Oct. 11, 1960 C. B. LEACH 2,955,675

ENGINE LUBRICATING SYSTEM

Original Filed June 17, 1954 4 Sheets-Sheet 1

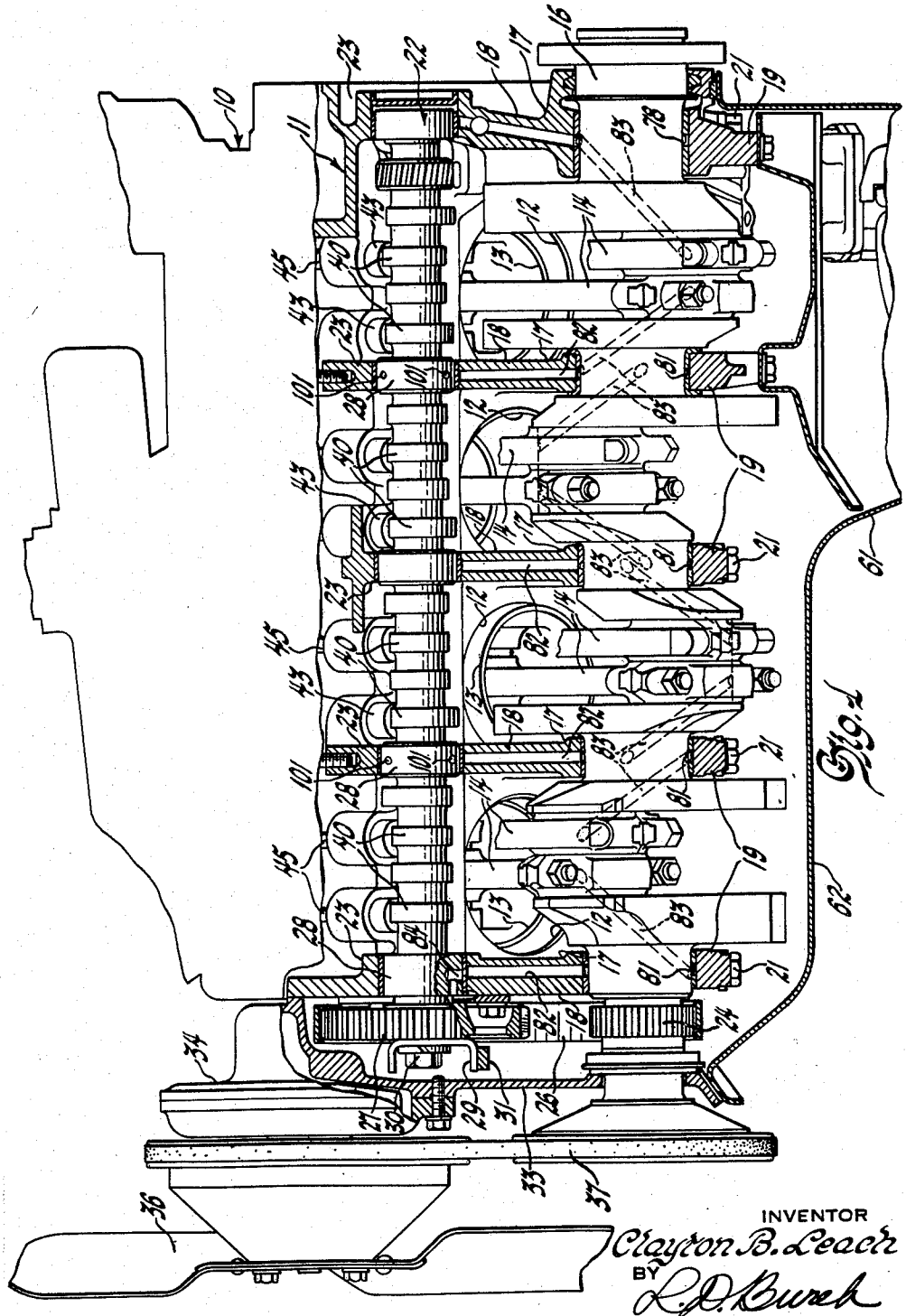


Fig. 1

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Original Filed June 17, 1954 4 Sheets-Sheet 2

