

March 17, 1942.

C. A. ERICKSON

2,276,568

PUMP

Filed July 12, 1940

Fig. 2.

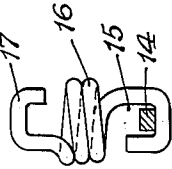


Fig. 1.

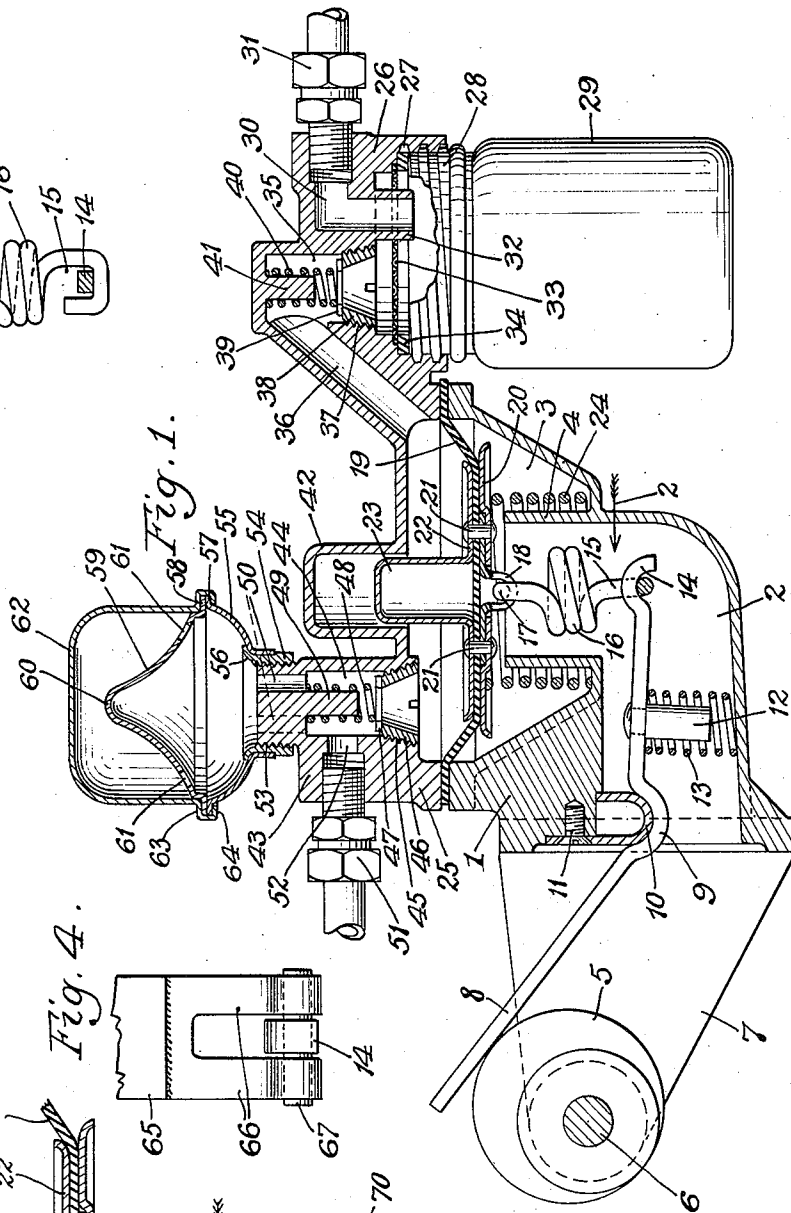


Fig. 4.

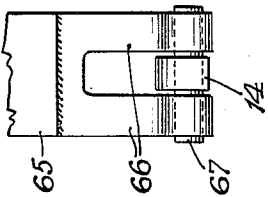


Fig. 3.

