Sept. 5, 1933. H. HUEBER ET AL 1,926,005

FUEL PUMP FOR MOTOR VEHICLES

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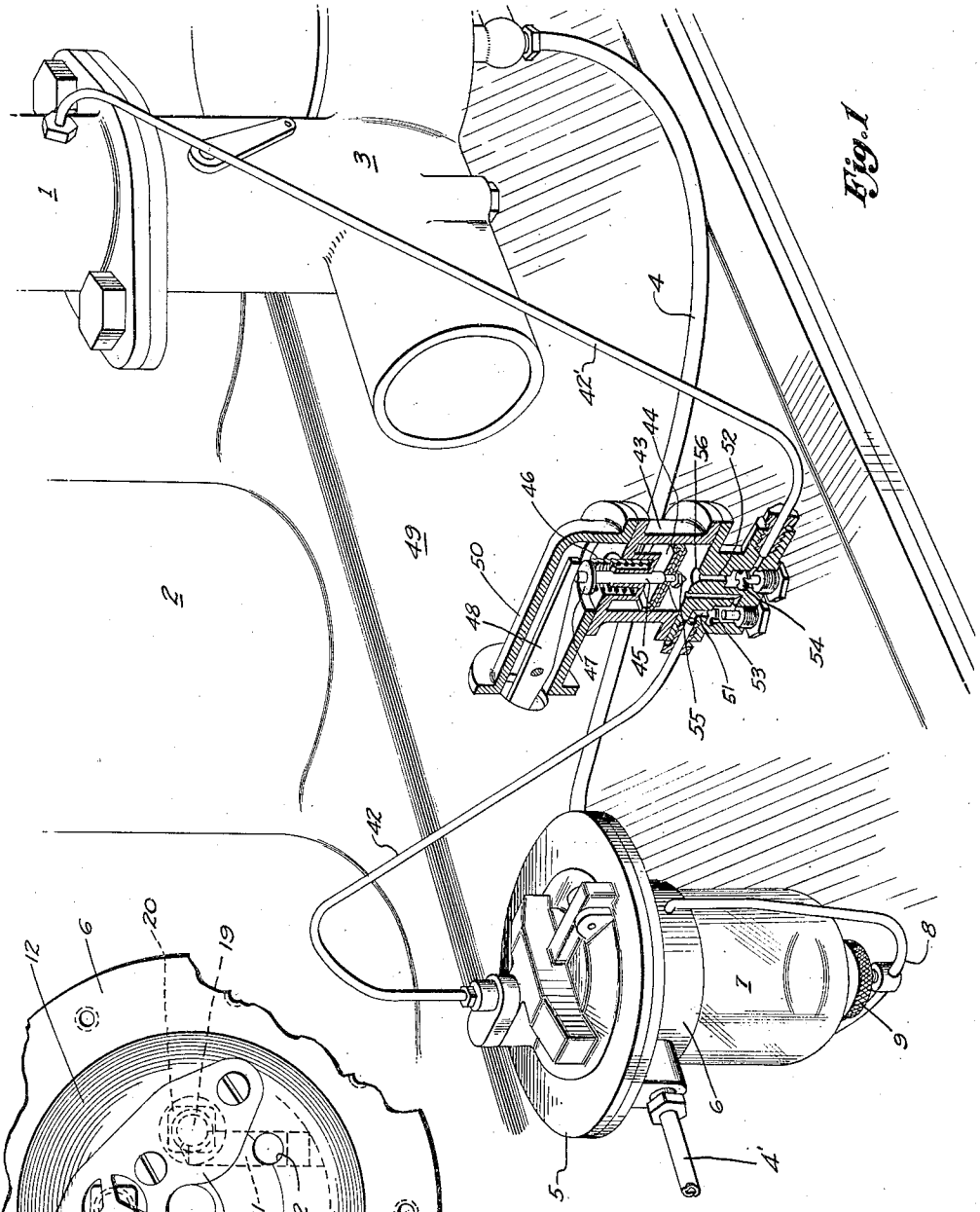


