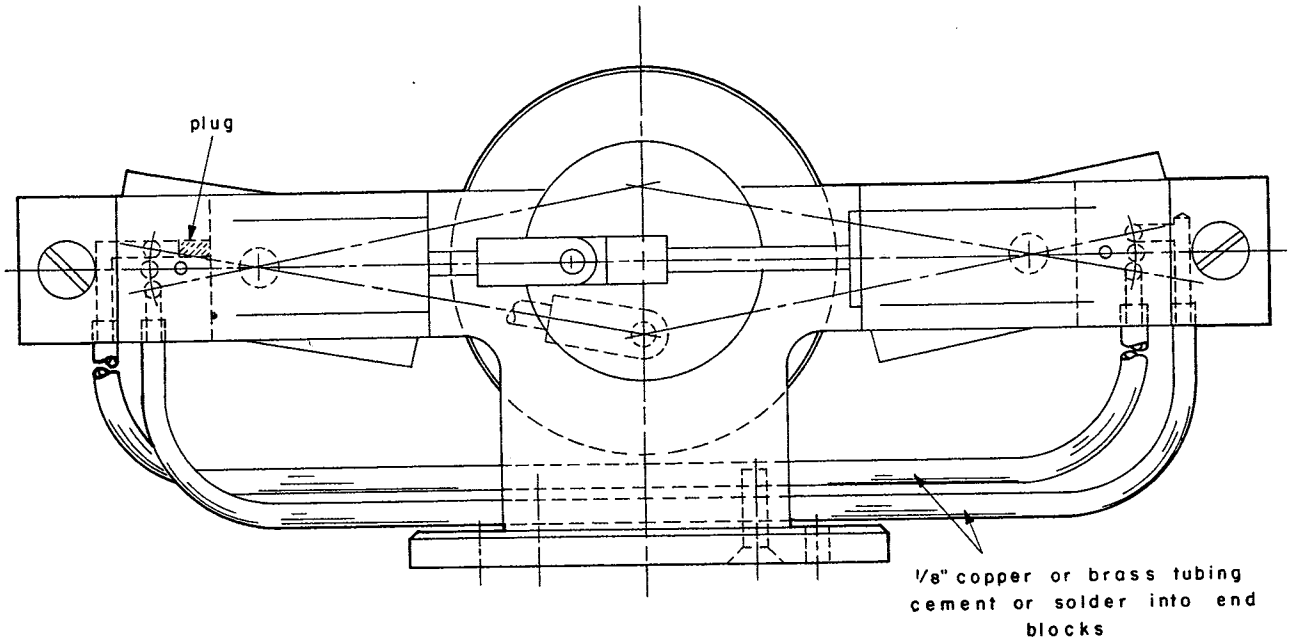


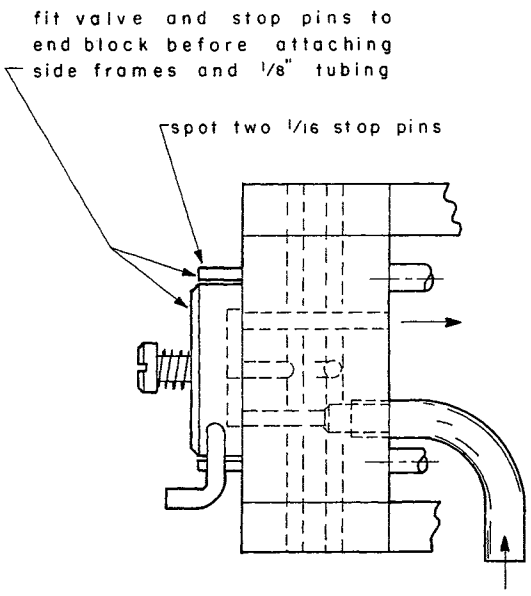


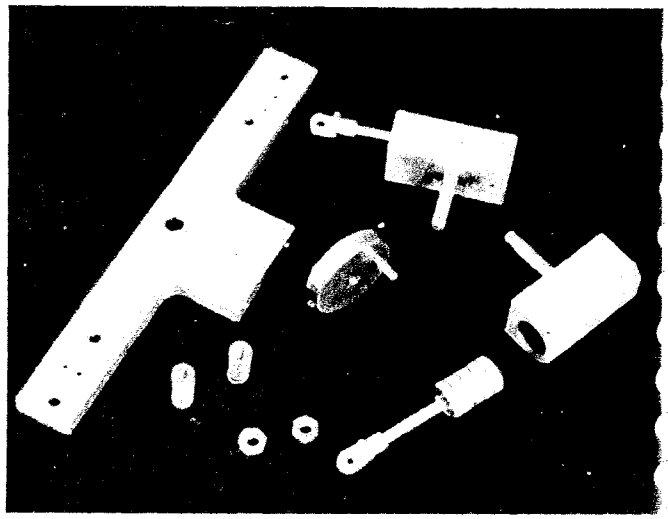
H-QUAD with reversing gear

Developed by Ralph Weidman from H-TWIN

