Feb. 7, 1950 H. N. EDENS 2,496,449

INTERNAL-COMBUSTION ENGINE

Filed March 18, 1946 2 Sheets-Sheet 1

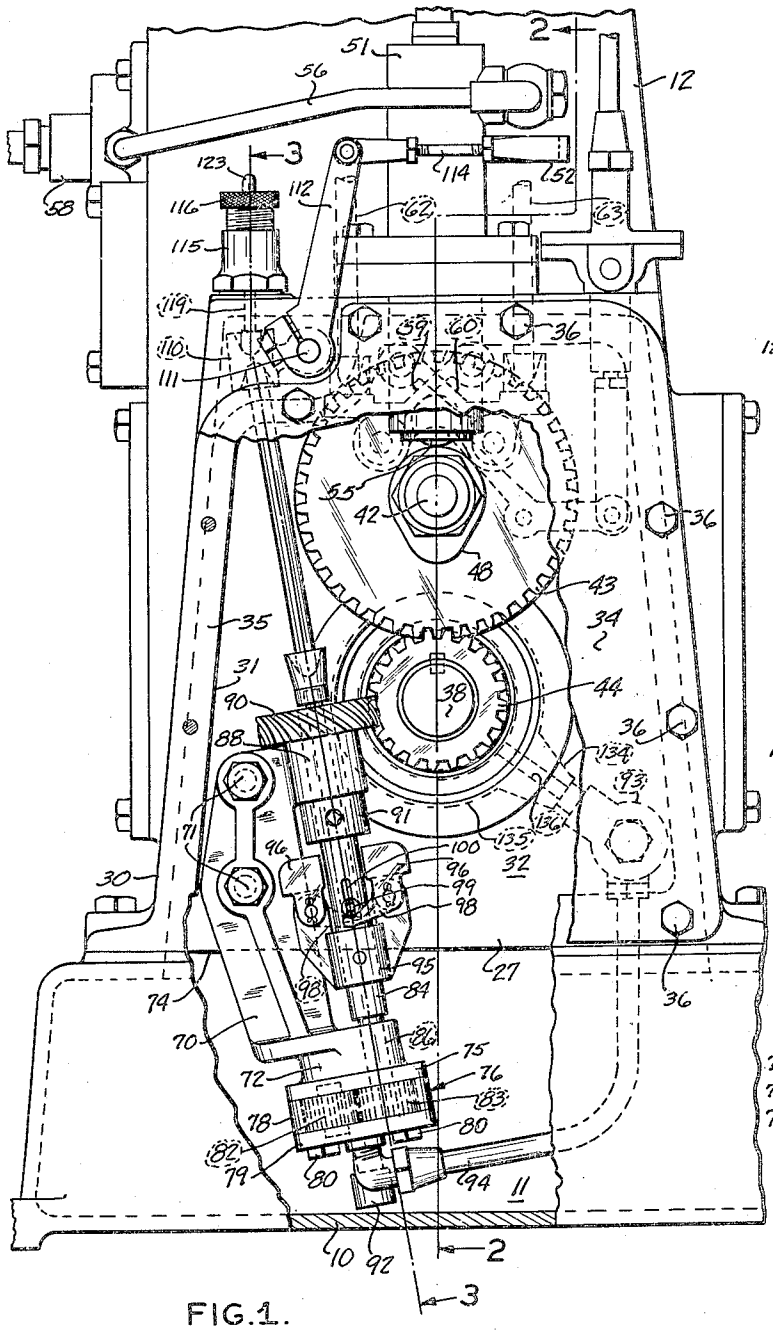


FIG. 1.