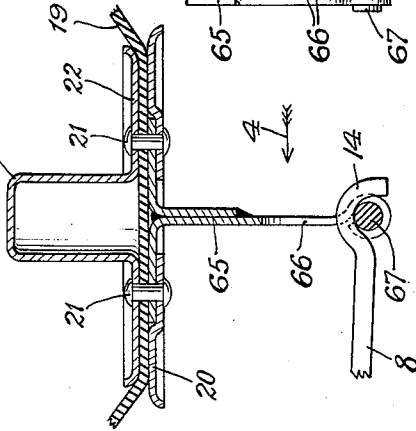
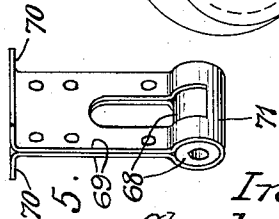


Fig. 5.



Inventor.
Charles A. Erickson.
by Parker & Carter.
Attorneys.

UNITED STATES PATENT OFFICE

2,276,568

PUMP

Charles A. Erickson, Chicago, Ill., assignor to
United Specialties Company, Chicago, Ill., a
corporation of Delaware

Application July 12, 1940, Serial No. 345,136

17 Claims. (Cl. 103—38)

This invention relates to a pump and particularly to a pump of a type suitable for pumping fuel. In the particular form shown herewith, the invention is illustrated as embodied in a fuel pump for use in connection with internal combustion engines which might, of course, be otherwise used, and the invention might be embodied in pumps not used to pump fuel. One of the objects of the invention is to provide a simplified pump construction. Another object is to provide a fuel pump which embodies a flexible non-metallic and non-fabric diaphragm. Another object is to provide a pump and means for operating it without the use of shafts in the pump. Another object is to provide a diaphragm guiding means in connection with a pump of the type indicated.

Other objects will appear from time to time throughout the specification and the claims.

The invention is illustrated more or less diagrammatically in the accompanying drawing, wherein:

Figure 1 is a vertical section with parts broken away and parts in elevation, illustrating a fuel pump made according to the present invention;

Figure 2 is a side elevation of one of the diaphragm springs looking in the direction of the arrow of Figure 1, with the rocker arm or driving means shown in section;

Figure 3 is a sectional detail illustrating a modified form of driving connection;

Figure 4 is an elevation taken in the direction of the arrow of Figure 3; and

Figure 5 illustrates a further modification of the construction of Figures 3 and 4.

Like parts are designated by like characters throughout the specification and the drawing.

1 is the main pump housing. It is formed with a cavity 2 in which the driving means are partially situated. 3 is a second cavity within which is formed a projection 4. The pump may be driven in a variety of ways. As shown, however, an eccentric 5 is mounted on a shaft 6 which may be journaled in supports 7, fastened to the pump housing 1. These details of the drive are shown merely as indicating one means for driving the pump. The shaft is rotated from any suitable source of power and the eccentric 5 bears against a rocker arm 8 which is shaped with a depression 9 which is mounted to rotate about a fulcrum member 10 which in the present case is a separately made piece secured by one or more screws 11 or otherwise. The fulcrum might be of any desired type and might be made integrally with the housing 1, if desired. A pin or

stud 12 is fastened to the rocker arm and a spring 13 is positioned about it and bears at one end against the rocker arm 8 and at the other end against the floor of the cavity 2. The inner end of the rocker arm is provided with a downwardly curved portion 14 which engages the enlarged loop 15 of the diaphragm spring 16. The loop 15 is larger than the portion 14 of the rocker arm 8 which lies within it and thus play between these two parts is provided for. At its upper end the spring 16 is provided with a curved or downwardly bent portion 17 which engages a loop 18 which is secured to the diaphragm 19 by a plate 20 and rivets or other fastening means 21, 21. Secured to the upper face of the diaphragm 19 is a stiffening or reinforcing plate 22 which has an upper enlargement 23 which serves as a guide. A spring 24 is positioned about the member 4 within the cavity 3, bears at one end against the floor of that cavity and at the other end against the diaphragm 19 or the plate 20.

Secured to the main housing 1 is an upper housing portion 25 which, together with the diaphragm 19, forms the pump chamber. An extension 26 from the housing 25 is interiorly threaded as at 27 to receive corresponding threads 28 of a vessel 29. An inlet passage 30 is formed in the extension 26 and receives a fluid connection 31 by means of which fluid is supplied from any suitable source. A downwardly directed nozzle portion 32 directs the fluid. A strainer or screen 33 is positioned in the extension 26 and is held in place by the gasket 34 and the upper edge of the vessel 29.

