March 5, 1935. C. H. FERGUSON 1,993,267

PUMPING APPARATUS

Filed July 14, 1923 2 Sheets-Sheet 1

Fig. 1.

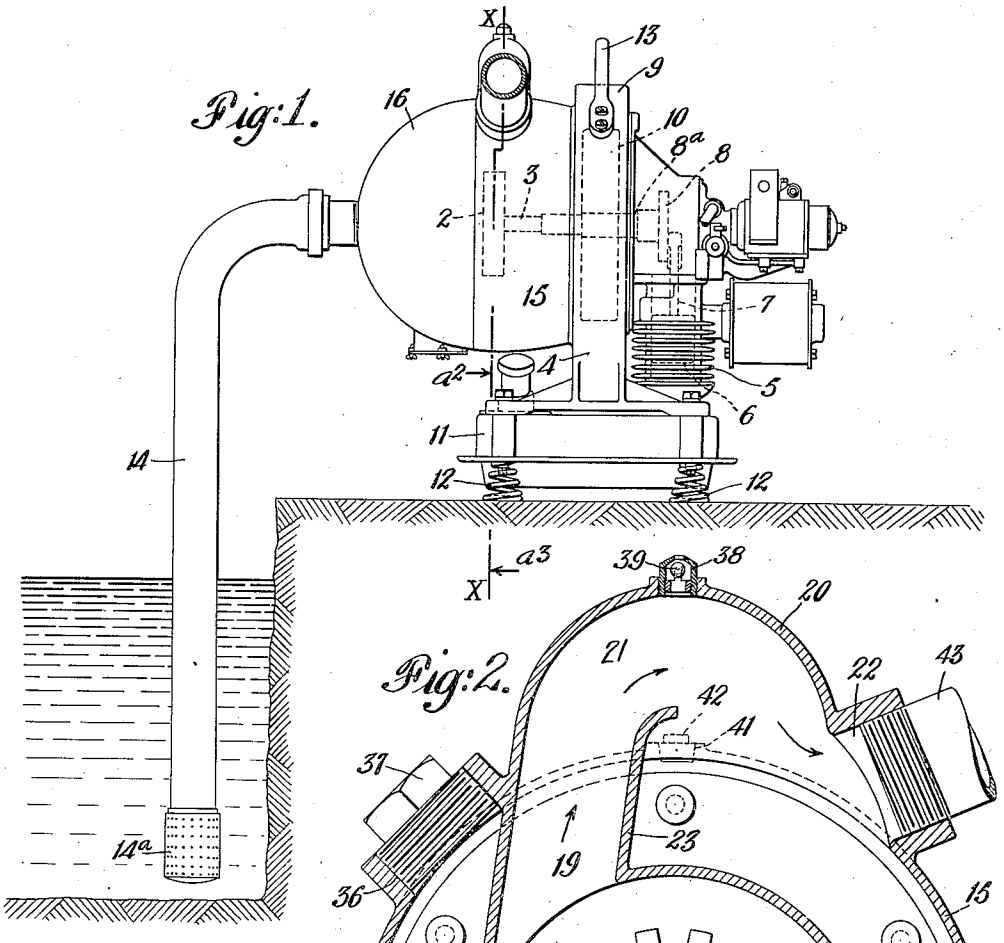


Fig. 2.

