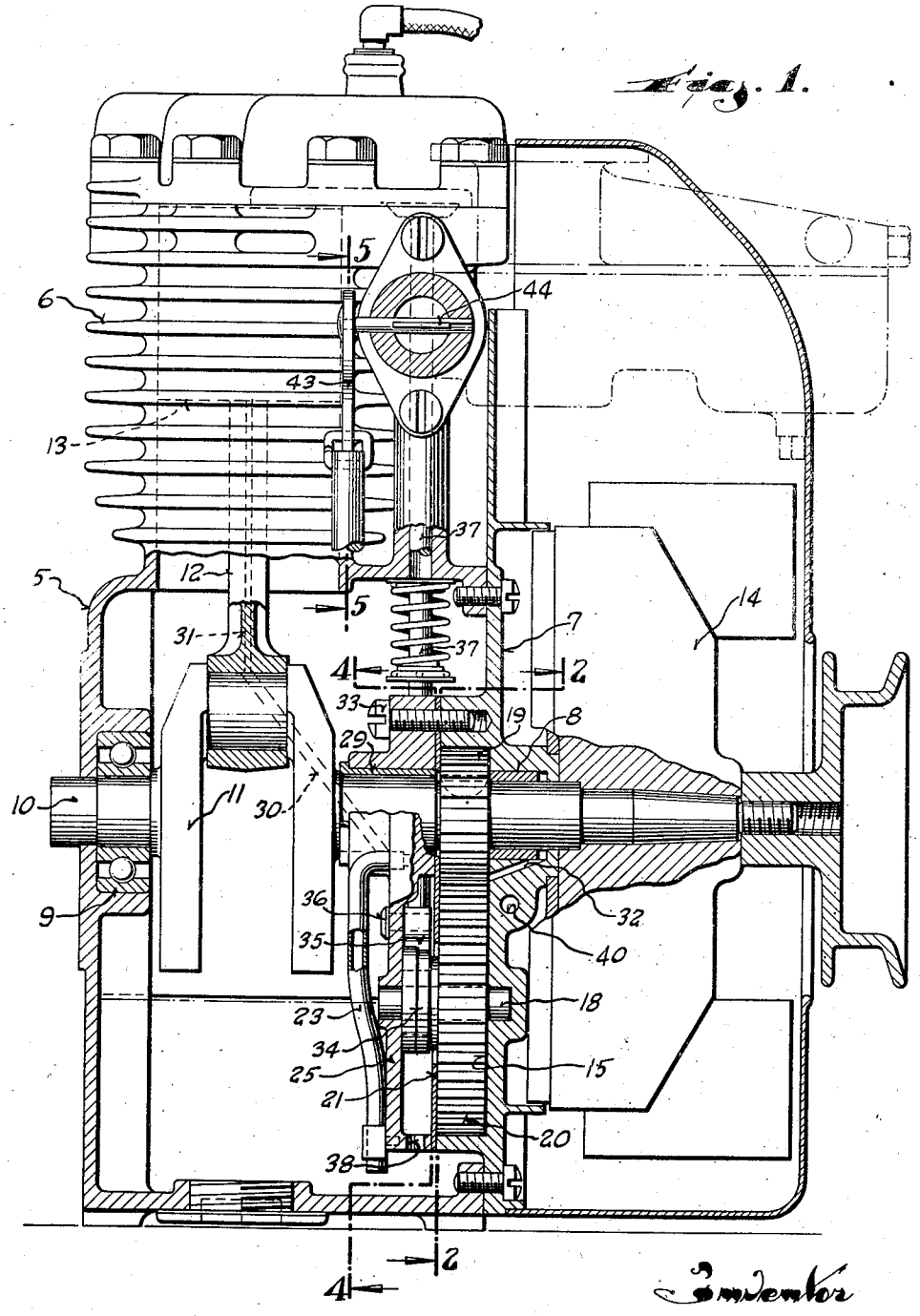
May 21, 1946. C. K. SCHWARTZ 2,400,575

INTERNAL-COMBUSTION ENGINE

Filed July 7, 1943 3 Sheets-Sheet 1

Fig. 1.



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INTERNAL-COMBUSTION ENGINE

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Fig. 2.

