Model Steam Engine
SIMPLIFIED FOR BEGINNERS

The finished engine and a small boiler installed in a model boat 18 in. long. The engine itself is only a trifle over 3 in. high

Can be built without a lathe if necessary, and without castings if you have brazing equipment

His model steam engine has been designed as a miniature power unit that can be built with the facilities of an ordinary home workshop. As built originally, it calls for a lathe and castings, but as explained later, it can be built up from stock materials, and with nothing more elaborate than ordinary hand tools.

The engine stands a little over 3 in. high, has a base of 1 by 1 1/2 in., a bore of 1/2 in., and a stroke of 3/4 in. It will operate satisfactorily on either a pot or a flash boiler and has sufficient power to drive a fair-sized model boat.

The base and cylinder are brass or bronze castings, which any brass foundry should supply from your patterns at a very moderate cost. White pine or mahogany may be used in making the patterns, with fillets of wax. Allow 1/16 in. for machining on surfaces that are to be finished.

To make the cylinder pattern, turn the cylinder from solid stock. Then turn a disk of wood 1 5/16 in. in diameter by 1/4 in. thick. (This thickness includes the 1/16-in. allowance for machining.) These two pieces are fitted together as shown in the drawing of the finished cylinder assembly. The 1 5/16-in. disk forms the sliding surface on which the cylinder oscillates.

The pattern for the engine base and frame can be built up of several pieces and filleted with wax.

The cylinder may be cast solid and drilled out to 3/8 in. on a power drill press, then bored to finished size on the lathe, or core prints may be put on the pattern and the casting made with a 3/8-
in. core. Having obtained your castings, proceed as follows.

Cylinder. Mount in four-jaw chuck or on angle plate bolted to faceplate as shown so that center line of cylinder bore is in line with lathe centers. Face off one end of cylinder. The casting may then be turned end for end. If the finished end is butted against face of chuck, the opposite end will be parallel and can be faced off.

To finish surface of disk that forms back of cylinder assembly, the casting may be mounted in the four-jaw chuck or on an angle plate fastened to the faceplate. The second method is preferable. If the angle plate is used, placing one finished end of cylinder on it will insure that cylinder is at right angles to lathe bed. It is then necessary only to adjust the casting until surface of disk to be finished is at right angles to a line between lathe centers. This can be done by mounting a scriber in tool post.

After surface of disk has been finished flat, take a 1/32-in. cut across the center, leaving a 3/16-in. rim at edge to reduce bearing.

The boiler and cocoa-can housing assembled preparatory to covering them with asbestos

To bore cylinder, mount it on an angle plate with one finished end flat against the surface of faceplate. Adjust until a line between lathe centers coincides with center line of cylinder bore. With boring tool, bore cylinder to finished size. The last cut should be fine, with a slow feed. The cylinder will be lapped in after piston has been made.

Drill steam ports as shown. Holes for boiler tubes with silver solder for use and, above, brazing.

Crankshaft. Build up from 1/8-in. cold-rolled steel.

Complete power unit ready for use and, above, brazing the tubes with silver solder

The general set-up, sectional drawing of boiler, and the safety valve
The general set-up, sectional drawing of boiler, and the safety valve.
HOW ENGINE IS CONSTRUCTED
Detail drawings of all principal parts—the base and frame, cylinder, piston and rod, and crankshaft—and two assembly views, one being partly broken away to show the construction. The bore is 1/2 in., stroke 3/4 in. While not complicated, the model will give an amateur mechanic excellent practice in pattern making and machine work.
scraped down so that only a small area around the steam ports is in contact with the bearing surface of the engine frame. Other surfaces can be filed smooth. In finishing the engine frame, file the surface against which the cylinder oscillates as flat as possible; then scrape down all but a small area around the steam ports.

**Materials.** One piece seamless brass tubing 2½ in. in diameter by 6 in. long. Six feet seamless brass tubing of 1/8-in. inside diameter. One piece copper or brass tubing ½ in. in diameter by 6 in. long. One piece 1/2 in. thick sheet brass, 6 by 8 in. for boiler ends and fuel tank. One 1-lb. cocoa tin of the type shown for boiler housing. ¼ lb. plastic asbestos, and a little asbestos wool. The safety valve, filler plug, and other small parts can be made from scrap material.

**Making Boiler.** Square and smooth ends of 6-in. length of 2½-in. brass tubing. Cut two disks of heavy sheet brass to fit snugly in ends.

Anneal 1/8-in. tubing by heating to a dull red and quenching in water. Take the entire length of tubing and, leaving enough stock to hold onto with a pair of pliers, make the first bend. Then, using the hands only to hold the tubing, make the second bend the proper distance from the first to form one of the water tubes. Saw off and trim to exact length.

As shown in cross section of boiler, the super-heater tube has its open end inside boiler about ¼ in. from the top. The tube then passes down through bottom of boiler and along underside between the water tubes, enters boiler again at opposite end, and passes up through top.

After all tubes have been formed and ends filed square and smooth, spot the ten holes on bottom of boiler into which the tubes are to be soldered. Drill holes a trifle undersize and file ends of tubes to a snug fit. Ends of water tubes should project into boiler about 1/32 in. Put tubes in place and bind securely with iron wire. If you have access to a brazing torch, the soldering should be done with silver solder. However, since the boiler operates at low pressure, a careful job of soft soldering will serve.

**Housing.** The 1-lb. cocoa can is exactly ½ in. longer than the boiler. Boiler and engine should be so placed as to make the distance from the boiler steam outlet to the engine as short as possible. A small globe steam valve should be inserted in steam line between boiler and engine. The photo of the entire power unit shows the engine connected to the boiler by a length of rubber tubing. At 25-lb. pressure this is entirely satisfactory where flexibility is desired in making tests and adjustments and in experimenting with the unit. Thick-walled rubber tubing of the type used on auto windshield cleaners is satisfactory.

This type of boiler can be altered slightly for high-pressure use in a speed boat on short runs by adding a water gauge and substituting a gasoline burner of the blow-torch type. By a few experiments with the throttle wide open, it can be determined just how much fuel can be used at one filling without exhausting the water supply.

The fuel tank is simply a small sheet brass tank or a can of suitable size. Insert a small shut-off cock between fuel tank and burner.

**Operation.** Open shut-off valve, allowing the fuel, which is alcohol, to run down into the burner. The size of the flame may be regulated by the valve.

If used in a boat, the fuel tank may be located in any convenient place so long as it is higher than the burner. Boiler and engine should be so placed as to make the distance from the boiler steam outlet to the engine as short as possible. A small globe steam valve should be inserted in steam line between boiler and engine. The photo of the entire power unit shows the engine connected to the boiler by a length

---

**Turning recess in disk at rear of cylinder**

**Boring cylinder with small boring attachment**

The ½-lb. burner tube with wick slots, the 1/8-in. feed tube, and tank for holding fuel of rubber tubing. At 25-lb. pressure this is entirely satisfactory where flexibility is desired in making tests and adjustments and in experimenting with the unit. Thick-walled rubber tubing of the type used on auto windshield cleaners is satisfactory.

This type of boiler can be altered slightly for high-pressure use in a speed boat on short runs by adding a water gauge and substituting a gasoline burner of the blow-torch type. By a few experiments with the throttle wide open, it can be determined just how much fuel can be used at one filling without exhausting the water supply.