Oct. 4, 1932. S. WILTSE 1,881,012

PUMP MECHANISM

Filed June 9. 1927 2 Sheets-Sheet 1

Fig. 1.

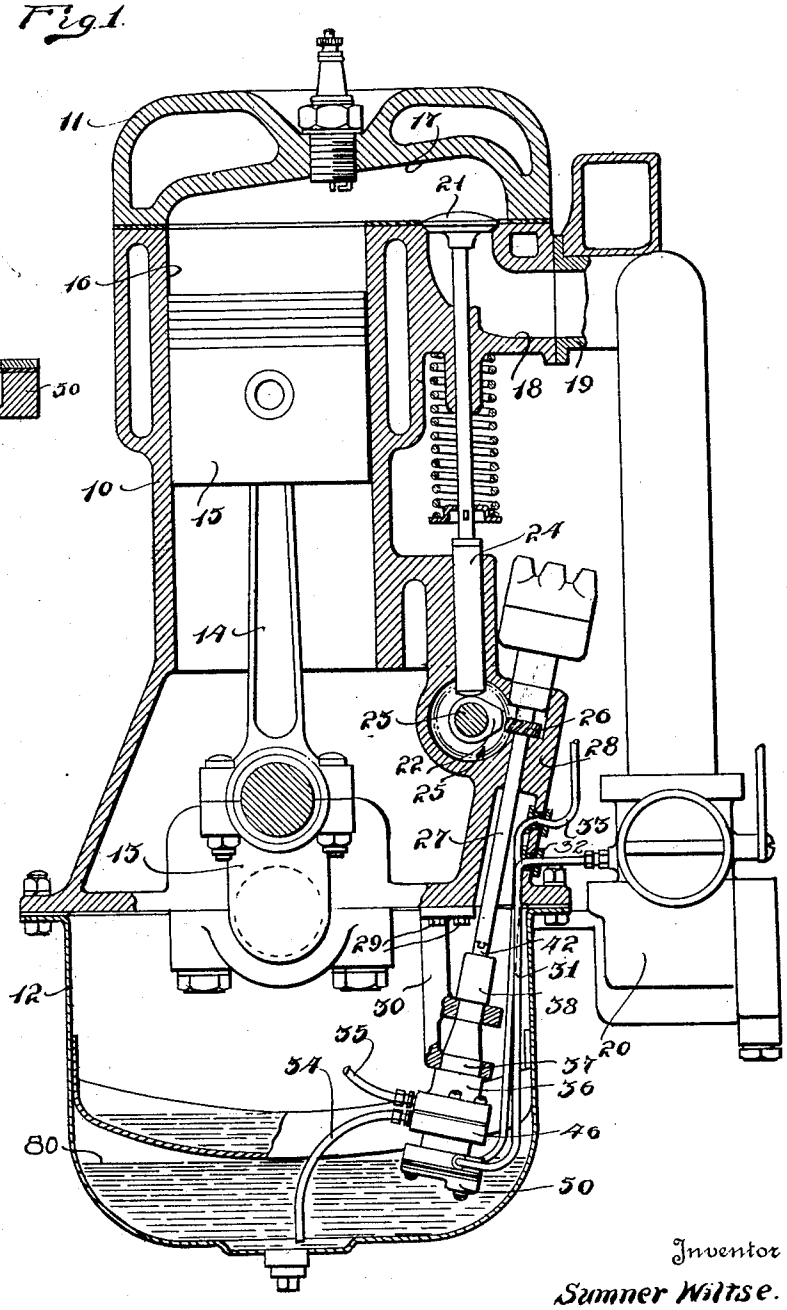
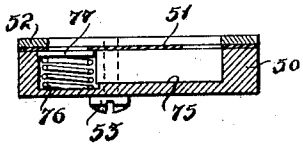


Fig. 8.



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Fig. 2.

