

May 9, 1944.

A. L. PARKER

2,348,567

FUEL PUMPING UNIT

Filed Jan. 10, 1941

3 Sheets-Sheet 1

Fig. 1.

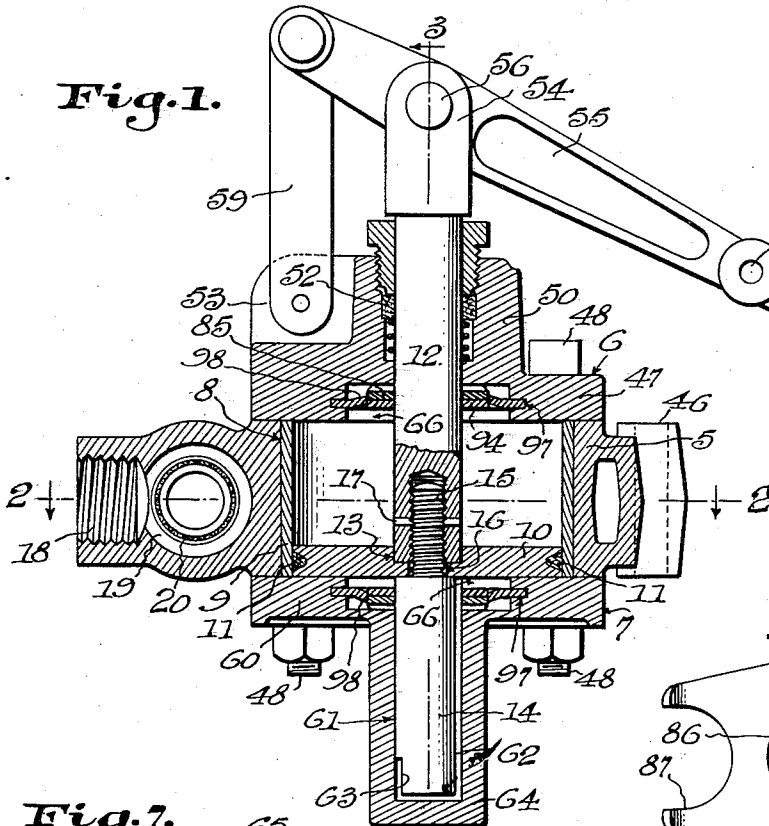


Fig. 13.

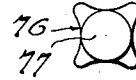


Fig. 7.

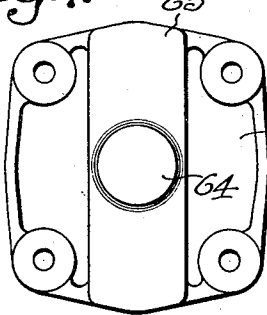


Fig. 9.

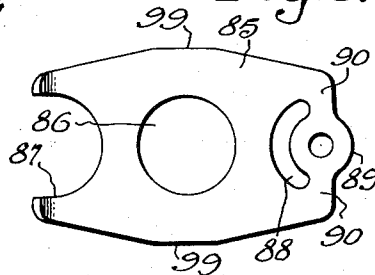


Fig. 10.

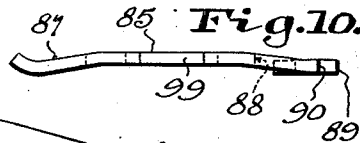


Fig. 11.

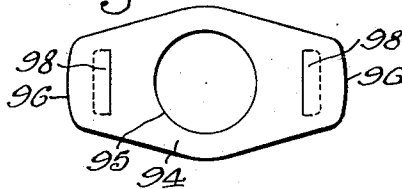


Fig. 8.

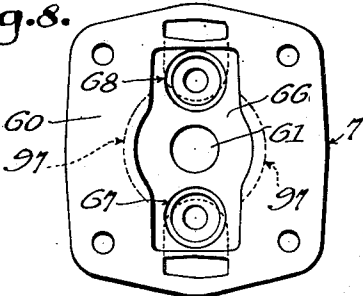
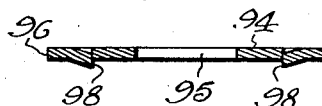


Fig. 12.



Inventor

Arthur L. Parker

Mason & Porter

Attorneys

May 9, 1944.

A. L. PARKER

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Fig. 2.