Fig. 1

Fig. 5

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Fig. 4

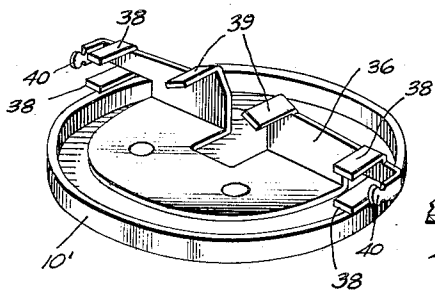


Fig. 2

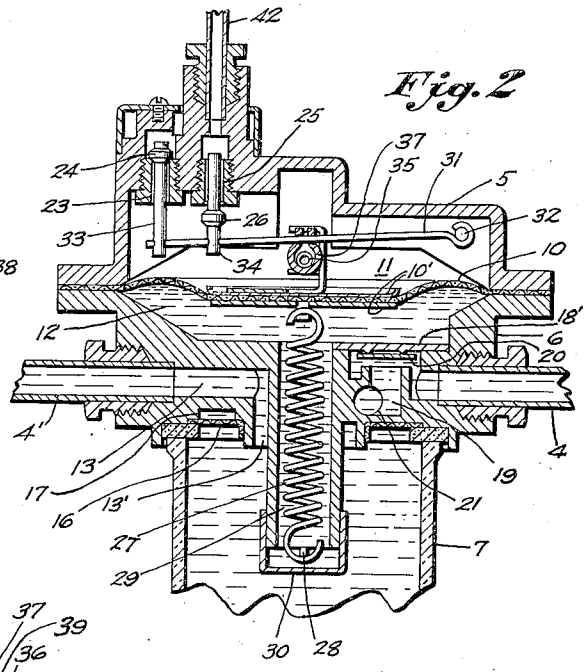


Fig. 3

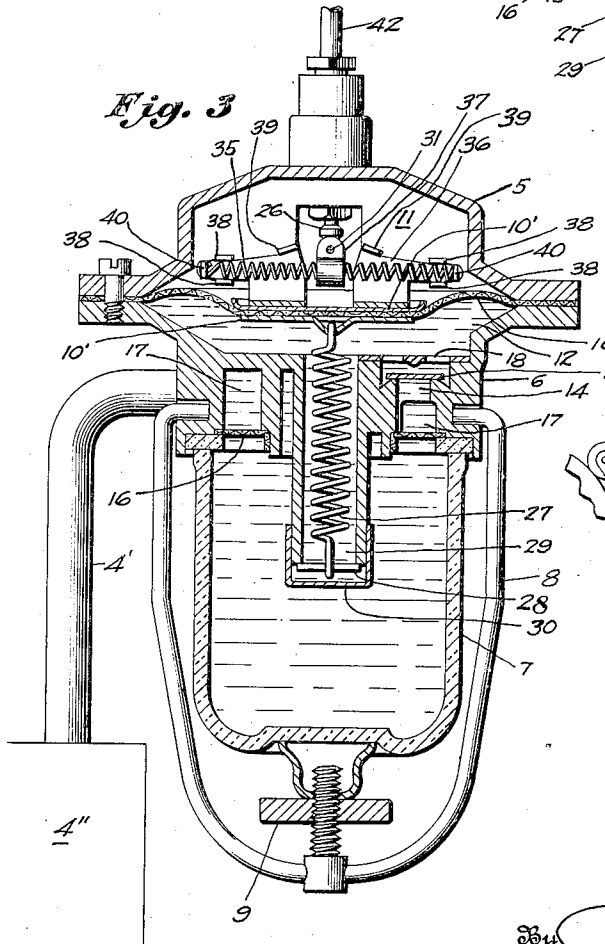


Fig. 6

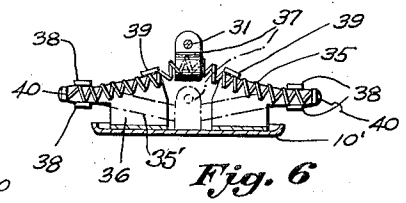
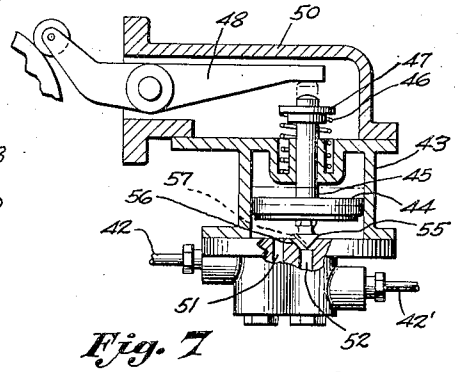


Fig. 7



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UNITED STATES PATENT OFFICE

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FUEL PUMP FOR MOTOR VEHICLES

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Application February 26, 1930. Serial No. 431,587

14 Claims. (Cl. 103—152)

This invention relates to a fuel feed system for internal combustion engines and is primarily designed for furnishing the internal combustion engine of motor vehicles with a constant supply of liquid fuel.