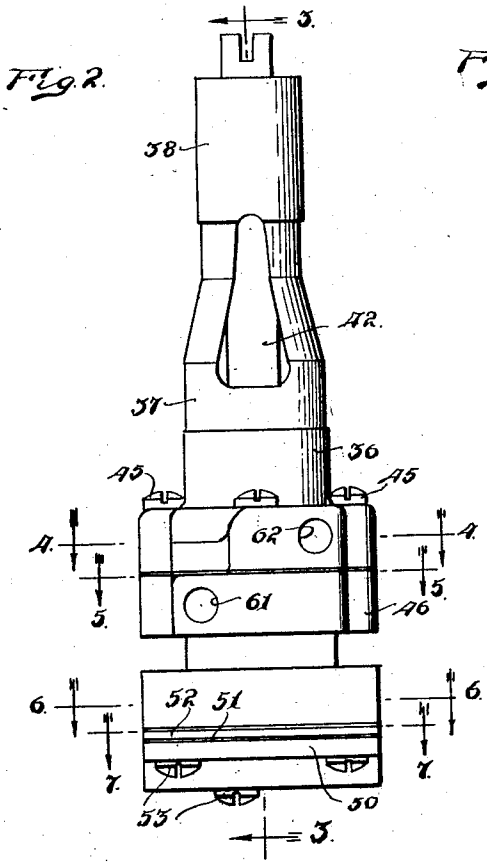


Fig. 3.

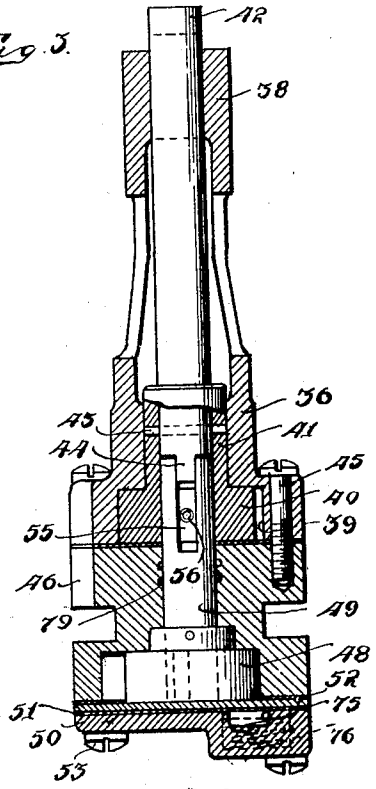


Fig. 4.

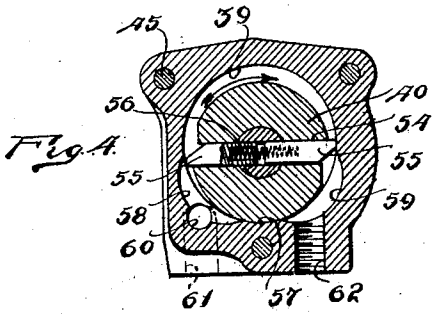


Fig. 5.

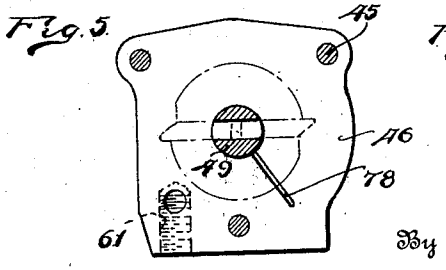


Fig. 6.

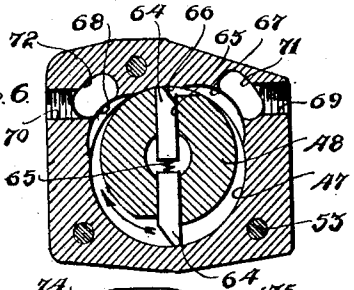
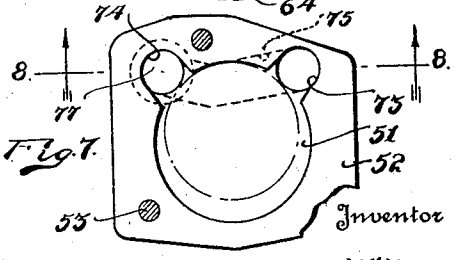


Fig. 7.



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1,881,012

UNITED STATES PATENT OFFICE

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PUMP MECHANISM

Application filed June 9, 1927. Serial No. 197,753.

This invention relates to pump mechanism and particularly to a combined oil and fuel pump for internal combustion engines, the principal object being the provision of a unitary oil and fuel pump simple in construction, economical to manufacture and easily applied.

Another object of the invention is to provide a combined oil and fuel pump in which corresponding ends of a pair of housing members are each provided with a chamber for receiving one rotor of a pair of aligned rotors, each rotor terminating in substantially the plane of the end of the housing in which it is received; the rotors are driven by a common line of shafting; and the housing of one chamber closes the chamber provided in the other.

