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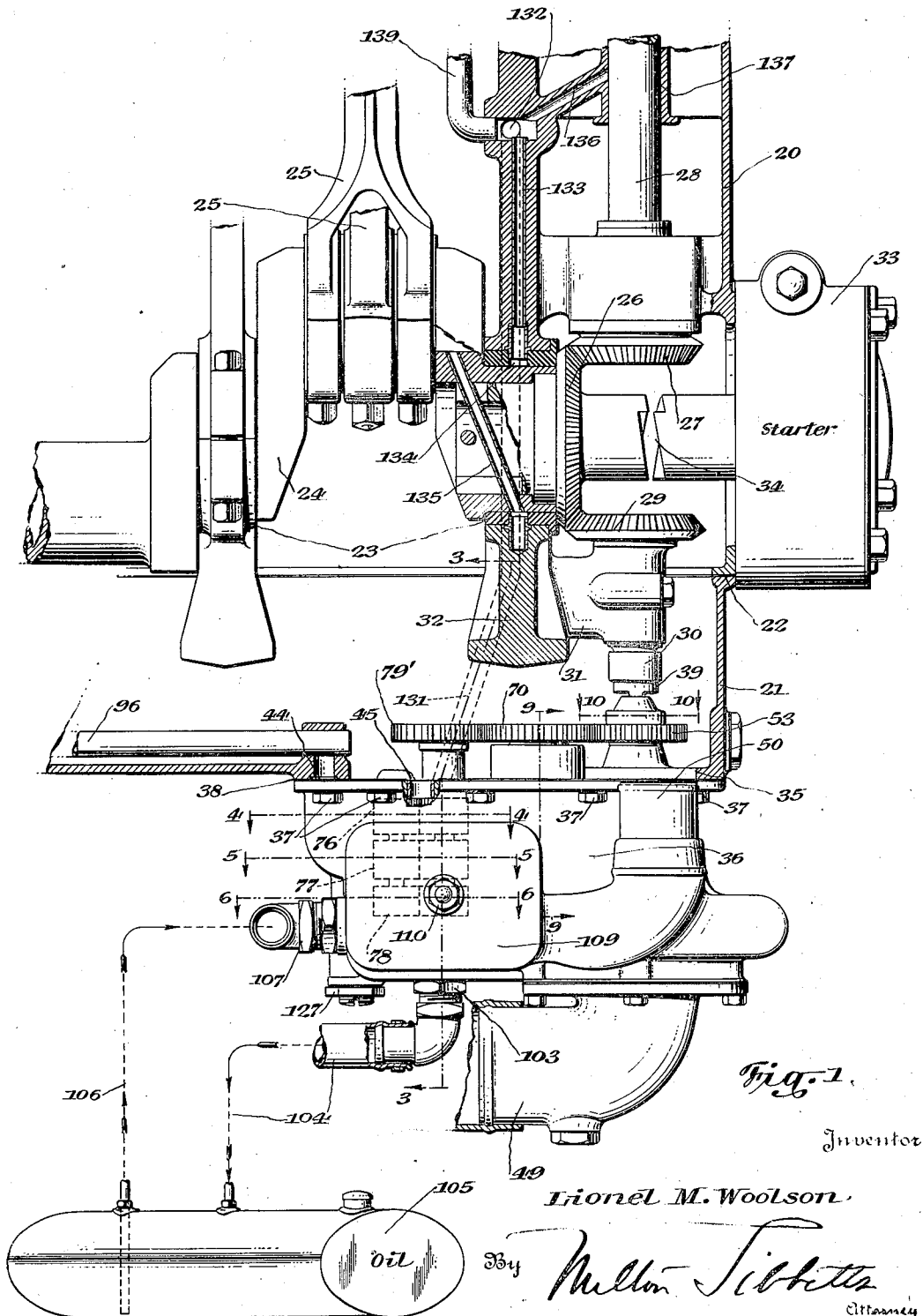
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L. M. WOOLSON