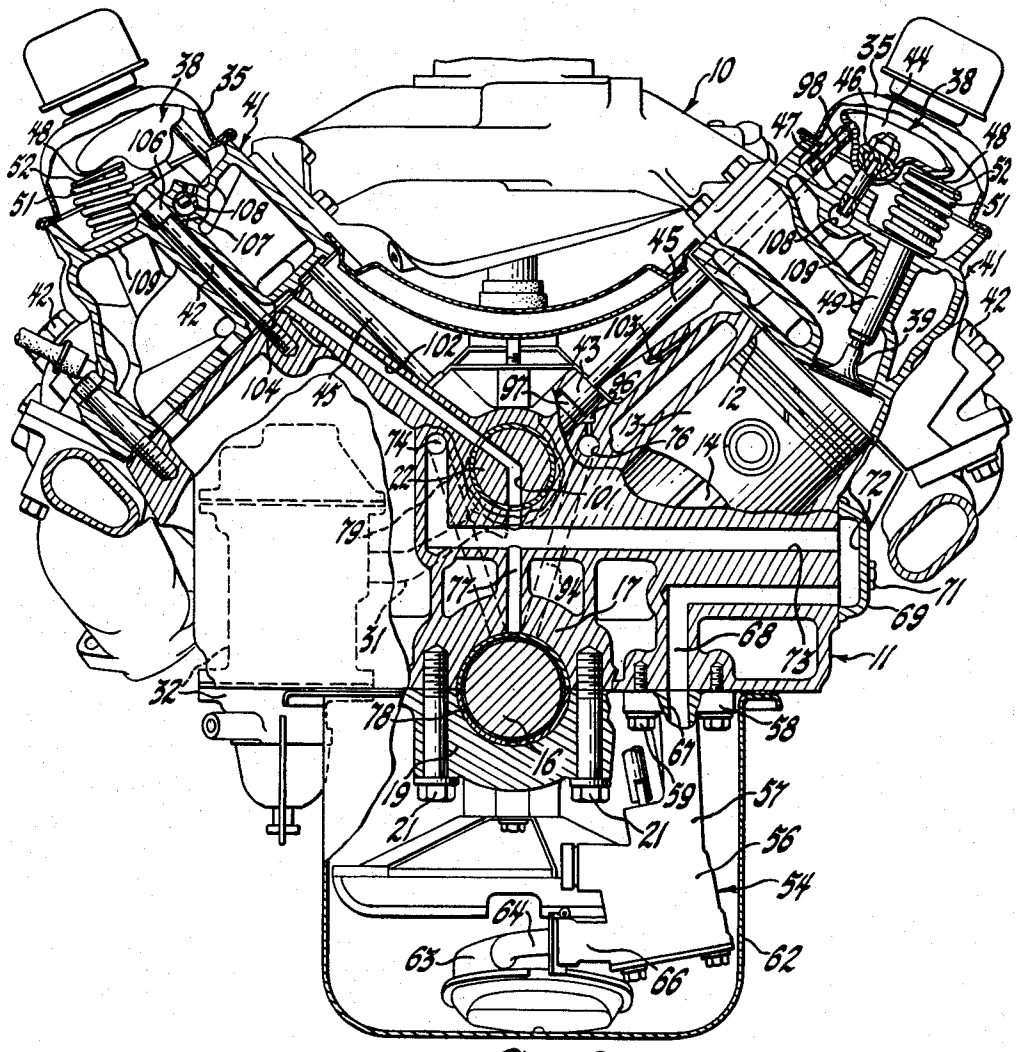


Fig. 2

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Original Filed June 17, 1954 4 Sheets-Sheet 3

