Jan. 20, 1931. C. W. VAN RANST 1,789,611

PUMP

Filed Oct. 29, 1926 2 Sheets-Sheet 1

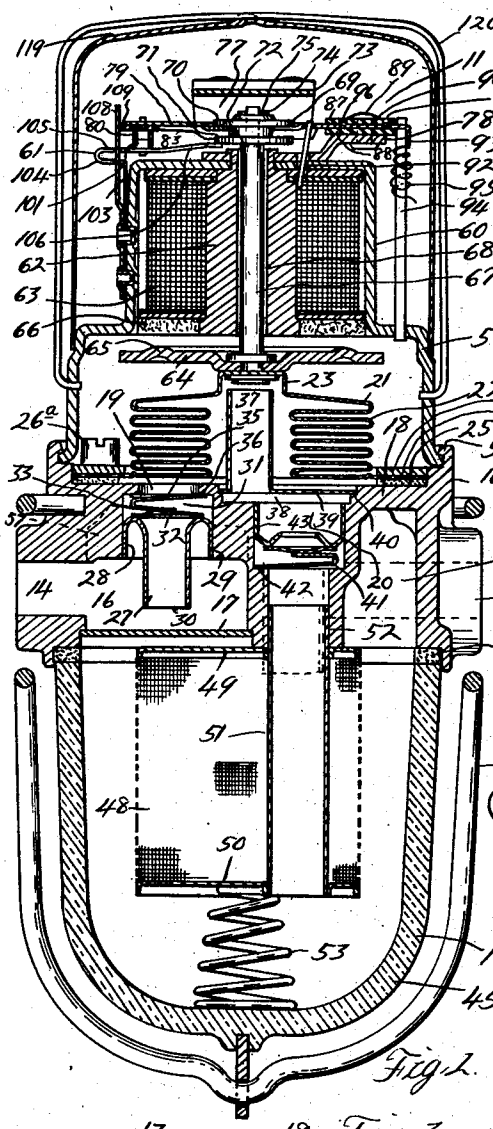


Fig. 1.

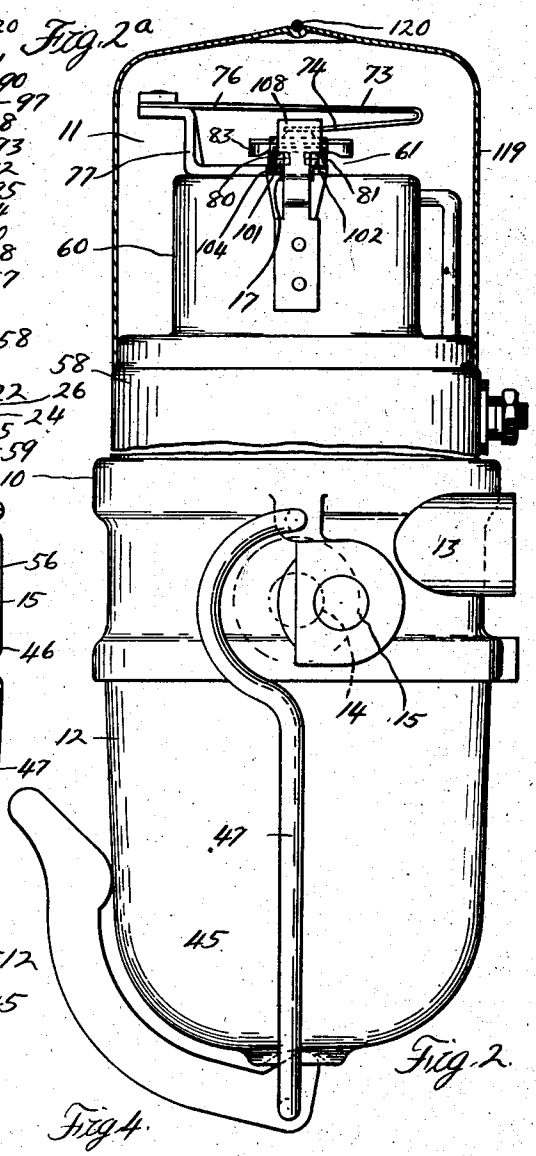


Fig. 2a

Fig. 2.