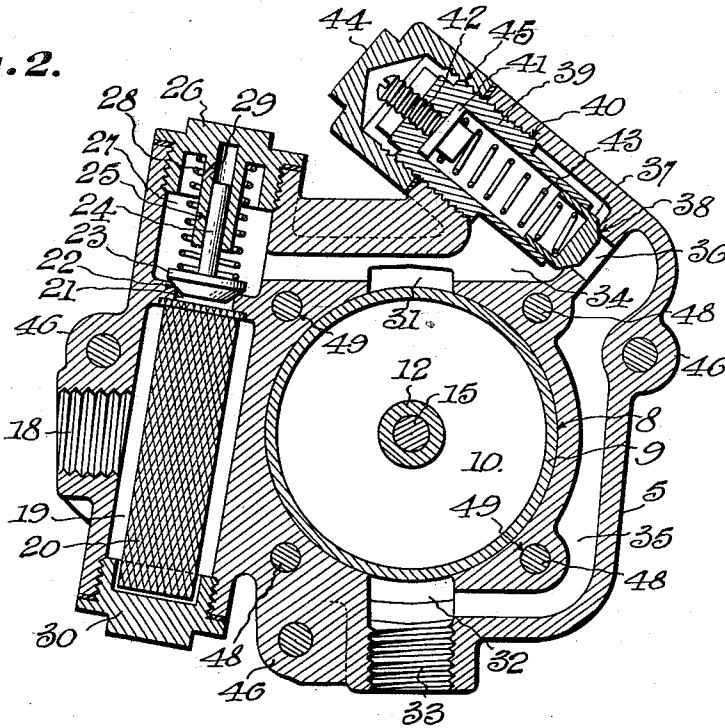
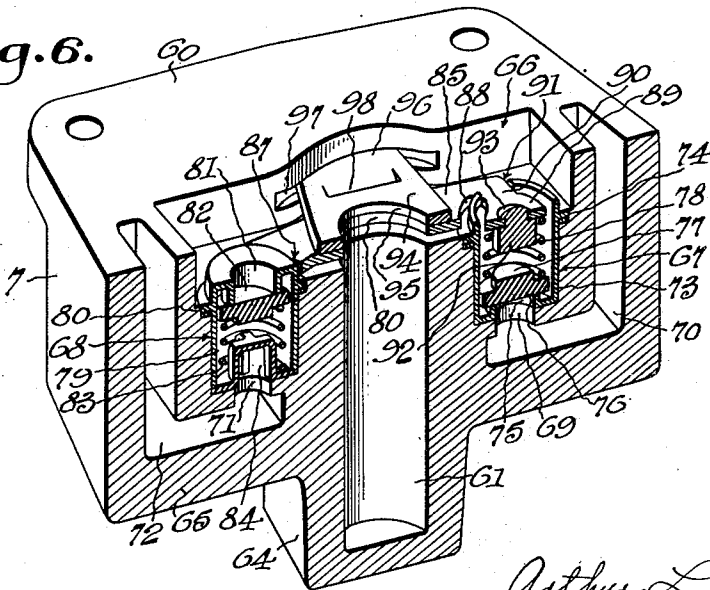


Fig. 6.



Inventor

Arthur L. Parker

By

Mason & Porter

Attorneys

May 9, 1944.

