March 5, 1935. C. H. FERGUSON 1,993,268

CENTRIFUGAL PUMP

Filed Aug. 16, 1929 4 Sheets-Sheet 1

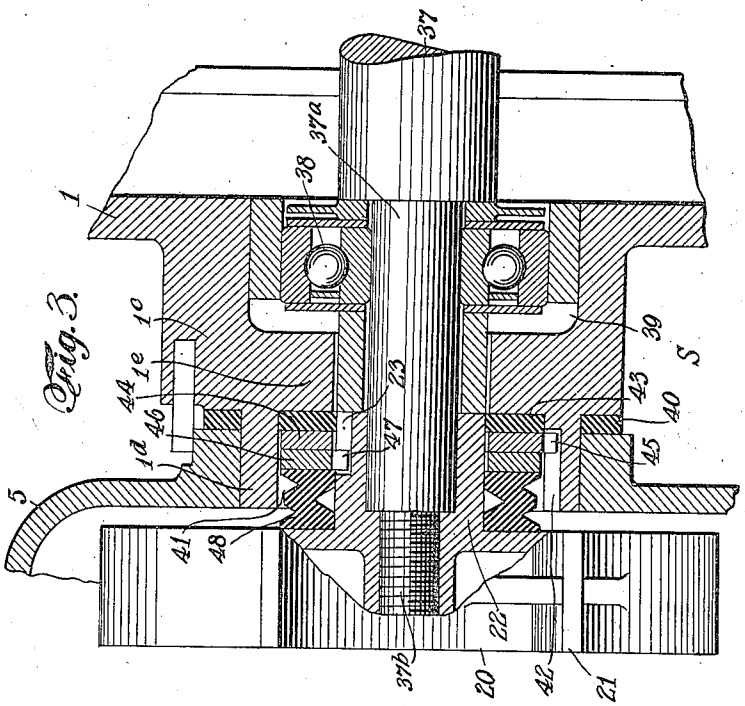


Fig. 3.

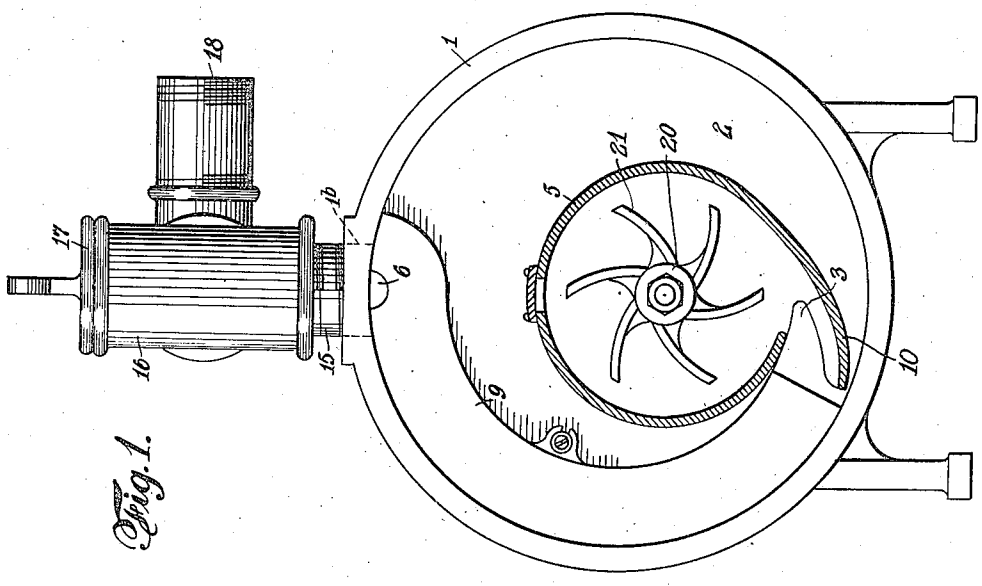


Fig. 1.

