

July 11, 1944.

F. A. LANE

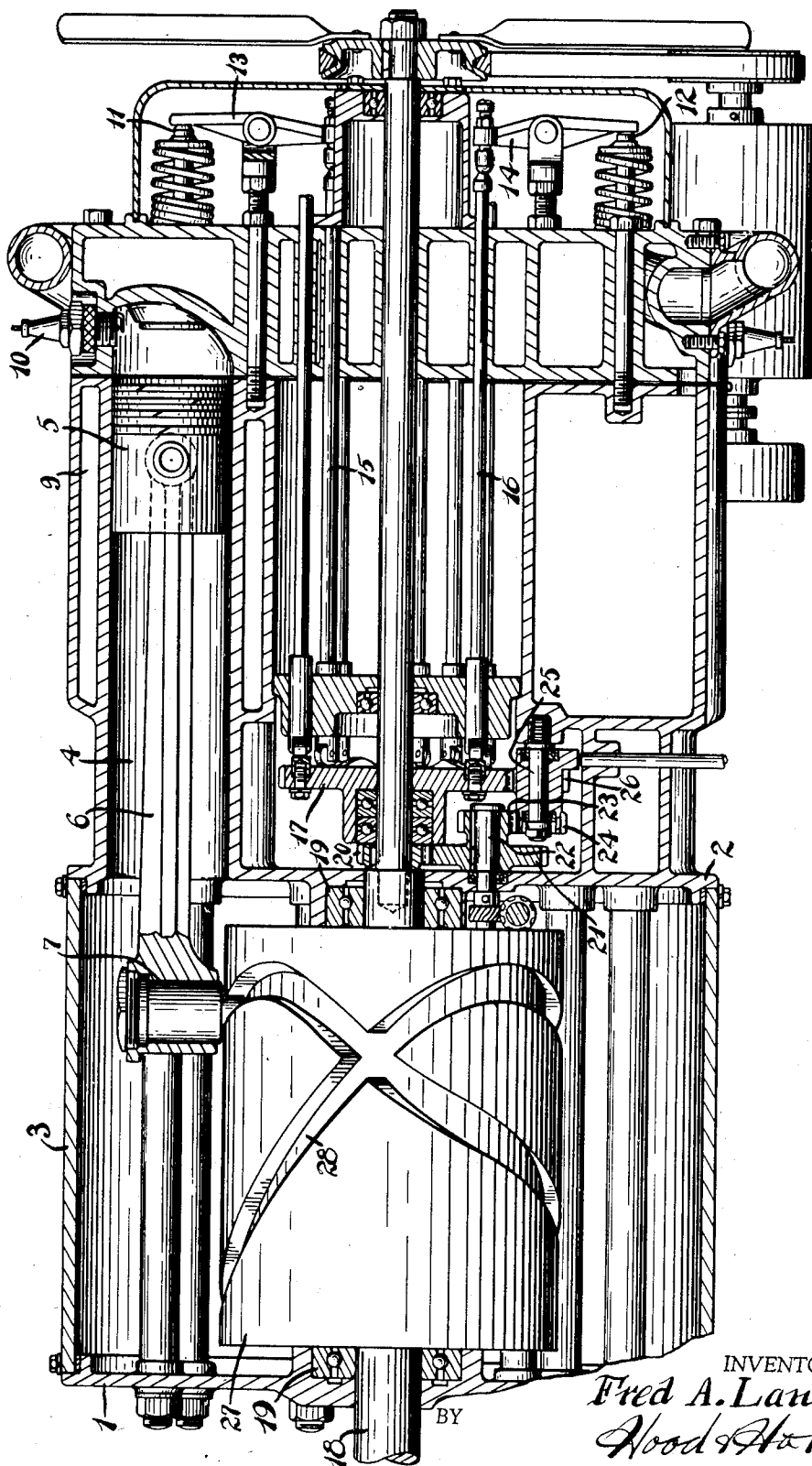
2,353,313

INTERNAL COMBUSTION ENGINE

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2 Sheets-Sheet 1

Fig. 1.



