B. READ.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 28, 1913.

1,237,386.

Patented Aug. 21, 1917.

3 SHEETS—SHEET 1.

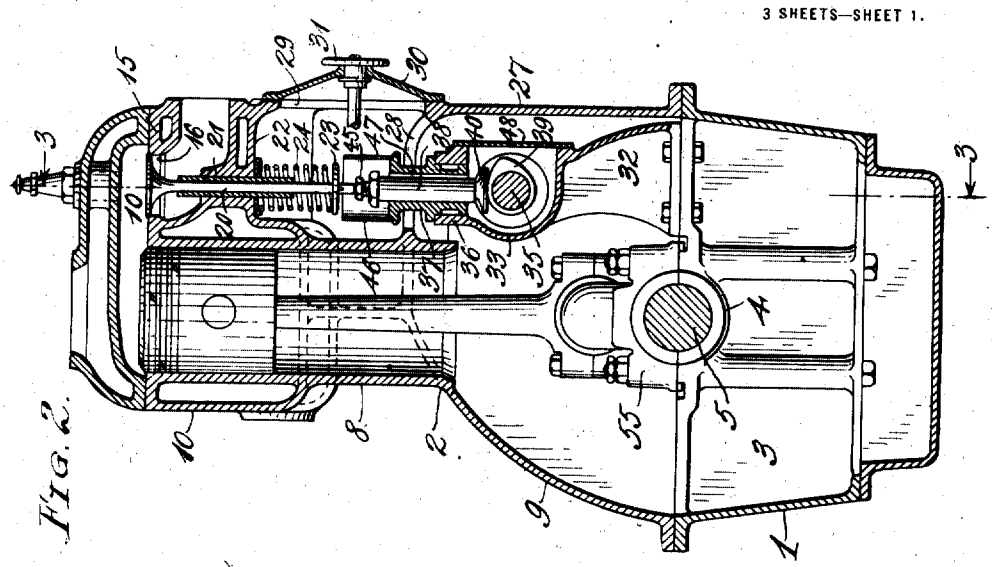

FIG. 2.

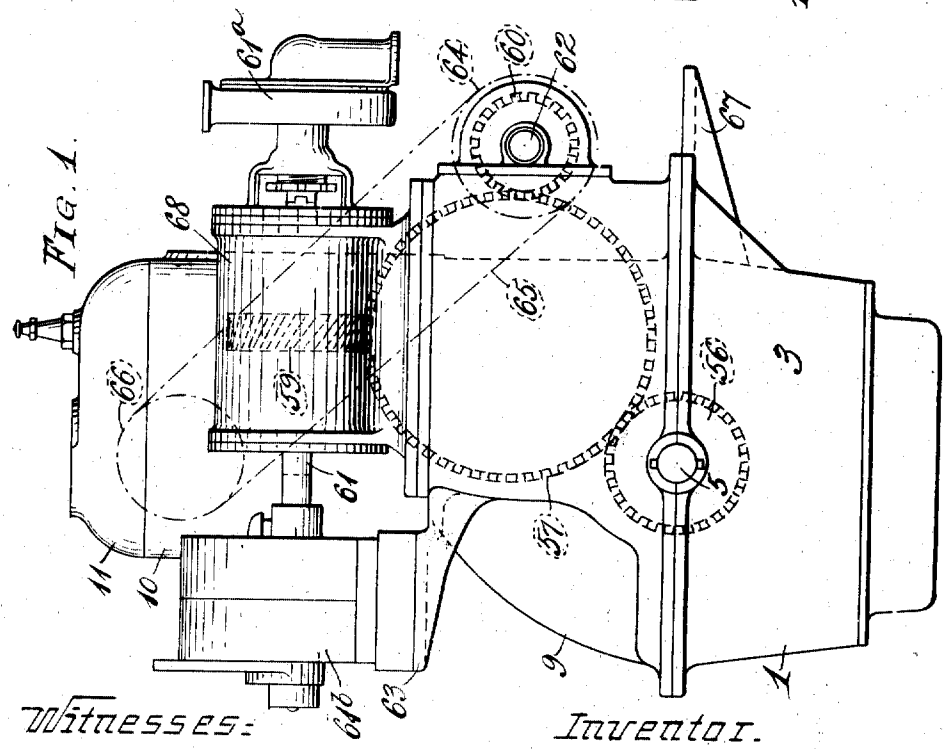

FIG. 1.

