TheMUNCASTER steam-engine models

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4-Horizontal Stationary Engines

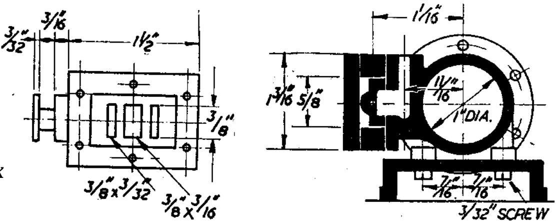
Continued from 21 March 1957. pages 420 to 422

IN DESCRIBING the function of the slide-valve and the effects of lap and lead [Fig. 17, March 12], no particular mention was made of exhaust timing. It would be a mistake to regard this as insignificant, but it is generally satisfactory to allow it to keep in phase with the steam admission, as it must inevitably do so in a simple slide-valve, and it is usual to make the inside edges, in other words the width of the valve cavity, such that they just, and only just, span the inside edges of the cylinder ports at mid travel (right-hand diagram).

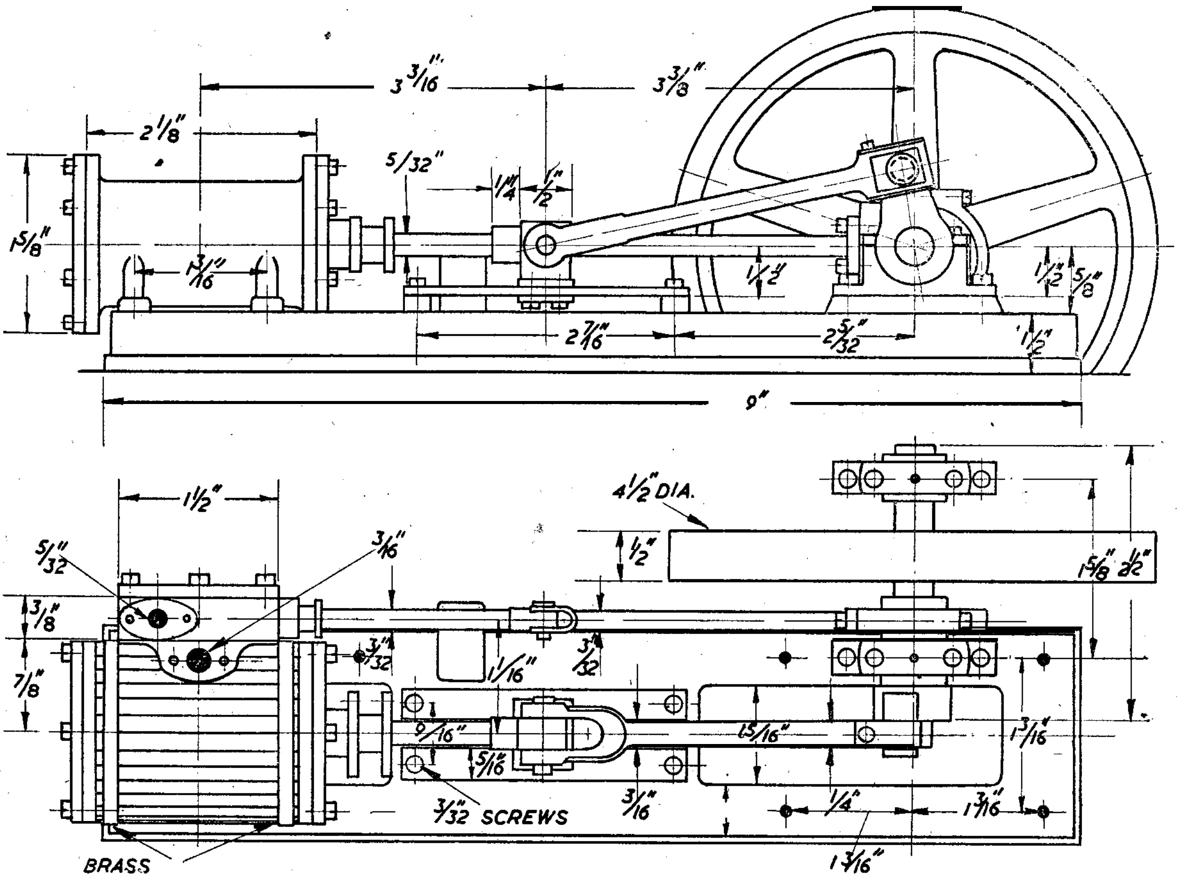
Thus the slightest movement either way opens one or other of the cylinder ports to exhaust. Occasionally, however, engines are timed to give either positive or negative exhaust lap, by narrowing or widening the valve cavity; the latter is the more common and its object is usually to avoid excessive " cushioning " or compression, or to eliminate risk of back pressure in the exhaust system.