Considerable attention has been given by automotive engineers to the problem of supplying the engine with a sufficient quantity of the liquid fuel under all operating conditions. In the prevailing arrangement, found in the modern motor vehicle, the fuel supply tank is disposed at the rear of the motor vehicle and the liquid fuel is transferred therefrom to the carburetor through the intermediary of power operated devices among which the vacuum tank and the engine operated pump are the best known.

In the fuel feed system utilizing the vacuum tank, the gasoline is lifted from the supply tank to the vacuum tank by a negative pressure or so-called suction as found in the intake manifold of the internal combustion engine. This source of suction produces a variable degree of suction, from a degree sufficient for the normal operation of the vacuum tank mechanism as when the engine is idling or its throttle is more or less closed, to a degree insufficient to lift the gasoline to the tank as when the engine is laboring or being accelerated and the throttle is more or less fully opened. Therefore, with the engine accelerating and operating at a high speed, as during fast traveling, the liquid fuel is not supplied to the carburetor with sufficient volume or constant flow to meet the demand, with a resultant inefficiency in the behavior of the engine.

In the positive pressure type of fuel lift for transferring the liquid fuel from the supply tank to the carburetor, there is interposed in the fuel line a mechanically driven pump in which the impeller, whether it be of the piston type or diaphragm type, is operated from the cam shaft or through the intermediary of other mechanical movements from, and in accordance with the speed of, the engine. Consequently, there is considerable wear and tear on the pump mechanism by reason of the accelerated speed of operation and movement of the cooperating parts, with no particular way of gauging the flow and therefore a consequential over or under supply of the liquid fuel occurs. In the case of an over supply of the fuel a by-pass or return passage must be provided to avoid rupturing the fuel line or otherwise disrupting the system.

It has also been suggested to utilize a diaphragm pump in which the diaphragm is operated by pulsations, but the action has failed to perform and has been such as to subject the diaphragm to strains and stresses which materially shortened its period of usefulness.

The present invention has for its objects to provide a fuel system which will be more efficient and longer lived in the actual service of transferring the motor fuel from the supply tank to the carburetor; to provide a controlled fuel feeding from a lower lever to a higher level, governed in accordance with the demand made by the engine without exceeding the requirements; and to provide a fuel transfer pump in which the piston member is in the form of a substantially non-resilient diaphragm, the diaphragm preferably having a fabric or fiber body. The fuel feeding system, as a system, and which is hereinafter referred to, forms the subject matter of our co-pending divisional application filed December 27, 1932, Serial No. 649,052.

The invention further resides in the provision of an improved fuel feeding pump of the diaphragm type wherein the life and usefulness of the diaphragm is materially increased and reflex bending or buckling movements of such element are avoided; to provide a diaphragm pump embodying valved atmospheric and suction ports in which the valves are controlled and actuated by a spring snap action to insure and effect a definite and positive seating and unseating of the valves in proper order and relationship whereby the dry side of the diaphragm is subjected first to a negative motivating pressure and then an atmospheric relieving pressure; and to provide a diaphragm pump in which the diaphragm is subjected to a negative lifting pressure for taking in a quantity of the liquid fuel, and then subjected to a yielding urge or pressure for expelling the quantity of liquid fuel in accordance with the demand.

The invention still further resides in the provision of a diaphragm lift in which the diaphragm is of fabric or cloth and is maintained bellied or flexed to one side against reflexing during operation.

In the drawings:—

Fig. 1 is a fragmentary perspective view showing the improved fuel feeding system incorporated in the motor vehicle power plant, the auxiliary suction producing mechanism being depicted in section.

Fig. 2 is a vertical sectional view through the fuel lift mechanism in the act of intaking liquid fuel.

Fig. 3 is a vertical sectional view through the

fuel lift taken on a vertical plane substantially at right angles to the plane of section of Fig. 2.

Fig. 4 is a detailed perspective view of the spring holding member.

