Feb. 28, 1939. H. E. KEMPTON ET AL 2,148,561

PUMP STRUCTURE

Filed Jan. 13, 1937 2 Sheets-Sheet 1

Fig. 1

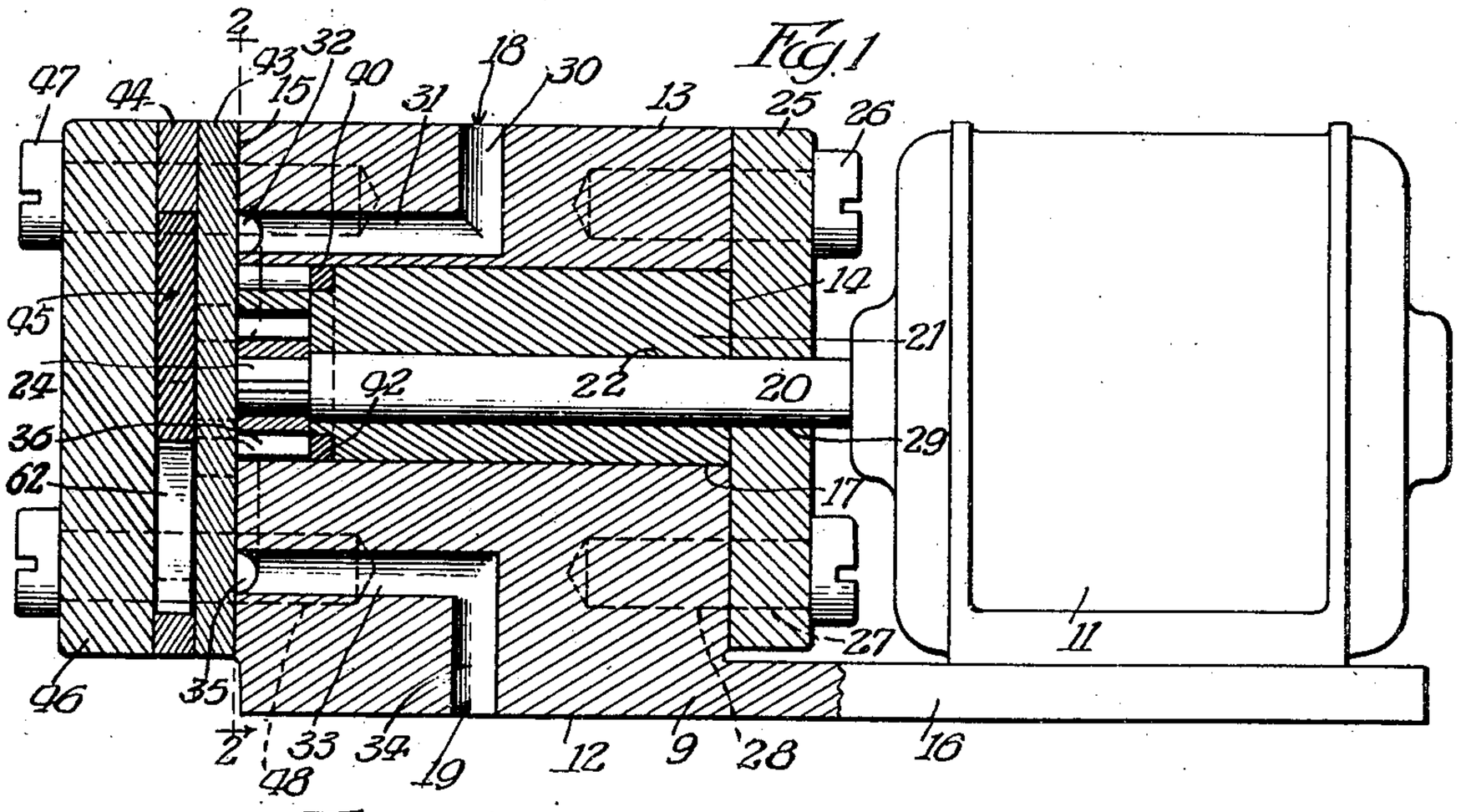