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3 SHEETS—SHEET 2.

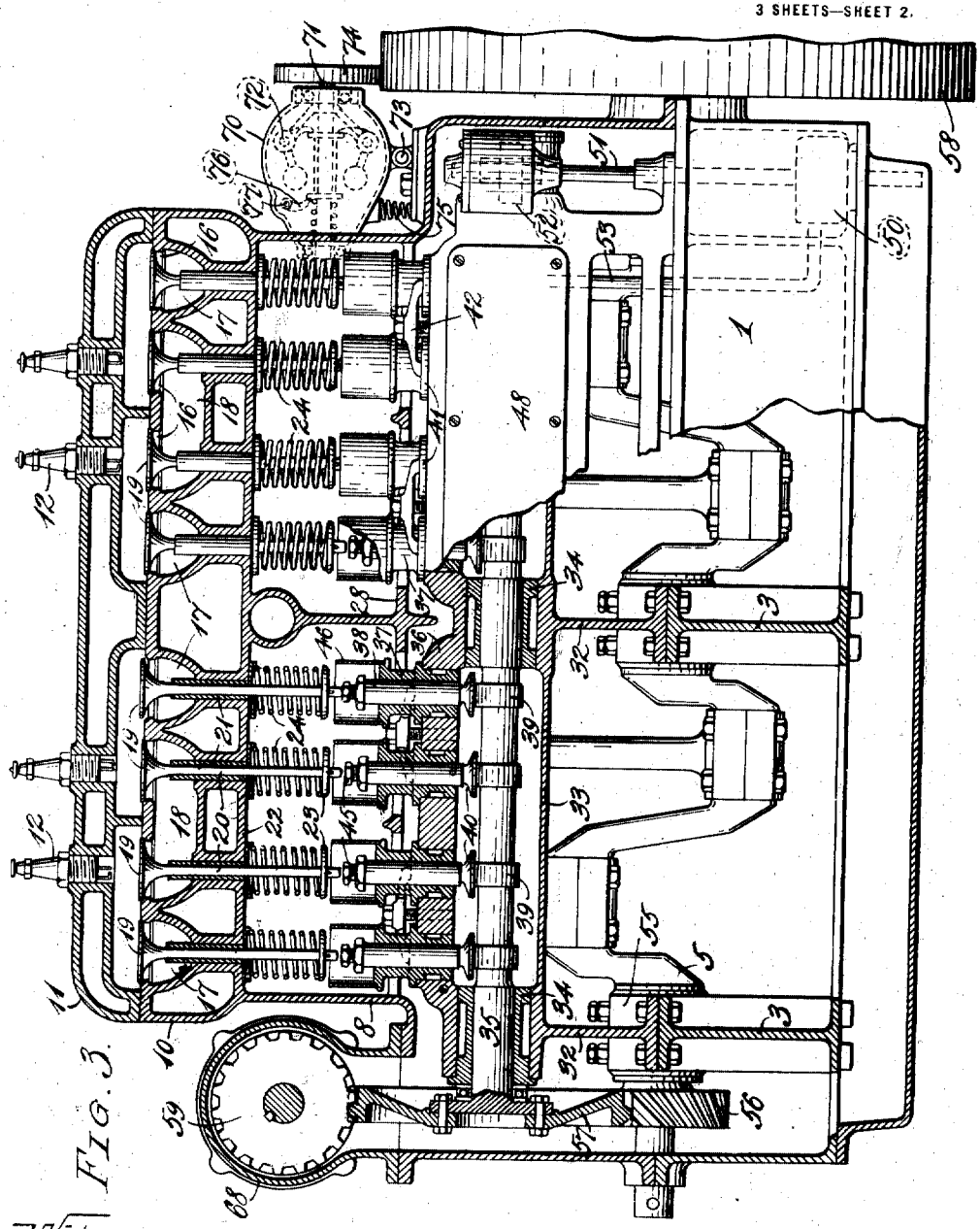

FIG. 3.

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3 SHEETS—SHEET 3.