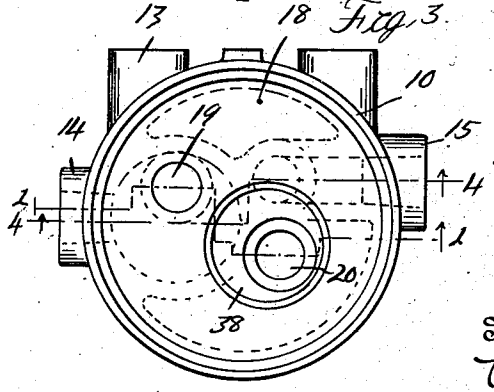


Fig. 3.

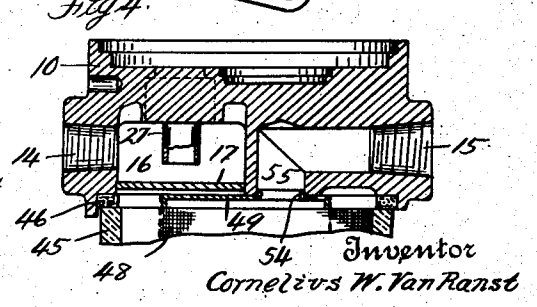


Fig. 4.

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PUMP

Filed Oct. 29, 1926 2 Sheets-Sheet 2

Fig. 8.

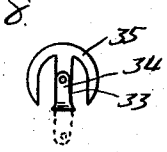


Fig. 7.

Fig. 5.

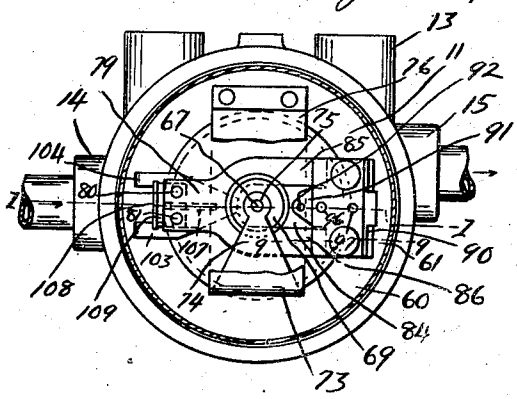


Fig. 6.

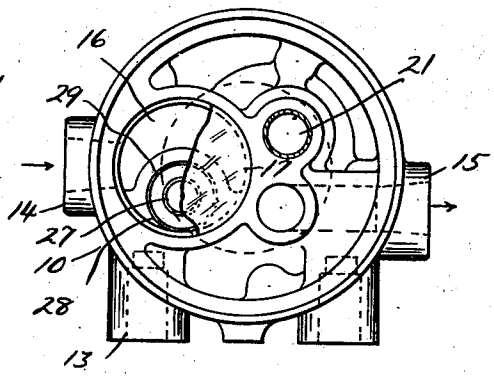


Fig. 10.

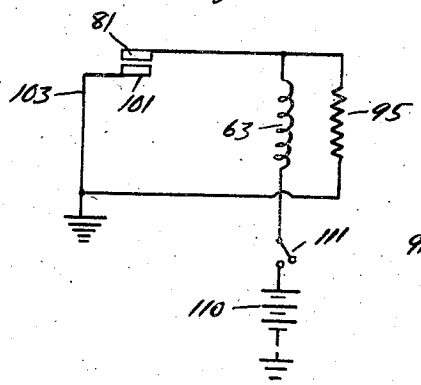


Fig. 11.

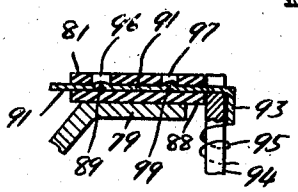
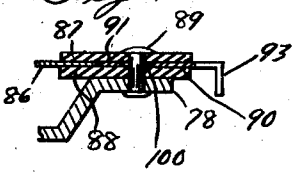


Fig. 9.



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UNITED STATES PATENT OFFICE

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PUMP

Application filed October 29, 1926. Serial No. 145,018.

