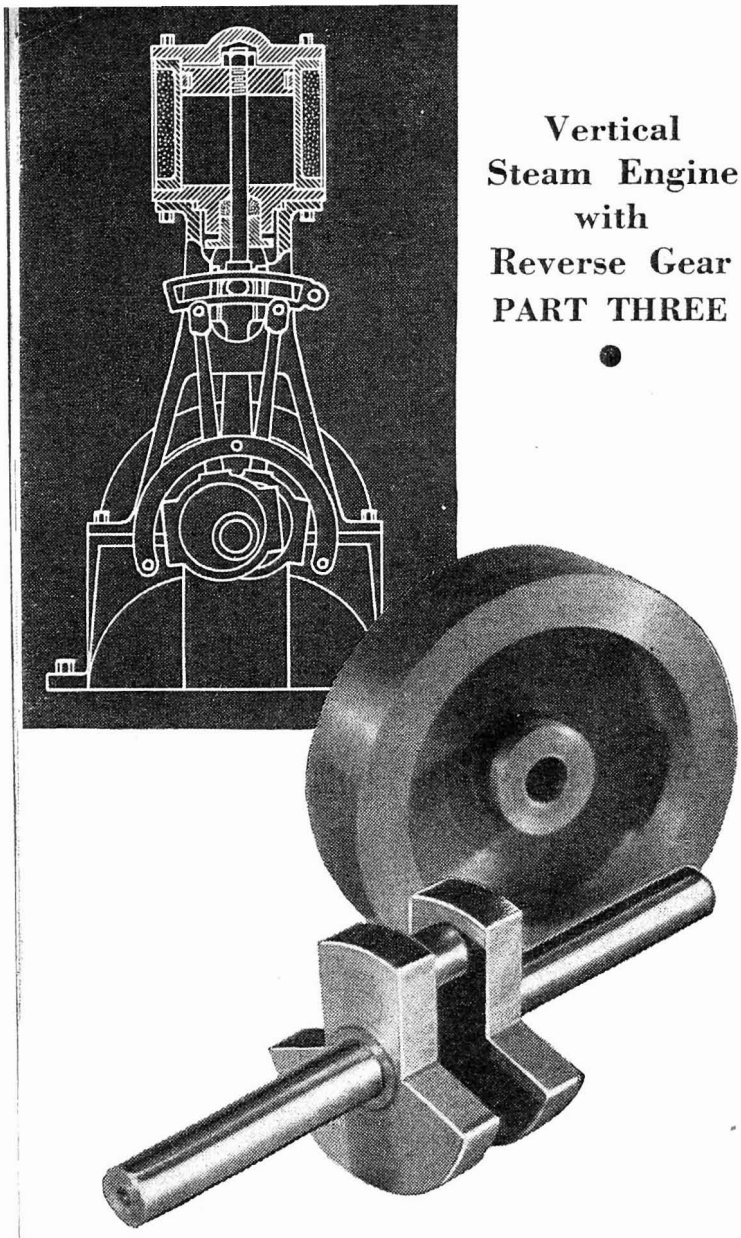


Vertical Steam Engine with Reverse Gear PART THREE

Making the

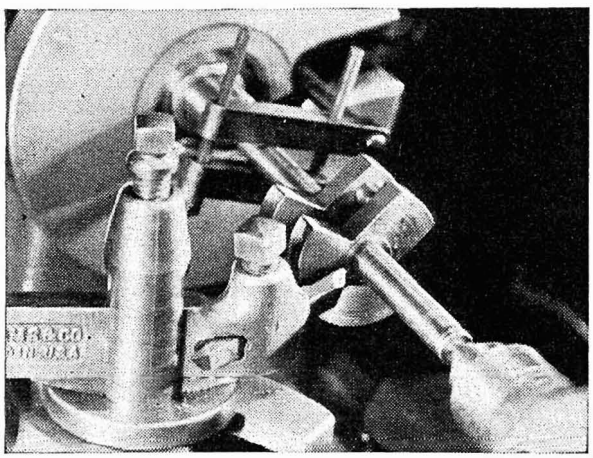
By C. W. Woodson

AN ACCURATE, true-running crankshaft is necessary if the model steam engine is to work freely and use steam with maximum efficiency. This part is assembled from a shaft, two webs, each with an integral counterbalance, and a crankpin. All are made up from solid steel stock, the webs cut with a hacksaw and filed to shape from two 5/16″ disks and the shaft and pin cut from drill rod.