FIG. 4.

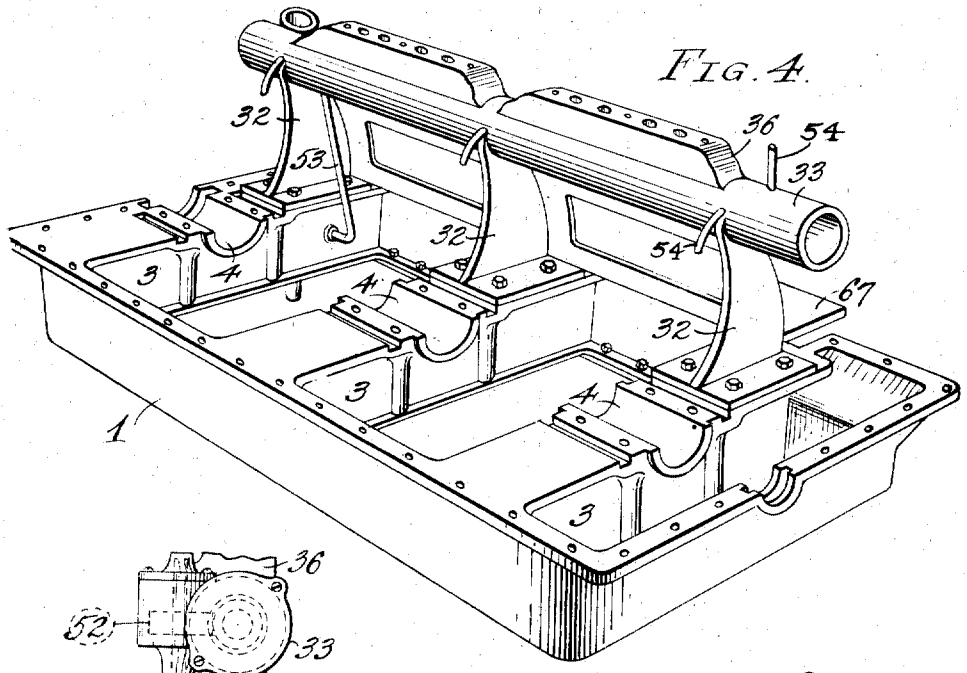


FIG. 5.

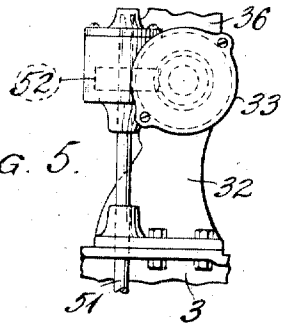


FIG. 7.

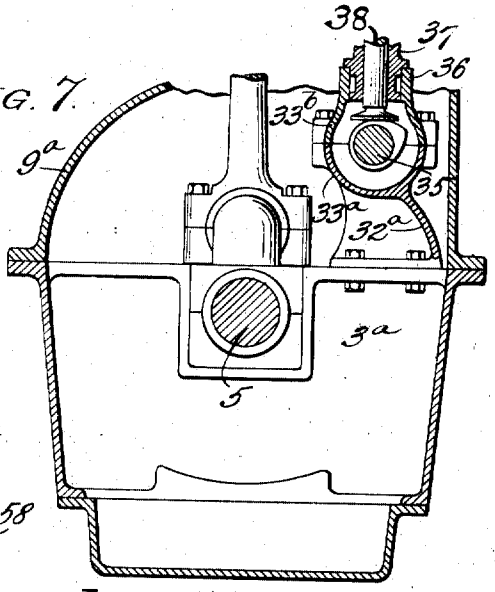
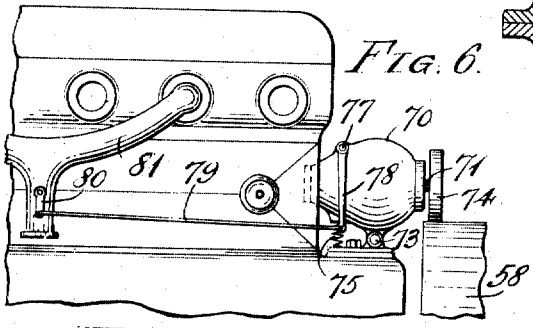


FIG. 6.