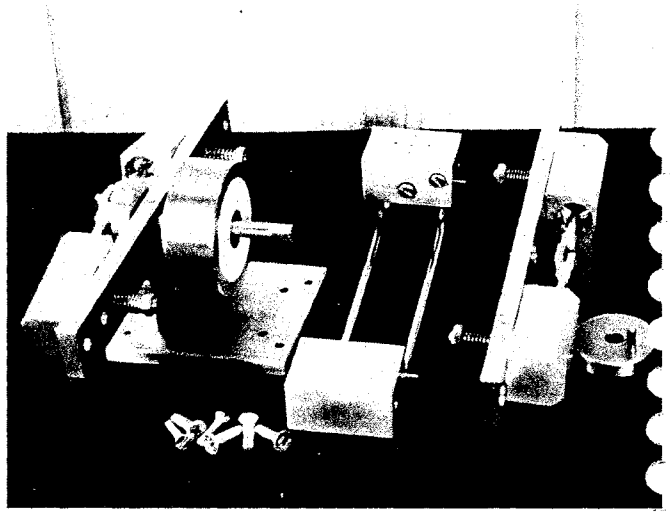




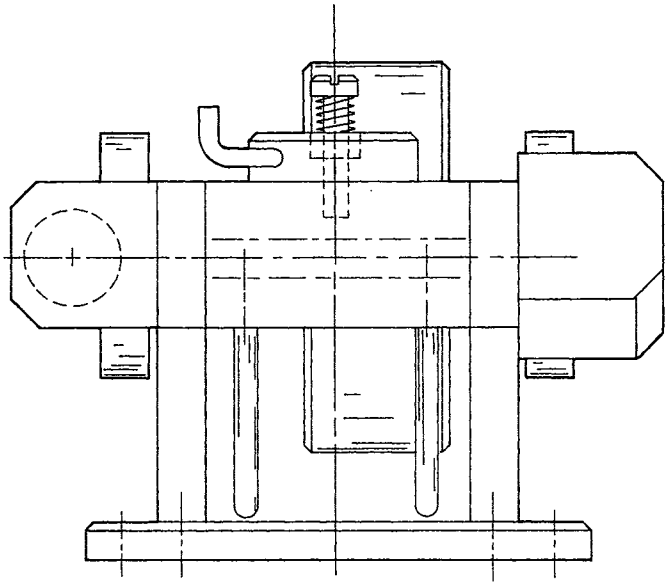


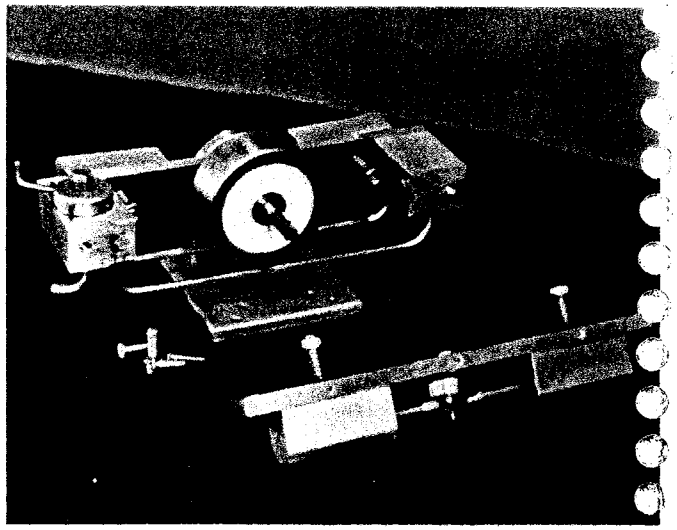


One Side Frame, Crank Disk, Cylinders, Pistons and springs.