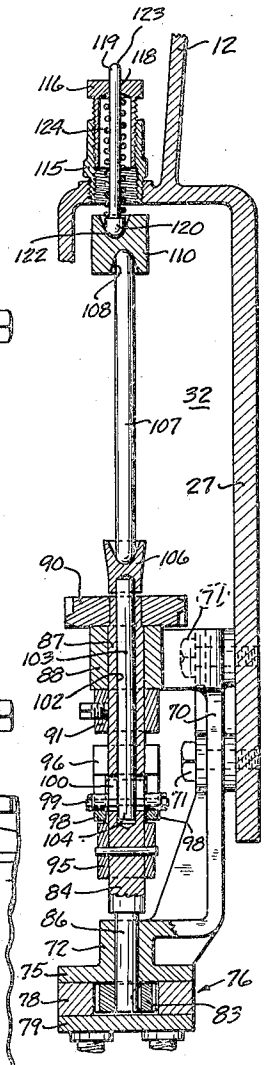


FIG. 3.

INVENTOR
HENRY N. EDENS
BY Paul L. Kuehl
ATTORNEY

Feb. 7, 1950 H. N. EDENS 2,496,449

INTERNAL-COMBUSTION ENGINE

Filed March 18, 1946 2 Sheets-Sheet 2

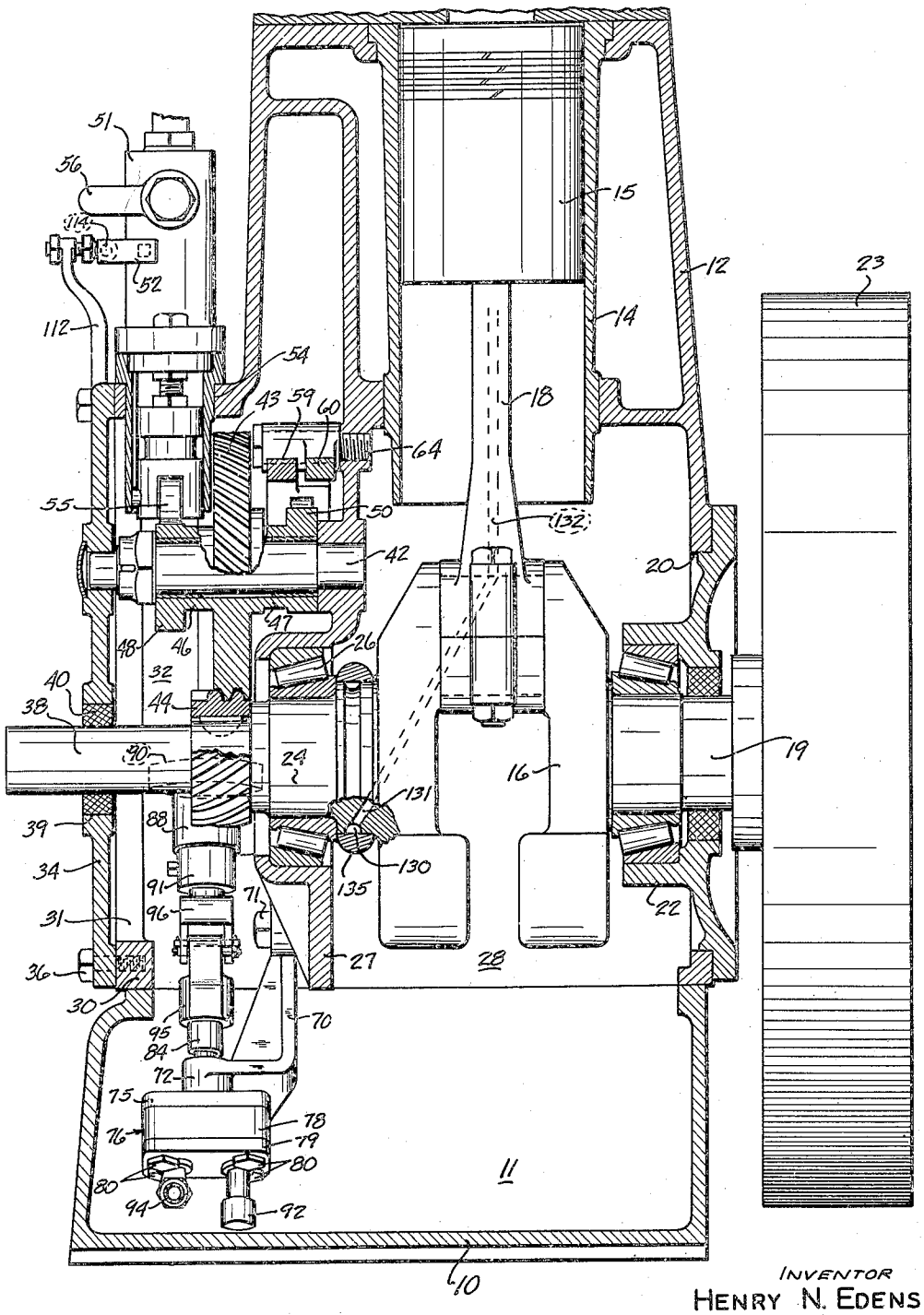


FIG. 2.

INVENTOR
HENRY N. EDENS
By Paul L. Keeler
ATTORNEY

Patented Feb. 7, 1950 2,496,449

UNITED STATES PATENT OFFICE

2,496,449

INTERNAL-COMBUSTION ENGINE

Henry N. Edens, Freeport, Ill., assignor to Fairbanks, Morse & Co., Chicago, Ill., a corporation of Illinois

Application March 18, 1946, Serial No. 655,110

7 Claims. (Cl. 123—195)

1

This invention relates to improvements in internal combustion engines, and has particular reference to a novel and compact arrangement and mounting of certain of the engine operating parts and auxiliaries including the engine camshaft, speed governor and lubricating oil pump, wherein the improvements are of a character to facilitate operation of such engine elements by a common drive means driven from the engine crankshaft. The present improvements are suitable in particular, to relatively low horsepower engines of single cylinder, four-cycle Diesel type for example, but may be applied with great advantage, to correspondingly small engines of other types.

An object of the invention is to provide in a single cylinder Diesel engine for example, a compact arrangement and operative support of the engine camshaft, speed governor and lubricating oil pump in one end of the engine crankcase such as to afford ready accessibility of these parts through a single crankcase access opening, and to afford actuation thereof from the crankshaft through a single driving element on the latter.

Another object is to provide a unitary support of the engine governor and lubricating oil pump, of a character to permit ready crankcase mounting or removal of these parts as a unit, the unitary support including a shaft member connected to the pump and serving as an operative support for parts of the governor mechanism.