INVENTOR
CHARLES H. FERGUSON
BY
Louis Prevost Whitaker
ATTORNEY

March 5, 1935. C. H. FERGUSON 1,993,268

CENTRIFUGAL PUMP

Filed Aug. 16, 1929 4 Sheets-Sheet 2

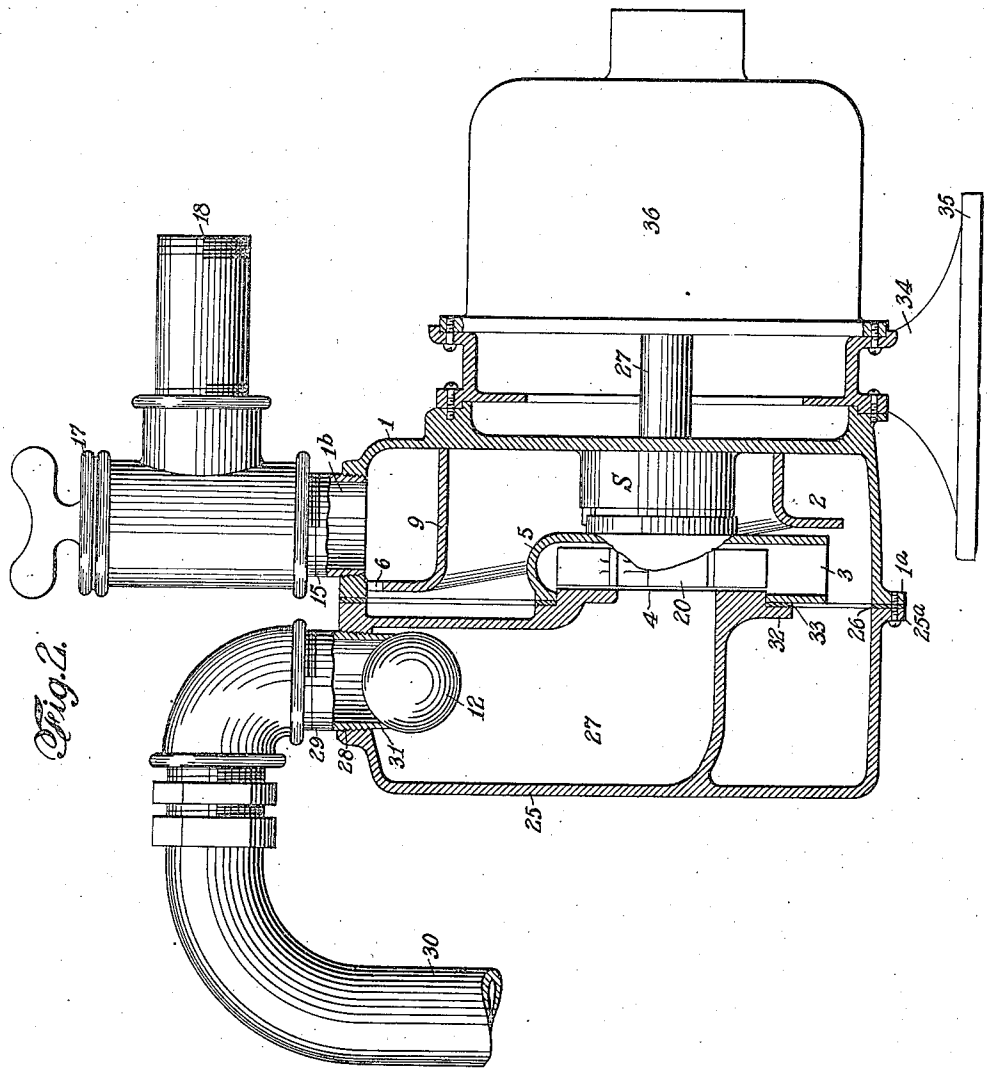


Fig. 2.