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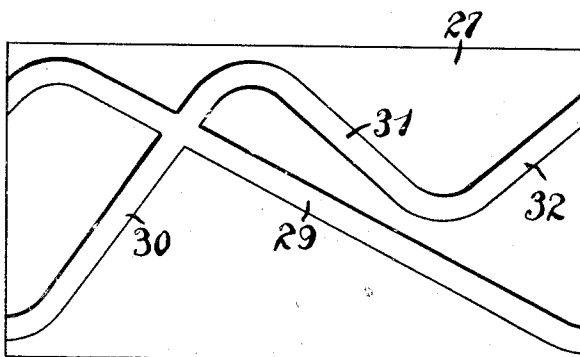
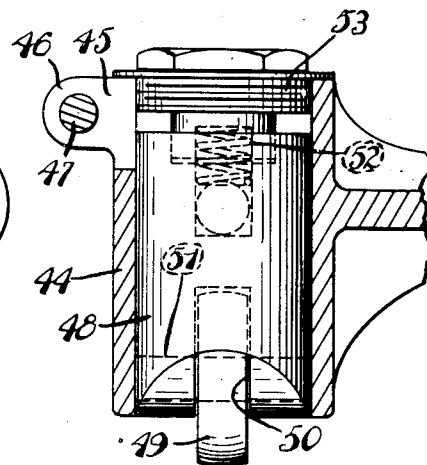
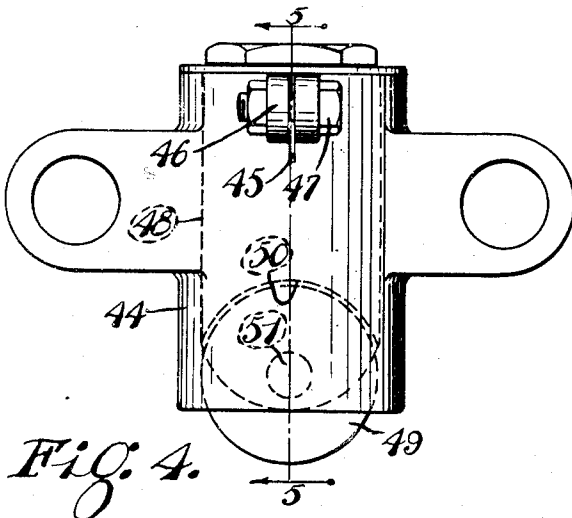
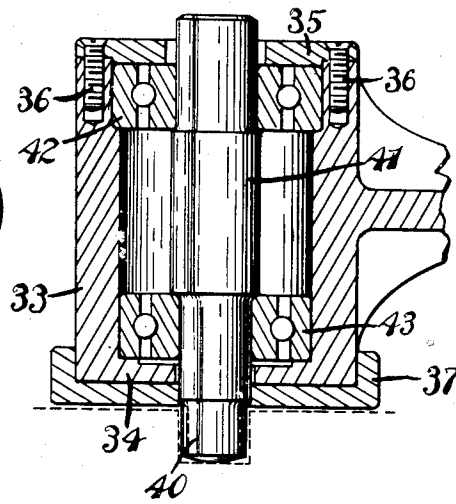
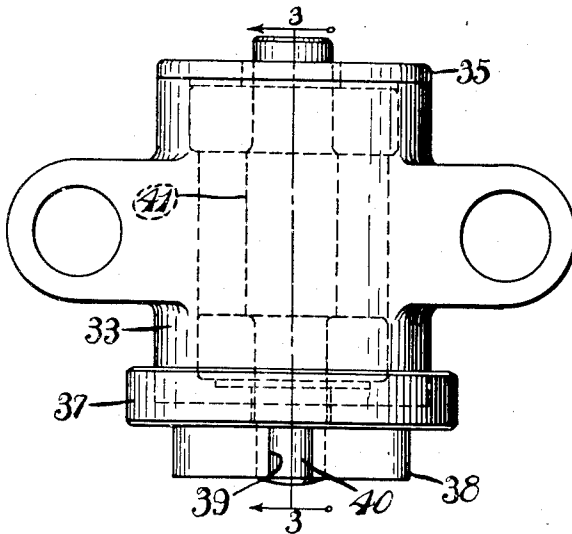
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2 Sheets-Sheet 2



BY

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UNITED STATES PATENT OFFICE

2,353,313

INTERNAL-COMBUSTION ENGINE

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Application May 28, 1941, Serial No. 395,604

9 Claims. (Cl. 74-569)

The present invention relates to improvements in internal combustion engines and particularly to the type of engine wherein there is provided a rotor in the nature of a cylinder adapted for connection with the piston or pistons of the engine through the medium of a follower arranged to operate in a groove in the rotor, the groove having intersecting runs.