INTERNAL COMBUSTION ENGINE

Filed Jan. 2, 1924

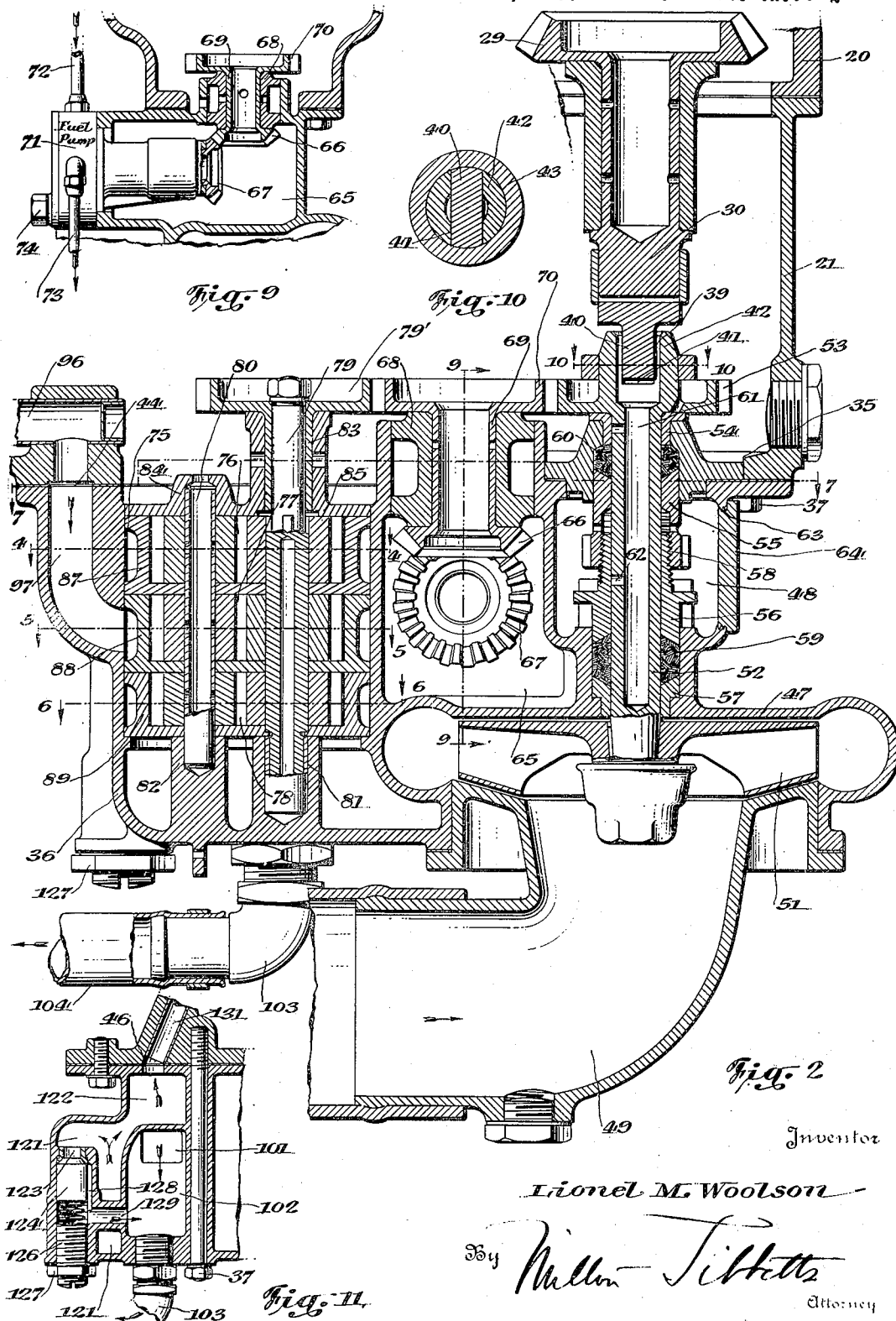
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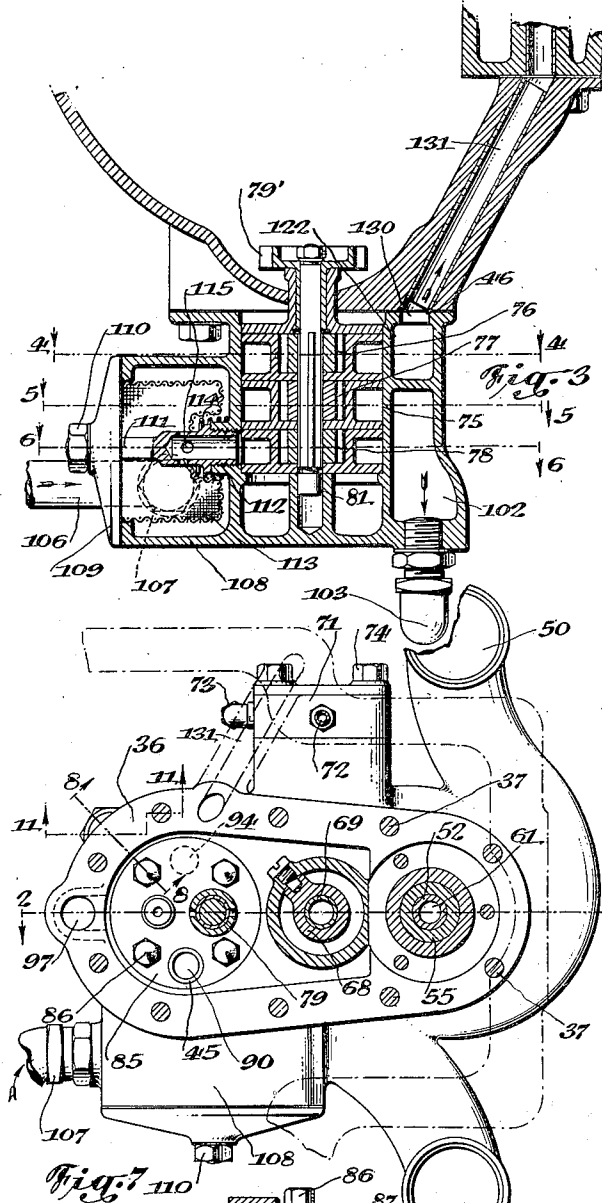
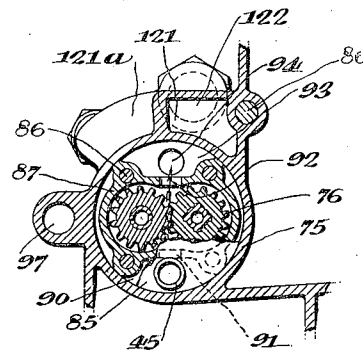