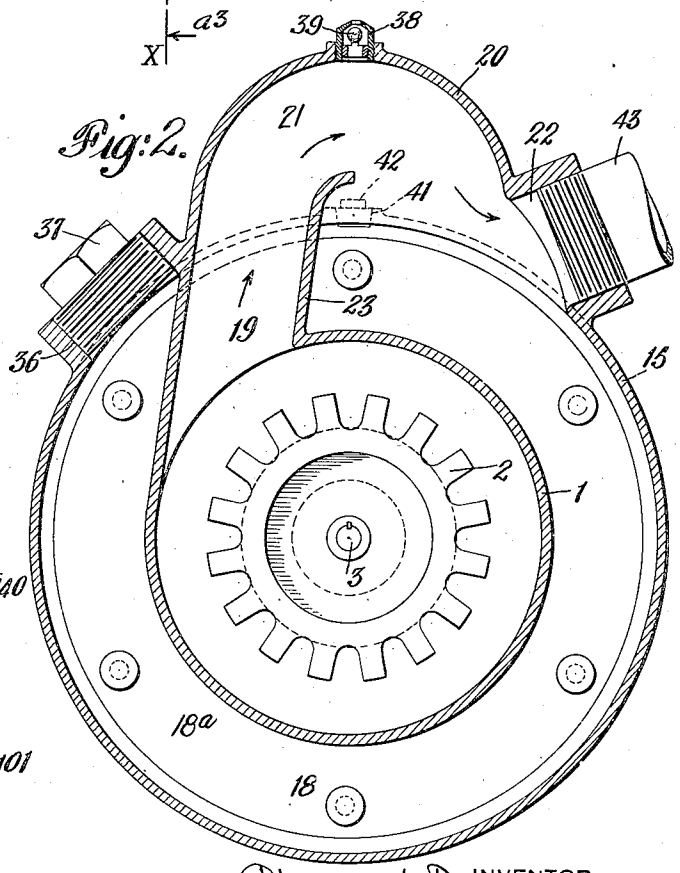
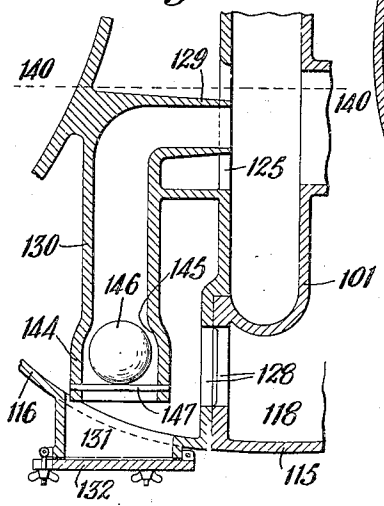


Fig. 3.



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Fig. 3.