The invention relates to pumps and more particularly to a device embodying an electromagnetic actuating means. While the invention in its broader aspects may be applied to a great variety of uses, the embodiment herein described is especially adapted for conveying liquid fuel from a supply tank to the carburetor of an internal combustion engine.

The primary object of the invention is to provide a device which will operate for long periods of time without adjustment or repair and which is composed of parts easily and cheaply manufactured, that can be assembled without requiring appreciable individual adjustment to insure proper operation.

Another object is to provide a construction in which the movable contacts for the electromagnet are housed in a separate portion of the device spaced from the portions containing the fluid passageways and arranged above the same to avoid all danger of fouling the contacts in case of slight leakage.

A further object is to provide a construction having a separate detachable unit forming a reservoir and filter, said unit being arranged on the opposite side of the pumping unit from the electromagnetic actuating means.

These and other objects are attained by employing the construction hereinafter described and illustrated in the accompanying drawings, wherein

Figure 1 is a vertical section through a pump embodying my invention, the upper portion of the section being taken on the line 1—1 of Figure 5 and the lower portion taken on the line 1—1 of Figure 3;

Figure 2 is a side view of the lower portion of the pump looking toward the right-hand side of Fig. 1;

Figure 2*a* is a side view of the upper portion of the pump looking toward the left-hand side of Fig. 1, the top casing being in section;

Figure 3 is a plan view of the body to which the actuating mechanism and the fluid reservoir are attached;

Figure 4 is a section of the body taken on the line 4—4 of Figure 3;

Figure 5 is a top plan view of the device with the top casing removed;

Figure 6 is a bottom plan view of the body;

Figure 7 is a diagrammatic view illustrating the pump applied to a motor vehicle for forcing liquid fuel from the supply tank to the engine carburetor;

Figure 8 is a view of the valve spring;

Figure 9 is a fragmentary section on the line 9—9 of Fig. 5;

Figure 10 is a diagram of the electrical connections;

Figure 11 is an enlarged fragmentary sectional view on the line 1—1 of Figure 5.

Referring now to the construction illustrated in the drawings, the device is composed of a body 10 to which is attached on the upper side the electromagnetic operating mechanism denoted generally as 11 and on the bottom the sediment chamber denoted generally as 12. The body of the device is preferably formed as an aluminum die casting, both because of its inherent lightness and its cheapness from a production standpoint. The body is generally of cylindrical outer contour provided with laterally extending bosses 13 for attachment to the engine casing and the inlet and outlet nipples 14 and 15 respectively for attachment to the fluid system. The inlet nipple 14 communicates with a chamber 16 formed in the body and closed at the bottom by means of a Hubbard plug 17. The top surface 18 of the body has an aperture 19 therethrough leading to the chamber 16 and adapted to receive the inlet check valve. The surface is also provided with the bore 20 extending completely through the body and adapted to receive the outlet check valve.

The displaceable pumping element utilized in this device preferably comprises a bel-

