May 26, 1925. 1,539,041

J. F. CRAWFORD

INTERNAL COMBUSTION ENGINE

Filed June 4, 1923 2 Sheets-Sheet 1

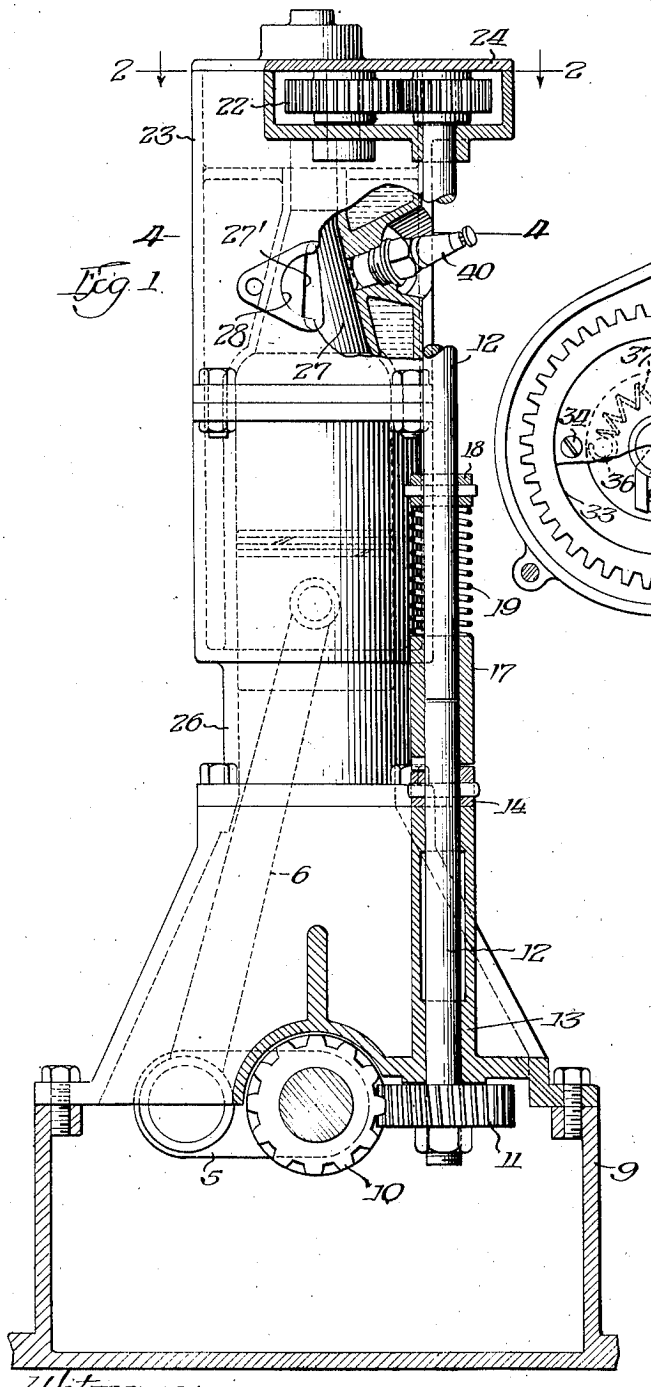

Fig. 1.

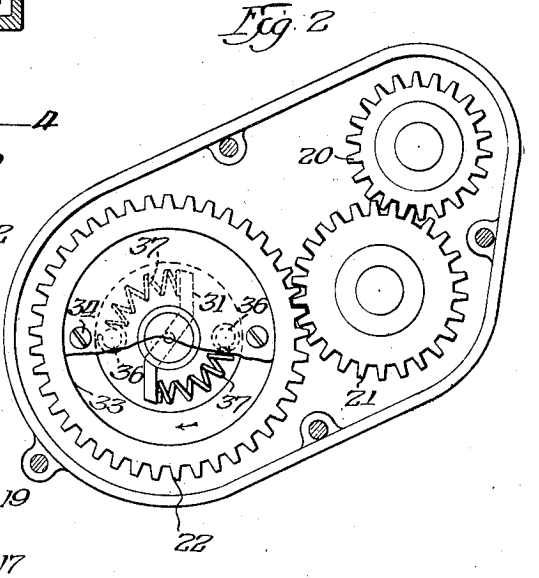

Fig. 2.

