PATENT SPECIFICATION

558,115

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COMPLETE SPECIFICATION

Improvements relating to Internal Combustion Engines

I, JAMES THOMAS BIRD, a British subject, of 6, Shottfield Avenue, East Sheen, London, S.W.14, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to internal combustion engines having opposed pistons working in a common cylinder.

The invention is applicable to two-stroke and four-stroke engines having one cylinder or a number of cylinders in line.

In accordance with the invention I connect the pistons of such an engine to crankshafts revolving in opposite directions and interconnected by wheel or other gearing, the axes of these crankshafts being in a plane at right angles to the axis of the cylinder or cylinders.

From another aspect the invention consists in an engine of the above type having the pistons connected to two crankshafts revolving in opposite directions in which the connecting rods are mainly subjected to tensile forces only.

In the preferred arrangement each piston carries a yoke passing through slots in the cylinder walls and these yokes are connected at each side of the engine by connecting rods to cranks on the two shafts.

Alternatively the slots may be formed as guides for the extensions of the piston yokes to which the small ends of the connecting rods are pinned, and in this case some portions of the outer cylinder ends may be dispensed with.

At maximum compression in the cylinders the cranks are preferably set at suitable equal angles to each other and all connecting rods are of equal length but the lengths or angular distance apart or both of the cranks may differ from one another in order to be able thus to vary the port events or for other reasons. Further the plane containing the axes of the engine shafts preferably intersects the cylinder axis at right angles thereto and substantially midway between the pistons when in their bottom dead centre positions.

In the accompanying drawings which illustrate the invention in a diagrammatic manner,

Fig. 1 is an elevation, partly in section, of a two-stroke engine embodying the invention and having three cylinders in line,

Fig. 2 is a section, taken through the first cylinder of the engine of Fig. 1 viewed from the front end,

Fig. 3 is a part sectional plan view of the same cylinder at the exhaust ports.

Referring to the drawings each cylinder 1 has working in it two opposed pistons 2, 3; these pistons have yokes 4, 5 at their outer ends passing through slots 6, 7 in the cylinders.

Connecting rods 8, 9 on each side of the engine run in pairs to cranks 10, 11 on shafts 12, 13. These cranks are arranged at 120° to each other and the crankshafts 12, 13 have axes in the diametral plane through the centre of the cylinders.

The yokes 4, 5 extend beyond the circumference of the cylinders and move up and down in slots on both sides, carrying the small ends of the eighteen connecting rods in bearings 19. The two connecting rods of each upper piston are connected to two pairs of cranks 10 and the forked connecting rods of each lower piston to two single cranks 11.

The crankshafts 12, 13 run in opposite directions and are interconnected by gear wheels 15, 16, 17, 18. The wheel 17 is of large diameter to serve as a final drive at a reduced speed, and the wheel 16 is of small diameter to drive an engine auxiliary, for example, a blower for scavenging and pressure-charging, at an increased speed relative to the rotational speed of the engine.

In Fig. 1 the sections are taken through the axis of the crankshaft 13 in front of the cylinders thus showing the bearings 30, 31, 32 for the shaft.

The inner halves 20 of the main bearing shells form part of a rigid structure cast in one with the cylinders, and the outer halves 21 take the form of casings suitably ribbed and bolted to the parts 20 to carry the crankshafts in roller bearings. The remainder of the engine is provided with detachable pressed metal covers 22.

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The pistons are shown in Fig. 2 in their inner dead centre positions and so shaped at their ends that a lenticular space 23 is provided.

The fresh charge enters from the blower or other charging device by a passage 24 running the length of the engine and forming annular delivery passages round each cylinder, with ports 25 tangentially arranged so that the charge enters at an inclination to the cylinder radii.

The liquid cooling medium enters a manifold 28 at one end of the engine and rises thence through passages 33, Fig. 3, into the jacket space 36 provided around the cylinders to the height of the inlet passage; these passages 33 divide the exhaust passage into two parts 34, 35 throughout the length of the engine.

The engine illustrated has twelve exhaust outlets 26, 29 and the exhaust from each cylinder is passing through ports 27 into the two passages 34, 35 and is split up into the passages 26, 29 as indicated by the arrows shown in Fig. 3.