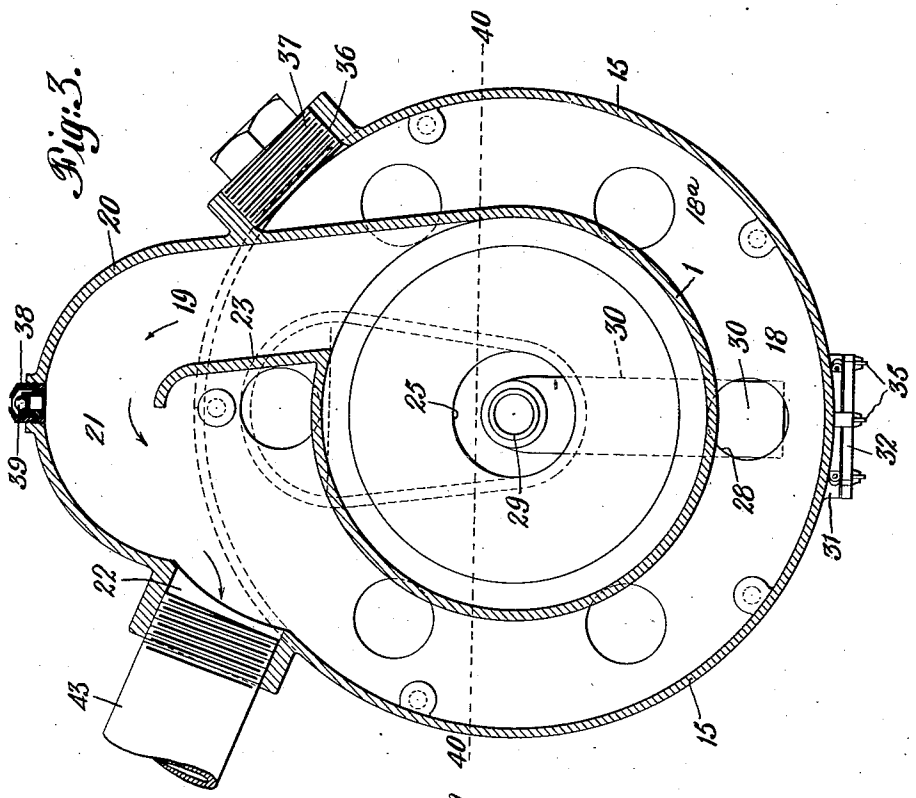
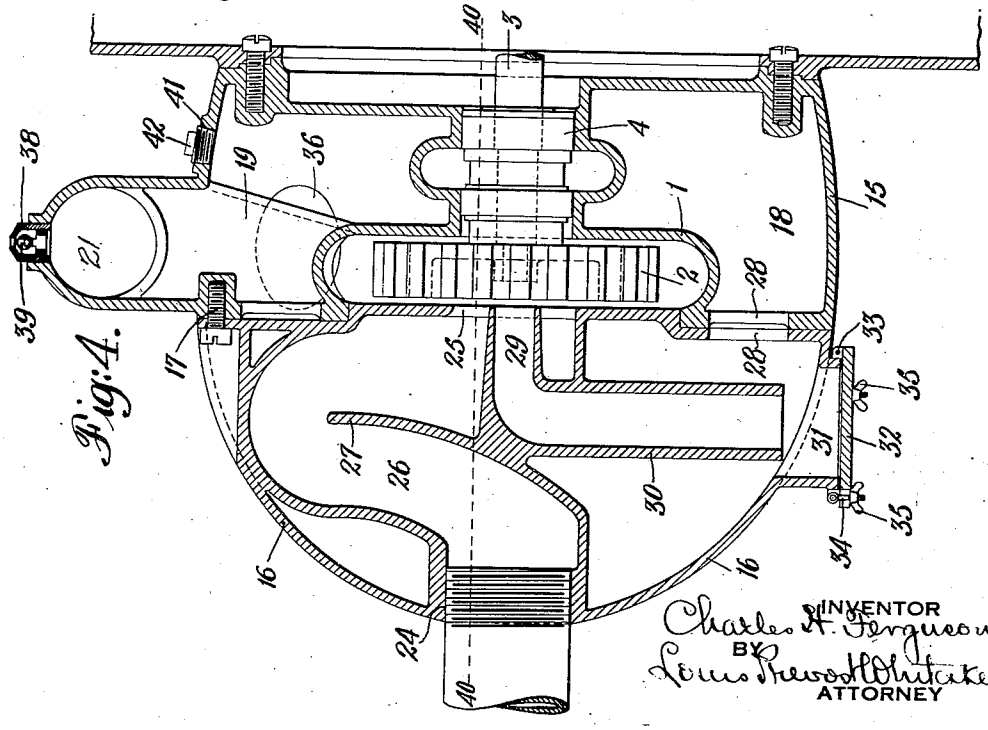


Fig. 4.



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1,993,267

PUMPING APPARATUS

Charles Hiram Ferguson, Valhalla, N. Y.

Application July 14, 1928, Serial No. 292,643

6 Claims. (Cl. 103—113)

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings, which show one embodiment of the same, and a slight modification thereof, selected by me for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

My invention is an improvement in pumping apparatus and consists in providing, in connection with a rotary pump comprising a pump casing having the usual inlet and discharge apertures for the liquid entering and leaving the casing in the normal operation of the pump, and a rotor in the casing, a priming nozzle communicating with the casing, preferably at a point adjacent to the axis of the rotor, and a priming reservoir having portions extending above and below the level of the discharge aperture of the priming nozzle, and being preferably attached to or formed with and surrounding the pump casing, means being provided to extend the supply of water in the reservoir at all times, and to prevent its being siphoned out of the reservoir in case the water level in the sump, ditch or cavity shall fall below the lower end of the uptake pipe leading to the pump casing.

