CHAPTER

13 Open Column Twin With Poppet Valves

A while back, Mr. D. A. Drayson of Westmont, Illinois, sent us a copy of a page from *The Boy Mechanic* Magazine published in 1913, thinking that it would be a good subject for some of our model makers. It showed a two-cylinder poppet valve engine made from odds and ends. The article states that the engine was made with simple tools, " ... the pistons were done in a machine shop for a small sum." On the basis of the 1-1/2" tubing used for the cylinders, the original was about 8" high with a heavy 4-1/2" flywheel "borrowed from another model." On the engine shown here, 1" O.D. tubing is used for the Cylinders. The Flywheel is 3-1/2" in diameter.

The original design showed solid valve rods. Adjustable Rods are used here and they turned out to be handy in making the rise the same for both Valves. When setting the Cams, the position was set so the top of thePiston was just ready to exhaust when the Valve tripped. Then, one-half turn around, the Valve STARTS to open just a degree or two after dead center. If the Valve Stem is "long," it rides the Cam longer and rises higher and opens early. If the Valve starts to open before top dead center (TDC), the stem can be shortened about .010" for a trial and, perhaps, bring the START after TDC. This changes the amount of flow, so this procedure can go only so far and then the flow is restricted and it is then necessary to cut the notch on the Cam back, say .025" for a trial. This shortens the time the Valve is open. This timing will take time and patience and you will disassemble several times.

This engine idles nicely on 5 to 10 psi air but, at 40 psi, the Valves were noisy because the Springs were set a bit tight. The Spring setting is a bit of dead reckoning. If you think the Spring pressure is low, drill a second set of holes in the Valve Stems. These Springs were picked out of about eight salvaged from ball point pens. One pair was about 1" long and the other 1-3/16". Either length is acceptable.

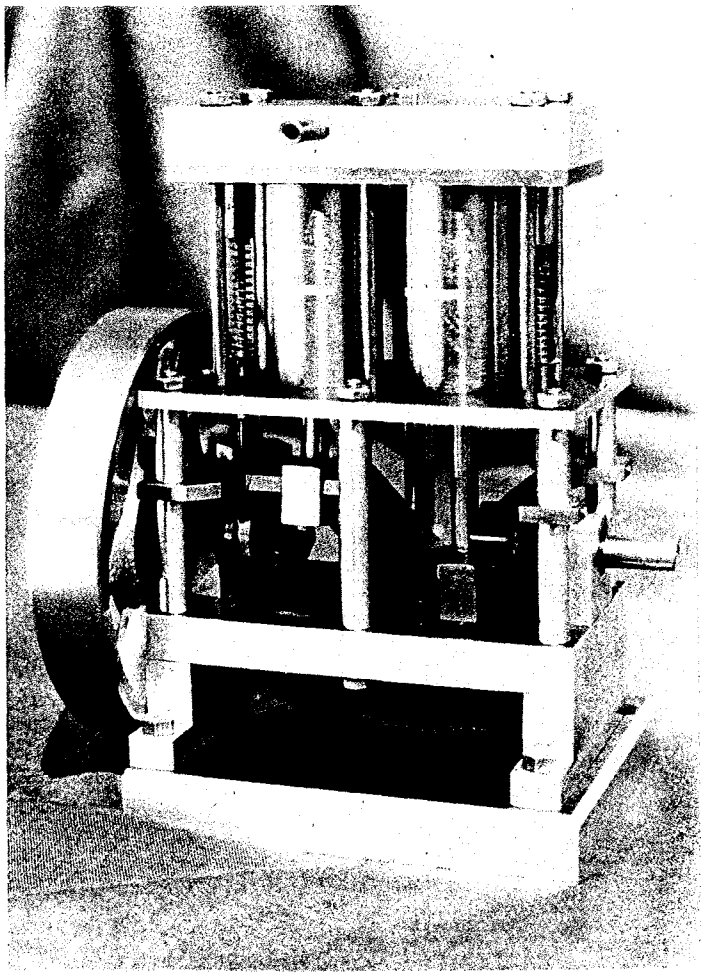
There is no provision for controlling the exhaust; it just escapes free out of the una-flow ports. The Valves showed slight leakage and were lapped in. Thin, approxiately .008" thick, Gaskets were added at the top end of the Cylinders. The 7/32" diameter Valve Seat that projects through the middle Valve Plate had a few thou clearance and was sealed with Permatex. So you have lots of fun, "fiddling', fussin' filin' and fittin'!"