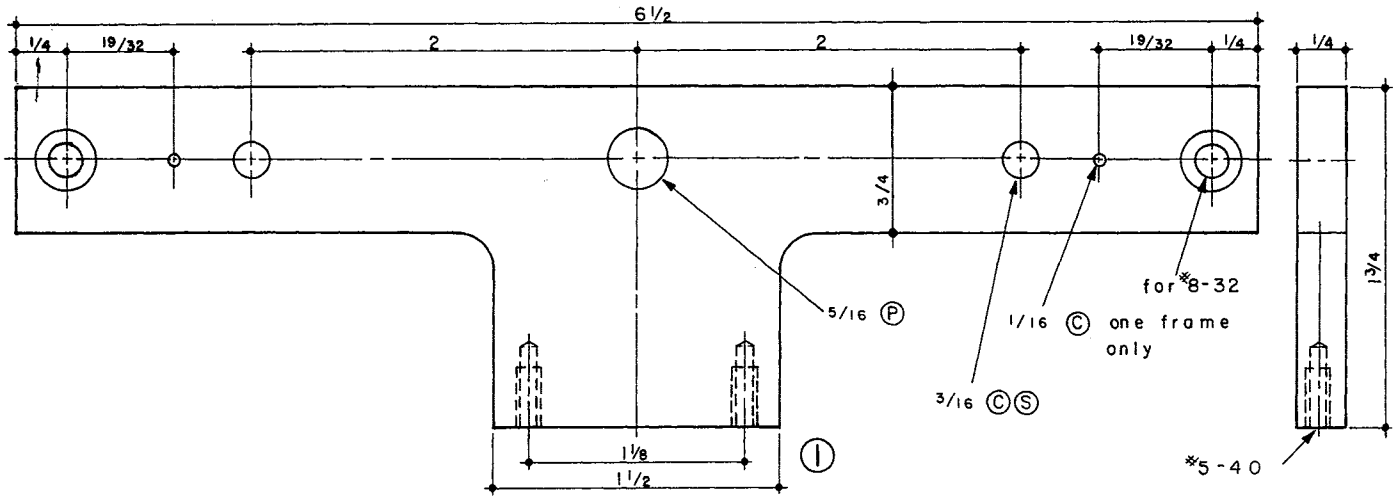


The three major assemblies.

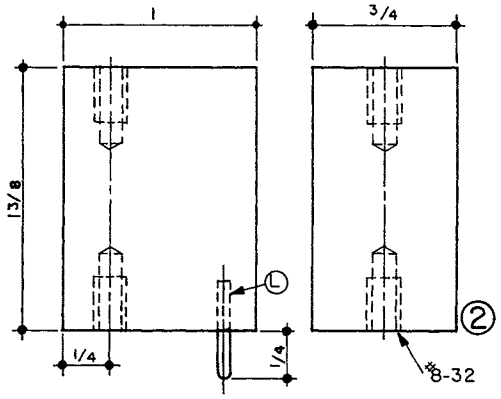




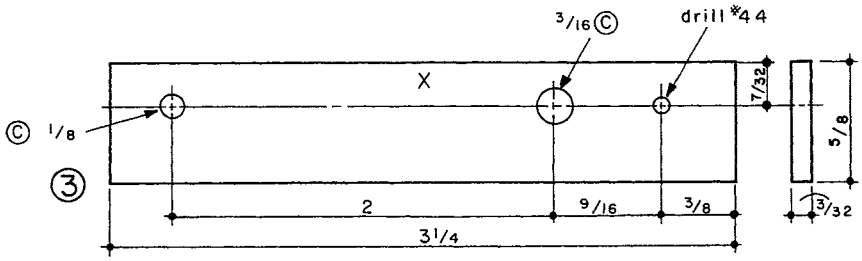
Two sub-assemblies bolted together and ready for the third.



