

July 21, 1942.

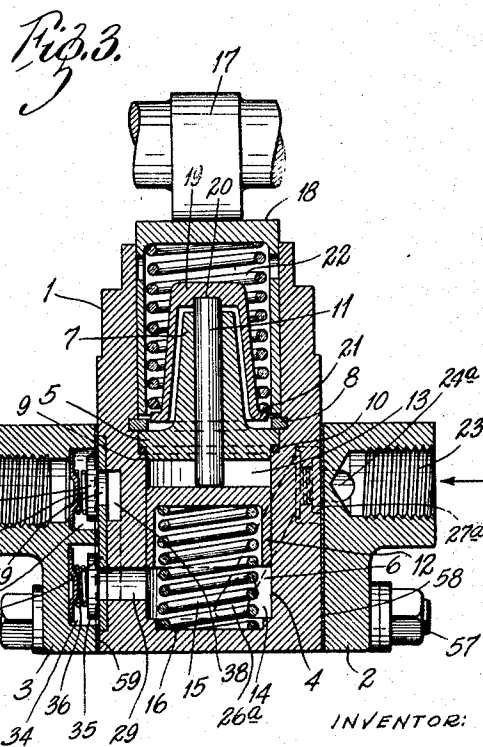
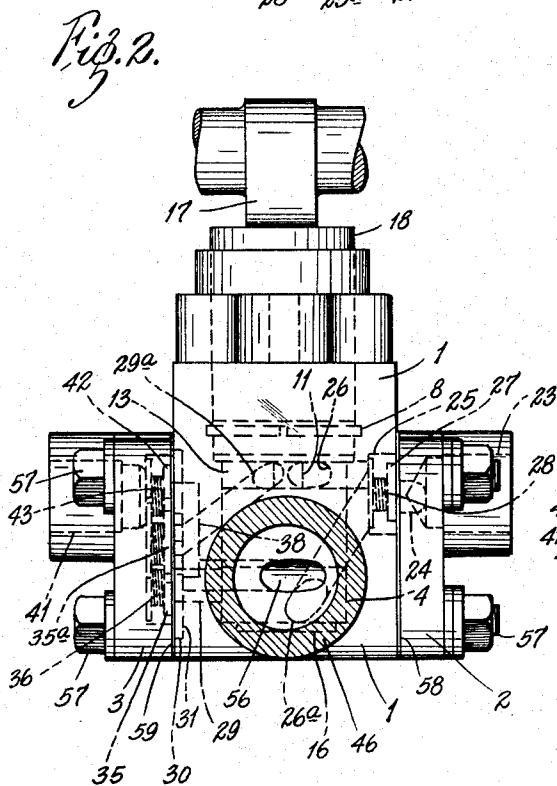
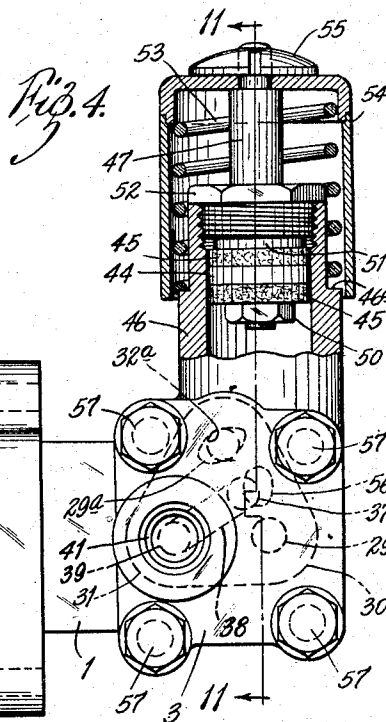
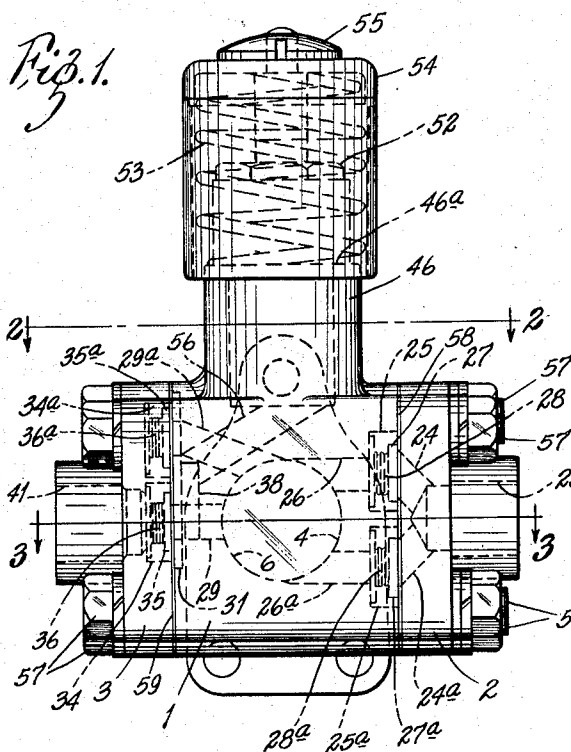
H. C. EDWARDS