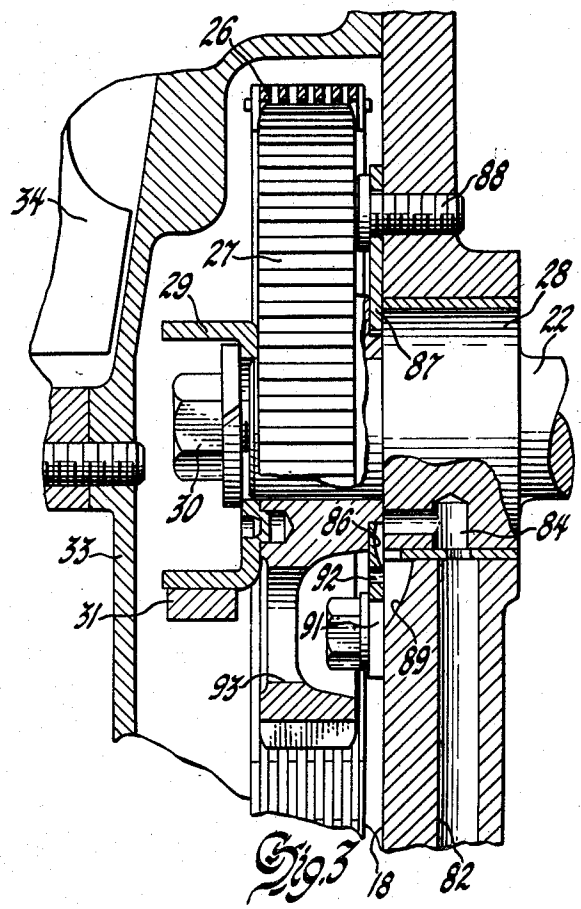


Fig. 3

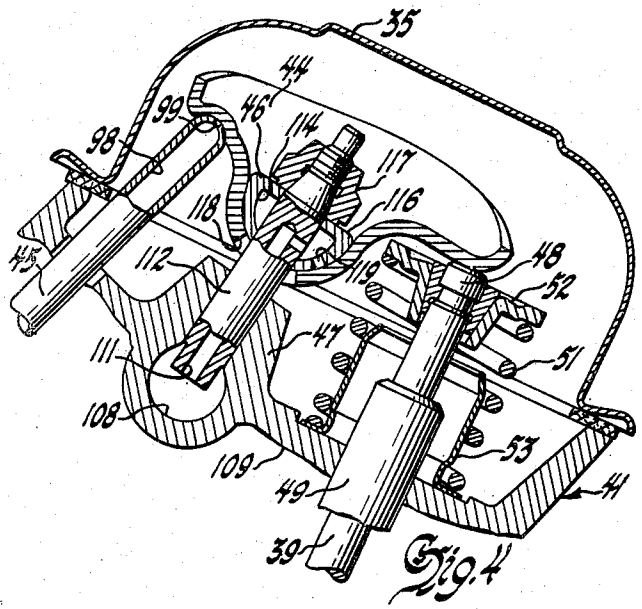


Fig. 4

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ENGINE LUBRICATING SYSTEM

Original Filed June 17, 1954 4 Sheets-Sheet 4

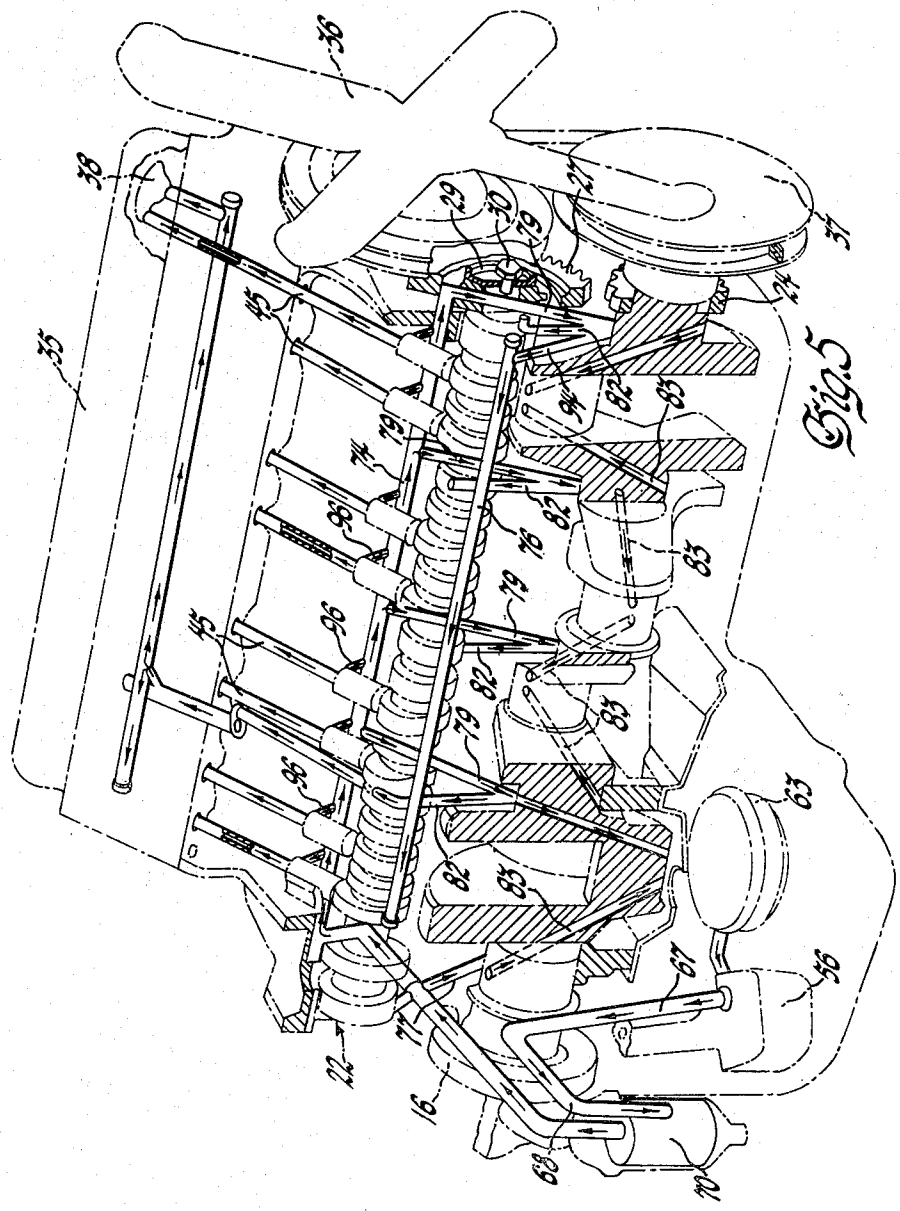


Fig. 5

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ENGINE LUBRICATING SYSTEM

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Original application June 17, 1954, Ser. No. 437,503, now Patent No. 2,865,361, dated Dec. 23, 1958. Divided and this application May 6, 1957, Ser. No. 657,169

3 Claims. (Cl. 184—6)

This application is a division of application S.N. 437,503, filed June 17, 1954, now Patent No. 2,865,361, for engine lubricating systems in the name of Clayton B. Leach.

This invention relates to engines and has particular relation to lubrication systems for internal combustion engines for automotive and other uses.

It is customary to lubricate conventional internal combustion engines for automotive purposes by employing forced feed lubrication systems which supply oil to the principal moving parts of the engines. In the present instance, however, the engine is not of conventional design and has many greatly improved features for which lubrication systems as heretofore employed are considered inadequate.

The present invention provides an improved engine in which an improved lubricating system is embodied.

In the engine embodying the invention the oil pump is mounted in a unique and more accessible manner and in a position in which it is possible to remove the bearing cap for the rear main bearing of the engine without first removing the oil pump. To accomplish this end it has been found necessary to redesign the pump casing and to provide an oil pan for closing the lower part of the crankcase that is wider on one side of the engine crankshaft than the other.