As a result of this construction, the starting of the pump will cause it to automatically prime itself whenever the lower end of the uptake is sealed, by extending below the surface of the water in the sump, ditch or cavity, from which the water is to be withdrawn, and as soon as the normal pumping operation is established, the water from the sump will pass through the inlet passage and the pumping casing, and will be discharged through the discharge aperture thereof. The reservoir is provided with means for cleaning it out at frequent intervals when this may be or become necessary. My improved pumping apparatus is particularly efficient and desirable for pumping out cellars of houses, ditches, for the construction of sewerage systems and the like, where it is frequently necessary to pump out water from cavities into which it is continually running in order to keep the pipes dry while making the necessary joints therein. In such instances it is desirable to have an apparatus which is easily portable, and as in many instances the water does not run into the cavity as fast as it is pumped out, my improved pumping apparatus will ordinarily prime itself whenever a sufficient amount of water accumulates to require pumping, the pump being operated continuously, and thus the additional labor which would otherwise be required to prime the pump at frequent intervals is avoided. In the preferred form of my invention herein illustrated, the entire apparatus, including the motor, is mounted upon a single base, as a unit, and is of such size and weight that it can easily be moved from place to place by hand by a single operator. In the modification of my invention herein shown, I have also provided means for positively preventing the circulation of water from and to the reservoir during the normal operation of the pump so as to prevent any diminution of the maximum capacity of the pump.

My invention also provides certain novel features of construction and combination of parts hereinafter described and particularly pointed out in the claims.

Referring to the accompanying drawings,

Fig. 1 represents a preferred embodiment of my invention selected by me for purposes of illustration, the apparatus being shown in operative relation for pumping water from a ditch or excavation.

Fig. 2 is an enlarged vertical section through the pump casing and reservoir on the line x—x of Fig. 1, looking in the direction of the arrow, A^2.

Fig. 3 is a similar section on the same section line x—x of Fig. 1, looking in the direction of the arrow, A^3.

Fig. 4 is an enlarged vertical longitudinal section through the pump casing and reservoir.

Fig. 5 is a partial view similar to Fig. 4, showing a slight modification.

In the drawings, 1 represents the casing of a centrifugal pump constructed and arranged in accordance with my invention. 2 represents the rotor which is mounted on a shaft 3, carried in suitable bearings in a supporting frame, indicated at 4, and in this instance directly connected with a prime motor. It is to be understood that any desired form of prime motor may be employed for operating the pump, as an internal combustion engine, an electric motor (where electric current is available) or other power applying means. I prefer, however, to employ an internal combustion engine secured to and mounted upon the same supporting base which carries the pump, and having its driving shaft directly connected with the motor as before indicated. In this instance, 5 indicates the cylinder of an internal combustion engine provided with a piston 6, indicated in dotted lines in Fig. 1, the piston rod 7, and crank 8 on the crank shaft 8^a, which is integral with or directly connected with the rotor shaft 3 of the pump. 9 indicates a fan casing containing a

rotary fan 10, shown in dotted lines in Fig. 1 for cooling the motor but the specific details of the motor form no part of my present invention. The base portion of the frame 4 which supports the motor fan casing, pump casing and reservoir is conveniently provided with a fuel reservoir indicated at 11, the entire apparatus being supported preferably on a plurality of spiral springs 12, preferably four in number, which take up the vibration of the apparatus and prevent it from moving laterally when placed on the ground or other supporting surface. The apparatus is preferably formed with a handle or other suitable lifting means, indicated at 13, and in this instance secured to the fan casing by which the entire apparatus can be lifted for transporting it from one location to another and as before stated, the apparatus is preferably so constructed as to size and weight, that it may be carried by one man.