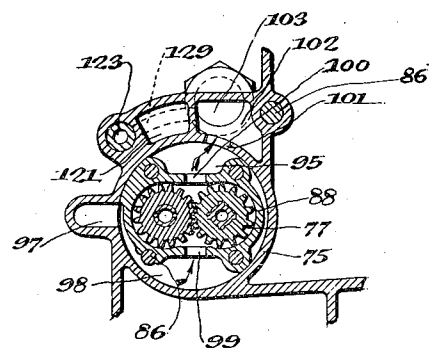
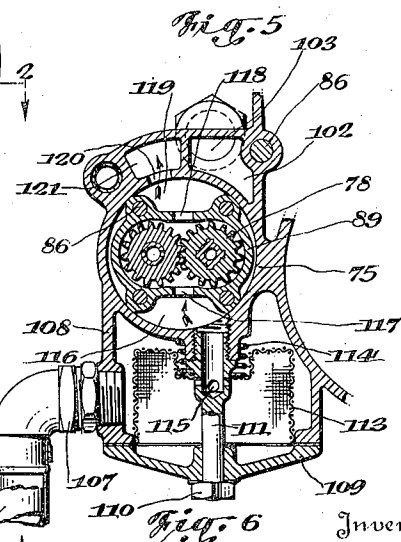
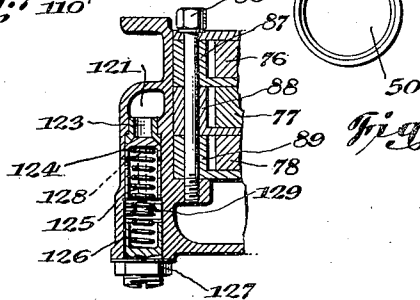


Fig. 8

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INTERNAL-COMBUSTION ENGINE.

