

Dec. 22, 1931.

C. G. WOOD

1,837,697

PUMPING APPARATUS

Filed Sept. 26, 1927

2 Sheets-Sheet 1

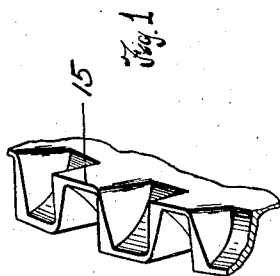
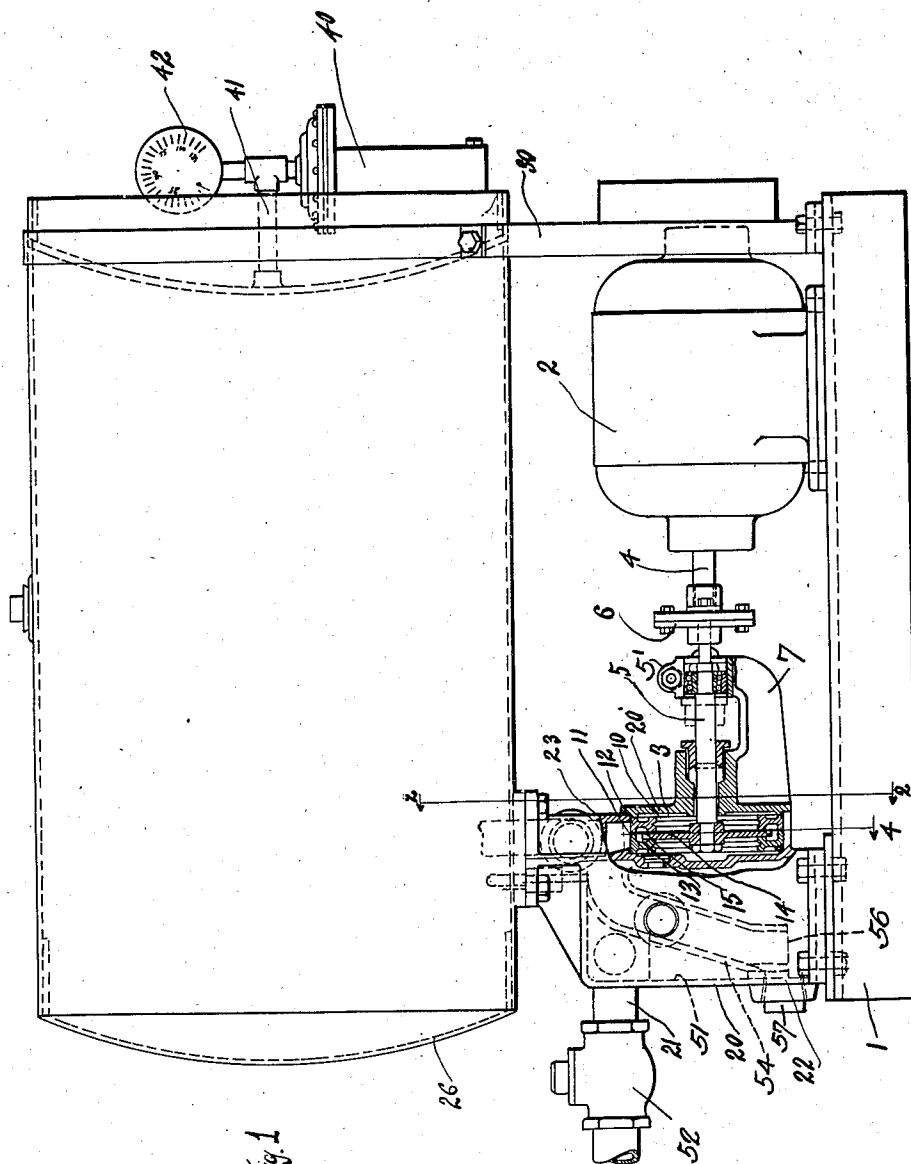