The **SUB-BASE** is not detailed. It can be most any form or material you wish. Its weight helps reduce vibration.

The **FEET, COLUMNS, TIE RODS** and **BASE** need no special attention.

The **TABLE** is a careful layout job. Chuck this part into a 4-jaw or clamp it to a faceplate to turn the Cylinder recess. Center with a center-test indicator. Make these recesses the same depth.

The **LOWER VALVE PLATE** is brass for easy soldering at the valve seats. Turn the Cylinder recesses as mentioned for the Table.



The **MIDDLE** and **TOP VALVE PLATES** are straight milling and drilling jobs. The Base, Table and three Valve Plates must match each other for a good, square assembly. Upon assembly, solder or Loctite the Tie Rods into the Lower Valve Plate. Tighten the Tie Rods onto the three Valve Plates before tightening the table-end of the Rods to avoid leakage between the Plates.

The **BEARINGS** can be brass, bronze or bushed aluminum. The Bushings on the engine shown are "Oilite." Often, on a set of Bearings like this, the Shaft will bind when the Bearings are tightened down to the Base. To reduce this condition, insert a straight, close-fitting 1/4" rod through the two Bearings and grasp all three with the Bearings about 3" apart. Lightly draw the mounting surfaces across a large fine file. The first pass will show the high spots. Do this until the entire mounting surface bears on a flat surface. This can also be done on emery cloth on a surface plate or plate glass.

The **VALVE GUIDE** is brass or bronze and, again, the holes must match the related Columns and Valve Stems.

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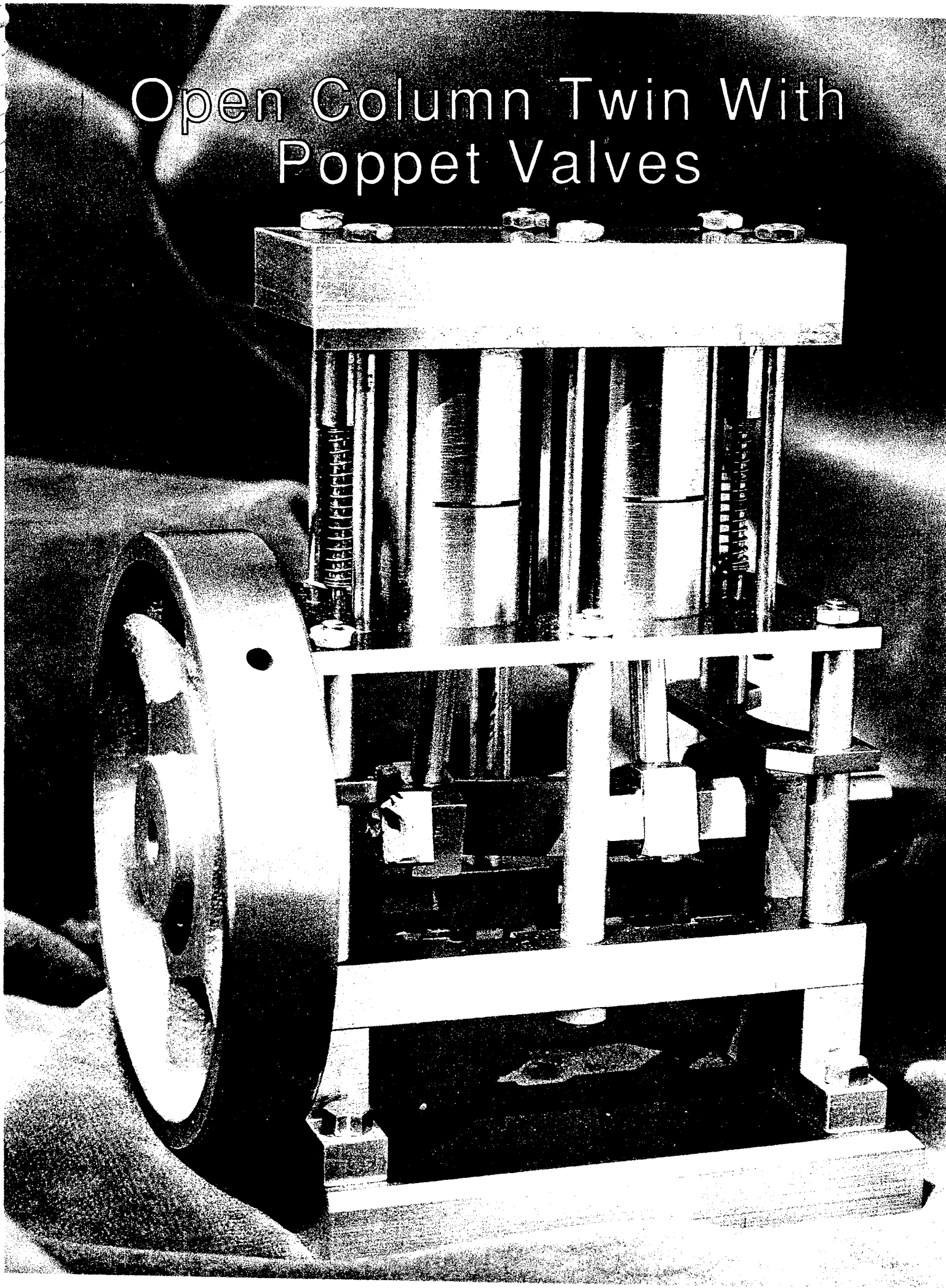

