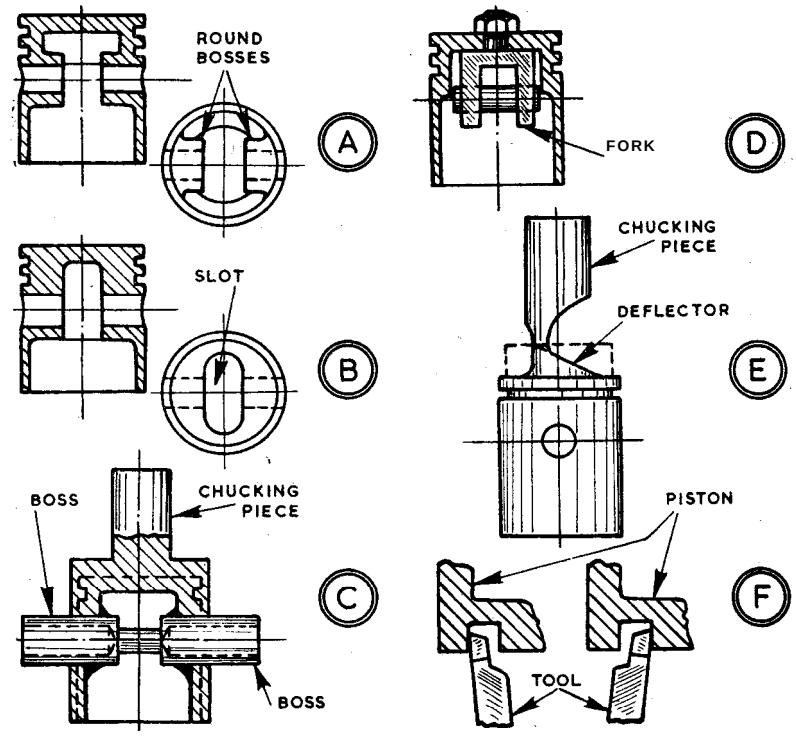
Small piston construction

by Geometer



ALTHOUGH a relatively simple component, a piston because of its internal shape offers constructional difficulties--in the smaller sizes at least . Without gudgeon pin bosses, a piston could be concentric inside and out ; but the gudgeon pin would then have bearing surfaces only in the thin side walls . Thickening the walls adds to the weight of the piston, which is undesirable as it, is a reciprocating component.

The ordinary construction, therefore, is a piston which has a concentric interior and integral bosses providing adequate bearing surfaces -an interior which in the commercial pistons of cars and motor-cycles may be strengthened with struts and ribs. For a model piston, as for the larger sizes, the ordinary construction as at ***A*** requires a casting, and this in turn demands a pattern and a core box for casting the interior.

Two methods

The alternatives in small sizes, utilising bar material, are machined-from-the-solid and built-up constructions. Machining from the solid, the interior is produced by boring and milling. Up to where the gudgeon pin " bosses " will be, the piston can be bored in the normal way. Then to form the bosses, a slot is milled as at ***B,*** setting the work up on the top slide or vertical slide and running an end mill in the chuck. If desired, the milling operation can be preceded by drilling two holes at the extremities of the slot, so only the metal between has to be milled away.

In very small sizes, the milling operation completes the interior. But in larger examples, a boring tool can be used above the bosses, and employing the vertical slide, some metal can be removed from the sides of the bosses, which eventually are approximately square. At the expense, then, of extra work, such a piston compares reasonably well for weight with one which has been cast, the material being aluminium alloy or duralumin bar.

For built-up constructions, there is the choice, broadly, of three methods: 1 crown and bosses can be made as a separate piece and the skirt screwed on-which results in a somewhat heavy piston and one whose parts may loosen with heat and vibration; 2 using cast-iron bar, the bosses can be bronze-welded in as at C, when the interior has been machined; 3 the bosses can be provided by a separate forked piece as a ***D***, held by a nut on the crown, a construction which also solves the problem of endwise locating the gudgeon pin.

For an engine of moderate speed, a cast-iron piston is no less suitable than one of light alloy and may be machined to a closer fit in the cylinder. For the construction at C holes for the bosses are carefully drilled or bored; then the bosses are prepared, also from cast-iron bar, with a central step smaller than the bore of the bosses and the length of their distance apart. The piece is then drilled up carefully from each end nearly to the centre. The bosses having been bronze-welded in-with good fillets round them-the holes are continued inwards to cut the centre piece away; finally, the holes can be reamed.

On small pistons and where internal machining is necessary, a chucking piece on the crown is a considerable advantage . In the case of a two-stroke piston,. this piece may also be used for holding in the vice while the deflector is filed and polished to shape as at ***E*** on the final operation. The material is gradually thinned until the piston is free when the last ragged edges can be cleaned up holding it in the hand.

Ring, grooves are usually best machined before the final finishing cut on a piston, and may be retained square-sided by using left and right-hand tools as at ***F.***

Piston clearances per in. of diameter for cast-iron cylinders may be: cast-iron, crown 0.003 in., skirt 0.002 in.; aluminium alloy, crown 0.006 in., skirt 0.003 in. ❑