Fig. 4

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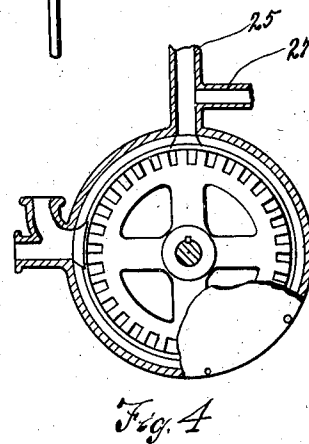
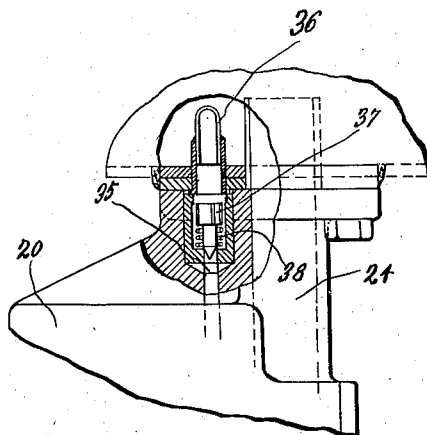
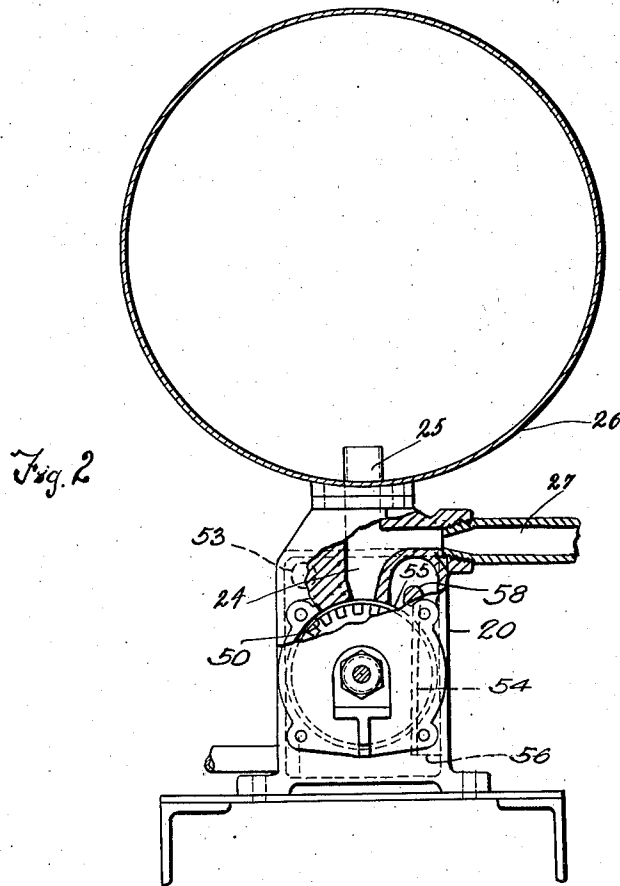
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PUMPING APPARATUS

Application filed September 26, 1927. Serial No. 222,016.

The present invention, relating as indicated to pumping apparatus, is more particularly directed to an improved construction of self-priming centrifugal pump. One of the principal objects of the invention is the provision of extremely simple apparatus of the type referred to which shall be automatically self-priming in operation and which is economical to construct, convenient to assemble, and neat and compact in appearance.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a side elevation partially in section of my improved apparatus; Fig. 2 is a section on the line 2—2 of Fig. 1, certain parts being broken away for clarity of illustration; Fig. 3 is a section on an enlarged scale of the leakage valve between the tank and the priming chamber; and Fig. 4 is a view in perspective of the periphery of the pump member showing the pumping vanes or buckets.

Referring now to Fig. 1, the apparatus is shown to consist of a base 1, upon which is mounted a suitable motor, such as an electric motor 2, driving a pump 3 by means of shafts 4 and 5, and an intermediate flexible coupling 6. The pump 3 consists of a chamber 10 of cylindrical form, the outer periphery of which is formed by means of two pump rings 11 and 12, respectively, these two rings forming between them a pumping channel 13, in which rotates a pump element in the form of a disc or wheel 14 having vanes 15, the construction of which is shown in Fig. 4. The pump mechanism is removably secured

as a unit in a suitably formed recess 50 in one side of a casing 20, which constitutes the priming chamber by means of a cover plate 20' which may be fastened to the casing by machine screws or the like. Said cover plate is provided with a projection 7 formed with a bearing 5' in which the shaft 5 is journaled and supported.