INVENTOR
CHARLES H. FERGUSON
BY
Thomas Prevost Whitaker
ATTORNEY

March 5, 1935. C. H. FERGUSON 1,993,268

CENTRIFUGAL PUMP

Filed Aug. 16, 1929 4 Sheets-Sheet 3

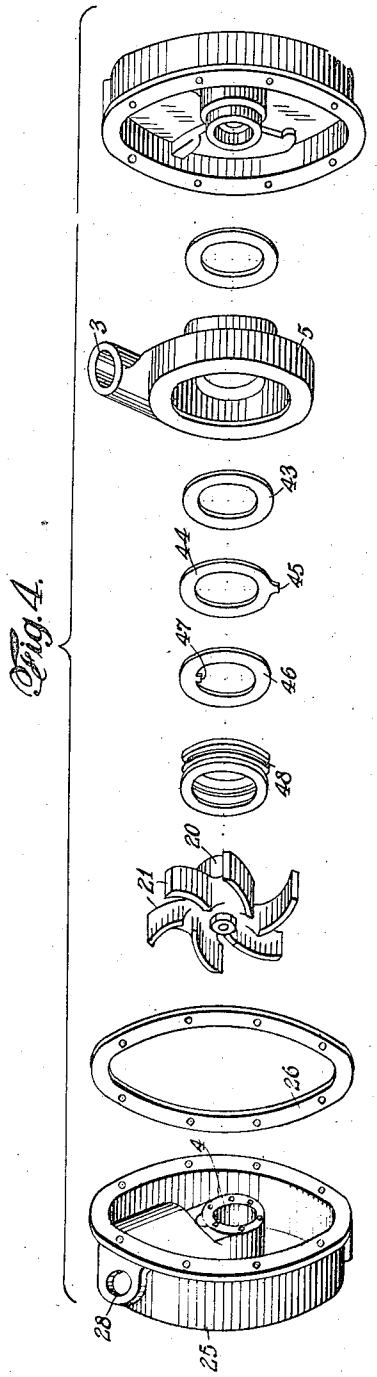


Fig. 4.

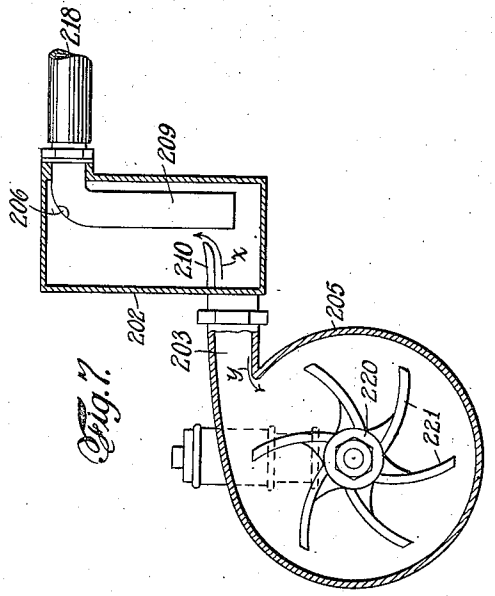


Fig. 7.

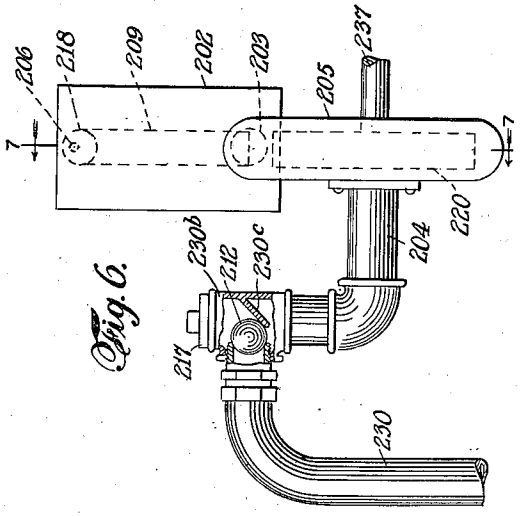


Fig. 6.

