

**Barry Orr**

*invites you to build a working*

# SIMPLE STEAM ENGINE

**T**HE SIMPLE steam unit illustrated, can be made entirely without the use of a lathe or any special tools. A Valtack blowlamp, or similar, a file and a junior hacksaw are the main tools needed and no previous experience in steam is required.

An oscillating steam engine is the simplest form of steam power that gives any sort of decent power and this little puffer pushes out more than sufficient power to drive a number of models. The cost, including a bought boiler, is well under thirty shillings.

## Construction

Before making a start on your own engine, study our illustrations and read the instructions until a good idea is gained of the general layout.

The heart of the engine is the cylinder unit and this is made from a  $1\frac{1}{2}$  in. length of thick-wall brass tubing with an inside diameter of  $\frac{3}{8}$  in. The piston is made from a short length of brass rod,  $\frac{3}{8}$  in. in diameter. Buy about four inches of both these items longer than you require, to give a good grip when "lapping" them in. As bought, the rod will be a very tight fit in the tube. Using a little patience and lots of "Brasso" they will soon become a good sliding fit.

Saw the cylinder to length and then saw off a  $\frac{3}{8}$  in. length of the rod for the piston. The piston should be drilled to a depth of about  $\frac{1}{8}$  in. in one end to locate the connecting rod (made from silver steel rod or any suitable piece of scrap axle). One end of the cylinder is plugged with a  $\frac{3}{8}$  in. length of the rod, which is soldered in place later.

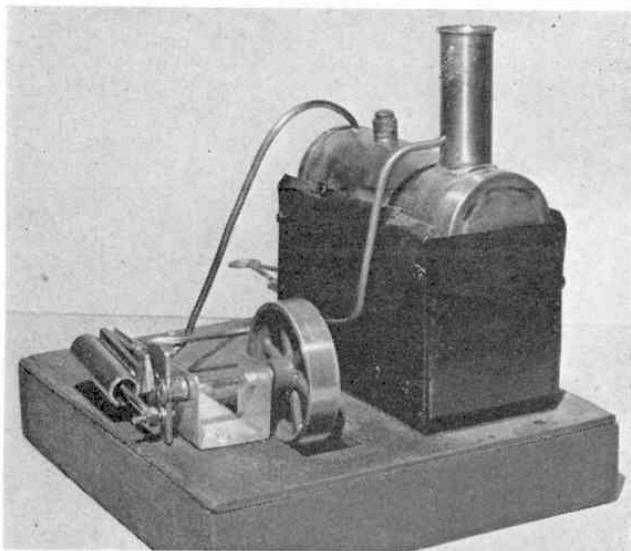
Two pieces of  $\frac{1}{8}$  in. thick brass measuring  $1\frac{3}{8}$  in. by  $\frac{1}{2}$  in. are required to make the standard and valve plates. Take the standard first. This is drilled  $7/64$  in. in the diagonal centre to take the pivot pin on which the cylinder oscillates. The cylinder is now soldered to the standard and this is made a lot easier if wire is used to bind it in position during the soldering. The cylinder should be located approximately an  $\frac{1}{8}$  in. in from one end of the standard. Insert the cylinder plug and saw the head off a 6 BA bolt (about  $1\frac{1}{2}$  in. long) and locate in centre hole. Bind the lot together and solder, ensuring a good run of solder along the full length of the cylinder where it makes contact with the standard.

Next drill a  $7/64$  in. hole through the standard so that it emerges at the very top of the cylinder, just inside the end plug. This is the steam port.

The valve plate has a hole drilled in the centre of the diagonals, to just clear the pivot pin soldered to the standard. Do not drill the steam and exhaust ports at this stage.

The engine bracket is bent up from tin, that from an old tin tray being ideal. The drawing gives the dimensions.

The valve plate should now be soldered to the bracket and the assembly allowed to cool before drilling out the centre hole through the tin of the bracket. The



The completed steam engine, constructed without the need for special tools.