15 represents an annular shell or casing, formed preferably substantially coaxial with the pump casing and rotor, and substantially surrounding the pump casing and conveniently formed as an integral casing therewith, and associated with this shell or casting 15 is a substantially hemispherically cored casting 16, which may be conveniently formed separately from the shell 15 and secured thereto by suitable screws or bolts, one of which is shown at 17, the lower portions of the shells 15 and 16 constituting, as hereinafter explained, the priming reservoir for the pump, which is indicated at 18. The pump casing 1 is provided with a tangential discharge passage, indicated at 19, extending into an upwardly projecting portion 20 of the shell 15 into a discharge chamber 21, provided with a normal discharge aperture 22 of the pump. As shown in the drawings, the inner wall 23 of the discharge passage 19 separates it for a portion of its length from the discharge chamber 21, so that the discharged water is obliged to pass upwardly over said wall 23 on its way to the discharge aperture 22, as indicated by the arrows in Fig. 3, for example, and the discharge chamber 21, is in open communication with the upper portion of the priming reservoir 18. The shell 16 is provided with a water inlet 24, to which the upper end of the uptake pipe 14 is connected, said pipe extending down into the ditch or cavity from which water is to be pumped and being provided at its lower end with a strainer 14*a*. I prefer not to provide the uptake pipe with any foot valve or other valve at its lower end as such a valve is likely to become clogged by sediment and interrupt the pump operation. 25 represents the inlet aperture of the pump casing, and it is desirable to connect the uptake pipe with the inlet aperture of the pump casing by an upwardly and downwardly extending passage or goose-neck to prevent undue siphoning of water from the pump casing and priming reservoir in case the lower end of the uptake pipe is opened by the lowering of the water level below it. This goose-neck may be formed in any desired way, but I find it convenient to provide it by means of a cored passage 26 within the outer shell 16, providing a vertical wall 27 between the inlet aperture 24 of said passage and the inlet aperture 25 of the pump casing, as clearly shown in Fig. 4. With this arrangement the uptake pipe 14, may be directly connected to the apparatus by connecting it with the aperture 24 in the shell 16.

The lower portions of the interior of the main shell 15 and the outer shell 16 are in communication at their lower ends and where the shells are formed separately and bolted together, as indicated in the drawings. This may be conveniently brought about by providing the shells 15 and 16 with registering apertures, indicated at 28, below the pump casing 1, so that the entire interior of both shells 15 and 16, exclusive of the goose-neck passage before referred to, constitute a priming reservoir which extends below and also above the axis of the rotor.

29 represents a priming nozzle discharging into the pump casing and preferably having its discharge portion located adjacent to the axis of the rotor, and having a downwardly extending portion 30 extending to a point near the bottom of the priming reservoir 18. The priming reservoir is also provided at its lower end with a clean-out aperture, indicated at 31, having a closure 32. In this instance the clean-out aperture is provided in the outer shell 16, and the closure 32 is hinged at 33 to the said shell and provided with clamping bolts 34 and wing nuts 35 for holding it in closed position. A suitable gasket may be employed to make a tight joint. The upper portion of the priming reservoir may be provided with an auxiliary discharge aperture, indicated at 36, on the side of the apparatus opposite the normal discharge aperture 22, which is normally closed by a plug 37 the portion of the priming reservoir 18 indicated at 18*a*, between the pump casing and shell 15, forms a curved passage which connects the discharge aperture 36 of the priming reservoir directly with the bottom of the reservoir to insure the removal of solid matter from the reservoir when the aperture 36 is used as the discharge aperture for the pumped water. The upper part of the priming reservoir is also provided with a vent aperture 38, which is normally open and disclosed by a valve 39. In this instance a vertically movable ball valve is shown which will be lifted into closed position by the water when the pump is in operation and any pressure exists within the reservoir, but will remain open in the absence of pressure and will place the upper portion of the reservoir in communication with the atmosphere when in open position.