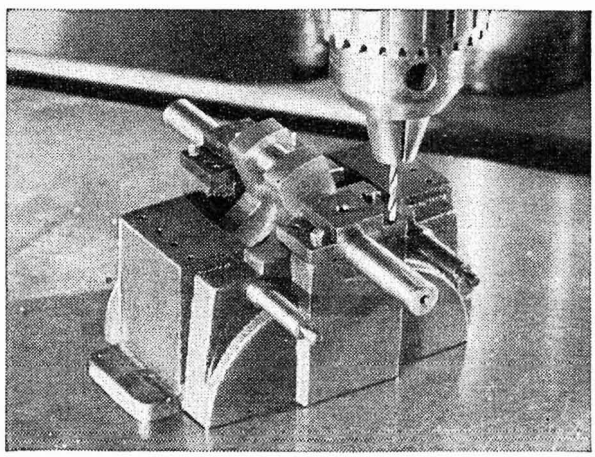
Clamp the webs together and drill them at the same time for a drive fit on the shaft and pin. Because the shaft is cut as one piece 4⅞″ long and must be driven a considerable distance, it may be necessary to ream the ⅜″ holes for it slightly. Press both webs on the crankpin first. Next, with a block between the webs to prevent bending the pin, drive the crankshaft through. Then drill and pin all parts. Pieces of bicycle spoke make good pins.

The assembled crankshaft is next mounted between centers in the lathe and with the block still between the webs. Face the outer web sides smooth, form the 1/32″ collars, and turn the outer rim of the balance weights and the ends of the webs smooth and to exact diameter. Finally cut out the part of the crankshaft between the webs and file the inner faces smooth. Key-

Alignment of the two ends of the shaft is assured if it is made as one piece and cut when pinned in place. The flywheel is turned from a casting.

