Sept. 15, 1931. E. F. McCARTHY 1,823,459

FLUID DISPLACEMENT PUMP

Original Filed July 19, 1928

FIG. 1.

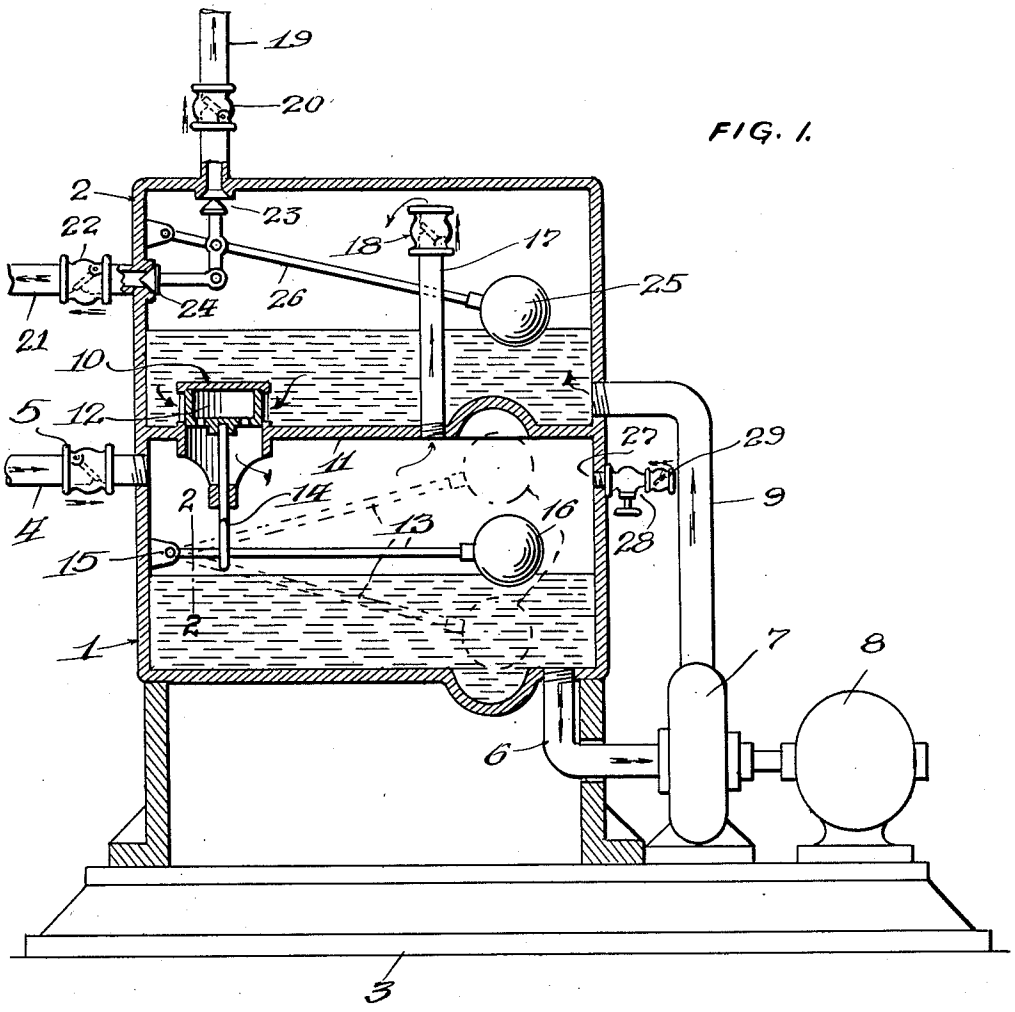
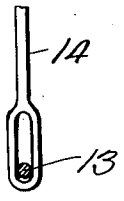


FIG. 2.



Inventor:
Edward F. McCarthy,
by Charles O. Skinner
his Atty.

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UNITED STATES PATENT OFFICE

EDWARD F. McCARTHY, OF CHICAGO, ILLINOIS, ASSIGNOR TO CHICAGO PUMP COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

FLUID DISPLACEMENT PUMP

Refiled for abandoned application No. 293,805, filed July 19, 1928. This application filed March 25, 1930. Serial No. 438,738.

This invention relates to fluid displacement pumps in which a liquid is used as the displacement medium in connection with a plurality of tanks or receptacles through which the liquid is transferred from one tank to the other and back again at predetermined intervals. This invention relates more particularly to the type of fluid displacement pumps shown and described in my co-pending application, Serial No. 268,699, filed April 9, 1928.

The present application is a substitute one for my prior application for patent on fluid displacement pumps, Serial No. 293,805, filed July 19, 1928, and now abandoned.

One of the objects of the present invention is to provide an apparatus of novel form and arrangement for producing or causing a partial vacuum or pressure, as desired, with a moving body of liquid as the displacement medium. Another object is to provide a simple and efficient fluid displacement pump for creating vacuum or producing pressure with the use of a body of liquid discharging from one tank or receptacle into the other and back again.