Fig. 5 is a fragmentary plan view of that section of the lift casing at the wet side of the diaphragm.

Fig. 6 is a diagrammatic showing of the snap action.

Fig. 7 is a sectional view through the suction pump.

Referring more in detail to the accompanying drawings, the numeral 1 designates the intake manifold of the motor vehicle engine 2 having the usual carburetor 3 to which leads the fuel line 4, 4' from the supply tank 4'' (Fig. 3) located at a level lower than the carburetor and which is usually disposed at the rear of the motor vehicle.

Interposed in the fuel line is the power lift which, as illustrated in Figs. 2, 3 and 4, comprises a casing having an upper section 5 and a lower section 6 to which latter may be secured a sediment trap 7, as by means of a removable bail 8 and a clamping adjustment 9. Interposed between the upper and lower sections 5 and 6 is a diaphragm 10, preferably of a treated fabric and dividing the interior of the casing 5, 6 into an upper dry chamber 11 and a lower wet chamber 12. The numeral 13 designates the inlet passage for the liquid fuel having a port 14 designed for being closed by a valve 15 against retrograde flow of the liquid fuel.

For trapping any dirt lifted from the supply tank with the gasoline or motor vehicle, the intake passage 13 first opens downwardly into he sediment trap or chamber 7, as through an annular groove or channel 13'. A screen or strainer 16 is provided in the sediment trap at the outlet side thereof, herein shown held in position by being clamped against the underside of the casing 6. The liquid fuel passes from the sediment trap upwardly through the strainer 16 into the annular chamber 17 and thence through the inlet port 14 into the fuel chamber 12, at the underside or wet side of the diaphragm 10, unseating the valve 15 in its upward passage. A spider 18 may be provided for preventing total displacement of the valve. The outlet for the liquid fuel chamber 12 is designated by the numeral 19 and is closed by an inwardly closing valve 20, communication being had with the outlet port 19 through a horizontal passage 21 and a vertical passage 22 opening upwardly into the chamber 12, this indirect passage permitting the use of a gravity seated outlet valve 20 which may also be restricted in its movement from its seat by the extension 18' of the spider 18.

The upper chamber 11 has an inlet, atmospheric port 23 closed at intervals by a valve 24, and an outlet suction port 25 connected to the source of suction and closed at intervals by a valve 26. The two valves are alternately seated and alternately unseated by a snap action which functions at the opposite limits of movement of the diaphragm. As the diaphragm reaches its lower limit, on the liquid expelling stroke, the valve 24 is seated and the valve 26 unseated whereby suction will maintain in the chamber 11 to urge the diaphragm upwardly for drawing in another quantity of gasoline, the valves remaining in such positions until the diaphragm about reaches its upper limit of movement when the valve 26 will close and the valve 24 open, breaking the lifting influence of the suction and permit the liquid expelling movement of the diaphragm.

This liquid expelling movement is provided by a constantly urging force or pressure, of a yieldable character whereby the liquid fuel is supplied only as the carburetor demands the same. In the illustrated embodiment this movement is imparted by a spring 27 preferably connected to the underside of the diaphragm and anchored at a suitable point such as by means of a pin 28 in the bottom of the well 29. A removable cap 30 may be provided over the bottom of the well to facilitate the anchoring of the lower end of the spring in practice. This spring is of sufficient strength to create a downward movement of the diaphragm when the upper chamber 11 is in communication with the atmosphere whereby the liquid fuel in the chamber 12 will be expelled through the outlet 19 and pipe 4 into the carburetor 3. When the chamber 11 is in communication with the source of suction the urge of the negative pressure on the upper side of the diaphragm will be sufficient to overcome the downward urge of the spring 27.

To insure a positive and quick change over from the suction supply to the atmosphere there is embodied in the lift a spring snap action. This snap action preferably consists of a valve actuator or lever 31 pivoted at 32 adjacent one end to rock in a vertical plane. The lever is provided with a valve actuating stem 33, designed to unseat the valve 24, and a second valve actuating stem 34 designed to actuate the valve 26. For simplicity, the stems have openings through which the end of the lever is threaded, or loosely passed.