Another object is to provide a combined oil and fuel pump comprising a housing enclosing a sliding vane type pump element, a second housing enclosing a similar pump element, the vanes of which are disposed at right-angles to the vanes in the first pump element and which housing closes the first housing, a substantially flat cap and cover being provided for the second housing enclosing a by-pass pressure relief valve for governing the maximum pressure capable of being built up by the second pump element.

Another object is to provide a unitary oil and fuel pump comprising a single pair of rotors suitably housed and driven by aligned shafting, parts of which are suitably connected together for equal rotation, a by-pass pressure relief valve operated by the outlet pressure of the fuel pump being provided for maintaining the pressure of the fuel as delivered to the carburetor at less than a predetermined maximum value.

Another object is to provide in combination with an internal combustion engine, a fuel pump positioned within the crankcase thereof, whereby the fuel passing through the same will absorb heat from the crank case and will result in a more economical and smoother running engine.

A further object is to provide in combination with an internal combustion engine, a unitary mechanically driven oil and fuel pump provided with a common member therebetween, and operated within the crank case of the engine in such a position as to come in contact with the oil therein whereby the fuel passing through the pump will be heated both by radiation of heat in the crank case and by conduction of heat from the oil pump part of the mechanism through the common member.

The above being among the objects of the present invention, the same consists in certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate a suitable embodiment of the present invention, and in which like numerals refer to like parts throughout the several different views,—

Fig. 1 is a vertical sectional view taken transversely through an internal combustion engine provided with a unitary oil and fuel pump within the crank case thereof.

Fig. 2 is an enlarged side elevation of the combined oil and fuel pump shown supported within the crank case of the engine in Fig. 1.

Fig. 3 is a vertical sectional view taken transversely of the oil pump shown in Fig. 2 as on line 3—3 of Fig. 2.

Fig. 4 is a horizontal sectional view taken on line 4—4 of Fig. 2 showing the rotor and sliding vanes constituting the moving elements of the oil pump of the present invention.

Fig. 5 is a view taken on line 5—5 of Fig. 2.

Fig. 6 is a horizontal sectional view taken on line 6—6 of Fig. 2 showing the rotor and sliding vanes constituting the moving parts of the fuel pump of the present invention.

Fig. 7 is a view taken on line 7—7 of Fig. 2 being a plan view of the cover secured to the lower face of the pump.

Fig. 8 is a sectional view taken through the cover shown in Fig. 7 as on line 8—8 of Fig. 7, illustrating the by-pass pressure relief valve mechanism.

The present invention is an improvement

on the construction shown and described in my application for Letters Patent of the United States for improvements in pumps filed April 18th, 1927, Serial No. 184,573.

In accordance with the present invention I have shown in Fig. 1 an internal combustion engine provided with a unitary crank case upper half and cylinder block 10, cylinder head 11 and crank case lower half or oil pan 12. Rotatably supported within the crank case of the engine is a crank shaft 13 connected by the conventional connecting rod 14 to the piston 15 which is adapted to reciprocate within the cylinder 16, formed within the cylinder block 10 upon rotation of the crank shaft 13. The cylinder 16 is connected by the combustion chamber 17 to the intake port 18 which in turn is connected to the intake manifold 19 which is provided with the usual carburetor 20. A valve 21 is positioned to close the port 18 and is actuated by the cam 22 formed on the rotatable cam shaft 23 through the tappet 24. A spiral bever gear 25 secured on the cam shaft 23 meshes with another suitable spiral gear 26 secured to the vertically extending shaft 27 suitably supported at its upper end by the bearing 28. Secured to the side of the crank case 10 by bolts 29 or other suitable means, is a bracket 30 which extends down into the lower part of the oil pan 12 and removably receives therein a combined oil and fuel pump formed in accordance with the present invention.

A tube 31 connects the carburetor 20 with the fuel discharge side of this pump mechanism, the tube 31 passing through the crank case upper half 10, which is sealed against leakage around the same by means of a nipple such as 32. A similar tube 33 connecting the fuel intake side of the pump mechanism with a source of fuel supply, such as a gasoline tank (not shown), passes through the crank case upper half 10 and is sealed against leakage by means of a nipple similar to nipple 32 shown in connection with tube 31. A short tube 34 connects the oil inlet side of the pump mechanism with the space in the bottom of the oil pan 12 and an oil discharge pipe 35 leads from the oil discharge side of the pump mechanism to the various bearings of the engine.