An outlet passage 35 leads from the vessel 29 to a passage 36. At its lower end the passage 35 is threaded as at 37 and receives a correspondingly threaded valve seat 38 upon which a valve 39 may be seated. A spring 40 tends to hold the valve closed but may yield to permit opening. A stud or projection 41, formed preferably integrally with the upper housing member 25, 26, positions the spring 40.

A hollow upward projection 42 is formed preferably integrally with the housing member 25 and is of such size and shape as to cooperate with the guide 23 as the pump diaphragm rises and falls but it is preferably large enough so that there is only a loose fit between the guide 23 and the inner surface of the projection 42. If the diaphragm operates equally, there may be no contact between the guide and the member 42. If there is a tendency of the diaphragm to operate unequally, the guide will prevent that. An extension 43, preferably formed integrally with

the housing member 25, has within it an outlet passage 44 threaded at 45 to receive a correspondingly threaded valve seat 46. A valve 47 is seated upon the upper surface of the valve seat and is normally held in place by a spring 48 which may yield to permit opening of the valve. A projection 49 is formed preferably integrally with the portion 43 and positions the spring. The member 43 is provided with one or more perforations 50 which communicate with the outlet passage 44. An outlet connection 51 is received in the housing 43 and in communication with a final outlet passage 52 leading from the outlet passage 44. The member 51 leads to any desired place where the fluid passing through the pump is to be delivered.

The upward extension of the member 43 in which the perforations 50 are formed is exteriorly threaded as at 53 and receives a correspondingly threaded collar 54 to which is secured the lower bowl 55 of a vapor dome. At its upper end the collar 54 may be spun or forced outwardly as at 56 to engage the bowl 55. At its upper edge the bowl preferably terminates in an outwardly extending flange 57 against which the flange 58 of a baffle 59 is positioned. This baffle is provided with an upwardly directed more or less conical point or portion 60 and with one or more perforations 61 positioned away from the conical point 60 and preferably close to the edge of the baffle. An upper bowl 62 is positioned over the baffle and is provided with a flange 63 and a downwardly depending inwardly bent portion 64 by means of which the two bowls and the baffle are held together.

For some purposes it is desirable to have a non-metallic contact between the rocker arm and the member by means of which the movement of the rocker arm is effective to move the diaphragm. This modified construction is shown in Figures 3 and 4. For this construction, instead of the spring 16, a strap or connection member 65 is secured at one end between the plate 20 and the diaphragm 19 and extends downwardly to be engaged by the rocker arm. The connection member 65 is provided with two arms 66, 66 between which a non-metallic pin 67 is mounted. The end 14 of the rocker arm 8 engages this pin.

Although there is shown an operative form of the device, it will be understood that many changes in the form, shape and arrangement of parts might be made without departing from the spirit of this invention, and it is wished that the showing be taken as, in a sense, diagrammatic.

The modified form of Figure 5 illustrates a non-metallic construction in which, instead of the member 67, there is substituted a tubular member 68; and instead of the members 66 and 67, a single straplike member is shaped to provide two arms 69 terminating in flange portions 70 and bent to provide a tubular section 71 which engages the non-metallic tubular member 68. This member may, for convenience, be formed of rubber tubing with or without reinforcing which gives some flexibility, or it might be formed of any other suitable non-metallic material.

The use and operation of this device are as follows:

As illustrated, the invention is applied as a fuel pump to furnish fuel from a tank or other source of supply to an internal combustion engine, the pump is of course ordinarily driven by the engine, the eccentric 5 being driven by the shaft 6 which is itself rotated by the engine.

The particular drive shown is purely diagrammatic.

As the eccentric rotates, the rocker arm 8 is rocked by the eccentric and about the fulcrum member 10. When the inner end of the rocker arm is depressed, it exerts a pull upon the diaphragm through the spring 16. This depresses the diaphragm, causes suction in the pump chamber above the diaphragm. This suction raises the valve 39 against the resistance of the spring 40 and draws fuel out of the vessel 29 into the pump chamber. This suction is also effective to draw fuel through the supply line 31 and into the vessel 29.