The engine is also provided with a unique means for driving the engine camshaft and the fuel pump. This means comprises a separately constructed casting and stamping which can be easily assembled on the end of the camshaft. Bifurcated jet means is provided for lubricating the two means embodied in the drive means and oil is intermittently supplied to the jet means by an arrangement of rotating ports located at opposite ends of a passage formed in an adjacent part of the camshaft.

The engine also embodies novel valve actuating means each pivotally and independently mounted on the heads of the engine. One part of the valve actuating means is lubricated by oil under pressure continuously supplied thereto. Another part of the valve actuating means is lubricated by oil under pressure intermittently supplied thereto.

In the drawing:

Figure 1 illustrates a longitudinal sectional view through the lower part of an engine embracing the principles of the invention. The upper part of the engine is indicated in outline.

Figure 2 is a rear end elevational view of the engine disclosed by Figure 1 with parts thereof broken away in different planes and illustrated in cross section to better illustrate the principal features of the invention.

Figure 3 is a fragmentary cross sectional view of the engine illustrating the camshaft and fuel pump drive and the lubricating means therefor.

Figure 4 is a fragmentary cross sectional view illustrating a part of the valve operating mechanism for the engine and the lubrication means therefor.

Figure 5 is a phantom view of the engine illustrating the lubrication system therefor in full line perspective view.

Referring particularly to Figures 1 and 2 the engine 10 comprises a frame or block 11 having rows of cylinders 12 arranged therein at 90°. The cylinders receive reciprocating pistons 13 which are connected by connecting rods 14 to a crankshaft 16 rotatably mounted in the frame 11 in bearings 17. The bearings 17 are formed in transverse walls 18 formed throughout the length of the frame 11 and in spaced relation to one another. The bearings 17 include bearing caps 19 secured by bolts 21 to the lower edges of the transverse walls 18.

The engine has a camshaft 22 which is mounted in bearings 23 formed in the frame 11 directly above the crankshaft 16 and between the rows of cylinders 12. The camshaft 22 is driven by a gear 24 on the front end of the driveshaft 16. The gear 24 drives a chain 26 which in turn drives a drive gear 27 secured on the front end of the camshaft 22. The gear 27 is a cast gear secured on the reduced end of the camshaft 22 beyond the front camshaft bearing 28. Also secured on the reduced end of the camshaft 22 and beyond the gear 27 is an eccentric cam 29 for driving a lever 31 employed in operating a fuel pump 32 secured on one side of the engine 10 to a side wall of the timing gear cover 33. The timing gear cover 33 also supports a water pump 34 and a fan 36, the two being driven by the crankshaft 16 through a belt and pulley drive 37. The eccentric 29 and the gear 27 are secured to one another and to the reduced end of the camshaft 22 by a nut and washer fastening means indicated at 30.

The camshaft 22 drives the valve actuating mechanism 38 for operating the valves 39 which are arranged in rows in the heads 41 for closing the outer ends of the cylinders 12. The heads 41 are secured to the block of the engine by bolts 42 which project through openings in the heads and into threaded openings extending within the upper wall of the engine block. The valve actuating mechanism 38 comprises valve lifters 43 which are slidably mounted in openings formed in the frame 11 adjacent the camshaft 22. The lifters 43 ride on cams 40 which are formed on the camshaft 22 at intervals throughout the length thereof. The lifters 43 actuate hollow push rods 45 which project through openings in the heads 41 and within the valve actuating mechanism compartments beyond the heads 41. The compartments are closed by covers 35 secured by any suitable means to the heads 41. The push rods 45 actuate rocker arms 44 which are pivotally mounted on the heads by pivot means indicated at 46. One of the pivot means 46 is employed for each of the rocker arms 44. The pivot means may be press fitted or otherwise secured in sockets or openings formed in bosses 47 projecting from the upper walls of the heads 41. The ends of the rocker arms opposite the push rods 45 engage valve stems 48 for the valves 39. There are two of the valves 39 for each cylinder 12 of the engine 10. Also there are two of the valve actuating mechanisms 38 for each cylinder of the engine, there being one of the valve actuating mechanisms 38 for the inlet valve and one for the exhaust valve for each cyinder 12 of the engine 10. The springs 51 may be mounted in valve stem guides 49 which may be constructed in any suitable manner, either as separate elements as shown or as integral parts of the heads 41. The valves 39 may be resiliently retained in closed position by valve springs 51 which are adapted to be compressed between spring retaining washers 52 and the outwardly flanged ends of spring dampeners 53. The spring dampeners project inside the springs 51 and are seated on the upper walls of the block 41 around the valve guide 49 and valve stems 48.