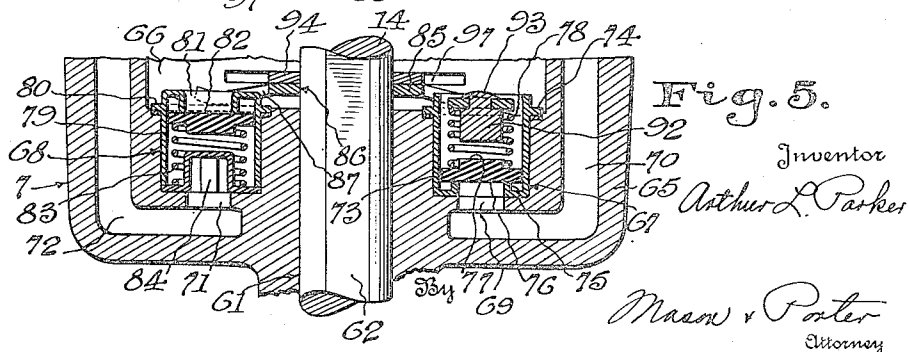
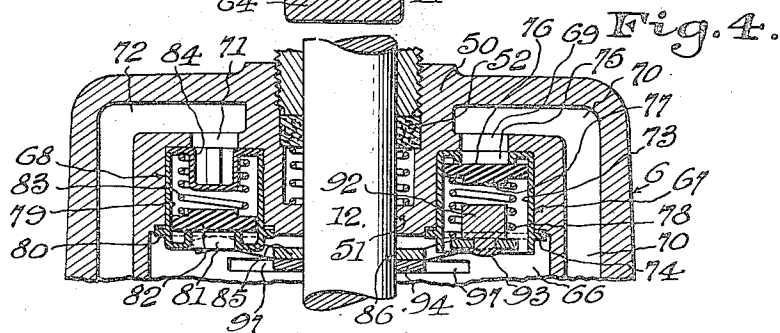
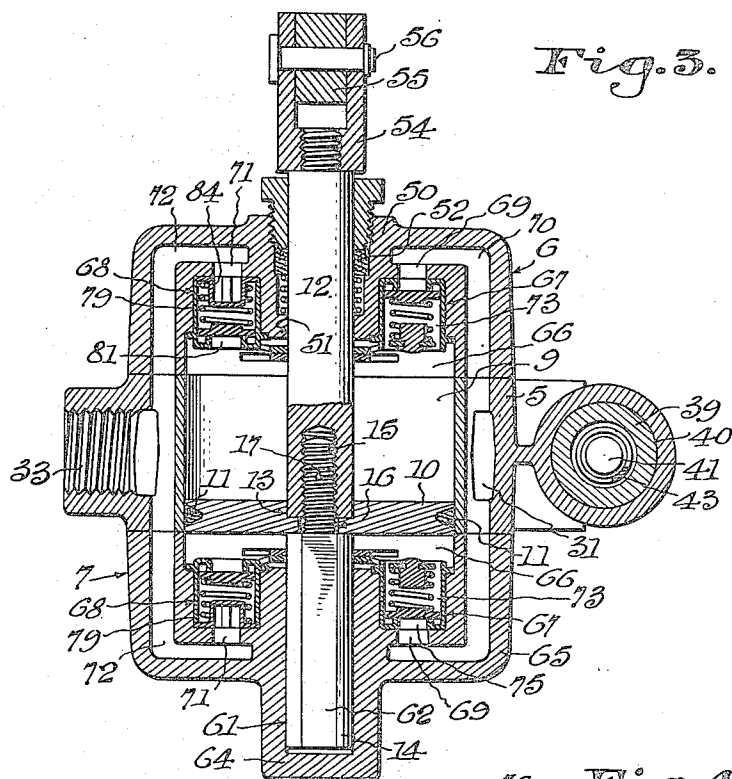
A. L. PARKER

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3 Sheets-Sheet 3



Inventor

Arthur L. Parker

Mason & Porter
Attorneys

UNITED STATES PATENT OFFICE

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FUEL PUMPING UNIT

Arthur L. Parker, Cleveland, Ohio, assignor to
The Parker Appliance Company, Cleveland,
Ohio, a corporation of Ohio

Application January 10, 1941, Serial No. 374,001

12 Claims. (Cl. 103-42)

The invention relates generally to liquid pumping equipments and primarily seeks to provide a novel compact fuel pumping unit particularly adaptable for low pressure services such as are encountered on airplane fuel system installations, said unit being designed principally for use as an emergency or a starting pump in such installations.

In its more detailed nature the invention has for an object to provide a pumping unit of the character stated in which the pump, of the double acting piston type, is arranged in a compact casing along with the strainer, a line check valve, and a relief valve, together with the inlet and outlet check valves, the relief valve being effective each time a predetermined discharge pressure is reached to by-pass some of the discharge fuel back to the inlet side of the pump, and the line check valve being closely related to the relief valve and the intake to the pump cylinder so that a quantity of fuel always will be trapped between the line check valve and the relief valve at said pump cylinder intake thereby to always keep the pump primed and assure operation of the same on the first stroke of its piston.

Another object of the invention is to provide a pump unit structure of the character stated which is exceedingly simple in construction and operation and exceptionally compact, the pump cylinder, the strainer, the line check valve and the relief valve all being arranged in a single, central open ended casing body portion, said body portion being closed at its ends by end closure caps in each of which inlet and outlet check valves are mounted and provision is made for reciprocally supporting and guiding the pump piston.