As the eccentric rotates, the outer end of the rocker arm 8 is lowered and the inner end rises, permitting the spring 24 to raise the diaphragm on the compression stroke of the pump. Pressure thus rises in the pump chamber above the diaphragm, the valve 39 is seated and held on its seat, the valve 47 is raised against the pressure of the spring 48 and liquid is forced outwardly through the pipe 51 to the engine. This cycle of alternate compression and suction is repeated as long as the engine is operated.

The tension spring 16 which is used in the form illustrated in Figure 1 on the suction stroke provides what is in effect a universal joint at each of its ends and allows full freedom of movement of the diaphragm. This elimination of fixed and rigid parts in this respect is important.

The loop 15 in the lower end of the spring 16 is larger than the member 14 which lies within it, thus permitting the spring to accommodate its two diaphragm movements within greater or lesser limits.

The upper diaphragm disk is also shaped to act as a preferably loose guide to hold the diaphragm in a horizontal position as it moves up and down. Any tendency of the diaphragm to tilt or to rise and fall unevenly is prevented by this guide.

The diaphragm itself is preferably formed of synthetic rubber and is preferably without any fabric or any other reinforcing, being formed merely of one or more sheets of the synthetic rubber. Two suitable forms of synthetic rubber are Neoprene and Duprene and a diaphragm formed of such highly flexible material under some conditions of operation requires the guiding furnished by the member 23.

While the pump of this invention may operate satisfactorily without any vapor dome or with the usual single chamber vapor dome, the use of the particular form of vapor dome shown has the advantage that it very largely prevents liquid passing through the pump from filling the dome, thus fuel may rise and may actually shoot up through the openings 50. When this occurs it will strike the baffle in the center, that is to say at a point away from the perforations 61 and it will not enter the air chamber above the baffle. The perforations 61 permit the air, which is compressed in the upper chamber during the discharge stroke of the diaphragm to expand and to force out fuel from the lower chamber of the vapor dome during the suction stroke of the diaphragm, thus the result of the double chamber or baffled vapor dome is to produce smoother flow and increased delivery in the pump and pump system. Should liquid actually be forced into the upper chamber, it can of course escape through the openings 61. In practical operation however it has been found that liquid

rarely enters the chamber formed above the baffle.

In the device as shown, leakage from the pump body is prevented by the construction of the rocker arm, by which it is unnecessary to use a shaft through the pump body or through the rocker arm, since the rocker arm is supported entirely upon the fulcrum member 10 and upon the spring 13, neither of which requires any opening in the pump body.

The modified form of connection between the diaphragm and the rocker arm, as shown in Figures 3 and 4 may be used, where high pump capacity is necessary, and it is desirable to use a solid connection from the diaphragm to the rocker arm instead of a spring. If a spring of sufficient tension for large capacities were used, there would be a tendency to produce an unreasonable noisy action. The construction of Figures 3 and 4 eliminates the spring by using the non-metallic member 67 which is supported by the connection members 66 and against which the portion 14 of the rocker arm 8 works. The use of a non-metallic member at this point very largely reduces the noise and tends to deaden the sounds which occur in the operation of the device.

I claim:

1. In combination in a pump, having a hollow housing, an inlet and an outlet passage, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber; means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a second spring connected at one end to said diaphragm, a fulcrum in said housing, means for pulling on said second spring, said means including a rocker arm loosely mounted on said fulcrum and engaged in the end of said second spring away from said diaphragm, and supports for said rocker arm comprising a spring, and a driving means adapted to rock said rocker arm, said last mentioned spring being positioned to one side of said fulcrum, said rocker arm positioned held thereagainst, by said last mentioned spring.

