Sept. 22, 1925. 1,554,350

R. K. JACK

LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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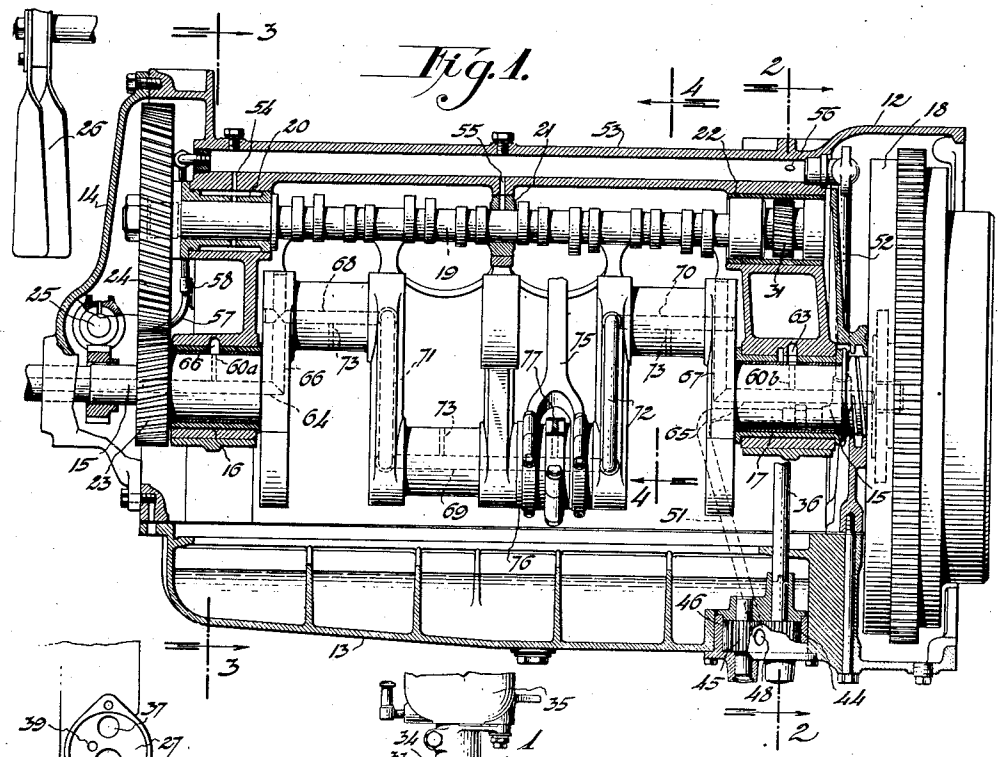

Fig. 1.

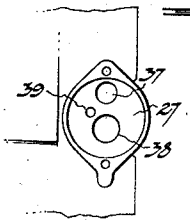

Fig. 5.

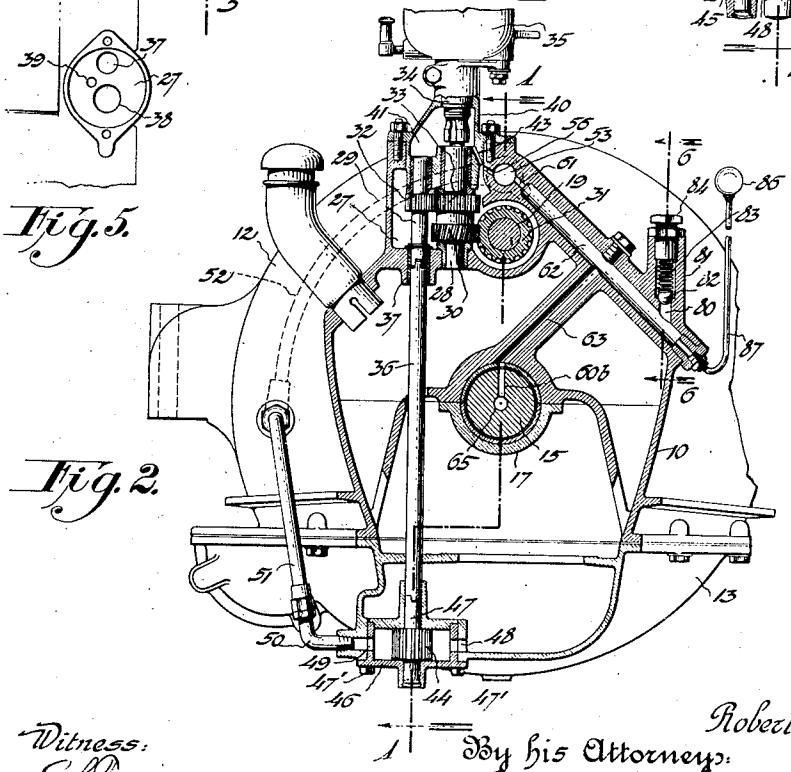

Fig. 2.

