Feb. 1, 1938. M. W. HUBER 2,107,152

REVERSIBLE FUEL PUMP

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Fig. 1

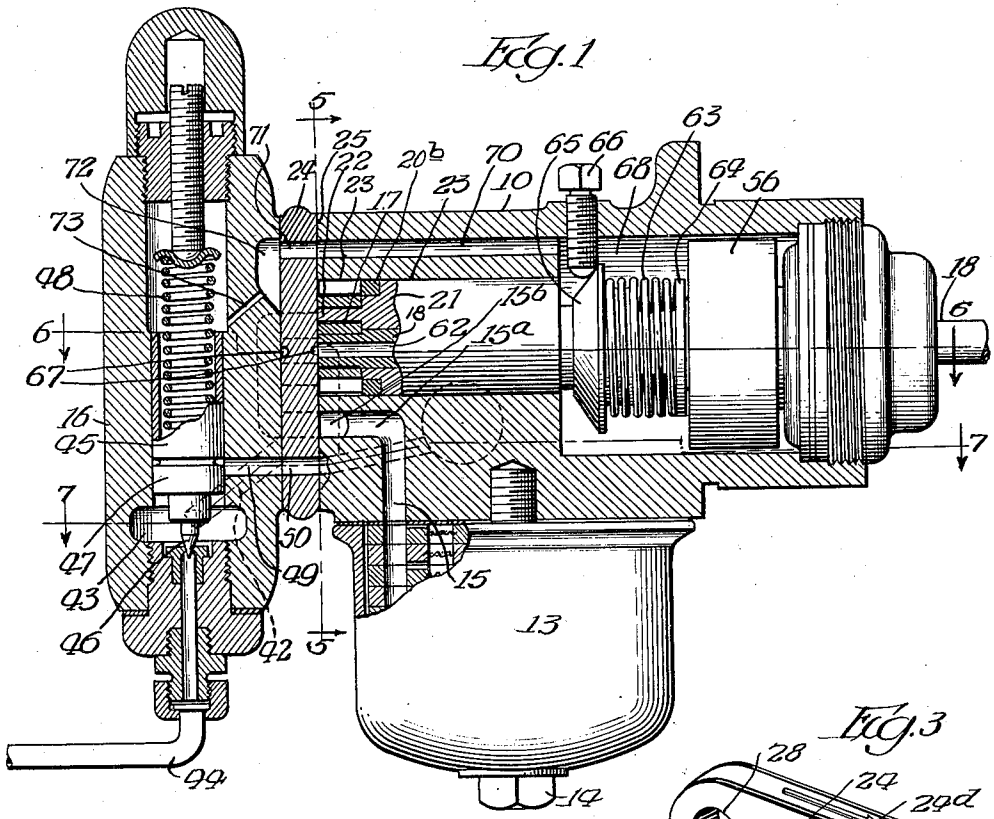


Fig. 2

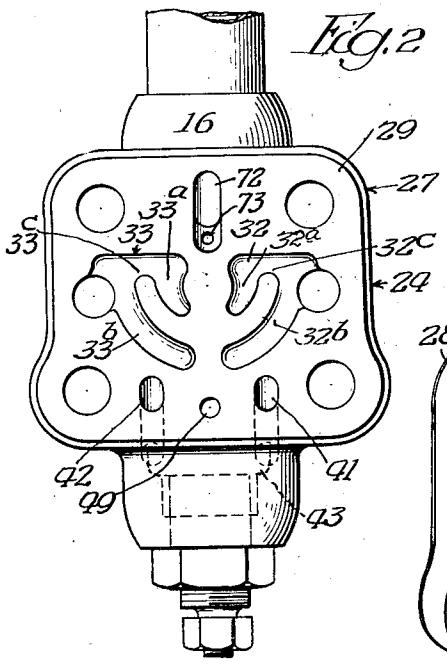


Fig. 3

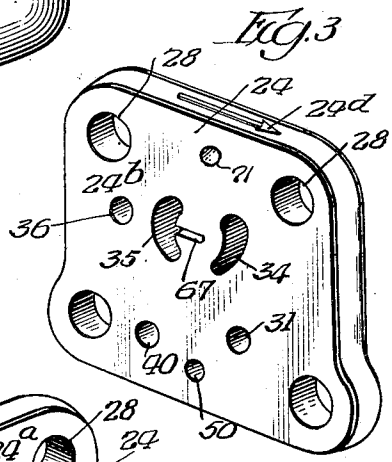
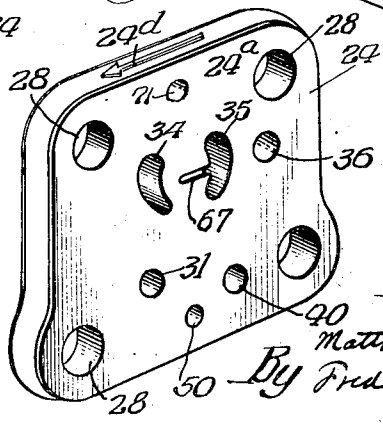