Assuming that the apparatus has been transported to the desired point and connected with an uptake pipe 14 having its lower end extending below the water level in the excavation from which water is to be pumped, the reservoir and pump casing will be filled with water up to a level indicated by the dotted line 40—40 above the upper edge of the priming nozzle 29. The water may be introduced into the reservoir through a filling aperture 41 in the upper portion of the reservoir normally closed by the plug 42, or the water could be introduced through the normal discharge aperture or through the auxiliary discharge aperture by removing the closure 37, as preferred. On starting the engine or motor, the rotor will immediately cause a circulation of the priming water, which will be discharged from the pump casing through the passage 19 into the discharge chamber 21, in which it will fall, returning to the lower portion of the reservoir. At the same time air will be withdrawn in from the intake pipe and goose-neck 26 into the pump casing above the water level 40—40 and will be carried upward with the water discharged from the pump into the discharge chamber 21,

the air passing out through the normal discharge aperture 22, and the water returning to the reservoir as before described. As the air is withdrawn from the uptake pipe and goose-neck, pressure of the atmosphere upon the surface of the water in the sump, ditch or cavity, will be forced upward in the uptake until all of the air is exhausted and the water from the uptake is drawn into the pump casing, after which the entire pump casing and reservoir, and the passages leading to and from the pump casing, will be filled with water and as the operation of the pump continues, the water drawn into the uptake will be discharged through the discharge aperture 22 where the water contains comparatively little solid matter, and the pump will be in normal operation. If the water lavel in the sump falls below the level of the uptake so that air is admitted, the water in the uptake will run back into the sump, but by reason of the goose-neck, this action will not siphon out the water materially below the level of the upper edge of the pump casing inlet aperture 25, as the admission of air to the upper part of the reservoir and pump casing as the water level descends will interrupt the siphoning effect so that a certain amount of water will always be left in the pump casing and reservoir extending above the discharge aperture of the priming nozzle 29. The continued operation of the pump will thereafter simply circulate the priming water and withdraw air through the uptake pipe until its lower end is again sealed by the rise of the water level in the sump. When this occurs the pump will be automatically primed, the air will be withdrawn from the uptake pipe, the water will be forced upward by the pressure on the surface of the water in the sump, in the manner before described and the normal pumping operation will be again resumed. It will be readily understood, therefore, that by simply maintaining the rotor in continuous operation, the pumping apparatus will need no attention except to insure the proper supply of fuel for the motor where an internal combustion engine, for example, is employed, as the source of power.

In the normal pumping action described, it will be seen that the water drawn up through the uptake will pass through the pump casing without entering the reservoir, which is located out of the path of the water and when the normal discharge outlet 22, is employed, the reservoir is located out of the path of the water through the inlet aperture, the pump casing and the discharge aperture. There may be a certain amount of recirculation of the priming water in the reservoir during the normal operation of the pump, but this will not materially detract from the output of the pump or impair its efficiency, although theoretically it may very slightly decrease the maximum amount of water which can be pumped in a given period. It has, however, been found in practice that the capacity of the pump shown in the accompanying drawings is usually very much in excess of its requirements. As the greater portion of the water withdrawn from the sump passes through the apparatus without entering the reservoir at all the collection of sediment is very slight as compared to what it would be if all the water pumped had to pass through a priming reservoir where the water contains comparatively little solid matter. Should the sediment so collected in the bottom of the reservoir as to in any way interfere with the priming action it may be readily removed by opening the clean-out aperture 31, in the bottom of the reservoir and removing the sediment. I prefer to provide the reservoir with the auxiliary discharge aperture to meet a condition in which the water to be pumped contains so much sediment as to require cleaning out with undesirable frequency. If such were found to be the case, the plug 37 can be removed and employed to close the normal discharge outlet 22, so that the water may be forced through the reservoir from the discharge chamber 22 and out through the passage 18*a* to the auxiliary outlet 36, which will insure the continuous discharge of all solid matter in the water and effectually prevent any accumulation of sediment in the reservoir while the priming operation would be exactly as hereinbefore described. It will be understood that where the pump is located so that the discharged water can be taken away as it flows directly from the discharge aperture of the pump, this course can be followed. Where it is desired to convey the water to a point at a distance from the pump before discharging it finally, a discharge pipe such as indicated at 43 may be screwed into the normal discharge outlet 22 (or into the auxiliary discharge outlet 36, if that is being used). Even where the water is discharged through the auxiliary outlet 36, it will be seen that the reservoir is located exterior to the path of the water through the inlet to the pump casing and through the pump casing and as before stated in the arrangement illustrated in the drawings where the water is discharged through the normal outlet aperture 22, the reservoir is located out of the path of the water through the entire apparatus. When the water is discharged through the outlet 22, the vent aperture 38 and valve 39, if employed, would simply assist in the delivery of the air withdrawn from the uptake pipe 14 during the priming operations, and as soon as the pump casing and reservoir become filled with water the valve 39 would be lifted into the closed position. Where the water is discharged through the auxiliary outlet 36, this vent valve will perform another function in releasing any air which might be imprisoned in the upper part of the apparatus and tend to cause the pump to become airbound. The vent valve, if used, is therefore preferably located at the highest point of the apparatus, namely at the top of the extension 20, as shown in the drawings. I wish it to be understood, however, that the use of this vent valve is optional and that it may be omitted, if desired.