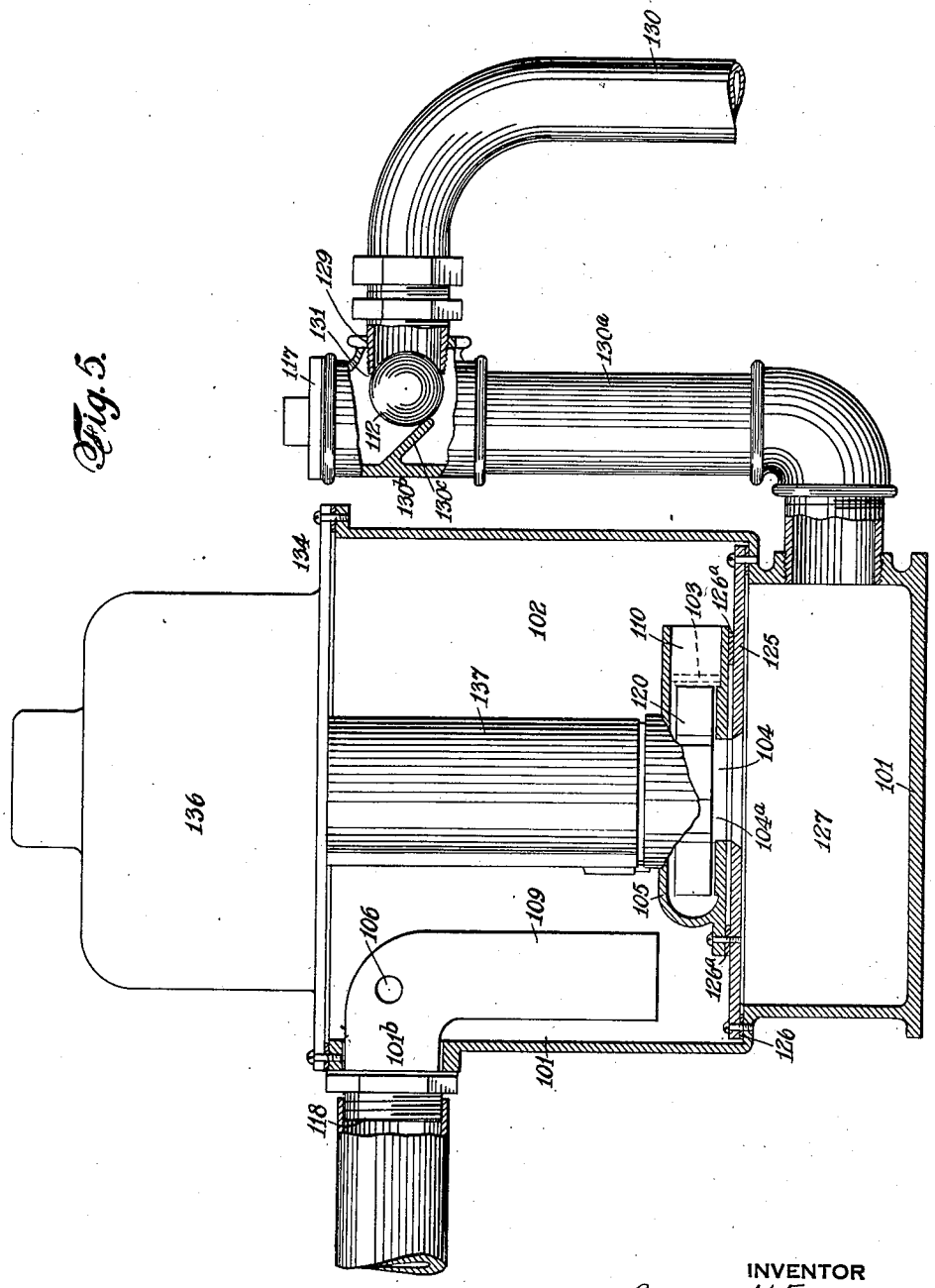
INVENTOR
CHARLES H. FERGUSON
BY
Louis Prevost Whitaker
ATTORNEY

March 5, 1935. C. H. FERGUSON 1,993,268

CENTRIFUGAL PUMP

Filed Aug. 16, 1929 4 Sheets-Sheet 4

Fig. 5.