Fig. 4



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Fig. 5

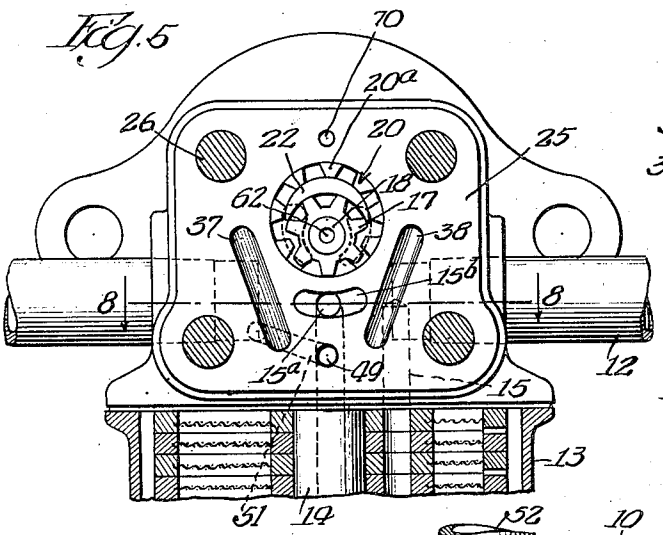


Fig. 8

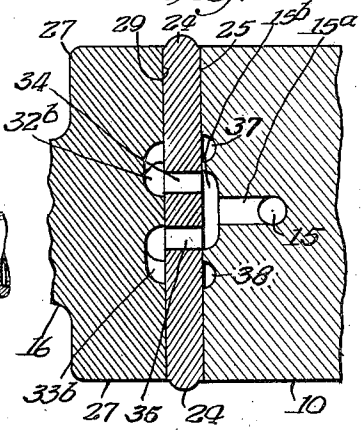


Fig. 6

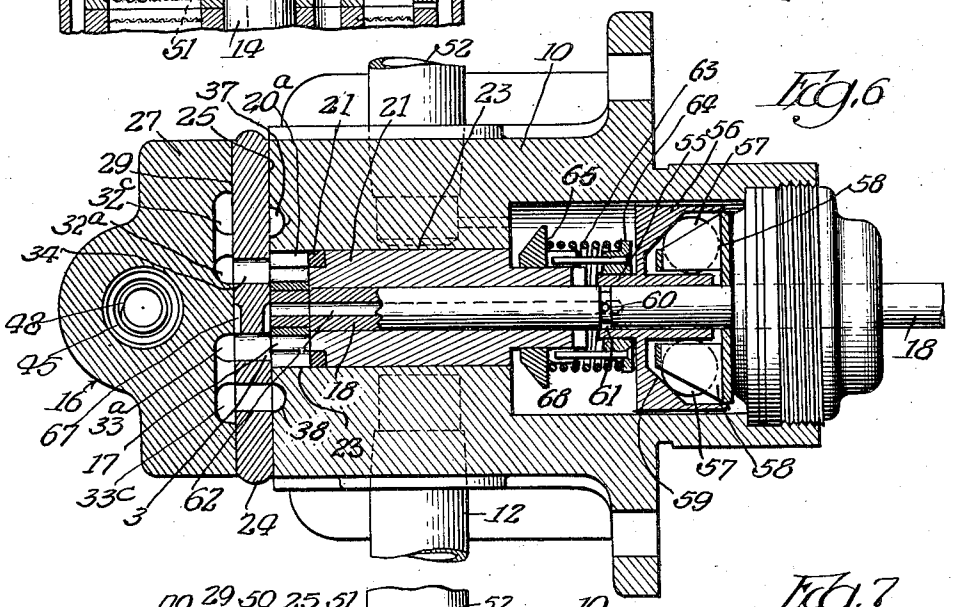
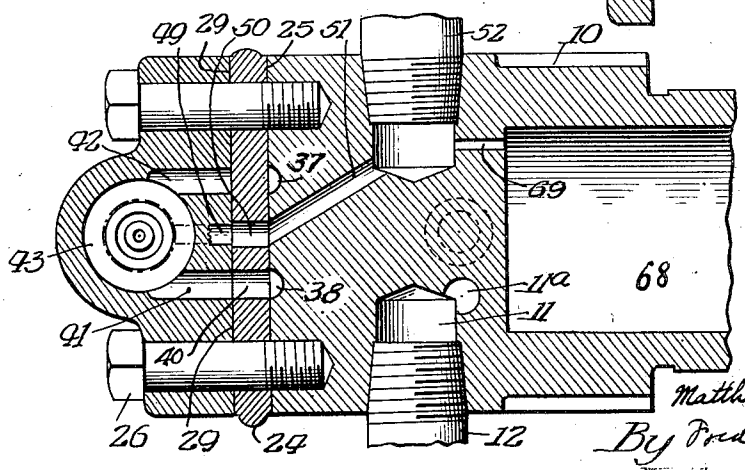