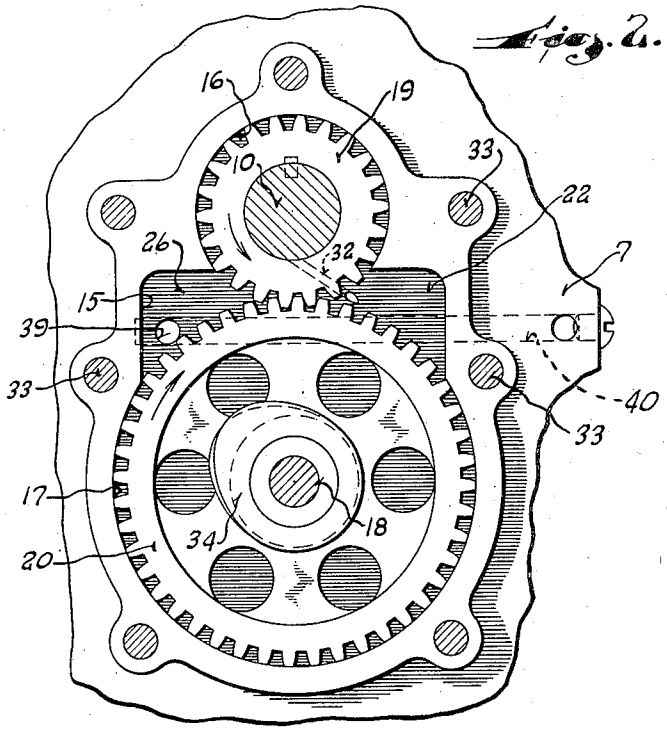
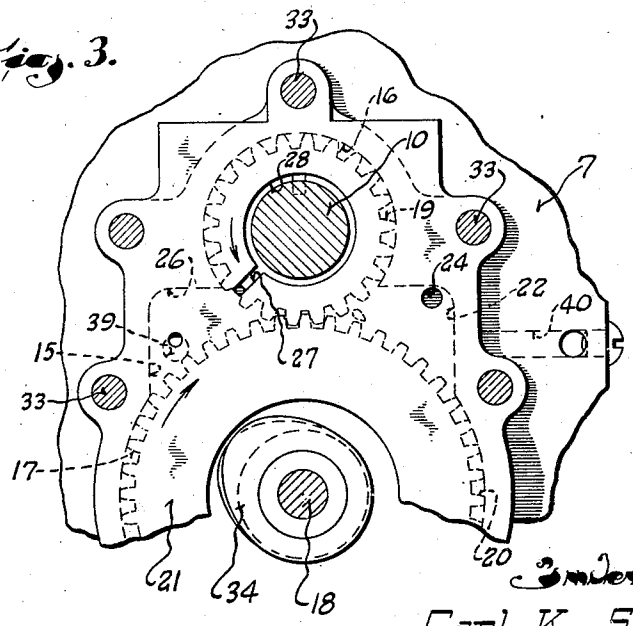


Fig. 3.



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INTERNAL-COMBUSTION ENGINE

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Fig. 4.

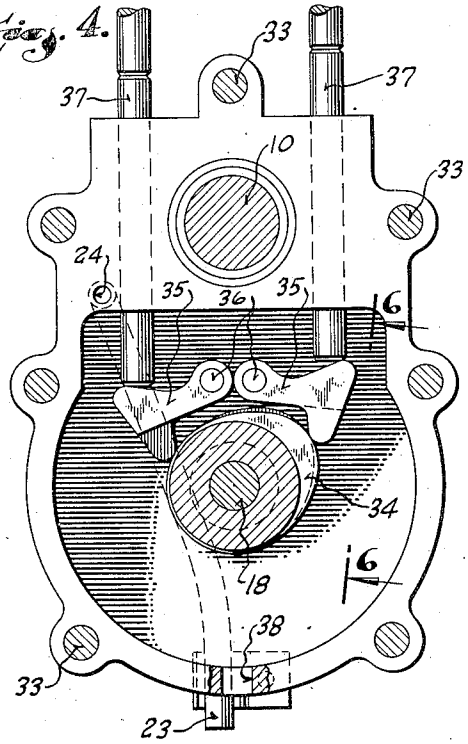


Fig. 6.

