

March 2, 1937.

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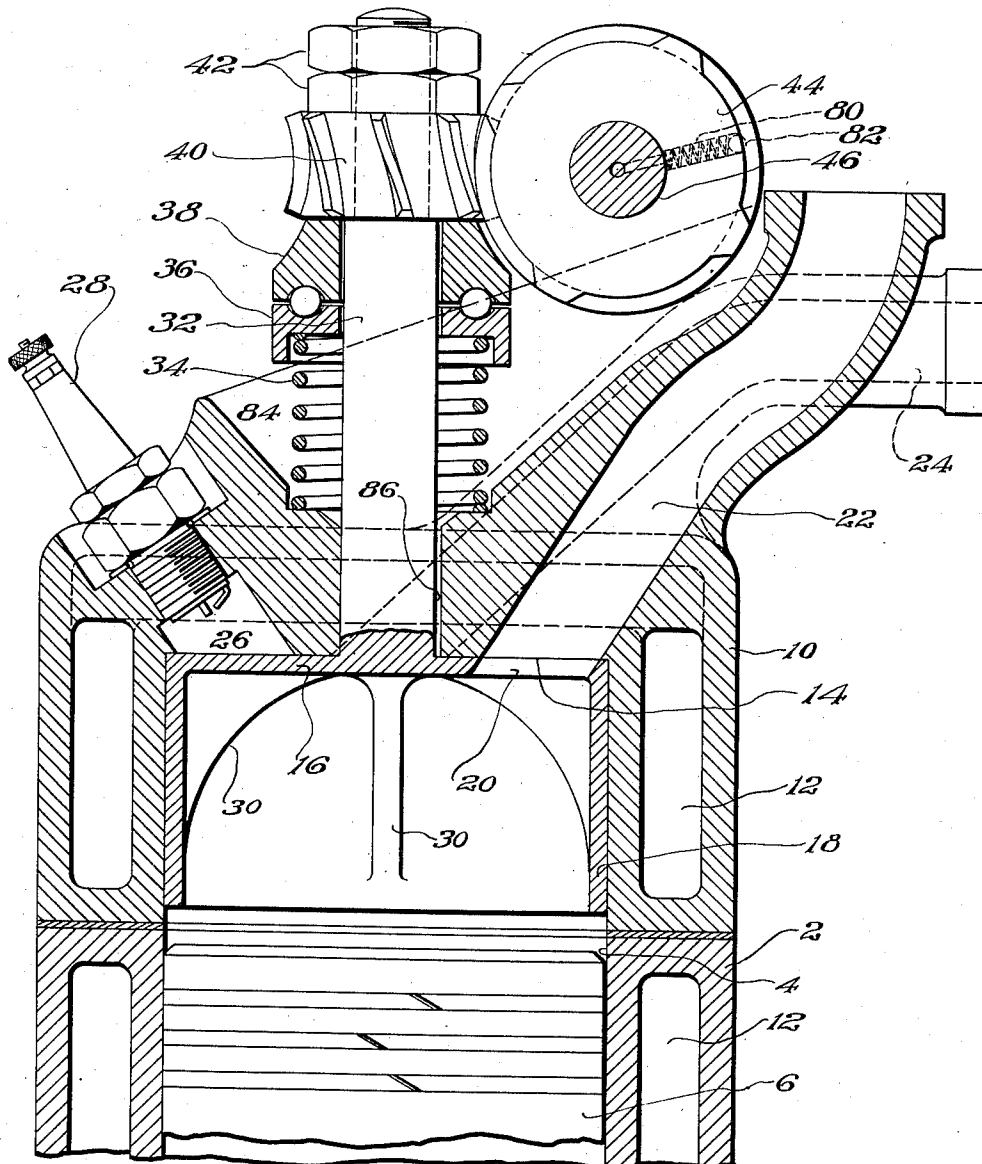
2,072,474