Fig. 2

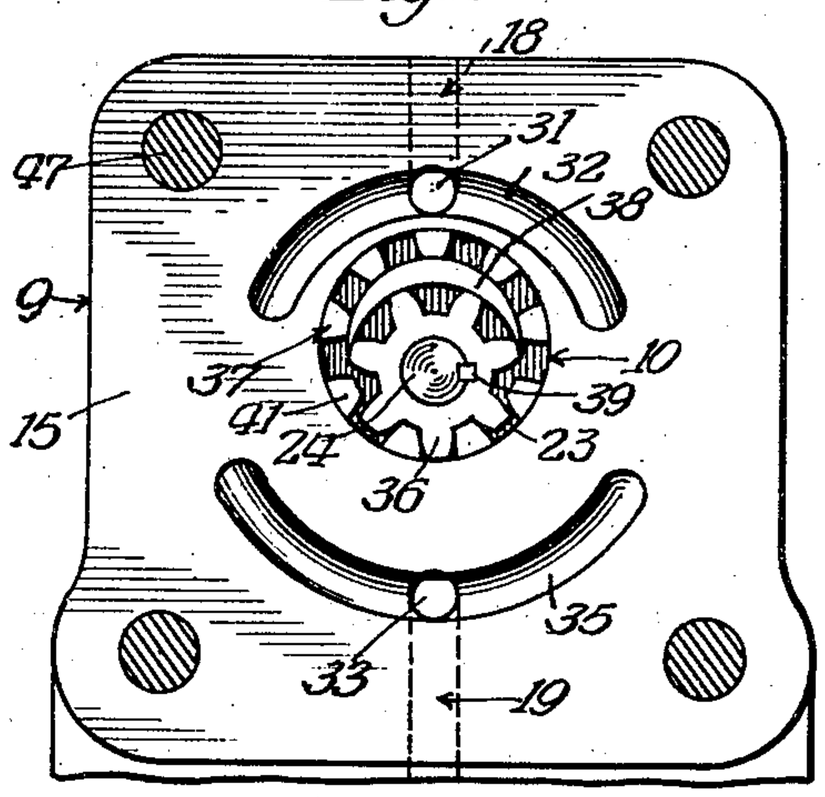


Fig. 3

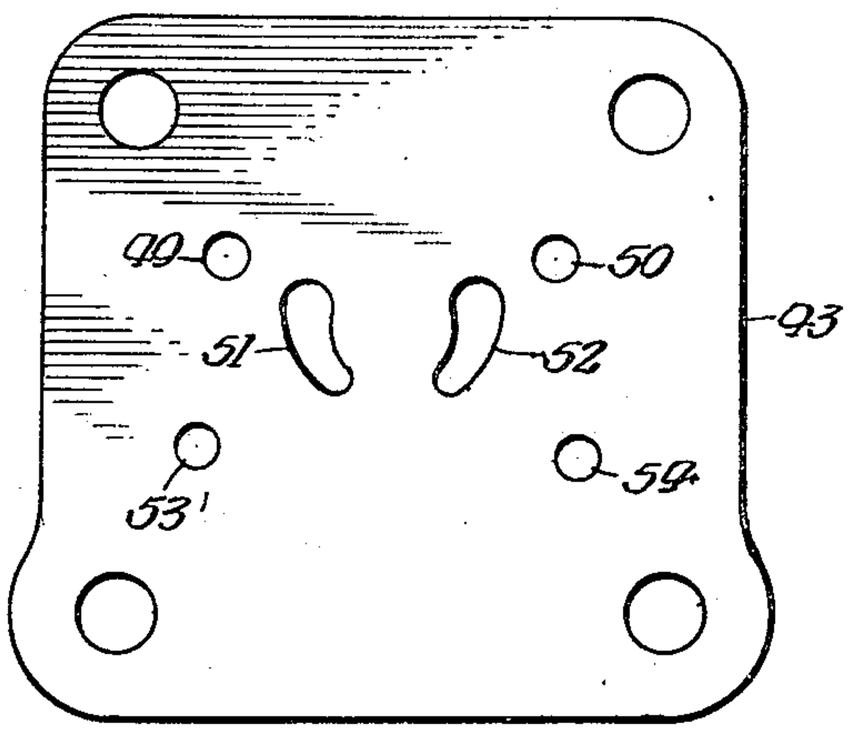
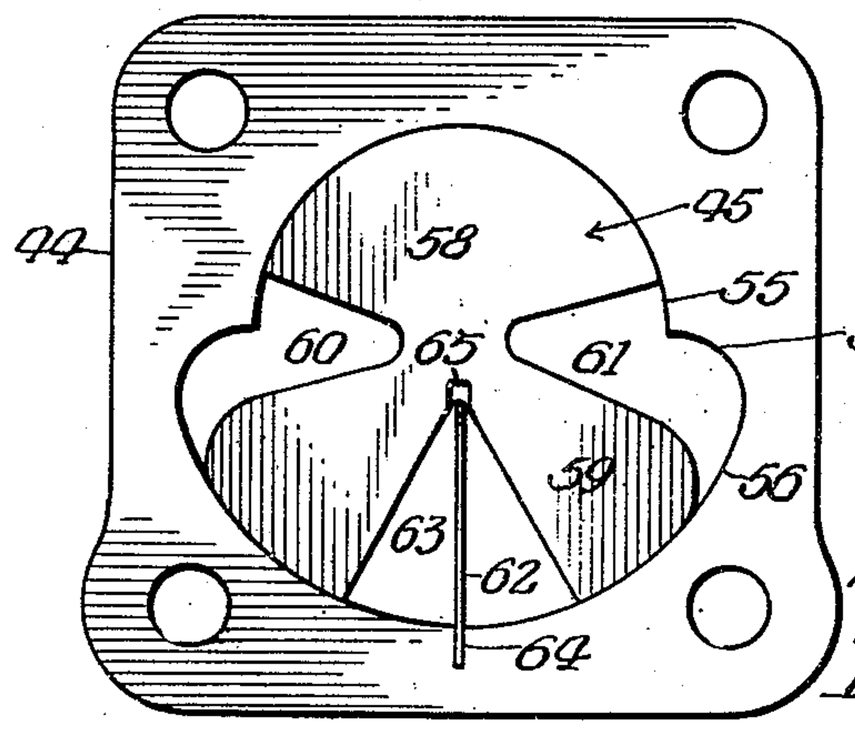


