PHASING GEAR CASING

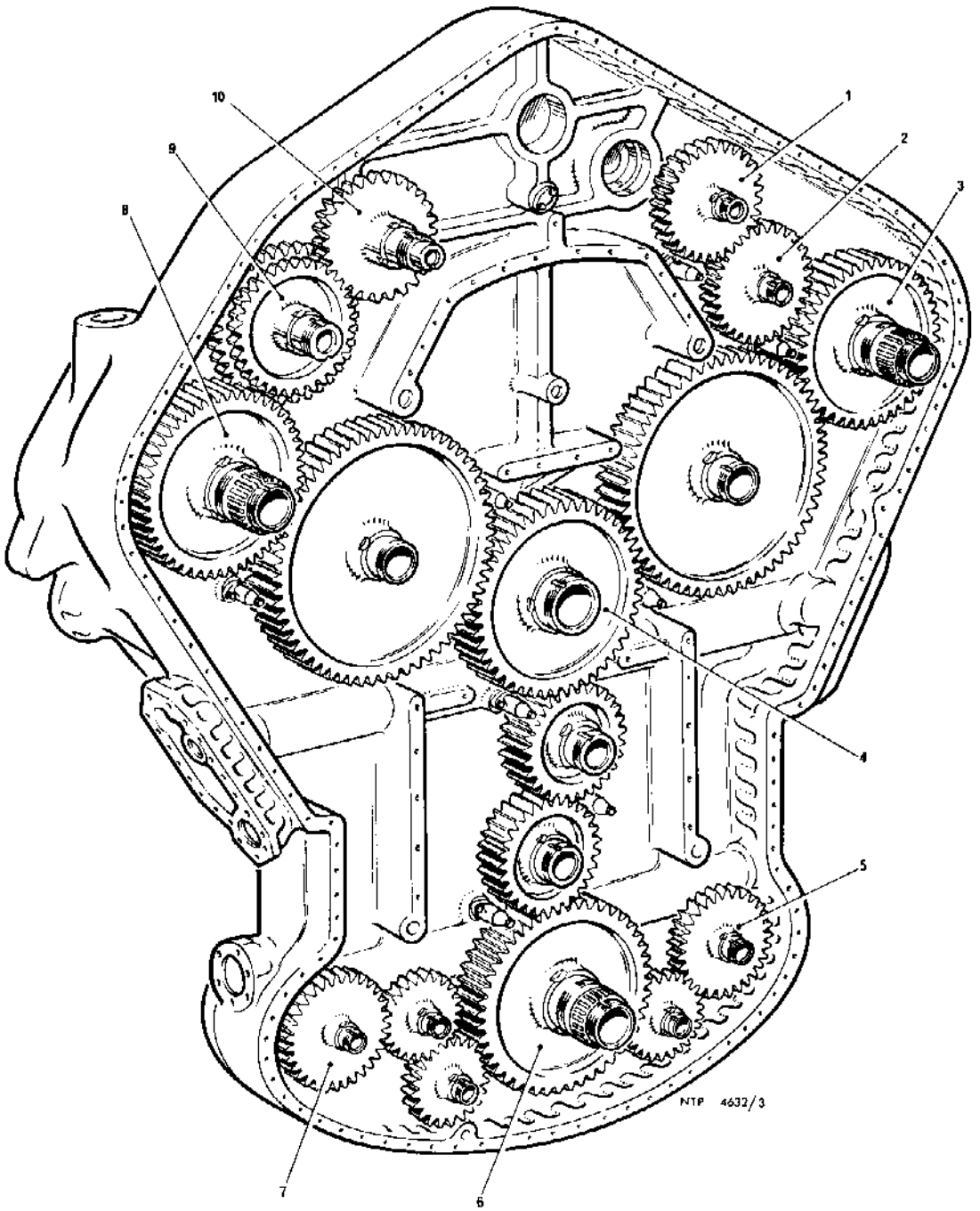
To combine the output from the three crankshafts and to phase the crankshafts in the required manner, the crankshafts are linked by a system of gears contained within the phasing gear casing. Provision is made for mounting and driving certain of the engine auxiliaries from the phasing gear casings, these include, the lubricating oil pressure and scavenge pumps, the engine governor and certain other auxiliary units dependent upon the type of engine.

The phasing gear casing is formed by two light alloy castings which are bolted together in a vertical plane. The free end casing has external machined faces for attachment to the engine and for mounting the pressure oil filter, the pressure and scavenge oil pumps, and auxiliary units. The drive end casing has a machined face to which may be mounted various assemblies dependant upon installation requirements. These assemblies include, a bi-directional gearbox for marine use, an adapter ring for a main generator for rail traction or industrial engines, and an end cover for certain applications. The casings are also provided with machined mounting faces which carry certsin of the engine auxiliary components. Both casings incorporate bosses for the accommodation of housings for the gear train and output shaft bearings, all gears within the phasing gear casing being supported in roller-bearings. The casings contain cored passageways and drillings for the circulation of lubricating oil.

Phasing gears and shafts

The drive from the three crankshafts is passed to the three phasing gears through quill-shafts, these shafts being designed, in conjunction with the crankshaft dampers, to reduce torsional vibrations in the crankshafts and gears. The quill-shafts have Barber Colman, taper splines, machined at their free ends, a bronze gear type coupling being located on these splines and secured in position by a ring nut. This bronze coupling mates with the gear type splines of the inner crankshaft gear. At their driving ends, the quill-shafts have a bolted on outer gear coupling which has internal gear tooth splines cut in it and mate with an inner gear coupling which in turn is splined on to the phasing gear hub and secured in position by a ring nut. Phasing adjustments of approximately $\frac{1}{4}^{0}$ can be obtained by the vernier number of teeth in the two gear-toothed couplings, one at each end of each quill-shaft.

