CRANKSHAFTS AND PISTON ASSEMBLIES

The three crankshafts differ only in that the crank throws on the 'CA' crankshaft are reversed to suit the geometry of the engine, which demands an opposite direction of rotation for this crankshaft in relation to 'AB' and 'BC' crankshafts. The crankshafts are machined from an alloy steel forging and are nitrided all over, suitable drillings in the journals, webs and crankpins convey lubricating oil from the main bearings to the big-end bearings.

Bolted to a flange at the driving end of each crankshaft is the crankshaft gear, of two piece construction, which drives the gear trains in the drive end compartments of each crankcase. The inner member of the crankshaft gear has internal gear tooth splines which transmit the drive from the crankshaft through a splined quill-shaft and coupling to the respective phasing gear within the phasing gear case.

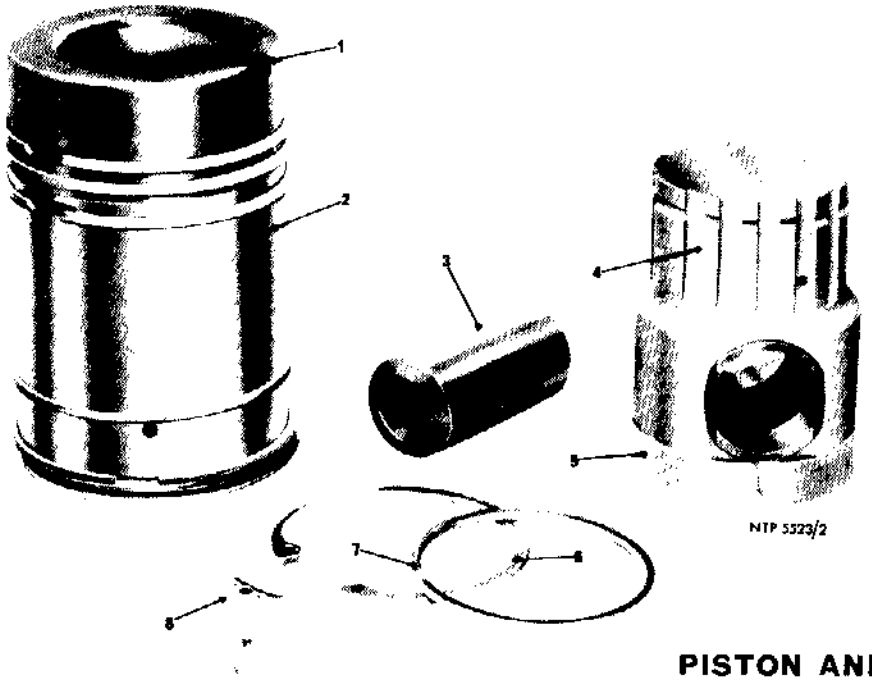
Torsional vibration of each crankshaft is limited by a viscous damper which consists of an annular inertial weight housed within a circular casing; the small internal clearances between the inertia weight and the casing are filled with a viscous fluid. The assembly of the damper, being a self contained unit, is bolted to a flange formed at the free end of the crankshaft and the inertia weight being mechanically free, is virtually unaffected by the torsional oscillations of the crankshaft and therefore maintains a uniform angular velocity; the drag between the weight and the casing by the viscous fluid reduces the amplitude of oscillation of the crankshaft. This damper assembly is a sealed unit, and its satisfactory functioning depends on the small annular clearances which could be easily destroyed by rough handling.

A dog, with which the claw of a hand turning gear engages, is fitted to the free end of 'BC' crankshaft, and a centrifugal breather is fitted, at the free end of 'AB' crankshaft.