Fig. 4



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PUMP STRUCTURE

Filed Jan. 13, 1937 2 Sheets-Sheet 2

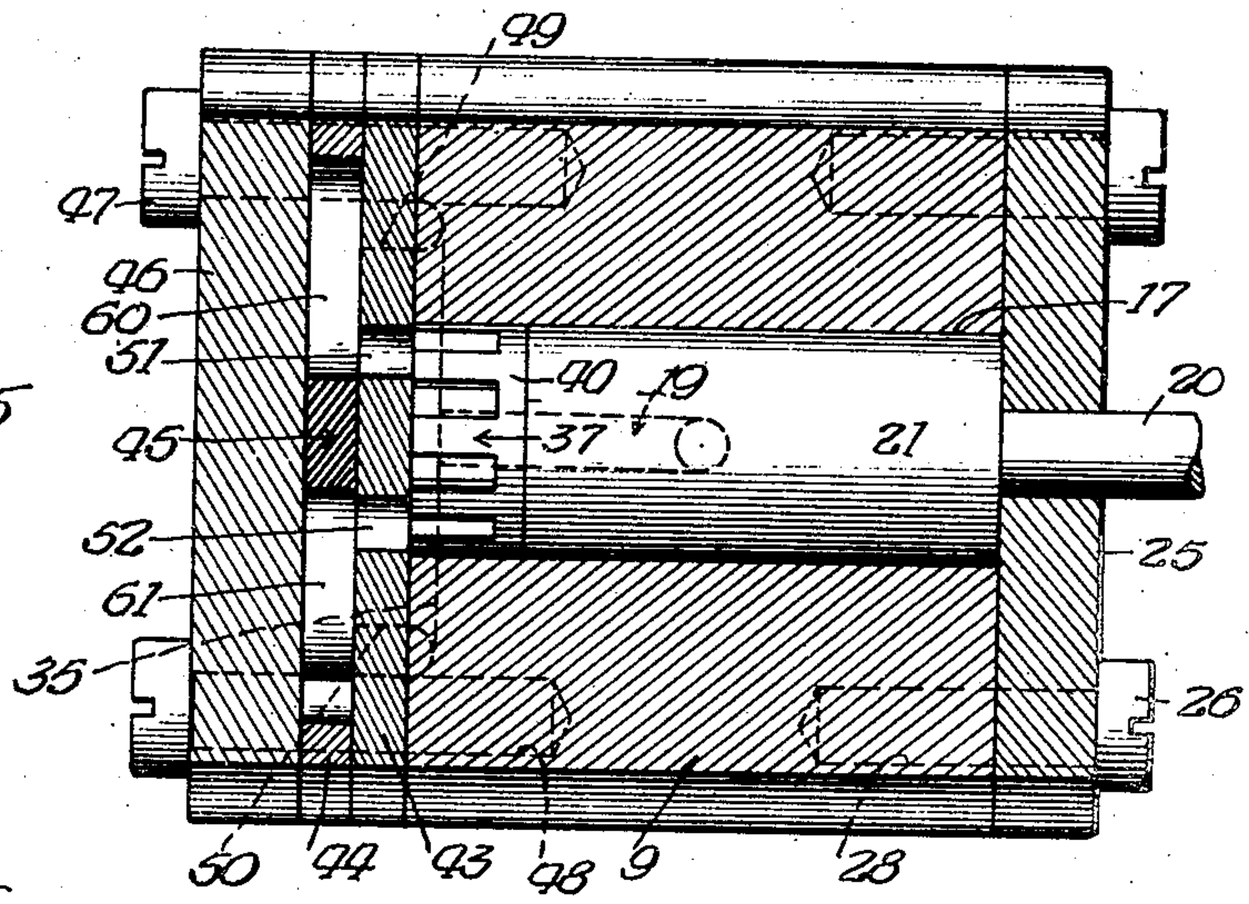


Fig. 5

Fig. 6

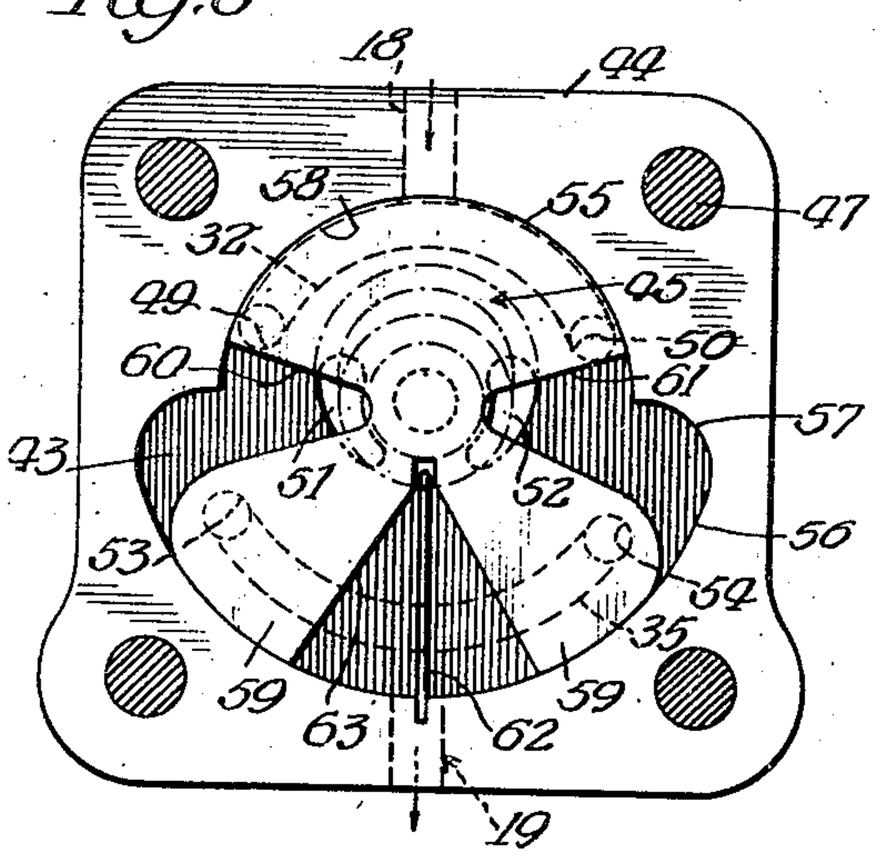
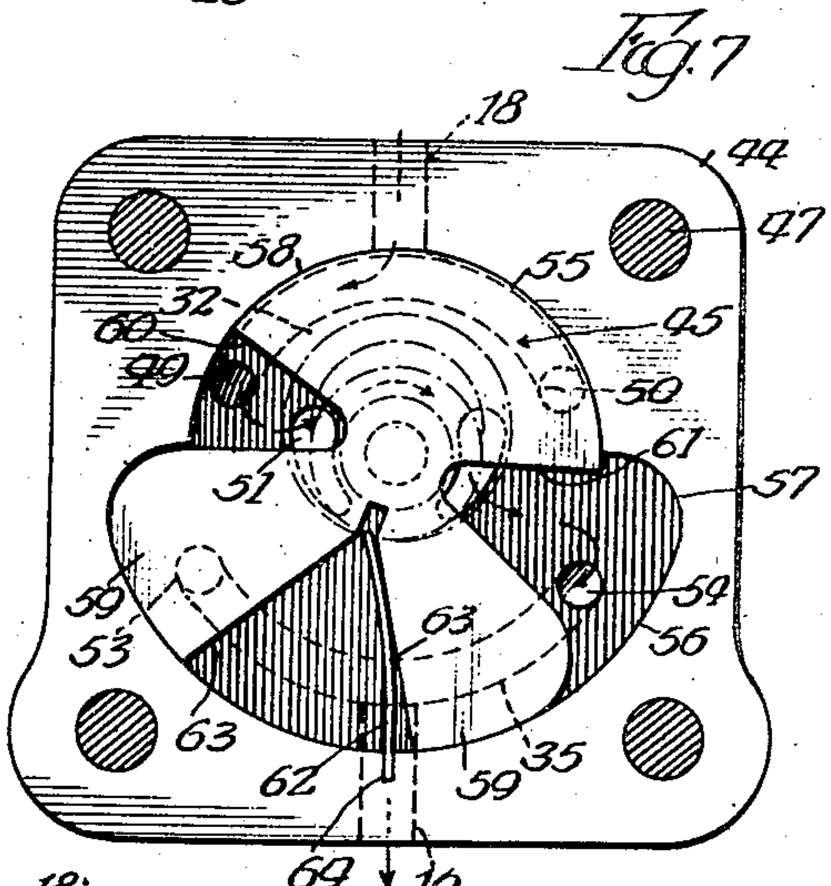