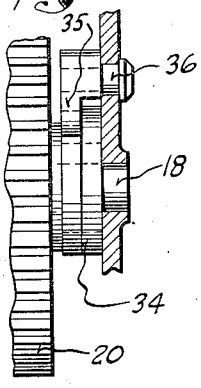
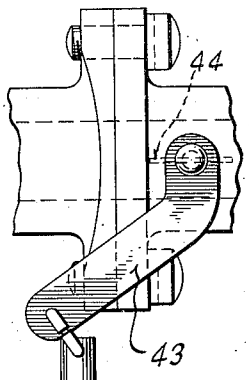


Fig. 5.



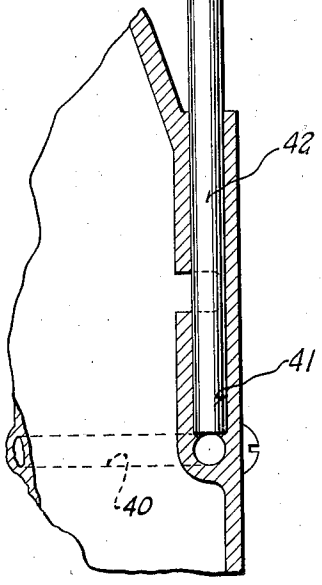
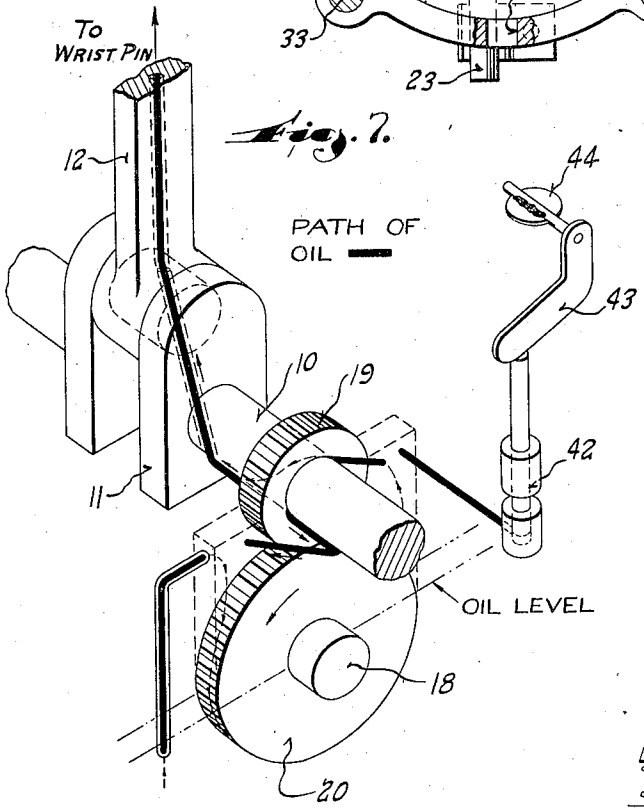


Fig. 7.



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Patented May 21, 1946 2,400,575

UNITED STATES PATENT OFFICE

2,400,575

INTERNAL-COMBUSTION ENGINE

Carl K. Schwartz, Elkhart Lake, Wis., assignor of one-half to Ira Milton Jones, River Hills, Wis.

Application July 7, 1943, Serial No. 493,741

5 Claims. (Cl. 123—195)

This invention relates to internal combustion engines and refers particularly to small portable single cylinder engines.

It is an object of this invention to improve the power rating of such small engines and also to simplify and improve the design and construction thereof.

Another object of this invention is to provide a simple manner of obtaining forced feed lubrication for the engine. In this connection it is more specifically an object of this invention to utilize the timing gears as a gear pump to provide a pressure source for the lubricating system.

Another object of this invention resides in the provision of a governor for the engine responsive to the pressure of the oil in its lubricating system.

Another object of this invention is to provide a simplified manner of actuating the valves of the engine with a view particularly to the elimination of parts by having but a single cam shaft with valve tappets arranged at opposite sides of the crank shaft and cam followers riding on the cam to lift the tappets.