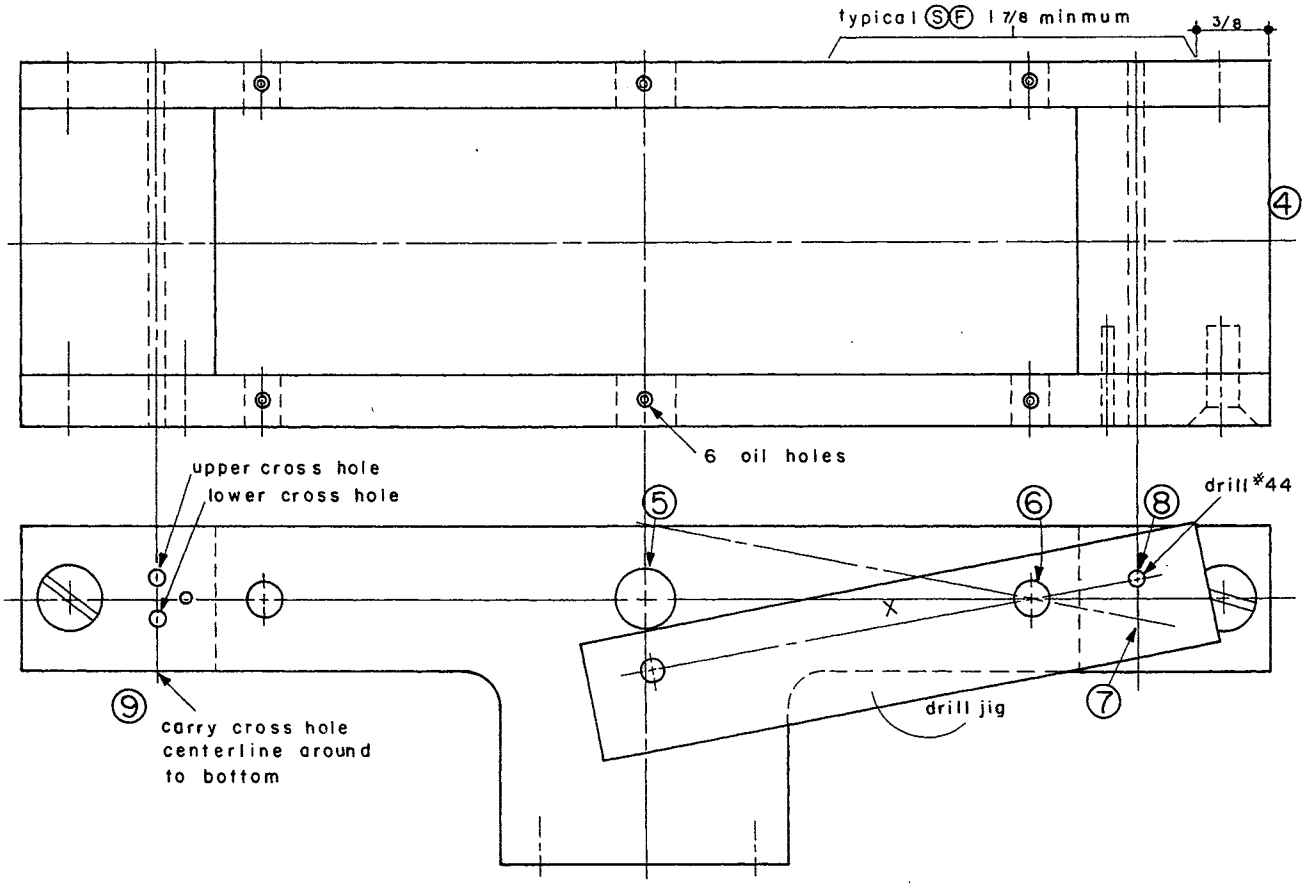
SIDE FRAME
Aluminum or Brass, 2 Required
Must be straight and flat