As illustrated in Figs. 2 to 8 inclusive, the pump mechanism comprises a housing 36 provided with external bearing portions 37 and 38 adapted to be removably clamped within the lower end of the bracket 30. Within the housing 36 and opening into the bottom face thereof is a recess 39 circular in section. Positioned within the recess 39 eccentrically thereof is a rotor 40 provided with a hub 41 extending upwardly into the casing 36 and provided with a suitable bearing therein. A shaft 42 extending axially down through the housing 36 and provided with a suitable bearing in the upper portion thereof, is loosely received within the hub 41 and is locked against relative rotation in respect thereto by the pin 43 which loosely passes through the shaft 42. The lower end of the shaft 42 is provided with a tongue 44, the purpose of which will presently be described.

Secured to the lower face of the housing 36 by means of the screws 45 is a second housing 46 closing the open end of the recess 39. The lower face of the housing 46 is provided with a recess 47 similar to the recess 39, and a rotor 48 similar to the rotor 40 is positioned eccentrically therein, a shaft 49 being loosely secured to the rotor 48 and extending upwardly through the housing 46, where it is provided with a suitable bearing surface in axial alignment with the shaft 42. The upper end of the shaft 49 is slotted and projects up through the rotor 40 where it is loosely received and slidably engages the tongue 44 formed on the lower end of the shaft 42. A cap 50 is shown as substantially flat, excepting as if it is shaped to form a valved bypass with thin metal cover 51; and, a spacer member 52 being optionally interposed, said cap and cover may be secured to the lower face of the housing 46 by means of screws such as 53.

The rotor 40 is provided with a transverse slot 54 extending across the diameter thereof in alignment with the tongue 44 and for the full depth of the rotor 40, and slidably received within the slot 54 are two vanes 55. Positioned between the vanes 55 is a spring 56 which constantly urges the vanes 55 outwardly into contact with the side walls of the recess 39. The projecting ends of the vanes 55 are bevelled off in the direction of rotation which is indicated by the arrow in Fig. 4 for substantially the full width of the same, for a purpose to be described later. The rotor 40 is of such a diameter that the periphery thereof slidably engages the side wall of the recess 39 on the line indicated as 57 in Fig. 4.

Formed within the walls of the recess 39 on either side of the line 57 is the inlet port 58 and outlet port 59. The inlet port 58 is connected by the passage 60 which passes down through the housing 36 into the housing 46 where it joins the horizontal passage 61 leading to the outer face of the housing 46 and which is preferably provided with threads or other means for connection to the pipe 34 shown in Fig. 1. The outlet port 59 is connected by the passage 62 to the outer face of the housing 36 where suitable means are provided for connection with the outlet pipe 35 shown in Fig. 1. The lower rotor 48 is provided with a transverse slot 63 of similar character to the slot 54 previously described in connection with the rotor 40, and which

slidably receives the vanes 64 which are shaped similarly to the vanes 55 and which are beveled off in the same manner and in the same direction, a suitable spring 65 being provided for constantly urging the vanes 64 apart and into contact with the side walls of the recess 47.

It is to be particularly noted that the axial line of the vanes 55 and the axial line of the vanes 65 are at right-angles to each other, this feature being provided in order to equalize the turning resistance between the same to provide a quieter running mechanism, and reduce the wear.

The rotor 48 contacts with the side walls of the recess 47 along the line indicated as 66 in Fig. 6, in the same manner as the rotor 40 contacts against the side wall of the recess 39, and formed in the side walls of the recess 47 on either side thereof is the intake port 67 and outlet port 68, the inlet port 67 being connected by the passage 69 with the exterior face of the housing 46 and to which passage 69 the fuel inlet pipe 33 is adapted to be suitably secured. The outlet port 68 communicates with the exterior face of the housing 46 by means of the passage 70 which is adapted to be suitably connected to the tube 31 extending from the same to the carburetor. Openings 71 and 72 connect the ports 67 and 68 with the lower face of the housing 46, and openings 73 and 74 may be formed in a cooperating part such as the mentioned cover member 51 between the cap 50 and housing 46 and in alignment with the openings 71 and 72. Formed in the upper face of the cap 50 and extending between the openings 73 and 74 is a mentioned by-pass passage 75 which passage is shown as completed by said cover member and as enlarged below the opening 74; and received therein is a coil spring 76. A disc 77 of larger diameter than the opening 74 and slidably received in the enlarged end of the passage 75 is shown as illustrating one type of valve element suitable to be constantly urged by the spring 76 upwardly against the under face of the member 51 in which position it closes the opening 74 from the passage 75.