2,290,829

FUEL PUMP

Filed Sept. 29, 1939

2 Sheets-Sheet 1



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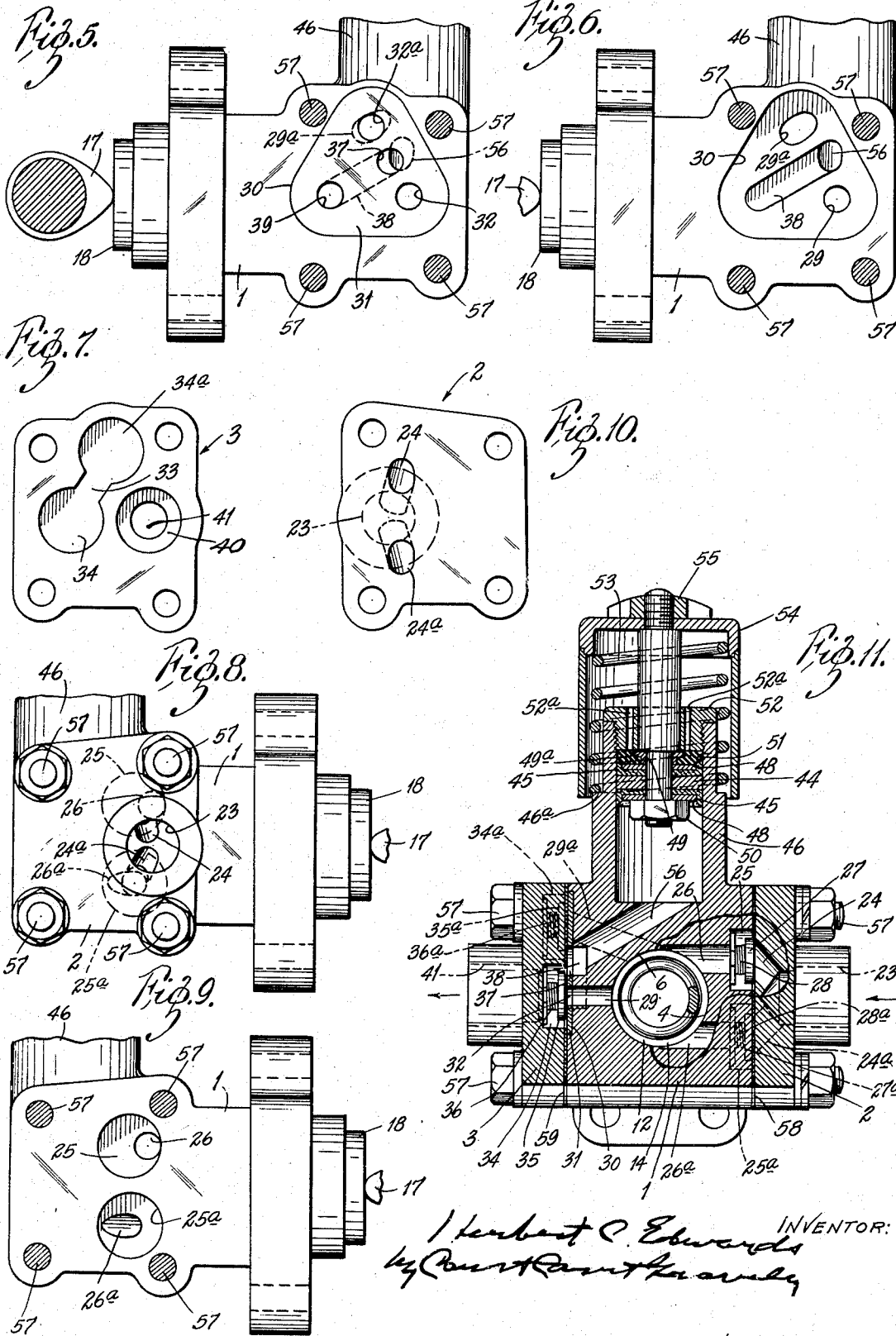
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,290,829