INTERNAL COMBUSTION ENGINE

Filed April 3, 1935

2 Sheets-Sheet 1

Fig. 1



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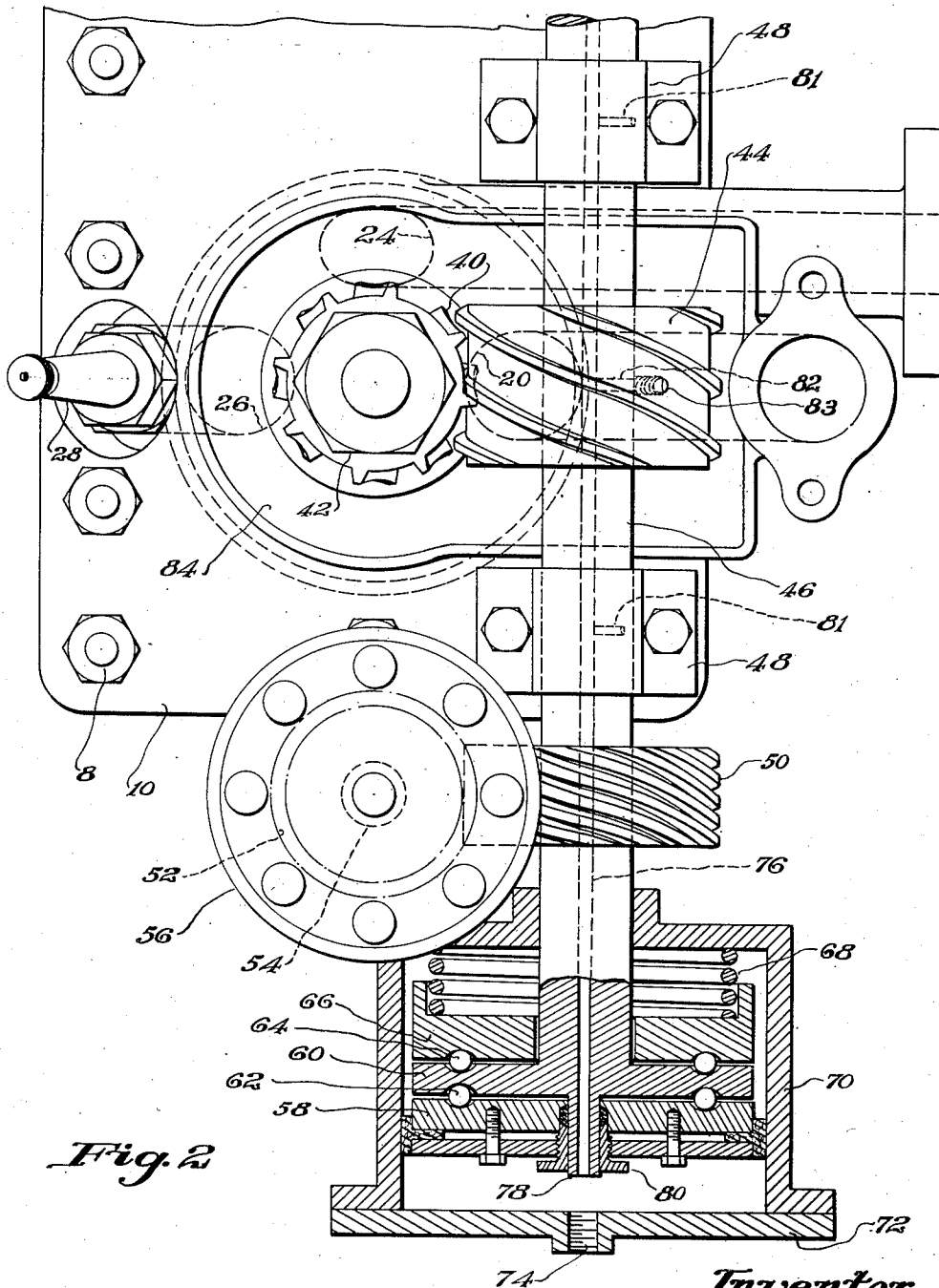


Fig. 2

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UNITED STATES PATENT OFFICE

2,072,474

INTERNAL COMBUSTION ENGINE

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Application April 3, 1935, Serial No. 14,431

2 Claims. (Cl. 123—80)

The present invention relates to internal combustion engines, and more particularly to a rotary valve for internal combustion engines employing spark plugs to ignite an explosive mixture.

