Feb. 6, 1923. 1,444,279.

C. R. SHORT.

LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES.

FILED MAR. 1, 1920. 3 SHEETS—SHEET 1.

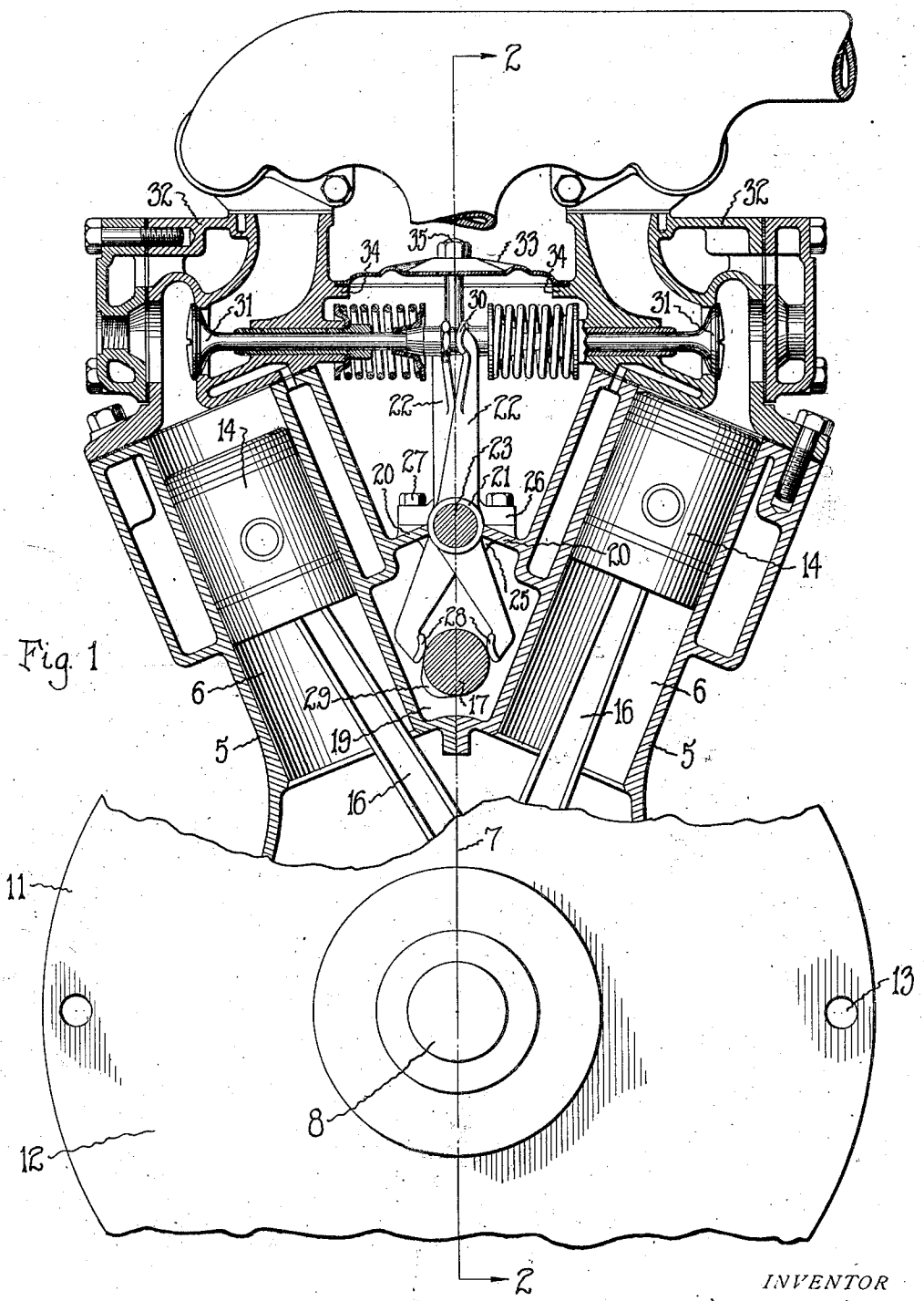