Piston Assemblies

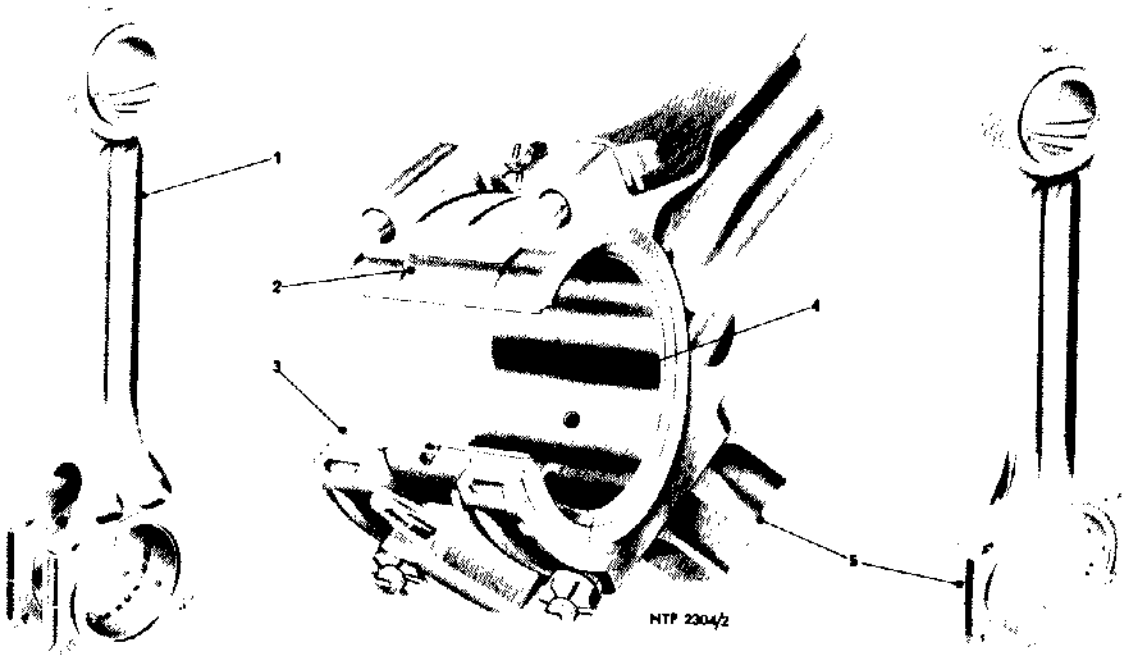
Each crankpin carries a pair of connecting rods, one plain and one forked. The exhaust pistons are connected to the forked rods, the big ends of which are spanned and reinforced by a nitrided steel sleeve. Internally this sleeve carries the big-end bearings which are of the thin wall shell type and similar to the main bearings; externally the steel sleeve provides a journal for the big-end bearing of the plain rod which carries the inlet pistons and oscillates within the fork of the exhaust piston rod.

The rods are drilled lengthwise to transfer oil from the big end bearings to the small-end bearings for lubrication of the gudgeon pin and for piston cooling. Since the bottom crankshaft rotates in the opposite direction to the top crankshafts a different arrangement of oil holes and grooves is provided in these big-end bearings.



1. Piston crown
2. Piston skirt
3. Gudgeon pin
4. Oil grooves
5. Gudgeon pin housing
6. Taper-seated circlip
7. Spacer ring
8. Stop block

PISTON AND GUDGEON PIN HOUSING



1. Forked connecting rod
2. Plain rod bearing
3. Steel bearing sleeve
4. Forked rod bearing
5. Plain connecting rod

BIG END BEARING AND CONNECTING ROD

Each oil cooled piston comprises an outer body and an inner member or gudgeon pin housing. The outer body is formed of two separate parts, an aluminium alloy skirt and a dished crown of "Hidural", the crown being screwed on to the piston skirt, torque loaded into position and locked through the medium of the piston ring locating pegs.

Three compression rings are positioned in tapered grooves immediately below the crown, the two uppermost grooves being machined in the dished piston crown, the lower groove in the aluminium alloy skirt. The rings are located in their correct angular position by pegs screwed into the tapered ring grooves.

Three scraper rings are positioned at the lower end of the piston skirt, two plain and one channel section slotted ring. These rings are etched with the word "TOP" and are fitted to their parallel grooves with the etched markings facing toward the crown of the piston. Holes drilled through the piston skirt communicate with the rear of the channel section ring, this arrangement permitting a rapid breakaway of the oil removed from the cylinder walls by the scraper rings.