lows 21 formed in the usual manner with the corrugated side walls 22 permitting an axial expansion and contraction of the element. The bellows is securely attached to the upper face 18 of the body with its open end in communication with the inlet and outlet apertures 19 and 20 and the closed end extending upwardly. In the preferred construction the closed upper end is of reduced cross sectional area, as indicated at 23, and preferably extends upwardly to a point slightly above the main portion of the bellows. The lower end of the bellows is provided with an annular flange 24 extending radially outward and adapted to seat upon an annular gasket 25 of cork or other suitable material and to be clamped securely to the body by a clamping ring 26 and a series of bolts 26ª. The inlet chamber 16 communicates with the interior of the bellows through a conduit 27 which has its upper portion return bent as indicated at 28 to fit the counterbore 29 in the body and has its lower end 30 projecting downwardly into the chamber 16. The conduit 27 is retained in position by having a close fit with the counterbore 29 and the upper portion of the conduit forms a seat for receiving the inlet valve 31. The valve preferably comprises a disk 32 to which is attached centrally a spring arm 33, preferably formed as shown in Figure 8 by bending over a tongue 34 of a substantially circular spring washer 35. The circular portion of the washer is adapted to seat upon the annular shoulders 36, thereby normally pressing the disk valve 32 against the upper portion of the conduit 27. The outlet from the bellows is through a conduit 37 extending into the upper end thereof and leading downwardly into the passageway 20 in the body. As shown, the body is provided with a circular recess 38 for receiving a disk 39 attached to the conduit 37 and seating on an annular shoulder 40. The outlet valve 41 may be constructed similarly to the inlet valve, the circular portion in this case seating on the annular shoulder 42 of the body and the disk seating upon a cup-shaped insert 43 pressed into the bore or passageway 20. The sediment chamber 12 comprises a bowl or receptacle 45, preferably of glass or other transparent material, which is seated on an annular gasket 46 and retained in position by suitable clamping means indicated at 47. Within the bowl 45 is arranged a cylindrical filter screen 48, which as shown is provided with the upper and lower heads 49 and 50 respectively. An imperforate conduit 51 extends through the cylindrical filter screen and projects upwardly therefrom for engagement with the bore 52 in the body, the latter being a continuation of the passageway 20. The filter screen is also held in position by means of a coil spring 53 arranged between the lower head 50 and the bottom of the bowl 45. 54 is an upwardly turned annular flange projecting from the upper head 49 of the filter screen and this engages a bore 55 in the body leading to the outlet nipple 15. The body 10 is provided with a chamber 56 communicating with the bowl 45 and extending upwardly to a point above the outlet passageway, this chamber being closed at the top and thereby serving as an air trap for retaining a gaseous cushion above the liquid in the bowl. The chamber 16 also has an upwardly extending portion 57 partially surrounding the conduit 27 and this chamber also serves to retain gas above the liquid. By means of the gaseous chambers above described a cushion is always maintained in communication with the liquid so that a steady flow of liquid through the device may be maintained without noise.

The actuating mechanism for the device is mounted on a shell 58, the lower portion of which engages the top surface of the body 10 and surrounds the bellows 21 and its retaining means. The shell is preferably permanently secured to the body by the turned in flange 59 and the shell is thereby secured to the body independently of the mounting of the bellows. The shell has an upper cylindrical portion 60 closed at its upper end and adapted to receive the electromagnet 61. The magnet comprises a cylindrical core 62 secured to the upper portion of the shell 60, the coil 63 being wound about the central core and filling the space within the shell. The armature of the electromagnet comprises a disk 64 attached to the upper end of the bellows 21 and arranged adjacent the lower end of the core 62. The armature is provided with an annular raised portion or bead 65 which, in the upward movement of the armature, strikes an annular washer 66 of suitable resilient material, such as leather or cork, thereby preventing metal to metal contact and insuring quietness of operation. 67 is a rod secured to the upper end of the bellows and extending through a longitudinal passageway 68 through the center of the core 62. Sufficient clearance is provided so that the rod is entirely free to reciprocate in the passageway without striking the sides thereof. The rod is formed with a portion of reduced diameter at its upper end on which is mounted a spool 69 preferably formed of insulating material and provided with upper and lower annular disks 70 and 71. The spool seats upon the annular shoulder 72 and is resiliently urged in a downward direction by means of a flat leaf spring 73, the free end 74 of which is apertured at 75 to fit over the projecting end of the rod 67. The spring has a return-bent portion 76 rigidly secured to a bracket 77, which in turn is attached to the top of the casing 60. The bracket is also provided with an upwardly extending portion 78 arranged at right angles to the portion 77 and forming

the support for the breaker arm 79. The breaker arm carries at its free end two contact points 80 and 81 arranged side by side. The arm has downturned side flanges 83 extending to a point adjacent the bracket 78 and is also provided with a central slot 84 forming the bifurcated ends 85 and 86. These bifurcated ends extend around the spool 69 and are inserted between two insulating blocks 87 and 88, the latter being secured to the bracket 78 by means of the rivets 89. 90 is a flat sheet metal piece also arranged between the insulating plates 87 and 88 and provided with a forward extension 91 extending between the bifurcated ends 85 and 86 and forming a terminal to which the magnet wire 92 is connected. The piece 90 also has another projection 93 forming the support for a vertical member 94 around which is wound an electrical resistance 95. The member 94 is preferably of insulating material and has its lower end supported on the magnet shell 60. For positioning the piece 90 between the insulating blocks the upper block is provided with two apertures 96 and 97, which are engaged by struck-up projections 98 and 99 on the member 90. This member also is provided with enlarged apertures 100 through which the rivets 89 pass without contact.