Fig. 1

INVENTOR
CHARLES R. SHORT
BY
Blackwood, Spencer & Flint
ATTORNEYS

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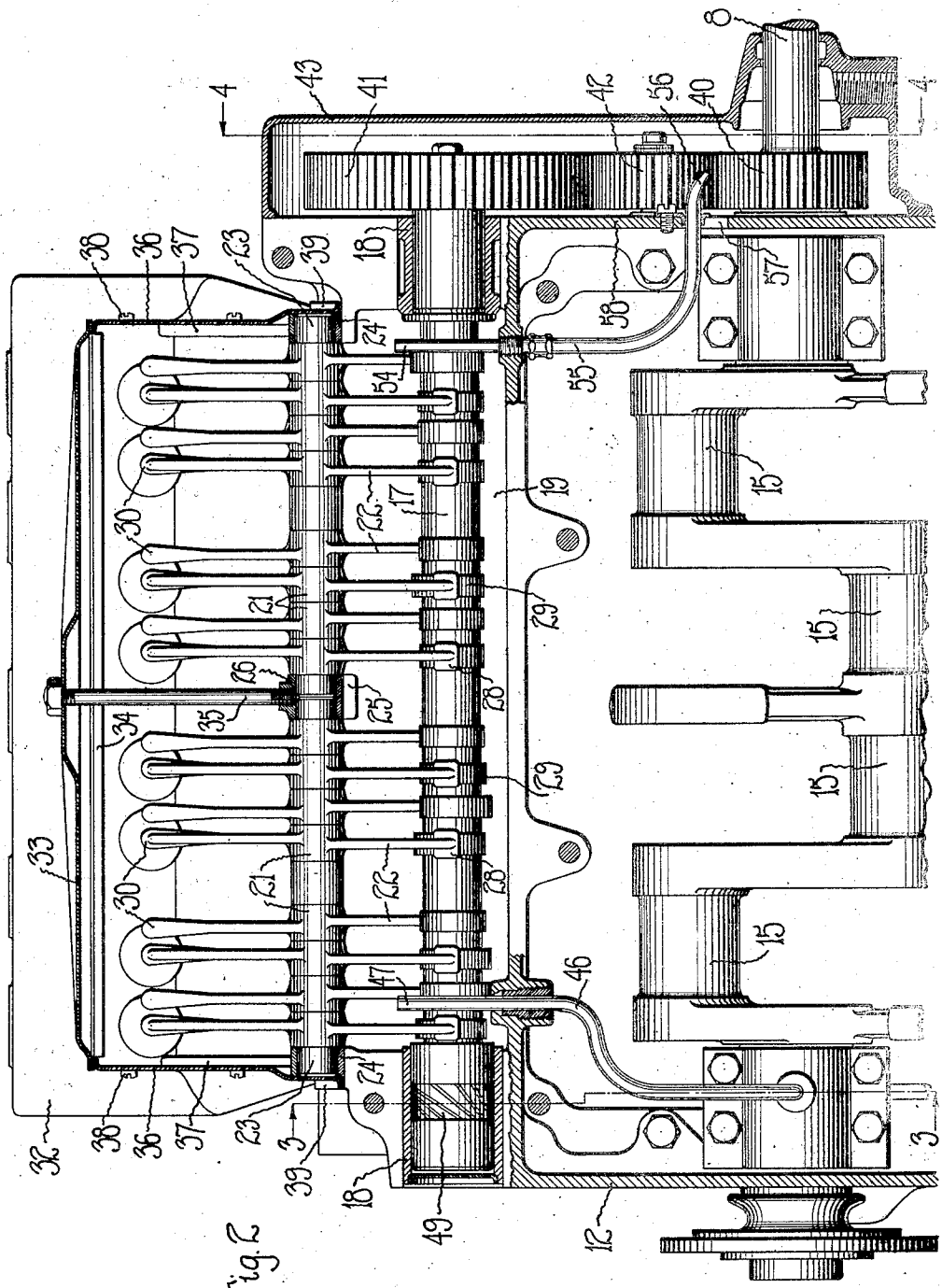


Fig. 2.