INVENTOR
CHARLES H. FERGUSON
BY
Thomas Prevost Whitaker
ATTORNEY

Patented Mar. 5, 1935 1,993,268

UNITED STATES PATENT OFFICE

1,993,268

CENTRIFUGAL PUMP

Charles Hiram Ferguson, Valhalla, N. Y.

Application August 16, 1929, Serial No. 386,340

15 Claims. (Cl. 103—113)

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings which illustrate several embodiments of the invention selected by me for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

My invention consists in a portable self priming pumping apparatus of the centrifugal or rotary type adapted particularly for handling heavily charged liquids containing sand, gravel and other solid matter. Self priming centrifugal pumps as heretofore constructed have met with limited success when used for handling liquids containing considerable amounts of foreign matter. The small and frequently numerous passages for the passage of liquid soon become clogged, and when screens have been resorted to to prevent foreign matter from entering the pump, it has been necessary to stop the operation of the pump at frequent intervals to permit the cleaning of the screens.

My invention overcomes these difficulties and provides a self priming pump which can be used without screens and without danger of becoming clogged by foreign matter in the liquid. According to my invention I provide a pump which has but one suction and one discharge opening, the discharge opening being of greater area than the suction opening and being extremely short so as to provide an easy outlet from the pump casing, and in connection with the pump I provide a priming reservoir which preferably surrounds the pump proper and into which the liquid is directly discharged from the discharge opening of the pump. I also provide means for maintaining priming water in the reservoir, which is drawn into the pump casing through the discharge opening thereof and discharged therefrom through the same opening together with air withdrawn from the suction aperture, as hereinafter described, so that should foreign matter be present in the priming water it will enter and leave the pump casing through the discharge passage thereof without interfering in any way with the priming action. Other objects of the invention include the provision of means for more effectively sealing the pump shaft against leakage from or to the pump casing, means for preventing the loss of the priming liquid when the pump is at rest, and means for providing access to the interior parts of the apparatus for repair or replacement of worn parts.

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

Referring to the accompanying drawings which illustrate several embodiments of the invention,

Fig. 1 represents a vertical sectional view of a pump embodying my invention, parts being shown in elevation.

Fig. 2 represents a vertical sectional view on the line 2—2 of Fig. 1, parts being shown in elevation.

Fig. 3 is a detail sectional view illustrating the sealing means for connecting the impeller housing or pump casing to the pump body and for preventing leakage around the impeller or pump shaft.

Fig. 4 represents the parts shown in Fig. 3 in separated relation.

Fig. 5 is a vertical sectional view of a pump embodying my invention showing a modification.

Fig. 6 is a partial elevation of a pump embodying my invention showing a modification.

Fig. 7 is a section on line 7—7 of Fig. 6.

In Figs. 1, 2 and 3, I have illustrated the preferred form in which I have embodied my invention. In these figures 1 represents what I term the main frame or body of the apparatus, which is in the form of a hollow casting closed at one end except for the necessary aperture for the passage of the pump shaft therethrough and open at the other end, and provided with an attaching flange 1^a. This pump body contains within it the main portion of the priming reservoir, indicated at 2, and is preferably provided with a curved discharge passage, indicated at 9, leading from the bottom of the reservoir to the upper part of the main body and communicating with the discharge opening of the apparatus, 1^b, through which the entire output of the apparatus is discharged. In this instance the discharge aperture 1^b is connected by a nipple 15 to one end of a T 16, the other end being provided with a detachable filling plug 17, and the central opening of the T being connected with the main discharge pipe 18 of the apparatus, which may be of any desired length. The discharge passage 9 within the reservoir 2, and at the extreme upper end of the reservoir, is provided with an air vent aperture 6, to facilitate the escape of air from the reservoir during the priming operation.