As the result of the cranks of each cylinder being set at about 120° to each other at the point where both pistons reach inner dead centre and the varying angularities of the connecting rods caused thereby, the relative travel and velocity of the pistons in one direction differ from those in the other direction. In this way the engine illustrated has an increased effective working stroke compared with that obtained with the axes of the crankshafts perpendicularly below the cylinder centres. Moreover and although the inlet ports are timed to open later than the exhaust, a larger inlet than exhaust area is produced and the exhaust ports will be closed before the inlet ports are covered by the pistons thus increasing, accelerating and prolonging the inflow of the fresh charge into the cylinder to an extent not possible with known types of opposed-piston engines.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An internal combustion engine with opposed pistons working in a common cylinder and connected to two crankshafts which revolve in opposite directions and are interconnected by wheel or other gearing and located with their axes in a plane at right angles to the axis of the cylinder or cylinders.

2. An internal combustion engine with opposed pistons working in a common cylinder and connected to two crankshafts revolving in opposite directions characterised in that all connecting rods are subjected to tension only from the gas pressures in the cylinder or cylinders.

3. An internal combustion engine with opposed pistons working in a common cylinder and connected to two crankshafts revolving in opposite directions in which the pistons carry yokes connected by connecting rods at each side to cranks symmetrically so arranged so that the pistons are not subject to side thrusts.

4. An engine as in Claim 1 in which the plane containing the crankshaft axes intersects the engine cylinder at right angles to the axis thereof substantially midway between the pistons when in their inner dead centre positions.

5. An engine as in Claim 1 in which the cranks connected to one piston are equal in length and angular distance apart to those connected to the piston opposed to it.

6. An engine as in Claim 1 in which the cranks connected to one piston are unequal in length or angular distance apart or both to those connected to the piston opposed to it.

7. An engine as in Claim 1 in which a wheel gearing the crankshafts together serves as a reduction gear and another wheel or wheels serves as a drive for an engine auxiliary.

8. An engine as in Claim 1 having an inlet passage connecting to inlet ports so arranged that the charge enters at an inclination to the cylinder radii.

9. An engine as in Claim 1 having exhaust ports connected to a number of exhaust outlets, some at the side of the engine and some at the top or bottom thereof.

10. An engine as in Claim 1 having an inlet manifold for introducing cooling medium at one end of the engine.

11. An engine as in Claim 1 having bearings for the crankshafts in which the inner halves are cast in one with the cylinders and the outer halves are bolted thereto.

12. An engine as in Claim 11 in which the working parts between the bearings and the cylinder or cylinders are enclosed by detachable metal covers.

13. An internal combustion engine substantially as described with reference to the accompanying drawings.

Dated the 16th day of June, 1942.

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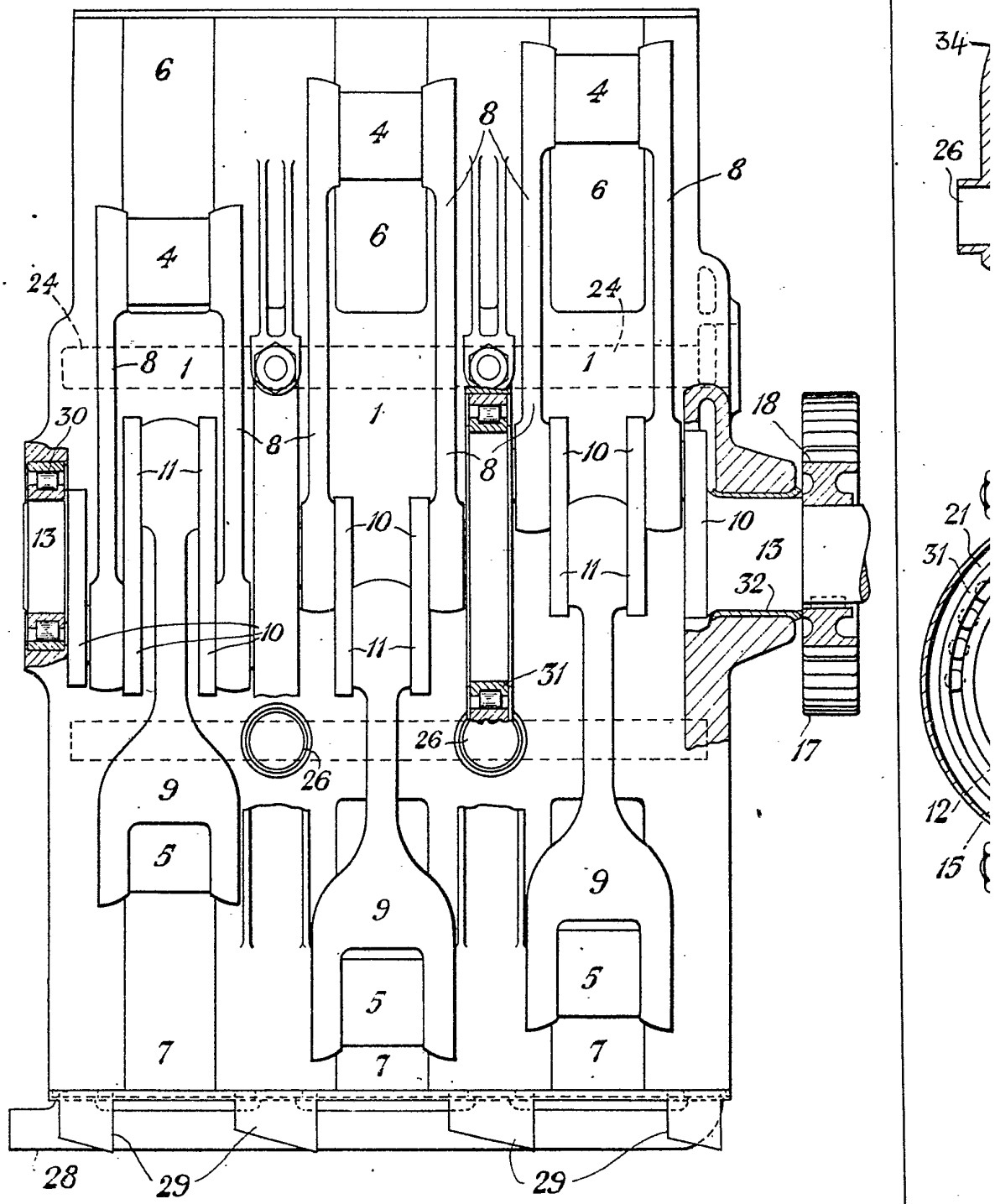
FIG. 1.