It is one of the objects of my invention to provide means on the follower whereby the reaches at their intersections will be bridged to lend continuity to said reaches to insure the proper travel of the follower in the groove.

It is a further object of my invention to provide a follower having the above characteristics which will prevent any tendency on the part of the follower to jump out of the groove as the result of the various movements of the follower in the groove.

For the purpose of disclosing my invention, I have illustrated an embodiment thereof wherein

Fig. 1 is a sectional view of an engine embodying my invention;

Fig. 2 is a side elevation of a type of follower used in connection with the rotor disclosed in Fig. 1;

Fig. 3 is a sectional view taken on the line 3-3 of Fig. 2;

Fig. 4 is a side elevation of a modified form of follower;

Fig. 5 is an end elevation of the follower on line 5-5 of Fig. 4; and

Fig. 6 is a diagrammatic development of the rotor.

In the structure illustrated, I provide a base structure comprising end plates 1 and 2 to the peripheries of which is secured a shell 3.

The cylinders 4 of the engine take the form of tubular extensions of the end plate 2. There may be as many of these cylinders as desired and in the type of engine illustrated, I preferably provide five cylinders. Each of the cylinders includes a piston 5 having a piston rod 6 connected therewith, the ends of which are provided with followers 7. The cylinders 4 are suitably surrounded with water jackets 9 and each cylinder is provided with a spark-plug 10 for exploding the charge therein.

Each cylinder, as is usual in four cycle engines of the type illustrated, is provided with suitable exhaust valves 11 and intake valves 12. These valves are respectively operated by suitable rocker arms 13 and 14 which, in turn, are respectively operated through the medium of valve rods 15 and 16.

These rods are reciprocated through the medium of a cam member 17 having cam surfaces thereon adapted to cooperate with the lower ends of the rods 15 and 16 for opening and closing the exhaust and intake valves in suitable timed relation. The cam 17 is driven from the rotor shaft 18 mounted in suitable bearings 19. For driving this cam member, I provide a gearing train including a gear 20 mounted on the shaft 18, a gear 21 mounted on a stub shaft 22, a gear 23 meshing with the gear 24 mounted on a stub shaft 25, and a gear 26 meshing with a gear formed on the periphery of the cam member 17. Through this gearing drive, the cam member 17 is rotated to cause the reciprocation of the valve rods 15 and 16 to open and close the valve rods at their proper timed intervals.

Mounted upon and driving the rotor shaft 18 is a rotor 27 provided with a cam slot 28.

As illustrated in Fig. 6, which shows a development of the slot in the rotor 27, the cam slot 28 is provided with what may be termed a declining reach 29 which is of such length as to permit each piston to deliver power to the rotor through more than 180° of its rotation. This reach constitutes the power phase of the cam slot 28 and passes into an ascending reach 30 which represents the exhaust phase of the cam slot and it is to be noted that this exhaust phase reach intersects the power phase reach 29 and at approximately right angles. The reach 30 is of such length as to effectively cause a complete exhaustion of the products of combustion and this reach 30 continues into the intake reach 31 which, it is to be noted is in substantially parallelism with the power reach 29. This reach 31 is of sufficient length to move the piston on its intake stroke a sufficient distance to draw into the cylinder the proper supply of fuel and this reach 31 continues into a compression reach 32 which constitutes the compression phase of the engine and moves the piston of each cylinder on its compression stroke so that ultimately, when the reach 32 continues into the reach 29, the engine is operating on its power delivery stroke. The cam slot extends twice around the rotor 27 so that the slot extends through 720° of rotation of the rotor or two complete rotations of the rotor. As before stated, the power reach of the cam slot is greater than 180° of the rotation of the rotor and the exhaust, intake, and compression reaches may be determined according to the length of the power reach but in each instance represents the difference between the length of the power reach and 720°.