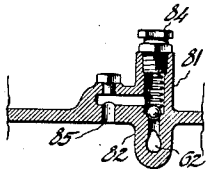

Fig. 6.

Witness:
G. L. Perna

Inventor:
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By his Attorneys:
Blackmore, Spencer & Blair

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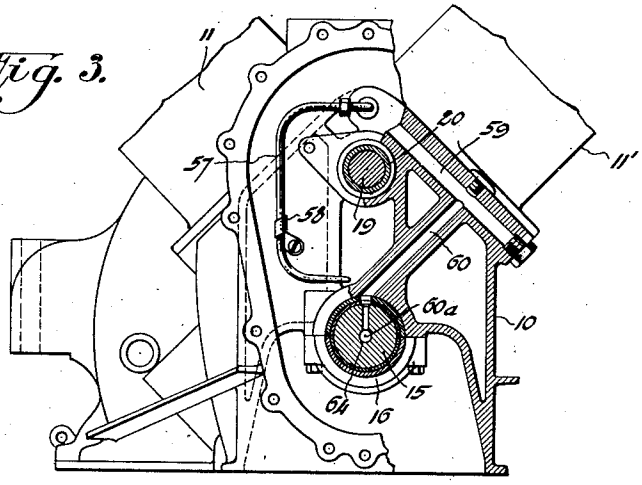
Fig. 3.



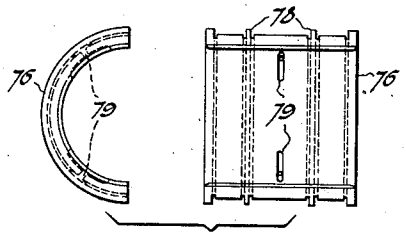


Fig. 7.

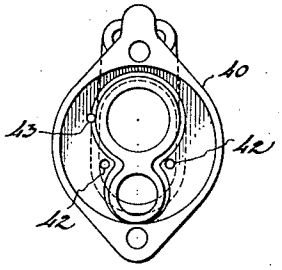


Fig. 8.

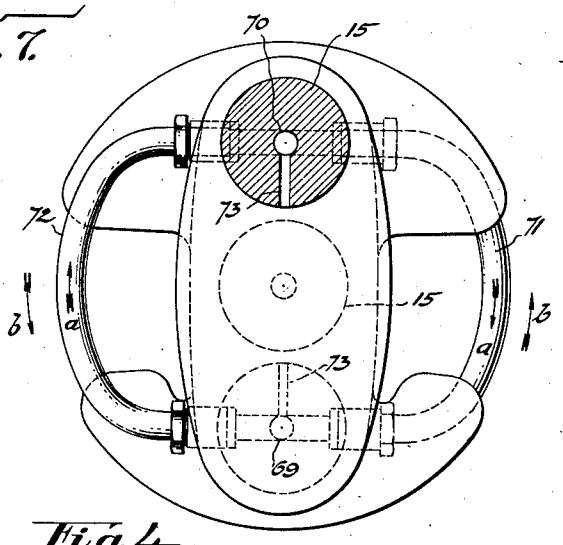


Fig. 4.

Witness:
H. L. Pena

Inventor:
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Patented Sept. 22, 1925. 1,554,350

UNITED STATES PATENT OFFICE.

ROBERT K. JACK, OF LANSING, MICHIGAN, ASSIGNOR TO GENERAL MOTORS CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF DELAWARE.

LUBRICATING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed September 2, 1921. Serial No. 497,956.

To all whom it may concern:

Be it known that I, ROBERT K. JACK, a subject of the King of Great Britain, and a resident of Lansing, county of Ingham, 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.