Formed within the upper face of the housing 46 as indicated in Fig. 5, is a groove 78 extending from the discharge port 59 to the bearing for the shaft 49 within the housing 46, the same groove being provided for conducting oil under pressure to the bearing in order that the same may provide a seal between the recesses 39 and 47. If desired, circumferential grooves such as 79 (see Fig. 3) may be provided in the bearing for the shaft 49 in order that oil may be conducted thereto from the passage 78 and better seal the recesses 39 and 47 from each other against the passage of fuel.

The operation of the device will be apparent from the above description which, stated shortly, is as follows:

Upon rotation of the cam shaft 23, the gear 25 secured thereto is caused to rotate and in turn causes rotation of the gear 26 secured to the shaft 27. The shaft 27 is provided with a suitable type of sleeve joint at its lower end, provided with a tongue (not shown) which slidably engages the groove in the upper end of the shaft 42, thus causing rotation of the shaft 42. In rotating, the shaft 42 carries with it the rotor 40 which, as before explained, is mounted eccentrically in the recess 39. In rotating, the vanes 55 seal the space between the rotor 40 and the side walls of the recess 39 and slide inwardly and outwardly of the slot 54 in order to accommodate the variation of the space between the outer edge of the rotor 40 and the side wall of the recess 39. As each vane 55 rotates past the intake port 59 it creates a suction back of it, thus causing the oil to be drawn through the port 58 between the rotor 40 and side wall recess 39 and between the vane 55 and the line of contact 57, the succeeding vane 55 causing this oil to follow around each of the first mentioned vanes 55, and as soon as the first mentioned vane 55 has rotated sufficiently to open the port 59 back of the same, the succeeding vane 55 forces this oil out through the port 59, and passage 62 causing a pressure to be built up in the same. Inasmuch as the shaft 49 is operatively connected to the shaft 42 by its upper slotted end slidably receiving the tongue 44, the rotor 48 is driven in the same direction, and at the same speed as the rotor 40, the vanes 64 slidably received within the slot 63 sliding inwardly and outwardly within the slot with their outer ends in contact with the side walls of the recess 47 in exactly the same manner as the vanes previously described in connection with the rotor 40, causing the fuel to be drawn in through the port 67 and discharged through the port 68. It is to be noted that the passages 71 and 72, openings 73 and 74, and the closed passage 75 form a continuous passage which, but for the valve disc 77, would allow fuel forced out of the port 68 to immediately return to the intake port 67, thus preventing any pressure from being built up in the fuel pump. The spring 76 is provided for controlling this return flow of fuel between the ports 67 and 68, it being so proportioned that until the maximum desirable pressure is built up in the discharge passages of the fuel pump, the disc 77 will remain seated and close the opening 74, but is so designed that as soon as this maximum desired pressure is built up, the disc 77 will be acted upon by such pressure, and will be moved away from the plate 51 thus allowing the excess fuel to flow from the port 68 through the passage 75 and back to the intake port 67.

Inasmuch as the volume of fuel pumped by

this type of pump varies in proportion to the speed of the same, it will be apparent that in order to obtain the necessary fuel requirements at low speeds of the engine that a pump must be provided which will supply a volume of fuel at high speeds greatly in excess of the amount needed. In order to prevent the pressure on the discharge side of the pump from building up over the desired maximum pressure, which for fuel pumps is seldom over one and one-half to two pounds, the openings 73 and 74 and the passage 75 are designed with ample dimensions to prevent any appreciable restriction in the flow of fuel therethrough at high speeds so that there will be no possibility of the pressure building up beyond the predetermined maximum value desired. In addition, the vanes 55 and 64 being beveled off at their ends in the direction of rotation, the pressure in the pumps acts on substantially the full end area of the vanes and exerts a tendency to force them inwardly. The springs 56 and 65 are preferably so proportioned in respect to the total pressure acting on the ends of the vanes 55 and 64 that when the respective pumps have built up their predetermined pressures, the vanes recede slightly from the walls of the corresponding recesses 39 and 47, thus aiding in slightly reducing the pressure built up, and in receding from the walls of the recesses substantially eliminate wear on the ends of the vanes.

It will be recognized that leakage of fuel past the shaft 49 and into the oil pump recess 39 would allow commingling of the fuel with the lubricating oil which might lead to serious results. In order to prevent such a possibility, the groove 78 is provided for conducting oil from the discharge port 59 of the oil pump to the bearing for the shaft 49 in the housing 46. Because of the superior pressure of the lubricating oil, a small amount of such oil is forced into contact with the shaft 49, and not only serves to lubricate the same in its bearing in the housing 46, but also provides an effective seal for preventing leakage of fuel therepast.