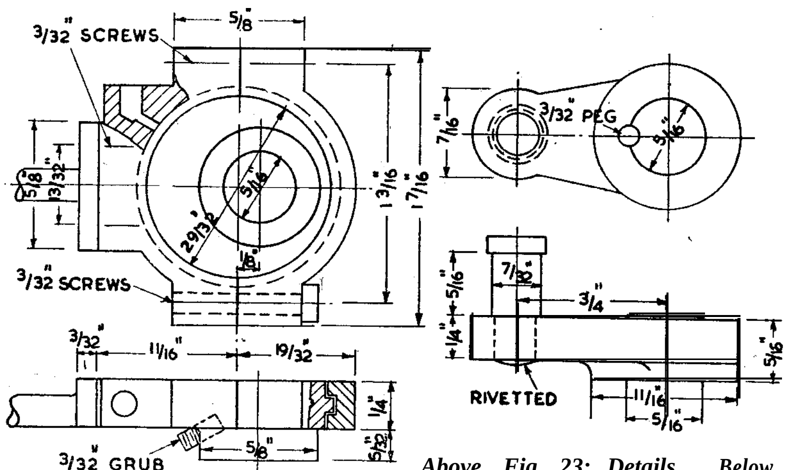
The conventional stationary or so-called " mill " engine forms an excellent exercise in steam-engine construction, and is deservedly popular. Several examples of these engines were

***Right, Fig. 20:** A cross section of steam-chest and a portface, showing the port dimensions*



***Below, Fig., 19:** A horizontal mill engine, 1 in. bore x 1 in. stroke, with bar crosshead slides*





Above, Fig. 23: Details of the crank and eccentric

designed by Muncaster, all generally similar in major features but differing in size and certain details. The first, shown in Fig. 18 [March 21], is scaled down from a fairly large engine, 12 in. bore x 18 in. stroke, in the proportion of 1 in. to 1 ft.

No dimensions are given on the actual drawing, but Muncaster gives a table of dimensions worked out to exact scale. I have taken the liberty of modifying some of these to give round fractional figures, as most constructors would undoubtedly wish to use standard drills, reamers and stock materials wherever possible; but general proportions have been closely adhered to.