Witness:
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Fig. 3.

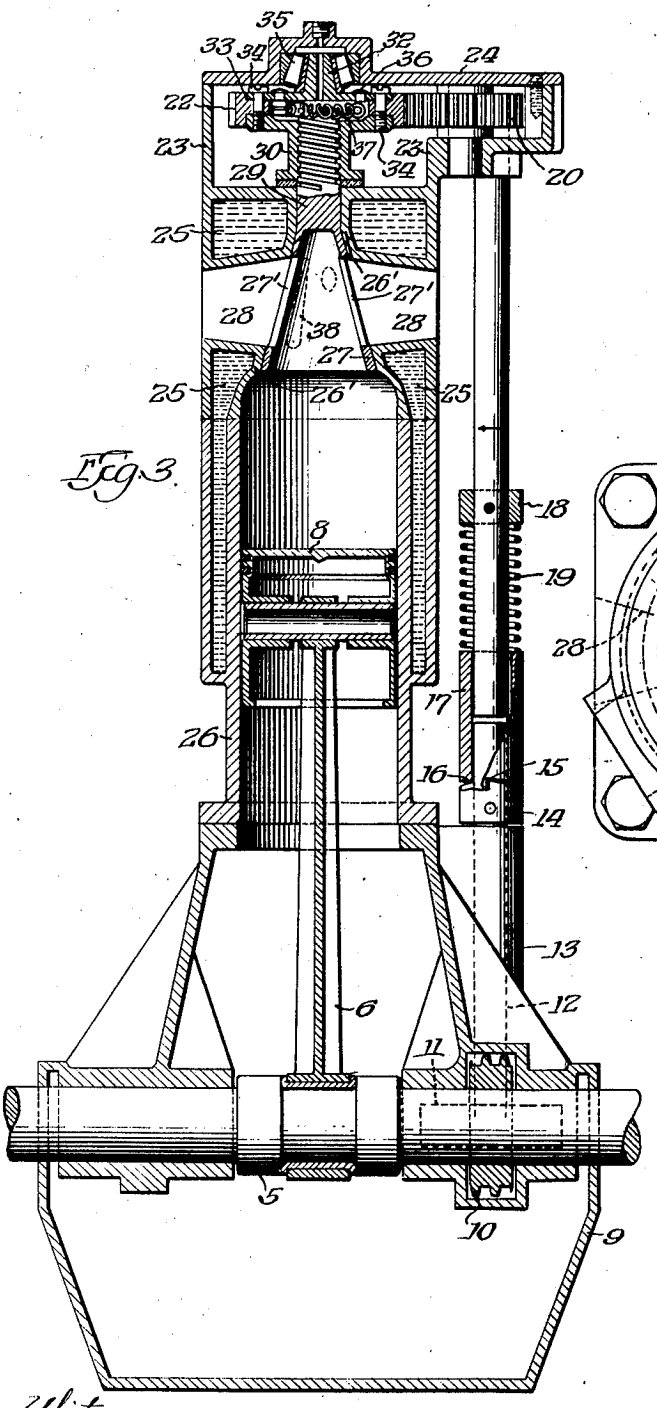
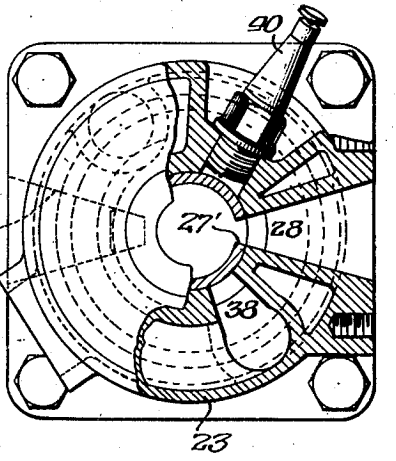


Fig. 4.



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Patented May 26, 1925. 1,539,041

UNITED STATES PATENT OFFICE.

JOHN F. CRAWFORD, OF RACINE, WISCONSIN.

INTERNAL-COMBUSTION ENGINE.

Application filed June 4, 1923. Serial No. 643,216.