The invention relates to oiling systems for internal combustion engines and has for its principal object the provision of means whereby the distribution of lubricant to the bearings and other interengaging surfaces of the engine may be effectively maintained while the engine is in operation.

In the accompanying drawings illustrating one embodiment of the invention as applied to an eight-cylinder V-type engine.

Figure 1 is a vertical longitudinal section through an engine crank case; on line 1—1 of Figure 2.

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is an elevation of the front end of the crank case sectioned in part on line 3—3 of Figure 1;

Figure 4 is a view of the crank shaft taken on line 4—4, Figure 1.

Figure 5 is a plan view of a portion of the crank casing showing a chamber for the distributor and pump driving gears.

Figure 6 is a detail view on line 6—6 of Figure 2 showing a form of relief valve mechanism.

Figure 7 is a view showing in end and side elevation a connecting rod bushing, and

Figure 8 is a bottom plan view of a bracket for supporting the distributor and its driving shaft.

Referring to the drawings, 10 indicates an engine crank case of a character suitable for use in connection with V-type, eight-cylinder motor vehicle engines, two blocks of cylinders being indicated at 11, 11′, Figure 3. The crank case as illustrated comprises a bell housing 12 at what may be designated as the rear end, in accordance with the position in which such engines are usually mounted in motor vehicles. An oil pan 13 is secured to the bottom of the crank casing and a front cover 14 to the forward end. The crank shaft 15 is mounted in main front and rear bearings 16, 17, suitably formed in the webs of the crank case, a flywheel 18 being secured to the shaft at the rear end and enclosed within the bell housing 12. The cam shaft 19 mounted in bearings 20, 21, 22, is driven from the crank shaft by timing gears 23, 24.

In the front cover 14 may be mounted a transverse shaft 25 driven by suitable gearing from the crank shaft and adapted to actuate pumps or the like. A fan 26 mounted at the front end of the engine and driven in any usual or suitable manner serves to cause a flow of air over the engine and through a cooling fluid radiator, (not shown).

A chamber 27 is formed in the upper portion of the crank case adjacent to the cam shaft bearing 22, within which are mounted short shafts 28, 29. A gear 30 on shaft 28 is arranged to mesh with a gear 31 on the cam shaft 19. Gears 32, 33, on shafts 28, 29, respectively serve to drive shaft 29. Shaft 28 engages at its upper end the shaft 34 of the distributor 35, while shaft 29 engages at its lower end with pump shaft 36.

The pump driving shafts 29, 36, have a bearing in a hole 37 in the bottom wall of chamber 27, (see Fig. 5) and the distributor shaft 28 has a bearing in a second hole 38 in the said wall. A third hole 39 through the wall serves to drain oil from the chamber into the crank case.

The distributor and pump driving shafts are journalled at their upper ends in bearings in the lower wall of a bracket 40 in which, above the bearings, is formed a chamber 41. Holes 42 (Fig. 8) are formed through the bottom wall of this chamber to drain oil therefrom into the chamber 27, and a hole 43 extends into the chamber 41 through the bracket to feed oil thereto as hereinafter described.

A pump is provided to supply oil under pressure to the lubricating system, which pump, as shown, comprises gears 44, 45, mounted within a casing 46, gear 44 being arranged to be driven by a short shaft 47 having detachable driving connection to shaft 36. The casing 46 is mounted removably in an aperture in the bottom of oil pan 13, being secured by screws 47′, so that

the pump may be removed as a unit when it is desired to inspect or repair the same. Oil is supplied to the pump through a hole 48 from the oil pan and is discharged through a hole 49 leading through the pump casing and oil pan and into a pipe fitting 50.

The lubricant forced by the pump through the pipe fitting 50 is conveyed through pipe 51 which connects, through the wall of the bell housing 12, with the pipe 52 extending upwardly within the housing to a point near the top of the crank casing. At this point it is connected to a main reservoir in the nature of a tube 53 formed in the crank casing adjacent to the top thereof and centrally of the engine, where its walls will be subject to the cooling influence of the fan. This conduit or main because of its position and size serves to some extent as a cooling chamber for the lubricant contained therein. Furthermore, the position being above the level of the bearings of the engine is such that oil will feed therefrom to said bearings by gravity at times, when the pump is inoperative or ineffective to produce normal pressure.