Application filed January 2, 1924. Serial No. 683,936.

This invention relates to internal combustion engines and particularly to the various pumps which form a part of the mechanism of such engines.

One of the objects of the present invention is to provide a pump unit for an internal combustion engine which will accomplish all of the pumping functions of the engine.

Another object of the invention is to provide a pump unit which will house the water and oil pumps in a single support.

Another object of the invention is to provide a pump unit that will support the oil, water and liquid fuel pumps together.

Another object of the invention is to provide a detachable unit for an internal combustion engine which will have as a part thereof, the oil pump, the water pump, and the liquid fuel pump.

Another object of the invention is to so combine three of the pump elements of an internal combustion engine that they will take very little room on the engine and be readily accessible for repair or replacement.

Another object of the invention is to provide a novel form of pump unit which is particularly useful where a plurality of pumps of different character are required.

Other objects of the invention will appear from the following description taken in connection with the drawings, which form a part of this specification, and in which:

Fig. 1 is a vertical section through the end portion of an internal combustion engine embodying the invention, the pump unit being shown in elevation;

Fig. 2 is an enlarged sectional view through the pump unit of this invention and contiguous parts of the engine in which it is mounted, the section being substantially on the line 2—2 of Fig. 7;

Fig. 3 is a section taken through the oil pump element and strainer, substantially at right angles to Fig. 2;

Fig. 4 is a horizontal section substantially on the line 4—4 of Figs. 1, 2 and 3;

Fig. 5 is a horizontal section substantially on the line 5—5 of Figs. 1, 2 and 3;

Fig. 6 is a horizontal section substantially on the line 6—6 of Figs. 1, 2 and 3;

Fig. 7 is a plan view of the pump unit on substantially the same scale as Figs. 1 and 3, with a portion of the engine crankcase shown in dot-and-dash lines. Some of the parts of this figure are shown in section and the sec-

tion is taken substantially on the line 7—7 of Fig. 2;

Fig. 8 is a section substantially on the line 8—8 of Fig. 7;

Fig. 9 is a section on the line 9—9 of Fig. 2;

Fig. 10 is a section on the line 10—10 of Fig. 2; and

Fig. 11 is a section substantially on the line 11—11 of Fig. 7, this figure being slightly distorted to more clearly illustrate some of the oil conduits or passages.

Referring to the drawings, 20 is the upper part and 21 the lower part or oil pan of an engine crankcase, these parts being detachably connected at the line 22, in the usual manner. Mounted in a plurality of separated bearings 23 is the engine crankshaft 24 upon the cranks of which are connecting rods 25. The two connecting rods on a single crank as shown are for a V-type engine. At the front end of the crankshaft is a bevel gear 26 meshing with a bevel gear 27 for driving a vertical shaft 28 which runs to the upper part of the engine for operating the camshaft or other mechanism of the engine. The gear 26 also meshes with a bevel gear 29 on a shaft 30 supported in a bracket 31 on a bearing cap 32 which supports the front bearing 23 of the engine crankshaft. Supported upon the front end of the crankcase is an engine starter 33, usually an electric starter, and this starter may be connected to the front end of the crankshaft by means of suitable clutch jaws 34 as will be understood.

The lower half or bottom pan 21 of the crankcase, which receives the oil drained from the various bearings of the engine, is formed with an opening 35, near the end of the crankcase, as shown particularly in Figs. 1 and 2, and this opening is adapted to be closed or covered by the pump unit of this invention. This pump unit is detachably connected over the opening so that the unit may be removed as a whole for repair or replacement and all of the connections between the pump unit and the interior of the crankcase are made and broken as the pump unit is attached to or detached from the crankcase.

The pump unit is represented generally by the numeral 36 and it is secured to the crankcase by means of a plurality of studs and nuts 37. A suitable gasket 38 may be arranged between the flanges or machined surfaces of the crankcase and pump unit so that a suitable tight joint may be made.

