March 15, 1932. E. DODSON 1,849,060

FUEL SUPPLY PUMP

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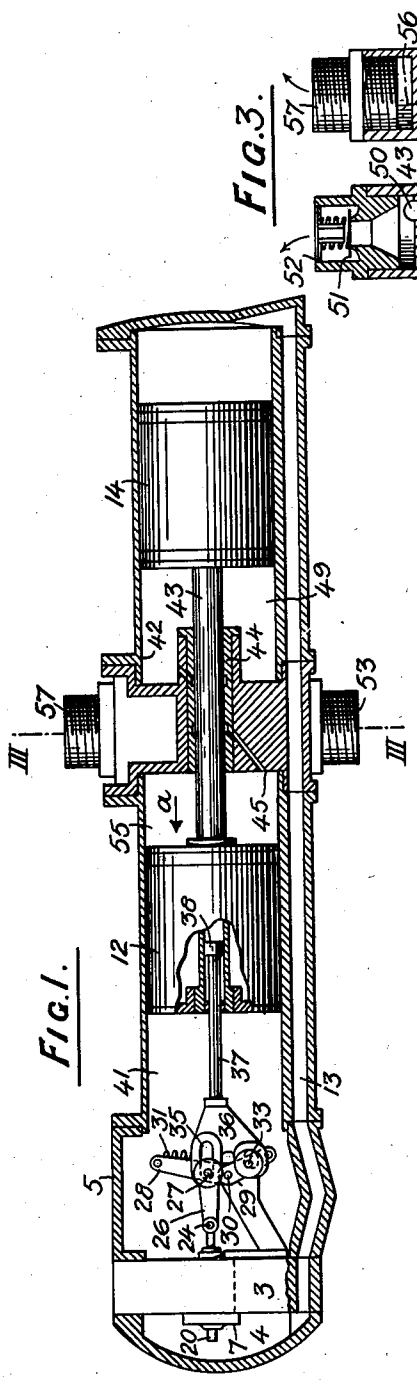


FIG. 1.

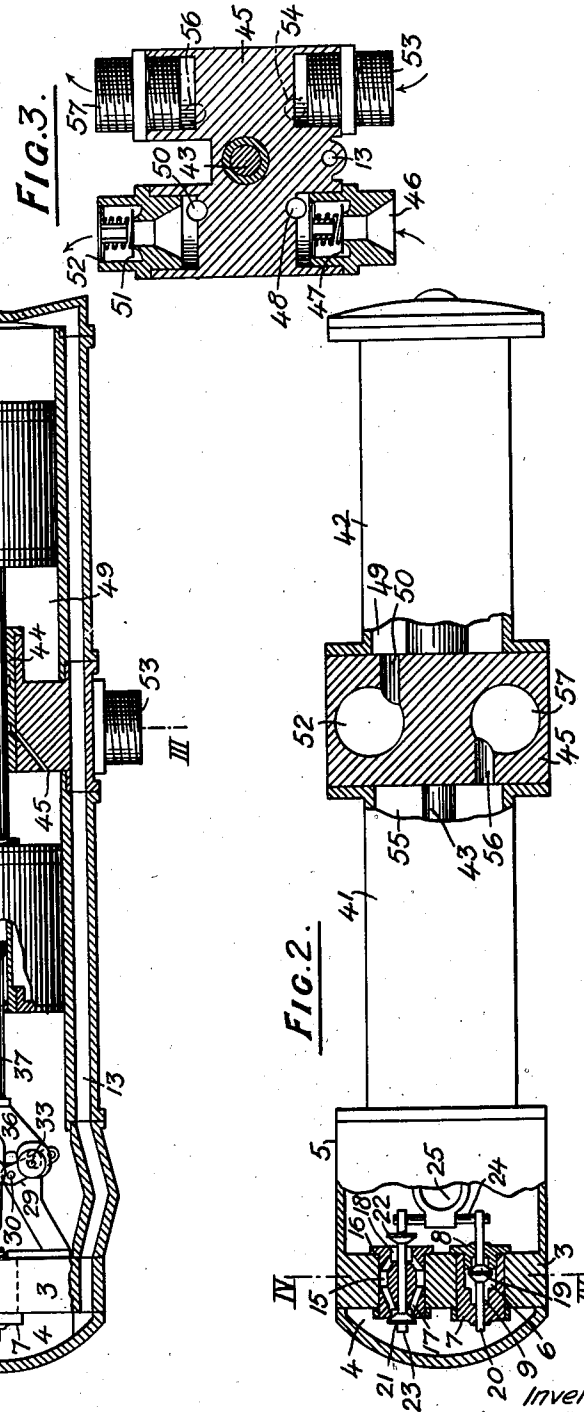


FIG. 2.