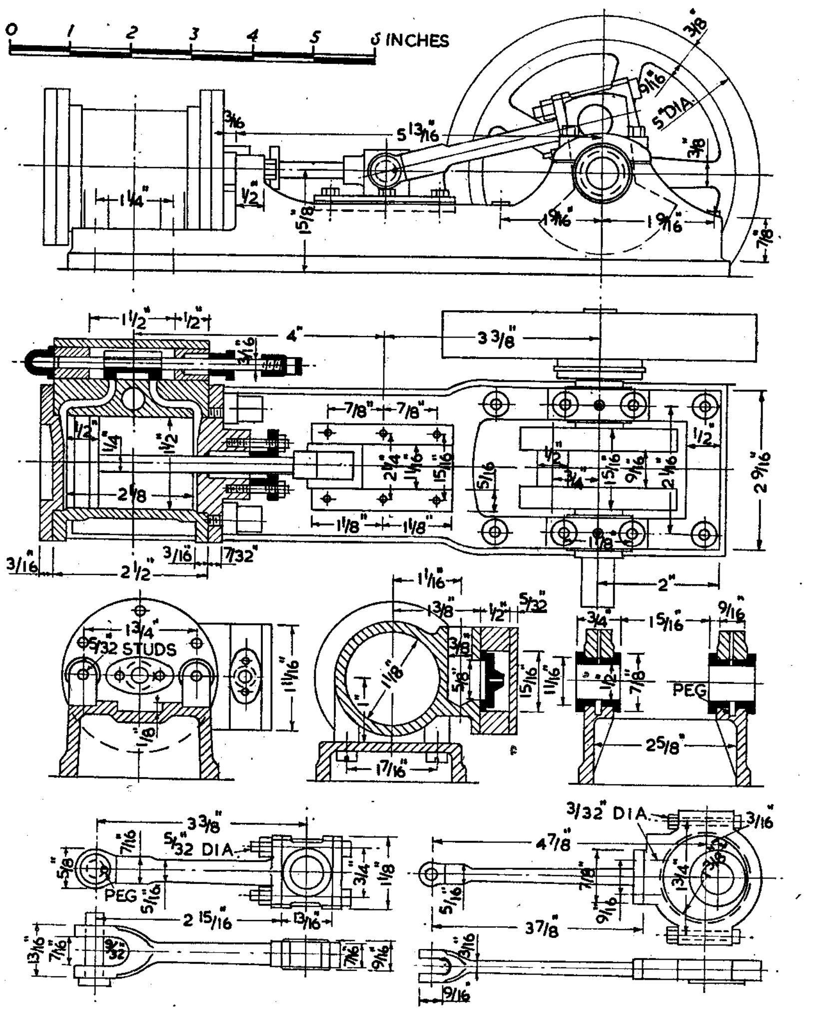
The cylinder dimensions for the 1 in. scale model are 1 in. bore x 1-1/2 in. stroke. Piston rod diameter 3/16 in.,crosshead fin. wide inside fork, with crosshead pin 3/16 in. dia. Connecting rod, circular section, fish-bellied, 3/16in. dia. at the two ends, swelling to 1/4in. centre; length between bearing centres 2-5/8 in. Crankshaft 7/16 in. dia., with journals reduced to 3/8in. x 1/2in. bearing length; crankpin 1/4 in. dia.‘ x 5/16 in. long. Flywheel 5 in. dia. with rim section 1/2 in. square. Eccentric throw 7/64 in., rod circular section, tapered from 1/8 in. to 7/64 in. Valve spindle 7/64 in. dia.,valve travel 7/32 in. Port dimensions: steam-ports 5/64in. x 7/16in., exhaust 5/32in. wide. Valve travel 7/32in. ,lap 3/64in., cavity 5/16 in., lead l/100 in. Steam inlet 1/4 in. dia., exhaust outlet 5/16 in.

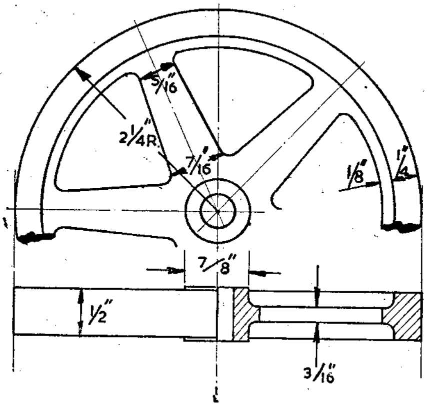
As, the constructional methods for this and the second engine are generally similar, they may be considered together. In the latter case, illustrated in Fig. 19, leading dimensions are given on the drawing. Both engines are intended to be built from castings, though fabrication of most of the components is practicable.

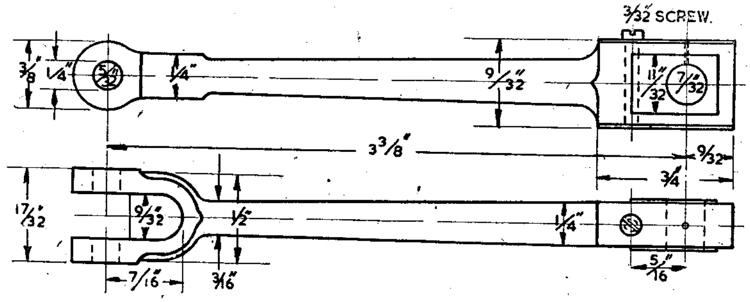
The main components are mounted on a long box-section bedplate, with machined facings where required, and it is desirable to machine these in order to ensure accurate location and secure mounting of the parts, but in the absence of proper facilities they may be filed and scraped, accuracy being checked by means of a surface plate.

It will be seen that both engines have an outboard crankshaft bearing, or "pillow block," which must be accurately lined up with the other bearing mounted on the bedplate; for this reason the actual foundation on which the latter is mounted must also be flat and true. It may be made from a thick slab of well-seasoned hardwood, with a cavity cut out to clear the flywheel.

Below, Fig. 24: A horizontal engine, 1-1/2 in. bore x $1\frac{1}{2}$ in. stroke, with a slipper crosshead







Left, Fig. 21: ***Details of* the *flywheel. Above, Fig. 22: Details of the connecting rod. Below, Fig. 25: An engine of similar dimensions with trunk crosshead***

Many constructors, no doubt, would prefer to make the engine self-contained by extending the cast bedplate to carry the outboard bearing; I have designed most of my engines to avoid the need for extraneous parts which have to be lined up. A single bedplate with facings for all essential parts, machined off to the same level throughout, greatly facilitates accurate construction.