A further object is to provide on the engine crankshaft, means forming an oil pressure chamber receiving lubricating oil under pressure for delivery to the engine piston pin assembly, the means serving also to facilitate lubrication of an adjacent crankshaft bearing.

Other objects and advantages of the present improvements will appear readily from the following description of a presently preferred embodiment of the invention as such is illustrated in the accompanying drawing, wherein:

Fig. 1 is an end elevation of an engine with portions broken away to show in particular, the mounting and crankshaft driven relation of the governor and lubricating oil pump devices in the crankcase;

Fig. 2 is a longitudinal section of the engine as taken along line 2—2 in Fig. 1, further illustrating features of the invention, and

Fig. 3 is a longitudinal section through the governor and pump devices and the governor operating rod and loading means, as viewed along the sectional line 3—3 in Fig. 1.

Referring to the drawing there is illustrated in part and by way of present example, a single cylinder Diesel engine of four-cycle type. As appears in Figs. 1 and 2, a hollow base 10 providing the engine lubricating oil storage chamber or sump 11, supports thereon the engine cylinder

2

and crankcase frame structure generally indicated by the numeral 12. Suitably mounted in frame 12 is a cylinder liner 14, within which operates a piston 15, the latter being connected to the engine crankshaft 16 by the usual connecting rod 18. One end 19 of the crankshaft projects axially through an opening 20 in the crankcase portion of the frame 12, and is supportingly journalled at such end, by a bearing assembly 22 mounted in and closing the opening 20. A flywheel 23 is secured upon the crankshaft end 19, as shown.

