Beginner's Workshop

TWO-STROKE ENGINE PROPORTIONS

By Geometer

WHATEVER its size, there are certain features of the simple two-stroke engine that are virtually automatically established from the functional principles-and while it is possible to vary the proportions reasonably, to do so substantially is to risk loss of performance.

Knowing what are reasonably good proportions, the dimensions of main components, height of ports, etc., can be obtained without difficulty for any size of engine, and to these can be added the detail design necessary to complete the engine.

In model sizes many engines have been started almost casually on the idea that a particular piece of material seemed suitable for some component -for example, a block of aluminium or duralumin for making a crankcase, or a design may have been evolved deliberately to utilise stock material. In such circumstances the constructor has often had to adapt dimensions to suit material and evolve an engine of appropriate capacity-which, as in orthodox free design, has required a preliminary layout on paper.

For a simple two-stroke engine there is a good deal to be said for a " square " design, with bore equal to stroke, though reasonable variations can be made either way. A long stroke, however, may add to crankcase capacity, so influencing pumping efficiency-and a short-stroke " over square " engine requires shallow ports.

With bore equal to stroke, the basic layout can be as at ***A.*** At the intersection of vertical and horizontal centre lines is the centre of the circle described by the crankpin-with t.d.c. at ***L*** and b.d.c. at M. A suitable centre distance for the connecting rod is twice the stroke, where again reasonable variations are possible, not overlooking that the longer the rod, the greater the crankcase volume, while the shorter the rod, the greater its angularity at mid-stroke, with the chance of its touching the cylinder. Centre length chosen, gudgeon pin centres are marked at N and 0.

The length of the piston for a simple two-stroke engine must always be greater than the stroke to provide overlap on the ports, so that the exhaust port, for instance, is not opened to the crankcase at t.d.c. Any overlap dimension can be chosen, depending on the layout of the ports and the fitting of the ring-or rings-in the piston.

On occasion, the overlap may have to be considerable; otherwise, it should be some small round dimension like 1/16 in. or 1/8 in.

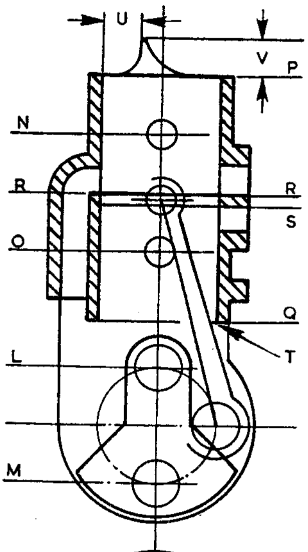
In positioning the gudgeon pin the overlap should be brought down the skirt as far as possible, thus reducing crankcase volume. Then the height above the gudgeon pin added at N, and the depth below subtracted at 0, give the cylinder length ***P*** and Q. Similarly, the height above the gudgeon pin at b.d.c. gives the bottom of the exhaust and transfer ports ***R,*** and the depth below the gudgeon pin at t.d.c. gives the ton of the inlet ports.

Placing the connecting-rod centres on vertical and horizontal centre lines gives the possible width of the rod and the clearance at ***T.*** Should width or clearance be too small, the gudgeon pin may be re-positioned lower down the skirt, and the whole cylinder thereby raised.

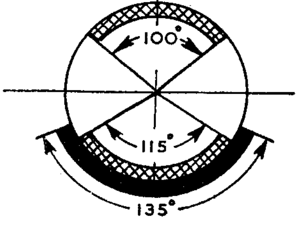
For the deflector on the piston crown, the dimension U can be a quarter to a third of the piston diameter, while depth ***V*** can be approximately equal to the height of the exhaust ports, which is governed by the timing and length of stroke.

Using " standard " timing as at ***B,*** it is transferred as at C. On the crankpin circle, the angular opening is 135 deg. With a big-end thus located, the gudgeon pm is positioned on the vertical centre line, and the height above it gives the exhaust port height ***W.*** With the smaller angle of 115 deg., the height of the transfer port can be obtained X, and in similar fashion the inlet port depth from the angle of 100 deg.

Owing to piston deflector height movement through distance Y would result in low compression in a plain space depth Z, so the cylinder head must conform in part to the piston, as at ***D.*** ❑



(A)



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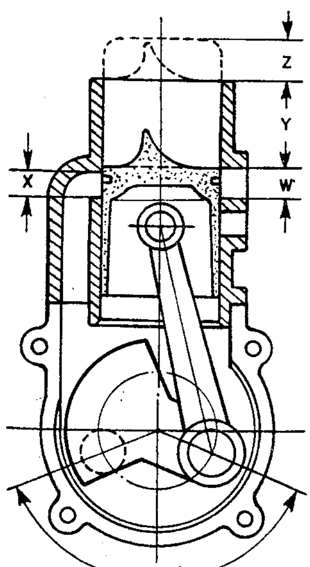
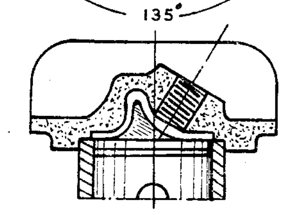


(C)



(D)