FUEL PUMP

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Application September 29, 1939, Serial No. 297,021

13 Claims. (Cl. 103—175)

This invention relates to pumps, particularly pumps for supplying fuel to the charge forming device of an internal combustion engine. It has for its principal objects to produce a strong, durable and compact oil and air-tight double-acting fuel pump of simple and economical construction, to provide for the easy assembly and disassembly of the parts, to provide ready accessible manually operable means for priming and flushing the pump and to obtain other advantages hereinafter appearing. The invention consists in the pump and in the construction and combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawings, which form part of this specification and wherein like symbols refer to like parts wherever they occur,

Fig. 1 is a front elevation of a pump embodying my invention,

Fig. 2 is a horizontal section through the pump above the main pump chambers on the line 2—2 in Fig. 1,

Fig. 3 is a horizontal section along the axis of the main pump chambers on the line 3—3 in Fig. 1,

Fig. 4 is a view looking at the outlet side of the pump,

Fig. 5 is a fragmentary side view similar to Fig. 4 with the outlet cover removed,

Fig. 6 is a view similar to Fig. 5 with the outlet valve plate removed,

Fig. 7 is an inner face view of the outlet cover,

Fig. 8 is a view looking at the inlet side of the pump,

Fig. 9 is a fragmentary view similar to Fig. 8 with the inlet cover removed,

Fig. 10 is an inner face view of the inlet cover; and

Fig. 11 is a vertical cross-section on the line 11—11 in Fig. 4.

The pump shown in the accompanying drawings comprises a housing 1 having inlet and outlet covers 2 and 3 removably secured to the opposite sides thereof. The housing has a central cylindrical blind bore 4 therein that extends forwardly from the rear end thereof to a point short of the front end thereof. Snugly fitting the housing bore 4 intermediate between the ends thereof is a circular closure member or disk 5, which forms a closed cylinder 6 forward of said closure and has a central rearwardly extending tubular stem portion 7 coaxial with said bore rearwardly of said closure. The closure disk 5 is held against axial displacement in the housing bore between a snap ring 8, which seats in

an annular groove in said bore on one side of said member, and an annular shoulder 9 formed in said bore on the opposite side of said disk. The pump cylinder 6 is sealed by a compressible gasket 10 clamped between the opposing faces of the closure disk 5 and the annular shoulder 9.