Fig. 7



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REVERSIBLE FUEL PUMP

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Fig. 9

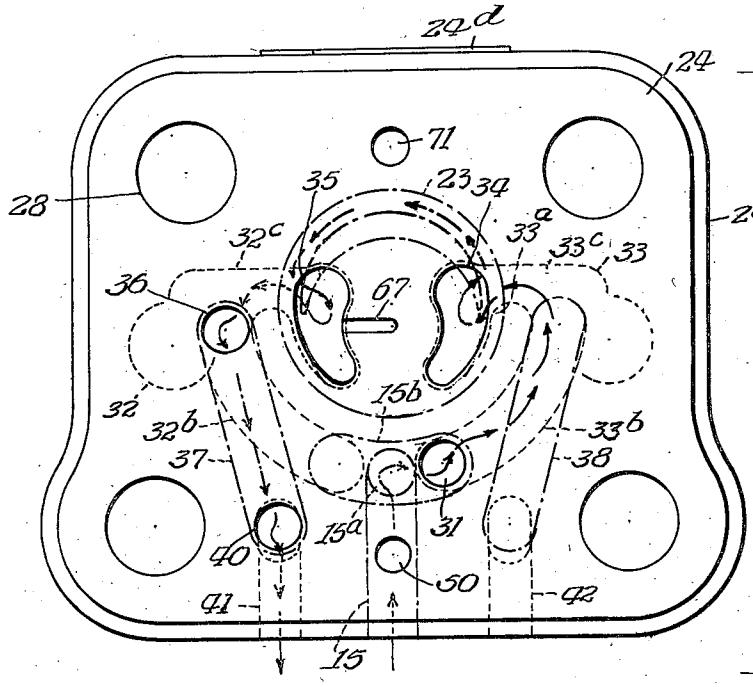


Fig. 10

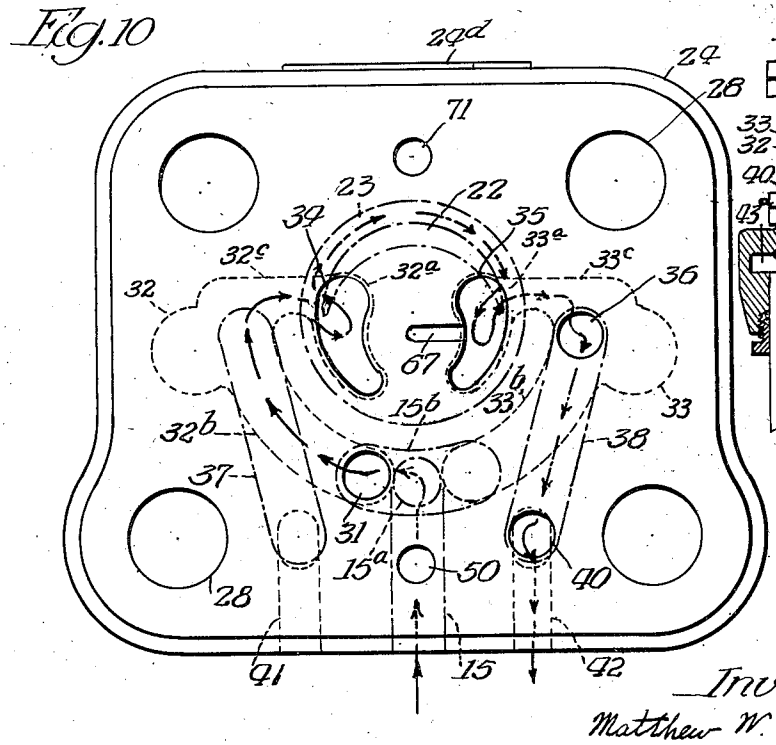
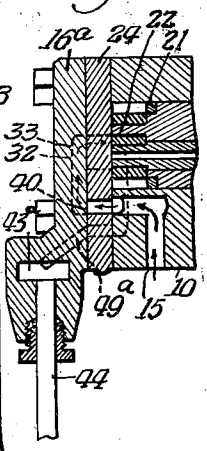


Fig. 11



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UNITED STATES PATENT OFFICE

2,107,152

REVERSIBLE FUEL PUMP

Matthew W. Huber, Chicago, Ill., assignor to Tuthill Pump Company, Chicago, Ill., a corporation of Illinois

Application August 13, 1936, Serial No. 95,797

7 Claims. (Cl. 103—117)

The invention relates to rotary pumps such, for example, as those which are adapted for delivering fuel under pressure to oil-burners.