Another object of the invention is to provide a pump structure of the character stated in which is included novel check valve units and means for removably mounting the same.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by following the detailed description, the appended claims, and the several views illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a vertical cross section of the unit taken centrally through the pump cylinder.

Figure 2 is a horizontal section taken on the line 2-2 on Figure 1.

Figure 3 is a vertical cross section taken on the line 3-3 on Figure 1.

Figure 4 is an enlarged fragmentary cross sec-

tional view taken through the upper end closure cap and illustrating the inlet and outlet valve units therein.

Figure 5 is an enlarged fragmentary cross sectional view taken through the lower end closure cap and illustrating the inlet and outlet valve units therein.

Figure 6 is a sectional perspective view of the lower end closure cap.

Figure 7 is an inverted plan view of the lower end closure cap.

Figure 8 is a top plan view of the lower end closure cap.

Figures 9 and 10 are plan and edge views respectively of the check valve unit keeper plate.

Figures 11 and 12 are plan and edge views respectively of the keeper plate locking element.

Figure 13 is a plan view of the valve element of one of the check valve units.

In the example of embodiment of the improved fuel pumping unit herein disclosed, there is included a main or central open-ended casing body 5, the upper end of which is closed by a top end closure cap 6 and the lower end of which is closed by a bottom end closure cap 7.

The casing body 5 includes a cylindrical bore 8 which has a cylindrical shell 9 of stainless steel or other wear-resisting metal pressed therein in the manner clearly illustrated in Figures 1, 2 and 3 of the drawings. Within the pump chamber formed within the shell 9, a double-acting piston 10 is reciprocally mounted, said piston having a suitable packing ring equipment 11. A piston plunger 12 is seated in a recess 13 provided in the piston and projects axially upwardly therefrom in the manner illustrated in Figures 1 and 3 of the drawings. A plunger guide extension 14 extends axially downwardly from the piston and includes a reduced externally threaded end portion 15 which projects through an aperture 16 in the piston 10 and is threadably mounted in and pin-secured to the plunger 12, as at 17.

The central casing body portion 5 includes an inlet port 18 which communicates directly into the longitudinal inlet chamber 19 wherein a strainer sleeve 20 is mounted in the manner illustrated in Figure 2 of the drawings. Liquid fuel entering the inlet port 18 must pass through the strainer sleeve to enter the inlet opening 21 which is provided with a valve seat 22 at one extremity of the strainer sleeve 20. See Figure 2. The seat 22 is engaged by a line check valve 23 which has its stem 24 guided in a guide bore 25 formed in a removable, threadably mounted plug 26 in the valve chamber 27 axially aligned

with the inlet chamber 19. The valve is urged against its seat by a compression spring 28 interposed between the valve body and the removable plug 26, and it will be observed by reference to Figure 2 of the drawings that a relief port 29 is associated with the valve guiding bore 25 endwise of the valve stem so as to prevent trapping of pressure in said guide bore.

A closure plug 30 is threadably mounted in the end of the inlet chamber 19 opposite the line check valve 23, and, because of the axial alignment of the chambers 19 and 20 and the end closure plugs 26 and 30, mounting and removal of the strainer sleeve 20 and the line check valve 23 is greatly facilitated and thorough cleaning of said chambers is made an easy matter.

By reference to Figures 2 and 3 of the drawings, it will be obvious that the central casing body portion 5 is equipped with a longitudinally disposed inlet chamber 31 and a longitudinally disposed outlet chamber 32 which is arranged diametrically opposite said chamber 31. It will be observed by reference to Figure 2 of the drawings that the longitudinal outlet chamber 32 communicates with an outlet or discharge port 33 from which pumped fuel is discharged from the unit.

An inlet and prime trapping passage 34 extends between the line check valve chamber 27 and the longitudinal inlet chamber 31, and it will be observed by reference to Figure 2 of the drawings that this passage 34 extends beyond said longitudinal chamber and communicates with a pressure relief and by-passing passage 35 through a port 36. The passage 35 communicates with the longitudinal outlet passage 32, and it will be obvious by reference to Figure 2 of the drawings that the longitudinal inlet and outlet chambers, respectively designated 31 and 32 communicate, one with the other, through the passage 35 and the extension of the passage 34 hereinbefore referred to. This communication between the longitudinal inlet and outlet passages 31 and 32 is controlled by a relief valve 37 engageable with a seat 38 formed in the passage 34, 35 in the manner clearly illustrated in Figure 2.