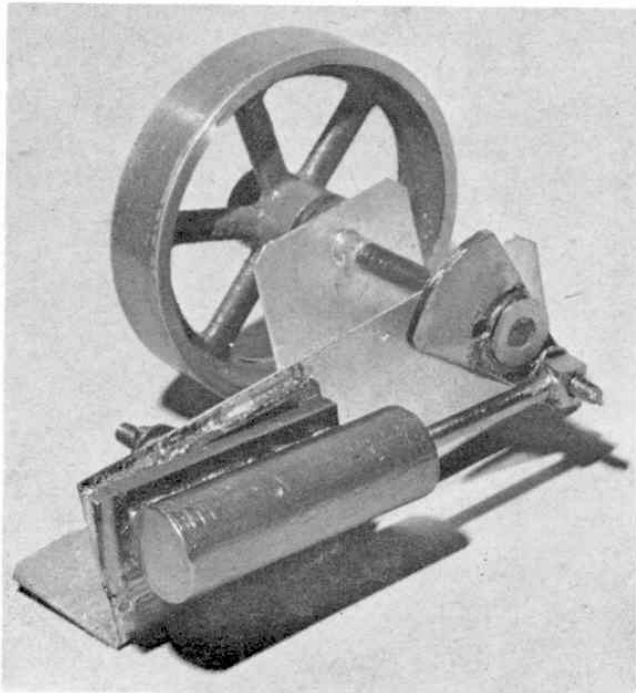
bearing holes should be drilled to take the flywheel shaft. These should be drilled at the same height from the bottom of the bracket, as the pivot hole in the valve plate.