The primary object of the invention is to provide an improved pump of the rotary type, which is readily adaptable for right or left-hand rotation, that is, clockwise or counterclockwise drive, without requiring any reconstruction or change in the inlet and outlet piping. This makes it possible readily to apply the pump to a right or left-hand electric motor.

Another object of the invention is to provide a rotary pump which is generally of new and improved construction and may be manufactured at a low and reasonable cost.

Other objects of the invention and the various advantages and characteristics of the present pump will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views: Fig. 1 is a longitudinal sectional view showing a pump embodying the invention with a strainer and valve unit attached thereto. Fig. 2 is an elevation of the valve-body showing the face having the ducts formed therein. Figs. 3 and 4 are perspectives of the reversible plate between the pump-housing and the valve-body, and illustrating the ports and ducts therein by which the flow of oil may be controlled for right or left-hand rotation of the pump. Fig. 5 is a section on the line 5—5 of Fig. 1. Fig. 6 is a horizontal section on the line 6—6 of Fig. 1. Fig. 7 is a section on the line 7—7 of Fig. 1. Fig 8 is a section on the line 8—8 of Fig. 5. Fig. 9 is a face view of the reversible oil delivery plate for the pump, the ducts in the face of the pump-housing and the face of the valve-body being indicated in dotted lines, the plate being in position for rotation of the pump in counter-clockwise direction. Fig. 10 is a similar view illustrating the plate in position to control the delivery of the oil to and from the pump when the pump is rotated in clockwise direction. Fig. 11 is a vertical central section illustrating a modified form of the invention.

The invention is exemplified in an oil-pumping unit comprising a pump-housing 10 having an inlet 11 in one of its sides for receiving oil from a pipe 12 (Fig. 7) which is connected to a suitable reservoir or supply tank (not shown); a strainer 13 secured by a bolt 14 against the bottom of the housing 10; a vertical duct 11a in housing 10 for delivering the oil to the inlet side of strainer 13; a vertical duct 15 in the housing for delivering the oil after it has been strained to the suction side of the pump; and a valve-structure 16 to which the pressure side of the pump delivers the oil for delivery to the burner.

The pump is of the internal gear type and comprises an externally toothed gear 17, a drive-shaft 18 to which gear 17 is fixed; an eccentrically disposed rotor 20 which includes gear-teeth 20a meshing with gear 17 and a ring 20b mounted around the shaft 18 and journaled in an annular groove in a sleeve 21 which is fixed in the pump-housing; and a crescent 22 between the crescent shaped space between the gear 17 and rotor-teeth 20a, and integrally formed with sleeve 21. The rotor 20 corresponds in diameter with, and fits in, a cylindrical pump-chamber 23. The chamber 23 containing gear 17, rotor 20 and crescent 22, is closed at its inner end by sleeve 21 and at its outer end by a plate 24 which fits between the flat end-face 25 of pump-housing 10 and the face 29 of the body 27 of valve-unit 16. Bolts 26 extend through lugs on the valve-body 27 and holes 28 in plate 24 and into the pump-housing, to clamp the plate between the flat face 29 on said valve body and the face 25 of the pump-housing.

The pump is adapted for rotation in either direction and to put the oil under pressure in transit from either side to the other, according to the direction of rotation of the pump. When the pump is rotated in a given direction, the suction or inlet is at one side, and the pressure or discharge is at the other side. When the direction of rotation is reversed, the inlet and discharge sides are reversed. By reason of this adaptability, and the hereinafter described means for reversing the inlet and discharge ducts for controlling the oil according to the direction of rotation of the pump-gears, the pump may be directly driven by a right or left-hand electric motor.

Plate 24 covers the outer end of the pump-chamber and embodies ports for conducting the oil to the suction side and from the pressure side of the pump. This plate is reversible and has embodied therein ports for controlling the oil, which are reversible into proper correlation with the pump, according to its direction of rotation. When side-face 24a of plate 24 is positioned against the face 25 of pump-housing 10, the oil will be directed to enter the chamber 23

at one side and to discharge at the other side when the pump is rotating in one direction and when the plate is reversed to bring its other side-face 24b against the face 25 of the pump-housing, the ports therein will be reversed to supply oil to and discharge it from opposite sides of the pump according to the rotation of the pump in the opposite direction.