The casing 20 is formed to provide said recess 50 and a priming chamber 51. A supply pipe 21 is connected through an inwardly opening check valve 52 to the inlet port 53 for said priming chamber 51. A tube 54 is formed in or mounted in said chamber 51, and said tube is of rebent form, its one end 55 opening directly into the pump channel 13 and forming the inlet therefor. The opposite end 56 of said tube is spaced slightly from the bottom of the priming chamber 51, whereby the interior of said tube 54 is always in communication with said priming chamber.

Mounted directly on the top of the casing 20 and upon a suitable support 30 at the other end of the base is the reservoir or pressure tank 26, into which any excess liquid supplied by the pump, and not removed through the conduit 27, is discharged and held. It will be evident that liquid from the tank 26 can flow downwardly through the conduit 25 and then out through the discharge conduit 27 so long as there is liquid in the tank, and that when the pump is being operated it will force liquid up through the conduit 25 to the interior of the tank which will, however, take only the excess liquid delivered by the pump and not allowed to pass through the discharge pipe 27.

Ordinarily, the pump organization herein described will be mounted in the basement of a house, and the delivery pipe 27 will extend upwardly above the level thereof. In case the unit is used for irrigation, or in some other relation where the point of delivery is on the same or a lower level than

the outlet branch 25, I prefer to insert a goose neck (not shown) in the delivery line immediately beyond the pump, such goose neck extending upwardly to a level slightly higher than the upper end of the tube 25. Such goose neck will insure against the loss of liquid through the delivery line at times when the pump has lost its direct prime from the supply line and is attempting to regain such prime by pumping liquid around the closed circuit including the priming chamber 51, the tube 54, the pump channel, the passage 25, the reservoir 26, and the passage 35.

In the upper portion of the casing 20 there is formed a port 35, making communication between the reservoir 26 and the interior of the priming chamber. At the upper end of this port there is mounted a screen 36 and in the body of the port a valve 37 normally held off from the seat by means of a spring 38. This valve mechanism serves to permit intermittent drainage from the reservoir 26 into the priming chamber 51 to maintain a sufficient level in the priming chamber to allow liquid therefrom to be drawn into the pump upon operation so long as there is any liquid in the tank 26. The top of the pipe 25, connecting the pump chamber and the tank, is materially above the point of entrance of the water through the screen 36 into the port 35, thus preventing the withdrawal of the last liquid from the chamber and reserving this liquid for the automatic filling of the priming chamber and thereby the automatic priming of the pumping mechanism, which ensures starting even though the impeller recess be empty and even though air is in the inlet pipe 21. Of course, it will be understood that the priming chamber 51 is normally full of liquid, since the port 53 is located near the top of said chamber, thus preventing the draining of said chamber through the inlet pipe 21. A drainage port 22, adapted normally to be closed by a plug 57 is provided for draining the casing 20 to permit cleaning thereof.

Various automatic means may be employed with my improved apparatus for controlling the operation of the pumping mechanism at suitable times. We have shown at the side of the tank 26 a switch casing 40 which may be employed to house an automatic cutout switch for breaking the circuit of the motor 2, the switch being operated by means of the pressure in the tank 1, which pressure is communicated to a suitable diaphragm in the box 40, as by means of a conduit 41, which may also be connected to the pressure gauge 42 for indicating the pressure in the reservoir tank.

It will be obvious that the whole pumping mechanism may be easily removed merely by disconnecting the flexible coupling 6, loosening the cover plate 20', and backing

the shaft 5 and its connected parts away from the casing 20.

The present mechanism is, as will be seen, formed in separate units consisting of reservoir, motor, pump and priming chamber which may be quickly and conveniently assembled or disassembled, while the entire mechanism is extremely simple and ensures proper operation of the pump so long as any liquid remains in the supply tank, thus avoiding the difficulty which is so common in the use of centrifugal pumps of being unable to start until the mechanism is primed by the operator.