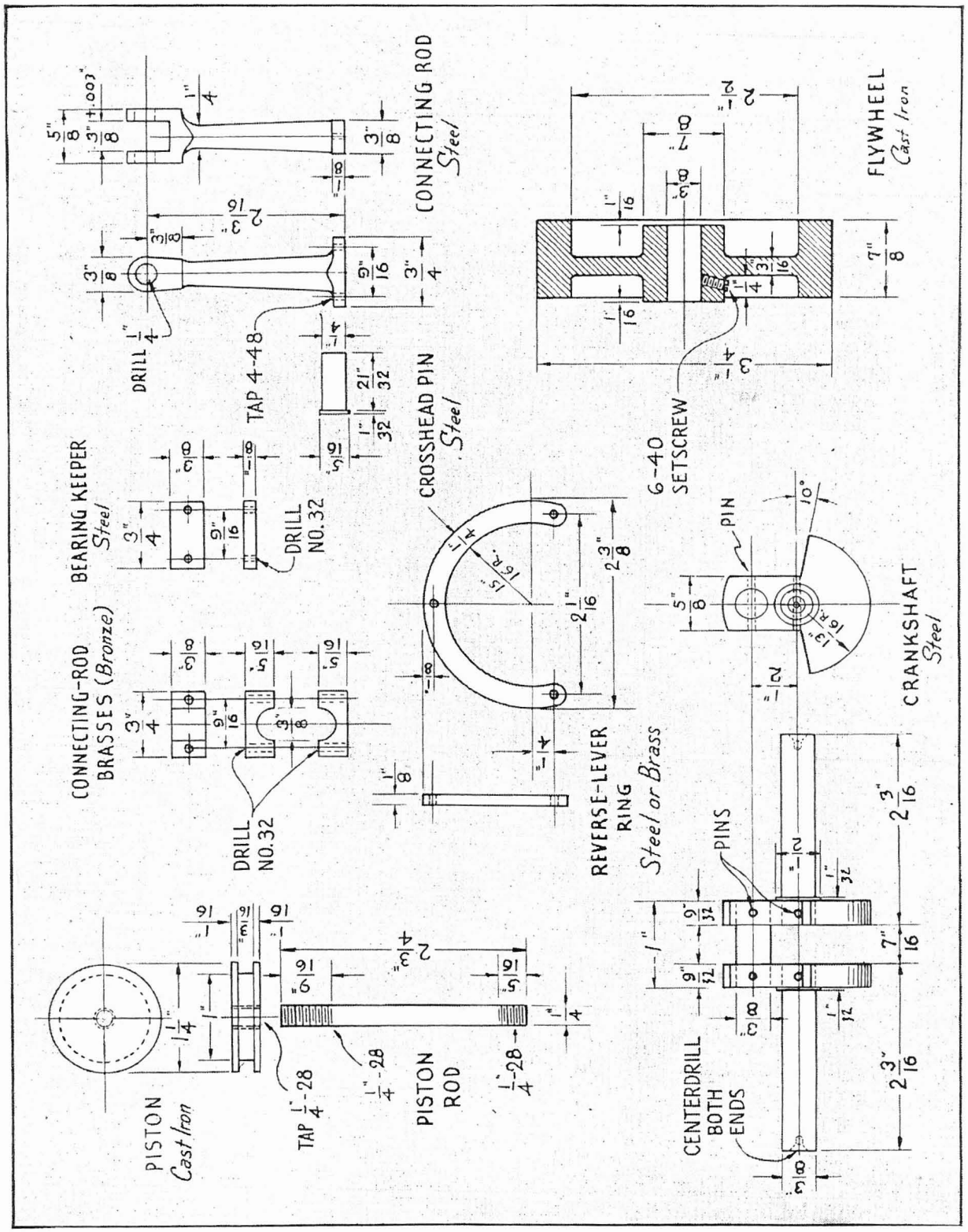


Mounted between centers, the crankshaft is faced smooth on the webs and the collar turned. A block between the webs prevents distortion.



Holes for the bearing bolts are drilled through the bearing caps while the crankshaft is in place to assure alignment of the bearing halves.

Crankshaft and Running Gear



All dimensions for the crankshaft, flywheel, connecting rod, piston, and piston rod are shown in the drawing. The reverse-lever ring is also shown and may well be made at this time.

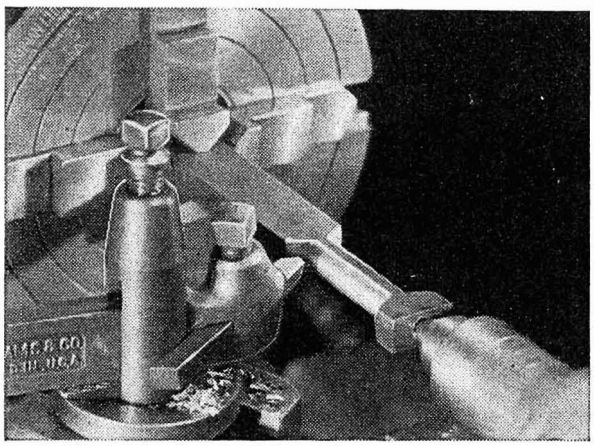
ways or setscrew flats are optional, depending on the use the engine is meant for.

Fit the finished crankshaft into the bearings next, clamp on the bearing caps, and rotate the shaft to make sure it turns freely. There should be no binding, since shaft alignment is insured when the webs are pinned before cutting out the center portion. With the shaft in place, drill and tap the bearing holes and bolt both caps down.

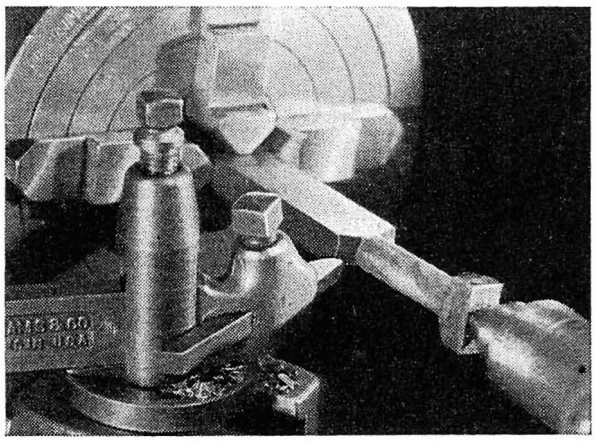
The connecting rod is rough-turned to shape from ⅜" by ¾" steel bar in the four-jaw chuck. It is removed and heated to a bright red, and the small end is twisted 90 deg. This can be done with a heavy wrench while the work is held in the vise. Then the piece is rechucked, its tapered section turned to shape and polished bright, and the work cut off. Drill, saw, and file the forked end to shape, and drill for the connecting-rod pin. Turn the pin to a force fit in the fork or thread it for a retaining nut.