The object of the present invention is to provide a novel and improved automatic timing arrangement for use with internal combustion engines.

With this and other objects in view, the present invention contemplates the provision in an internal combustion engine of novel and improved means for automatically changing the timing of the engine.

This and other features of the present invention will be clearly understood from the following description taken in connection with the accompanying drawings in which Fig. 1 is a view in vertical section of a portion of an engine embodying the invention; and Fig. 2 is a plan view, partly in section, of the engine.

The engine illustrated includes a cylinder block 2 bored to form a cylinder 4 in which is mounted for reciprocation a piston 6. Attached to the cylinder block 2 by means of bolts 8 is secured a cylinder head 10 having a water jacket 12 surrounding the walls thereof. The water jacket also extends downwardly through interconnecting passages (not shown) into the cylinder block 2.

Engines provided with rotary valves have heretofore been constructed with curved or dome shaped end walls to avoid possible lines of leakage which might form along corners formed by intersecting surfaces of the cylinder and end wall. Now while the curvature of a dome shaped cylinder head assists in preventing distortion of a closely fitting valve under extremes of temperature, it is also true that where the surfaces are curved or dome-shaped, special forming tools are required. In all respects, the manufacture of accurate curved surfaces is more difficult than of flat surfaces. Other rotary-valve constructions include various arrangements of intake, exhaust, and spark plug passages formed both in the end and side walls of the cylinder so as to permit as great a distance as possible between the entrances of the various passages. With differently spaced passages a plurality of openings is required in the rotary valve, so that a corresponding increase in the liability of leakage exists.

The intake, exhaust, and spark plug passages, of the present engine, are all grouped closely together to pass through a single easily machined

flat surface 14 at the end of the cylinder having a disk-shaped valve 16 closely engaging it. To prevent leakage between the surface of the valve 16 and the surface 14 of the cylinder-head end-wall, the valve 16 is formed with an imperforate cylindrical skirt 18 conforming closely with the side wall of the cylinder head. With this arrangement, the heated gases must make their way between the cylindrical skirt and the side wall and through a restricted space of considerable length in order to escape from compression. The corner formed between the end wall surface 14 and the side wall of the cylinder is not subject to such high pressure as it would be without the presence of the skirt portion 18 of the valve; and since the skirt may be formed of relatively thin material, there is a tendency of the valve under high temperature and pressure to expand slightly in the direction of the cylinder side wall, thereby decreasing the possibility of leakage. The valve is also provided with a single opening 20 which may be brought into successive registration with the intake passage indicated at 22, the exhaust passage indicated at 24, and the spark-plug passage indicated at 26, entering the end wall of the cylinder. With a single opening 20 there is less likelihood of leakage than there would be with a series of openings, and the maximum pressure which occurs during the power stroke of the engine assists in holding the disk shaped valve portion 16 against the end wall surface 14. The explosive stroke occurs, of course, while the spark plug passage 26 is exposed, but no leakage is permitted from passage 26 on account of its being closed by a plug 28.

To strengthen the valve and reduce the possibility of undesirable distortion from heat, there are provided between the disk-shaped portion 16 of the valve and the skirt portion 18 a series of ribs 30. The ribs also assist in distributing the cooling effects of the water jacket 12 in the cylinder head from the skirt portion 18 over the disk portion 16 of the valve.

The valve is formed at the lower end of a vertical shaft 32 extending downwardly through the end wall of the cylinder head, and the valve is yieldingly forced against the end wall surface 14 by a spring 34 coiled around the shaft and compressed between the top of the cylinder head and a collar 36 around the shaft. The collar 36 forms the lower member of a thrust bearing having an upper member 38; and above the bearing 38 there is secured to the shaft a gear 40 held in place by a pair of lock nuts 42.