5 represents the pump or impeller casing, which is provided with a suction inlet, indicated at 4, adjacent to the axis of the rotary impeller, which is indicated at 20, and is provided with a series of blades 21, which preferably do not extend to the inner periphery of the impeller casing, as

shown in Fig. 1. The impeller casing is provided with a substantially tangential discharge outlet, indicated at 3. The impeller casing, 5, is provided on the outer side of the outlet, 3, with a projecting wall or deflector, indicated at 10, to facilitate the discharge of liquid from the casing. This discharge outlet, 3, is the only outlet with which the impeller casing is ordinarily provided, and the pump or impeller casing is preferably so mounted that this outlet 3, is below the axis of the impeller and preferably closely adjacent to the lower end of the curved discharge passage, 9, although this is not absolutely essential, and the apparatus will work effectively with the discharge aperture in other positions if the discharge aperture is maintained below the level of the priming water in the reservoir. As will be more particularly explained hereafter, the discharge aperture 3, from which the liquid and solid matter passing through the pump is discharged, also serves to admit priming water to the pump or impeller casing during the priming operation. The outer face of the body 1 is closed by an end plate, indicated at 25, provided with flanges 25^a which are clamped to the flanges 1^a of the body 1 by bolts or screws, a packing washer, indicated at 26, being employed between the flanges in order to make a tight joint. Within the end plate 25 is a space 27, separated by suitable partition walls. This space I term the suction reservoir, and at the upper end of the same is the main inlet aperture 28 for the apparatus, here shown as screw threaded to receive a nipple 29, to which the usual uptake pipe 30 is connected. The inlet aperture 28 is preferably provided with a valve seat, and in this instance I have shown the nipple 29 extending into the suction reservoir 27, and provided with a valve seat 31 at its lower end. This valve seat is adapted to receive a floatable ball valve, indicated at 12, which may be formed of balsa wood or cork composition, or any other suitable material. This ball valve will be easily pushed away from its seat by the incoming water when the pump is operating, and when the pump is stopped the ball valve will seat and prevent the water within the pump casing and reservoir being siphoned back through the uptake 30. The lower end of the suction reservoir 27 communicates with the pump or impeller casing, by the aperture 4 adjacent to the axis of the impeller, and as shown in Fig. 2, the end plate 25 is provided with annular flange portions, indicated at 32, to engage the impeller housing, a suitable gasket, indicated at 33, being provided between the parts in order to make a tight joint. The body 1 of the pump is supported by means of a standard, indicated at 34, provided with a suitable base 35 and this standard and base may be cast integrally with the body 1 or formed separately, as herein shown, and connected thereto in any usual or desired manner. The opposite face of the standard supports a suitable motor for driving the impeller, and in this instance I have indicated diagrammatically an electric motor 36, but it is to be understood that a gasoline engine or other type of motor may be employed. 37 indicates the impeller shaft, which may be formed integrally with the motor shaft, or connected thereto in any desired way.