Another object is to provide a fluid displacement pump of novel construction embodying a body of liquid as the displacement medium, which may be used in connection with steam heating systems to remove air and other condensates from the system and return the water to a boiler or other place, or it may be used as a sump pump or vacuum pump for handling gases.

With these and other objects and advantages in view, this invention consists of a fluid displacement pump having upper and lower tanks, connected by a float controlled valve, whereby the liquid may be discharged from the upper tank into the lower one at predetermined intervals, in combination with a water pump or other pump-like device for discharging the liquid from the lower tank and delivering it into the upper tank, whereby when the liquid is transferred from the lower tank into the upper one, a partial vacuum is created in the lower tank and the gaseous fluid in the upper tank is discharged therefrom. The invention further consists in the several novel features hereinafter fully set forth and claimed.

The invention is clearly illustrated in the drawings accompanying this specification in which—

Figure 1 is a view, partly in side elevation and partly in vertical longitudinal section, of a fluid displacement pump embodying a simple form of the present invention, and Fig. 2 is a detail cross section taken on the line 2—2 of Fig. 1.

Referring to said drawings, the reference character 1 designates a lower tank or receptacle and 2 designates an upper tank or receptacle located above the same, and of substantially the same cubic capacity as the tank 1. The tanks may be mounted upon a base 3 and may be formed of any suitable material as desired.

Leading into the lower tank 1 is an inlet pipe 4 controlled by a check valve 5 opening toward the tank 1, and leading from the bottom of the tank 1 is a liquid discharge pipe 6 which is connected to the inlet side of a pump 7 mounted on the base 3 and driven by any suitable means, as, for instance, an electric motor 8, also mounted on the base. The pump 7 may be in the form of a centrifugal pump and from its discharge side leads a liquid discharge pipe 9 which connects with and discharges liquid into the tank 2.

The tank 2 connects with the tank 1 through a valve 10, which, in the form of the invention as illustrated, is contained in the partition or wall 11 which separates the two tanks 1 and 2. As a preference, the valve 10 is in the form of a slide valve, the moving element 12 being connected to an arm 13 of the float mechanism by a valve stem 14 having a limited amount of lost motion with respect to the arm 13. The arm 13 is shown as fulcrumed upon one of the walls of the tank 1 at 15, and on its free end is a ball float 16. By reason of the lost motion connection between the arm 13 and the valve stem 14, the arm and its float 16 may swing down from its highest position to the position shown in full lines in Fig. 1 before it begins to open the valve. The friction between the movable element 12 and the sta-

tionary part 10 of the valve is sufficient to prevent movement of the movable element except when acted upon by the arm 14.

Leading up from the tank 1 and into the tank 2 is an air or gas discharge pipe 17 which extends into the tank 2 and terminates at a place adjacent the upper end thereof and is provided with an outwardly opening check valve 18. Leading from the upper end of the tank 2 is an air or gas discharge pipe 19, also controlled by an outwardly opening check valve 20.

In the operation of the fluid displacement pump above described, the tank 1 is first filled or partially filled with liquid to prime the pump 7, and as the pump is set into operation, it discharges liquid from the tank 2 and delivers it into the tank 1. The valve 10 remains closed during substantially all of the time that the liquid is being discharged from the tank 2, but when the level of the liquid reaches a certain predetermined low point therein, the float mechanism opens the valve 10 and permits the liquid which has been delivered to the tank 2 to re-enter the tank 1. It will be noted that the liquid in the tank 1, as it is being discharged from the tank, acts in the nature of a fluid piston, moving in a downward direction, thereby causing a partial vacuum in the space above the liquid, into which gas and other fluid may enter from the inlet pipe 4.

As the liquid from the tank 2 flows into the tank 1, the level of the liquid in the tank 1 rises, thereby expelling the air, gases and other gaseous fluid through the discharge pipe 17 and into the tank 2, and when the level of the liquid in the tank 1 reaches a certain predetermined high level, the float mechanism closes the valve 10 and the pump 7 discharges the liquid from the tank 1 into the tank 2, thereby displacing the air, gases or gaseous fluid therein and discharging them through the discharge pipe 19. From the above, it will be seen that a partial vacuum is created in the tank 1, due to the falling liquid therein, and pressure is created in the tank 2 and air or other gaseous fluids are discharged therefrom, owing to the rise of the liquid in said tank.

When used in connection with a system wherein gases and liquids are acted upon by the pump, as, for instance, when used in connection with a steam heating plant as a vacuum condensation pump, the inlet pipe 4 is connected to the return pipe of the steam heating plant. The upper tank is provided with liquid discharge pipe 21, preferably controlled by a check valve 22, and valves 23 and 24 are provided for the air and gas discharge pipe 19 and the liquid discharge pipe 21, which valves may be operated by a float 25 and a float rod 26 connected to the valves in such manner that when the float is raised to a certain predetermined level, it operates to open the valve 24 and close the valve 23, whereby the pump 7 may discharge liquid from the tank 2 through the liquid discharge pipe 21 and thence to the boiler or other place where it is desired to deliver the liquid. As the liquid is being discharged from the tank 2, the float lowers and closes the valve 24 and opens the valve 23, which valves remain in such position until the liquid in the tank 2 again rises above the predetermined high level.