The relief valve 37 is telescopically mounted in a sleeve plug 39 threadably mounted, as at 40, in the central casing body 5. The sleeve plug carries an abutment head 41 threadably adjustable thereon, as at 42, for varying the compression of the valve seating spring 43 which is interposed between said abutment head and the valve element 37. A closure plug 44 may be threaded onto the end of the sleeve 39, as at 45, for enclosing the end of said sleeve.

The central casing body 5 preferably is provided with apertured mounting ears 46 for facilitating rigid mounting of the fuel pumping unit.

The top end closure cap 6 is in the nature of a flat, generally square body 47 which is secured at its corners to the casing body 5 by bolts 48 which pass through receiving apertures 49 in said casing body. See Figures 1 and 2 of the drawings.

The end closure cap 6 includes a central transverse rib or enlargement 50 having a piston plunger receiving bore 51 therethrough for accommodating the piston plunger 12 in the manner illustrated in Figures 1 and 3 of the drawings. The plunger passes through a packed gland 52 in the closure cap and the cap also

includes a laterally projected ear equipment 53. A head 54 is provided on the plunger 12 and an actuating lever 55 is pivoted intermediate its ends, as at 56, on said head. One end of the lever 55 is weighted, as at 57, and equipped with an aperture 58 for facilitating connection with any suitable form of remote control device (not shown). The other end of the lever 55 is pivotally connected, as at 59, with the laterally projected ear equipment so that by oscillating the lever 55, reciprocatory movement can be imparted to the plunger 12 and the piston 10 secured thereto.

The bottom end closure cap 7 is in the nature of a flat, generally square body 60 which is secured in assembly by the bolts 48 hereinbefore described and in the manner best illustrated in Figures 1 and 2 of the drawings. See also Figures 7 and 8.

The closure cap 7 is equipped with a plunger extension guiding bore 61, and it will be observed by reference to Figures 1 and 3 of the drawings that the plunger extension 14 is flattened, as at 62, within this bore so as to prevent the trapping of the fluid at the lower end of the bore during operation of the pump. The extension 14 may also be provided with a flattened portion 63 for facilitating application of a wrench thereto. See Figure 1.

The bore 61 is formed in a lower extension or central depending portion 64 of the cap body 60 which merges into transverse rib 65, as best illustrated in Figures 1 and 7 of the drawings.

The rib extensions 60 and 65 of the end closure caps 6 and 7 are identical except for the pump plunger and plunger extension guiding equipments thereof, and each includes a chamber portion 66 which, when the caps are secured to the casing body 5 in the manner illustrated in Figure 1, forms a continuation of the pump chamber. Each said rib extension includes an inlet check valve unit receiving bore 67 and an outlet check valve unit receiving bore 68, the former communicating through a port 69 and duct 70 with the longitudinal inlet chamber 31 and the inlet and prime trapping passage 34, and the latter communicating through the port 71 and duct 72 with the longitudinal outlet chamber 32 and the pressure relief and by-passing passage 35, 34.

An inlet check valve unit is mounted in each of the bores 67 and each such unit includes a thin metal cylindrical shell 73 proportioned to snugly fit the respective bore 67 and including a mounting flange 74 engageable in a suitable receiving counterbore. The shell includes a seat flange 75 which is engaged by the non-circular base of a check valve 76 shaped in the manner best illustrated in Figures 4, 5 and 13 of the drawings. It will be observed by reference to the figures mentioned that the check valve element includes an upstanding circular boss 77 which is surrounded by a compression spring 78 effective to yieldably hold the valve element against its seat.

Each outlet check valve unit includes a thin metal cylindrical shell 79 snugly receivable in the respective bore 68 and also having a mounting flange 80 engageable in a suitable receiving counterbore. These unit shells also include seat flanges 81 engageable by the check valve elements 82 which are identical with the elements 76, 77 illustrated in detail in Figure 13 and similarly have the circular bosses thereof surrounded by compression springs 83 which yieldably hold

them against their seats. The springs 83 also surround the central hub portions of spiders 84 held in the bottoms of the outlet valve bores 68 by abutment thereof with the bottom ends of the outlet valve unit shells 79.

