April 30, 1963 D. V. POTTER 3,087,582

ENGINE LUBRICATING APPARATUS

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Fig. 1

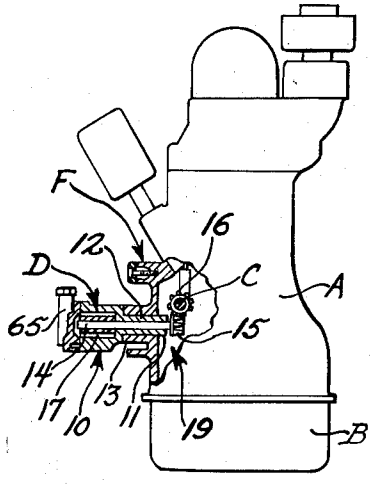

Fig. 2

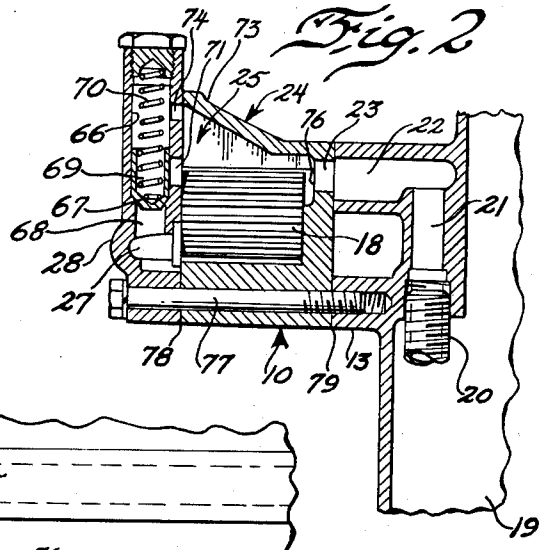

Fig. 3

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Fig. 4

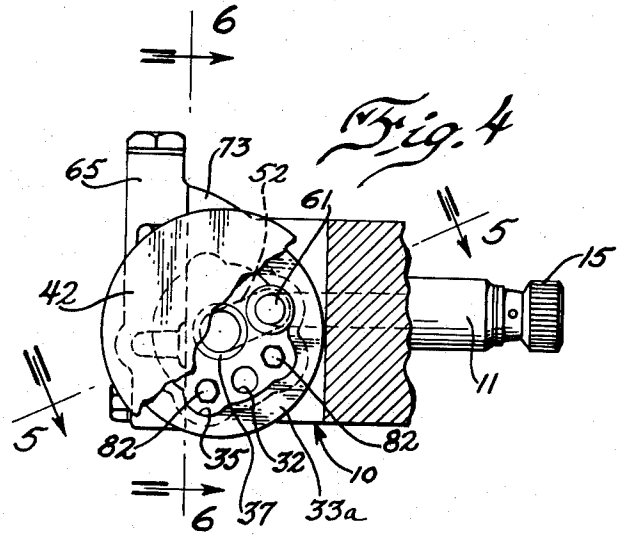


Fig. 5

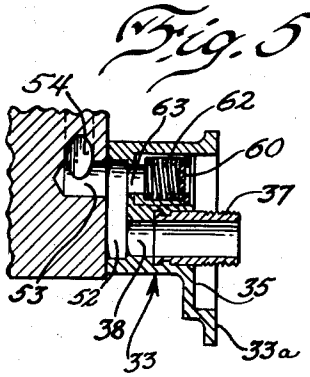
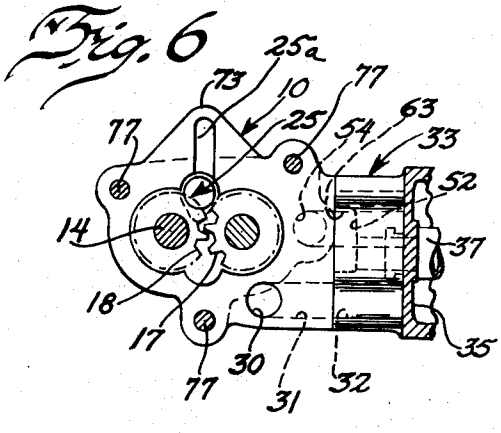


Fig. 6



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3,087,582

ENGINE LUBRICATING APPARATUS

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5 Claims. (Cl. 184—6)

The invention relates to a lubrication system for an internal combustion engine and to the pumping and filtering mechanism forming a part of such system.