Inventor
CHARLES R. SHORT

By Attorneys
Blackwood, Spencer & Elliott

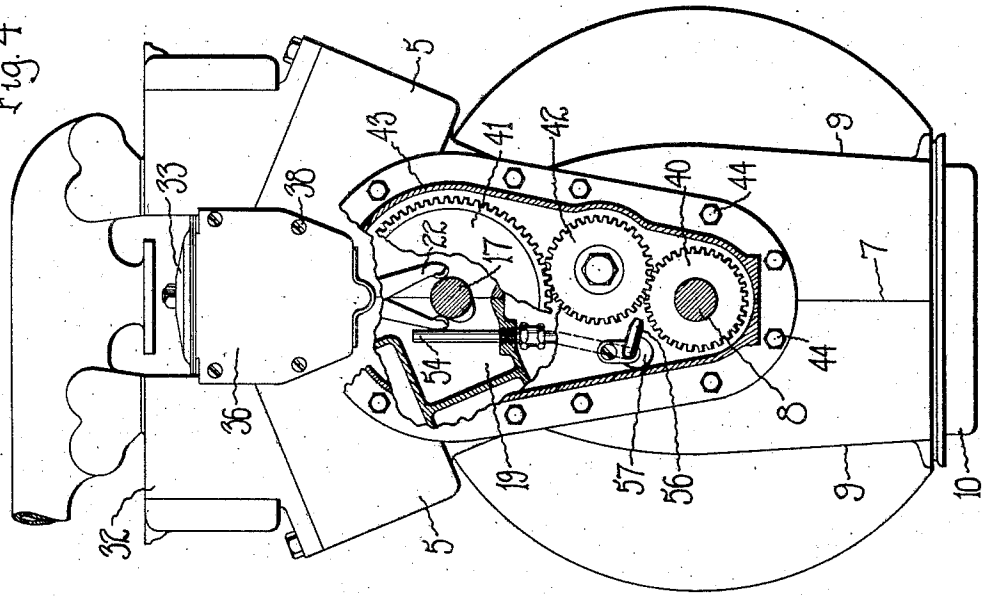
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Fig. 4



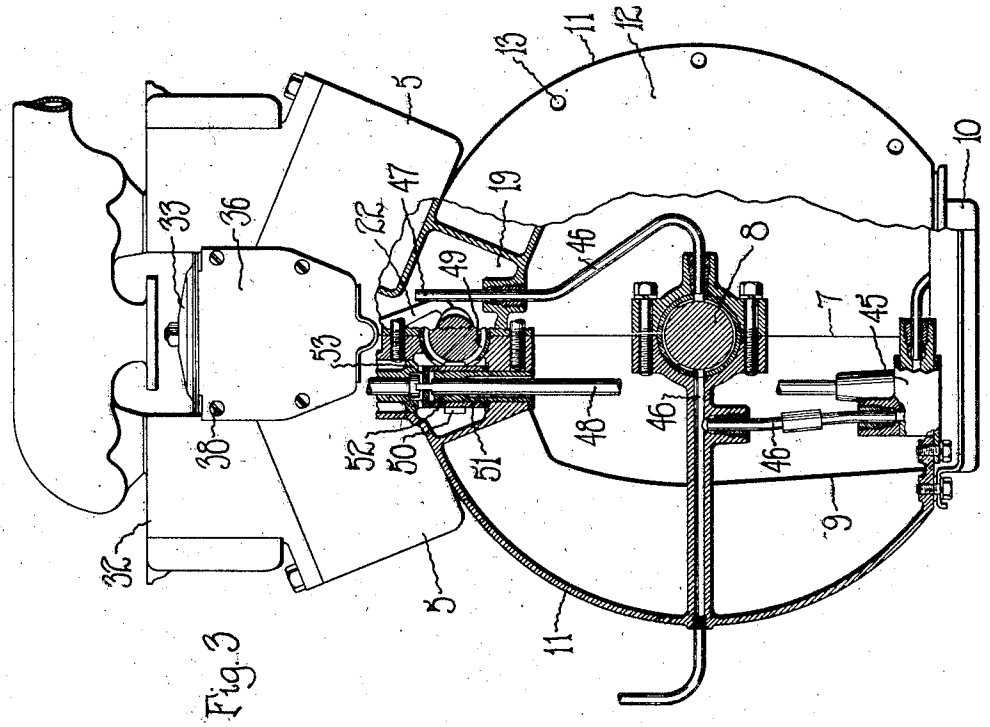


Fig. 3

Inventor
CHARLES R. SHORT

By Attorneys
Pickering, Spencer & Hunt

Patented Feb. 6, 1923. 1,444,279

UNITED STATES PATENT OFFICE.