Witnesses:-

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UNITED STATES PATENT OFFICE.

BALFOUR READ, OF MARION, INDIANA.

INTERNAL-COMBUSTION ENGINE.

1,237,386. Specification of Letters Patent. **Patented Aug. 21, 1917.**

Application filed March 28, 1913. Serial No. 757,308.

To all whom it may concern:

Be it known that I, BALFOUR READ, a subject of the King of Great Britain, and a citizen of the Dominion of Canada, residing at Marion, in the county of Grant and State of Indiana, have invented a certain new and useful improvement in Internal-Combustion Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to internal combustion engines, and has for its general object the improvement of a device of this type in certain matters of detail connected with the design, assembling, and maintenance of the engine. More specifically the objects of the invention are the provision of a device of this character in which the cam shaft can be assembled independently of the rest of the engine, thereby permitting the engine parts to be dismounted and repaired and inspected without disarranging the cam shaft and its associated parts; the provision of new and improved means for supporting the valve lifting devices and for lubricating the same; the provision of means for diminishing the noise produced by the operation of the cams and valves; the provision of new and improved means for permitting the inspection and adjustment of the valve operating devices; the provision of new and improved arrangement and mode of operating the water pump and magneto; while further objects and advantages of the invention will become apparent as the description proceeds.

Generally speaking my invention may be defined as consisting of the constructions and combinations recited in the claims hereto annexed and illustrated in the drawings accompanying and forming a part of this application, wherein: Figure 1 is a forward end elevation of an engine constructed in accordance with my invention: Fig. 2 is a transverse, cross-sectional view taken through the center of one of the valves; Fig. 3 is a longitudinal cross-sectional view taken upon the line 3—3 of Fig. 2 and looking in the direction of the arrows, a portion of the cam shaft housing being shown in side elevation; Fig. 4 is a perspective view of the base frame showing the cam shaft housing in position thereon; Fig. 5 is an end elevational view of the rearward end of the cam shaft housing showing the method of driving the lubricating oil pump; Fig. 6 is a detail view illustrating the method of supporting and operating the governor; and Fig. 7 is a transverse cross-sectional view of an engine illustrating a slightly modified form of cam shaft housing.

Describing the parts by reference characters 1 represents the engine base and 2 represents generally the upper part of the engine. The base consists of a one-piece oblong casting having transverse walls 3, 3, 3, provided with semi-cylindrical journal halves 4, 4, 4, adapted for the reception of a crank shaft 5. In the present embodiment three such walls are shown, one in the middle, and others spaced upon each side of the same a sufficient distance for the reception of two cranks, since a four-cylinder engine is chosen for purposes of illustration herein. It will be understood that the particular arrangement of these members is entirely a matter of choice. The upper part 2 of the engine body comprises a cylinder block 8 and a downwardly flaring portion 9, preferably integral therewith and adapted to be secured to the top of the engine base 1. The cylinder block 8 is made with a plurality of cylindrical recesses forming the cylinders, the same being here shown as vertical and directly in line with the crank shaft. These cylinders may have the usual water jackets 10, head 11, and spark plugs 12. At one side of the cylinder block an extension 15 is provided formed with a plurality of vertical apertures 16, two apertures being allotted to each cylinder. These apertures communicate with chambers 17 and 18 formed in this extension cylinder, and connected with the exhaust and inlet manifolds respectively. Coöperating with each aperture 16 is a puppet valve 19 having a stem 20 depending coaxially with the aperture 16 and reciprocable in a sleeve 21 mounted in the bottom wall of the chamber. The lateral extent of the extension 15 preferably causes it to come substantially flush with the side wall of the engine base 1, and its vertical extent causes it to terminate in a flat wall 22 intermediate between the ends of the cylinder bore. The ends of the stems 20 project a considerable distance beyond this wall 22, as illustrated in Figs. 2 and 3, and are provided adjacent to their ends with fixed collars 23 between which and the wall 22 are interposed spiral springs 24

whereby the valves are yieldingly held in closed position.