The opposite crankshaft end portion 24 is operatively journalled in a bearing 26 supported in an internal wall portion 27 of frame 12, depending in the crankcase chamber 28. Frame 12 is extended longitudinally outwardly from the wall 27 as at 30, and provides a relatively large opening 31 giving direct access to the crankcase compartment 32 formed by the frame extension in cooperation with the wall 27. Opening 31 normally is closed by a removable closure plate 34 which may be attached to the end margin 35 of frame extension 30, by suitable bolts 36 or the like. For power takeoff, the crankshaft end 24 is extended in the reduced portion 38, outwardly through an opening 39 in closure plate 34, and is sealed at said opening against the entrance of dust and dirt, as well as oil discharge to the crankcase exterior through the opening, by a suitable packing or sealing member 40.

In the upper portion of the crankcase compartment 32 and substantially vertically above and paralleling the crankshaft portion 38, is a pin or shaft element 42 which spans the wall 27 and closure plate 34 and has its ends nonrotatably supported in the latter elements. Freely rotatably mounted on the shaft element 42 is a large gear member 43 of helical type adapted to engage in driven relation, a helical drive pinion 44 keyed or otherwise secured upon the crankshaft portion 38. The gear hub is axially extended on opposite sides, as at 46 and 47, and on the hubextensions are integrally formed cams 48 and 50 respectively. It may be noted here that in the present four-cycle engine, the gear ratio of the connected gear 43 and drive pinion 44 is selected at 2:1, so that the cams 48 and 50 which actuate engine valves and a fuel pump as presently will be described, rotate at one-half crankshaft speed.

Mounted on the upper end of the frame extension 30 is a fuel pump 51 (which may be of the well known "Bosch" or other plunger type), controllable as to fuel quantity delivery in a well known manner, through a rack indicated generally at 52. Actuation of the rack by an engine speed responsive governor device presently to be described, is afforded in order to regulate fuel delivery such as to maintain a constant engine

speed with variable loading. The lower end of the fuel pump 51 is projected downwardly through an opening 54 in frame extension 30, to engage the pump plunger follower 55 with the pump actuating cam 48. At its delivery end, the pump is connected by a conduit 56 with a suitable cylinder fuel injection valve indicated in part at 58 in Fig. 1.

The opposite cam 50 serves to actuate the engine scavenging air intake and exhaust valves (not shown), through rocker arms 59 and 60 shown partly in Fig. 2, and in broken outline in Fig. 1 as connected respectively, to the exhaust valve stem 63 and the air intake valve stem 62; the rocker arms being pivotally supported by a pin or stud 64 in frame wall 27.

Turning now to the governor and lubricating oil pump assembly, a bracket member 70 is removably attached as by bolts 71, to the frame wall 27 near one side of the engine and in the compartment 32, with the lower end portion 72 of the bracket extending downwardly through compartment opening 74 into the sump chamber 11. The bracket lower end 72 is off-set as shown and is formed to provide one side wall 75 of a gear-type oil pump 76. The gear case 78 and opposite closure wall 79 of the pump are secured to the bracket wall 75 by bolts 80, and within the gear case are meshing pump gears 82 and 83 shown in dotted lines in Fig. 1, and in section as to gear 83, in Fig. 3. Drive of the gears is effected through gear 83, by a shaft 84 having its reduced lower end 86 journalled in the bracket wall 75 and secured to the pump gear 83. The shaft is extended upwardly along the bracket and has its upper end 87 supported in a bearing 88 formed as a part of the bracket 70. On the shaft above the bearing 88, is a helical gear 90 which engages in driven relation, the crankshaft pinion 44, there being provided a collar 91 fixed to shaft 84 and abutting the bearing 88, serving with gear 90 to prevent axial displacement of the shaft. The oil pump thus driven and located in the sump chamber 11, receives oil through a suitable strainer device 92 at the pump intake, and delivers the same under pressure through a conduit 94 to a junction indicated in broken outline at 93, from which oil delivery may be made to the crankshaft bearings and other points in the engine structure requiring lubrication.