The set of check valves comprising an inlet and outlet valve mounted in each of the end closure caps 6 and 7 is held in place by a keeper plate 85 illustrated in detail in Figures 9 and 10 of the drawings. Each of these keeper plates comprises an elongated flat metal body having a central aperture 86 for receiving the piston plunger 12, or its extension 14 as the case may be, and is recessed or forked at one end, as at 87, to straddle the outlet shell 79 and yieldably press against the mounting flange 80 thereof. Each keeper plate also is provided at its other end with an arcuate recess 88 enabling it to straddle an edge of the respective inlet valve shell 79 and yieldably engage the mounting flange 80 thereof. The formation of the arcuate recess 88 provides an abutment ear 89 which joins the keeper plate body at the ends of the arcuate recess by connecting legs 90 receivable in notches 91 formed in the edge of the respective shell 79. The abutment ear 89 opposes the respective valve seating spring 78 and carries a spring centering boss 92 which is secured thereto by a pin projected through and upset in an aperture in the ear, as at 93.

Each keeper plate 85 is secured in the position illustrated in Figures 4 and 5 of the drawings, wherein it is effective to yieldably hold the inlet and outlet check valve units in their receiving bores, by a lock plate 94. It will be observed by reference to Figures 4, 5, 6, 11 and 12 of the drawings that each lock plate comprises a thin, flat metal body having a central aperture 95 for fitting over the piston plunger 12 or its extension 14 as the case may be. The ends 96 of each lock plate are engageable, by a movement of rotation, in receiving recesses 97 formed in the respective end closure caps 6 or 7 in the manner best illustrated in Figures 4, 5 and 6 of the drawings. By reference to Figures 6, 11 and 12, it will be observed that each end of each lock plate is provided with an upset locking ear 98 engageable with the adjacent flat side 99 of the respective keeper plate 85 for locking the parts in position. It will be obvious that the lock plates 94 cannot be rotated about the plunger or plunger extension unless the locking ears 98 are displaced from the locking position illustrated in Figure 12 to a releasing position in the plane of the remainder of the plate, thereby to release engagement with the flat sides 99 of the keeper plate 85.

It will be obvious that the fuel pumping unit herein disclosed is very compact in its construction and arrangement. By oscillating the lever 55 the piston 10 is reciprocated in the cylinder 9, and upon each movement of the piston in one direction or the other, fuel will be drawn into the pump chamber through an inlet check valve at one end thereof and forced out of said chamber through an outlet check valve at the opposite end. All liquid fuel drawn into the pump chamber comes through the end port 13 and is strained by the strainer sleeve 20 before it passes through the line check valve 23. Whenever the discharge pressure of fluid being pumped reaches a predetermined maximum pressure determined by the adjustment of the abutment 41, the relief valve 37 will open and by-pass fluid through the passage 35, 36, 34 back

to the inlet side of the pump, or, in other words, to the longitudinal inlet chamber 31.

It will be observed by reference to Figure 2 of the drawings that the relief valve 37, 38 and the line check valve 23 are both disposed close to and at opposite sides of the inlet chamber 31. By this arrangement, the pump is kept primed at all times. Thus, when the pump has been standing idle, fluid within the passages 31, 34 between the valves 23 and 37 will pump through the inlet check valves on the first stroke of the pump even though fluid has fallen away from the inlet port 13. By thus keeping the pump always primed, the pump is not caused to operate dry for intervals, and excessive wear of the moving parts is avoided, in addition to providing a more efficient operable pump structure.

It is of course to be understood that the details of structure and arrangement of parts may be variously changed and modified without departing from the spirit and scope of my invention.

I claim:

1. In a liquid fuel pumping unit, a reciprocatory pump, an inlet line leading to the pump, inlet and outlet check valves for controlling the flow of liquid fuel into and from the pump, a duct having a relief valve therein and communicating between the outlet and inlet valves of the pump, said relief valve being responsive to liquid fuel pressure in said duct for by-passing liquid fuel back to the inlet valve whenever discharge pressure of liquid fuel in said duct exceeds a predetermined maximum, and a line check valve in said inlet line, said line check valve, said relief valve and said inlet check valve being closely related and in mutual communication whereby a priming of liquid fuel will be trapped between said relief valve said inlet check valve and said line check valve following each operation of the pump, thereby to assure delivery of a fuel charge volume of liquid fuel by said pump on each pressure stroke thereof.