For cooperating with the contacts 81 and 82 there is another set of contacts 101 and 102 carried by a spring arm 103. This spring arm is secured to the side of the magnet casing 60 and is outwardly bent at 104, return-bent at 105 and upwardly bent at 106, extending to a point beneath the spool 69. The spring arm is preferably slotted at 107, forming two independently flexible portions respectively carrying the contacts 101 and 102. A flat leaf spring 108 is also secured to the side of the casing and the free end thereof bears inwardly against an insulating member 109 mounted on the free end of the breaker arm 79. This spring therefore has a frictional engagement with the breaker arm and tends to restrain the movement thereof. The spring arm 103 is electrically connected to one end of the resistance 95, the other end of the resistance being connected to the member 90, which in turn is connected to the breaker arm 79.

The electrical connections are illustrated most clearly in Figure 10 where it will be observed that the spring arm 103 is grounded on the shell of the device. Electric current may be obtained from the battery 110, or other source of power, the circuit being through switch 111, magnet coil 63, contact 81, contact 101, and spring arm 103 to the ground. When the contacts 81 and 101 are separated, the circuit is completed through the resistance 95, which is sufficiently high to reduce the current flowing through the circuit to a very small value. The use of the resistance, however, reduces the arcing between the contacts when they are drawn apart.

The electromagnet and the contact devices are housed within a removable casing 119 which seats on the magnet shell 60 and is held in position by the wire clamp 120.

In Figure 7 I have shown my improved pumping device connected to a carburetor of an internal combustion engine in order to deliver fuel thereto from a fuel supply tank. In this figure the pump is represented at 112, the inlet being connected by a conduit 113 to the supply tank 114 and the outlet being connected by conduit 115 to the carburetor 116. The carburetor is shown as being provided with the intake manifold 117 leading to the engine 118.

The operation of the device is as follows: The armature 64 is normally held in its lower position by the spring arm 73 and in this position the bellows is contracted. When the electromagnet is energized through a suitable controlling switch 111, the circuit is completed through the contacts and the armature is drawn upwardly, thereby expanding the bellows. The motion of the armature being communicated to the spool 69 causes the same to move upwardly, but due to the lost motion connection between the breaker arm 79 and the spool, the breaker arm is not immediately actuated and the contacts remain in engagement. This is facilitated by the retarding action of the spring arm 108 and also by the upward pressure of the contacts 101 due to the resiliency of the spring arm 103. When the lost motion is taken up and the lower flange 71 of the spool strikes the breaker arm 79, the latter is positively moved upward, and since it has a longer leverage than the spring arm 103 carrying the lower contacts, a separation of the contacts takes place and the circuit through the electromagnet is broken. The armature is thereupon moved in the reverse direction under the influence of the flat spring 73 and when the lost motion of the spool and breaker arm is again taken up, the arm is moved downwardly until the contacts again come into engagement. This cycle is repeated, causing an alternate expansion and contraction of the bellows.

When the bellows is expanded, the liquid is drawn through the inlet chamber 16, conduit 27 and inlet valve 32 into the interior of the bellows and when the bellows is again contracted, the liquid is expelled through the conduit 37, outlet valve 43 and conduit 51 into the bowl 45. From the bowl the liquid passes through the cylindrical filter screen 48 up through the outlet 55 to the outlet nipple 15.

In order to secure the maximum efficiency of the stroke of the bellows, it is necessary that the same be completely filled with liquid at all times, and to insure that this condition exists the outlet from the bellows is by means of the conduit 37 which extends to

the extreme upper portion of the bellows. Furthermore the upper portion of the bellows is of small cross sectional area and these two factors combined insure that no air or gas will be present within the bellows during its operation. On the other hand, it is also important that a gas cushion be provided both on the inlet and outlet sides of the pump, this being secured by providing the chamber 28 surrounding the inlet valve and the chamber 56 above the fluid bowl.