The main or reservoir 53 extends substantially throughout the length of the engine, and passages 54, 55, lead therefrom directly to the cam shaft bearings 20, 21. Near the rear end a passage 56 permits flow of oil to the chamber 27 thus providing a bath of oil in which the distributor and pump driving gears run, delivering oil also through passage 43 to chamber 41, to lubricate the upper bearings in bracket 40. The oil bath also supplies oil to the cam shaft bearing 22. At the front end of main 53 is a pipe 57 attached to the front web of the crank casing, as by the clip 58, in position to deliver a constant stream of oil to the timing gears 23, 24. Passages 59, 60, drilled in the front web of the crank case lead from the reservoir 53 near its front end to the front crank bearing 16. A small hole 61 near the rear end of the reservoir also provides communication, through passages 62, 63 drilled in the rear crank casing web, with the rear bearing 17, the purpose of which will be presently described.

The lubrication of the crank pin bearings as well as of the pistons and piston pin bearings is accomplished by supplying oil through the crank shaft from the main bearings. For this purpose, the crank shaft is provided with radial holes 60^a, 60^b, adapted to communicate respectively with the passages 60, 63, and with a conduit extending throughout the length of the crank shaft between the two main bearings. This conduit comprises the passages 64, 65, positioned axially of the shaft bearings, passages 66, 67, drilled radially in the end cheeks, passages 68, 69, 70 along the axes of the crank pin journals, and pipes 71, 72, in the planes of the intermediate cheeks. Pipe 71 connects the passages 68 and 69 while pipe 72 connects passages 69 and 70. Oil holes 73 are drilled radially in the crank pin journals to the passages 68, 69 and 70, respectively, to supply oil to the crank pin bearings. The excess of oil supplied to these bearings is thrown off by centrifugal action and a portion of it is deposited on the pistons and cylinder walls, thereby serving to lubricate the pistons and piston pin bearings.

It will be noted that the oil feed holes 73 are located on the inside of the crank pin journals, i. e., on the side toward the axis of the shaft. I have found by experience that when these holes are placed upon the outside of the pins the oil is forced out by centrifugal force at such a rate that an excess of oil is thrown into the cylinder bores thereby causing waste of oil and fouling due to excessive carbon deposits. Furthermore, the oil fed to the bearing, being already at the point farthest removed from the axis of rotation, tends to flow directly to the edge of the bearing by reason of centrifugal force, and is not properly distributed over the bearing area. By locating the oil holes on the inside of the journals the effect of centrifugal force in ejecting the oil is partially neutralized while still permitting the flow necessary to properly lubricate the crank pin bearings and to provide an oil mist thrown from the bearings sufficient to insure proper piston lubrication. The distribution over the bearing surfaces of the crank pin is also greatly improved since the effect of centrifugal force is to spread the oil over the journal in its tendency to reach the point farthest from the axis.

The connecting rods, which, for corresponding pairs of cylinders are preferably in the same plane, may be arranged as shown in Figure 1, the forked rod 75 being mounted upon and secured to a bushing 76 engaging directly with the crank pin and the blade rod 77 having a bearing upon the bushing between the flanges 78 thereof, (Fig. 7). Holes 79 are provided in the bushing 76 and positioned at points other than those upon which the greatest pressure is exerted in the operation of the engine thus avoiding the obstruction of the flow of oil to the blade rod bearing by reason of pressure between the rod and bearing.

The small passage 61 permits the flow of a small quantity of oil directly from the main 53 to the rear crank shaft bearing 17, thus insuring the proper lubrication of this bearing when the engine is being started. The small amount of oil flowing through this passage will find its way along the oil conduit or passages in the crank shaft until it meets the main body of oil flowing nor-

mally in the opposite direction with which it will merge without materially affecting the normal flow.

The oil escaping normally from the passage 60b after lubrication of bearing 17 will flow by way of passages 63, 62, to the discharge conduit 80 whence it returns to the crank case through the relief valve 81. This valve comprises, as shown in Figs. 2 and 6, a spring ball valve 82 opening against the pressure of a spring 83 adjustable by a screw plug 84. The oil escaping through the valve returns to the crank case through the passage 85.

A pressure gage of ordinary type, indicated at 86, may be connected to the system beyond the last bearings to be lubricated, as by a pipe 87 communicating with passage 62.

