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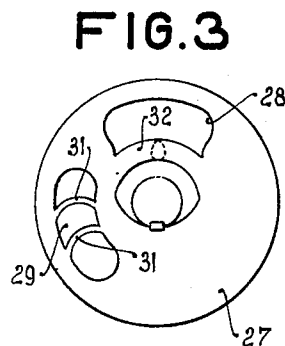
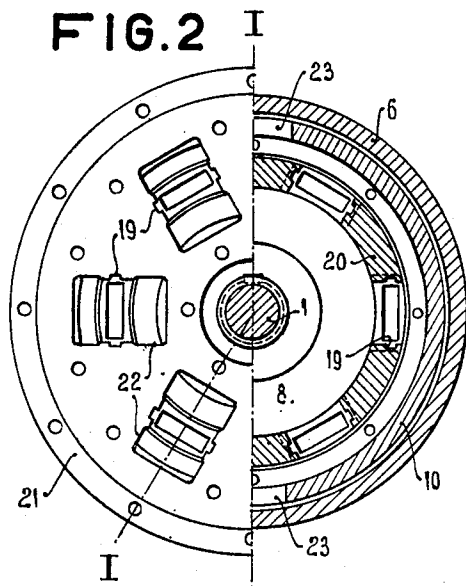
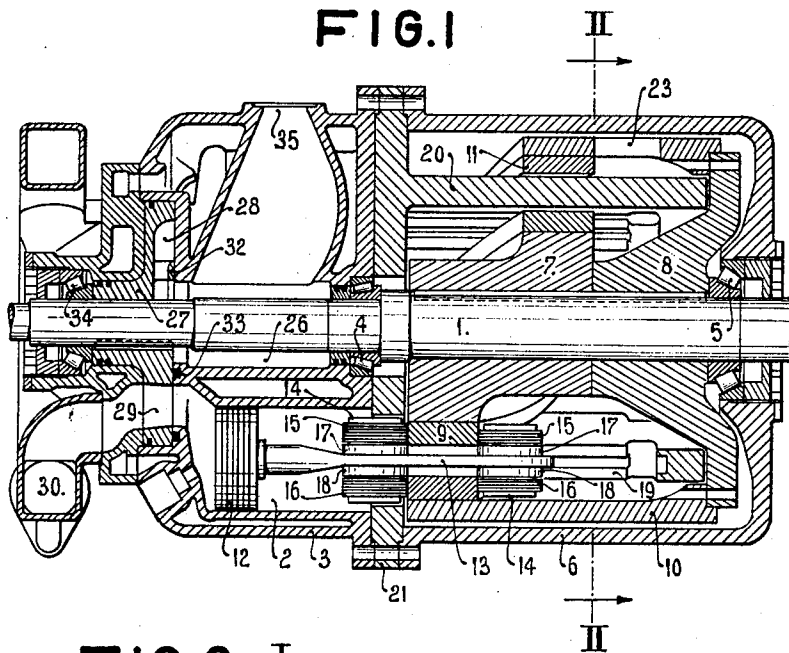
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2,514,728

MULTICYLINDER PISTON ENGINE

Filed Jan. 23, 1947

2 Sheets-Sheet 1



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FIG. 4

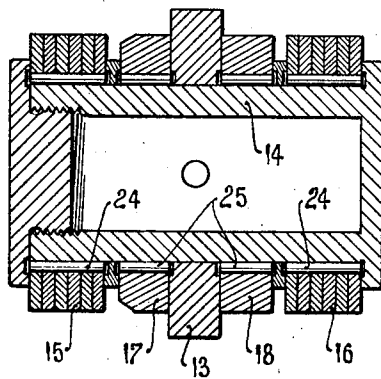
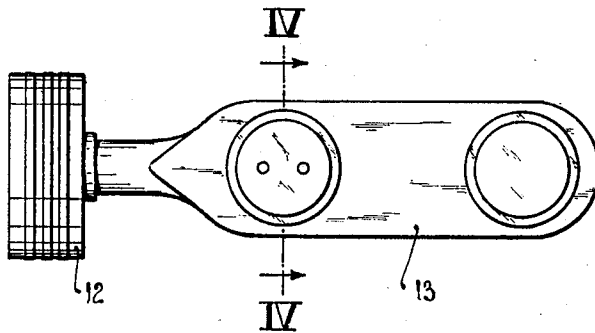


FIG. 5



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UNITED STATES PATENT OFFICE

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MULTICYLINDER PISTON ENGINE

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5 Claims. (Cl. 74—56)

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This invention relates to a multi-cylinder piston engine the cylinders of which are arranged parallel to a central shaft and the piston rods of which carry rollers engaging with two concentric cam rings secured to said shaft in order to convert the rectilinear movement of the pistons into a rotary one of the shaft.

The invention has for its principal object to release the piston rods from bending stresses caused by forces due to the combustion pressure and the inertia and to release the pistons from lateral pressure.

Further object of the invention is to obtain an engine of the class referred to of compact and serviceable form.

With these objects in view according to the invention both concentric cam rings are each provided with a cam track on either side and the piston-rods carry two sets of rollers for cooperation with said cam tracks and further carry rollers engaging with stationary guides formed as axial slots in a cylindrical member extending between the cam rings.