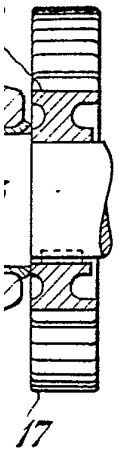


FIG. 3.

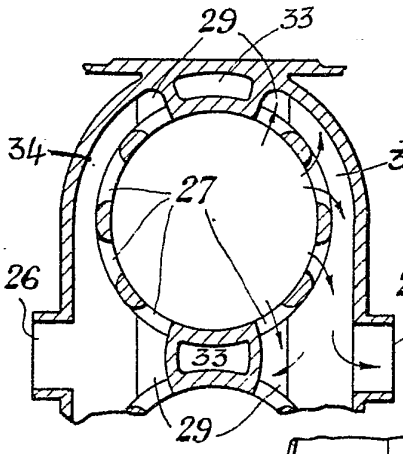


FIG. 2.

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[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1.

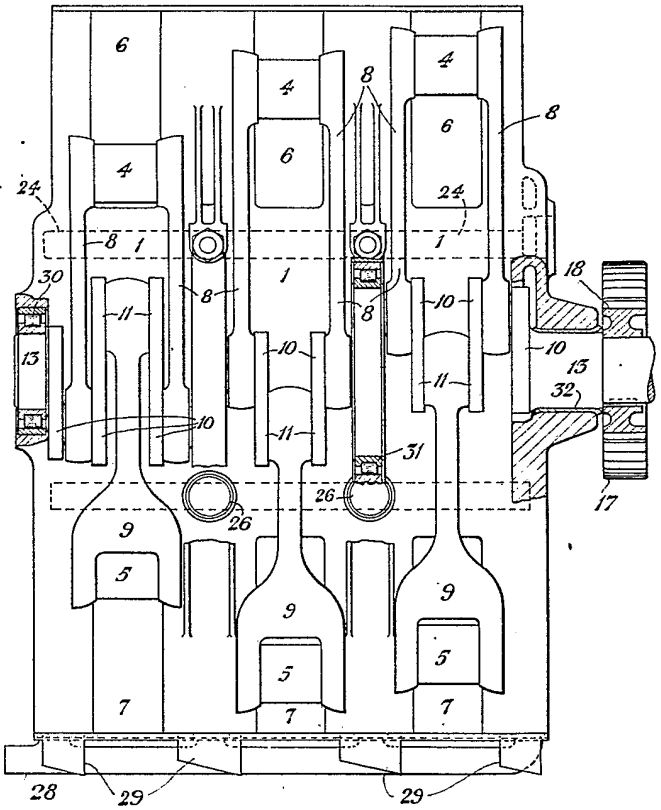

FIG. 3.

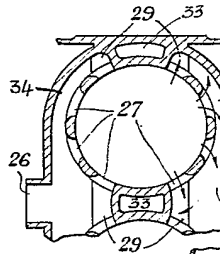

FIG. 2.

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