CHARLES R. SHORT, OF DETROIT, MICHIGAN, ASSIGNOR TO GENERAL MOTORS CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF DELAWARE.

LUBRICATING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed March 1, 1920. Serial No. 362,253.

To all whom it may concern:

Be it known that I, CHARLES R. SHORT, a subject of the King of Great Britain, and a resident of Detroit, county of Wayne, and State of Michigan, have invented certain new and useful Improvements in Lubricating Systems for Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description, such as will enable others skilled in the art to which the invention relates to make and use the same, reference being made therein to the accompanying drawings, which form a part of this specification.

My invention relates to internal combustion engines, and particularly to lubricating devices or systems designed to provide an effective lubrication for the crank shaft and the valve operating shaft and valve operating mechanism in its entirety, of the internal combustion engine to which the invention is applied and with which it is used.

More particularly stated, my invention relates to lubricating devices or systems for use with multiple cylinder internal combustion engines; and the object thereof is to provide an improved lubricating system for accomplishing the proper lubrication of the valve operating mechanism and other parts of a multiple cylinder internal combustion engine in which the cylinders are arranged at an angle relative to one another, as in the form or type of engine commonly referred to as the V-type; a circulation of the lubricating material past the elements to be lubricated being maintained by means of a suitable pump, and the valve operating or cam shaft of the engine being located within a suitable chamber formed by the diverging cylinders of the engine and disposed between the lower ends thereof, and which shaft is entirely or partially submerged in a body of lubricant contained within said chamber.

With the above and other objects of invention in view my invention consists in the improved lubricating system for multiple cylinder internal combustion engines of the V-form or type illustrated in the accompanying drawings and hereinafter described and claimed; and in such variations and modifications thereof, within the scope of the concluding claims, as will be obvious to those skilled in the art to which my invention relates.

Referring now to the drawings wherein the preferred embodiment of my invention is illustrated:

Figure 1 is a view partly in section and partly in end elevation showing a multiple cylinder engine of the V-form or type, the same being provided with a lubricating system made in accordance with my invention.

Figure 2 is a view showing the engine shown in Figure 1 in section upon a central vertical plane extending longitudinally thereof and the position of which is indicated by the line 2, 2, Figure 1.

Figure 3 is a view showing the engine shown in Figures 1 and 2 upon a somewhat smaller scale, and as seen from a position to the left of Figure 2, the view being partly in section upon a transverse plane indicated by the line 3, 3, Figure 2, and partly in elevation.

Figure 4 is a similar view showing the engine as seen from a position to the right of Figure 2, the sectional portion of the same being taken just within the gear case cover, and upon a transverse plane indicated by the line 4, 4, Figure 2.

Referring now to the drawings, the engine illustrated therein is made up of two cylinder blocks 5 each provided with a plurality of cylinders 6 and which cylinder blocks are secured together along a vertical central plane indicated at 7 and extending longitudinally of the engine, as best shown in Figure 1. The outer side walls of these cylinder blocks depend some distance below the crank shaft 8 of the engine, as indicated at 9 in Figure 4, thus providing a crank case which is made up of side walls disposed substantially parallel with one another and which walls extend for some little distance below the crank shaft of the engine, and end walls integral with the cylinder blocks and which walls support the bearings in which the crank shaft of the engine is rotatable. The open lower end of the crank case thus

formed is closed by a cover 10 extending throughout substantially the entire length of the engine.

The left-hand ends of the cylinder blocks are provided with enlarged portions formed integrally therewith and which are indicated by the reference numerals 11, the said enlarged portions upon the two blocks together forming a supporting member or casing to which the housing, not shown, but within which the fly-wheel of the engine the usual clutch and other elements of the power plant of a vehicle may be located and housed; the said flywheel casing being secured to the end walls 12 of the enlarged portions 11 by means of suitable bolts extending through holes 13 provided in said end walls. It will be appreciated that these enlarged portions are located closely adjacent one end of the engine and that the walls thereof merge with the depending walls 9 of the cylinder blocks at the left-hand end of the engine, referring to Figure 2, as the engine illustrated is intended to be used for propelling a motor driven vehicle; altho it may be here stated that my improved lubricating system is capable of use in and as forming a part of internal combustion engines generally, and such as are used for purposes other than for driving a motor driven vehicle.