FIG. 3.

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FIG. 6.

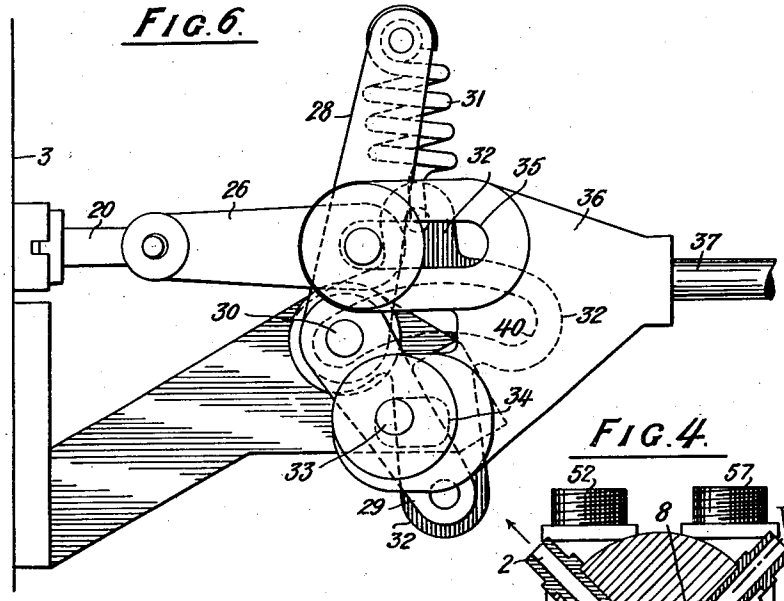


FIG. 4.

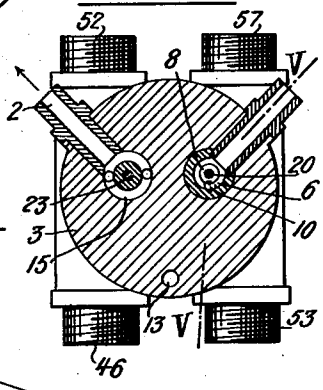


FIG. 7.

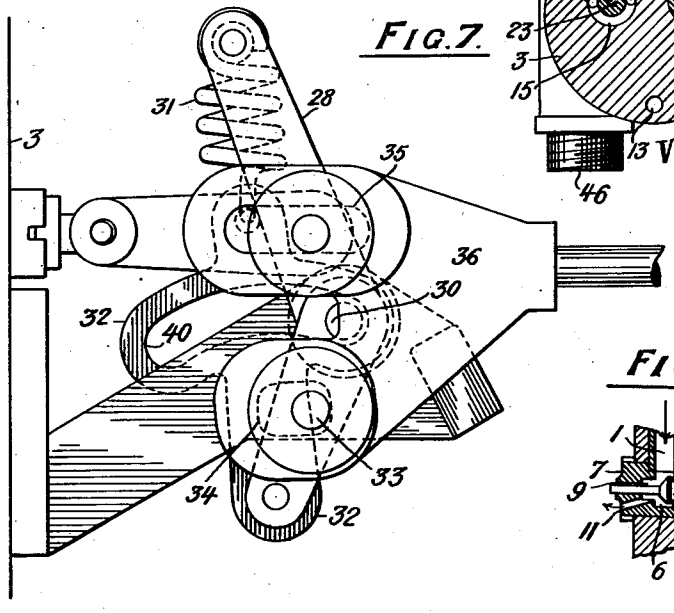


FIG. 5.

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UNITED STATES PATENT OFFICE

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FUEL SUPPLY PUMP

Application filed November 6, 1930, Serial No. 493,772, and in Great Britain February 26, 1930.

This invention relates to pumps for supplying liquid fuel or other fluid (hereinafter referred to as 'fuel') from a fuel tank or other similar supply source (hereinafter merely referred to as a 'fuel tank') to an internal combustion engine or to an auxiliary tank or float chamber associated therewith (hereinafter referred to as the 'internal combustion engine').