The walls of the slot 28 extend at right angles to the periphery of the rotor 27 so that the walls of the slot are sharply defined. Cooperating with this slot is a follower 7, one being connected to each piston rod of the pistons of the engine, and, as illustrated in Figs. 2 to 5, this follower member is provided with a follower projection. In the structure illustrated in Figs. 2 and 3, the follower 7 comprises a cylindrical member 33 formed at the end of the piston rod. This cylindrical member is preferably hollow having an integral head 34 at one end and a removable head 35 at the other end. The removable head 35 is secured in position through the medium of suitable screws 36 passing through the head and into the walls of the cylinder 33. Fitting on the opposite end of the cylinder 33 is a cap 37 having a longitudinally extending rib 38. This rib 38 is adapted to operate in the slot 28 and the longitudinal extent of this rib is greater than the width of the slot 28 whereby, as the rib 38 passes the intersection of the runs of the slot 28, the intersection point will be bridged to insure the continued movement of the follower in its proper run. Intermediate its ends, the rib is provided with a vertical slot 39, the side walls of which are arcuate, and this slot receives a roller pin 40 mounted upon a roller shaft 41. The rib 38 is slightly narrower than the diameter of the roller 40 so that in its movement in the slot 28, the roller 40 bears upon the side walls of the slot, taking the drive between the follower and thereby reducing the friction between the parts. The pin 41 is mounted in suitable bearings 42 and 43 and it is to be noted that, due to the fact that the cap 35 is removable, the roller 40, and its associated shaft 41, may be readily removed from the bearings and a new roller inserted in event of wear or damage.

In Figs. 4 and 5, I have illustrated a modified form of follower. In this form, the follower comprises the cylindrical hub 44 which is split as at 45 at its upper end having clamping lugs 46 thereon, which lugs receive a clamping bolt 47. Operating within this cylindrical hub 44 is a piston member 48 carrying at its lower end a roller 49 projecting beyond the end of the cylindrical hub 44 and operating within a slot 50 in the end of the piston member 48. This roller is mounted upon a shaft 51 carried in the lower end of the piston member and this roller will operate in the cam slot 28 in the same manner as the guide member for the follower, shown in Figs. 2 and 3. The diameter of this roller is sufficiently great to insure that portion of the roller operating in the slot 28 having a longitudinal extent greater than the width of the slot so that as the roller passes through the intersection between the reaches of the cam groove 28, the cam groove will be bridged and the continued movement of the roller in its proper reach insured.

The piston 48 is biased in a direction toward the rotor 27 through the medium of a coiled spring 52 bearing against the underface of a threaded plug 53 threaded into the rear end of the cylindrical hub 44. Due to the fact that the upper end of the cylindrical hub is split, this plug 53, when the bolt 47 is loosened, may be readily threaded into the hub and then by the tightening of the bolt 47, the plug is maintained against loosening as the result of vibration.

The side walls of the rib 38 and the side walls of the roller 49 are straight without taper, to coincide with the straight side walls of the slot 28 so that pressure may be exerted between the

walls of the cam slot and the follower without danger of the follower being forced out of the cam slot.

I claim as my invention:

1. For use with a rotor in the nature of a cylinder having a continuous groove in the peripheral face thereof having intersecting runs, the side walls of said groove being parallel from top to bottom to provide straight thrust-receiving walls, a follower including a rotatable pin adapted to project into said groove, that portion of the pin adapted to project into said groove being of constant diameter throughout its length, and guiding ribs of substantially the same vertical extent as the groove engaging portion of the pin disposed on said follower in front of and to the rear of said pin, the combined length of said ribs and pin being greater than the width of said groove to bridge the reaches of the intersection.
2. For use with a rotor in the nature of a cylinder having a continuous groove in the peripheral face thereof having intersecting runs, a cylindrical sleeve, a pin rotatably mounted in said sleeve and projecting beyond said sleeve and adapted to enter said groove, that portion of the pin adapted to enter the groove having a diameter substantially equal to the width of the groove, a pair of ribs supported from said sleeve and disposed on opposite sides of the groove-engaging portion of said pin and having substantially the same vertical extent as the pin to provide a follower member having a longitudinal extent greater than the width of the groove to bridge the reaches of the intersection.
3. For use with a rotor in the nature of a cylinder having a continuous groove in the peripheral face thereof having intersecting runs, a cylindrical sleeve, a pair of bearings mounted within said sleeve, a rotatable pin mounted in said bearings and having a portion projecting beyond said sleeve and adapted to engage in said groove, and a pair of ribs carried by said sleeve, enterable in said groove and disposed on opposite sides of that portion of the pin adapted to engage in said groove, the combined longitudinal length of said ribs and pin being greater than the width of said groove to bridge the reaches of the intersection.
4. For use with a rotor in the nature of a cylinder having a continuous groove in the peripheral face thereof having intersecting runs, a pin rotatably supported on a carrying element and having a portion adapted to project into said groove, a rotatable support on said carrying element provided with ribs enterable in said groove and disposed on opposite sides of said pin, the combined length of said ribs and pin being greater in extent than the width of the groove in the rotor to bridge the reaches of the intersection.
5. For use with a rotor in the nature of a cylinder having a peripheral groove in the face thereof having intersecting runs, the side walls of the groove being parallel from top to bottom to provide straight thrust-receiving walls, a carrying element having an opening in its end, vertically spaced apart bearings arranged in said opening, a thrust pin mounted in said bearings and extending beyond the bottom wall of said opening and adapted to fit into said groove, a rotatable head surrounding said thrust pin, and guide ribs projecting from said head disposed on either side of the groove engaging portion of the pin and adapted to fit into said groove, the longitudinal extent of said ribs and pins being greater than the width of the groove to bridge the reaches of said intersections.

6. For use with a rotor having a continuous groove in the peripheral face thereof having intersecting runs, a carrying element providing a cylindrical journal bearing open at both ends and positioned on an axis perpendicular to the axis of said rotor, a follower member journaled in said bearing means secured to said element and closing the open upper end of said bearing and restraining said member against movement away from said rotor, and means oscillably associated with said follower member and adapted to be received in said groove and having a dimension perpendicular to the axis of said bearing greater than the width of said groove to bridge the reaches of the intersection.

7. For use with a rotor formed with a cam groove having intersecting runs, follower mechanism comprising an element formed to provide a cylindrical journal bearing, a follower pin journaled in said bearing for oscillation about an axis substantially perpendicular to the base of said groove and adapted to extend into said groove, and means associated with said follower pin and oscillable with respect to said element and said pin and enterable in said groove, said last-named means having a dimension in the direction of its travel through said groove greater than the width of said groove to bridge the reaches of the intersection.

8. For use with a rotor formed with a cam groove having intersecting runs, follower mechanism comprising an element formed to provide

a socket, a pair of anti-friction bearing units coaxially mounted in said socket, a pin journaled in said bearing units, held against axial movement with respect thereto, and projecting axially out of said socket and into said groove, a cap swivelly mounted on said element for oscillation about the axis of said pin, said cap being externally provided with a rib interrupted by a perforation through which said pin projection extends, and said rib having a width substantially equal to the width of said groove and a length substantially greater than the width of said groove, and being received in said groove to bridge the reaches of the intersection.

9. For use with a rotor formed with a cam groove having intersecting runs, follower mechanism comprising an element formed to provide a cylindrical journal bearing, a member journaled in said bearing for oscillation about an axis substantially perpendicular to the base of said groove, means restraining said member against movement away from said rotor, a roller journaled upon said member on an axis perpendicularly intersecting the axis of oscillation of said member, at least a portion of said roller projecting axially outside said journal bearing and adapted to extend into said groove, the segment of said roller adapted to be received in said groove being defined by a cord substantially longer than the width of said groove, whereby said roller bridges the reaches of said intersection.

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