2. In combination in a pump, having a hollow housing, an inlet and an outlet passage, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber; means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a second spring connected at one end to said diaphragm, a fulcrum in said housing, means for pulling on said second spring, said means including a rocker arm loosely mounted on said fulcrum and loosely engaged in the end of said second spring away from said diaphragm, and supports for said rocker arm comprising a spring, and a driving means adapted to rock said rocker arm, said last mentioned spring being positioned to one side of said fulcrum and held yielding thereon by said last mentioned spring, said rocker arm positioned thereagainst.

3. In combination in a pump, having a hollow housing, an inlet and an outlet passage, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber; means for reciprocating said diaphragm, said means including a spring positioned within said housing and effective upon said diaphragm to move the same in one direction, and a connection con-

nected at one end to said diaphragm, means for pulling on said connection, said means including a rocker arm engaged in the end of said connection away from said diaphragm, and supports for said rocker arm comprising a spring, and a driving means adapted to rock said rocker arm, a fulcrum in said housing, said last mentioned spring being positioned to one side of said fulcrum, said rocker arm positioned loosely thereagainst, said rocker arm being free on said fulcrum and being held thereagainst by said last mentioned spring.

4. In combination in a pump, a hollow housing, an inlet and an outlet passage, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber; means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a connection connected at one end to said diaphragm, means for pulling on said connection, said means including a rocker arm loosely engaged in the end of said connection away from said diaphragm, and supports for said rocker arm comprising a spring, positioned therebeneath, and a driving means adapted to rock said rocker arm, a fulcrum in said housing, said last mentioned spring being positioned to one side of said fulcrum, said rocker arm positioned loosely thereagainst, said rocker arm being free on said fulcrum, and being held thereagainst by said last mentioned spring.

5. In combination in a pump, having a hollow housing, an inlet and an outlet passage, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber; means for guiding said diaphragm comprising a chamber formed in said housing, and a member projecting from one face of said diaphragm and fitting within said chamber, and means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a second spring connected at one end to said diaphragm, means for effecting tension on said second spring, said means including a rocker arm loosely engaged in the end of said second spring away from said diaphragm, a fulcrum against which said rocker arm is loosely positioned, and supports for said rocker arm comprising a spring, adapted to hold said rocker arm against said fulcrum, and a driving means adapted to rock said rocker arm, a fulcrum in said housing, said last mentioned spring being positioned to one side of said fulcrum, said rocker arm positioned thereagainst.

6. In combination in a pump, having a hollow housing, an inlet and an outlet passage, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber, and means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a second spring connected at one end to said diaphragm, means for effecting tension on said second spring, said means including a rocker arm engaged in the end of said second spring away from said diaphragm, and supports for said rocker arm comprising a spring positioned within said housing, and a driving means positioned outside of said housing and adapted to rock said rocker arm, a fulcrum in said housing, said last mentioned spring being positioned to one side of said

fulcrum, said rocker arm positioned thereagainst, and held thereagainst by said spring, said rocker arm being free on said fulcrum.

7. In combination in a pump, having a hollow housing formed of a plurality of members, an inlet and an outlet passage formed in one of said members, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber, means for guiding said diaphragm comprising a chamber formed in said housing, and a member projecting from one face of said diaphragm and fitting within said chamber, and means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a second spring connected at one end to said diaphragm, means for effecting tension on said second spring, said means including a rocker arm engaged in the end of said second spring away from said diaphragm, and supports for said rocker arm comprising a spring, and a driving means adapted to rock said rocker arm, a fulcrum in said housing, said last mentioned spring being positioned to one side of said fulcrum, said rocker arm positioned and held thereagainst, by said last mentioned spring.

8. In combination in a pump, having a hollow housing formed of a plurality of members, an inlet and an outlet passage formed in one of said members, and having a pump chamber formed within said housing, and a diaphragm positioned within said housing and forming a wall of said chamber, means for guiding said diaphragm comprising a chamber formed in said housing, and a member projecting from one face of said diaphragm and fitting loosely within said chamber, and means for reciprocating said diaphragm, said means including a spring positioned within said housing and bearing upon said diaphragm, and a second spring positioned within said first spring and connected at one end to said diaphragm, means for effecting tension on said second spring, said means including a rocker arm loosely engaged in the end of said second spring away from said diaphragm, and supports for said rocker arm comprising a spring positioned within said housing, and a driving means positioned outside of said housing and adapted to rock said rocker arm, a fulcrum in said housing, said last mentioned spring being positioned to one side of said fulcrum, said rocker arm positioned and held thereagainst, by said last mentioned spring.

9. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a spring bearing at one end against said diaphragm, and a link attached to said diaphragm, a rocker arm engaging one end of said link, a fulcrum positioned on said housing, said rocker arm loosely engaging said fulcrum, and a spring, supporting one end of said rocker arm, and adapted to hold said arm against said fulcrum, and a driving means for rocking said rocker arm, said driving means supporting the opposite end of said rocker arm.

10. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a spring bearing at one end against said diaphragm, and a link positioned within said first spring and attached

to said diaphragm, a rocker arm engaging one end of said link, a fulcrum positioned on said housing, said rocker arm engaging said fulcrum, and a spring, supporting one end of said rocker arm, and adapted to hold said arm against said fulcrum, and a driving means for rocking said rocker arm, said driving means supporting the opposite end of said rocker arm.

11. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a compression spring bearing at one end against said diaphragm, and a link positioned within said first spring and attached to said diaphragm, a rocker arm engaging one end of said link, a fulcrum positioned on said housing, said rocker arm engaging said fulcrum, and a spring, supporting one end of said rocker arm, and adapted to hold said arm against said fulcrum, and a driving means for rocking said rocker arm, said driving means supporting the opposite end of said rocker arm.

12. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a compression spring bearing at one end against said diaphragm, and a link positioned within said first spring and attached to said diaphragm, a rocker arm loosely engaging one end of said link, a fulcrum positioned on said housing, said rocker arm engaging said fulcrum, and a spring, supporting one end of said rocker arm, and adapted to hold said arm against said fulcrum, and a driving means supporting the opposite end of said rocker arm.

13. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a compression spring bearing at one end against said diaphragm, and a link positioned within said first spring and attached to said diaphragm, a rocker arm loosely engaging one end of said link, a fulcrum positioned on said housing, said rocker arm engaging said fulcrum, and a spring, supporting one end of said rocker arm and adapted to hold said arm against said fulcrum, bearing upon a portion of said housing, and a driving means for rocking said rocker arm, said driving means supporting the opposite end of said rocker arm.

14. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a spring bearing at one end against said diaphragm, and a link member secured to said diaphragm, said link member including a non-metallic contacting part, a rocker arm engaging said non-metallic contact part, and means for supporting and moving said rocker arm, said means including a yielding supporting member positioned within said housing, and a driving means positioned outside of said housing, said driving means adapted to rock said rocker arm.

15. In a pump having a hollow housing, means defining an inlet and an outlet passage and a pumping chamber, a diaphragm in said pumping chamber, and means for reciprocating said diaphragm; said means including a spring bearing at one end against said diaphragm, and a link

member secured to said diaphragm, said link member including a non-metallic contacting part, a rocker arm loosely engaging said non-metallic contact part, and means for supporting and moving said rocker arm, said means including a yielding supporting member positioned within said housing, and a driving means positioned outside of said housing, said driving means adapted to rock said rocker arm.

16. In a pump, a pump casing, a movable pump member therein, an actuating lever therefor, means for rocking said lever, a fulcrum member supported on said casing, said actuating lever being loosely positioned about said fulcrum member and projecting beyond said casing, and means for holding said lever against said fulcrum, said means including a spring, said

spring being positioned on the side of said fulcrum away from said lever rocking means and adapted to support one end of said lever.

17. In a pump, a pump casing, a movable pump member therein, an actuating lever therefor, means for rocking said lever, a fulcrum member supported on said casing, said actuating lever being loosely positioned about said fulcrum member and projecting beyond said casing, and means for holding said lever against said fulcrum, said means including a spring, positioned below said fulcrum and bearing at one end thereupon and at the other end upon said casing, said spring being positioned on the side of said fulcrum away from said lever rocking means and adapted to support one end of said lever.

CHARLES A. ERICKSON.