In accordance with the present improvements, the engine speed governor mechanism is carried by the shaft 84, and includes a bracket 95 pinned to the shaft for rotation therewith, which pivotally supports the governor weight elements 96. Each of the latter has an arm 98 in operative engagement with a pin 99 extended transversely of the shaft through a shaft slot 100 (Fig. 3). Shaft 84 is axially bored at 102 inwardly from its upper end to the zone of slot 100, and slidingly received in the shaft bore is a rod element 103, the lower end 104 of which is connected to the transverse pin 99. Thus engine speed responsive displacements of the governor weights 96 will produce through the described connections, corresponding axial movements of the rod 103 relative to shaft 84.

The upper exposed end of rod 103 supports a cup-like member 106, the latter receiving the lower rounded end of a further rod element 107. Rod 107 extends upwardly in the crankcase compartment 32 to abutment of its upper end in a recess 108 of an arm 110 secured on a pivot shaft 111. Shaft 111 projects outwardly of the frame extension 30 and has secured thereto an arm 112 which extends upwardly to connection with linkage 114 leading to and connected with the fuel pump control rack 52. Accordingly, governor displacement of rod 103 will produce through the indicated connections to the fuel pump rack, a corresponding adjustment of fuel quantity delivery by the pump to the cylinder injector.

The governor loading means in the present assembly, is arranged in operative association with the arm 110 and so as to be readily accessible exteriorly of the engine, to permit loading adjustments to determine engine speed. As appears in Figs. 1 and 3, an internally threaded nipple 115 is secured in an opening in crankcase extension 30 overlying the arm 110, and threaded in the nipple is a cap member 116 providing a central cap opening 118. A plunger pin 119 having its head 120 seated in a recess 122 in arm 110, extends vertically through the nipple and cap elements and has its upper end 123 projecting through and guided in the cap opening 118. Encircling the pin 119 and bearing between the pin head 120 and cap 116, is a compression spring 124 which is of suitable capacity to afford effective loading of the governor. The spring tension may be adjusted so as to determine the desired engine speed, by threading cap 116 upwardly or downwardly relative to the nipple 115.

From the foregoing it will now appear that the governor and oil pump as mounted on the bracket 70, are thereby supported as a unit, which may be removed from the compartment 32 or inserted therein as a single assembly, access for this purpose being had through the crankcase opening 31 upon removal of the closure 34. Opening 31 also affords direct access to the cam assembly related to the fuel pump and valve rocker arms in the upper part of compartment, as well as to the crankshaft pinion 44. Moreover and importantly to the present improvements, the governor and oil pump unit and the cam assembly are compactly and relatively arranged such that the crankshaft pinion 44 provides a single drive common to these assemblies.

A further feature of the present improvements resides in a novel provision for the pressure delivery of oil from the crankshaft at a point adjacent one of the crankshaft bearings, through the crankshaft and piston connecting rod to the piston-rod journal. As shown in the figures, the crankshaft is circumferentially grooved at 130 adjacent the bearing 26, and extending from the groove is a passage 131 in the crank portion of the crankshaft, the passage leading to communication with a passage shown in broken outline at 132, longitudinally in the connecting rod 18. Passage 132 leads to the connection of the rod and piston (not shown) for pressure lubrication thereof. Oil under pressure is led from the junction 93 to a projection or neck 134 extending substantially radially from a chamber-forming ring member 135 (Fig. 2), the ring closely seating on the crankshaft in overlying position to the groove 130. The ring neck has a passage 136 (shown dotted in Fig. 1) opening to groove 130. Thus oil under pressure from junction 93, is thereby admitted directly into the groove, and is in great part, confined to the groove for delivery through the passages 131 and 132 to the piston. The ring 135 is fixed relative to the crankshaft and has a relatively close running fit

therewith, which however, is not sufficient to prevent some pressure leakage of oil from the chamber defined by the ring and groove 130. Pressure leakage is of advantage here, because of the proximity of the ring to the crankshaft bearing 26, since the lubricant leakage will pass to the bearing surfaces at bearing 26.