The side of the crank casing nearest to these valves is preferably made with a substantially upright wall as shown at 27 in Fig. 2, which may be braced from the cylinders by occasional webs 28, and preferably has an elongated aperture 29 immediately below the wall 22 permitting access to the valve stem for the purpose of inspection and repair. This aperture is preferably covered by a suitable plate 38 held in place in any suitable manner as by the hand clamp 31. The space provided inside the crank casing by this peculiar construction is utilized for the reception of the cam shaft in the manner now to be described.

Secured above the walls 3, 3, 3, as by means of the brackets 32, 32, 32, is an elongated housing 33 provided with bearings 34, 34, in which is journaled the lay shaft 35. The side of the housing 33 adjacent to the valve stems 20 is thickened as at 36, and this thickened portion apertured for the reception of bearing sleeves 37, 37, in which are slidably mounted rods 38, each of which has its lower end formed to coöperate with one of the cams 39 carried by the shaft 35. In the present embodiment, these rods are shown as provided with mushroom heads 40, although it is obvious that rollers or the like could be employed without invention. Each of the sleeves 37 is preferably formed with a flange 41 adapted to engage the upper face of the thickened portion 36, and the sleeves are secured in place by means of yokes 42 bolted to the thickened portion 36 and engaging the flanges.

The sleeves 37, 37 are arranged, one in line with each of the valve stems 20, and the upper end of each of the rods 38 is provided with an adjustable extension 45 whereby the lift of the valve may be adjusted. The upper end of each of the sleeves 37 is surmounted by an open cup 46, the bottom whereof is placed in constant communication with the interior of the housing 33 by means of a duct 47 formed in the sleeve 37. The sides of the housing 33 may, if desired, be made integral, but are preferably, as here shown, formed with removable plates 48 permitting access to the interior for purposes of inspection, cleaning, and repair.

Associated with the engine is the usual oil pump 50, here shown as of the rotary type and driven by the shaft 51 which in turn is operated from the lay shaft 35 through the agency of spiral gears 52. This oil pump is connected by means of the conduit 53 with the housing 33 so that oil from the pump will be delivered under pressure into the interior of the housing, a small portion of it passing by way of the ducts 47 to the cups 46 and overflowing into the interior of the crank case, and the remainder passing through suitable tubes 54 to the different parts of the engine which require lubrication. The housing 33 thus takes the place of the usual header or manifold from which the oil tubes start. The cams being entirely underneath the surface of the oil will be so thoroughly cushioned that the noise of their operation will be at a minimum, while the presence of oil in the cups 46 to a height above the lower ends of the valve stems will serve to cushion the ends of the rods against them, thus diminishing the noise at this point. Finally the length of the housing 33 being less than that of the crank casing permits the housing together with the lay shaft, cams, sleeves, cups, rods, etc., to be assembled in a convenient and efficient manner, and the upper part of the engine applied to the base part after the completion of this assembly, or removed therefrom without disturbing the lay shaft and its adjuncts.

The crank shaft 5 is mounted in the journal halves 4 and secured therein by the yokes 55. One end of the crank shaft is provided with the gear 56 meshing with the gear 57 carried by the lay shaft and serving to rotate the same at the proper speed. In the present embodiment, the gears 56 and 57 are shown as disposed at the opposite ends of the casing from the fly wheel 58 and lubricating pump 50, this arrangement being chosen largely for purposes of design and is not necessarily followed. In the present embodiment, I have shown the gear 57 as associated with two gears, 59 and 60, the gear 59 being mounted upon a jockey shaft 61 transverse to the crank shaft 5, and the gear 60 upon a second jockey shaft 62 parallel therewith. The shaft 61 is here shown as connected to the water pump 61 and may also drive a magneto 61^b which is mounted upon the bracket 63. The shaft 62 drives, through the agency of the belt pulley 64 and belt 65 a pulley 66 to which the radiator fan may be attached. The shaft 62 may also, if desired, drive a magneto (not shown) mounted upon the bracket 67, such arrangement being the alternative of that before suggested. The transverse relation of the shafts 35 and 61 necessitates the use of spiral gears 57 and 59, and hence this requirement necessitates the use of spiral gears 56 and 60 also. Obviously the particular method of transmitting power from the crank shaft to the lay shaft is entirely optional with the designee, the mode here shown being merely a combination scheme for purposes of simplicity. Obviously spongers, chains, or any other suitable expedient might be employed instead of the spiral gears shown. When the arrangement illustrated is employed the gear 59 is preferably inclosed in a housing 68 as shown.