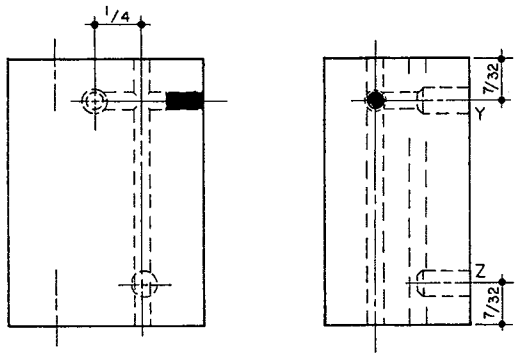


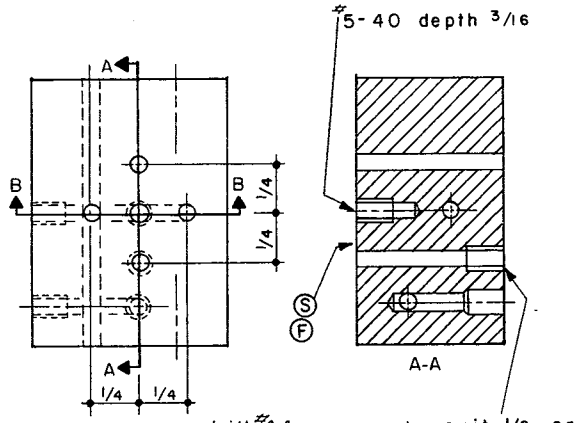
END BLOCK
Aluminum or Brass, 2 Required

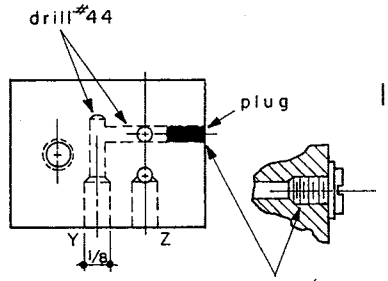


DRILL JIG
Steel









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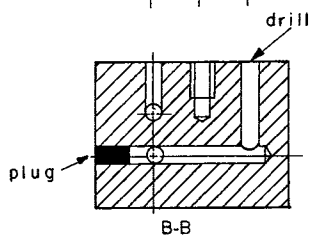

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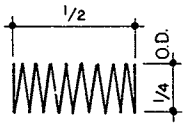
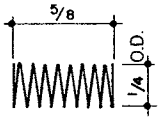
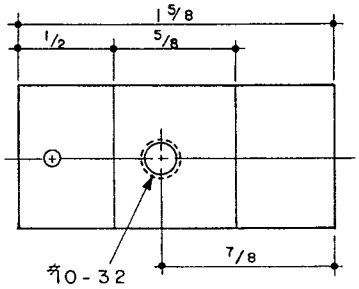
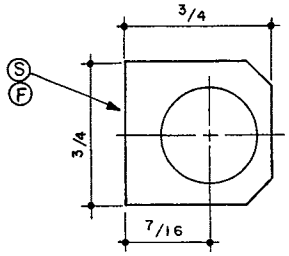


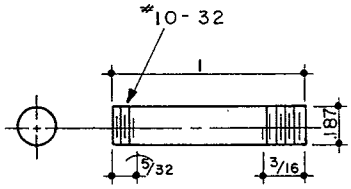
VALVE SPRING
Steel, .030" wire
approximately 6 coils



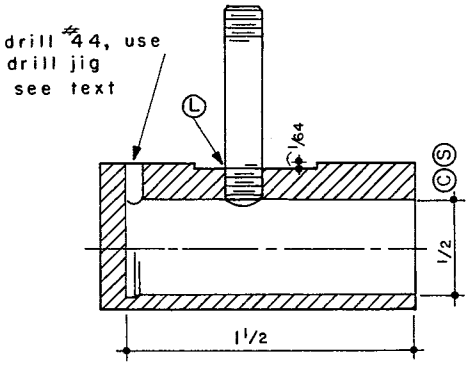
PIVOT SPRING
Steel, .030" wire
approximately 8 coils