When the pump unit is placed in position against and secured to the crankcase, four connections between the unit and the interior of the crankcase are automatically made.

- 5 The first of these is a mechanical connection which comprises a joint 39, shown particularly in Figs. 1, 2 and 10, this being a slip joint between the depending end of the shaft 30 and a shaft mounted in the pump unit, which
10 latter shaft will be hereinafter more fully described. The joint comprises a tongue 40 on the shaft 30 which slips into a cross slot 41 formed in the head 42 of the driven shaft referred to above. A collar 43 surrounds the
15 head 42 to strengthen the latter. It will be seen that with this connection the unit can be moved upwardly into position and the tongue 40 will readily enter the slot 41 and form a driving connection between the shaft
20 30 and the head 42.

- The second of the four connections is indicated at 44, in Figs. 1 and 2, and this is simply a union between two passages, one in the pump unit and the other in the crankcase, so
25 as to form a continuous passage.

- The third connection between the pump unit and the interior of the crankcase is the upwardly opening mouth or port 45 of one of the pump connections which will be hereinafter more fully described. This port is
30 shown particularly in Fig. 1 and it is evident that it is in communication with the interior of the crankcase at the bottom thereof near the front end.

- 35 The fourth of these connections is shown particularly in Fig. 11 and is indicated at 46, this also being a union between a passage in the pump unit and a passage in the crankcase. Its purpose will hereinafter more fully appear.
40

- The pump unit 36 is shown as a casting forming several casings or compartments in which the various pumps and shafts and gears are mounted or supported. Referring
45 to Figs. 1, 2 and 7, it will be seen that the right-hand part of the casting there shown forms a casing 47 for a centrifugal pump and forming an extension above this casing is a casing 48 for the shaft of that pump. A large
50 inlet for the centrifugal pump, which may be a water pump, is indicated at 49 and the two outlets are shown at 50, in Figs. 1 and 7. The inlet is adapted for connection by rubber hose or otherwise with the outlet end of the
55 radiator of the engine and the outlets 50 are adapted for connection by hose or otherwise with the respective cylinder blocks of the engine. Further connection will be made, of course, from the cylinder blocks to the intake
60 end of the radiator, not shown. This provides full circulation for the water for cooling the engine. The water pump impeller is indicated at 51 as mounted in the casing 47 and its shaft is shown at 52 extending through
65 the casing 48 and its upper part forming the

head 42 previously described. At its upper end also the shaft 52 has a gear 53 thereon for driving other parts of the pump unit. The shaft 52 is mounted in bearing rings 54, 55, 56 and 57, and the two rings 55 and 56 are
70 preferably threaded together as shown at 58 so that by turning them relatively they may be adjusted longitudinally of the shaft. Packing material is provided at 59 and 60 and by adjusting the rings 55 and 56 this
75 packing material may be compressed more tightly around the shaft 52. By thus providing two separate packing means for the shaft 52 there is very little chance for any water from the centrifugal pump to reach the interior of the crankcase 21. For lubricating the bearing sleeves of the shaft 52, the latter is drilled out as shown at 61 and provided with branch openings 62.

The interior of the casing 48 is accessible
85 through an opening 63 closed by a removable plug or cover 64.

A small compartment or casing about the size of the casing 48 is formed in the casting 36 above part of the casing 47 and alongside
90 of the casing 48. This casing is indicated at 65 and it houses a pair of bevel gears 66 and 67 for driving the liquid fuel pump of the engine. The casing is open at its upper end and a block 68 is mounted in the opening and forms a bearing for the hollow shaft 69 of the gear 66. A spur gear 70 is shown as formed integral with the upper end of the shaft 69, which spur gear meshes with the
95 spur gear 53 above referred to. Thus the shaft 69 is parallel with and adjacent to the shaft 52 of the water pump and it is driven by the water pump shaft. This compartment and gearing are shown best in Figs. 2 and 9. Referring particularly to Fig. 9, it will be
100 seen that the gear 67 is connected directly to a pump 71, having an inlet pipe 72 and an outlet pipe 73, which pipes may be connected respectively with the fuel supply tank and the engine carburetor or mixture device. The fuel pump 71 is detachably connected to the casing 36 as by one or more bolts 74 and in removing the pump the gear 67 and its bearing are removed with it.