Oil under suitable pressure may be supplied to the

lubrication system of the engine by a pump 54 having a pump casing 56 with an elongated upwardly projecting support means 57 formed thereon. The support means 57 is flanged at the upper end thereof at 58 and is adapted to be secured rigidly to the lower edge of the rear wall 18 of the frame 11 by screws indicated at 59. The lower end of the pump 54 is adapted to extend downwardly into the enlarged and downwardly projecting rear end 61 of an engine oil pan indicated at 62. The pump 54 is adapted to be supplied with oil by a pump screen float means 63 having an outlet conduit 64 adapted to be pivotally mounted within the pump inlet connection 66. The pump 54 is adapted to be connected directly to the lower edge of the rear wall 18 of the frame 11 at one side of the rear main bearing cap 19. It will be apparent from this construction that the main bearing caps 19 and the crankshaft 16 can be entirely removed from the engine without interfering with the oil pump 54. The oil pan 62 is secured to the lower part of the frame 11 to close the crankcase of the engine and is secured to the frame 11 in such manner that the side walls of the oil pan are spaced unequally on opposite sides of the axis of rotation of the crankshaft 16. The side wall of the oil pan 62 which is disposed at the greatest distance from the axis of rotation of the crankshaft 16 is on the side of the engine receiving the oil pump 54 to provide room for securing the oil pump to the frame at one side of the rear main bearing cap 19.

The pump 54 supplies oil under pressure to the various moving parts of the engine 10 through an outlet passage 67 leading from the casing 56 and communicating with an oil passage 68 formed in the rear wall 18 of the frame 11. The passage 68 terminates in a side wall of the engine and there may communicate with the interior of a cap 69 which may be removably secured to the frame 11 by bolts indicated at 71. The cap 69 provides a passage 72 leading upwardly along the side wall of the frame and communicating with the end of an oil passage 73 which is also formed in the rear wall 18 of the frame 11. The cap 69 may be removed if it is desired to use an oil filter and the oil filter may be connected to the side wall of the frame with the support therefor secured to the frame by employing the same openings adapted for receiving the bolts 71. The oil filter may have inlet and outlet passages communicating with the passages 68 and 73 respectively.

The opposite end of the passage 73 terminates at the rear end of one of the two oil galleries indicated at 74 and 76. The oil galleries 74 and 76 are adapted to extend throughout substantially the entire length of the engine frame, in spaced relation to one another, on opposite sides of the camshaft 22 and between the valve tappets 43 and the lower ends of the cylinders 12. The rear main bearing of the crankshaft 16 and the rear bearing of the camshaft 22 are lubricated by an oil passage 77 which is formed in the rear wall of the frame, in such a way as to intersect the passage 73. The lower end of the passage 77 communicates with an oil groove 78 in the rear main bearing while the upper end thereof opens into the bearing surface of the rear camshaft bearing. The remaining main bearings of the crankshaft 16 are lubricated by oil supplied by passages 79 which are formed in the walls 18 obliquely and downwardly from the gallery 74. The lower ends of the passages 79 communicate with grooves 81 formed peripherally around the inside surfaces of the bearing bushings. The bearings for the connecting rods 14 are lubricated by obliquely disposed passages 83 which extend between the connecting rod bearings and the main bearings 17. The passages 79 also merge with vertically disposed passages 82 which also are formed in the walls 18. The upper ends of the passages 82 terminate in the bearing surfaces of the camshaft in all of the bearings 23 except the rear bearing for the camshaft. The ends of the passages 83 are continuously supplied with oil by the grooves 78 and 81 in the inner surfaces of the bushings for the main bearings of the crankshaft 16.