One object of the invention is to provide an arrangement of castings suitably cored to provide the necessary passages for accommodating a pumping mechanism and a full flow filtering mechanism free of exterior piping and both situated externally of the cylinder block.

Another object is to provide a suitable casting arrangement wherein the filtering device is situated close to the pressure source so that any cold weather bypassing will not pick up friction from the walls of the drilled or cored holes with its resulting build up of pressure against the pump gears.

A further object is to provide in a lubricating system, an externally located pump in association with an appropriate adapter casting and filtering device wherein all coring and machining for such filter and adapter are done in the pump casting and adapter casting and wherein any foundry or machining scrap will be concentrated in a smaller and less expensive item than the crankcase of the engine.

Another object is to provide an externally situated pump device employing a relief valve built into the pump cover casting and thereby according pressure relief means for the pump. In this respect, the pump housing is provided with an appropraite narrow pocket for communicating with the relief valve chamber to permit return of oil to the low pressure side of the pump under undue pressure conditions thereby assuring a more satisfactorily operating pump.

Other objects and advantages of the invention will be apparent from the ensuing specification and appended drawings in which:

FIG. 1 is a generally schematic and elevational view of an internal combustion engine showing in sectional detail on a reduced scale a portion of the lubricating system, which portion is taken on the line 1—1 of FIG. 3.

FIG. 2 is a fragmentary sectional view of a portion of the lubricating system taken on the line 2—2 of FIG. 3.

FIG. 3 is a side elevational view of the major portion of the lubricating system. Portions of the system are broken in section at different levels in order to better illustrate the passage arrangements.

FIG. 4 is a fragmentary end view of the components shown in FIG. 3 with a portion of the filtering unit removed to reveal the end face of the filter adapter casting and associated parts.

FIG. 5 is a fragmentary sectional view taken on the line 5—5 of FIG. 4 with the filtering unit removed.

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 4, the cylinder block not being shown.

Referring to FIG. 1, there is shown schematically a typical internal combustion engine including the engine cylinder block A to the underside of which the crankcase pan B is secured. A cam shaft C, driven by the crankshaft (not shown) in a conventional manner serves to drive the pumping mechanism D which forces the engine lubricating oil through a filtering unit E (see FIG. 3) from whence the oil is directed to the conventional oil gallery F in the cylinder block. Thus, the oil is pressurized by the pump for distribution to the various parts of the engine from the oil gallery F.

The pump casting 10 has a diametrically reduced cylindrical end portion 11 which is recieved within a suitable bore 12 in the boss portion 13 of the cylinder block. The pump drive shaft 14 has a gear 15 at one end meshing with a gear 16 on the cam shaft for driving pump gear 17. The idler gear 18, of course, forms the second gear of the pumping mechanism. The oil pump, through displacement, causes atmospheric pressure within the crankcase 19 to force the oil from the oil pan reservoir B up through the inlet tube 20 into the low pressure side of the pump.

Referring to FIG. 2, the oil travels up through tube 20, passages 21 and 22 in the block boss 13, thence through port 23 in the pump housing 24 into the chamber area 25, which is the low pressure side of the pump.

The rotating pump gears carry the oil between the gear teeth and pump body to the discharge or high pressure side of the pump from whence the oil is then directed toward the filtering unit E. On the high pressure side of the pump the oil is forced into the chamber 27 in the pump housing cover casting 28 from whence the oil is directed through transfer passage 29 which is formed in the pump housing cover (see FIG. 3.) The pressurized oil then travels through a transverse passage 30 which is formed in the pump housing and which opens into the pump housing cover passage 29. The pump housing passage 30 opens into a laterally directed passage 31 (see FIGS. 3 and 6) formed in the pump housing and terminates at the end face 31*a* thereof. From passage 31 the oil travels through passage 32 in the adapter casting 33. When the adapter casting is anchored to the pump housing casting, the passages 30 and 31, of course, are in registry. Passage 32 opens into an enlarged chamber 35 formed in the generally bell-shaped end portion 36 of the adapter casting.