The engine shown is provided with the usual dry sump system, that is, a system in which the oil is drawn from the crankcase and discharged into a suitable oil container or tank from which it is pumped under pressure to the various bearings of the engine.
110 The withdrawing pump or pumps have a greater capacity than the pressure pump so that practically no oil remains in the bottom of the crankcase. In the form shown there are two oil pumps for draining the oil from the crankcase, one connected at either end of the crankcase, and a single pump, smaller in capacity than either of the other two, for pumping the oil from the oil tank to the engine bearings. These three oil pumps are
120 125 130

mounted as a unit in a compartment or casing of the casting 36 alongside of the casing 65. This oil pump casing is indicated at 75 and the three pumps are designated respectively 76, 77, and 78. The pumps 76 and 77 are the withdrawing pumps and pump 78 is the pressure pump. All three of these pumps are shown as gear pumps and they are all driven by a single shaft 79 upon which one of the gears of each pump is mounted, the other gear of each of the pumps being mounted upon a shaft or tube 80. Bearings 81 and 82 are provided for the lower ends of these shafts respectively, and bearings 83 and 84 are provided for their upper ends. The latter two bearings are in a block or cover 85 which secures the three pumps in the casing, bolts 86 being provided for this purpose. The gears of pump 76 are in a block or housing 87, the gears of pump 77 are in a block or housing 88 and the gears of pump 78 are in a block or housing 89, and these blocks form parts of the pumps and serve to separate them in their action and form passages for the oil. A gear 79' meshes with gear 70 and drives shaft 79.

Referring particularly to Figs. 1, 4 and 7, it will be seen that the port 45 hereinbefore referred to, opens through the plate 85 into a space 90 formed between a portion of the block 87 and the casing 75. From this space 90 there is a port 91 leading to the inlet side of the pump 76. On the opposite or delivery side of the pump 76 there is a port 92 leading to a space 93 formed between another portion of the block 87 and the casing 75. A port 94 leads downwardly from the space 93 to a similar space 95 between a portion of the block 88 and the casing 75.

Arranged in the bottom of the crankcase or pan 21 and extending from adjacent the opposite end thereof to the connection 44 above referred to, is a pipe 96. This pipe connects, as will be seen in Figs. 1 and 2, with the joint or connection 44 and as the pipe runs to the remote end of the crankcase any suction therein will draw oil from that end of the crankcase when it is lower than the end of the crankcase in which this pump unit is mounted. A passage 97 formed in the casting 36 extends from the joint 44 to a space 98 formed between a portion of the block 88 and the casing 75. A port 99 leads to the intake side of the pump 77 and a port 100 leads from the outlet side of the pump into the space 95 above described. Thus pumps 76 and 77 both empty into this space 95. A port 101 leads into a space or conduit 102 which extends downwardly through the casing, as shown particularly in Fig. 11, to an outlet pipe 103, which pipe may be connected by a suitable tube 104 with the oil reservoir or tank. In Fig. 1 the pipe 104 is shown diagrammatically as leading to a tank or supply reservoir 105, this tank preferably being vented

so that the oil therein is under atmospheric pressure.