In Fig. 7, I have shown a slightly modified form of lay shaft housing and a slightly

modified form of engine base. In this view the walls 3^a of the base are shown as projecting a considerable distance above the center of the crank shaft 5 necessitating the employment of bearings of correspondingly different shape, the height of the upper portion of the crank casing being correspondingly reduced as illustrated at 9^a. Mounted upon the upper edges of the walls 3^a upon short brackets 32^a is a lay shaft housing consisting of a trough 33^a having an upper part 33^b secured to the same and completely inclosing the lay shaft 35. The upper part of the top 33^b is formed with a thickened portion 36, as in the previous case, said thickened portion being apertured for the reception of sleeves 37 as before.

For governing the speed of the engine, I preferably employ the device illustrated in Figs. 3 and 6 which consists of a hollow pear-shaped casing 70 having a shaft 71 coaxial therewith and provided inside the casing with suitable fly-ball governor mechanism 72 as illustrated in Fig. 3. The casing is supported upon a pivot 73 transverse to the crank shaft 5 in such manner that the end of the shaft 71 shall project over and parallel to the fly-wheel, and the shaft 71 is provided with a friction wheel 74 adapted to be held against the periphery of the fly-wheel by means of a spring 75 whereby the whole casing 70 is rocked. The movement of the governor balls is transmitted by means of a finger 76 and rock shaft 77 to an arm 78 exterior of the casing 70. A link 79 connects the end of this arm to the handle 80 of a suitable throttle valve or damper mounted in the inlet manifold 81, and in this way the operation of the engine is controlled by throttling the charge.

While I have necessarily described my invention in detail, I do not propose to be limited to such details, except as the same may be positively included in the claims hereto annexed or may be rendered necessary by the prior state of the art.

Having thus described my invention, what I claim is:

1. In an internal combustion engine, the combination, with a split crank case having its line of separation generally transverse to the cylinder axis, cylinders carried by one portion of the crank case, and reciprocable valves carried by the cylinders, of a lay shaft rotatably supported by the other portion of the crank case, and cams carried by said lay shaft for operating said valves.

2. In an internal combustion engine, the combination, with a split crank case having its line of separation generally transverse to the cylinder axis and reciprocable valves carried by the cylinders, the cylinders being carried by one portion of the crank case, of a lay shaft rotatably supported by the other portion of the crank case, cams carried by said lay shaft, and valve lifting devices supported adjacent to said cams and adapted to engage the stems of said valves.

3. In an internal combustion engine, the combination, with a split crank case having its line of separation generally transverse to the cylinder axis, and reciprocable valves carried by the cylinders, of brackets secured to the portion of said crank case farthest from said cylinders, a lay shaft journaled in said brackets at one side of said cylinders, and cams carried by said lay shaft and adapted to operate said valves.

4. In an internal combustion engine, the combination, with a split crank case having its line of separation generally transverse to the cylinder axis, and reciprocable valves carried by the cylinders, of a crank shaft journaled in the portion of said crank case farthest from said cylinders, brackets carried by the same portion of the crank case as said crank shaft, said brackets being disposed at one side of said crank shaft and inside the limits of said case, a lay shaft journaled in said brackets, the length of said lay shaft being less than that of the case, driving connections between said shafts within the limits of said case, cams carried by said lay shaft, and operative connections between said cams and said valves.

5. In an internal combustion engine the combination, with a split crank case, and cylinders carried by one part of the same, the plane of separation of said crank case being generally transverse to the axis of the cylinders, of a crank shaft journaled in the part of said case farthest from said cylinders, reciprocable valves mounted at one side of said cylinders and substantially parallel therewith, brackets carried by the side of said crank case farthest from said cylinders, a lay shaft journaled in said brackets substantially in alinement with said valves, cams carried by said lay shaft and jump rods slidably supported in engagement with the cams and in alinement with said valves.