The diaphragm may have central disks 10' to facilitate the attachment of the spring 27 and constitute a means for mounting the standard or upright plate 36. This plate has outturned ears 40 between which a coiled spring 35 is suspended. The intermediate portion of this spring may flex up and down from a normal position and is adapted to be connected to the lever 31, as by means of a saddle 37 which is suspended from the lever and encloses the spring 35. The plate also has upper and lower lugs or shoulders 38 above and below the spring and adjacent its points of suspension. The spring is designed to alternately bear on these lugs as it flexes up and down to avoid substantial pivoting of the spring about the ears 40. Fuel intaking movement of the diaphragm will flex the spring downwardly, as indicated approximately by the dotted showing 35' in Fig. 6, thereby placing the spring under sufficient lateral tension to bring the valve 26 to its seat for closing communication with the source of suction and to quickly and simultaneously unseat the valve 24 whereby the negative pressure in the chamber 11 will rise to atmospheric pressure and the spring 27, having its counteracting force disrupted, will urge and pull the diaphragm downwardly for expelling the liquid fuel. As the diaphragm continues its liquid expelling movement the spring 35 returns to its normal position (Fig. 3) and moves beyond or to the opposite side thereof whereby the spring is again flexed laterally but upwardly, substantially as indicated by the full lined showing in Fig. 6, and when the spring potential has built up sufficiently to overcome the pressure acting to hold the valve 26 seated the spring will act quickly to unseat the valve 26 and seat the valve 24, again restoring communication between the chamber 11 and the

source of suction to the exclusion of the exterior atmosphere whereupon upward travel of the diaphragm will again begin.

After the spring 35 has been placed under sufficient tension to effect a quick shifting of the valve, it is desired to provide a positive connection between the lever 31 and the diaphragm which in the present showing is obtained through the saddle 37 coming alternately into contact indirectly with spaced shoulders 39 and directly with the diaphragm assembly. The shoulders 39 project from the upright plate 36 at opposite sides of the saddle and above the spring 35, being disposed close to the saddle so that the intermediate spring portions will practically constitute rigid abutments or connections therebetween when the shoulders are engaged with the spring. Thus, when the spring has been flexed to the position 35' (Fig. 6) the saddle 37 will contact with the diaphragm plate 10', or other fixed part thereon, to provide a direct thrust connection between the diaphragm and the lever 31 to positively unseat the valve 24 whereupon the stored up energy in the spring 35 will act unrestrictedly in seating the valve 26, and vice versa, when the spring has been flexed to the full lined position in Fig. 6 the saddle will indirectly engage the shoulders 39 (through the portions of the spring 35 between the saddle and the shoulders 39) and establish positive connection between the lever 31 and the diaphragm to positively unseat the valve 26 whereupon the stored up energy of the spring 35 will expend itself in bringing the valve 24 to its seat.

The suction port 25 is connected to the intake manifold through the conduit 42, 42', and since it is well known that the manifold suction fluctuates considerably—ranging between a very high or excessive degree to an almost negligible degree,—there is also provided an auxiliary device which is positively driven for creating a supplementing supply of suction which together with the manifold suction will provide a substantially constant supply for the operation of the lift regardless of the throttle position in the manifold.

The auxiliary suction producer preferably comprises a suction pump driven by the automobile engine. This pump, as shown, consists of a casing 43 and a piston 44 operable therein and having a piston rod 45 extending upwardly through the head of the casing 43 where it is supported in an elevated position by a spring 46 the latter being compressed between a fixed part of the head and a collar 47 carried by the piston rod. Overlying the upper end of the piston rod is a power driven actuator 48 extending within the crank case 49 of the engine for being operated by a cam on the cam shaft, or otherwise. A housing 50 encloses the actuator 48 and serves to support the pump casing from the crank case. The pipe 42 leads to the inlet port 51 while the pipe 42' communicates with the outlet port 52 of the pump, these two ports being respectively provided with check valves 53 and 54 for directing the flow of fluid through the piston chamber of the pump from the lift to the manifold. The spring 46 tends to establish the connection between the actuator and the piston rod 45 but its force is overcome by the manifold suction when the latter is sufficient of itself to operate the lift, or is in excess thereof. When the manifold suction is of such a degree the piston 44 will be drawn downwardly thereby and consequently withdraw the piston rod 45 more or less from the operative path of the actuator. An excess degree of manifold suction will completely withdraw the piston from any operating contact with or by the actuator. The piston therefore constitutes a suction responsive member for rendering the connection active or inactive.