Having now described the invention, it is to be understood that modifications in parts and the arrangement thereof may be made without departing from the spirit and full intended scope of the invention as defined by the appended claims.

I claim:

1. In an internal combustion engine providing an engine rotated shaft, an engine governor and oil pump unit comprising a bracket, an oil pump on the bracket, a shaft member rotatably carried by the bracket and drivingly connected to said pump, a governor mechanism operatively supported by said shaft member, and means operatively connecting said shaft member to said engine rotated shaft.

2. In an internal combustion engine providing an engine rotated shaft, an engine governor and oil pump unit comprising a bracket, an oil pump on the bracket, a portion of the bracket providing a side wall of the pump, a shaft member rotatably supported by the bracket and drivingly connected to said pump, a governor mechanism operatively carried by said shaft member, and gear means interconnecting said shaft member and the engine rotated shaft.

3. In an internal combustion engine providing an engine rotated shaft, an engine governor and oil pump unit comprising a bracket, an oil pump on the bracket including a pump casing formed in part by a portion of said bracket and by wall elements secured to the bracket, a shaft member rotatably supported by the bracket and drivingly connected to said pump, a governor mechanism operatively carried solely on said shaft member, and gear means operatively connecting the shaft member to said engine rotated shaft.

4. In an internal combustion engine having a crankcase and a crankshaft therein, the crankcase having an access opening, a cover normally closing said opening, a pinion on said crankshaft located thereon near said opening, and a governor and oil pump unit removably mounted in the crankcase near said crankcase opening, said unit comprising a bracket, an oil pump carried on the bracket, a shaft member rotatably supported on the bracket in driving connection with said pump, a governor mechanism operatively supported on said shaft member, and a gear on the shaft member, said gear being adapted for engagement with said crankshaft pinion when the governor and oil pump unit is in place in the crankcase, to effect the drive of said shaft member from the crankshaft.

5. In an internal combustion engine having a crankcase, a crankshaft therein and a fuel pump controllable as to fuel delivery to the engine, a governor and oil pump unit removably mounted in the crankcase, said unit comprising a bracket, an oil pump carried thereby, a shaft member rotatably supported by the bracket, governor mechanism operatively carried by said shaft member and including an actuating element arranged coaxially of said shaft member and displaceable longitudinally of the latter, means operatively connecting said shaft member to said crankshaft, and means connecting said actuating element to said fuel pump for controlling fuel delivery thereby.

6. In an internal combustion engine providing a crankcase having a compartment therein, a crankshaft extending in said compartment and having a pinion thereon, a camshaft in said compartment and driven from said pinion, and a governor and oil pump unit, said unit including a bracket removably secured in said crankcase compartment, an oil pump supported by said bracket, a shaft member rotatably carried by the bracket and extending to a driving connection with said oil pump, governor mechanism operatively supported solely by said shaft member, and a gear on the shaft member enmeshing said crankshaft pinion.

7. In an internal combustion engine providing a crankcase, an oil sump chamber therebelow, and a crankshaft in the crankcase, a removable governor and oil pump unit comprising a bracket detachably mounted in the crankcase and extending into said sump chamber, an oil pump carried by said bracket and disposed in the sump chamber, a shaft element rotatably supported on said bracket in driving connection with said oil pump, gear means operatively interconnecting said shaft element and crankshaft, and engine speed governor mechanism carried solely by said shaft element for actuation thereby.

HENRY N. EDENS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,139,578	Ragan	May 18, 1915
1,341,152	Ostenberg	May 25, 1920
1,459,563	Thamm	June 19, 1923
1,554,350	Jack	Sept. 22, 1925
1,631,185	Anibal	June 7, 1927
1,647,434	Chorlton	Nov. 1, 1927
1,731,823	McCuen	Oct. 15, 1929
2,040,847	Hesselman	May 19, 1936