The invention further consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

The invention is illustrated in the accompanying drawings in which:

Fig. 1 is a longitudinal section of the engine.

Fig. 2 is in the left hand half an end elevation of the engine with the cylinder-block removed and in the right hand half a cross section on the line II—II in Fig. 1.

Fig. 3 is an end elevation of the rotary valve.

Fig. 4 is a longitudinal section of a set of rollers on the line IV—IV of Fig. 5 and drawn on a larger scale, and

Fig. 5 is a view of the piston with its rod and rollers.

Referring to the drawings 1 designates the shaft of the engine which is a four-cycle internal combustion engine with six cylinders 2 united to form a block 3. The shaft 1 is supported by the aid of roller bearings, one of which (4) is fitted in the block 3 and the other (5) is mounted in the end wall of a cylindrical casing 6 which is bolted to block 3.

On shaft 1 are keyed two hub-like members 7, 8, the member 7 of which carries the inner cam ring 9, whereas to member 8 a sleeve 10 is secured which carries the outer cam ring 11.

The rod 13 of each piston 12 is provided with two sets of rollers which are mounted on hollow pins 14 secured in the rod 13. Each set of rollers

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comprises an inner roller 15 and an outer roller 16 for cooperation with the inner cam ring 9 and the outer cam ring 11 respectively. The rings 9 and 11 have a cam track on either side with which one of the rollers 15, 16 engages.

As shown in Fig. 4 each of the rollers 15, 16 consists of separate discs which are independently rotatable on the pin 14, in order to allow for the difference in rolling speed between the inner and the outer face of the respective roller.

Each set of rollers further comprises two rollers 17, 18 which cooperate with tracks 19 formed by slots in a cylindrical cage extending between the cam rings 9, 11 and secured with a flange 21 between the flanges of the block 3 and the casing 6. The rollers 17, 18 serve to guide the pistons in a rectilinear path.

The flange 21 of the cage 20 has openings 22 through which the piston rod with its rollers may pass. For removing or mounting the rollers at the end of the piston rod remote from the piston the sleeve 10 has one or more openings 23. If said rollers have to be removed first the casing 6 and the bearing 5 are removed, whereupon the hub member 8 is disconnected from sleeve 10 and slid from the shaft, so that access to the rollers is obtained. The innermost rollers 15, 17 can now be removed. The outer rollers 16, 18 together with their hollow trunnion 14 may then be withdrawn through the opening 23 in sleeve 10. During said operation said sleeve must be rotatably supported.

As shown in Fig. 4 the rollers are supported on needles 24, 25 respectively. Said needles together with the adhering oil form a liquid ring which only slowly follows the rapid rotation of the roller. Direct contact of metal with metal does not take place. Although the discs which are farther from the shaft 1 are rotating faster the needles owing to said hydraulic friction can not be damaged by tilting movement.

The rollers may also be supported by slide-bearings. In this instance the hollow trunnion 14 may be provided with steel bushings having a bearing surface of a suitable bearing-metal. Alternatively each of the discs may have a bushing provided with a lining of a suitable bearing-metal.

As double lobed cam rings are provided two complete reciprocations are performed by each piston during one revolution of the engine shaft. The valve 27 may, therefore, be directly keyed to the shaft 1. If, however, the cam rings have only one lobe a gear should be provided between the shaft and the valve as said latter should then rotate with half the angular velocity of the shaft.

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The resultant pressure of the fluid acting on the valve is taken up by an axial thrust bearing 34. The pressure of the exhaust gases tending to force the valve on its seat, is only small owing to the suction of said gases in the annular exhaust chest 30.

The valve 27 may be statically and dynamically balanced by bore holes. When employed to a steam engine having double lobed cam tracks the valve is provided with two inlet- and two exhaust-ports which are diametrically opposite one another so that the valve itself is balanced in every respect.

What I claim is:

1. A fluid pressure operated multi-cylinder piston engine including in combination a main central shaft, a plurality of cylinders arranged parallel to and concentrically about the central shaft, pistons operating in the cylinders, rods extending from the pistons, a fixed cylindrical cage arranged about the outer ends of the rods and provided with a series of axial slots forming guides, two concentric cam rings fixed with respect to the shaft and positioned adjacent the inner and outer faces of the cage and providing cam tracks, two pairs of rollers on the piston rods for engagement with the cam tracks so as to embrace said latter, and additional guide rollers mounted on the rods and engaging the guides formed by the axial slots.

2. A fluid pressure operated engine as claimed in claim 1 in which the first mentioned pair of rollers each consists of a plurality of independently rotating discs.

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3. A fluid pressure engine as claimed in claim 1 in which a hub is mounted on the shaft, a sleeve carried by the hub for supporting the outermost cam ring and provided with at least one opening in its periphery through which the rollers at the outer ends of the piston rods may be introduced and removed.

4. A fluid pressure engine as claimed in claim 1 in which the additional rollers are mounted on the axes of the first mentioned rollers and are positioned on and engage the opposed faces of the rods.

5. A fluid pressure engine as claimed in claim 1 in which hollow pins are provided for mounting the rollers on the piston rods, the first mentioned rollers being arranged at the outer ends of the pin so as to be readily engaged by the cam track while the last mentioned rollers are positioned on opposite sides and in contact with the rod.

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