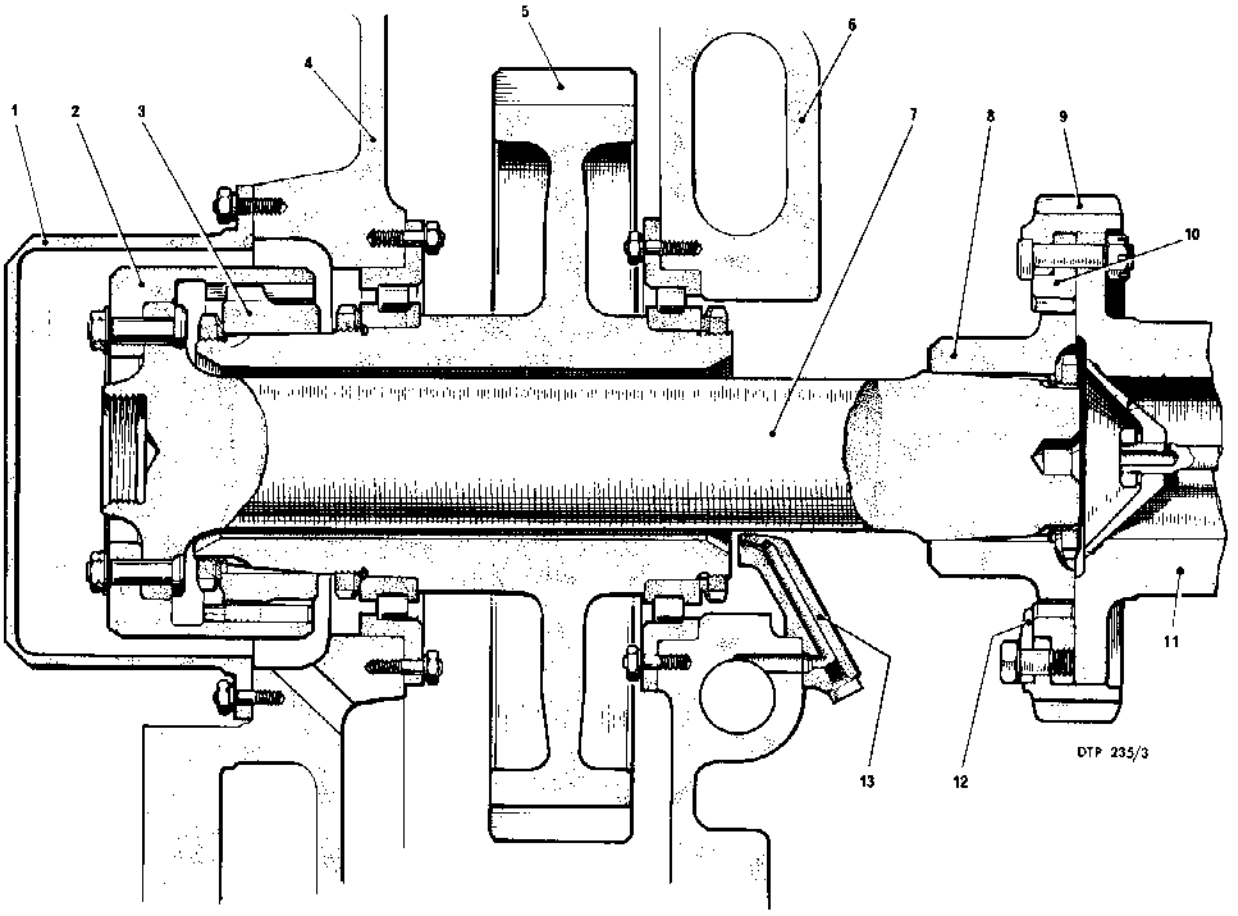
The underside of the piston crowns are indium plated to resist corrosive attack on the copper alloy of the crown material, by the oil supplied to the piston assembly.

The gudgeon pin housing carries two bronze bushes as bearings for the fully floating nitrided steel gudgeon pin. The form of the housing is such that an annulus is formed when the housing is inserted in the outer body. Drillings in communication with the connecting rod small end transfer oil to the annulus for piston cooling.

The sequence of assembly of the piston and connecting rod is as follows. The gudgeon pin housing is heated and the gudgeon pin inserted through the housing bushes and connecting rod small end. The outer body is then heated and the assembled gudgeon pin housing and connecting rod inserted, being located angularly by a dowel positioned on the inside of the outer body and groove cut in the gudgeon pin housing. The gudgeon pin housing is retained in the outer body by the shrink fit and by a taper seated, tapered circlip. A distance piece is positioned between the horns of the circlip, a small gap being provided between the horns and the distance piece. This arrangement allows for differential expansion to take place between the two piston members.

The numerical position of each piston assembly is etched on the rod adjacent to the joint of the rod and rod cap, each rod cap carries a number stamped on the flat adjacent to the joint and the rod carries a corresponding number. Each big end bolt is also marked for position; plain rod bolts being marked for example with numbers thus: 45 and 45., and the exhaust rod bolts of which there are four thus: A37 and A37., B37 and B37., the respective holes for these bolts are similarly marked, thus during reassembly after major inspections all parts will return to their original positions.

It should be noted at this point that of the six bolts in a big-end assembly the four securing the forked rod large end have a plain central land, the two securing the plain rod large end have a fluted central land. Whilst only one of these fluted bolts provides an oilway for the passage of oil from the large end of the plain rod to the small end, both bolts have been machined with flutes to avoid any mal-assembly. The arrangement of oilways in the forked rods is different. The lubrication system is discussed in a later chapter.



1. Quill-shaft cover
2. Outer gear-type coupling
3. Inner gear-type coupling
4. Phasing gear case drive-end casing
5. Phasing gear
6. Phasing gear case free-end casing
7. Quill-shaft
8. Gear-type coupling
9. Crankshaft gear
10. Inner gear
11. Crankshaft
12. Locking plate
13. Spray jet and quill support

CRANKSHAFT COUPLING AND QUILL SHAFT