To all whom it may concern:

Be it known that I, JOHN F. CRAWFORD, a citizen of the United States, residing at Racine, in the county of Racine and State of Wisconsin, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines of the rotary valve type in which the valve is located in the cylinder head and forms a part of the combustion chamber and in which it is constantly subjected to the pressures created therein during the compression and power strokes of the piston. In motors of this type the pressure caused by the operation of the piston has a tendency to increase friction between the valve and its seat because of insufficient lubrication and otherwise, and it is my object to reduce or minimize such friction and thus improve the construction of an engine of this character and materially increase its longevity and efficiency in the manner to be described.

In the accompanying drawings, forming part hereof, Figure 1 is a vertical sectional view of a motor embodying my invention; Fig. 2, a plan of certain parts of the actuating mechanisms embodied in said motor indicated by section line 2—2 in Fig. 1; Fig. 3, a vertical view of said motor at right angles to that shown in Fig. 1 and partially in section, and Fig. 4 is a horizontal sectional view taken on the dotted line 4—4 in Fig. 1.

The cylinder piston, crank-shaft, crank-case and common components of such motor structure may be of a conventional or desired character, and it will be understood that my valve structure while illustrated and generally described as of a tapered shape may have any other desired formation, and, therefore, to such specific construction I do not confine myself. It may be further explained that while I show and describe a single cylinder motor, any desired multiplicity thereof may be employed each of which may embody the principle herein disclosed with such slight modifications as the assemblage of a plurality of cylinders may require, as my invention relates more specifically to the rotary valve principle to be described and the operative parts associated therewith.

As indicated, the crank-shank, 5, pitman, 6, and piston, 8, may be of any construction and arrangement suitably mounted and connected as desired, as also the crank-case, 9.

The crank-shaft 5 is provided with a spiral gear, 10, adapted to mesh with a spiral gear, 11, on the end of a split shaft, 12, which latter shaft extends upwardly through bearings, 13, in crank-case 9 and has pinned or otherwise secured to it a collar, 14, having a clutch-jaw, 15, on its upper surface (Fig. 3) adapted to engage a clutch jaw 16 on the lower end of a sleeve, 17, said sleeve being slidably keyed to shaft 12. Above said sleeve 17 is a collar, 18, on shaft 12, between which collar and the sleeeve 17 is interposed a spiral spring, 19, the function of said spring being to urge jaw 16 into engagement with jaw 15. Shaft 12 extends upwardly into the head of the motor and at its end is provided with a gear, 20, which meshes with an idler, 21 (Fig. 2), so that gear, 22, to be hereinafter referred to, may rotate in the same direction as shaft 12, which latter is driven in one direction only, as indicated by the arrow in Fig. 3. The motor head casting, 23, is provided with a cover, 24, secured in any suitable manner, and it will be understood that the motor body generally is provided with waterways, as 25, for cooling purposes as is common. The cylinder, 26, is so cast as to provide an upwardly tapered formation for the reception of a cone-shaped valve, 27 (Fig. 3), which is seated within the walls, 26′, of the cylinder, the latter being provided with port holes, 28, as indicated. Said valve 27 has a stem, 29, provided with screw-threads which mate with a nut, 30, and extends through said nut, its upper end having a slot therein for receiving a bar, 31, which may be bent at opposite angles as indicated in Fig. 2. Above said valve 27 is a cap, 32, having a flange, 33, which said flange is secured to nut 30 by screws, 34, or otherwise, and between said cap and the cover 24 I interpose roller bearings, 35, of any appropriate character which bear against the cover and provides what is termed a running fit so far as rotary motion is concerned, but prevents any end play of the assembled parts.

In cap 32 I install pins, 36, to which are attached coiled tension springs, 37, their opposite ends abutting against bar 31 for a purpose to be described; and, as indicated in Fig. 3, valve 27 is provided with ports, as 27′, which register with the inlet ports, 38,

and exhaust ports, 28, forming part of the cylinder 26, and a spark-plug, 40, is inserted in cylinder 26 for igniting the compression charge as is common.