A cylindrical connector sleeve 37 is anchored in the passage 38 of the adapter casting and is externally threaded at its outer end. The base plate 40 of the filtering unit is threaded onto the connector and a suitable gasket 41 assures liquid tight connection between the filtering unit container 42 and the end face 33*a* of the adapter casting. The filter cartridge assembly 43 has its base plate 44 guided onto the connector under tension of spring 45. The pressurized oil travels through a series of annularly arranged ports 46 formed in the base 40 and into the annular chamber 47 formed between the inner wall of the container 42 and the outer wall of the cylindrical filter cartridge 48 and thence through the filtering material, then through openings 50 in the cylindrical central supporting tube 51. The filtered oil then travels through the hollow connector 37, passage 38 and then into the transverse transfer passage 52, through passage 53 in the pump housing. Passage 53 opens into the transverse passage 54 in the pump housing which opens into passage 55 which is formed in the boss portion 56 in the side wall of the cylinder block. The filtered oil is thus forced into the oil gallery F from whence it is distributed to the various working parts of the engine in a conventional manner.

Thus, the pumping unit and the filtering device are both situated externally of the cylinder block and all of the passages leading from the pump housing through the filtering unit and thence back to the oil gallery are formed in the separate castings 24, 28 and 33.

Referring to FIGS. 4 and 5, there is shown a bypass route controlled by a check valve for handling excessive pressure build up due to filter clogging. When the oil reaches chamber 35, if the filter cartridge is clogged to the extent of causing excessive pressure build up within the chamber 47, then the oil pressure exerted on the outer face 60 of valve disc 61 will cause the valve to open against the resistance of spring 62 permitting the oil to travel directly from passage 32 into chamber 35

and thence through passage **63** into transfer passage **52** from whence it travels directly into discharge passage **55**.

Formed integrally with the pump housing casting is a tower **65** which houses a pressure relief valve assembly. The tower has a cylindrical bore **66** at the lower end of which valve seat **67** is located. The diametrically reduced lower end **68** of the bore opens into the high pressure chamber **27**. Valve plunger **69** is, under normal pressure conditions, seated against the valve seat under the influence of spring **70**. In the event of an excessive pressure build up in the chamber **27**, the valve plunger is forced upwardly uncovering the port **71** for permitting the oil to be returned to the low pressure side of the pump. The pump housing is provided with an upwardly directed boss **73** to provide the narrow pocket **25***a* which communicates with port **74**. A certain amount of oil seeps past the valve plunger when the plunger is moved upwardly to open position and such oil passes through port **74** into the pocket **25** to the low pressure side of the pump. At the port **23** an enlarged recess **76** serves to lessen the possibility of a hydraulic lock occurring during the operation of the pump.

The pump cover and pump housing are both anchored to the cylinder block boss **13** by means of suitable bolts **77** and suitable gaskets would be inserted between the castings at the locations **78** and **79** to assure a liquid tight lubrication system. The gaskets have not been shown in the drawings. At the juncture where the adapter casting **33** engages the pump cover casting and pump housing casting, indicated by the numeral **80**, a gasket would be used although not shown in the drawings. The adapter casting is anchored to the pump housing casting by means of suitable bolts **82** as shown in FIG. 4. Thus, it can be seen that the complete routing of the oil from the inlet tube **20** through the pump housing casting, pump cover casting, and adapter casting **33** is provided by means of passages which are formed either by coring or by drilling in these various castings, thereby eliminating the need of any exteriorly situated tubing connections.