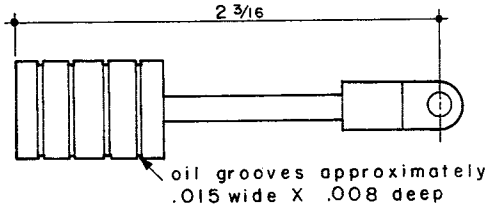


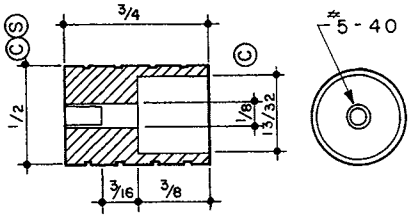


PIVOT
Brass or Steel
4 Required

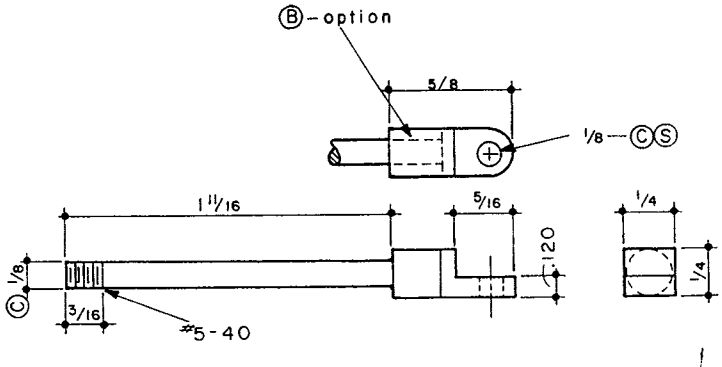


CYLINDER
Brass or Aluminum
4 Required

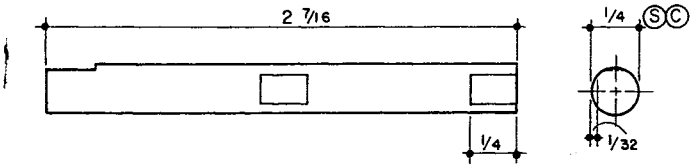




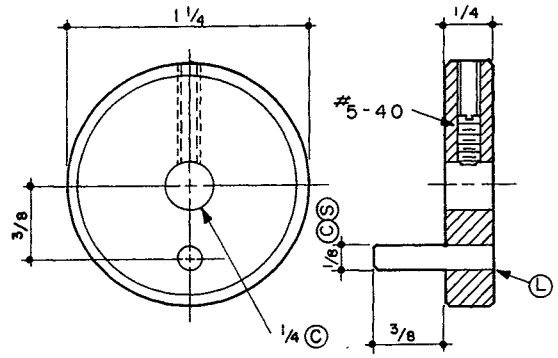
PISTON
Brass or Steel, 4 Required



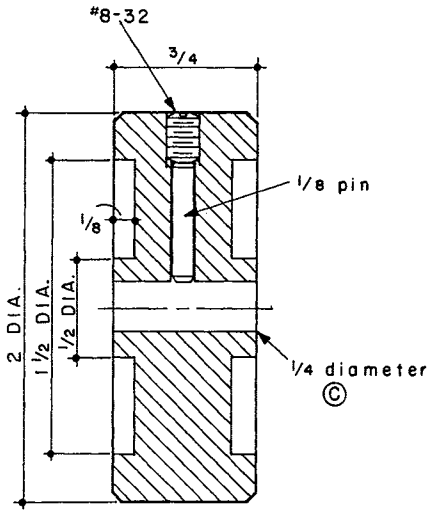
PISTON ROD
Brass or Steel, 4 Required



CRANKSHAFT
Steel

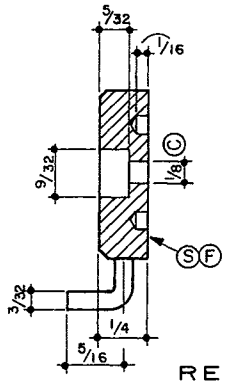


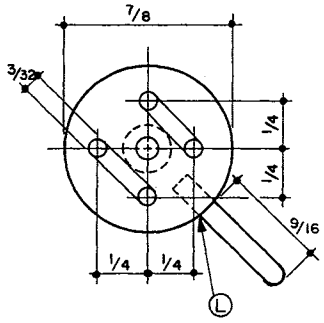
CRANK DISK
Brass or Steel, 2 Required



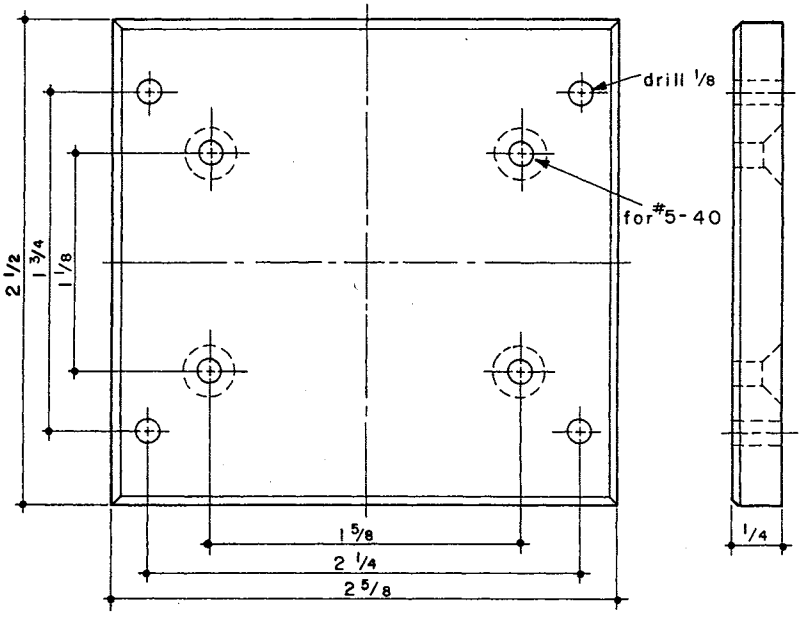
FLY WHEEL
Any Metal

Ⓒ close fit
Ⓢ smooth
Ⓕ flat
Ⓟ press fit or "loctite"
Ⓛ "loctite"
Ⓑ braze or solder

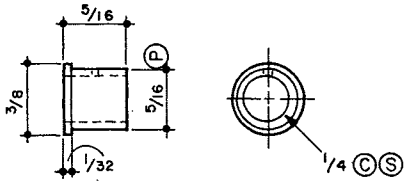




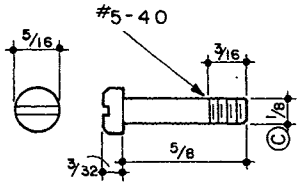
REVERSING VALVE
Brass or Aluminum



BASE
Aluminum or Steel



CRANKSHAFT BEARING
Bronze, 2 Required



VALVE PIVOT SCREW
Brass or Steel

and reamed for the 1/8" Crank Pin and 3/16" Cylinder Pivot Pin. Stamp the side **X** for locating purposes.

STEP 4. Assemble the two Side Frames and End Blocks, well aligned and tight. Run a 1/16" drill through the Side Frame hole into the End Blocks and remove that Side Frame. Set the two 1/16" dowels in the End Blocks with Loctite. Wait for it to cure and wipe away any on the outside so it won't set up in the Side Frame. Attach the Side Frame. Number each corner 1 through 4 and stamp the bottom of the Side Frames and End Blocks so it is easy to reassemble in the way it was machined.

STEP 5. Insert a close-fitting rod in the 5/16" Crankshaft holes and a 3/16" rod in the Cylinder Pivot holes.

STEP 6. Place Jig over the 3/16" rod and hold Jig against 5/16" rod as shown. Drill #44 about 1/8" deep.

STEP 7. Turn Jig over and repeat for other port hole.

STEP 8. Drill eight holes in this manner. Next, remove pins and drill #44 carefully and squarely halfway through from one side and turn the assembly over and drill until the holes meet in the center of the End Blocks. Do not drill all the way through from one side.

STEP 9. Carry the center of these cross holes around to the bottom.

STEP 10. Remove the End Blocks, lay out and drill up from the bottom at **Y** and **Z**. Counterbore for 1/8" tubing. Carry the center of the upper cross hole to the face and drill as shown. Make both blocks alike. When they are assembled to the Side Frames, they will be set for the tubing which must connect the lower cross hole at one end to the upper cross hole at the other end. This is shown in the lower lefthand assembly view. In operation, one tube is **INTAKE** and the other is **EXHAUST**. The reverse changes these to opposite — intake becomes exhaust, etc. As you can see, when the Crank is down, one Cylinder is "taking steam" and the other Cylinder on that same side is exhausting.