Fig. 7



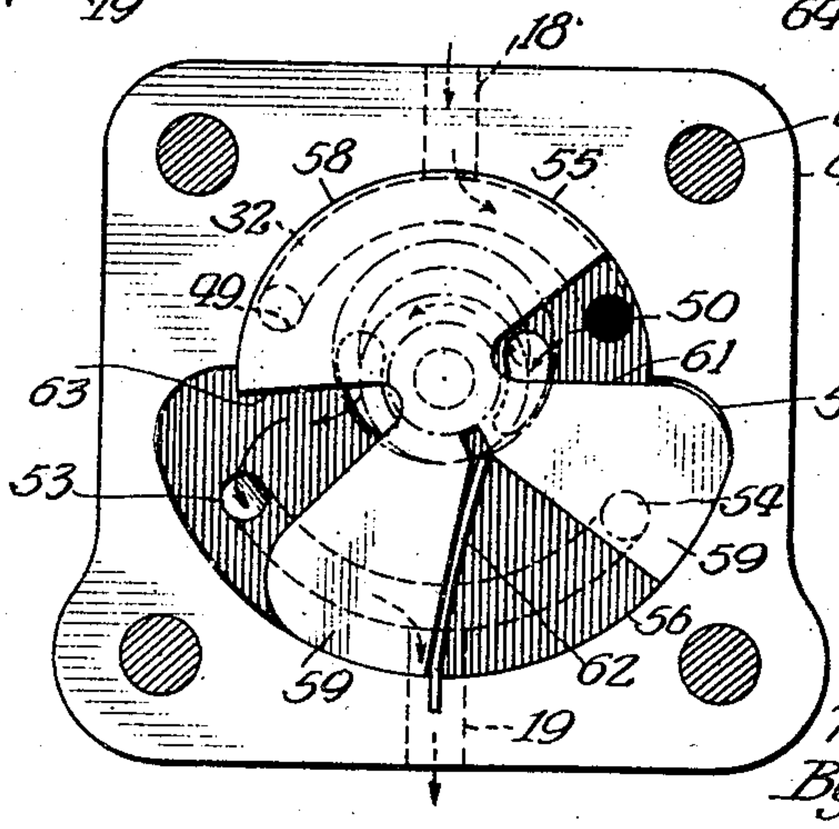


Fig. 8

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PUMP STRUCTURE

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Application January 13, 1937, Serial No. 120,330

7 Claims. (Cl. 103—117)

The present invention relates generally to pump structures. More particularly the invention relates to that type of pump structure which comprises a housing with an inlet and outlet duct for liquid, a gear pump in the housing, and an electric motor for driving the pump so that it operates to draw liquid through the inlet duct and to discharge it under pressure from the housing via the outlet duct.

One object of the invention is to provide a structure of this type which includes novel and improved control means whereby the flow of liquid through the housing is uni-directional regardless of the direction of drive of the gear pump.

Another object of the invention is to provide a pump structure of the last mentioned character in which the control means whereby the flow of liquid through the pump structure is uni-directional regardless of the direction of drive of the gear pump is in the form of a plate-type reversing valve which is controlled or actuated in a positive manner by the pressure of the liquid at the outlet side of the gear pump.

A further object of the invention is to provide a pump structure of the type and character under consideration which is generally of new and improved construction, consists of but a small number of parts, 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 structure 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:

Figure 1 is a vertical longitudinal sectional view of a pump structure embodying the invention;

Figure 2 is a vertical transverse section taken on the line 2—2 of Figure 1 and showing in detail the construction and location of the gear pump;

Figure 3 is a front or face view of the port plate which is located at one end of the housing and includes ports leading to the inlet and outlet ducts in said housing;

Figure 4 is a front or face view of the reversing valve and the plate in which the valve is mounted;

Figure 5 is a horizontal longitudinal sectional view of the structure;

Figure 6 is a vertical transverse sectional view showing the reversing valve in its neutral position, that is, the position which it assumes when the gear pump is inoperative;

Figure 7 is a similar sectional view showing the reversing valve in the position in which it is shifted when the gear pump is driven in a clockwise direction as viewed in Figure 2; and

Figure 8 is a vertical transverse sectional view showing the reversing valve in the position into which it is shifted when the gear pump is driven in a reverse direction, that is, in a counterclockwise direction as viewed in Figure 2.

The pump structure which is shown in the drawings constitutes the preferred embodiment of the invention and is primarily adapted to pump liquid such as oil. It is of the internal gear type and comprises a pump housing 9, an internal gear pump 10 within the housing, and an electric motor 11 for driving the pump.

The housing 9 is preferably in the form of an elongated rectangular one-piece casting and has a flat bottom face 12, a flat top face 13, and a pair of flat end faces 14 and 15. The top and bottom faces are parallel and the end faces extend at right angles to the top and bottom faces and are arranged one opposite the other. In addition to the aforementioned faces the housing has an integral platform 16 and is provided with a horizontal longitudinally extending bore 17, an inlet duct 18, and an outlet duct 19. The platform 16 is located adjacent to and projects outwardly from the end face 14 and serves as a support for the electric motor 11. The latter has an armature shaft 20 and is fixedly secured to the platform 16 so that the shaft extends longitudinally of the pump housing 9. One end of the armature shaft 20 projects outside of the motor casing and extends into and through the bore 17. This bore is formed in the upper portion of the housing 9. It is of uniform diameter from one end thereof to the other and extends between and through the flat end faces 14 and 15 of the pump housing. A cylindrical plug 21 fits in the bore 17, as shown in Figures 1 and 5, and has a longitudinally extending eccentrically disposed bearing forming hole 22. One end of this plug is flush with the end face 14 of the housing and the other end of the plug terminates inwardly of the end face 15 and forms with the adjacent end of the bore 17 a cylindrical chamber 23 in which the operating pumps of the internal gear pump 10 are disposed. The outer or projecting end of the armature shaft 20 extends through and is journaled in the bearing forming hole 22 in the