The cylinders of both engines are bolted down to the bedplate, being provided with cast feet or flanged brackets, and the bearings, which are of the split plummer block type, are similarly fixed. Details of the steam-chest, flywheel, connecting rod, crank and eccentric sheave, with its strap, are given in Figs 20 to 23.

The main difference in the two engines is in the type of crosshead employed; the first example has die blocks fitted to the extended ends of the crosshead pins and working between girder-shaped guide bars mounted on pillars fixed to the bedplate, while the other has a slipper type crosshead working on single guide bars each side. Both types are well established in full-size practice; they require very careful lining up in respect of height and parallelism with the cylinder axis to ensure smooth movement of the piston rod.

In this respect they may possibly be more difficult to fit than the trunk type of crosshead, in which alignment is automatic if machining is properly carried out; on the other hand, they are sometimes preferred because they offer facility of adjustment to compensate wear or initial errors.

The crosshead of the first engine is forked to admit the little-end eye of the connecting rod, but in the second arrangement matters are reversed by forking the end of the rod to span the slipper crosshead block. This type of rod may be a little more difficult to shape than the previous type, but it looks very nice when properly carried out and I have given instructions on how to produce forked rods from the solid in articles on the Unicorn mill engine.

Muncaster suggests forging parts of this nature, which is very sound advice-or at least it was in his time, when nearly all fitters had some knowledge of smith's work; but this seems to be practically a lost art nowadays. There are, however, many

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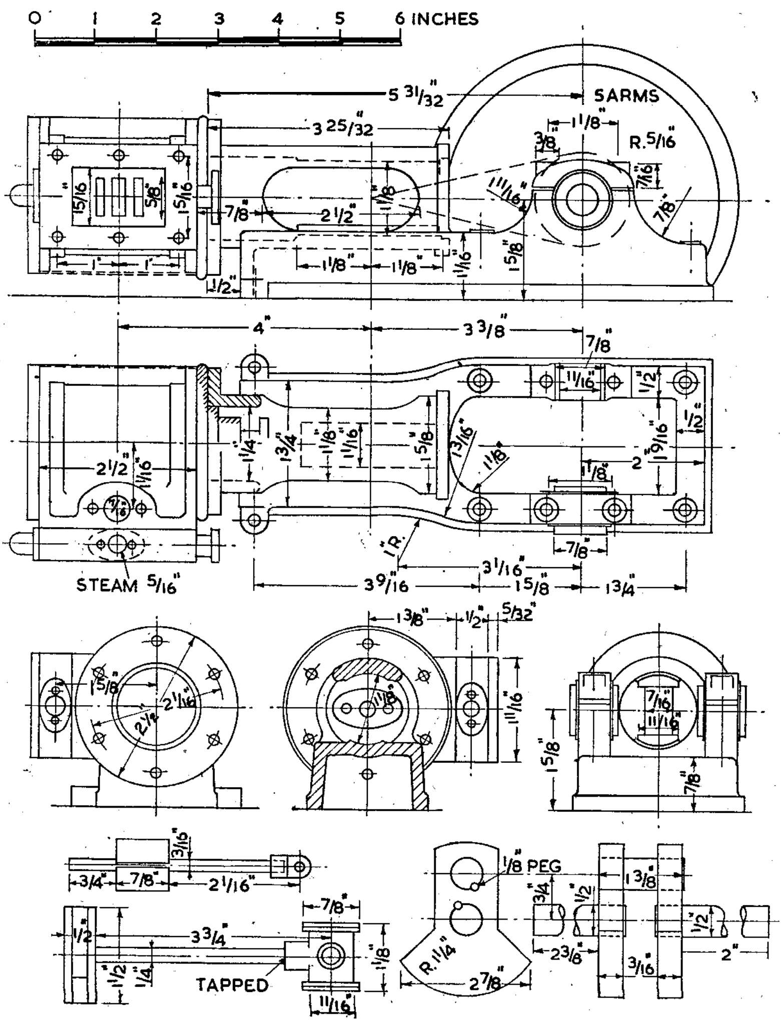

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Oil-bath lubrication is of course employed, and I recommend the use of a light oil, such as Shell Vitrea, so as to keep down losses due to fluid friction.. It is of course necessary to fit an au vent or breather to the top of the box, but I have not shown this as 'its position will have to be arranged so as not to interfere with any control gear fitted to the cover. The box should be filled to a depth of 1/2 in.