Another object of this invention is to provide added rigidity for the crank shaft through the provision of an auxiliary crank shaft bearing which extends close to that side of the crank removed a substantial distance from the crank case cover.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view in side elevation with parts broken away and in section, illustrating an engine embodying this invention;

Figure 2 is a detail sectional view taken through Figure 1 on the plane of the line 2—2, said view showing the timing gears which operate in a gear chamber formed in the crank case cover;

Figure 3 is a view similar to Figure 2 but with the cover plate for the gear chamber in place;

Figure 4 is a detail sectional view taken through Figure 1 on the plane of the line 4—4 looking into the crank case and illustrating particularly the manner in which the cam, cam followers, and valve tappets are corelated;

Figure 5 is a detail sectional view taken through Figure 1 on the plane of the line 5—5 and illustrating particularly the manner in which the throttle valve of the engine is controlled by oil pressure;

Figure 6 is a detail sectional view taken through Figure 4 on the plane of the line 6—6 to illustrate the manner in which the cam followers are mounted and corelated to the cams; and

Figure 7 is a perspective view diagrammatically illustrating the forced feed lubricating system.

Referring now particularly to the accompanying drawings, in which like numerals indicate like parts, the numeral 5 designates the crank case of a single cylinder, four cycle gasoline engine which, as is customary, is formed as a casting and has an air cooled cylinder 6 cast integrally therewith.

The open side of the crank case is closed by a removable cover 7 provided with a crank shaft bearing 8 in line with a similar bearing 9 in the opposite wall of the crank case. Journalled in these bearings is the customary crank shaft 10 with its crank 11 spaced a substantial distance in from the cover and close to the bearing 9.

A connecting rod 12 between the crank and the piston 13 operates in the customary manner, and also as is customary in engines of this type, the cover 7 mounts the stationary instrumentalities of a flywheel magneto the rotating parts of which are carried by the flywheel 14.

The inner face of the cover 7 has a gear chamber 15 formed therein and comprising an upper portion 16 concentric with the crank shaft and a lower portion 17 concentric with a cam shaft 18. The timing gears consisting of a pinion 19 fixed to the crank shaft and a gear 20 on the cam shaft 18 operate in this gear chamber.

The depth of the gear chamber 15 is substantially no greater than the width of the gear teeth and its arcuate side walls lie close to the gear teeth. Hence, with the open face of the gear chamber closed by a cover plate 21 the pinion and gear operating in the chamber constitute a gear pump for pumping oil from the crank case to the bearings and other parts of the engine to be lubricated.

The low pressure zone 22 of the gear chamber is supplied with lubricant from the crank case by a supply pipe 23 leading from the lower portion of the crank case to a port 24 in a cam housing 25 (to be later described) and the partition wall 21. The high pressure zone 26 of the gear chamber is communicated with the crank case bearing 8 by a radial slot 27 and an annular groove 28 in the cover plate 21 as best shown in Figure 3. The annular groove 28 also opens to an auxiliary crank shaft bearing 29 carried by the cam housing 25 and extending into close juxtaposition to the crank of the shaft to provide an exceptionally rigid construction.

From this bearing 29 an oil duct 30 leads to the connecting rod bearing and a duct 31 extending through the connecting rod provides for forced lubrication of the wrist pin.

Excess oil supplied to the bearing 8 is drained back into the low pressure side of the gear chamber through a duct 32.

The cover plate 21 is held in place as a partition wall between the crank case cover 7 and the cam housing 25 secured to the inner face of the cover 7 by cap screws 33. The hub of the gear 20 passes through the partition wall formed by the plate 21 into the interior of the cam housing to have a cam 34 secured thereon; and the shaft 18 upon which the gear is mounted projects beyond the hub of the gear to enter a pilot bearing in the cam housing.

At opposite sides of the median plane of the engine which bisects the cam housing and the gear chamber, cam followers 35 are pivotally mounted on fixed studs 36. These cam followers ride on the cam and have valve tappets 37 resting thereon. The valve tappets are guided for vertical reciprocation at opposite sides of the crank shaft in line with the valves of the engine to operate the same in the customary manner.

While a single cam may be employed to operate both valves, it is preferable to have each valve operated by its own individual cam and to this end the cam is divided into two sections and the cam followers are offset as illustrated in Figure 6 so that each follower rides on only one cam section or one half the cam surface.