6. In an internal combustion engine, the combination, with a split crank case and cylinders carried by one part of the same, the plane of separation of said crank case being generally transverse to the axis of the cylinders, of a crank shaft journaled in the part of said case farthest from said cylinders, reciprocable valves mounted at one side of said cylinders and substantially parallel therewith, a trough supported by the side of said crank case farthest from said cylinders, a lay shaft journaled in said trough, cams carried by said lay shaft within said trough, and valve lifters carried by said trough and coöperating with said cams, each of said valve lifters being operatively associated with one of said valves.

7. In an internal combustion engine, the combination, with a split crank case, a crank

shaft journaled in one half of said crank case, and cylinders carried by the other half of the case, the plane of separation of said case being generally transverse to the axis of said cylinders, of reciprocable valves mounted at one side of said cylinders and substantially parallel therewith, the side of said crank case carrying said cylinders being laterally enlarged upon the side of said valves for the reception of valve operating means, a lay shaft rotatably supported by the side of said crank case farthest from said cylinders, cams carried by said lay shaft, and valve operating means supported upon the same side of said crank case as the lay shaft and projecting into the enlarged portion of the other part of the crank case.

8. In an internal combustion engine, the combination, with cylinders and reciprocable valves mounted at one side of said cylinders and substantially parallel therewith, of a split crank case, one part of said crank case being connected with said cylinders and having a lateral enlargement upon the side adjacent said valve, a crank shaft journaled in the other half of said crank case, the plane of separation of said crank case halves being generally transverse to the axis of said cylinders, brackets carried by the half of said crank case farthest from said cylinders and projecting into the enlarged portion of the other crank case half, a lay shaft journaled in said brackets and substantially parallel with the crank shaft, sleeves supported by said brackets substantially in line with said valves, jump rods mounted in said sleeves and adapted to engage the stems of said valves, and cams carried by said lay shaft and adapted to reciprocate said jump rods.

9. In an internal combustion engine, the combination, with cylinders and reciprocable valves mounted at one side of said cylinders and substantially parallel therewith, of a split crank case, one part of said crank case being connected with said cylinders, and the plane of separation of said crank case halves being generally transverse to the axis of said cylinders, a crank shaft journaled in the other half of said crank case, brackets carried by the half of said crank case farthest from said cylinders and projecting into the other crank case half, an oil trough carried by said brackets, a lay shaft journaled in said trough and substantially parallel with the crank shaft, valve lifting devices carried by said trough in contact with the oil therein, and cams carried by said lay shaft and adapted to operate said valve lifting devices.

10. In an internal combustion engine, the combination, with cylinders and reciprocable valves for said cylinders, of a lay shaft at one side of said cylinders, a trough surrounding said lay shaft, cams carried by said shaft within said trough, longitudinally reciprocable valve operating members projecting into said trough into proximity to said cams, and means for maintaining said trough filled with oil whereby said cams and a portion of said valve operating mechanism will be continually submerged.

11. In an internal combustion engine, the combination, with cylinders and reciprocable valves for said cylinders, of a split crank case, one part of said case carrying the cylinders and the plane of separation of the case-parts being generally transverse to the axes of the cylinders, of a frame secured to the part of the crank case farthest from said cylinders, bearings carried by said frame, a lay shaft journaled in said bearings, cams carried by said shaft, and valve operating members carried by said frame and engaging said cams, said valve operating members being entirely independent of said case parts.

12. In an internal combustion engine, the combination, with cylinders and reciprocable valves for said cylinders, of a lay shaft at one side of said cylinders, a trough surrounding said lay shaft, cams carried by said shaft within said trough, longitudinally reciprocable valve operating members projecting into said trough into proximity to said cams, an oil pump, and connections between the oil pump and said trough whereby said trough is kept plentifully supplied with oil and said lay shaft and valve operating means continually submerged.

13. In an internal combustion engine, the combination, with cylinders and reciprocable valves for said cylinders, of a lay shaft at one side of said cylinders, a housing inclosing said lay shaft, cams carried by said shaft, valve operating members projecting into said housing and extending into proximity to said cams, an oil pump, and connections between said oil pump and the interior of said housing, said housing being formed with relief openings adjacent to said valve operating members for the overflow of oil therefrom.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

ARTHUR READ.

Witnesses:
ETHEL READ,
FERNE ANDERSON.