To maintain a substantially uniform degree of negative pressure there is also provided means for tempering or throttling the influence of the excessive manifold suction on the lift, which means is preferably under the control of the influenced piston 44 and in the present showing comprises a valve 55 carried by the piston 44 and movable thereby toward and from the valve seat 56 about the outlet port 52. An imperfect seating of the valve 55 is provided for, such as by means of a bleed passage 57 so as to avoid complete interruption between the manifold and the lift. Obviously, as the manifold suction increases to an excessive degree the valve 55 will be moved closer to its seat 56 and vary the size of the port 52 with its increasing resultant restriction upon the influence on the lift.

In starting the engine with the valve 24 seated and the valve 26 opened, the manifold suction will create a lifting action on the upper or dry side of the diaphragm whereby the liquid from the fuel tank 4'' is drawn into the chamber 12 past the unseated inlet valve 15, the outlet valve 20 being held seated by such lifting action of the diaphragm. Upon completion of the lifting stroke of the diaphragm, as defined by the snap action imparted by spring 35, the communication with the source of suction is interrupted by the seating of the valve 26 and atmospheric communication established by the unseating of the valve 24, breaking the vacuous condition in chamber 11 and permitting the motivating element 27 to come into play for exerting a downward pressure on the diaphragm which causes the inlet valve 15 to seat and the outlet valve 20 to unseat with a consequent expelling of the liquid fuel from the chamber 12 on into the carburetor. This expelling action is elastic or yieldable thereby providing a constant propelling influence on the fuel in the chamber 12 so that the motor fuel will be forced into the carburetor as the latter requires the same in meeting the demands of the engine.

As the engine throttle is opened more and more, the available manifold suction decreases whereupon the spring 42 will overcome the manifold suction influence and bring the piston rod 45 into the operative path of the actuator 48 so that a mechanical production of negative pressure will start up, since the action of the plunger 44 is to intake the air from the lift chamber 11, through pipe 42, past inlet valve 53 and into the piston chamber in casing 43, and expel it therefrom through outlet 42, past outlet valve 54 and, by means of pipe 42', deliver it to the manifold 1. As soon as the manifold suction again reaches its normal or excessive degree of suction the auxiliary, mechanically driven suction producer is rendered inoperative while the lift continues its rhythmic operation (varied only by a change in the demand),—as though the auxiliary suction producer was not present, except as to the throttling action which it brings into play when the manifold suction becomes excessive.

The improved fuel feeding system will therefore maintain a constant supply of fuel for all engine requirements and demands without an over supply and without having a mechanically

driven pump or lift which is under constant driving pressure or connection with the engine.

Furthermore, the improved fuel feeding system maintains a constant supply of negative pressure furnished largely by the manifold suction and supplemented by the auxiliary pump only as the manifold suction may require a boosting or augmenting component. The air is practically undergoing a constant change in the pressure chamber 11, taking in a fresh supply of air during the ensmallment of the fuel chamber 12 and passing it on into the intake manifold on the enlargement of said fuel chamber.

The life of the diaphragm is materially lengthened and may be constructed from thin stock since in its action it is not subjected to violent pressures and stresses, nor is it reflexed or turned over upon itself, the flexure being always to the same side of the diaphragm. The pressures on the diaphragm at both sides are of a yielding nature, the dry side being subject to a fluid pressure preferably not above atmospheric, while the pressures or forces applied to the wet side and consisting of the spring 27 and the atmosphere forcing the fuel into the chamber 12, do not exceed atmospheric.

Even a single ply fabric diaphragm will stand up in service materially longer than the metal diaphragm, or the multiply fabric diaphragm when mechanically driven, since there is no element in the improved lift which directly or indirectly reflexes the diaphragm or causes it to bend or turn upon itself. The central disks 10' give to the fabric a rigidness sufficient to support or attach the spring 27 and the snap action, leaving the surrounding diaphragm portion free to flex but which flexes only toward the dry side.

What is claimed is:

1. A fuel lift comprising a casing having a fuel chamber and a pressure chamber divided by a flexible non-resilient diaphragm supported at its margin and having its central portion free to flex, said fuel chamber having valved inlet and outlet ports and said pressure chamber having valved inlet and outlet ports one of which latter ports is connectible to a source of operating pressure, a spring urging the diaphragm and constituting the sole source of power therefor in one direction of movement to ensmall one of said chambers, and mechanism for operatively controlling the admission of operating pressure to the pressure chamber for moving the diaphragm against the tensioning of said spring to enlarge said specified chamber.