plug 21 and embodies a reduced stem 24 which, as shown in the drawings, is disposed in and extends through the chamber 23. Outward movement of the plug 21 in the direction of the electric motor 11 is prevented by means of a substantially square cover plate 25. This plate fits against the end face 14 of the pump housing 9 and is secured in place by means of screws 26. The latter extend through holes 27 in the corner portions of the plate 25 and fit within internally threaded sockets 28 in the contiguous end of the pump housing. A hole 29 is formed in the central portion of the cover plate 25. This hole registers with the eccentrically disposed bearing-forming hole 22 in the plug 21 and forms an auxiliary bearing for the projecting end of the armature shaft 20. The inlet duct 18 is formed in the upper portion of the pump housing 9. It is L-shaped, as shown in Figure 1, and embodies a vertical branch 30 and a horizontal branch 31. The vertical branch extends through the flat top wall 13 of the pump housing and is adapted to be connected by a pipe (not shown) to a reservoir or tank (also not shown) containing the liquid to be pumped by the pump 10. The horizontal branch 31 of the inlet duct is disposed directly over and extends longitudinally of the bore 17 in which the plug 21 fits. One end of the branch 31 joins or intersects the lower end of the vertical branch 30 of the inlet duct and the other end leads to the flat end face 15 of the pump housing and intersects and communicates with the central portion of a substantially semi-circular groove 32 in said end face of the housing. As shown in Figure 2, this groove 32 extends around and is substantially concentrically positioned with respect to the upper portion of the chamber 23 for the operating parts of the internal gear pump 10. During operation of the pump structure the internal gear pump 10, as hereinafter described, operates to draw or suck liquid through the inlet duct 18 and to discharge it under pressure from the pump housing 9 by way of the outlet duct 19. This outlet duct, as shown in Figure 1, is formed in the lower portion of the housing 9. It is L-shaped and embodies a horizontal branch 33 and a vertical branch 34. The horizontal branch of the outlet duct is disposed beneath and extends lengthwise of the bore 17 and leads from the central portion of a substantially semi-circular groove 35 in the flat end face 15 of the pump housing to the upper end of the vertical branch 34. The vertical branch of the inlet duct extends downwardly from the horizontal branch 33 and its lower end extends through the flat bottom face 12 of the pump housing and is adapted to be connected by way of a pipe or like conduit to the apparatus or place where the pumped liquid is to be utilized. The groove 35 underlies the chamber 23 for the operating parts of the internal gear pump 10 and has a larger radius than the groove 32 at the so-called inner end of the inlet duct 18. It is positioned substantially concentrically with respect to the chamber 23 and the central portion thereof is spaced a greater distance from said chamber than the central portion of the groove 32.

The internal gear pump 10 is of standard or conventional design and consists of a gear 36, a rotor 37, and a crescent 38. The gear 36 of the pump is disposed in the cylindrical chamber 23 and is fixedly secured by way of a key 39 to the reduced stem 24 on the armature shaft 20 of the motor 11. Due to the fact that the bearing forming hole 22 is eccentrically disposed in the plug 21 the gear 36 is eccentrically positioned in the chamber 23. The rotor 37 is in the form of a ring gear and corresponds in diameter to and fits within the chamber 23. It surrounds and meshes with the gear 36, as shown in Figure 2, and comprises a ring 40 and a plurality of axially extending annularly disposed teeth 41. The ring 40 of the rotor fits rotatably within an annular groove 42 in the contiguous end of the plug 21 and the teeth 41 extend across the chamber 23. The crescent 38 is stationary. It is formed as an integral part of the plug 21 and fits in and seals the crescent shaped space betwen the gear 36 and the rotor, that is, the space where the teeth of the gear 36 are not in mesh with the teeth 41 of the rotor. When the pump 10 is driven as the result of operation of the electric motor 10, the gear 36 is driven and rotates the rotor 37. During drive of the gear 36 and rotation of the rotor the teeth at one side of the gear emerge from meshing relation with the teeth of the rotor and the teeth at the other or opposite side of the gear enter into meshing relation with the contiguous or adjacent teeth of the rotor. As the teeth at the one side of the gear emerge from meshing relation with the adjacent teeth of the rotor, suction is created and liquid is caused to be drawn from the inlet duct 18, as hereinafter described, into the spaces between the teeth of the gear and the rotor on what may be termed the suction side of the pump. As the teeth of the gear enter into meshing relation with the teeth of the rotor at the other, or what may be termed the pressure side of the pump, the liquid in the spaces between the teeth is forced out of said other side of the pump and flows, as hereinafter described, under pressure from the pump housing via the outlet duct 19.

The pump structure in addition to the housing 9, the gear pump 10, and the electric motor 11, comprises a port plate 43, a plate 44, a reversing valve 45 and a cover plate 46. The port plate 43 is substantially square and fits against the flat end face 15 of the pump housing 9. It forms an end closure for the chamber 23 in which the operating parts of the internal gear pump 10 are disposed, and is clamped in place by means of a set of bolts 47. The plate 44 is the same in size and shape as the port plate 43. It serves as a housing for the reversing valve 45 and fits against the outer face of the port plate. The cover plate 46 serves as a closure for and fits against the outer face of the plate 44 and like the plate 44 and the port plate 43 is substantially square. The bolts 47 extend through aligned holes in the corner portions of the cover plate 46 the plate 44 and the port plate 43 and fit within internally threaded sockets 48 in the contiguous end of the pump housing 9. These bolts when tightened cause the cover plate to clamp the two plates 43 and 44 with respect to the pump housing and hold them in sealed relation.

The port plate 43 has formed therein a pair of inlet ports 49 and 50, a pair of kidney-shaped holes 51 and 52, and a pair of outlet ports 53 and 54. The inlet ports 49 and 50 are positioned on opposite sides of the internal gear pump 10, as shown in Figures 6, 7 and 8. They extend completely through the plate 43 and register and communicate respectively with the ends of the semi-circular groove 32 in the end face 15 of the pump housing 9. The kidney-shaped holes 51 and 52 are positioned one directly opposite the other and extend completely through the plate 43. They are disposed slightly inwards and beneath

the inlet ports 49 and 50 and register with the side portions of the chamber 23. The hole 51 is positioned adjacent to the inlet port 49 and the hole 52 is positioned adjacent to the port 50. The outlet ports 53 and 54 are located beneath and outwardly of the inlet ports and extend through the plate 43. They register and communicate respectively with the ends of the substantially semi-circular groove 35 and are positioned beneath the kidney-shaped holes 51 and 52. The latter, as shown in the drawings, are substantially concentrically arranged with respect to the gear 36 of the pump 10. When the pump is driven in one direction the hole 51, as hereinafter described, permits liquid to be drawn or sucked into the pump from the inlet port 49 and the hole 52 serves as the discharge side of the pump and, as hereinafter described, is connected to the outlet port 54 so that the liquid is free to flow out of the housing via the outlet duct 19. When the pump is driven in the opposite or reverse direction the hole 52, as hereinafter described, permits liquid to be drawn into the pump from the inlet port 50 and the hole 51 constitutes the discharge side of the pump and is connected, as hereinafter described, to the outlet port 53 so that the liquid is discharged from the pump housing 9 by way of the outlet duct 19.