The interior of the cam housing has open communication with the crank case interior through a port 38 in its bottom wall, and inasmuch as the normal oil level reaches at least above the lower portion of the cam, adequate lubrication is afforded for the cam and its followers.

Oil under pressure is also taken from the high pressure zone through a port 39 and a duct 40 to a cylinder 41 formed in one wall of the crank case. Slidable in this cylinder is a piston 42 the upper end of which is connected through linkage 43 with the butterfly valve 44 of the carburetor. In this manner, by controlling the weight of the piston 42 or its resistance to being lifted by oil pressure in the cylinder 41, it is possible to regulate the engine speed from the pressure of the oil developed.

From the foregoing description, taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an internal combustion engine of the single cylinder, four cycle type which has many advantages over similar engines heretofore available.

What I claim as my invention is:

1. In an internal combustion engine: a crankcase; a cover closing one side of the crankcase; aligned bearings on the cover and the opposite crankcase wall; a crank shaft journalled in said bearings; means on the inner face of the cover defining a hollow chamber which opens to the interior of the crankcase; a detachable closure for the open side of said hollow chamber; a cam shaft in the hollow chamber; bearings in said cover and the closure, in which the cam shaft is journalled; means within the hollow chamber providing a driving connection between the shafts; reciprocable valve tappets entering the hollow chamber through the top thereof; and tappet actuating mechanism including cam means on the cam shaft and cam followers movably mounted on the detachable closure within the hollow chamber and operable to transmit motion from the cam means to the tappets.

2. In a single cylinder internal combustion engine: a crankcase; a cover closing one side of the crankcase; two aligned axially spaced bearings on the cover; a crank shaft journalled in said bearings with its crank in juxtaposition to the inner one of said two bearings; means on the cover defining a hollow chamber in line with and communicating with the space between said two bearings; and valve actuating means including tappets which enter the hollow chamber, a pinion on the crank shaft in the space between said bearings, and means within the hollow chamber driven by the pinion for reciprocating the tappets.

3. In a single cylinder internal combustion engine having a crankcase and a crank shaft: a cover providing one side wall of the crankcase; a bearing in the cover for rotatably journalling the crank shaft therein; means on the inside of the cover providing substantially closed side by side chambers between the cover and the crank; a rotatable cam shaft having portions thereof in each of said chambers, said cam shaft being substantially parallel to the crank shaft axis but spaced a distance therebeneath; cooperating meshing gears in one of said chambers to drivingly connect said shafts; a pair of tappets straddling the crank shaft and having their lower portions projecting into the interior of the other of said chambers; and tappet operating means in said other chamber driven by the cam shaft for effecting periodic lifting the tappets.

4. In a single cylinder internal combustion engine: a crankcase having two opposite outside side walls; a crank shaft; a crank shaft bearing carried by each of said two opposite outside side walls in which the crank shaft is journalled; means carried by one of said two outside side walls defining a hollow chamber within the crank case adjacent to the crank shaft bearing on said designated wall and extending beneath the crank shaft axis; valve tappets, one at each side of the crank shaft axis with their lower ends disposed within the hollow chamber; guide bearings on said designated side wall in which the tappets reciprocate; and means in the hollow chamber beneath the crank shaft axis and driven from the crank shaft for effecting lifting of the tappets in timed relation to rotation of the crank shaft.

5. In a single cylinder internal combustion engine: a crankcase having two opposite outside side walls; a crank shaft; a crank shaft bearing carried by each of said two opposite outside side walls in which the crank shaft is journalled; means on one of said two outside side walls defining a hollow chamber which extends beneath the crank shaft bearing on said designated wall; valve tappets at opposite sides of said designated crank shaft bearing with their lower ends disposed within the hollow chamber; guide bearings

on said designated side wall in which the tappets reciprocate; a cam shaft in said hollow chamber; bearings in opposite walls of the hollow chamber in which the cam shaft is journalled for rotation on an axis parallel to and spaced a substantial distance below the designated crank shaft bearing; drive means in said hollow chamber for drivingly connecting the cam shaft with the crank shaft; and means in the hollow chamber including cams on the cam shaft located below the designated crank shaft bearing for effecting lifting of the tappets in timed relation to rotation of the crank shaft.

CARL K. SCHWARTZ.