Reciprocable in the rearwardly extending hollow stem or barrel 7 of the closure or partition 5 in the housing bore is a push or piston rod 11, whose inner end is disposed in abutting relation to the opposing end of a piston 12, which is reciprocable in the cylinder 6 and divides the latter into separate rear and front expansible pump or pulsation chambers 13 and 14, respectively. This piston, which is in the form of a cylindrical cup which opens towards the forward pump chamber 14, is displaced rearwardly in the direction of the push rod 11 by the expansive effort of a coil compression spring 15, one end of which bears against a seat in a recess 16 provided therefor in the forward end of said chamber and the other end of which seats against the bottom of said cup-shaped piston. The forward stroke of the piston is produced by a power operated tappet or edge cam 17 that engages the bottom or closed rear end of a tappet cup 18 mounted for reciprocating movement in the pump housing bore 4 rearwardly of the closure disk 5. This tappet cup surrounds an inwardly opening thimble 19 that surrounds the rearwardly extending piston rod supporting stem 7 of the closure disk 5 and has a recess 20 in its closed rear end adapted to receive the projecting rear end of the piston or push rod 11. Mounted in the tappet cup 18 between the closed cam engaging rear end thereof and an outstanding flange 21 on the open forward end of the thimble 19 is a compression coil spring 22, which serves to yieldably hold said tappet cup in contact with the power operated tappet or edge cam 17 and transmit the forward movement of said cam to the piston rod actuating thimble 19.

The pump has valved inlet and outlet passageways, each communicating with both of the pump chambers 13 and 14. The inlet passageway is formed by a passageway 23 that leads inwardly through the inlet cover 2 and terminates at the inner face thereof in two diverging branch passageways 24, 24a, that open into enlarged valve chambers 25, 25a formed in the opposing vertical outside face of the pump housing. One of these valve chambers 25 communicates with the rearward pump chamber 13 through a passageway 26, and the other valve chamber 25a communicates with the front pump chamber 14

through a passageway 26a. The valve chambers 25 and 25a contain suitable inwardly opening check valves 27, 27a that are held against the inner ends of the branches 24, 24a of the inlet passageway 24 in the inlet cover 2 by means of springs 28, 28a. By this arrangement, these inlet or suction valves 27, 27a permit flow of the fuel to the rear and front pump chambers 13 and 14 but prevent return flow of said fuel through the inlet passageways.

The outlet passageway for the rear and front pump chambers 13 and 14 is formed by passageways 29, 29a that lead from the front and rear pump chambers, respectively, and open through the bottom of a triangular recess 30 formed in the vertical outlet cover opposing face of the pump housing. Snugly seated in this triangular recess with its outer face flush with the outside face of the pump housing is a triangular plate 31 having ports 32 and 32a extending therethrough that register with the respective passageways 29, 29a where they open into said recess. The inner or valve plate opposing face of the outlet cover 3 has an elongated recess therein, forming a passageway 33 that establishes communication between the two ports 32 and 32a that register with the passageways 29, 29a leading from the respective front and rear pump cylinders. The portions of the passageway 33 located opposite the ports 32, 32a in the valve plate 31 are shaped to form enlarged valve chambers 34, 34a which contain outwardly opening check valves 35 and 35a, respectively. These valves are held in closed position over the outer ends of the ports 32 and 32a in the valve plate 31 preferably by means of coil compression springs 36, 36a, thereby permitting the fuel in the front and rear pump chambers to flow into the passageway 33 while preventing return flow of such fluid to said chambers. The passageway 33 communicates midway of its valve chambers 34, 34a with a port 37 that extends through the valve plate 31 midway between the ports 32, 32a that are closed by the valves 35, 35a in said chambers; and this intermediate port 37 opens at its inner end into one end of a passageway 38 formed by an elongated groove in the bottom of the triangular valve plate receiving recess 30. The other end of this passageway 38 opens into a port 39 in the triangular valve plate 31 and this port opens into a circular valve chamber 40 in the inner face of the outlet cover 3, which chamber, in turn, opens into a discharge passageway 41 that opens through the outer face of said outlet cover. Located in this discharge valve chamber 40 is a suitable outwardly opening check valve 42 that is yieldably held against the outer face of the valve plate 31 over the outlet port 39 therein by means of a coil compression spring 43, thereby permitting discharge of fuel from the discharge passageway 41 but preventing return flow of such fuel.