From the phasing gears the drive is passed through idler gears to an output gear. From the output gear the method of passing the drive to the various assemblies which can be mounted does vary slightly in detail but basically it may be said that a splined quill-shaft performs this service. (See Chapter 6).

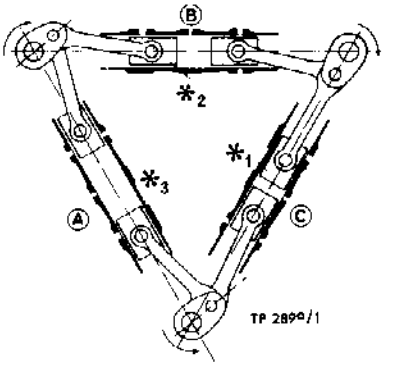


1. Governor drive gear
2. Idler gear
3. 'AB' phasing gear
4. Output gear
5. Pressure-oil pump drive gear
6. 'CA' phasing gear
7. Scavenge oil pump drive gear
8. 'BC' phasing gear
9. Idler gear
10. Clutch pump drive gear

PHASING GEAR CASE

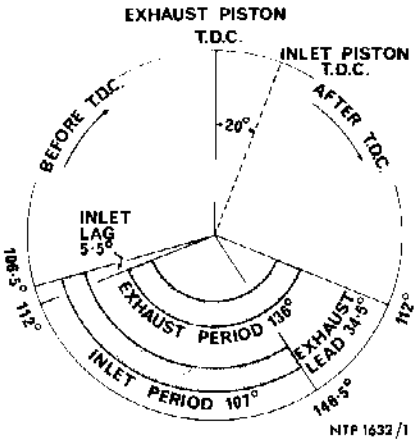
CRANKSHAFT PHASING
(On No. 1 cylinders)

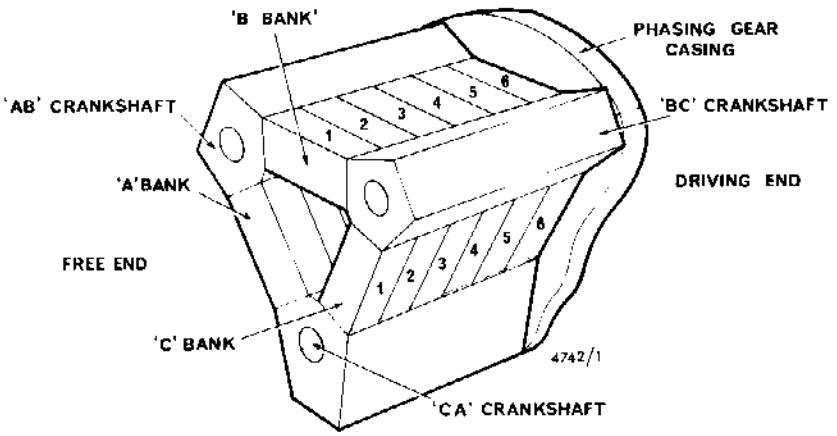
C.1 Exhaust piston (*1)	T.D.C.
B.1 Exhaust piston (*2)	40° before T.D.C.
A.1 Exhaust piston (*3)	80° before T.D.C.
Exhaust piston lead	20°



PORT TIMING (Relative to exhaust T.D.C.)

Inlet opens 146.5° after T.D.C.
Inlet closes 106.5° before T.D.C.
Exhaust opens 112° after T.D.C.
Exhaust closes 112° before T.D.C.





FIRING ORDER

4741/1

CYL. BANK	MEAN CRANK ANGLE (C.1. CYLINDER) - DEGREES														
	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350
C	1			5			3			4			2		6
B			1			5			3			4			2		6
A		6			1			5			3			4			2	

PHASING AND TIMING

Phasing

In two stroke engines having piston-controlled inlet and exhaust ports, the exhaust port must be opened before the inlet port to ensure maximum efficiency in scavenging and pressure-charging. This exhaust port lead is normally obtained by the positioning of the ports in relation to the piston movement, but, in opposed piston engines, it can be obtained by a combination of port positioning and crankshaft phasing, the crankshafts being phased so that the inlet and exhaust pistons do not reach T.D.C. together. The difference between the relative positions of the two pistons is referred to as the phase difference.

With an equilateral triangular arrangement of the cylinders it can be shown that with two pistons in two cylinders in phase, the pistons in the third cylinder will be out of phase to the extent of 180°. This can be modified by reversing the direction of one of the crankshafts (in practice the bottom one), the phase difference will then be 60°. This phase difference of 60° is divided equally between the three cylinders, making a phase angle of 20° of crankshaft rotation.

This means that one piston in each cylinder must lead the other by 20°. This lead is given to the exhaust piston, as an exhaust port lead is advantageous to the scavenging and cylinder charging processes.

As the exhaust and inlet pistons in each cylinder are out of phase, port timing cannot conveniently be stated in terms of degrees of rotation of the crankshaft to which each piston is attached, the exhaust piston is therefore taken as the datum, and the timing of both pistons referred to the crankshaft to which the exhaust piston is connected.

The ideal exhaust port lead for this type of engine is that which allows the combustion pressure to fall below the scavenge pressure at the point of inlet port opening. The inlet port is closed after the exhaust port, and thus the blower supercharges each cylinder after the exhaust port has closed. During the period that both ports are open, the air flow from the blower scavenges the cylinder of all exhaust gases and assists in cooling the cylinder walls and piston crowns.