The object of the present invention is to provide a pump of improved construction which can be driven by air or other fluid pressure and which will act to feed the fuel under pressure from the fuel tank to the internal combustion engine.

According to this invention, the cylinder of a double acting piston pump is provided with inlet and exhaust passages for supplying fluid pressure to the outer sides of two pistons, which passages are controlled by valves so that when the outer side of one piston is open to the inlet the outer side of the other piston is open to exhaust and vice versa in accordance with the movement of the pistons so as thereby to cause the pistons to reciprocate in said cylinder, and said cylinder is provided between said pistons with non-return inlets through which fuel can be drawn into the cylinder at one stroke of the pistons and with non-return outlets through which the fuel thus drawn into the cylinder can be ejected at the other stroke of the pistons. By arranging the parts of the pump in this way a higher pressure will be maintained on the outer sides of the pistons than on their inner sides and thus leakage of fuel past the pistons will be prevented. The interconnected pistons are preferably operated by one unconnected push rod.

The invention will now be described with reference to a preferred embodiment shown in the accompanying drawings, in which:—

Fig. 1 is a sectional elevation of the pump, but showing the valve mechanisms in elevation.

Fig. 2 is a plan view with parts thereof in section to illustrate the valve mechanisms.

Fig. 3 is a cross-sectional view on the line III—III in Fig. 1, illustrating the fuel valve mechanism.

Fig. 4 is a cross-sectional view through the driving fluid pressure valve mechanism on the line IV—IV in Fig. 2.

Fig. 5 is a fragmentary section on the line V—V in Fig. 4.

Fig. 6 is an enlarged elevation of valve control mechanism for actuating the valves controlling the driving fluid pressure, said control mechanism being shown in one position.

Fig. 7 is a similar view to Fig. 6 but illustrating the mechanism in its alternative position.

The inlet 1 and the exhaust 2 for the fluid pressure driving the pump and the valve mechanism for controlling said inlet and exhaust (hereinafter described) are conveniently mounted in a cylindrical member 3 formed separately from and fixed between the cylinder end cover 4 and a casing 5. The inlet passage 1 communicates with the central portion 6 of an inlet valve casing 7 mounted in the carrying member 3. The inlet valve casing is provided with diametrically opposite spaces 8 and 9 communicating with the central portion 6 and formed with valve inlet ports 10 and 11 extending to opposite sides of the carrying member 3. The fluid pressure can either pass through one of these inlet ports 10 to one side of the piston 12 or through the other inlet port 11, the space between the cover 4 and the carrying member 3 and the transfer passage 13 formed in the pump casing, to the opposite side of the other piston 14.

The exhaust passage 2 communicates with a central annular portion 15 in the exhaust valve casing 16 and oppositely extending exhaust ports 17 and 18 opening at opposite sides of the carrying member 3. The fluid pressure from one side of the piston 12 exhausts through the ports 18 while fluid pressure from the opposite side of the piston 14 exhausts through the transfer passage 13, the space between the cylinder cover 4 and the carrying member 3 and the exhaust ports 17. The inlet ports are controlled by an inlet valve consisting of a single valve member 19 located between the spaces 8 and 9 and adapted to open one port when the other is

closed and vice versa, by reciprocation of the valve member through the valve spindle 20 to the valve casing 7. The exhaust ports are similarly controlled by two spaced valve members 21 and 22, one valve member 21 being adapted to close the ports 17 when the other valve member 22 opens the ports 18 and vice versa. These valve members 21 and 22 are mounted for reciprocation on a valve spindle 23. These valve members are so arranged that the fluid pressure tends to retain them in their closed position, sealing either of the ports in each valve casing as determined by the valve control mechanism.