2. A fuel lift comprising a casing having a fuel chamber and a pressure chamber, a non-resilient flexible diaphragm means dividing the two chambers and acting to ensmall and enlarge the fuel chamber, a spring connected to the central portion of the diaphragm and constantly urging the same to ensmall the fuel chamber whereby the outer portion of the diaphragm is flexed away from said fuel chamber, and means adapted for operatively connecting the pressure chamber first to a source of suction and then to the atmosphere whereby to maintain the diaphragm so fixed away from the fuel chamber and against a reflex movement of the diaphragm, said fuel chamber having valved inlet and outlet ports.

3. A fuel lift comprising a casing having a fuel chamber and a pressure chamber, each provided with inlet and outlet ports, a non-resiliently, flexible diaphragm dividing the chambers, the central portion of the diaphragm being reinforced against flexing and to define a rigid effective displacing area, means exerting a constant pressure on the reinforced central portion of the diaphragm in one direction of movement of the diaphragm, said pressure chamber ports constituting an operating pressure port and an atmospheric pressure port, valves controlling said ports, means connecting said pressure chamber valves for simultaneous movement to effect a seating of one valve and a concurrent unseating of the companion valve, and vice versa, resilient means connecting the valve connecting means to the diaphragm for being tensioned during both in and out movements of the diaphragm for effecting a continued operation of said valve connecting means when such movement has been initiated.

4. A fuel lift comprising a casing having a fuel chamber and a pressure chamber, a fabric diaphragm dividing the chambers and operating to ensmall and enlarge the same, means exerting pressure on the diaphragm constantly in one direction and constituting the sole mechanical force for moving the diaphragm in such direction, said pressure chamber having an operating pressure port and an atmospheric pressure port, valves controlling said ports, and a valve snap action interposed between both pressure chamber valves and the diaphragm for effecting a seating of one valve and a concurrent unseating of the companion valve, and vice versa, during in and out movement of the diaphragm.

5. A fuel lift comprising a casing, a fabric diaphragm dividing the same into a dry chamber and a wet chamber, each chamber having valved inlet and outlet ports, the central portion of the diaphragm being rigid, and a snap action carried in part by said central rigid portion of the diaphragm and operable by and during movement of the diaphragm for seating the inlet valve and opening the outlet valve of the dry chamber, and vice versa.

6. A fuel lift comprising a casing, a flexible but non-resilient fabric diaphragm secured about its edges therein and dividing the casing interior into a dry chamber and a wet chamber, each chamber having inlet and outlet ports, the outlet port of the dry chamber being connectible to a source of suction and the inlet port to the atmosphere, snap-acting valve mechanism operable by the diaphragm for intermittently opening and closing the outlet port of the dry chamber whereby the suction influence on the fabric diaphragm is completely relieved at intervals, and resilient means acting on the diaphragm for moving it to ensmall the wet chamber when the outlet port of the dry chamber is closed.

7. A fuel lift comprising a casing, a non-resilient diaphragm dividing the casing into a fuel chamber and a suction chamber, a spring anchored at one end in the fuel chamber and connected centrally of and to the diaphragm for exerting a pull on the latter to expel fuel from said fuel chamber, and means controlled by the diaphragm for alternately opening the pressure chamber first to a source of suction and then to the atmosphere, the suction when admitted to the pressure chamber acting to move the diaphragm against the action of said spring for intaking fuel into the fuel chamber, the diaphragm between the point of securement of the spring thereto and its marginal mounting in the casing being constantly bulged toward the pressure chamber side to avoid back and forth buckling of the diaphragm.

8. A fuel lift having a fuel chamber with valved

inlet and outlet ports, a fabric diaphragm arranged in the chamber and operable to enlarge and ensmall the chamber for the intaking and expelling of fuel, a suction chamber divided from the fuel chamber by said diaphragm and having a suction port and an atmospheric port, valves for controlling said suction chamber ports, means independent of the diaphragm for imparting a fuel expelling movement to the diaphragm and constituting the sole means for moving the diaphragm during such movement, and snap acting means operable by and during movement of the diaphragm to open the suction port and simultaneously close the atmospheric port at the close of such diaphragm movement to thereby connect the suction chamber to a source of suction for effecting a fuel intaking movement of the diaphragm, said snap acting means acting at the end of such intaking movement and independently of further diaphragm movement to close the suction port and to simultaneously open the atmospheric port to permit said diaphragm moving means to again actuate the diaphragm for expelling fuel.