Plate 24 has formed therein a pair of symmetrically arranged kidney-shaped slots 34, 35 which are adapted to communicate with the suction and pressure sides of the pump chamber 23 and function as an inlet or suction port and a pressure or discharge port. These slots 34, 35 are adapted to function at either side of the pump according to the position of the plate 24 and the direction of rotation of the pump. When the face 24a of plate 24 abuts and is secured against face 25 of the pump-housing, the slot 34 will function as an inlet or suction port at the suction side of the pump and the slot 35 will function as an outlet port at the pressure side, while the pump is rotating in one direction. When the reverse face 24b of plate 24 is placed against the pump-casing, the slots 34, 35 will be reversed from one side to the other, so they will be positioned to function for reverse rotation of the pump.

Duct 15 (Fig. 1) in the pump-housing, through which oil is drawn by suction, has an angular end 15a which terminates in an arcuate recess 15b at the face 25 of the pump-housing. Plate 24 has a through-port 31 which is off-set with respect to the vertical center of the pump and registers with either end of the arcuate recess 15b to conduct oil through the plate 24 while the latter is in either of its reversible positions. The face of the valve-body 27, which fits against either face of the plate 24, is provided with a pair of separated grooves 32, 33 which are symmetrically disposed on opposite sides of the vertical center of the pump. Groove 32 comprises a pair of substantially concentric arcuate branches 32a and 32b which are connected at the top, as at 32c. Groove 33 comprises a pair of substantially concentric arcuate branches 33a and 33b, the upper ends of which are connected at 33c. The branches 32a and 33a of grooves 32 and 33 in the face of the valve-body 27, conform to the kidney-shaped slots 34, 35 in plate 24 and are adapted to register with said slots while the plate is in either of its positions.

Port 31 in plate 24 is adapted to conduct oil from either end of arcuate recess 15b, through the plate. With the plate in one of its positions, port 31 will establish communication between inlet duct 15 and the lower end of arcuate groove 32b in the valve-body 27, for the delivery of oil through recess branch 32a to the kidney-shaped slot 34 in plate 24 at that side which constitutes the suction side of the pump while rotating in one direction. When the plate 24 is reversed, its port 31 will establish communication with the other end of groove 15b and the branch 33b of recess 33 in the valve-body 27 for conducting the oil through branches 33c and 33a to the kidney-shaped slot 34 which is located at the other side of the pump which then functions as the suction side of the pump during reverse rotation of the pump.

Plate 24 is provided with a port 36 which extends therethrough and serves as a discharge port at one side of the pump when the plate 24 is in one of its positions, and at the other side of the pump when the plate is reversed. A pair of discharge-grooves 37, 38 are formed in the face 25 of the pump-housing and are symmetrically disposed with respect to the axis of the pump. The discharge port 36 of plate 24 is adapted to register alternately with the upper end of either of these grooves 37, 38, according to the position of the plate 24. When the plate is in one of its positions, port 36 will register with the upper end of groove 37 in the face of the pump-housing, to deliver oil under pressure into said groove. When the plate is reversed, port 36 will register with the upper end of groove 38 to deliver oil under pressure into that groove. Plate 24 is provided with a hole 40 which extends therethrough and is adapted to register alternately with the lower end of either of the ports 37, 38 according to the position of the plate 24 and its adaption to the direction of rotation of the gear-pump. These holes 36 and 40 are provided only at one side of the plate so that when the plate is in one of its positions the discharge will be through the groove 38 and when the plate is in its other position the discharge will be through groove 37. The valve-body is provided with ports 41, 42 disposed on opposite sides of the center of the pump, and adapted, respectively, to deliver oil from port 40 in the plate 24 when the latter is in either of its positions, according to the direction of rotation of the pump. With the pump operating in either direction, the oil will be discharged under pressure through port 40 from the pressure side and either of the ports 41, 42 in the valve-body to the valve-chamber 43.