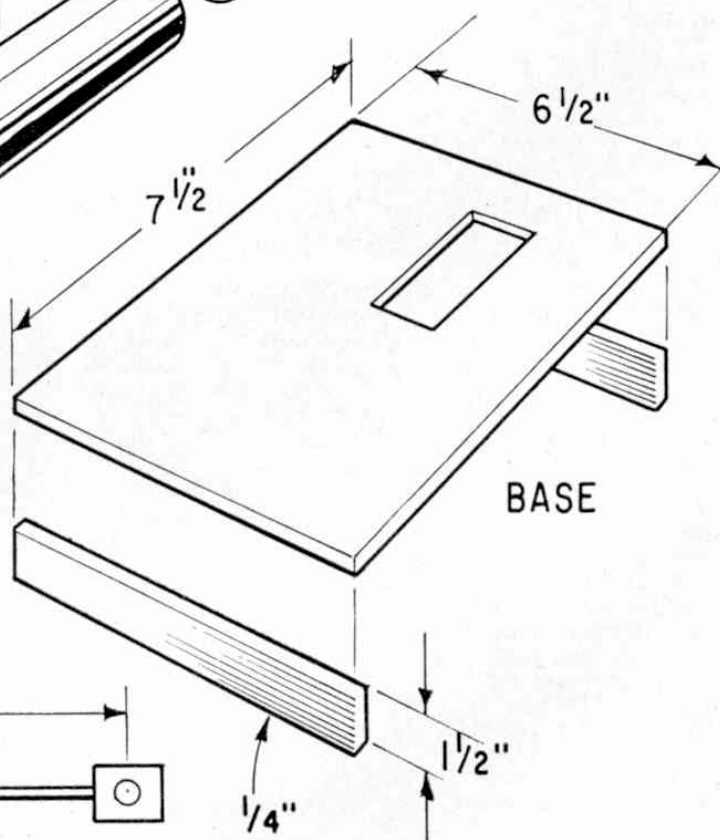
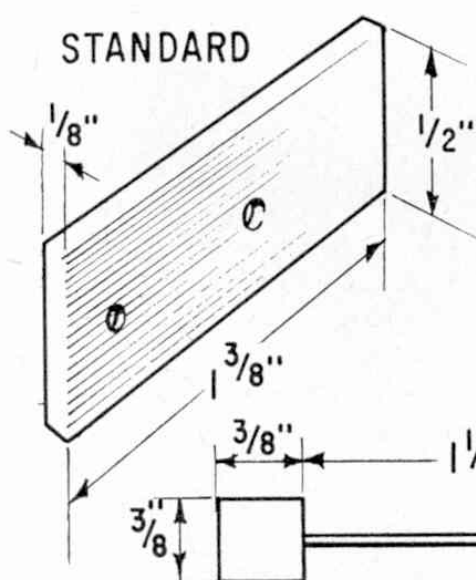
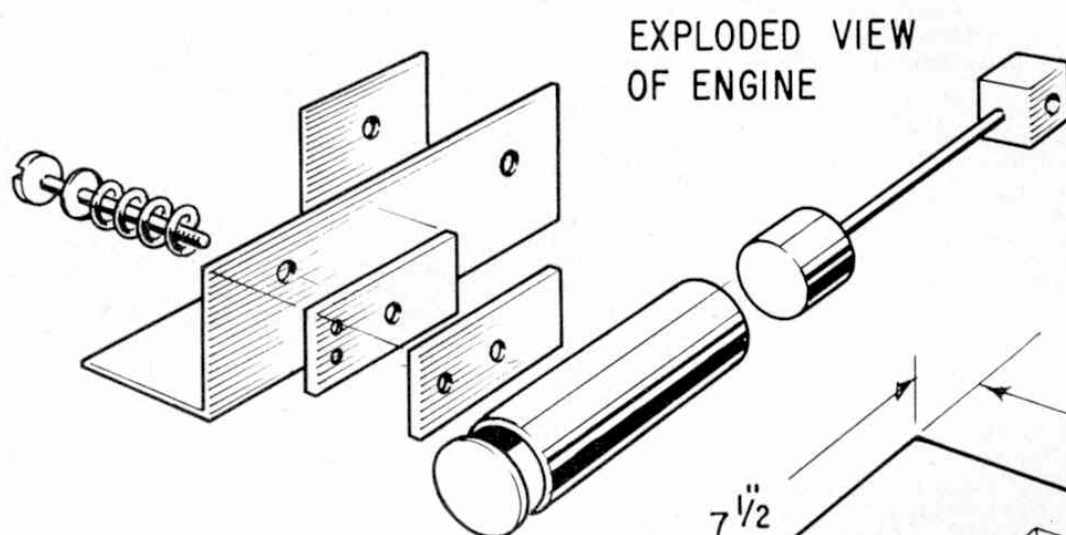
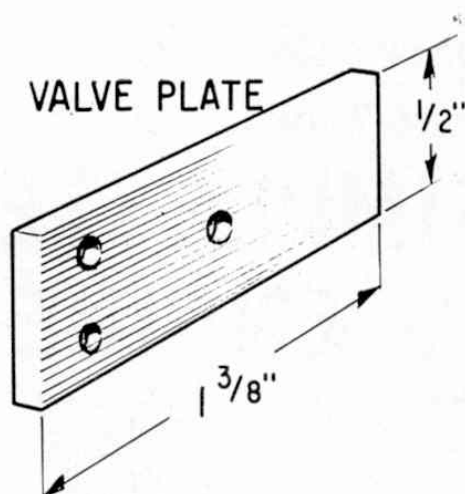
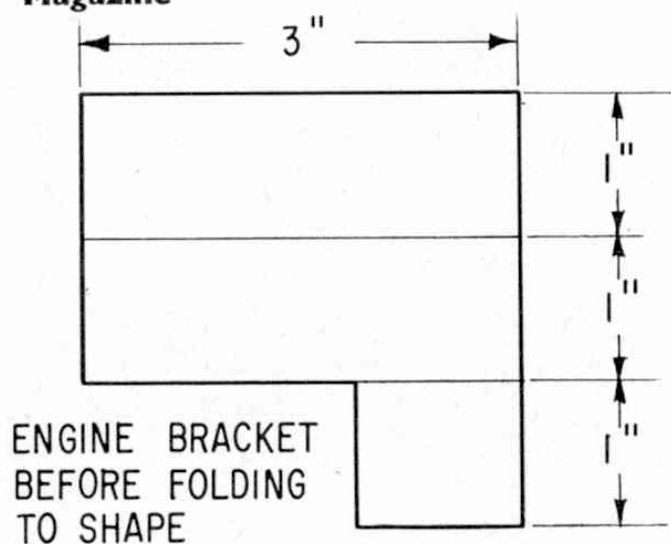
Now the piston. Saw the connecting rod to the correct length (see drawing) and file the big-end from a small piece of scrap brass and solder in place. Note that the distance between the end of the piston and the centre of the hole in the big-end should be  $1\frac{1}{2}$  in. It is a good plan to drill the end of the big-end slightly to take the connecting rod.

## Base

A simple base should now be made from a piece of plywood and two end pieces (see drawing). A slot

A close-up view of the flywheel and piston, showing its simplicity.





PISTON CONNECTING ROD  
AND BIG END

measuring 3 in. by 1 in. should be sawn out to clear the flywheel. Mount the engine bracket on the base, using wood screws.