The plate 44 has in the central portion thereof an upper semi-circular space 55 and a lower semi-circular space 56. These two spaces face and join one another and are concentrically positioned with respect to the gear 36. The upper space 55 faces the upper central portion of the port plate 43 and exposes the inlet ports 49 and 50 and the upper portions of the kidney-shaped holes 51 and 52. The lower space 56 faces the lower central portion of the port plate 43 and is of greater diameter than the semi-circular upper space 55. It exposes the outlet ports 53 and 54 and the lower portions of the holes 51 and 52 and has curved end corners 57 which join and are located outwardly of the end corners of the upper space 55.

The reversing valve 45 is confined within the spaces 55 and 56 in the plate 44 for rotation about the same axis as the gear 36. It is of plate like design and comprises an upper sector-shaped part 58 and a lower sector-shaped part 59. These parts are associated with the spaces 55 and 56 respectively and are joined together at their central portions. The opposed outer portions of the two parts are separated by a pair of wedge-shaped spaces 60 and 61. These two spaces are positioned one diametrically opposite the other and their inner ends register respectively with the kidney-shaped holes 51 and 52 in the port plate 43. The upper sector-shaped part 58 of the valve has a radius equal to that of the semi-circular upper space 55 in the plate 44, and its periphery engages slidably the portion of the plate 44 which defines the space 55. The part 58 is of such size that when the valve 45 is in its neutral position, as hereinafter described, as the result of stoppage of the gear pump, it seals or closes both inlet ports 49 and 50 (see Figure 6). The lower sector-shaped part 59 of the valve has a radius equal to that of the lower semi-circular space 56 and the outer periphery thereof fits slidably against the portion of the plate 44 which defines said space 56. The size of the lower part 59 is such that when the valve is in its neutral position, as shown in Figure 6, as a result of stoppage of the pump it covers and closes the outlet ports 53 and 54. The outer corners of the lower part 59 of the valve are rounded conformably to the curved end corners 57 of the lower space 56 in the plate 44 and coact with such end corners to limit rotative movement of the valve. When the valve is rotated in one direction (see Figure 7) the upper sector-shaped part 58 moves out of lapped or sealed relation with the inlet port 49 and the lower sector shaped part 59 moves out of lapped or sealed relation with the discharge port 54 and the wedge-shaped spaces 60 and 61 are brought into such position that the one registers with the inlet port 49 and effects communication between the port and the hole 51 and the other, that is the wedge-shaped space 61 registers with the outlet port 54 and effects communication between the latter and the kidney-shaped hole 52. When the valve is rotated in the opposite or reverse direction, as shown in Figure 8, the upper sector-shaped part 58 moves out of lapped relation with the inlet port 50 and the lower part 59 moves out of lapped or sealed relation with the outlet port 53 and the two wedge-shaped spaces 60 and 61 are brought into such position that the space 61 registers with the inlet port 50 and effects communication between the latter and the hole 52 and the other space, that is, the space 60 registers with the outlet port 53 and effects communication between such port and the kidney-shaped hole 51. The inlet ports 49 and 50 are arranged so that they are uncovered immediately upon turning of the valve 45 and the outlet ports 53 and 54 are arranged so that they are not uncovered by the lower sector-shaped part 59 of the valve until after opening of the inlet ports. When the pump structure is primed the wedge-shaped spaces 60 and 61 and the kidney-shaped holes 51 and 52 are filled with liquid. Turning of the valve is brought about by the pressure of the liquid within the pump housing when the drive of the gear pump is started. When the gear pump is driven in a clock-wise manner, as viewed in Figure 2, so that the hole 51 becomes the suction side of the pump and the hole 52 the pressure side the liquid in the hole 51 and also in the wedge-shaped space 60 is drawn into the pump and is forced under pressure through the hole 52 into the wedge-shaped space 61. As the liquid enters the space 61 it builds up pressure within the space and causes the valve 45 to rotate in a clock-wise manner. Rotation of the valve in this manner is attributable to the fact that the lower part 58 of the valve is of greater length or radius than the upper part of the valve and hence is subject to greater rotative force than the upper part. During the initial part of clock-wise turning of the valve the inlet port 49 is exposed and hence the suction side of the pump is free to draw liquid from the inlet duct 18 by way of said inlet port 49. When the valve is turned clock-wise as far as possible as the result of the delivery of liquid into the space 61 the outlet port 54 is uncovered and the liquid is discharged from the casing by way of the outlet duct 19. The pressure of the liquid in the space 61 during clock-wise drive of the gear pump serves to hold the valve 45 so that the spaces 60 and 61 are in registry respectively with the inlet port 49 and the outlet port 54. When the pump is driven in a counter-clockwise manner, as viewed in Figure 2 of the drawings, the liquid in the kidney-shaped hole 52 and the wedge-shaped space 61 is sucked into the pump and is forced under pressure through the hole 51 into the wedge-shaped space 60. As the liquid enters this space it creates such pressure that the valve 45 is caused to rotate in a counter-clock-