The pistons 14 which operate within the cylinders 6 are connected with the crank pins 15 of the crank shaft 8 by means of suitable connecting rods 16, as is usual in multiple cylinder internal combustion engines; and the reference numeral 17 designates a valve operating or cam shaft the ends of which are supported in bearings 18 held in place between the meeting surfaces of the cylinder blocks and located one at each end of the engine, and which shaft is arranged within and extends longitudinally of a space or chamber 19 formed by the merging of the lower portions of the walls of the two cylinders blocks, as best shown in Figure 1; said valve operating shaft being thus located in the crotch or space between the diverging series of cylinders of the two cylinder blocks, and at the lower end of said space.

The merging lower ends of the inner sides or walls of the cylinders of the two blocks thus provide the bottom and side walls of the crotch or chamber within which the valve operating shaft is located, while the upper portion of this chamber is closed by means of walls 20, see Figure 1, which extend inward from the inner side walls of the cylinder blocks or of the cylinders formed therein, and terminate close to the central bosses or bearings 21 of a series of valve operating levers 22; the joints between said inner edges of the walls 20 and the bosses or bearings 21 being sufficiently tight to prevent the splashing of any considerable quantity of oil out of the space or chamber 19 and upwardly past said bearings and through said joints.

The valve operating levers 22 are arranged substantially vertically, and as many such levers are provided as may be necessary to operate the inlet and exhaust valves of the several cylinders of the engine. These valve operating levers are supported upon two shafts 23 which lie between the inner free edges of the walls 20 and extend through openings provided in the bosses 21, and the outer ends of which shafts are supported in bearings 24 supported between the two cylinder blocks; and the inner ends of said shafts are supported and held in place by arms 25 extending inward beneath said shafts from the walls 20 above referred to, and a cap member 26 engaging the upper portions of said shafts and secured to said walls 20 by means of cap screws 27 in the embodiment of my invention illustrated. It will be appreciated, however, that the shafts which support the valve operating levers 22 may be supported from the frame or wall of the engine otherwise than as herein explained, and that a single shaft instead of two separate shafts may be used should it be deemed necessary or desirable to do so.

The lower ends of the valve operating levers 22 are provided with toes 28 which are acted upon by cams 29 properly spaced along the valve operating shaft 17 to thereby impart oscillatory motion to said levers, and the upper ends of said levers are provided with toes 30 through which motion is communicated to the valves 31 of the several engine cylinders; each cylinder being provided with an inlet and with an exhaust valve as will be appreciated. These valves are commonly located in heads 32 formed separate from the cylinder blocks as is usual in engines of the class to which my invention relates, and the upper end of the space between the diverging cylinder blocks is closed by means of a cover plate 33 extending longitudinally of the engine and resting upon ledges 34 formed one upon each cylinder block, said cover plate being shown as held in place by means of a bolt 35 extending upward from and the lower end of which is connected with the cap 26 of the central bearing provided by the walls 20 for supporting the shafts 23 which in turn support the valve operating levers.

The cover plate 33 thus forms a wall above the valve mechanism of the engine; and the ends of the space or crotch between the diverging cylinders within which the entire valve mechanism is located are closed by separable cover plates 36 the side edges of which overlie oppositely disposed ledges 37 formed adjacent the ends of the cylinder blocks. These end cover plates are secured

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in place by cap screws 38 extending into the flanges 37 and the portions of the cylinder blocks which the edges of said plates contact with and the lower ends of said cover plates have depending lugs which overlie the ends of the valve lever supporting shafts 23, as best shown at 39 in Figure 2.

The valve operating shaft 17 is operated from the crank shaft 8 of the engine at half the speed at which the crank shaft operates through the usual two to one gears 40, 41 and an intermediate idler gear 42 through which motion is communicated from one of said gears to the other; all of said gears being located within a closed chamber provided by a cover plate 43 which is secured to the end walls of the lower portions of the two cylinder blocks by means of cap screws 44.