It will also be understood that when the pump is shut down by stopping the motive power for the rotor, as at the end of a day's work or to enable the apparatus to be moved from one point to another, as along a ditch, there will always be left in the reservoir a sufficient quantity of water to extend above the level of the discharge orifice of the nozzle, so that as soon as the rotor is again started the pump will automatically prime itself and resume normal pumping operation as long as the lower end of the uptake pipe is submerged.

In Fig. 5 I have shown a slight modification of my invention, in which the parts corresponding with those shown in Figs. 1 to 4 and previously described are given the same reference characters with the addition of 100 to avoid repetition. In this construction, the parts are identical with those previously described, except that I provide means for closing the lower end of the pipe 130 supplying water to the priming nozzle 129 from the reservoir whenever the pump is

operating under normal conditions and pumping water through the uptake 114. This may be accomplished in different ways but in the present instance I have shown the lower end of the pipe 130 provided with an enlargement 144 having a valve seat 145 for a ball valve 146, held from accidental displacement by cross-rods 147 or other suitable retaining means, which will permit the passage of the priming water around them and around the ball. This ball valve is constructed of suitable material having such a specific gravity that when the water level in the reservoir is substantially at the point indicated by the dotted line 140, the ball 146 will remain unseated against the circulation caused by the suction at the discharge end of the nozzle 129. When, however, the pump and reservoir have become entirely filled with water and the ball valve is subjected at its lower surface to an upward pressure of the water at the higher level, in addition to the suction at the orifice of the nozzle, the ball valve will rise and seat itself, thereby preventing any re-circulation of the priming water in the reservoir and making it certain that the pump will discharge the maximum quantity of water without any possible detraction therefrom. The arrangement of this automatic ball valve affords a very simple way of accomplishing this result without the use of a calibrated spring operated valve which would be likely to become clogged and get out of order.

It will be understood that in my pumping apparatus there is an entire absence of valves in the water passages which is especially desirable in apparatus which is used for pumping water from ditches and other places where a considerable amount of sediment and solid material is necessarily carried up with the water and passed through the pump, which solid material would necessarily interfere seriously with the operation of any valves in the water passages. It is obvious that if the apparatus be used for pumping perfectly clear water without appreciable sediment a foot valve might be installed in the uptake, but for whatever purposes for which this pumping apparatus is particularly applicable, such a valve is extremely undesirable and would interfere materially with the operation of the device.

What I claim and desire to secure by Letters Patent is:—

1. In a pumping apparatus, the combination with a priming reservoir, of a centrifugal pump located in and substantially surrounded by said reservoir, and comprising a pump casing and a rotor therein, said pump casing being provided with an inlet adjacent to the axis of the rotor, and a discharge outlet above the axis of the rotor communicating with said reservoir, priming means independent of said inlet for connecting the pump casing with said reservoir below the axis of the rotor, said reservoir being provided with a discharge aperture for pumped water above the level of the axis of the rotor and out of direct communication with the discharge outlet of the pump casing, and communicating with said discharge outlet through the reservoir for insuring the delivery from the reservoir of the solid matter in the pumped water.