As above described, the shaft 42 is provided with a relatively close fitting bearing in the upper end of the housing 36 and is loosely received within the hub 41 of the rotor 40 which hub is provided with a relatively close bearing within the lower portion of the housing 36. This provides a construction very economical to manufacture inasmuch as no particular pains need to be taken for perfectly aligning the bearings for the shaft 42 and the hub 41, and but two relatively close fits are necessary for the same. In addition, the shaft 49 loosely receives the tongue 44 and no particularly accurate machine work is required at this point. The groove within the upper end of the shaft 49 may be suitably relieved so that the vanes 55 slidably passing through the same are free of any tendency to bind therein, and no particular precision is necessary in connecting the housings 36 and 46 together.

A particularly important feature of the present invention is the positioning of the mechanism within the lower part of the oil pan 12, and preferably below the normal level 80 of the oil therein. The advantages realized by this feature of the invention are that the fuel passing through the pumping mechanism is heated and ample lubrication is provided for the bearing for the shaft 42 and the bearing for the hub 41. It is to be noted that not only is the heat of the lubricating oil within the oil pan 12 transmitted to the fuel by contact with the walls of the housing 46 when such housing is positioned below the level 80 of the oil, but where it is found necessary or desirable to position the pump mechanism partially or wholly above the level of the oil, the heat transmitted to the housing 36 and 46 by the oil passing therethrough passes down through the housing 46, heating the same, and causing the fuel passing therethrough to be heated. The housing 46 and cap 50, where the same are positioned above the normal level of the fuel, are also heated by the spray of oil from the bearings of the engine, which comes in contact with the same. By thus heating the fuel being fed to the carburetor 20 more complete vaporization of the same is obtained with the resulting smoother and more economical performance of the engine.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit and substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. A fuel and oil pump having, in combination, an oil pump casing, said casing having a pump chamber extending to an end thereof, said casing having an oil inlet and an oil outlet communicating with the chamber, an oil pump rotor bearing in the casing, said oil pump rotor having a bore, and having an end in substantially the same plane as the corresponding end of said casing, a drive shaft in the bore non-rotatably connected to the oil pump rotor, a fuel pump casing so formed and attached to the oil pump casing as to close the mentioned chamber, the fuel pump casing having an inlet opening, a pump chamber extending to the corresponding end thereof, and an outlet opening, a fuel pump rotor terminating substantially in the plane of said corresponding end and bearing in the fuel pump casing, said fuel pump rotor having a bore, and a driven shaft non-rotatably connected at one end to the fuel pump rotor and extending at the other end into the oil pump chamber and non-rotatably connected

to the drive shaft, and a substantially flat cover for the fuel pump chamber.

2. The combination in claim 1 in which the fuel chamber is provided with a cap which contains a duct and has a relief valve therein, an apertured cover being interposed beneath said cap, and said duct leading from the inlet to the outlet of the chamber, whereby to by-pass the fuel upon an overload.

3. A pump structure comprising a pair of approximately aligned pump casings having pump chambers formed therein, a partition separating the chambers, a pump rotor in each chamber, a shaft interconnecting the two rotors, each end of the shaft being slotted and one slotted end projecting into one of the rotors and a transversely disposed impeller blade extending outwardly from the outer periphery of said one of the rotors and being disposed in the last-mentioned slotted end of the shaft.

4. A pump structure comprising a pair of approximately aligned pump casings having pump chambers formed therein, a rotor disposed in each chamber, a shaft connecting the two rotors, one end of the shaft being slotted and extending through an opening in one of the rotors and being engaged by a tongue upon a drive shaft, said slot also receiving an impeller blade extending transversely through the last-mentioned rotor.

5. In combination: an oil pump comprising a housing which provides a pump chamber at an end thereof and a single rotor disposed in said chamber and terminating in the plane of said end; a fuel pump comprising a housing having an inlet opening and an outlet opening and a single rotor, an end of the last mentioned housing cooperating with the first mentioned housing to close the oil pump chamber and being provided in its other end with an additional chamber; a substantially flat cap for closing said last-mentioned chamber; cooperating parts embodying a by-pass pressure relief valve for said fuel pump; and a single line of shafting for driving both of said rotors, a tongue and slot being respectively provided for cooperation at adjacent ends of parts of said shafting and a vane of said oil pump being slidably received in said slot.

SUMNER WILTSE.