The valve spindles 20 and 23 are connected together by a rod 24 fixed to a yoke 25 the arms 26 of which are connected by pins 27 to the link 28 of a double linkage system of which the other link is marked 29, which links are jointed together like a toggle linkage system on a fixed fulcrum 30. These links have their ends remote from the fixed fulcrum connected together by means of a spring 31 and a link 32. The link 29 is provided with a pin 33 and this pin 33 and the pin 27 on the link 28 pass through slots 34 and 35, respectively, in a bifurcated arm 36 on the end of a rod 37 projecting from the piston of the pump. The rod 37 is provided with an enlarged end 38 which can partake of a limited sliding motion in the piston 12 and acts in such a manner that as the piston 12 is reciprocated, the rod 37 and bifurcated arm 36 are, towards the end of the piston stroke, reciprocated by the piston and this reciprocatory movement of the bifurcated arm 36 through the pins 27 and 33 causes the links 28 and 29 to be thrown over a dead centre position and are thus caused by the spring 31 and link 32 to operate the valve spindles 20 and 23 quickly and thus immediately reverse the flow of fluid pressure to and from the side of said pistons 12 and 14 at the required moment. To allow for movement of the link 32 relative to the fixed fulcrum 30 a slot 40 is provided in the link 32. This mechanism is so arranged that the action of the toggle-like links 28 and 29 is followed by the bifurcated arm 36 so that, if the action of the toggle-like links is insufficient to effect the required movement of the valves, the valves will be positively moved by the bifurcated arm 36.

With the driving fluid valve mechanism so arranged at one end of the pump, the pressure fluid from the inlet may be supplied to the side of the piston 14 remote from the mechanism and the exhaust from this piston 14 may also be conveyed to the exhaust valve by means of a single transfer passage 13.

The pistons 12 and 14 reciprocate in cylinders 41 and 42, respectively, and are interconnected by a push rod 43 freely mounted between the pistons and supported in the bearing 44. The bearing 44 is carried by a diaphragm 45 located in between the cylinders 41 and 42. The diaphragm 45 carries two sets of inlet and exhaust valves for the fuel to be pumped. The inlet 46 to one of these sets of valves is controlled by a non-return inlet valve 47 and communicates with a passage 48 passing to the space 49 between the piston 14 and the diaphragm 45. From this space 49 fuel can pass out through a passage 50 and non-return discharge valve 51 to the outlet 52 of this set of fuel valves. On a diametrically opposite side of the diaphragm a similar inlet and inlet valve marked 53 and inlet passage 54 are provided for admitting fuel into the space 55 between the piston 12 and the diaphragm 45 and similar outlet passage 56 and outlet and discharge valve 57 are provided for the discharge of fuel from the space 55. Thus on reciprocation of the pistons 12 and 14 in the direction indicated by arrow *a* in Fig. 1, fuel will be drawn into the space 55 through the inlet 46 and inlet passage 48. At the same time, fuel which has been drawn into the space 49 at a preceding stroke of the pistons will be discharged through the discharge passage 56 and outlet and discharge valve 57. After the pistons have completed their reciprocation in direction of the arrow *a* and are reciprocated in the opposite direction by the driving fluid as previously explained, the fuel drawn into the space 55 will be prevented from returning through the inlet 46 by the non-return valve 47 and will be discharged through the discharge passage 50 and outlet 52. At the same time, fuel will be drawn through the inlet and inlet valve 53 and inlet passage 54 into the space 49. The cycle will then be repeated indefinitely, fuel being drawn into the pump and being discharged from the pump at each stroke thereof.

With the arrangement described herein, a higher pressure is maintained on the outer ends of the pistons than on the piston ends in contact with the fuel, so that fuel will not leak past the pistons.

Where air is used as the fluid pressure, the exhaust passage of the pump, will of course, be open to the atmosphere, but where any other fluid is employed, the exhaust may be connected with a return passage of a closed circulatory system.

A pump in accordance with this invention is particularly applicable to a method of feeding liquid fuel or other fluid from a source of supply to a remote source of power in which the fluid pressure for operating the pump is supplied by a pump driven by the source of power, as described in my co-pending application Serial No. 493,771, filed November 6, 1930, for method of and means for supplying liquid fuel or other fluid from a supply source to a delivery point at or adjacent a source of power remote from the supply source.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A pump for supplying fuel to internal combustion engines comprising, a cylinder, two interconnected pistons in said cylinder, non-return fuel inlet valves between said pistons through which fuel can be drawn into said cylinder on one stroke of the pistons, non-return fuel outlet valves between said pistons through which fuel drawn in through said inlet valves can be ejected during the next stroke of said pistons, means for supplying fluid pressure to and its exhaust from the outer sides of said pistons, a single set of inlet and exhaust valves at one end of said cylinder for controlling the supply of fluid pressure to and its exhaust from the outer sides of said pistons in such a manner that the outer side of one piston is supplied with fluid pressure when the other is open to exhaust and vice versa in accordance with the movement of the pistons, so as thereby to reciprocate said pistons and by maintaining a greater pressure on the outer sides of said piston than on the inner sides thereof prevent leakage of fuel past the pistons, quick change-over mechanism for operating said inlet and exhaust valves and means for positively operating said inlet and exhaust valves if these are not properly operated by the quick change-over mechanism.