A  $2\frac{1}{2}$  in. length of axle is now fitted in the bearing holes and the flywheel secured. The flywheel can be a Meccano artillery wheel or one of the Mamod range. The crank can be cut and filed from scrap brass or, as in the original, may be made from an old stripped Meccano gear, sawn to segment shape to provide a balance weight for smooth running. The crank pin (a 6 BA bolt) is located  $\frac{1}{8}$  in. from the centre.

### Locating steam and exhaust ports

While the majority of dimensions given so far have only been given as a rough guide, the following simple instructions should be followed closely.

Using nail varnish or shellac as marking fluid, paint the surface of the valve plate and allow to dry before assembling the engine. The cylinder unit is kept in place by a light spring, held by a washer and nut on the engine bracket side. The nut should only be tightened sufficiently to ensure a firm but not tight fit between the standard and the valve plate. With the engine assembled turn over the flywheel a few dozen times by hand. Now strip the engine and you will find that the hole (steam port) in the standard has left a curving mark on the nail varnish on the valve plate. The steam and exhaust ports are located at the ends of this mark, the outsides of the  $7/64$  in. holes forming the outer curve. Drill these holes  $7/64$  in. and re-assemble the engine to ensure that, with the crank first in the vertical top position and then in the vertical bottom position, the steam and exhaust ports coincide with the steam port in the standard.

### Boiler

It is not recommended that the beginner to steam attempts to make his own boiler. Messrs. Mamod Ltd., make a range of extremely efficient boilers, complete with safety valves and it was the smallest of these that was used in the original. The boiler housing is made up from tin and bolted together with Meccano nuts and bolts. Do not forget to punch out sufficient air holes along the bottom to allow the engine to breathe. The square opening at one end is cut out to allow free entrance for the burner (once again, this may be bought or folded up from tin and stuffed with asbestos wool).

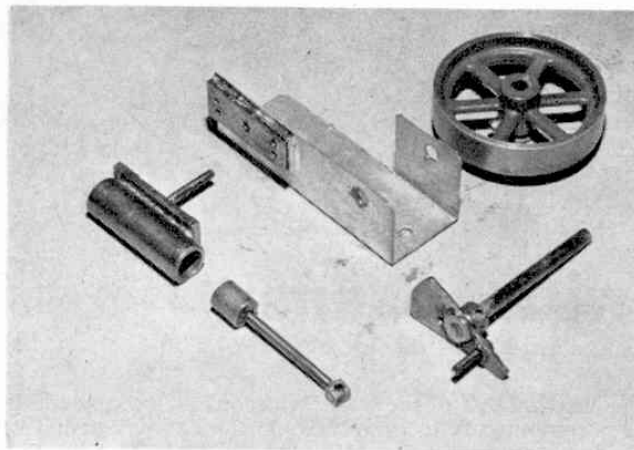
The boiler sits on two simple curved brackets but before locating the boiler, screw the housing to the base with wood-screws.

After removing the safety valve from the boiler, solder the steam pipe in place and bend it round to line up with the ports in the engine bracket. When soldering the steam and exhaust pipes to the valve plate, remove the cylinder unit and bolt the valve plate to the bracket to ensure that it remains in its exact position should the solder holding it melt when the pipes are being soldered.

Hook up the other port to the chimney and the end is in sight!

### Important

Do not fool around with a steam engine. If carefully run and commonsense is used, there is no danger. Here are a few important points for safety of operation. Ensure that the boiler is always between half and three-quarters full with water before firing. When filling the burner with methylated spirits, do not spill any. If this happens, wipe it up before lighting the burner.



An exploded view of the piston assembly showing the five main parts.

Steam engines love oil so apply liberally to all moving parts, particularly the cylinder bore.

All set? Light the fire and sit back and await the sizzling sound that precedes the first burst into life! Turn the engine over by hand a few times to clear away any condensed water that may be in the pipes or cylinder. Then let her rip!

### Driving models

While the Mamod flywheels all have pulleys built in, if a Meccano wheel is used it will be necessary to add a small pulley.

All materials, brass, steam tubing, etc. may be obtained from most plumbers suppliers for a few shillings.

### Difficulties ?

If the little puffer does not spring into life soon after steam up, check the following points. Are the steam and exhaust pipes clear of dirt, solder, etc.? Do the ports coincide with the steam port in the standard? If not then make another valve plate, or reverse the old one and start the timing operation again. Ensure that the spring holding the cylinder unit to the valve plate is not too tight.

A rear view of the completed unit in full working order.