The hereinbefore described double acting fuel supply pump is also provided with separate or auxiliary manually operable priming and flushing means. Said means comprises a plunger including a disk 44 and cup leathers 45 reciprocable in an upright cylinder 46 on the top of the pump housing 1. The plunger disk and leathers are sleeved on the reduced lower end portions of a plunger rod 47. Metal washers 48 are also sleeved on said portion of said plunger rod above and below the cup washers; and the plunger disk, leathers and washers are secured against axial movement on the plunger rod between a

spacer sleeve 49 sleeved thereon between the uppermost washer and the shoulder formed by the reduced lower end portion of said rod and a nut 50 threaded on the lower end thereof in abutting relation to the lowermost washer. A compressible gasket or sealing washer 51 is mounted around the spacer sleeve 49 between an outstanding flange 49a at the upper end thereof and the uppermost washer.

The plunger rod 47 is supported for axial sliding movement in the cylinder 46 by means of a closure member for the outer end thereof in the form of a sleeve nut 52 that is threaded into the upper end thereof and has suitable vent holes 52a extending therethrough. A coil compression spring 53 surrounds said cylinder exteriorly thereof and serves to hold the plunger in its uppermost position with the compressible sealing washer 51 bearing against the underside of the plunger rod guide nut 52 and closing the vent openings 52a therein. This spring has its lower ends seated on an annular shoulder 46a provided therefor around the exterior face of the cylinder 46 with its upper end pressing upwardly against an operating knob in the form of a downwardly opening cylindrical cap 54 which is secured to the upper end of said plunger rod by means of a nut 55. The lower end of the auxiliary cylinder 46 opens into one end of an inclined passageway 56, while the other end opens into the passageway 38 in line with the valve plate port 37 that communicates with the passageway 33 that connects the two-valved ports 32, 32a in the valve plate 31.

The inlet and outlet covers 2 and 3 are secured to the housing by through bolts 57 that extend entirely through both covers and the housing; and the respective cover plates are sealed by gaskets 58 and 59 that are clamped between said covers and housing and have openings therethrough registering with the passageways and recesses in the covers.

The operation of the hereinbefore described pump is as follows: When the tappet cup 18 is forced inwardly by the rise or nose of the edge cam 17, such movement is transmitted through the tappet spring 22 and spring holder of thimble 19 to the rod 11 which bears against the inner end of the piston 12 and thus forces the same towards the front end of the cylinder against the pressure of the spring 15. This movement of the piston opens the inlet valve 27 and draws fuel therethrough into the rear pump chamber 13 through the branch 24 of the inlet passageway 23 in the inlet cover 2. At the same time, fuel that has previously been drawn into the front pump chamber 14, in the manner hereinafter described, is forced by the piston 12 through the passageway 29, valve plate port 32, valve 35, passageway 33, valve plate port 37, passageway 38, valve plate port 39 and discharge valve 42 into the fuel discharge passageway 41 in the outlet cover 3.

When the drop or base circle of the cam 17 is in contact with the tappet cup 18, the pressure on the piston 12 is relieved and the piston is forced rearwardly by the expansive action of the spring 15. This rearward movement of said piston causes fuel to be drawn into the front pump chamber 14 through the inlet valve 27a and the branch 24a of the inlet passageway 23 in the inlet cover 2. At the same time, fuel that has previously been drawn into the rear pump chamber 13 is expelled therefrom by the rearward travel of the piston 12. This fuel passes through the passageway 29a, valve plate port 32a,

valve 35a, passageway 33, valve plate port 37, passageway 38, valve plate port 39, and discharge valve 42 into the final discharge passageway 41 in the outlet cover 3. Thus, induction and education is effected on each stroke of the reciprocating piston.