2. A pump for supplying fuel to internal combustion engines comprising, a cylinder, two interconnected pistons in said cylinder, a diaphragm in said cylinder between said pistons, non-return fuel inlet valves in said diaphragm through which fuel can be drawn into said cylinder on either side of said diaphragm during one stroke of the pistons, non-return fuel outlet valves in said diaphragm through which fuel drawn in through said inlet valves can be ejected during the next stroke of said pistons, means for supplying fluid pressure to and its exhaust from the outer sides of said pistons, inlet and exhaust valves for controlling said supply of fluid pressure and its exhaust in such a manner that the outer side of one piston is supplied with fluid pressure when the other is open to exhaust and vice versa in accordance with the movement of the pistons, so as thereby to reciprocate said pistons and by maintaining a greater pressure on the outer sides of said piston than on the inner sides thereof prevent leakage of fuel past the pistons, quick change-over mechanism for operating said inlet and exhaust valves and means for positively operating said inlet and exhaust valves if these are not properly operated by the quick change-over mechanism.

3. A pump for supplying fuel to internal combustion engines, comprising, in combination, a pump cylinder, interconnected pump pistons in said pump cylinder, means for supplying fuel to and from said pump cylinder between said pistons, supply means for supplying fluid pressure to the outer side of one piston when the outer side of the other piston is open to exhaust and vice versa, means connecting said pistons to said supply means, and quick change-over mechanism in said connecting means adapted, when a predetermined position is reached, to operate independently of said connecting means in order to reverse the supply means.

4. A pump for supplying fuel to internal combustion engines comprising, in combination, a cylinder, two interconnected pistons in said cylinder, non-return fuel inlet valves between said pistons through which fuel can be drawn into said cylinder on one stroke of the pistons, non-return fuel outlet valves between said pistons through which fuel drawn in through said inlet valves can be ejected during the next stroke of said pistons, means for supplying fluid pressure to and its exhaust from the outer sides of said pistons, inlet and exhaust valves for controlling said supply of fluid pressure and its exhaust in such a manner that the outer side of one piston is supplied with fluid pressure when the other is open to exhaust and vice versa in accordance with the movement of the pistons, so as thereby to reciprocate said pistons and by maintaining a greater pressure on the outer sides of said pistons than on the inner sides thereof, prevent leakage of fuel past the pistons, quick change-over mechanism for operating said inlet and exhaust valve adapted to reverse the flow of fluid pressure and its exhaust immediately the pistons have passed a predetermined position, and means for positively operating said inlet and exhaust valves if these are not properly operated by the quick-change-over mechanism.

5. A pump for supplying fuel to internal combustion engines, comprising, in combination, a pump cylinder, interconnected pump pistons in said pump cylinder, reversible means for supplying fluid pressure to the outer side of one piston when the outer side of the other piston is open to exhaust and vice versa, quick change-over mechanism connected to said reversible means, means connecting said quick change-over mechanism to said pump pistons adapted to initiate the movement of said mechanism but permit the mechanism to complete its movement independently in order quickly to reverse said reversible means, and means whereby fuel may be drawn into and ejected from the inner sides of said pistons.

6. A pump for supplying fuel to internal combustion engines, comprising, in combination, a pump cylinder, interconnected pump pistons in said cylinder, passages for supplying fluid pressure to the outer sides of said pistons, an inlet port and an exhaust port communicating with said passages, valves

controlling said passages adapted to communicate said inlet port to the passage to the outer side of one piston when the passage to the outer side of the other piston communicates with said exhaust port and vice versa, quick change-over mechanism connected to said valves, a push rod connected to said quick change-over mechanism and having lost motion relatively to said mechanism adapted to initiate the movement of said quick change-over mechanism but permit the mechanism to complete its movement independently, means on said push rod engaging freely in one of said pistons and adapted to be actuated by said piston when this has reached a predetermined position, and means whereby fuel may be drawn into and ejected from the inner sides of said pistons.

In witness whereof I have hereunto set my hand.

EDWARD DODSON.