2. In a pumping apparatus, the combination with a priming reservoir, of a centrifugal pump located in and substantially surrounded by said reservoir, and comprising a pump casing and a rotor therein, said pump casing being provided with an inlet adjacent to the axis of the rotor, and a discharge outlet above the axis of the rotor communicating with said reservoir, priming means independent of said inlet for connecting the pump casing with said reservoir below the axis of the rotor, said reservoir being provided with a discharge aperture for pumped water located above the axis of the rotor and communicating with the bottom of the reservoir by a curved passage exterior to the pump casing, said passage being in communication with the discharge outlet of the pump casing, whereby the pumped water is delivered to said discharge aperture from the bottom of the reservoir to insure the discharge therefrom of the solid matter in the pumped water.

3. In a pumping apparatus, the combination with a priming reservoir, of a centrifugal pump located in and substantially surrounded by said reservoir, and comprising a pump casing and a rotor therein, said pump casing being provided with an inlet adjacent to the axis of the rotor, and a discharge outlet above the axis of the rotor communicating with said reservoir, priming means independent of said inlet for connecting the pump casing with said reservoir below the axis of the rotor, said reservoir being provided with a discharge aperture for pumped water located above the axis of the rotor and communicating with the bottom of the reservoir by a curved passage exterior to the pump casing, said passage being in communication with the discharge outlet of the pump casing, whereby the pumped water is delivered to said discharge aperture from the bottom of the reservoir to insure the discharge therefrom of the solid matter in the pumped water, said reservoir being also provided with a discharge aperture above the axis of the rotor and directly connected with the discharge outlet of the pump casing, and a removable closure for one of said discharge apertures in the casing.

4. In a pumping apparatus the combination with a pump casing, having inlet and discharge passages, and a rotor within said casing, of a priming nozzle discharging into the pump casing adjacent to the axis of the rotor, a priming reservoir surrounding the pump casing and having portions extending above and below the level of the discharge aperture of said nozzle, a tubular connection from the lower portion of the reservoir to said nozzle, the upper portion of the reservoir being provided with a normal outlet aperture communicating with the discharge passage from the pump, and said reservoir on one side of the pump casing being in communication with said discharge passage, said reservoir being provided with an auxiliary discharge aperture on the other side of the pump, and means for closing one of said discharge apertures.

5. In a pumping apparatus, the combination with a pump casing and rotor, said casing having an inlet aperture coaxial with the rotor and a tangential discharge passage extending upwardly from the casing, of a priming nozzle arranged substantially coaxial with respect to the rotor, a priming reservoir surrounding the pump casing and said discharge passage and extending above and below the level of the discharge aperture of said nozzle, a tubular connection from the lower part of the reservoir to said nozzle, means for supplying liquid to be pumped to said inlet aperture having a portion located above the level of said aperture, the upper portion of said reservoir having a normal discharge aperture in communication with said discharge passage and

said reservoir communicating at its upper end with said discharge passage, an air vent for the upper portion of said reservoir, and a normally open vent valve therefor constructed to be closed when the pump is operating normally and the upper portion of said reservoir is filled with liquid, said reservoir having an auxiliary discharge aperture at a point remote from the connection between the reservoir and said discharge passage, and a closure for one of said discharge apertures.

6. In a priming apparatus, the combination with a priming reservoir, of a centrifugal pump located within and substantially surrounded by said reservoir, and comprising a pump casing and a rotor therein, said pump casing being provided with an inlet adjacent to the axis of the rotor and a discharge outlet communicating with said reservoir, a priming nozzle independent of said inlet discharging at its upper end into the pump casing adjacent to the axis of the rotor and having a tubular inlet portion communicating with the reservoir below the axis of the rotor, and a ball valve for closing said inlet portion of the nozzle, said ball having a specific gravity which will hold it unseated against the suction of the pump through said nozzle, but will cause it to be seated by the addition of water pressure on its lower surface when the reservoir is substantially filled with water.

CHARLES HIRAM FERGUSON.