Make up the connecting-rod brasses from flat bar bronze stock and the connecting-rod keeper from steel. Cut to length and drill for the screws that hold them to the connecting rod. Drill and tap the end of the rod and with two 4-48 steel screws assemble brasses and keeper on the rod. The crankpin hole is then drilled and reamed through the bearing brasses, and the end assembly is filed accurately to size.

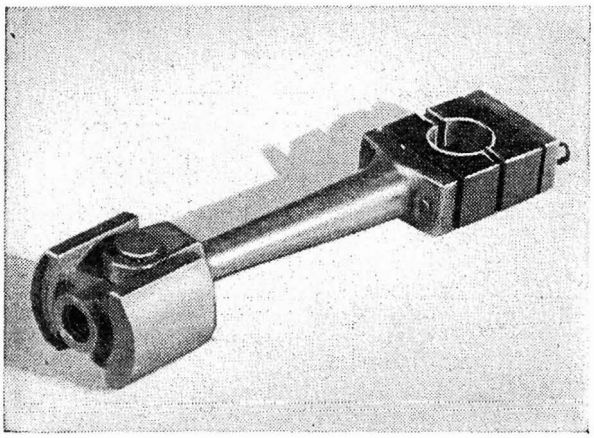
Centerdrill a 2¾" length of drill rod for the piston rod, thread both ends, and screw it into a hole drilled and tapped in a rough piston blank made from a ⅜" steel disk. Mount the work between centers and face both sides of the piston so it will run dead true. Then turn it to a nice sliding fit in the cylinder bore and cut the groove to width and depth for the piston ring. This ring, being a standard size, can be purchased, though one can be made up in the lathe from a short bar of cast iron if the



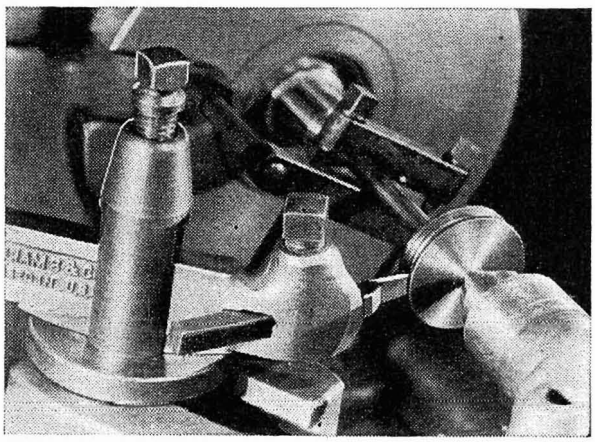
Steel bar stock is rough-turned to shape for the connecting rod, removed from the lathe, heated a bright red, and the small end twisted 90 deg.



Back in the four-jaw chuck, the connecting rod is turned for the taper, which is polished bright, and the piece is then cut off to length.



This is the connecting-rod assembly. The brasses are drilled and reamed while screwed together to give a nice running fit on the ⅜" crankpin.



The piston is turned from a blank that has been drilled, tapped, and screwed to the piston rod. It is faced true, turned to size, and grooved.

modelmaker is experienced in ring turning.

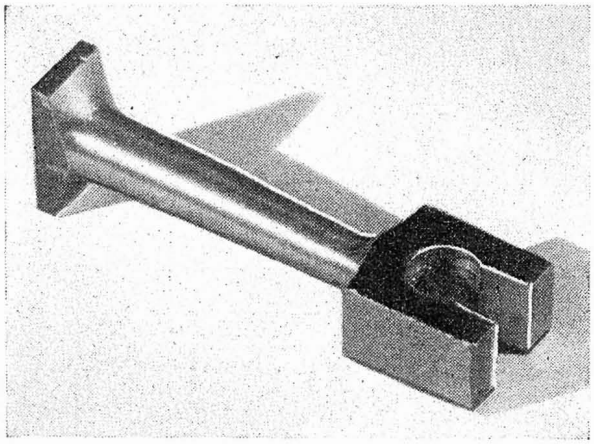
Enough of the parts will now have been completed so that you can make a trial assembly and test the piston travel. Assemble the base, the column or standard, the bottom cylinder cover, the cylinder itself, the piston and piston rod, and the connecting rod. Leave off the top cylinder cover so the movement of the piston can be checked. Likewise it will be unnecessary to put in the glands for the test.