It will be seen that, when the pump is not operating, the pressure in the reservoir 26 and the pressure in the priming chamber 51 will be equal, since communication between the reservoir and the priming chamber is permitted through the tube 25. Under such conditions, the spring 38 will hold the valve 37 in open position to permit liquid to flow from said reservoir 26 into the priming chamber 51 to keep such chamber always substantially full of liquid so long as there is liquid in the reservoir. As soon as the pump is started, however, the pressure in the priming chamber 51 is reduced, whereby the force of the spring 38 is overcome, and the valve 37 is moved to its seat to prevent liquid from flowing in a circle. In the event that the pump loses its prime, the pressure in the priming chamber builds up once more, and the valve 37 is again opened by the spring 38 and will not close until the pump picks up its prime.

When, in the use of the system, the pressure in the reservoir 26 reaches a value low enough to permit the diaphragm in the box 40 to close the switch therein, the motor 2 will drive the impeller 14, and said impeller will draw liquid through the tube 54 from the chamber 51 and force the same through the conduit 25 to the reservoir 26 or through the pipe 27 to a point of use. If the valve 52 is properly tight, liquid in proportionate amounts will be drawn through the valve 52 from a source of supply to replace the liquid withdrawn from the priming chamber by the pump. If, however, the valve 52 has leaked to permit the liquid level in the supply pipe 21 to fall, only air will be drawn into this chamber from the supply pipe, and the liquid level in the priming chamber 51 will soon fall below the level of the lower edge 56 of the tube 54, and the prime of the pump will be broken. As soon as this condition arises, the pump ceases to withdraw liquid from the chamber 51, the valve 37 opens, and said chamber is slowly refilled through the trickle passage 35. As soon as the liquid in the priming chamber reaches the level of the shoulder 58 the pump will begin once more to withdraw liquid from the chamber 51 with a siphon effect, thus reducing the pressure in

the chamber 51 and causing the valve 37 to be closed, and this cycle will be repeated until the liquid in the supply pipe 21 is drawn up to the level of the pump, whereafter the pump will continue to operate smoothly and continuously until the pressure in the reservoir 26 attains a value sufficient to cause actuation of the switch in the box 40 to break the energizing circuit to the motor 2.

In most systems of this general character which include a pump, a reservoir, often called a pressure tank, and a switch in the pump operating motor circuit adapted to be operated by pressure in the pressure tank, it is necessary to provide a valve in the supply line to permit air to be drawn into the system and forced into the pressure tank. As will be obvious, the presence of air in the pressure tank is essential to the proper operation of the system, and, as is well known, where air is compressed in contact with water, some of the air is dissolved in the water. In other systems known to me, the pressure tank becomes "water logged", after a long period of use; in other words, substantially all of the air in the pressure tank is dissolved in the water and is carried out of the system with such water.

In the use of the present system, it has been found that no such valve is necessary, and that the pressure tank does not become water logged. It has also been noted that, after a period of running, when the pump is stopped there is an audible gurgle between the priming chamber and the pressure tank. Experiments were made with a transparent tube comprising a trickle passage 35, and it was found that, when the pump was stopped, after a period of use, a material amount of air bubbled up through this trickle passage from the priming chamber to the pressure tank.

It will thus be seen that the structure herein described provides for an automatic replenishment of the air in the pressure tank. This operation may be explained upon the following theory. When the pump is in operation, the pressure existing in the priming chamber is materially below atmospheric pressure. All water in contact with air at atmospheric pressure contains a certain amount of air in solution. It is well known that a reduction in pressure on the surface of a liquid will cause the release therefrom of any gas dissolved therein. Thus, when the liquid is drawn from the source of supply into the priming chamber, as it enters the region of low pressure therein, some of it is dissolved or is released or withdrawn therefrom. This air collects in the upper part of the priming chamber during the operation of the pump. When the pump is stopped, the pressures in the pump chamber, the priming chamber, and the pressure tank tend to equalize through the com-

munication therebetween provided by the tube 25. This equalization is brought about by a rush of liquid from the reservoir through the tube 25 into the pump chamber and so into the priming chamber. Simultaneously, the valve 37 opens, and the rush of liquid into the priming chamber forces the air collected in the upper portion thereof through the trickle passage 35 and into the reservoir 26.