2. In a liquid fuel pumping unit, a pump of the double acting reciprocating piston type and including inlet and outlet valves at each end thereof for controlling the flow of liquid fuel therinto and therefrom, an inlet line leading to the pump, a duct having a relief valve therein and communicating between the outlet and inlet valves of the pump, said relief valve being responsive to liquid pressure in said duct for by-passing liquid fuel back to said inlet valves whenever discharge pressure of liquid fuel exceeds a predetermined maximum, and a line check valve in said inlet line, said line check valve said relief valve and said inlet valves being closely related and in mutual communication whereby a priming of liquid fuel will be trapped between said relief valve said inlet valves and said line check valve following each operation of the pump, thereby to assure delivery of a fuel charge volume of liquid fuel by said pump on each pressure stroke thereof.

3. In a liquid fuel pumping unit, a reciprocatory pump, an inlet line leading to the pump, inlet and outlet check valves for controlling the flow of liquid fuel into and from the pump, a duct having a relief valve therein and communicating between the outlet and inlet valves of the pump said relief valve being responsive to liquid fuel pressure in said duct for by-passing liquid fuel back to the inlet valve whenever discharge pressure of liquid fuel in said duct exceeds a predetermined maximum, a line check valve in said inlet line, said line check valve, said

relief valve and said inlet check valve being closely related and in mutual communication whereby a priming of liquid fuel will be trapped between said relief valve said inlet check valve and said line check valve following each operation of the pump, thereby to assure delivery of a fuel charge volume of liquid fuel by said pump on each pressure stroke thereof, and a unitary casing structure housing all said parts.

4. In a fuel pumping unit, a pump of the double acting reciprocating piston type and including inlet and outlet valves at each end thereof for controlling the flow of fuel thereinto and therefrom, an inlet line leading to the pump, means including a relief valve communicating between the outlet and inlet valves of the pump for by-passing fuel back to said inlet valves whenever discharge pressure of fuel exceeds a predetermined maximum, a line check valve in said inlet line, said line check valve, said relief valve and said inlet valves being closely related and in mutual communication whereby a priming of fuel will be trapped between said relief valve, said inlet valves and said line check valve following each operation of the pump, said piston having a plunger and a guide extension projecting axially therefrom, a central open-ended casing portion housing said piston, said line check valve and said relief valve, and end closure caps on said open-ended casing portion, each carrying the inlet and outlet valves for the respective end of the pump and each having provision for slide guiding one of said plunger and guide extension.

5. In a fuel pumping unit, a central ring-like casing body having a central opening forming a pump cylinder open at its ends, a removable closure cap closing each cylinder end, a piston reciprocable in said cylinder, an inlet and outlet check valve set in each closure cap and communicating directly with the respective end of the cylinder, the check valves of each set being removably mounted in the respective closure cap, and a single means mounted wholly within the respective end cap for removably securing in position the check valves comprising each set.

6. In a fuel pumping unit, a central ring-like casing body having a central opening forming a pump cylinder open at its ends, a removable closure cap closing each cylinder end, a piston reciprocable in said cylinder, an inlet and outlet check valve set in each closure cap and communicating directly with the respective end of the cylinder, each check valve including a removably mounted cylindrical shell having a mounting flange, a valve seat and a valve therein spring pressed against said seat, said piston having a plunger projecting axially therefrom, a keeper plate surrounding the plunger and engaging the shell mounting flanges of the valves of each set for removably holding said shells in position, and means carried by each cap for securing the respecting keeper plate in position.

7. In a fuel pumping unit, a central ring-like casing body having a central opening forming a pump cylinder open at its ends, a removable closure cap closing each cylinder end, a piston reciprocable in said cylinder, an inlet and outlet check valve set in each closure cap and communicating directly with the respective end of the cylinder, each check valve including a removably mounted cylindrical shell having a mounting flange, a valve seat and a valve therein spring pressed against said seat, said piston having a plunger projecting axially therefrom,

a keeper plate surrounding the plunger and engaging the shell mounting flanges of the valves of each set for removably holding said shells in position, and a lock plate for securing each keeper plate in position and having an aperture therein for surrounding said plunger, each said cap having lock plate end securing recesses therein, and each said lock plate having end portions engageable by a movement of rotation in the recesses of the associated cap and displaceable lock fingers for engaging the respective keeper plate and preventing rotation of said lock plate.