The cover plate 10 which closes the lower end of the crank case obviously prevents the escape of oil from the same, and the oil which reaches the crank case collects in the lower portion thereof, or in a sump provided in the said cover plate 10, and is pumped by a rotary or other type of pump 45 from the crank case and up into the chamber 19 between the diverging cylinders through a discharge conduit 46, and discharged into said chamber preferably through a stand pipe 47 located within said chamber; said conduit preferably extending through the adjacent main bearing for the crank shaft of the engine to thereby accomplish the lubrication of said bearing incidental to the supply of lubricant to the chamber 19 in which the valve operating shaft is located, as best shown in Figure 3. Such conduit, however, may lead from the pump 45 directly into the chamber 19 should such an arrangement be deemed preferable.

The pump 45 is operated from the valve operating shaft 17 through a vertical pump operating shaft 48 operatively connected with said pump, and spiral gears 49, 50, one upon the said valve operating shaft and the other upon a sleeve 51 which rotates upon a tubular bearing 52 extending upward from the wall of the engine and which sleeve is operatively connected with the said shaft 48 through a cross-pin 53 extending through openings in said sleeve and in said shaft. This sleeve is also provided with an upward extension which operates the distributor or other auxiliary element or device of the engine which feature, however, is not involved in this present application.

The lubricant supplied by the pump 45 to the chamber 19 is intended to fill said chamber up to about the level of the upper discharge end of the stand pipe extension 47 of the supply conduit 46, so that the valve operating shaft 17 will be submerged in a lubricant within said chamber in the preferred embodiment of my invention illustrated. The lubricant supplied to said lubricant containing chamber flows out therefrom after the chamber is sufficiently full through a stand pipe 54 the inlet end of which is at about the same level as the discharge end of the stand pipe 47, and which stand pipe communicates with an outlet and return conduit 55 the lower discharge end 56 of which terminates adjacent the two to one gearing within the casing 43, to thereby accomplish a lubrication of the gears through which the valve operating shaft 17 is operated. The lubricant thus supplied to the interior of the gear casing may flow out therefrom through an opening provided at the lower end of said casing, or through an opening 57 provided above the lower end of said casing and in the end wall 58 of the crank case of the engine; the said lubricating material in either case finding its way back into the crank case of the engine to be again pumped therefrom by the pump 45, thus maintaining a continuous circulation of lubricant through the system and to the parts of the engine to be lubricated.

In view of the premises it will be appreciated that my improved lubricating system is one in which the valve operating shaft of the engine will be submerged in a body of lubricant, thus providing copious lubrication for the wearing surfaces between the valve operating cams and the toes at the lower ends of the valve operating levers at which an excessive amount of friction occurs in the ordinary operation of internal combustion engine valves. At the same time there will be a sufficient surging or splashing of the lubricant within the chamber 19 to provide adequate lubrication for the bearings between the bosses 21 of the valve operating levers and the shaft or shafts 23 whereby they are supported, while at the same time the inwardly extending walls 20 will prevent the passage of any considerable quantity of lubricant upward and beyond the points of pivotal support of the valve operating levers. Incidentally, and during the return of the lubricating material from the chamber 19 to the crank case, the lubricating material passes through the chamber within which the gearing which operates the valve operating shaft is located, thus again providing copious lubrication for another group of elements of the engine in which an inordinate amount of friction is commonly present. Finally, the operating means for the oil pump is built into one of the cylinder blocks and is located within a chamber provided therein for it in such a way as to be effectively housed, and the gears which drive the pump operating shaft are lubricated by lubricant which finds its way out from the chamber 19; while the entire valve operating mechanism is enclosed within a dust-proof casing formed by the top cover

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plate 33 and the end cover plates 36 all of which, however, may be readily removed to permit access to the valve operating mechanism should it become necessary or desirable to do so.

Having thus described and explained my invention, I claim and desire to secure by Letters Patent:

1. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another and having each a plurality of cylinders; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotatable valve operating shaft located within said chamber; a plurality of oscillating valve operating levers located between said cylinder blocks and pivotally supported adjacent the upper end of said chamber, and which levers are operated by cams upon said cam shaft; a pump; a lubricant supply conduit leading from said pump to and discharging into said lubricant containing chamber above the bottom thereof; gearing through which said valve operating shaft is operated from the crank shaft of the engine; an outlet conduit leading from said chamber above the lower end thereof so as to maintain a constant body of oil within the same, and which conduit discharges onto the gearing aforesaid; and means for driving said pump.