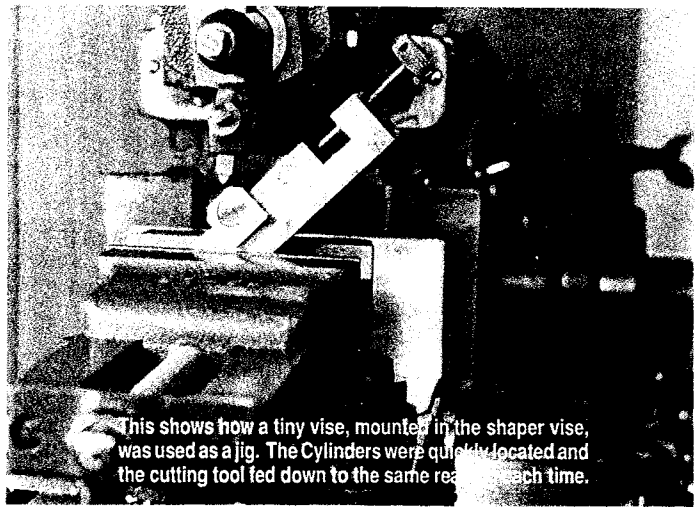
STEP 11. On one block only, which becomes the reverse control, drill from the inside face as in section **B—B** through the lower cross hole. Drill four Valve holes at 1/4" distance as shown. Two holes go way through the block and become the engine intake and exhaust. One or both can be tapped to take a tubing fitting. A third goes down and enters the upper cross hole. The fourth goes down to meet the hole that passes through the lower cross hole. Drill and tap 5-40 for the Valve Pivot Screw. The top of the block must be flat and smooth to seal against the Valve.

You can now polish all the parts with fine emery on a flat surface. Note the "flat" areas needed at the Cylinder locations. Make and press fit or Loctite the two Crankshaft Bearings into the Side Frames. Drill six oil holes. When all machining is done, blow out all passages and plug as shown. Short screws and gaskets are optional.

The **CYLINDER** and **PIVOT** are straight layout and machine work. Make some relief at the bottom of the bore for reamer run-out. Don't leave a ridge that the Piston will strike. Try to make the Pivot as square as possible to the rubbing face of the Cylinder. This rubbing face must be flat and smooth for a good seal.

Make the **PISTONS** and **RODS**, fitting each to a Cylinder. Stamp each Cylinder and Rod with the number of the Frame corner at which it is mounted.

Insert the Piston in its Cylinder and place the drill jig over the Pivot. Run a close-fitting 1/8" pin through the jig and Rod Bearing. Drill #44 for the Cylinder port.



This shows how a tiny vise, mounted in the shaper vise, was used as a jig. The Cylinders were quickly located and the cutting tool fed down to the same re[illegible]ch time.

You will probably search your spring collection and try to find something near the dimensions shown for this model.

The **REVERSE VALVE** is made from a short length of 7/8" stock chucked in the 3-jaw. Face the end smooth and make a center dimple with a tiny center drill. Paint the face with layout dye and scribe the 1/2" circle. Make the 1/8" center hole and part-off at 1/4" thickness. Reverse the piece in the chuck and take a skin cut off the face and counterbore for the Spring. Divide the 1/2" circle into four equal spaces and drill four 3/32" holes 1/16" deep. Clamp the piece to the milling machine table and make the 3/32" end mill cuts as shown. Add a 3/32" lever.

The **CRANK DISKS** are plain machining. They are held on the **CRANKSHAFT** by set screws bearing against flats that are 90° apart. This 90° makes the engine self-starting and requires the set screws to be on the same centerline as the Crank Pin.

The **FLYWHEEL** can be your own idea as to size and style. If you mount it off-center to make room for a pulley, make the flat on the Shaft accordingly, as well as a flat for the pulley set screw.

Make the **TUBING** to match the assembled Frame. If you use brass tubing and brass blocks they can be soldered. On the aluminum material for the model shown, the tubes were set with epoxy. Form the Tubing so it is down near the Base and will not interfere with the Flywheel. On the model shown they were run too high and the Flywheel had to be centered in the Frame.

This is an interesting engine and it shows a lot of action. It runs easy on 5 to 10 pounds of air. There are several variations that can be made from this basic design such as two cylinders only on one side opposed, or two cylinders diagonally opposed, and a double-size H-Twin.

Close-up view of the Reverse Valve.