Various modifications of the details of the gearbox may suggest themselves to readers but the general design, in which all really essential features are incorporated, can be guarapteed reliable and efficient.

One point which should be noted about reverse gears of this type is that the gears are only under load when actually in reverse, which will normally be no more than a very small proportion of the total working time; when running ahead, the gears run idly and the only losses are those due to running friction and oil drag, which can be kept very low; thus there. is no appreciable reduction in the performance of the boat.

FOR SHIP MODELLERS

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components in model engines which could be produced more efficiently and economically by hand forging than by any other method, and a revival of this skill would be well worthwhile.

The crankhead bearings or " big ends " of both engines are of the solid box type, with split brasses of rectangular section fitted. These were usually secured by a tapered gib and cotter, which enabled the bearings to be adjusted for wear; but Muncaster shows them simply located in place by a screw, which passes through a notch in the rear half-bearing to prevent its moving sideways. The front half would presumably have side lips to engage the sides of the box frame for the same purpose; removal of the screw would enable the rear half to slide back enough to withdraw it over the collar of the crankpin.

Governor gear is fitted to the first engine, and could be adapted to the second- if desired; some further information on this subject will be given later.

Two further examules of horizontal stationary engines are illustrated in Figs 24 and 25. Each has its own distinctive features,, but many of the working parts are sunilar or identical; the cylinder dimensions are l-1/2in. bore x l-1/2in. stroke, which may be considered on the large side by many constructors, but it would be quite practicable to reduce the scale to half these dimensions or even less if desired.

The' first of these engines has a crosshead of the slipper type, working on a slideway machined on the top surface of the bedplate, with keep plates secured by three studs or bolts on each side. A rather unusual method of fixing the cylinder is employed, the underside of the casting being provided with four projections or feed, into which setscrews or studs are screwed from the inside of the bedplate.

In addition, two vertical lugs are extended upwards from the bedplate and drilled horizontally to take extensions of two of the cylinder cover studs. This undoubtedly gives additional strength to resist working stresses, but may be regarded as " gilding the lily," to use a. popular misquotation.

The height of the cylinder, crosshead and main bearing centres must all be exactly the same, and careful adjustment in machining or fitting will be necessary to ensure this. A vew slight error in the height of the shaft centre would not be harmful; but any misalignment of cylinder and crosshead would cause binding of the working parts, and possibly gland trouble.

Errors of this kind are often botched up by makng the parts a sloppy fit, which certainly enables the engine to run, with sundry clanks and groans, but such slovenliness should never be tolerated in model engineering.

In the second example, Fig. 25, a bored "trunk" guide is employed, similar to that which I have described for the Theseus and Perseus engines, and this enables all uncertainty in the alignment of cylinder and crosshead to be eliminated,. so long as machining is properly carried out. The trunk in this case is cast integral with the baseplate, therefore, unless special machining facilities are available, it will be necessary to mount the casting on the lathe saddle, packed up to the exact centre height, for boring the guide seatings and facing the rear flange.

It can then be swung round for boring the main bearing housings, the caps of which should previously have been fitted, and facing both their inner and outer sides. All these operations can be carried out with boring bars between 'centres, and fitted with suitable cutter bits. The centre lines of the trunk and main bearings must be exactly at right angles to each other.

It will be noted that the bearings of both engines are of the same type, also the crankshaft, which may be either machined from the solid or built up as indicated in the details included in Fig. 24. The journals and crankpin in this case are made a press fit in the webs, and accuracy should be checked after assembly, positive location then being ensured by fitting pegs or dowels endwise as shown.

The front end cover of the cylinder (Fig. 25) is sandwiched between the flanges of the cylinder and the trunk; it must be accurately machined on both sides, including the boring of the- gland, to avoid introducing alignment error. I have described how to ensure this in connection with previous engines.

In other respects, the components of the two engines are identical, including' the connecting rod and crankhead bearing, eccentric sheave, strap and rod (Fig. 24), and the slidevalve with its rod and knuckle (shown in Fig. 25); it will be seen that the method of attaching the valve to the rod, to allow free " floating " location, is the same as in the Theseus and Perseus engines; namely, by reducing either the width or diameter of the rod to fit a slot cut in the back of the valve.

● ***To be continued.***