The driving means 27 and 29 for the camshaft 22 and the fuel pump 32 respectively is supplied with oil by the vertical passage 82 in the front wall 18 of the frame 11. This passage is adapted intermittently to communicate with an inlet port at the end of a rotating passage 84 which is formed in the front bearing of the camshaft 22 in such a way as to communicate with both the peripheral and end surfaces thereof. Disposed beyond the end of the front bearing 28 of the camshaft 22 is a chamber 86 which is formed in a plate 87 secured by bolts 88 to the front wall of the frame 11. The plate 87 projects into an annular groove formed in the end of the hub of the gear 27 adjacent the end of the front bearing 28 and provides a thrust bearing for the camshaft 22.

It will be apparent that the rotation of the camshaft 22 and the passage 84 will cause the ports forming the opposite ends of the passage 84 to communicate with the passage 82 in the front wall 18 and the chamber 86 simultaneously and once during each revolution of the camshaft 22. A slot 89 is also formed in the front bushing and bearing support for the front bearing of the camshaft 22 in such manner as to extend downwardly along the front of the front wall 18 and to terminate in a slot 91 formed immediately opposite thereto and across the lower edge of the plate 87. The rear wall of the slot 89 is curved as indicated in Figure 3 and in such manner that the lower end thereof opposite the slot 91 is directed toward the lower part of the gear 27. The upper end of the slot 89 communicates with the chamber 86 and is intermittently supplied with oil by the rotation of the passage 84 in the camshaft 22. The plate 86 also is provided with a transverse opening 92 which communicates with the upper part of the slot 89 and is directed toward the lower part of the eccentric 29 and the end of the lever 31. The gear 27 is formed to provide a plurality of openings 93 between the hub and the rim thereof so that as the gear rotates oil will be supplied through the opening 92 that is directly opposed to one of the openings 92 when oil is intermittently supplied to the chamber 86 by rotation of the passages 84. It will be apparent that the lower extremity of the slot 89 and the passage 92 form jet means for intermittently supplying oil for lubricating the timing gear 27 and timing chain 26 and the eccentric 29 and lever 31. It will be apparent that the oil intermittently supplied to the chamber 86 also will lubricate the thrust bearing formed by the plate 87 between the hub of the gear 27 and the end of the front camshaft bearing 28.

The front end of the oil gallery 76 also communicates with the lower end of the passage 79 in the front wall 18 of the frame 11 through a passage 94 which extends obliquely upwardly from the junction between the passages 82 and 79 at the front bearing of the camshaft 16. It will be apparent that oil will circulate forwardly in the gallery 74, downwardly through the passage 79 in the front wall of the block, upwardly through the passage 94 and rearwardly through the gallery 76.

The valve tappets 43 are lubricated by the oil galleries 74 and 76 through passages 96 formed in the frame 11 and through annular grooves 97 formed in the outer surfaces of the tappets. The grooves 97 communicate with the oil chambers within the tappets through suitable radial openings formed in the tappet walls. The chambers within the tappets 43 also communicate with passages 98 formed in the push rods 45. The passages 98 terminate in openings 99 in the spherically formed upper ends of the push rods 45 which are adapted to be seated in spherically formed sockets in the ends of the rocker arms 44.

It will be apparent that oil under pressure will be continuously supplied to the tappets 43 by the galleries 74 and 76 and the oil from the tappets 74 and 76 will be

continuously supplied to the sockets in the rocker arms **44** through the openings **99**.