The operation of the pump mechanism thus far described will be as follows: When the drive-shaft 18 is driven in counter-clockwise direction, the face 24a of plate 24 will be secured against the face 25 of the pump-housing and its face 24b will be against face 29 of the valve-body 27 so the ports and ducts in the pump, plate and said body, will be positioned, as diagrammatically illustrated in Fig. 9. At such time oil will pass to the suction-side of the pump (right side of Fig. 5) through duct 15, one branch of arcuate recess 15b, port 31 in plate 24, branches 33b, 33c, 33a of groove 33 in valve-body 27 and kidney-shaped port 34 to the suction side of the gear-pump. The oil will be forced from the pressure-side of the pump, which is then the left side in Fig. 9, through kidney-shaped port 35, branch 32c of groove 32 in the valve-body, port 36 in plate 24, groove 37 in the face 25 of the pump-housing, port 40 in plate 24 and port 41 in the valve-body to the valve-chamber 43.

When the pump is driven in clockwise direction by the motor, the plate 24 will be reversed so its face 24b will abut on the face 25 of the pump-housing 10 and its face 24a will abut the face 29 of valve-body 27 to bring its ports into the position illustrated in Fig. 10 of the drawings. Upon removal of the bolts 26, this plate 24 can be readily reversed for this purpose. In such reversed position, oil will pass to the suction-side of the pump (then the left-hand side of the pump chamber 23 in Fig. 10) through duct 15, duct end 15a and one branch of recess 15b, port 31 in plate 24, branches 32b, 32c, 32a of groove 32 in the face of valve-body 27, and kidney-shaped port 34 in plate 24. The oil from the pressure-side of the pump will pass through kidney-shaped port 35 in plate 24, branches 33a, 33c of groove 33 in the valve-body 27, port 36 in plate 24, groove 38 in the face 25 of the pump-housing, port 40 in plate 24, and duct 42 in the

valve-body to the valve-chamber 43. When the plate 24 is in one of its positions, for example that shown in Fig. 9, there will be no communication between the groove 38 in the pump-housing and the groove 33 and port 42 in the valve-body at the suction-side of the pump and when the plate is reversed for the opposite rotation of the pump, communication between the groove 37 in the pump-housing and groove 32 in the valve-body, is cut off by plate 24. As a result, a mere reversal of the plate 24 is the only change necessary to adapt the pump for rotation in opposite directions while a uni-directional flow of oil is maintained. An arrow 24d is provided on the top edge of plate 24 to indicate the correct setting of the plate with respect to the direction of rotation of the pump.

A pipe 44 is coupled to the lower end of the valve-body 27 to deliver the oil under pressure to the oil-burner or for any other use. A plunger 45 is slidably mounted in the valve-body 27. A conical valve 46 is fixed to the lower end of the plunger to control the delivery of the fuel from chamber 43 to the pipe 44. The plunger is also formed with a valve-member 47. An adjustable spring 48 is applied to force the plunger normally downwardly. Valve-member 47 is located above the pressure-chamber 43. When the pressure in chamber 43 exceeds a predetermined point, it will force the plunger 45 and its member 47 upwardly and open valve 46, to supply the fuel under pressure-pipe 44 to its point of use. This action is caused by the pressure developed in chamber 43 by fuel from the pressure-side of the pump while it is rotating in either direction. In order to permit any excess fuel delivered into pressure-chamber 43 to be by-passed back to the supply tank, a port 49 is formed in valve-body 27 between its face 29 and the cylinder in which slide the plunger 45 and valve member 47, said valve moving upwardly to open the port 49 when the pressure in chamber 43 becomes excessive. From port 49 the oil is conducted first through a port 50 which is centrally disposed in plate 24 and communicates with the port 49 while the plate 24 is in either of its alternative positions, and thence through a port 51 (Fig. 7) in the pump-housing which leads to a pipe 52 for by-passing the oil to the supply tank.

The pump may be equipped with means for controlling it so that no oil is supplied to the burner unless the pump and its shaft 18 are driven at or in excess of a predetermined speed by an electric motor (not shown) as described and illustrated in detail in application serially numbered 89,913, filed July 10, 1936, by Herbert E. Kempton, to which reference may be had for the details of construction thereof.

This means comprises a sleeve-valve 55 on a non-rotatable drum 56 which is longitudinally movable on the pump-shaft 18 and a series of centrifugal balls 57 which are carried in a cage 58 rotatable with the pump-shaft 18, and engage a conoidal surface 59 on the drum. Valve 55, when the pump is at rest, is positioned to open a port 60 in an annular groove 61 in the pump-shaft, which leads to an axial duct 62 extending to the inner end of said shaft and to the reversible plate 24. When the pump-shaft acquires a predetermined speed, sufficient to cause the usual blower to supply the required amount of air for combustion to the burner, centrifugal force will force the balls 57 outwardly against the conoidal surface 58 and slide the valve 55 on shaft 18 into position to close the port 60. Drum 56 is normally pressed by a spring 63 to force the balls 57 toward the axis of shaft 18. This spring is interposed between a collar 64 which engages drum 56 and a conoidal collar 65 engaged by a screw 66 so that the pressure of the spring to resist the centrifugal force of the balls 57, may be varied as desired. Plate 24 is provided on each of its faces with a groove 67 leading from the discharge port 35 in the casing into registry with, and terminating at, the axial port 62 in pump-shaft 18. By providing a groove 67 on each of the faces of plate 24, communication will be established between the discharge port 35 and the sleeve-valve 55 while the plate 24 is mounted for rotation of the pump in either direction.