A pipe 106 leads from the bottom of the tank 105 back to the pump unit or to the inlet connection 107 thereof. The inlet connection 107 is on a strainer housing 108, shown particularly in Figs. 3 and 6, which housing extends from the side of the casing 75 and is preferably formed as an integral part of the pump unit. The open end of the housing 108 is closed by a cover 109 secured in place by a nut 110 on the end of a shaft 111, which shaft is hollow at its inner end and threaded as at 112 into the casing 75 in line with the pump 78. A strainer 113, of basket form, is arranged in the housing 108 and a spring 114 presses it lightly towards the cover 109. Thus the cover and spring retain the strainer in position. The hollow part of the shaft 111 has several lateral openings 115 for communication between the interior of the strainer and the interior of the shaft. Thus the oil passing from the pipe 106 and through the connection 107 into the housing 108 will pass through the screen 113 and into the shaft 111. The interior of the shaft communicates with a space 116 between a portion of the pump block 89 and the casing 75, and a port 117 communicates with the intake side of the pressure pump 78. A port 118 leads from the pressure side of the pump to a space 119 between another portion of the plug 89 and the casing 75. From the space 119 a port 120 leads to a space 121, which is a conduit of somewhat spiral form on the outside of the casing 75 and which leads from the lower part of the casing to the upper part thereof. The upper part of this space 121 is indicated by the numeral 122 in order to make it somewhat clearer and the continuity of this passage is shown best in Fig. 11. The space 122 is shown in Fig. 4 and the outside of the space 121 is also shown in plan in that view, the numeral 121^a being used to indicate it.

In order that the degree of pressure may be limited, a pressure relief valve is provided in the outlet from the pressure pump 78. This relief valve is shown in full section in Fig. 8 and in part section in Fig. 11. The outlet port from the space 121 to the relief valve is indicated at 123 and the valve itself is shown at 124. A spring 125 holds the valve to its seat and this spring is adjustable by a threaded plug 126. A lock nut 127 sets the plug in its adjusted position. There are several passages 128 through which the oil may pass to the interior of the valve chamber and a passage 129 extends from the relief valve to the space 102 above referred to. It will be understood that the space 102 is the space into which both of the other pumps, 76 and 77, deliver and from there the oil is carried through the pipes 103 and 104 to the tank 105. In Fig. 11 the passage 129 appears to be somewhat shorter than it

actually is because that view is somewhat distorted for the purpose of illustrating the spiral space 121, 122. The passage 129 is shown in dotted lines in Fig. 5 as extending from the relief valve to the space 102.

From the above description of the relief valve and its connections it will be seen that when the pressure in the space 121 reaches a predetermined point the valve will open and some of the oil from the pressure pump will pass back into the oil reservoir so that the maximum pressure desired in the system will not be exceeded.

The space or pressure chamber 122 may be seen in Figs. 3, 4 and 11. Its outlet port 130 forms the union 46 above described between the pump unit and the crankcase. The port 130 communicates with a passage or conduit 131 passing diagonally upwardly through the wall of the crankcase. It may be seen in dotted lines in Fig. 1 and in dash lines in Fig. 7. Referring particularly to Fig. 1, it will be seen that its upper end connects with a union 132 having several branches for carrying oil under pressure to the various branches of the engine. One of these branches, 133, leads downwardly to an annular groove 134 in the bearing 123 above described and a pipe 135 in the crankshaft leads some of the oil from this groove to the connecting rod bearings. Another branch, 136, from the union 132 leads to a bearing 137 for the vertical shaft 128, and a third branch 139 leads to other bearings of the engine.

As the full course of the oil from the crankcase through the pumps 76 and 77 to the oil reservoir 105 and from that reservoir through the pump 78 to the various bearings of the engine, has been fully described in the description of the drawings, it is not necessary to repeat it. The operation of the other parts of the mechanism has also been fully set forth. It is obvious that the pump unit as a whole may be removed from the crankcase by removing the bolts 37 and withdrawing the unit downwardly. It may be replaced or another similar unit connected to the crankcase by the reverse operation. With the unit removed from the engine the water pump may be dismantled without dismantling the other parts, and the same thing is true of the oil pump. The three oil pumps may be taken out without disturbing the fuel pump. The fuel pump may be removed without disturbing the other pumps. The oil strainer may be removed and cleaned or replaced without disconnecting the pump unit from the engine. The fuel pump may be removed as a unit without removing the entire pump unit from the engine.

While I have herein described in some detail a specific embodiment of my invention, which I deem to be new and advantageous and may specifically claim, I do not desire

it to be understood that my invention is limited to the exact details of the construction, as it will be apparent that changes may be made therein without departing from the spirit or scope of my invention.

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

1. In an internal combustion engine, a pump unit comprising a support, three parallel shafts mounted in said support removably secured to the engine, a water pump connected to one of said shafts, an oil pump connected to another of said shafts, and a liquid fuel pump connected to be driven by the other of said shafts.