The device embodying my invention differs from all other devices of the same general character in that it has only one place where there is any friction between the movable parts of the mechanism and that is between the spring arm 108 and the breaker arm 79. In this place the areas withstanding the friction are so large and the pressure is so small that in the operation of the pump it is not possible to detect any wear whatsoever. It will also be noted that the armature which actuates the bellows is free from bearings of any type, the lower portion of the armature and the shaft supported thereby being held and supported by the bellows 21 and the upper end of the shaft being located centrally by the flat spring 73. The shaft 67 does not come in contact with the core of the magnet and is free to move up and down without any friction or wear on any of the parts. This is a very important feature and is a great improvement over other devices which are provided with bearings for which no means of lubrication are furnished. Such constructions are therefore a source of trouble and possible failures.

Another feature of my construction is that the breaker mechanism including the contacts are arranged at the top of the device so that if there is any leakage of gasoline in the pump or around the pump, there is no danger of the liquid coming in contact with the breaker points and interfering with their operation.

What I claim as my invention is:

1. In a pump, the combination with a pump body having inlet and outlet fluid passageways therein, check valves in said passageways, an annular bellows having an open end provided with an annular flange extending radially outward, means for securing said annular flange to said pump body whereby said open end is in communication with said inlet and outlet passageways, a gasket between said flange and body, an annular shell surrounding said bellows and secured to said body independently of said bellows, and electromagnetic actuating mechanism for said bellows carried by said shell.

2. In a pump, the combination with a body having inlet and outlet fluid passageways therein, check valves in said passageways, an annular bellows having an open end secured to said body in communication with said passageways, a shell surrounding said bellows and secured to said body independently of said bellows, an electromagnet secured within said shell above and in axial alignment with said bellows, said magnet having a central longitudinal passageway therethrough, an armature secured to the upper end of said bellows adjacent the lower end of said magnet, a rod extending upwardlly from said armature through said longitudinal passageway, a contact arm mounted on the exterior of said shell above said magnet, and means on said rod for actuating said contact arms.

3. In a pump, a bellows having a lower stationary and an upper movable end, an inlet opening to the lower part of the bellows, and an outlet comprising a conduit extending upwardly into said bellows, and means for actuating the movable end of said bellows.

4. In a pump, a bellows having a lower stationary and an upper movable end, an inlet opening to the lower part of the bellows, and an outlet comprising a conduit extending upwardly into said bellows, and an electromagnet located above said bellows and comprising an armature connected to the movable end of said bellows for actuating the same.

5. A pump comprising a head, an expansible member seated thereon, the upper end of which is movable, a liquid receptacle seated against the lower side of said head, a hollow screen having a closed lower end located within said receptacle, the upper end of the screen being seated against said head, an inlet to said expansible member, an outlet therefrom comprising a pipe leading through said screen and an outlet from said receptacle communicating with the interior of said screen, whereby the liquid is caused to flow through said screen.

6. A pump comprising a head, an expansible member seated thereon, means for operating said member, a liquid receptacle detachably seated against the lower side of said head and communicating with said expansible member, an inlet passage to said expansible member and an outlet from said receptacle passing through said head.

7. A pump comprising a head, an expansible member seated thereon, means for operating said member, a liquid receptacle detachably seated against the lower side of said head, a hollow screen detachably seated against said head within said receptacle, an inlet to said expansible member, an outlet therefrom to said receptacle, and an outlet from said receptacle communicating with the interior of said screen whereby the liquid is caused to flow through said screen.

8. In a pump, a body having inlet and outlet ports, an expansible member seated on said body, an inlet chamber in said body in communication with said inlet port and having a passage communicating with said ex-

pansible member, a conduit having its lower end portion projecting within said chamber and having its upper end provided with an open return bent portion secured to the walls of said passage and a check valve in said passage above said conduit.