If the machining has been accurately done, the assembled engine should work freely when the crankshaft is turned. Note carefully the travel of the piston, which should be the same distance from the top and bottom of the cylinder, clearing at both points by 1/32". If it should hit at the bottom, the piston rod can be turned a little further out of the crosshead. Place the top cover on the cylinder and again move the piston through its travel. Any binding at the top will indicate that the piston is striking there, and a shortening of the piston rod will be necessary.

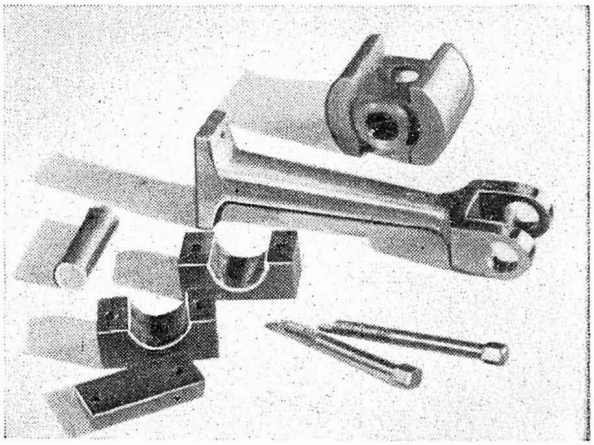
The reverse-lever ring is a section of a circle turned from a square piece of ⅛" steel plate. It is first chucked in the four-jaw chuck, where the center is bored to size. Rechucked in the three-jaw with the expanding jaws gripping inside the hole, it is brought to proper outside diameter. A section of the ring is next cut out, and the holes are drilled for mounting the part on the engine base.

After so much work on bar stock, machining the flywheel will be a pleasant relief. This is made from a fine gray-iron casting. It is rough-turned to size in the three-jaw chuck, and the shaft hole is then drilled and reamed. The work is next mounted on a mandrel held between centers, and the hub, edges, and inside of the rim are faced to run dead true.

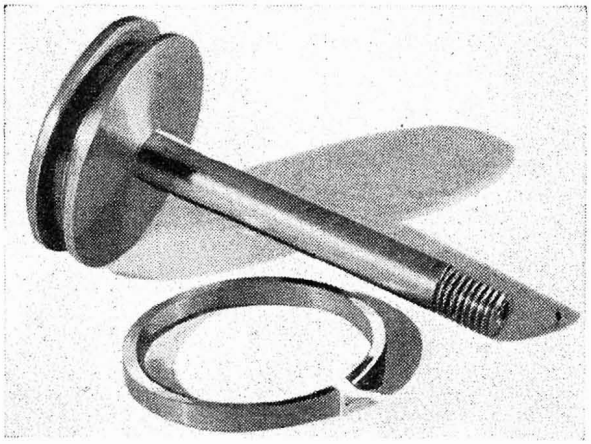
TO BE CONTINUED



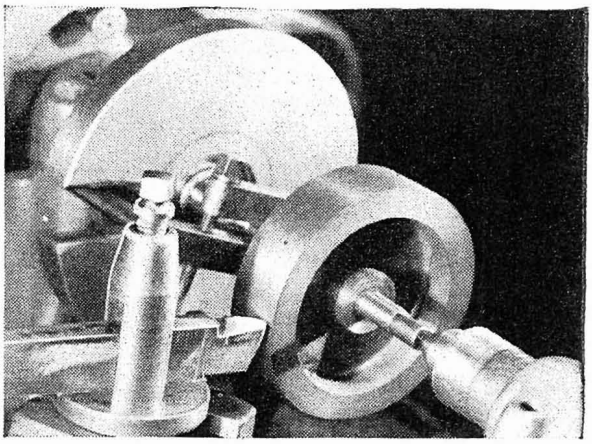
Shaping of the forked end is begun with a drilled hole and rough sawing, and the fork is brought to final dimensions by hand filing or milling.



Here the connecting rod is shown with its keeper, brasses, pin, and screws, together with the crosshead, which was described in Part I.



It will hardly pay to make your own piston ring, which is a standard size readily available. It is shown here with the completed piston and rod.



Rough-turned to size from a casting, drilled, and reamed, the flywheel is next mounted on a mandrel and its rim and hub are faced to run dead true.