I claim:

1. A lubrication system for an internal combustion engine comprising: a cylinder block forming a part of the engine; an oil reservoir secured to the underside of the cylinder block; a pump housing casting secured to the side wall of the cylinder block, said pump housing casting having a pump chamber extending outwardly from the cylinder block; a pump cover casting closing off the outer end of the pumping chamber at the outer end of the pump housing casting; a pumping mechanism located within the pump chamber of the pump housing casting; a pump shaft projecting into the interior of the cylinder block; a driving shaft interiorly of the cylinder block and having driving engagement with the pump shaft; a separable adapter casting anchored to a side wall of the pump housing casting and projecting laterally therefrom in a direction transverse with reference to the pump chamber; a filtering device anchored to the adapter casting; said pump housing casting having an oil inlet port opening into the low pressure side of the pumping mechanism and the cylinder block having an oil feed passage communicating with the oil inlet port; an oil feed tube having one end extending into the oil reservoir and the other end opening into the cylinder block passage; said pump cover casting having a passage leading from the high pressure discharge side of the pumping mechanism; said pump housing casting having a passage communicating with the pump cover casting passage and leading to the adapter casting; said adapter casting having a passage communicating with the pump housing casting passage and opening into the filtering device; said adapter casting having a second passage leading from the filtering device to the pump housing casting and said pump housing casting having a second passage communcating with the second passage of the adapter casting and leading to the cylinder block; said cylinder block having a second passage communicating with the second passage of the pump housing casting for returning the oil back into the interior of the cylinder block.

2. A lubrication system for an internal combustion engine comprising: a cylinder block forming a part of the engine; an oil reservoir secured to and closing off the underside of the cylinder block; a pump housing casting having an end wall directed toward the cylinder block and an end wall opposite from the first end wall and a side wall directed transversely with reference to the end walls; a pump cover casting closing off the outer end wall of the pump housing casting and an adapter casting having an inner end face engaging and closing off the side wall of the pump housing casting; a pumping mechanism located within the pump housing casting; a pump shaft projecting into the interior of the cylinder block; a driving shaft located interiorly of the cylinder block and having driving engagement with the pumping shaft; the adapter casting having an end face at its outer end; a filtering device having a container wtih an end face anchored to the outer end face of the adapter casting; an oil route leading from the oil reservoir to the filtering device and then to the cylinder block, said route including a feed passage in the cylinder block, an inlet passage in the first end wall of the pump housing casting and communicating with the cylinder block passage, an oil discharge passage in the pump cover casting at the high pressure side of the pump, a second passage in the pump housing casting communicating with the pump cover casting passage, a first passage in the adapter casting communicating with the second passage in the pump housing casting and opening into the filtering device, a second passage in the adapter casting serving as the return passage from the filtering device, a passage in the cylinder block leading to the interior thereof and a third passage in the pump housing casting establishing communication between the second passage in the adapter casting and the return passage in the cylinder block; said pump cover casting and pump housing casting being anchored to the cylinder block and said adapter casting being anchored to the side wall of the pump housing casting.

3. A lubrication system for an internal combustion engine comprising; a cylinder block forming a part of the engine; an oil reservoir secured to and closing off the underside of the cylinder block; a pump housing casting having a first end wall directed toward and secured to the side wall of the cylinder block; said pump housing casting having a second end wall directed away from the cylinder block; a pump cover casting closing off and secured to the second end wall of the pump housing casting; a side wall on the pump housing casting directed transversely with reference to the end walls of the pump housing casting; a separable adapter casting having an inner end face anchored to and closing off the side wall of the pump housing casting and an outer end face at the opposite end of said adapter casting; a filtering device having a container with an end face anchored to the outer end face of the adapter casting; an oil route commencing from the interior of the cylinder block and leading through the pump housing casting to the pumping mechanism, through the pump cover casting, then through the pump housing casting to the adapter casting, then through the adapter casting into the filtering device, then returning from the filtering device through the adapter casting, then through the pump housing casing and back to the cylinder block.

4. A lubrication system for an internal combustion engine as set forth in claim 3 wherein, a valve casing is formed integrally with the pump cover casting, said casing having a port in one wall thereof communicating with

the inlet side of the pumping mechanism and a passage communicating with the outlet side of the pumping mechanism, said valve, when opened, establishing communication between the outlet side of the pumping mechanism and the inlet side of the pumping mechanism.

5. A lubrication system for an internal combustion engine as set forth in claim 3 wherein a by-passage establishes communication between the first passage in the adapter casting and the second passage in the adapter casting, said by-passage being located in the adapter casting and being normally closed off by a check valve.

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