wise manner into a position wherein the wedge-shaped spaces 61 and 60 register respectively with the inlet port 50 and the outlet port 53. Counter-clockwise turning or rotation of the valve 45 in response to delivery or pumping of liquid into the space 60 is attributable to the fact that the lower part 59 of the valve has a greater radius than the upper part of the valve and hence the pressure thereagainst is greater than the pressure against the upper part and effects or produces rotative movement of the valve. A leaf spring 62 serves when the internal gear pump 10 is stopped to return the reversing valve 45 to its neutral position, that is, into a position wherein the upper sector-shaped part 58 of the valve closes both of the inlet ports 49 and 50 and the lower part 59 closes both of the outlet ports 53 and 54. This spring is positioned radially with respect to the valve and extends across a wedge-shaped space 63 in the central portion of the lower sector shaped part 59 of the valve. The outer end of the spring is fixedly secured in a notch 64 which is formed in the lower portion of the plate 44 and leads to the lower semi-circular space 56 in such plate. The inner end of the spring extends into a notch 65 which is formed in the hub or central portion of the lower part 59 of the valve and communicates with the apex portion of the space 63. When the valve 45 is turned either clock-wise or counter-clockwise depending upon the drive of the pump, the spring 62 is deflected or placed under tension, as shown in Figures 7 and 8. As soon as the gear pump 10 is stopped and the pressure of the liquid at the discharge side thereof subsides the spring 62 rotates the valve 45 into its neutral position. In this position of the valve the inlet and outlet ports are closed, as heretofore pointed out, and hence the liquid in the spaces 60 and 61 cannot escape and the pump remains in a primed condition. The reversing valve 45 constitutes simple and novel means for controlling the pump structure so that there is a uni-directional flow of liquid therethrough regardless of whether the gear pump 10 is driven in one direction or the other.

The operation of the pump structure is as follows: When the gear pump is driven in a clock-wise manner as viewed in Figure 2 the liquid in the kidney shaped holes 51 in the space 60, as hereinbefore described, is drawn through the pump and forced under pressure through the hole 52 into the space 61. Upon entry of the liquid into the space 61 the reversing valve 45 is caused to rotate in a clockwise manner. During the initial portion of such rotation the inlet port 49 is exposed and permits additional liquid to be drawn or sucked into the pump via the hole 51. During the latter part of the clock-wise rotative movement of the valve the outlet port 54 is exposed so that the liquid delivered into the space 61 is free to pass into the outlet duct 19. During clock-wise drive of the pump 10 liquid flows as follows into the suction side of the pump; vertical branch 30 of the inlet duct 18; horizontal branch 31; groove 32; inlet port 49; wedge-shaped space 60; and kidney-shaped hole 51. During such rotation of the pump the pumped liquid flows as follows from the pump: kidney-shaped hole 52; wedge-shaped space 61; outlet port 54; groove 35; horizontal branch 33 of outlet duct 19; and vertical branch 34 of said duct. As soon as the pump is stopped as a result of the stoppage of the supply of current to the electric motor 11 pumping of the liquid ceases and the leaf spring 62 returns the valve to its normal position (see Figure 6). When the pump is driven counter-clockwise, as viewed in Figure 2, the valve 45 is rotated in the opposite direction, that is, counter-clockwise as shown in Figure 8. This is attributable to the flow of liquid from the hole 52 and the space 61 through the hole 50 into the space 60 and the building up of such pressure that the valve is forced to rotate in a counter-clockwise manner. During the initial part of this counter-clockwise rotation of the valve the inlet port 50 is exposed and in the latter part of such movement the outlet port 53 is exposed. During counter-clockwise drive of the pump the flow of liquid into the chamber 23 is as follows: inlet duct 18; groove 32; inlet port 50; space 61; and hole 52. During such counter-clockwise drive of the pump the pumped liquid flows from the chamber 23 as follows: hole 51; space 60; outlet port 53; groove 35; and outlet duct 19. Upon stoppage of counter-clockwise drive of the pump the spring 62 swings or rotates the valve 45 back to its neutral position.

The herein described pump structure consists of but a small number of parts and hence may be manufactured at a low or reasonable cost. It is extremely efficient in operation due to the fact that the reversing valve which controls the inlet and outlet ports so that there is a uni-directional flow of the liquid through the structure regardless of the direction in which the pump is driven is positively controlled or operated by the pressure of the liquid at the outlet side of the gear pump. The structure is especially adapted for use in an oil burner installation where the connections leading from the tank to the pump and from the pump to the burner are fixed and there is a likelihood of a reversible electric motor being employed to drive the pump or a right hand drive motor being substituted for a left hand drive motor.

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 we claim as new and desire to secure by Letters Patent is:

1. In a pump structure of the character described, the combination of a housing having a pump chamber therein and an inlet duct and an outlet duct for liquid, a reversible rotary pump for pumping liquid from the inlet duct through the outlet duct disposed in the chamber and having a suction side at one side of the chamber and a pressure side at the opposite side of the chamber when driven in one direction and a suction side at said opposite side of the chamber and a pressure side at said one side of the chamber when driven in the reverse direction, and a single automatic rotary plate type valve mounted in the housing independently of and in axially spaced relation with the rotary pump and constructed and arranged so that when the pump is driven in said one direction it is rotated a predetermined distance in one direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to connect the inlet duct with said one side of the chamber and said opposite side of the chamber with the outlet duct and when the pump is driven in said reverse direction it is rotated a predetermined distance in the reverse direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to connect said

inlet duct to said opposite side of the chamber and said one side of the chamber to the outlet duct.

2. In a pump structure of the character described, the combination of a housing having a pump chamber therein and also having a liquid inlet duct with a pair of branches at its inner end and a liquid outlet duct with a pair of branches at its inner end, a reversible rotary pump for pumping liquid from the inlet duct to the outlet duct disposed in the chamber and having a suction side at one side of the chamber and a pressure side at the opposite side of the chamber when driven in one direction and a suction side at said opposite side of the chamber and a pressure side at said one side of the chamber when driven in the reverse direction, and a single automatic rotary valve associated with the housing and constructed and arranged so that when the pump is driven in said one direction it is rotated a predetermined distance by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close one branch of the inlet duct and connect the other branch within said one side of the pump and to close one branch of the outlet duct and connect the other branch with said opposite side of the pump and when the pump is driven in said reverse direction it is rotated a predetermined distance by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close said other branch of the inlet duct and connect the one branch to said opposite side of the pump chamber and to close said other branch of the outlet duct and connect said one branch of the outlet duct to said one side of the pump chamber.