The position of the piston 12 is determined by the balance of the forces of the two springs 15 and 22 in the different positions of the tappet cup 18; and the length of stroke of said piston and the quantity of fuel discharged thereby vary according to the back pressure of the fuel in the fuel discharge lines. Thus the quantity of fuel discharged depends on the fuel consumption of the engine; and, regardless of the length of stroke of the piston or the pressure pumped, the piston or push rod 11 will always remain in contact with the piston 12. The tappet cup 18, tappet spring 22 and thimble 19 are free to rotate as a unit about the push rod 11 as a centering member. The combined closure member and piston rod guide 5 is easily inserted in and removed from the housing bore 4 and is removably held in said bore by means of the snap ring 8. The inlet and discharge passageways, ports and valves are accessible for inspection and cleaning merely by removing the inlet and outlet covers and the discharge valve plate.

When it is desired to flush or prime the main pump, the piston of the primer is reciprocated in the auxiliary cylinder 46 by means of the operating cap or knob 54 on the outer end of the auxiliary pump plunger rod 47. Outward movement of the auxiliary plunger or piston under the action of the spring 53 causes the fuel to be drawn into the two pump chambers 13 and 14 through the inlet passageway 23, branch passageways 24 and 24a, the inlet valves 27 and 27a and passageways 26 and 26a. The suction of the auxiliary plunger also draws the fuel from the two pump cylinders 13 and 14 through the passageways 29 and 29a, valve plate ports 32 and 32a, valves 35 and 35a, passageway 33, valve plate port 37 and passageway 56 into the lower end of the cylinder 46. Inward movement of the auxiliary piston against the pressure of the spring 53 forces the fuel thus drawn into the auxiliary cylinder 46 back through the passageway 56 into the connecting passageway 38 and thence through the discharge valve 42 into the final discharge passageway 41. The spring 53 holds the auxiliary pump plunger in its outermost position; and in this position of said plunger the sealing washer 51 carried thereby is pressed tightly by said spring and by the constant discharge pressure of the power pump against the closure member 52 for the outer end of the auxiliary cylinder 46 and thus serves to close the vent openings 52a in said closure member.

Obviously, the hereinbefore described pump admits of considerable modification without departing from the invention. Therefore, I do not wish to be limited to the precise construction shown and described.

What I claim is:

1. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder, said housing having an inlet passageway opening into said cylinder and a discharge passageway leading from said cylinder, an inwardly opening check valve in said inlet passageway, an outwardly opening check valve in said outlet passageway, resilient means for displacing said piston in one direction, and driving means for displacing said piston in the other direction, said

driving means comprising a rod reciprocable in said housing with one end extending into said cylinder co-axial with and in abutting relation to the adjacent end of said piston, an inwardly opening thimble surrounding said rod outside of said cylinder with its closed end seated on the outer end of said rod without being secured thereto, an inwardly opening cam actuated tappet cup surrounding said thimble and reciprocable in said housing axially of said cylinder, and a single spring located in said cup with one end seated against the closed outer end thereof and with the other end seated on said thimble adjacent to the open inner end thereof and operating to hold said rod in abutting relation to said piston in all positions thereof.

2. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the latter into two pulsation chambers, said housing having an inlet passageway with branches opening into the respective chambers and a discharge passageway with branches leading from respective chambers, inwardly opening check valves in the respective branches of said inlet passageways, outwardly opening check valves in the respective branches of said outlet passageways, resilient means for displacing said piston in one direction, and driving means for displacing said piston in the other direction, said driving means comprising a rod reciprocable in said housing with one end extending into one of said chambers co-axial with and in abutting relation to the adjacent end of said piston, an inwardly opening thimble surrounding said rod outside of said chamber with its closed end seated on but unsecured to the outer end of said rod, an inwardly opening cam actuated tappet cup surrounding said thimble and reciprocable in said housing axially of said cylinder, and a single spring interposed between said thimble and said tappet cup with its outer end seated on the closed outer end of said tappet cup and with its inner end seated on said thimble adjacent to the open inner end thereof.

3. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the latter into two pulsation chambers, said housing having an inlet passageway with branches opening into the respective chambers and a discharge passageway with branches leading from the respective chambers, inwardly opening check valves in the respective branches of said inlet passageway, outwardly opening check valves in the respective branches of said outlet passageway, resilient means for displacing said piston in one direction only, and driving means for displacing said piston in the other direction, said driving means comprising a rod reciprocable in said housing with one end extending into one of said chambers co-axial with and in abutting relation to the adjacent end of said piston, an elongated inwardly open thimble surrounding said rod outside of said cylinder and having an outstanding flange at its open inner end and having its closed outer end seated on but unsecured to the outer end of said rod, an inwardly opening cam actuated tappet cup surrounding said thimble and reciprocable in said housing axially of said cylinder, and a single coil compression spring surrounding said thimble with its inner end seated against the closed outer end of said tappet cup and with the other end seated on the outstanding flange at the open inner end of said thimble.

4. A pump comprising a housing having a blind

bore therein, a closure member snugly fitting within said bore intermediate between the ends thereof and forming a closed pump chamber, a piston reciprocable in said chamber; removable means for holding said closure member in said bore against axial movement therein, a rod reciprocable in said closure member with one end extending into said chamber in abutting relation to the adjacent end of said piston, a tappet cup reciprocable in said bore between the open end thereof and said closure member, and a single spring forming the only operative connection between said tappet cup and said rod; said closure member, piston, rod, tappet cup and spring being all insertable in and removable from the open end of said blind bore.

5. A pump comprising a housing having a blind bore therein, a closure member snugly fitting within said bore intermediate between the ends thereof and forming a closed pump chamber, a piston reciprocable in said chamber, removable means for holding said closure member in said bore against axial movement therein, a rod reciprocable in said closure member with one end extending into said chamber in abutting relation to the adjacent end of said piston, a tappet cup reciprocable in said bore between the open end thereof and said closure member, an elongated cup-shaped member located in said tappet cup with its closed end seated on the other end of said rod, and a single coil compression spring interposed between said tappet cup and said cup-shaped member with one end seated on said cup-shaped member inwardly of the outer end of said rod and with its other end seated against the closed outer end of said tappet cup.

6. A pump comprising a housing having a blind bore therein, a closure member snugly fitting within said bore intermediate between the ends thereof and forming a closed pump chamber, said closure member having a tubular stem portion extending in the direction of the open end of said bore, a piston reciprocable in said chamber, removable means for holding said closure member in said bore against axial movement therein, a rod reciprocable in the tubular stem portion of said closure member with one end extending into said chamber in abutting relation to the adjacent end of said piston, an inwardly opening tappet cup reciprocable in said bore between the open end thereof and said closure member, an inwardly opening thimble located in said tappet cup with its closed end seated on the other end of said rod and with its body portion surrounding said stem portion of said closure, said thimble having an exterior shoulder adjacent to its open end, and a coil compression spring interposed between said tappet cup and said thimble with one end seated against the bottom of said cup and the other end seated on the shoulder adjacent to the inner open end of said thimble.

7. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the latter into two expansible chambers, said housing having an inlet passageway and inlet passageways opening into the respective chambers and outlet passageways leading from the respective chambers, inwardly opening check valves in said inlet passageways, outwardly opening check valves in said outlet passageways, said housing having a second cylinder and a passageway establishing communication between said second cylinder and said outlet passageways outwardly of the check valves therein, and a second

manually operable piston reciprocable in said second cylinder.

8. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the latter into two expansible chambers, said housing having an inlet passageway with branches leading to the respective chambers and an outlet passageway with branches leading from the respective chambers, check valves in the respective branches of said inlet and outlet passageways, a check valve in the discharge end of said outlet passageway, said housing having a second cylinder and a passageway establishing communication between said cylinder and said outlet passageway between the check valves in the branches thereof and the check valve at the discharge end thereof, and a manually operable piston reciprocable in said second cylinder.

9. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the latter into two expansible chambers, said housing having inlet passageways opening into the respective chambers and outlet passageways leading from the respective chambers, inwardly opening check valves in said inlet passageways, outwardly opening check valves in said outlet passageways, said housing having a second cylinder and a passageway establishing communication between said second cylinder and said outlet passageways outwardly of the check valves therein, a second piston reciprocable in said second cylinder, a closure for the outer end of said second cylinder, a plunger rod axially slidable in said closure member and having said second piston fixed thereto, a knob fixed to the outer end of said plunger rod, and a spring interposed between said knob and said housing for holding said piston in its outermost position of its sliding movement.

10. A pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the latter into two expansible chambers, said housing having an inlet passageway with valved branches leading to the respective chambers and an outlet passageway with valved branches leading from the respective chambers, said housing having a second cylinder and a passageway establishing communication between said second cylinder and said outlet passageway outwardly of the valve branches thereof, a manually operable piston reciprocable in said second cylinder, a closure for the outer end of said second cylinder, said closure having vent openings extending therethrough adapted to be closed by said manually operable piston in the outermost position of its sliding movement, and a spring for yieldably holding said manually operable piston in such position.

11. A double acting pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the same into two pump chambers, said housing having inlet passageways communicating with the respective chambers, inwardly opening check valve means in the respective inlet passageways, said housing having outlet passageways leading from the respective chambers and opening into a recess in the outer face of said housing, a valve plate snugly fitting said recess and having ports extending therethrough in register with the respective outlet passageways, an outlet cover removably secured to said housing over said valve plate and having a recess in its valve plate opposing face forming a connecting passageway between said ports, outwardly opening check valves

for the respective ports mounted in said connecting passageway, a third port extending through said valve plate for establishing communication between said connecting passageway and one end of a groove in the bottom of the valve plate receiving recess, said outlet cover having a final discharge passageway extending therethrough with its inner end in communication with a fourth port extending through said valve plate and in communication with the other end of said groove, an outwardly opening check valve for said fourth port located in said final discharge passageway said housing having a priming cylinder in continuous communication with the groove in the bottom of said valve plate receiving recess, and a priming plunger reciprocable in said priming cylinder.

12. A double acting pump comprising a housing having a cylinder, a piston reciprocable in said cylinder and dividing the same into two pump chambers, said housing having a valved inlet passageway communicating with both of said chambers, inwardly opening check valve means in said inlet passageway, said housing having outlet passageways leading from the respective chambers and opening into a recess in the outer face of said housing, a valve plate snugly fitting said recess and having ports extending therethrough in register with the respective passageways, an outlet cover removably secured to said housing over said valve plate and having a recess in its valve plate opposing face forming a connecting passageway between said ports, outwardly opening check valves for said ports mounted in said connecting passageway, a third port extending through said valve plate for es-

establishing communication between said connecting passageway and one end of a groove in the bottom of the valve plate receiving recess, said outlet cover having a final discharge passageway extending therethrough with its inner end in communication with a fourth port extending through said valve plate in communication with the other end of said groove, an outwardly opening check valve for said fourth port located in said discharge passageway, said housing having a second cylinder and a manually operable plunger therein and a passageway communicating at one end with said second cylinder at the other end with the first mentioned end of the groove in the bottom of the valve plate receiving recess in said housing.

13. A double acting pump comprising a housing having a cylinder and a piston reciprocable in said cylinder and dividing the latter into two separate pump chambers, said housing having valved inlet and outlet passageways for the respective pump chambers, a spring for displacing said piston in one direction, and means for displacing said piston in the opposite direction including a power operated member and a single spring between said member and said piston, the two springs being of substantially equal strength, whereby the position of said piston in said cylinder is determined by the balance of the forces of the two springs in the different positions of the power operated member and the length of the stroke of said piston and the quantity of discharge varies according to the back pressure in the discharge passageways of said pump chambers.

HERBERT C. EDWARDS.

CERTIFICATE OF CORRECTION.

Patent No. 2,290,829.

July 21, 1942.

HERBERT C. EDWARDS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 32, for "chambers 34, 24a" read --chambers 34, 34a--; and second column, line 59, for "valave" read --valve--; page 4, first column, lines 66 and 67, claim 7, strike out "an inlet passageway and" and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of September, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.