Of course, if all of the liquid drawn through the pump were forced into the pressure tank 26 and were permitted to stand there under pressure, any air withdrawn from solution in the liquid in the priming chamber and introduced into the pressure tank would be redissolved in the liquid in the pressure tank. In the present system, however, it will be noted that the passage 24 is branched to communicate not only with tube 25 but also with the service pipe 27. During a part of the time of operation of the pump, liquid is often withdrawn from the system through this pipe 27 and such liquid flows directly from the impeller through the pipe 27 and out of the system. Thus it will be seen that more air is extracted from the liquid in the priming chamber than can be redissolved in the liquid in the pressure tank, and the result is the maintenance of a proper amount of air in the pressure tank.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. The combination with a centrifugal pump of a casing enclosing said pump, a priming chamber in said casing having constant communication with the pump chamber through a siphon connection, a reservoir mounted adjacent said pump, a delivery tube leading from said pump to said reservoir, and means responsive to differences between the pressures in said reservoir and in said priming chamber, respectively, to establish and cut off communication between said reservoir and said priming chamber.

2. In a liquid supply system, a centrifugal pump having peripheral inlet and delivery ports, a reservoir mounted adjacent said pump, a priming chamber for said pump having communication with the pump chamber through said inlet port, a conduit connecting said priming chamber with a source of supply, a conduit extending from said priming chamber and into said reservoir, a resiliently mounted valve in said conduit, a tube leading from said delivery port into said reservoir and extending to a point appreciably above

- the end of said conduit, and a pipe leading from said delivery port and from said tube to a point of use whereby liquid may be discharged from said system without passing through said reservoir.
3. In a liquid supply system, a base, a casing mounted on said base adjacent one end thereof, a motor mounted adjacent the other end of said base, a centrifugal pump in a chamber in said casing and connected to said motor, a priming chamber in said casing, means providing communication between said priming chamber and said pump chamber, a support mounted on said base and beyond said motor, a reservoir mounted on said casing and said support and overlying said casing, pump, and motor, a conduit connecting the delivery end of said pump with said reservoir, and a second conduit connecting said reservoir with said priming chamber.
4. In a liquid supply system, a base, a casing mounted on said base adjacent one end thereof, a motor mounted adjacent the other end of said base, a recess in the side of said casing adjacent said motor, a centrifugal pump mounted in said recess and having a shaft extending toward said motor, a cover plate sleeved on said shaft and closing said recess, a projection on said plate forming a bearing for said shaft, a flexible connection between said shaft and said motor, a priming chamber in said casing, said casing being formed with a passage providing communication between said priming chamber and said pump chamber, a support mounted on said base and beyond said motor, a reservoir mounted on said casing and said support and overlying said casing, pump, and motor, a conduit connecting the delivery end of said pump with said reservoir, and a second conduit connecting said reservoir with said priming chamber.
5. In a pumping apparatus of the character described, the combination in a self-contained unit, of a supporting case, a pump mounted on said base, a motor connected therewith for driving the same, the motor also being mounted on said base, a storage tank disposed above the pump having one end thereof directly connected with the outlet side of the pump in close coupled relation, the connection serving to support the one end of the tank on the pump, and means for supporting the other end of said tank on the base, said tank being adapted to have communication with a service pipe, and there being a check valve on the suction side of the pump adapted to control communication with a supply pipe.
6. A pumping apparatus of the character described comprising in combination, in a self-contained unit, a supporting base, a pump mounted on one end of said base and extending upwardly therefrom, a storage tank disposed above the pump over the base and supported on the latter at one end by a pipe connection with the discharge side of the pump, means for supporting the other end of said tank from the base, an automatic pressure regulator communicating with the tank, and an electric motor mounted on the base having a direct mechanical driving connection with the pump on the one hand and an electrical connection with the regulator on the other hand.
- Signed by me this 20th day of September, 1927.
- CLARENCE G. WOOD.

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CERTIFICATE OF CORRECTION.**Patent No. 1,837,697.****Granted December 22, 1931, to****CLARENCE G. WOOD.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: In the drawings, Sheet 2, strike out "Fig. 4"; page 4, line 45, claim 5, for "case" read base; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of February, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)