3. In a pump structure of the character described, the combination of a housing having a pump chamber therein and also having a liquid inlet duct with a pair of branches at its inner end and a liquid outlet duct with a pair of branches at its inner end, a reversible rotary pump for pumping liquid from the inlet duct to the outlet duct disposed in the chamber and having a suction side at one side of the chamber and a pressure side at the opposite side of the chamber when driven in one direction and a suction side at said opposite side of the chamber and a pressure side at said one side of the chamber when driven in the reverse direction, and a single movably mounted automatic valve adapted when the pump is at rest to assume a neutral position wherein it serves to close the two branches of the inlet duct and also the two branches of the outlet duct and constructed and arranged so that when the pump is driven in said one direction it is shifted a predetermined distance in one direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close one branch of the inlet duct and connect the other branch with said one side of the pump and to close one branch of the outlet duct and connect the other branch with said opposite side of the pump and when the pump is driven in said reverse direction it is shifted in the opposite direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close said one branch of the inlet duct and connect the one branch to said opposite side of the pump chamber and to close said other branch of the outlet duct and connect said one branch of the outlet duct to said other side of the pump chamber, and spring means for shifting the valve into its neutral position when the pump is stopped.

4. In a pump structure of the character described, the combination of a housing having a pump chamber therein and also having a liquid inlet duct with a pair of branches at its inner end and a liquid outlet duct with a pair of branches at its inner end, a reversible rotary pump for pumping liquid from the inlet duct to the outlet duct disposed in the chamber and having a suction side at one side of the chamber and a pressure side at the opposite side of the chamber when driven in one direction and a suction side at said opposite side of the chamber and a pressure side at said one side of the chamber when driven in the reverse direction, and a single rotatably mounted automatic valve adapted when the pump is at rest to assume a neutral position wherein it serves to close the two branches of the inlet duct and also the two branches of the outlet duct and constructed and arranged so that when the pump is driven in said one direction it is rotated a predetermined distance in one direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close one branch of the inlet duct and connect the other branch with said one side of the pump and to close one branch of the outlet duct and connect the other branch with said opposite side of the pump and when the pump is driven in said reverse direction it is rotated a predetermined distance in the opposite direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close said one branch of the inlet duct and connect the one branch to said opposite side of the pump chamber and to close said other branch of the outlet duct and connect said one branch of the outlet duct to said other side of the pump chamber, and a spring for rotating the valve into its neutral position when the pump is stopped.

5. In a pump structure of the character described, the combination of a housing provided with a flat face and having a pump chamber leading to and intersecting said face and also having a liquid inlet duct with a pair of branches at its inner end leading to said flat face and a liquid outlet duct with a pair of branches at its inner end also leading to said flat face, a reversible rotary pump in the chamber for pumping liquid from the inlet duct to the outlet duct, a port plate fitting against said flat face of the housing and having a pair of inlet ports extending therethrough and registering respectively with the branches of the inlet duct and a pair of outlet ports extending therethrough and registering respectively with the branches of the outlet duct and also having a pair of holes therethrough registering respectively with opposite sides of the pump chamber and adapted one to form the inlet to the suction side of the pump and the other to form the outlet from the pressure side of the pump when the pump is driven in one direction and the other to form the inlet to the suction side of the pump and the one to form the outlet from the pressure side when the pump is driven in the reverse direction, and a plate- type valve movably mounted against the outer face of the port plate and arranged and constructed so that when shifted in one direction it serves to close one inlet port and connect the other inlet port to said one hole and to close one outlet port and connect the other outlet port with said other hole and thus adapt the pump

for drive in said one direction and when shifted in the opposite direction it serves to close said other inlet port and connect said one inlet port to the other hole and to close said other outlet port and connect said one outlet port to said one hole and thus adapt the pump for rotation in said reverse direction.

6. In a pump structure of the character described, the combination of a housing provided with a flat face and having a pump chamber leading to and intersecting said face and also having a liquid inlet duct with a pair of branches at its inner end leading to said flat face and a liquid outlet duct with a pair of branches at its inner end also leading to said flat face, a reversible rotary pump in the chamber for pumping liquid from the inlet duct to the outlet duct, a port plate fitting against said flat face of the housing and having a pair of inlet ports extending therethrough and registering respectively with the branches of the inlet duct and a pair of outlet ports extending therethrough and registering respectively with the branches of the outlet duct and also having a pair of holes therethrough registering respectively with opposite sides of the pump chamber and adapted one to form the inlet to the suction side of the pump and the other to form the outlet from the pressure side of the pump when the pump is driven in one direction and the other to form the inlet to the suction side of the pump and the one the outlet from the pressure side when the pump is driven in the reverse direction, and an automatic valve fitting against the outer face of the port plate and constructed and arranged so that when the pump is driven in said one direction it is shifted by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close one inlet port and connect the other inlet port to said one hole and to close one outlet port and connect the other outlet port to said other hole and when the pump is driven in said reverse direction it is shifted by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close said other inlet port and connect the one inlet port to said other hole and to close said other outlet port and connect said one outlet port to said one hole in the plate.

7. In a pump structure of the character described, the combination of a housing provided with a flat face and having a pump chamber leading to and intersecting said face and also having a liquid inlet duct with a pair of branches at its inner end leading to said flat face and a liquid outlet duct with a pair of branches at its inner end also leading to said flat face, a reversible gear pump in the chamber for pumping liquid from the inlet duct to the outlet duct, a port plate fitting against said flat face of the housing and having a pair of inlet ports extending therethrough and registering respectively with the branches of the inlet duct and a pair of outlet ports extending therethrough and registering respectively with the branches of the outlet duct and also having a pair of holes therethrough registering respectively with opposite sides of the pump chamber and adapted one to form the inlet to the suction side of the pump and the other to form the outlet from the pressure side of the pump when the pump is driven in one direction and the other to form the inlet to the suction side of the pump and the one to form the outlet from the pressure side when the pump is driven in the reverse direction, and a rotary valve fitting against the outer face of the port plate adapted when the pump is at rest to assume a neutral position wherein it serves to close both inlet ports and both outlet ports and constructed and arranged so that when the pump is driven in said one direction it is rotated in one direction by the pressure of the liquid at the pressure side of the pump into a position wherein it serves to close one inlet port and connect the other inlet port with said one hole of the port plate and to close one outlet port and connect the other outlet port with said other hole and when the pump is driven in said reverse direction it is rotated in the reverse direction by the pressure of the liquid in the pressure side of the pump into a position wherein it serves to close said other inlet port and connect said one inlet port and said other hole and to close said other outlet port and connect said one outlet port to said one hole, and spring means for returning the valve to its neutral position when the pump is stopped.

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