The second and the fourth bearings **28** of the camshaft **22** also are provided with angular passages **101**, the opposite ends of which form ports terminating in the bearing surfaces of the camshaft. The two passages **101** are constructed in the same angular relation so that when one end of each passage is directed downwardly the opposite ends will be directly obliquely upwardly in the same direction. Formed in the inside wall of each bank of cylinders of the engine are passages **102** and **103**, the lower ends of which terminate in the second and fourth bearings of the camshaft **22** and in such position as to register with the passages **101** in the camshaft **22** as the camshaft **22** rotates. Since the camshaft **22** rotates only one-half as fast as the crankshaft **16** it will be apparent that the passages **102** and **103** will be supplied with oil by the passages **101** only once during each two revolutions of the crankshaft **16**. If one of the passages **101** is communicating with the passage **102** it will be apparent that the other of the passages **101** will not communicate with the passage **103** until the camshaft **22** is rotated 120° in a counterclockwise direction. However, each passage **101** will communicate with one of the passages **102** or **103** once during each revolution of the camshaft **22**. When the passages **101** communicate with either of the passages **102** or **103** the ports at the lower ends of the passages **101** will communicate with the oppositely disposed passages **82** which supply oil to the second and fourth bearings of the camshaft **22**. The upper ends of the passages **102** and **103** communicate with cavities **104** formed around the lower ends of two of the bolts **42** which are employed in securing the heads **41** upon the block of the engine. The bolt holes for the two bolts **42** are considerably enlarged to provide passages around the bolts and the lower ends of which communicate with the cavities **104**. The two bolts **42** at the upper ends thereof adjacent the heads of the bolts are provided with enlarged ends **106** which close the enlarged holes receiving the bolts to prevent the escape of oil to the upper surface of the heads. Below the enlarged ends **106** of the bolts **42** the enlarged bolt holes communicate through passages **107** with elongated passages **108** formed in the upper walls **109** of the heads **41** and extending substantially throughout the length thereof. The passages **108** are directly below the pivot means **46** for supporting the rocker arms **44** and communicating with passages **111** formed in studs **112** which form a part of each of the pivot means **46**. The studs **112** are adapted to be secured in bosses **47** which project upwardly from the upper walls **109** of the heads **41**. The upper ends of the passages **111** communicate with cavities **114** formed in hemispherical bearings **116** which are secured by nuts **117** on the upper ends of the studs **112**. The hemispherical bearings engage hemispherical bearing surfaces formed in the rocker arms **44** around openings **118** through which the studs **112** project.

It will be apparent that the passages **108** are intermittently supplied with oil from the lubricating system of the engine once during each revolution of the camshaft **22** and that one of the passages **108** will be so supplied 120° ahead of the other passage **108**. The oil which is so intermittently supplied to the passages **108** and the cavities **114** will be supplied to the bearing surfaces between the hemispherical bearings **116** and the rocker arms by openings indicated at **119**.

I claim:

1. An internal combustion engine comprising an engine frame formed to provide a transverse wall and a cylinder, said transverse wall having a lower edge formed to provide a plane surface, bearing means associated with said transverse wall and having a bearing cap secured to said lower edge of said transverse wall and on one part of said surface, a crankshaft having a journal mounted in said bearing means, a piston in said cylinder and connected to said crankshaft, an oil pump having a pump casing formed to provide an inlet and an outlet, said pump casing being secured at said outlet to said lower edge of said transverse wall and at one side of said bearing cap and on another part of said surface, lubricating passage means formed in said frame and communicating with said outlet, said lubricating passage means terminating within and intersecting said another part of said surface of said transverse wall engaging and supporting said pump casing, means separately securing said pump casing and said bearing cap to said transverse wall, said bearing cap and said pump casing each being independently removable from said transverse wall by operation of said means, and an oil pan secured to said frame and enclosing said bearing cap and said pump and having an oil sump formed therein in open communication with said pump casing inlet.

2. An internal combustion engine as defined by claim 1 and in which said frame has other lower edges around said lower edge of said transverse wall and to which said oil pan is removably secured, said other lower edges of said frame being in the plane of the axis of said crankshaft and of said plane surface.

3. An internal combustion engine as defined by claim 1 and in which said oil pan is wider on one side of a vertical plane through the aix is of rotation of said crankshaft than on the other, said wider side of said oil pan being formed to accommodate said oil pump at one side of said bearing cap.

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