2. In a multiple cylinder internal combustion engine, two separate and independent cylinder blocks arranged at an angle to one another and secured together along a joint lying in a vertical plane extending longitudinally of the engine; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said chamber; gearing whereby said shaft is driven; a vertically arranged pump operating shaft rotatable in a bearing in one of said cylinder blocks; gearing between said valve operating shaft and said pump operating shaft and through which the latter is driven; a pump operated by said pump operating shaft and adapted to force lubricant into the lubricant containing chamber aforesaid; a return conduit leading from said lubricant containing chamber and through which lubricant is supplied to said first mentioned gearing; and a plurality of oscillating valve operating levers located between said cylinder blocks and operated by cams on said valve operating shaft.

3. In a multiple cylinder internal combustion engine, two separate and independent cylinder blocks arranged at an angle to one another and having each a plurality of cylinders and which blocks are secured together along a joint lying in a vertical plane extending longitudinally of the engine; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said chamber; a vertically extending pump operating shaft the upper end of which extends into a chamber provided in one of said cylinder blocks; gearing located within said last mentioned chamber and through which said pump operating shaft is operated from said valve operating shaft; a plurality of oscillating valve operating levers located between said cylinder blocks and operated by cams upon said valve operating shaft; a pump operated by said pump operating shaft; a conduit leading from said pump and discharging into the lubricant containing chamber aforesaid; and a return conduit leading from said lubricant containing chamber to the crank case of the engine.

4. In a multiple cylinder internal combustion engine having two separately formed cylinder blocks arranged at an angle to one another and connected together along a vertically arranged joint to thereby provide a lubricant containing chamber between said blocks and adjacent the lower ends of the cylinders within the same, and a crank case below the lower ends of said cylinders and within which the crank shaft of the engine is supported in suitable bearings; a rotatable valve operating cam shaft located within the chamber aforesaid; means for driving said cam shaft from the crank shaft of the engine; a plurality of valve operating members located between said cylinder blocks and operated by cams upon said cam shaft; a pump so arranged as to derive its supply of lubricant from the interior of said crank case; a discharge conduit leading from said pump and discharging into said lubricant containing chamber; a return conduit leading from said chamber and through which lubricant flows on its return to the interior of the crank case of the engine; and means assembled with one of said cylinder blocks for operating said pump.

5. In a multiple cylinder internal combustion engine, two separate and independent cylinder blocks arranged at an angle to one another; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a valve operating shaft located within said lubricant containing chamber; a plurality of valve operating devices arranged between said cylinder blocks and operated by cams upon said valve operating shaft; a pump; an operating shaft supported in bearings in one of said cylinder blocks and adapted to drive said pump; gearing whereby said pump shaft is driven from said cam shaft; a lubricant supply conduit leading from said pump and discharging into

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said lubricant containing chamber; and an outlet conduit leading from said lubricant containing chamber.

6. In a multiple cylinder internal combustion engine two cylinder blocks arranged at an angle to one another; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotatable valve operating shaft located within said chamber; means for operating said valve operating shaft from the crank shaft of the engine; a plurality of oscillating valve operating levers arranged between said cylinder blocks and operated by cams upon said valve operating shaft; walls extending inward one from each of said cylinder blocks, and which walls terminate adjacent the points of pivotal support of said valve operating levers; and means for supplying lubricant to the interior of said lubricant containing chamber.

7. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another and having each a plurality of cylinders; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said lubricant containing chamber; two walls extending inward one from each of said cylinder blocks, and the inner ends of which are spaced apart from one another; a supporting shaft located adjacent the inner ends of said walls and between the same; a plurality of oscillating valve operating levers supported upon said supporting shaft and which levers are operated by cams upon said valve operating shaft; and means for supplying lubricant to the interior of said lubricant containing chamber.

8. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another and having each a plurality of cylinders; a lubricant containing chamber arranged between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said chamber; two walls extending inwardly one from each of said cylinder blocks, and the inner ends of which walls are spaced apart from one another; a supporting shaft located between the free inner ends of said walls; a plurality of oscillating valve operating levers arranged between said cylinder blocks and which levers are supported by said shaft, and have depending portions which are engaged by cams upon said valve operating shaft; arms carried by said walls and extending beneath and adapted to support said supporting shaft; a cap secured to said walls and engaging said supporting shafts to thereby hold the same in place; and means for supplying lubricant to the interior of said lubricant containing chamber.

9. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said chamber; a plurality of oscillating valve operating levers disposed between said cylinder blocks and operated by cams upon said valve operating shaft; means for supplying lubricant to said lubricant containing chamber; a top cover plate located between said cylinder blocks and adapted to close the upper end of the space between said blocks; and end cover plates secured to said cylinder blocks and adapted to close the ends of the space between said blocks.

10. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another and having each a plurality of cylinders; a lubricant containing chamber disposed between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said chamber; a supporting shaft located above said valve operating shaft; a plurality of oscillating valve operating levers arranged between said cylinders and operated each by a cam upon said valve operating shaft; means for supplying a lubricant to said lubricant containing chamber; cover plates located one at each end of the space between said cylinder blocks, and which plates are detachably secured to said blocks and the lower ends of which overlie the ends of said supporting shaft; and a top cover plate adapted to close the upper end of the space between said blocks.

11. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another; a lubricant containing chamber disposed between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said chamber; a supporting shaft located above said valve operating shaft; a plurality of oscillating valve operating levers arranged between said cylinders and operated each by a cam upon said valve operating shaft; means for supplying a lubricant to said lubricant containing chamber; and cover plates located one at each end of the space between said cylinder blocks, and which plates are detachably secured to said blocks and the lower ends of which overlie the ends of said supporting shaft.

12. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotatable valve operating shaft located within said lubricant containing chamber; gearing located within a closed

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chamber and through which gearing said valve operating shaft is operated from the crank shaft of the engine; a plurality of valve operating members located between said cylinder blocks and operated by cams upon said valve operating shaft; a pump so arranged as to derive its supply of lubricant from the crank case of the engine; a lubricant supply conduit leading from said pump and discharging into said lubricant containing chamber; an outlet passage leading from said lubricant containing chamber and discharging into the chamber aforesaid in which said gearing is located; and a passage through which lubricant may flow from said last mentioned chamber into the crank case of the engine.

13. In a multiple cylinder internal combustion engine, two cylinder blocks arranged at an angle to one another; a lubricant containing chamber located between said blocks and adjacent the lower ends of said cylinders; a rotating valve operating shaft located within said lubricant containing chamber; a plurality of valve operating members located between said blocks and operated by cams upon said valve operating shaft; a pump so arranged as to derive its supply of lubricant from the interior of the crank case of the engine; a lubricant supply conduit leading from said pump through one of the bearings in which the crank shaft of the engine is supported, and which conduit extends to and discharges into said lubricant containing chamber; an outlet conduit leading from said lubricant containing chamber from a point above the bottom thereof and through which lubricant flows on its return to the interior of the crank case of the engine; and means for operating said pump.

14. In a multiple cylinder internal combustion engine, two cylinder blocks arranged adjacent to one another and forming between the walls thereof a chamber for lubricants; and means whereby lubricant may be supplied to said chamber, said lubricant chamber being formed partly in one and partly in the other of said cylinder blocks.

15. In a multiple cylinder internal combustion engine, a plurality of cylinder blocks arranged to form therebetween a lubricant chamber, a valve-operating shaft mounted to rotate in said chamber, a plurality of oscillating valve-operating levers having their bearings in the top wall of said chamber and arranged to be lubricated by the lubricant in said chamber, and means for maintaining a constant level of lubricant in said chamber.

16. In a multiple cylinder internal combustion engine, two cylinder blocks arranged adjacent to one another and having their walls connected to form a lubricant chamber, transverse walls extending toward each other from the sides of said blocks to form the top of the chamber, a valve-operating shaft mounted to rotate in said chamber, valve operating levers having their bearings intermediate of said transverse walls and means for maintaining a supply of lubricant in said chamber.

17. In a multiple cylinder internal combustion engine two cylinder blocks, a lubricant chamber intermediate of the said blocks and formed partly in one and partly in the other of them, a valve-operating shaft mounted to rotate in said chamber, means for driving said shaft from the engine shaft, means for maintaining a body of lubricant in said chamber, and means for feeding lubricant from said chamber to the said driving means.

In testimony whereof I affix my signature.

CHAS. R. SHORT.