The **CRANKSHAFT** is machine steel and drill rod, asembled with Loctite and Spring Pins. Make the center throw 51/64" wide and cut away the corners after reaming the holes. At assembly, set a slide calipers to 2-5/64" and lock. Set a rule depth gauge at 1-11/32" and an inside calipers at 21/64". Assemble the entire Crankshaft loosely. Apply Loctite at joints **A** and **B** only and set aside to cure on a flat surface. When cured, slide the pieces apart enough to apply Loctite to all the remaining joints and slide back together, using the calipers to space the parts. When cured, add the Spring Pins and mill away the sections as shown.

The **CYLINDERS** were made of steel on the model shown. Brass would have been preferred, but none was in the "odds and ends department." Common galvanized pipe was used. Ordinarily, iron pipe is tough to cut and get a fine finish but this time it was not bad. Make the two Cylinders the same length so the Table and Valve Plate will be parallel. When everything from the Table on down is done, assemble and insert the Pistons and Cylinders. Hold the Cylinders in place while measuring from the top of the Cylinder down to the top of the Piston in its lowest position. Use this dimension as the bottom edge of the una-flow port.

The **PISTONS** are plain turning and drilling jobs. If the 7/8" bores in the Cylinders were not reamed, they should be fine-turned as near alike as possible. Fit the Pistons to the Cylinders, mark them and keep each with its own.

The **CONNECTING RODS** start out as two accurate aluminum or brass bars 5/16" x 19/32" x 2-1/2". Lay out and TAP-drill for the two screws. Squarely cut a 7/32" piece off the end with a slitting saw in the mill. Tap the Rod and drill the Cap #43. Assemble and dress the four sides flush and neat. Lay out a centerline the full length of the 19/32" face of each piece. Carry this centerline around onto the end and prick punch the exact center. Prick punch the point on the centerline at the Cap joint. From this point, lay out the Wrist Pin center. Squarely drill and ream the 1/4" and 1/8" holes. Chuck in a 4-jaw with about 1/4" projecting and center with a center-test indicator. Make the center hole with a tiny center drill. Mark two adjacent jaws with chalk. Loosen these two jaws and move the piece out with about 2-1/8" projecting. Hold the piece against the tailstock center while tightening the two chalked jaws. Complete the turning and dress to 2-5/32" from the joint.

The **WRIST PIN** is simple drill rod. At assembly, a slight prick punch mark will flow some Piston metal over the ends of the Pin to keep it in