The pipes 71, 72, will be preferably so mounted that the portions of the oil conduit provided thereby will extend circumferentially of the shaft and at substantially the same distance from the axis of the shaft as are the axes of the crank pins. By this means the passage of the oil conduit back and forth across the axis of the shaft is avoided and the interference of centrifugal force with the free flow of oil is eliminated. Furthermore, the pipes are preferably so arranged that the normal direction of rotation of the shaft, indicated by arrows *b*, Figure 4, is opposite to the direction of flow of oil in the pipes, indicated by arrows *a*, by which arrangement I have found that the flow of oil along the shaft is facilitated.

While I have described herein the preferred embodiment of the invention it will be understood that many variations may be made in specific details without departing from the spirit and scope of the invention and therefore I do not wish to be limited to the specific structure herein described except as required by the language of the appended claims in view of the prior art.

I claim:

1. In a lubricating system for an internal combustion engine having a crank case and blocks of cylinders mounted thereon in V relation, a cam shaft and a crank shaft both located within said crank case, the combination of a lubricant reservoir in the upper part of said crank case between said blocks and formed in the wall of said crank case, means for supplying oil under pressure to said reservoir, and means for feeding oil directly from said reservoir to the bearings of said cam shaft and crank shaft.

2. In a lubricating system for an internal combustion engine having a crank case and blocks of cylinders mounted thereon in V-relation, a cam shaft and a crank shaft both located within said crank case, and connecting rods thereon suitably connected with said crankshaft and to pistons in the cylinders of said blocks, the combination of a lubricant reservoir in the upper part of said crank case between said blocks and formed in the wall of said crank case, means for supplying oil under pressure to said reservoir, and means for feeding oil directly from said reservoir to the bearings of said cam shaft and crankshaft and from the bearings of said crankshaft to the bearings of said connecting rods.

3. In a lubricating system for internal combustion engines having crank shaft and cam shaft bearings and distributor, pump and timing gears, a lubricant conduit, means for supplying lubricant under pressure to said conduit, a chamber for distributor and pump gears, and means for feeding lubricant from said conduit to said chamber, to the cam shaft bearings, to the timing gears, and to the crank shaft bearings.

4. In a lubricating system for internal combustion engines having a crank shaft with connecting rod bearings thereon, crank shaft and cam shaft bearings and distributor and pump gears, a lubricant conduit, means for supplying lubricant under pressure to said conduit, a chamber for said distributor and pump gears, and means for feeding lubricant from said conduit to said chamber, to the cam shaft bearings, to the crank shaft bearings, and through the crank shaft to the connecting rod bearings.

5. In a lubricating system for internal combustion engines having a crank shaft and front and rear crank shaft bearings the combination of a reservoir situated above the level of the engine bearings, means for supplying lubricant to said reservoir, a relief value, and a conduit leading from said reservoir to the front crank shaft bearing, thence along the shaft to the connecting rod bearings, thence to the rear crank shaft bearing, and thence to said relief valve.

6. In a lubricating system for an internal combustion engine having a crank case, a crank shaft and bearings therefor, a lubricant conduit leading to one of said bearings and thence through the crank shaft to another of said bearings, an outlet for said conduit to the crank case beyond the last-mentioned bearing, and pressure actuated means for controlling flow of lubricant through said outlet, said means constructed and arranged to be adjusted from the exterior of the crank case.

7. In a lubricating system for internal combustion engines, the combination of a pump, a distributor, a chamber, gears and shafts for driving said distributor and pump mounted in said chamber, means for driving said gears, and means for supplying lubricant to said gears and shafts.

8. In a lubricating system for internal combustion engines, the combination of a chamber formed in the crank case, a pump, a dis-

tributor, gears and shafts for driving said distributor and pump mounted in said chamber, means for driving said gears from the cam shaft, and means for supplying lubricant to form an oil bath in said chamber.

9. In a lubricating system for an internal combustion engine of the V-type having a crank case and a fan for the cooling system thereof, a lubricant conduit formed within the upper wall of the crank case and extending longitudinally between the cylinder blocks, said conduit positioned to permit the air current from said fan to pass directly over the outer wall thereof.

In testimony whereof I affix my signature.

ROBERT K. JACK.