It will be understood, of course, that when the motor is started, crank 5 actuates shaft 12 to rotate valve 27 through the chain of gearing indicated in Fig. 2, which valve rotates continuously and alternatively communicates with the ports 38 and 28 to open and close the same so that when piston 8 is at the top of its stroke, and the valve having its two opposite ports registering with the ports 38, the piston when starting downwardly, takes in a fuel charge, while the valve 27, rotating continuously, closes the port 38 slightly below its bottom center, thus sealing the valve chamber. At the end of the stroke the piston travels upwardly and compresses the charge and as its stroke limit is reached a port 27′ is brought into registry with spark-plug 40 which ignites the charge whereupon the piston is forced downwardly for its return power stroke. When near the bottom of the stroke port 27′ is brought to register with exhaust port 28. During the compression and power strokes high pressures are created in the combustion chamber, constituted by valve 27 as a continuation of the main cylinder, which pressure results in a frictional load on the valve-seat 26′, which produces a severe strain upon the valve and its connections. However, when such pressure exceeds the pressure upon the springs 37 said springs will yield and thus cause the nut 30 to climb upon the valve-stem, and as said nut cannot move end-wise because of its thrust bearing 35 said valve 27 must constantly move downwardly and thus alleviate the friction from the valve-seat 26′ until said springs 37 assume normal condition and thereby enabled to control the rotation of the valve. It will be understood, of course, that such movement of the valve is of an extremely infinitesimal degree, that is to say, a minute fractional part of an inch, and it may be explained that in practice such slight disturbance is noiseless when caused either by working pressure, uneven heat expansion, lack of lubrication, or otherwise.

As indicated in Fig. 3, shaft 12 rotates in one direction and consequently valve 27 turns likewise but it is obvious that should any condition arise to prevent such shaft and valve to so continue rotation as described such emergency is provided for by the clutch arrangement, 15, 16, on shaft 12 referred to, and which condition may arise from back-fire of the charge or when reversing the motion of the motor for any reason, and while I have shown a simple clutch-mechanism for the purpose it will be understood that the same can be increased to more accurately time valve 27 as the clutch takes up the load of driving. As herein stated, a single cylinder is illustrated and described but which may be increased in number, and while I have described a system of driving mechanism for transmitting rotary motion to valve 27, any appropriate devices for the purpose may be employed, my object primarily being to provide a rotary valve properly timed for controlling the fuel charge and which may be self-adjusted to avoid undue frictional engagement with its seat in the manner described.

I claim as my invention:

1. An internal combustion engine comprising a cylinder terminating in a conformation to constitute a valve-seat, a valve seated for rotation therein having a screw-threaded stem, a nut surrounding and mating with said stem, a cap above said nut and connected thereto, yielding means interposed between said stem and cap for controlling the rotary movement of said valve stem in said nut, and means for rotating said valve.

2. In an internal combustion engine, the combination of a cylinder having ports therein and terminating in a conformation to constitute a valve-seat, a valve seated therein and provided with ports adapted to register with said cylinder ports, a screw-threaded stem on said valve, a nut surrounding and mating with said stem means for rotating said valve, and means for resisting the end thrust of said valve stem.

3. In an internal combustion engine, a rotary valve for said engine, a screw-threaded valve stem for said valve, means within which said valve stem may turn, a cap connected to said means, and means interposed between said cap and means within which said valve stem may turn, for controlling the spiral rotation of said valve.

4. In an internal combustion engine, a cylinder having a valve seat with ports therein, a rotary valve seated in said seat, a screw-threaded stem on said valve, a cross-bar in said stem, a cap over said stem, springs between said cap and stem, and means for securing one end of said springs to said cap the opposite ends thereof abutting against said cross-bar, for controlling the movement of said stem.

5. In an internal combustion engine, a cylinder, a cover therefor, a rotary valve in said cylinder, a screw-threaded stem on said rotary valve, a mating nut in which said stem is seated, a cap over said stem, an anti-friction bearing between said cover and for said cap, and means for rotating said valve.

6. In an internal combustion engine, a rotary valve terminating in screw threaded formation, a nut within which said screw threaded portion is adjusted, a bar arranged transversely of said valve, a cap over said

valve, and springs connected to said cap and abutting against said bar for controlling the rotary movement of said valve.

7. In an internal combustion engine, a cylinder, a valve therein, means for rotating said valve within said cylinder, a nut for receiving the upper end of said valve, yielding means above said nut for controlling the longitudinal movement of said valve, a cap above said yielding means and connected thereto, and anti-friction bearings above said cap for controlling the movement thereof.

In testmony whereof I affix my signature.

JOHN F. CRAWFORD.