9. A pump comprising a head, an expansible member seated thereon, means for operating said member, a liquid receptacle seated against the lower side of said head and communicating with said member, an inlet to said expansible member, an outlet from said receptacle, and a chamber in said head opening into said receptacle and having its top portion extending above said outlet and entirely closed, thereby forming an air trap for retaining a gaseous cushion above the liquid in said receptacle.

10. In a pump, the combination with a body having inlet and outlet passageways therein, a bellows secured on said body to communicate with said passageways and having its closed end of reduced cross sectional area and extending upwardly to a point slightly above the main portion of the bellows, and a conduit on said body having its lower end communicating with said outlet passage and its upper end opening into the reduced portion of said bellows and means for operating said bellows.

11. A pump including in combination a head, an expansible member associated with one side of said head, a chamber associated with the other side of said head, a hollow screen within said chamber, an inlet to said expansible member, an inlet to said chamber comprising a pipe passing through said screen, and an outlet from said chamber communicating with the interior of the screen whereby the liquid flowing through said chamber is caused to flow through said screen.

12. A pump including in combination, a head, an expansible member associated with one side of said head, a chamber associated with the other side of said head, a hollow screen within said chamber having closed upper and lower ends, a spring interposed between the end of said screen and one end of said chamber for yieldably retaining said screen in position, an inlet to said expansible member, an inlet to said chamber comprising a pipe passing through said screen, and an outlet from said chamber communicating with the interior of the screen whereby the liquid flowing through said chamber is compelled to flow through said screen.

13. A pump including in combination a head having inlet and outlet passages, a transparent chamber on one side of said head, an expansible member on the other side of said head, and means for actuating said expansible member to effect a flow of liquid from said inlet passage through said transparent chamber to said outlet passage.

14. A pump including in combination a head having inlet and outlet passages, a chamber on one side of said head, inlet and outlet passages for said chamber, a screen within said chamber arranged between the inlet and outlet passages thereof whereby liquid flowing through said chamber is compelled to pass through said screen, an expansible member on the other side of said head and in communication with the inlet passages of said head and chamber, and means for actuating said expansible member to effect a flow of liquid from the inlet of said head through said chamber to the outlet passage of said head.

15. A pump including in combination, a head having inlet and outlet passages, a chamber on one side of said head, a hollow screen in said chamber, said screen having closed ends, a pipe passing through said screen and forming an inlet passage for said chamber, an outlet from said chamber communicating with the interior of said screen, an expansible member associated with said head and communicating with the inlet passages of said head and chamber, and means for actuating said expansible member to effect a flow of liquid from the inlet passage of said head through said chamber to the outlet passage of said head.

16. In a pump, a head having inlet and outlet passages, an expansible member associated with said head and communicating with said passages for drawing a fluid through said inlet passage and forcing the same out through said outlet passage, and a globe associated with said head and communicating with one of said passages whereby the fluid passes through said globe in its flow from the inlet to the outlet passage.

17. A pump, comprising a head having a passageway therethrough, an expansible member seated on said head, an inlet to said expansible member, said expansible member and head cooperating to form a pumping chamber communicating with said inlet and passageway, means for operating said member, a liquid receptacle, a hollow screen within said receptacle having closed upper and lower ends, a pipe leading through said screen and secured to the closed ends thereof, said pipe having a portion extending above the upper end of the screen and projecting within the passageway in said head, an outlet from said receptacle covered by said screen, and resilient means for detachably retaining said screen against said head.

18. A pump, comprising a head having a passageway therethrough, an expansible member seated on said head, an inlet to said expansible member, said expansible member and head cooperating to form a pumping chamber communicating with said inlet and passageway, means for operating said member, a liquid receptacle, a hollow

screen within said receptacle having closed upper and lower ends, a pipe leading through said screen and secured to the closed ends thereof, said pipe having a portion extending above the upper end of the screen and projecting within the passageway in said head, an outlet from said receptacle covered by said screen, and a coil spring interposed between the base of said receptacle and the lower ends of said screen for detachably retaining said screen against said head.

In testimony whereof I affix my signature.

CORNELIUS W. VAN RANST.