While the pump has been shown and described as a fluid displacement pump, it is to be understood that it can be used in many places where fluid displacement pumps of this character are capable of use. For instance, it may be used for handling fluids containing liquid, or liquid fluid containing gases and air. It may be used in connection with steam heating systems to remove air and other condensates from the steam, and to return the water of condensation back to the boiler or other place.

When used for creating pressure, the pipe 4 may open to the atmosphere, or a separate air inlet 27 may be provided for the lower tank 1, which inlet may be controlled by a valve 28, whereby the air inlet 27 may be entirely shut off when the apparatus is used for creating vacuum. An inwardly opening check valve 29 is provided for the air inlet 27, whereby air is admitted to the tank 1 as the level of the liquid therein lowers, and is transferred to the upper tank as the level of the liquid in the lower tank rises. The air is discharged from the upper tank as the level of the liquid rises therein, as will be readily understood.

More or less variation of the exact details of construction is possible without departing from the spirit of this invention. I desire, therefore, not to limit myself to the exact form of the construction shown and described, but intend, in the following claims, to point out all of the invention disclosed herein.

I claim as new, and desire to secure by Letters Patent:

1. A fluid displacement pump comprising upper and lower tanks, there being a fluid inlet to the lower tank and a fluid discharge leading from the upper tank, means for transferring a liquid fluid from the lower tank into the upper tank, intermittently operating means controlled by variations of the volume of liquid in one of said tanks for discharging the liquid back into the lower tank at predetermined intervals, and a gaseous fluid discharge pipe having an upwardly opening check valve and leading from the lower tank into the upper tank.

2. A fluid displacement pump comprising an upper tank and a lower tank, a fluid inlet pipe leading to the lower tank and a fluid discharge pipe leading from the upper

tank, a gaseous fluid discharge pipe leading from the lower tank and discharging into the upper tank, said pipe having an upwardly opening check valve through which gaseous fluid is discharged from the lower tank, and means for transferring a liquid fluid from the lower tank through the upper tank and back into the lower tank including a float controlled valve between the upper and lower tanks, whereby gaseous fluid is discharged from the tanks by displacement therein.

3. A fluid displacement pump comprising an upper tank and a lower tank, a fluid inlet pipe leading to the lower tank and a fluid discharge pipe leading from the upper tank, a gaseous fluid discharge pipe leading from the lower tank and discharging into the upper tank, and means for transferring a liquid fluid from the lower tank through the upper tank and back into the lower tank including a periodically operating float controlled valve between the upper and lower tanks, the float being contained in the lower tank.

4. A fluid displacement pump comprising upper and lower tanks disposed one above the other, the lower tank having a fluid inlet and the upper tank having a fluid discharge, intermittently operating means controlled by variations of the volume of liquid in one of the tanks, whereby liquid fluid is caused to flow at predetermined intervals from the upper tank to the lower tank by gravity, a gaseous fluid discharge pipe having an upwardly opening check valve and leading from the lower tank into the upper tank, and means for discharging liquid fluid from the lower tank into the upper tank.

5. A fluid displacement pump comprising upper and lower tanks, intermittently operating means controlled by variations of the volume of liquid in one of the tanks, whereby a liquid fluid is caused to flow at predetermined intervals from the upper tank into the lower tank by gravity, there being a fluid inlet to the lower tank and a fluid discharge from the upper tank, a gaseous fluid discharge pipe having an upwardly opening check valve and leading from the lower tank into the upper tank, and a water pump having its inlet side connected to the lower tank and its discharge side connected to the upper tank.

6. A fluid displacement pump comprising an upper tank and a lower tank, a fluid inlet leading to said lower tank and a fluid discharge leading from said upper tank, a gaseous fluid discharge pipe leading from the lower tank into the upper tank through which pipe gaseous fluid is discharged by displacement in the lower tank, a float controlled valve interposed between said tanks, and a water pump having its inlet side connected to the lower tank and its discharge side connected to the upper tank.

7. A fluid displacement pump comprising upper and lower tanks, there being a liquid inlet to the lower tank and the liquid discharge leading from the upper tank, means for circulating liquid from the lower tank and into the upper tank, a float valve controlled port through which liquid is discharged back into the lower tank at predetermined intervals, a gaseous fluid discharge pipe leading from the lower tank into the upper tank through which the gaseous fluid is discharged into the upper tank by displacement in the lower one, a gaseous fluid discharge pipe opening outward from the upper tank, and means for controlling the passage through said liquid discharge and outwardly discharging gaseous fluid discharge pipe.

EDWARD F. McCARTHY.