The operation of this means for by-passing the fuel through the pump-shaft until the pump reaches a predetermined speed, is as follows: Normally, valve 55 will be positioned to open the port 60; when the pump-shaft 18 is driven, the pump will be rotated and the groove 67 in the face of the plate 24, which lies against the face 25 of the pump-casing, will deliver oil from the discharge port 35 through the axial duct 62 in the pump-shaft 18, port 60 and annular groove 61 into the chamber 68 in the pump-housing, from which it will flow through a duct 69 to the return or by-pass pipe 52. As soon as the pump-shaft reaches the desired predetermined speed for operating the blower to deliver sufficient air to the burner for proper combustion, and at which the delivery of fuel should begin, balls 57, under centrifugal force, will shift the drum 56 axially and slide sleeve 55 over annular groove 61 and thus cut off the escape of oil from duct 62 in the pump-shaft 18, to the chamber 68. Thereupon, the full flow of oil under pressure will be delivered from the pump to the valve-chamber 43.

In order to prevent the plunger 45 and its valve 46 from being lifted or opened until the pump has reached the desired speed or while the sleeve-valve 55 is open, a duct 70 is formed in the pump-housing between chamber 68 and the face 25 of the pump-housing. This duct registers with a central port 71 (Fig. 1) in plate 24. A recess 72 is formed in the face 29 of valve-body 27 in communication with port 71 and a duct 73 delivers oil from recess 72 into the valve-body on the upper side of plunger 45. As a result of this connection, part of the oil in chamber 69 flows into the plunger-chamber of valve-body 27 and builds up sufficient pressure to retain the valves 46 and 47 in their closed position until sleeve-valve 55 is closed, and then all of the oil from the pump will be delivered under pressure into the chamber 43 of the valve-unit 16.

In the modification illustrated in Fig. 11, the valve-unit is eliminated and a cover-plate 16a is substituted therefor. In this form of the invention, the plate 16a has its inner face, which is adapted to abut against the reversible plate 24, provided with grooves 32, 33, with their branches of the form described in connection with the construction shown in Figs. 1 to 10, and ports 49a, for delivering fuel under pressure from port 49 in plate 24 to a chamber 43a in plate 16a for conduction to a valve or any other element. In this form of the invention the recess 72, ports 73 and 49 are omitted.

The invention exemplifies a fuel-pump unit, which includes a reversible plate whereby the pump can be quickly adapted for operation by a right or left-hand motor and in the field, without reconstruction. Also a pump-unit of this type

which is simple in construction and can be produced at a low cost.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

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

1. A pump unit comprising in combination, a pump housing having a face at one side and a pump chamber opening on to said face, means forming an inlet duct for fluid terminating adjacent to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of grooves therein, and a plate between the two faces having a suction slot, a pressure slot and a fluid inlet port, and adapted when disposed in one position between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct and one of the grooves in the element and also to have the suction slot register with and effect communication between said one groove and the suction side of the pump chamber and the pressure slot register with the pressure side of the pump chamber, and when disposed in a reverse position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct and the other groove in the element and also to have the suction slot register with and effect communication between said other groove and the suction side of the pump chamber and the pressure slot register with the pressure side of said chamber.

2. A pump unit comprising in combination, a pump housing having a face at one side and a pump chamber opening onto said face and also having an inlet duct for fluid leading to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of elongated grooves therein, and a plate between the two faces having a suction slot, a pressure slot and a fluid inlet port and adapted when disposed in one direction between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct in the housing and one end of one of the grooves in the element, and also to have the suction slot register with and effect communication between the other end of said one groove and the suction side of the pump chamber and the pressure slot register with the pressure side of the pump chamber, and when disposed in a reverse position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct and one end of the other groove in the element and also to have the suction slot register with and effect communication between the other end of said other groove and the suction side of the pump chamber and the pressure slot register with the pressure side of said chamber.