To rotate the valve supporting shaft 36 the valve gear 40 meshes with a worm 44 fixed to a lay shaft 46 horizontally arranged and rotatably mounted in bearings 48 at the top of the cylinder head. The lay shaft also carries a worm 50 meshing with a gear 52 on a shaft 54 on which is mounted rotating parts of a spark distributor or timer 56, the arrangement being such that the valve and timer are operated in unison.

To adjust automatically the timing of the engine, according to the present invention the lay shaft 46 is mounted for lengthwise movement in the bearings 48 and is provided with a piston 58 rotatably mounted at its forward end. The shaft 46 carries an enlarged flange 60 acting through a thrust bearing 62 against the plunger 58 and also through a second thrust bearing 64 on a flanged collar 66 enclosing a coiled spring 68. The coiled spring 68 is compressed between the collar 66 and one end of a cylinder 70 surrounding the piston 58 and having a suitable mounting on the cylinder head 10. The cylinder 70 is closed at its forward end by a cover plate 72 having a threaded opening 74 connected to the usual pressure lubricating system of the engine. As the speed of the engine increases, the pressure of the oil is increased correspondingly, so that the piston 58 is forced rearwardly in the cylinder 70 and the shaft 46 moved lengthwise. This movement causes a simultaneous advance in the timing of the valve 16 and the spark timer 56.

To lubricate the valve operating mechanism the main shaft 46 is centrally drilled at 76, and the forward end of the shaft is formed with a reduced tubular portion 78 extending through a packing gland 80 in the piston 58. The central passage 76 of the shaft 46 is connected by outlets 81 to the bearings 48 and also by an outlet 82 extending through the side of the worm 44. The outlet 82 is normally closed at its outer end by a spring-pressed ball 83 projecting slightly above the surface of the gear 44 in such position that it will be engaged by the gear 40 as the engine operates. During the short engagement with the ball 83 in each rotation of the shaft 46, oil will be ejected under pressure to the gears 40 and 44. Any excess oil will drop by gravity into a funnel-shaped portion 84 on the cylinder head and thence downwardly along a groove 86 in the bearing of the valve shaft 32 to the upper surface of the valve 16. As a result of the cooling effects of the water jacket about both end and side walls of the cylinder head on the

valve disk 16 and its skirt 18, the oil is permitted to remain on the valve and lubricates it properly.

As a further means of increasing the efficiency of the valve, the teeth on the gear 40 are cut in an irregular fashion, the spacing of the teeth at the upper side of the gear being unequal so that when the worm 46 is rotated, it will cause a rapid opening or closing of the valve; while the time in which the valve remains open or closed will be relatively increased. By this construction it is possible to permit a slight dwell in the movement of the valve during the instant of extreme pressure as the explosive charge is fired within the cylinder.

While the invention is described in connection with a single cylinder, it is particularly adapted for use with an engine having a plurality of cylinders. In this case the main horizontal shaft 46 extends across the tops of all the cylinders, there being but a single timer which is adjusted simultaneously with the automatic timing of the valves in all the cylinders.

Having thus described an embodiment of the invention, what is claimed is:—

1. An internal combustion engine having, in combination, a cylinder, a piston in the cylinder, a spark timer, a timer shaft, a lay shaft arranged transversely of the timer shaft and provided with a passage to lubricate the lay shaft, gears on said shafts for driving the timer shaft from the lay shaft, a piston at the end of the lay shaft, and a cylinder for the piston on the lay shaft carrying oil under a variable pressure depending upon engine speed for shifting the lay shaft lengthwise automatically to change the timing of the spark timer.

2. An internal combustion engine having, in combination, a cylinder, a piston in the cylinder, a rotary valve in the cylinder, a valve-supporting shaft extending through the cylinder wall, a gear carried by the shaft externally of the cylinder, a spark timer, a timer shaft, a gear on the timer shaft, a lay shaft arranged transversely of the valve supporting and timer shafts, gears on the lay shaft for rotating the valve and timer, a piston at the end of the lay shaft, and a cylinder for the piston on the lay shaft carrying oil under variable pressure depending upon engine speed for shifting the lay shaft lengthwise automatically to change the timing of the valve and spark timer.

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