9. A fuel lift having a fuel chamber with valved inlet and outlet ports, a non-resilient diaphragm arranged in the chamber and operable to alternately enlarge and ensmall the chamber, a suction chamber divided from the fuel chamber by said diaphragm and having a suction port and an atmospheric port, valves for controlling said suction chamber ports, means for constantly urging a fuel expelling movement of the diaphragm, valve actuating means movable in one direction for simultaneously closing the suction port and opening the atmospheric port of said suction chamber and movable in a reverse direction for reversing the positions of said suction chamber valves, and means connecting said valve actuating means to said diaphragm for operation thereby and embodying a spring snap-over action for effecting a quick change-over in the positions of the suction chamber valves.

10. A fuel lift having a fuel chamber with valve inlet and outlet ports, a diaphragm arranged in the chamber and operable to enlarge and ensmall the chamber for intaking and expelling fuel, a suction chamber divided from the fuel chamber by said diaphragm and having a suction port and an atmospheric port, valves for controlling said suction chamber ports, means for imparting a fuel expelling movement of the diaphragm, valve actuating means movable in one direction for simultaneously closing the suction port and opening the atmospheric port of said suction chamber and movable in a reverse direction for simultaneously opening the suction port and closing the atmospheric port, said valve actuating means embodying a support having spaced ears, a spring suspended by and between said ears, and a connecting member, said support, spring and connecting member acting upon up and down movement of the diaphragm to operatively dispose the suction chamber valves.

11. A fuel lift having a fuel chamber with valve inlet and outlet ports, a diaphragm arranged in the chamber and operable to enlarge and ensmall the chamber for intaking and expelling fuel, a suction chamber divided from the fuel chamber by said diaphragm and having a suction port and an atmospheric port, valves for controlling said suction chamber ports, an actuator for the valves, a member in the suction chamber having spaced arms, a spring suspended by and between said arms, a connecting member engaged with the spring and adapted to tension the spring, said spring acting upon up and down movement of the diaphragm to operatively dispose the suction chamber valves, and means for establishing a positive connection between the diaphragm and actuator subsequent to the tensioning of the spring by said connecting member whereby movement of the diaphragm in one direction will simultaneously close the suction port and open the atmospheric port of said suction chamber and upon movement in a reverse direction simultaneously open the suction port and close the atmospheric port.

12. A fluid pump having a pump chamber with inlet and outlet passage means, a flexible non-resilient diaphragm forming a wall of the pump chamber and operating on its intaking stroke to enlarge the chamber and on its expelling stroke to ensmall the chamber, means placing a constant urge on the diaphragm in its fluid expelling direction of movement and solely acting to move yieldingly the diaphragm on its expelling stroke, and means intermittently acting to move the diaphragm on its intaking stroke and against the constant urge of said first diaphragm moving means, said intermittently acting means when operative overcoming the first diaphragm moving means.

13. A fuel lift comprising a casing, a fabric diaphragm dividing the same into a dry chamber and a wet chamber, each chamber having valved inlet and outlet ports, means for intermittently applying suction to the dry chamber for urging the diaphragm in one direction of movement, and means separate and distinct from the diaphragm and constituting the sole means for creating a constant urge on the diaphragm in the opposite direction for moving the diaphragm in the absence of the suction application, said diaphragm being flexed toward the dry chamber throughout its movements in opposite directions.

14. A fuel feed device comprising a casing, a diaphragm dividing the casing into a fuel chamber and a motor chamber, a tension spring in the fuel chamber and associated with the diaphragm for flexing it to discharge fuel from said chamber, and means in the motor chamber for flexing the diaphragm to draw fuel into the fuel chamber and to re-tension said spring, said means becoming effective when the diaphragm reaches its limit of fuel discharging flexure.

HENRY HUEBER.
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CERTIFICATE OF CORRECTION.

Patent No. 1,926,005. September 5, 1933.

HENRY HUEBER, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 67, claim 2, for "fixed" read "flexed"; 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 24th day of October, A. D. 1933.

F. M. Hopkins

(Seal) Acting Commissioner of Patents.