3. A pump unit comprising in combination, a pump housing having a face at one side and a pump chamber opening onto said face and also having an inlet duct for fluid leading to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of grooves therein, and a plate between the two faces having a suction slot, a pressure slot, a fluid inlet port, and a fluid outlet port, and adapted when disposed in one position between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct and one of the grooves in the element and the suction slot register with and effect communication between said one groove and the suction side of the pump chamber, and also to have the pressure slot register with and effect communication between the pressure side of the pump chamber and the other groove and the outlet port register with said other groove, and when disposed in a reversed position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct and said other groove and the suction slot register with and effect communication between said other groove and the suction side of the pump chamber, and also to have the pressure slot register with and effect communication between the pressure side of said chamber and said one groove and the outlet port register with said one groove.

4. A pump unit comprising in combination, a pump housing having a face at one side and a pump chamber opening onto said face and also having an inlet duct for fluid leading to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of elongated grooves therein, a plate between the two faces having a suction slot, a pressure slot, a fluid inlet port, and a fluid outlet port, and adapted when disposed in one position between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct and one end of one of the grooves in the element and the suction slot register with and effect communication between the other end of said one groove and the suction side of the pump chamber and also to have the pressure slot register with and effect communication between the pressure side of the pump and one end of the other groove and the outlet port register with the other end of said other groove, and when disposed in a reverse position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct and said other end of said other groove and the suction slot register with and effect communication between said one end of said other groove and the suction side of the pump and also to have the pressure slot thereof register with and effect communication between the pressure side of the chamber and said other end of said one groove and the outlet port register with said one end of said one groove, and means for discharging fluid from the outlet port when the plate is in either of its positions.

5. A pump unit comprising in combination, a pump housing having a face at one side thereof and a pair of fluid outlet grooves therein and also having a pump chamber opening onto said face and an inlet duct for fluid leading to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of grooves therein, and a plate

between the two faces having a suction slot, a pressure slot, a fluid inlet port and a fluid outlet port, and adapted when disposed in one position between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct and one of the grooves in the element and the suction slot register with and effect communication between said one groove in the element and the suction side of the pump chamber and also to have the pressure slot register with the pressure side of the pump chamber and the other groove of the element and the outlet port register with said other groove of the element and one of the grooves in the pump housing, and when disposed in a reverse position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct and said other groove in the element and the suction slot register with and effect communication between said other groove in the element and the suction side of the pump chamber and also to have the pressure slot register with the pressure side of the chamber and said one groove in the element and the outlet port register with said one groove in the element and the other groove in the pump housing.

6. A pump unit comprising in combination, a pump housing having a face at one side with a pair of grooves therein and also having a pump chamber opening onto said face between the grooves and an inlet duct for fluid leading to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of grooves in said face and a pair of fluid outlet ducts leading from said face, and a plate between the two faces having a suction slot, a pressure slot, a fluid inlet port, and a pair of fluid outlet ports, and adapted when disposed in one position between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct and one of the grooves of the element and the suction slot register with and effect communication between said one groove of the element and the suction side of the pump chamber and also to have the pressure slot register with the pressure side of the pump chamber and the other groove in the element and one of the outlet ports register with and effect communication between said other groove in the element and one end of one of the grooves in the pump housing and the other outlet port register with and effect communication between the other end of said one groove in the pump housing and one of the outlet ducts in the element, and adapted when disposed in a reverse position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct in the housing and said other groove in the element and the suction slot register with and effect communication between said other groove in the element and the suction side of the pump chamber and also to have the pressure slot register with and effect communication between the pressure side of said chamber and said one groove in the element and said one outlet port register with and effect communication between said one groove in the element and one end of the other groove in the pump housing and said other outlet port register with and effect communication between the other end of said other groove in the pump housing and the other outlet duct in the element.

7. A pump unit comprising in combination, a pump housing having a face at one side and a pump chamber opening onto said face, means forming an inlet duct for fluid terminating adjacent to said face, a reversible rotor in the pump chamber, an element having a face positioned in spaced relation with said face of the pump housing and provided with a pair of grooves therein, a plate between the two faces having a suction slot, a pressure slot and a fluid inlet port, and adapted when disposed in one position between said faces and the rotor is driven in one direction to have the inlet port thereof register with and effect communication between the inlet duct and one of the grooves in the element and also to have the suction slot register with and effect communication between said one groove and the suction side of the pump chamber and the pressure slot register with the pressure side of the pump chamber, and when disposed in a reverse position between said faces and the rotor is driven in the opposite direction to have the inlet port thereof register with and effect communication between the inlet duct and the other groove in the element and also to have the suction slot register with and effect communication between said other groove and the suction side of the pump chamber and the pressure slot register with the pressure side of said chamber, and means for by-passing fluid from the pressure side of the pump chamber regardless of the position of the plate comprising a groove in each side of the plate.

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