2. In an internal combustion engine, the combination with the crankcase having an opening therein and a crankshaft mounted in said crankcase, of a shaft driven by said crankshaft and having its end extending adjacent said opening, a pump unit including a casing forming a cover for said opening and detachably connected to the crankcase, and an oil pump and a water pump mounted in said casing said pumps being adapted to be driven from said pump shaft.

3. In an internal combustion engine, the combination with the crankcase having an opening therein, and a crankshaft mounted in said crankcase, of a shaft driven by said crankshaft and having its end extending adjacent said opening, a pump unit including a casing forming a cover for said opening and detachably connected to the crankcase, and a plurality of other pumps mounted in said pump casing and driven from said water pump shaft.

4. In an internal combustion engine, the combination with a crankcase having a bottom opening, a crankshaft in the crankcase, and an auxiliary shaft driven by the crankshaft and having its free end adjacent said opening, of a pump unit forming a cover for said opening and detachably connected to the crankcase, a water pump mounted in said pump unit and having a vertical shaft adapted to connect with said auxiliary shaft when the pump unit is in place, and a plurality of other pumps mounted in said unit and connected to be driven by said water pump shaft.

5. In an internal combustion engine, the combination with the crankcase having an opening therein, of a pump unit forming a cover for said opening and having inlet and outlet oil conduits which are made and broken within the crank case as the unit is connected to and disconnected respectively from the crankcase, oil pump means mounted in said pump unit and connected to said conduits, another pump supported by said pump unit and having outside inlet and outlet connections, and means for driving both of said pumps from a moving part of the engine.

6. In an internal combustion engine, the

combination with a crankcase having an opening therein, of a pump unit covering said opening and detachably secured to the crankcase, a water pump mounted in said unit and having a shaft extending into said crankcase, and a telescoped joint within the crankcase adapted to connect said shaft to a movable part of the engine for driving said water pump.

7. In an internal combustion engine, including a crankshaft and a crankcase having an opening therein, a pump support forming a cover for said opening and detachably connected to the crankcase, a water pump connected to said support and having a shaft extending through the support into the crankcase, separated packing devices around said pump shaft to prevent water getting into the crankcase, and means within the crankcase for driving said water pump from said crankshaft.

8. In an internal combustion engine, the combination with the crankcase having an opening therein, of a pump support forming a cover over said opening and detachably connected to the crank case, a water pump connected to said support and having a shaft extending through the support into the crankcase, two separated packing devices around said pump shaft to prevent water getting into the crankcase, a single adjusting means for taking up both of said packings, and means within the crank case for driving said water pump from a movable part of the engine.

9. In an internal combustion engine, a pump unit comprising a support having a flange for attachment to the engine crankcase, a water pump having inlet and outlet connections, an oil pump device having inlet and

outlet connections through said flange, and means within the crankcase for driving both of said pumps.

10. A pump unit comprising a casting forming an oil pump casing and a casing for a water pump and water pump shaft, said casting also having a casing formed between the oil pump casing and the pump shaft casing for the gears of another pump, gears within the third casing, an oil pump in the oil pump casing, a water pump and shaft in the water pump and shaft casing, and means for driving the oil and water pumps and the gears for the third pump.

11. The combination with a crankcase of an oil pump, a water pump arranged alongside the oil pump and having a shaft extending parallel to the oil pump, and gearing arranged between the oil pump and the water pump shaft, said gearing being positioned within the crankcase.

12. In a pump unit, the combination of a casing, three pumps mounted in said casing, shafts for driving said pumps, said shafts being mounted with parallel axes, spur gears connecting said shafts, and means connected to one of said shafts for driving all of said pumps.

13. In an internal combustion engine, the combination with a support detachably connected to the engine, of a plurality of parallel shafts mounted in the support, gears connecting said shafts, a water pump operated by one of said shafts, an oil pump operated by another of said shafts, and a liquid fuel pump operated by another of said shafts, and means to drive all of said shafts from the engine.

In testimony whereof I affix my signature.

LIONEL M. WOOLSON.