8. In a fuel pumping unit, a central ring-like casing body having a central opening forming a pump cylinder open at its ends, a removable closure cap closing each cylinder end, a piston reciprocable in said cylinder, an inlet and outlet check valve set in each closure cap and communicating directly with the respective end of the cylinder, said central casing body having longitudinally disposed inlet and outlet passages extending through the ends thereof and a circumferentially extending passage communicating between said passages and extending beyond the longitudinal inlet passage, a line check valve in said passage extension close to the longitudinal inlet passage, a pressure relief valve in said circumferential passage close to and opening toward said longitudinal inlet passage, and an end closure cap for each end of said central casing body and having an inlet check valve and an outlet check valve communicating with the cylinder at the respective end and two passages one an inlet passage communicating between the respective inlet check valve and the longitudinal inlet passage and the like passage in the other cap and the other one an outlet passage communicating between the respective outlet check valve, the longitudinal outlet passage and the like passage in said other cap.

9. In a fuel pumping unit, a central ring-like casing body having a central opening forming a pump cylinder open at its ends, a removable closure cap closing each cylinder end, a piston reciprocable in said cylinder, an inlet and outlet check valve set in each closure cap and communicating directly with the respective end of the cylinder, said central casing body having longitudinally disposed inlet and outlet passages extending through the ends thereof and a circumferentially extending passage communicating between said passages and extending beyond the longitudinal inlet passage, a line check valve in said passage extension close to the longitudinal inlet passage, a pressure relief valve in said circumferential passage close to and opening toward said longitudinal inlet passage, an end closure cap for each end of said central casing body and having an inlet check valve and an outlet check valve communicating with the cylinder at the respective end and two passages one an inlet passage communicating between the respective inlet check valve and the longitudinal inlet passage and the like passage in the other cap and the other on an outlet passage communicating between the respective outlet check valve, the longitudinal outlet passage and the like passage in said other cap, plunger and guide extensions from said piston, and means on said end closure caps for slide guiding said plunger and guide extensions.

10. In a fuel pumping unit, a pump of the double acting reciprocating piston type and including inlet and outlet valves at each end there-

of for controlling the flow of fuel thereinto and therefrom, means including a relief valve communicating between the outlet and inlet valves of the pump for by-passing fuel back to said inlet valves whenever discharge pressure of fuel exceeds a predetermined maximum, a line check valve, said line check valve said relief valve and said inlet valves being closely related and in mutual communication whereby a priming of fuel will be trapped between said relief valve said inlet valves and said line check valve following each operation of the pump, said piston having a plunger and a guide extension projecting axially therefrom, a central open-ended casing portion housing said piston said line check valve and said relief valve, said central casing portion having an enlarged inlet chamber therein passage through which is controlled by said line check valve and which is generally cylindrical, a strainer in said inlet chamber through which fuel being pumped must pass, and a full diameter closure plug removably mounted in each extremity of said inlet chamber one thereof having provision for reciprocally mounting said line check valve, and end closure caps on said open-ended casing portion each carrying the inlet and outlet valves for the respective end of the pump.

11. In a pump, the combination of a cylinder, a pump piston reciprocable in the cylinder and having a plunger projecting axially therefrom, a set of pumped fluid flow controlling inlet and

outlet check valve units disposed one at each side, said plunger at one end of said cylinder, each said unit including a removably mounted cylindrical shell having a mounting flange a valve seat and a valve therein spring pressed against said seat, a keeper plate surrounding the plunger and engaging the mounting flanges of the shells for removably holding them mounted, and means for securing said keeper plate in position.

12. In a pump, the combination of a cylinder, a pump piston reciprocable in the cylinder and having a plunger projecting axially therefrom, a set of pumped fluid flow controlling inlet and outlet check valve units disposed one at each side of said plunger at one end of said cylinder, each said unit including a removably mounted cylindrical shell having a mounting flange a valve seat and a valve therein spring pressed against said seat, a keeper plate surrounding the plunger and having diametrically oppositely extended ends, one said end being forked to partially straddle one said shell and engage the mounting flange thereof, and the other of said ends having an arcuate clearance therein to receive a portion of the upper end of the other of said shells and form a bridge piece engaging the mounting flange of said other shell and providing an abutment for the valve pressing spring therein, and means for securing said keeper plate in position.

ARTHUR L. PARKER.