In Figs. 3 and 4, I have indicated means for insuring a tight joint between the impeller housing and the main body, and between the impeller shaft and the parts through which it passes from the impeller to the motor. As shown in this figure, 38 represents the supporting bearing for the impeller shaft, in this instance a ball bearing of usual construction, which is inserted in a recess 39 in the main body 1, which is provided with a hub portion 1^c surrounding this recess. This hub is provided with a sleeve of reduced diameter, indicated at 1^d, upon which the impeller housing 5 is fitted and secured in any desired manner, a packing washer, indicated at 40, being inserted between the impeller housing and the hub 1^c. The hub 1^c is provided with a recess 41 separated from the recess 40 by an inwardly extending annular wall 1^e. A reduced portion 37^a of the pump shaft extends through the bearing 38 and through the recess 41 and is provided with a threaded portion 37^b upon which the impeller 20 is secured, the impeller hub 22 extending into the recess 41. The impeller hub 22 is provided with a longitudinally locking groove or recess, indicated at 23, on its exterior, and the inner face of the recess 41 is provided with a similar locking groove or recess 42. In assemblying the parts of the apparatus I employ a packing gasket 43 which surrounds the hub of the impeller within the recess 41, and rests against the face of the wall 1^e, which is perpendicular to the axis of the impeller. On the outer face of this gasket I employ a metal sealing washer 44, which has a projection 45 extending into the groove 42 in the hub 1^c so as to prevent it from rotating. 46 represents a similar metal sealing washer, which engages the washer 44, and has a projecting portion 47 extending into the groove 23 in the hub of the impeller so that it will rotate therewith. Between the metal sealing washer 46 and the impeller 47 I employ a yielding resistance member, indicated at 48, which in this instance is formed of molded rubber corrugated in cross-section. It will be seen that this resistance member 48 exerts at all times a pressure against the washers 46 and 44 and the gasket 43 in a direction parallel to the axis of the impeller, which will make a very tight seal between the impeller shaft and the parts through which it extends, while the only surfaces in wearing contact are the adjacent surfaces of the metal sealing washers 44 and 46. The various parts just described are shown in separated relation in Fig. 4, and it will be seen that by having the parts of the pump body formed separately and detachably connected in the manner shown, access may be readily had to the pump housing for the removal, replacement or repair of any of the parts of the apparatus.

Assuming that the apparatus hereinbefore described is to be operated for the first time, the reservoir 2 is filled with liquid through the opening provided by removing the cap 17, and the cap is replaced. The liquid will enter the impeller housing or pump casing through the discharge opening 3, and will tend to compress the air in the portion of the pump casing above the inlet aperture. The liquid is trapped within the reservoir and pump casing in communication with the discharge aperture of the pump casing or impeller housing which it effectively seals. The impeller is rotated in the direction of the arrow *a* in Fig. 1. The liquid within the pump casing will be thrown to the periphery and will be discharged through the discharge opening 3 along the outer side thereof, and as the opening 3 is in direct communication with the reservoir 2, liquid will be drawn into the pump casing through the aperture 3 adjacent to the inner side thereof and at the same time air will be drawn in through the suction opening 4 from the

suction reservoir and uptake. Thus as the rotation of the impeller continues, the liquid being heavier than the air is forced outwardly toward the periphery of the pump casing or impeller casing and carried around what may be described as an outer channel therein, while the air will be drawn in adjacent to the axis of the impeller and thrown outwardly against the wall or channel of water, the air being discharged along with the water through the discharge aperture 3. The air will rise through the priming water either within the discharge passage 9, in which case it goes directly to the outlet pipe 18, or exterior to the passage 9, in which it will pass through the vent aperture 6, and proceed to the outlet pipe 18. This action continues until the air is exhausted from the suction reservoir and uptake, whereupon liquid from the source of supply will rise in the uptake, filling the suction chamber and the pump or impeller housing, and being discharged through the opening 3 into the reservoir 2. As soon as this condition exists the discharge of water from the pump or impeller casing will completely fill the discharge opening 3, and the pump will continue to discharge into the reservoir 2 a stream having the cross section of the discharge aperture, 3. As soon as the reservoir 2 is filled, a pressure will be created therein and the liquid will be forced out through the discharge passage 9 and the outlet pipe 18. As the discharge passage 9, extends to a point near the bottom of the reservoir, it will follow that as the water is forced out through this discharge passage it will necessarily carry with it the heavier and other particles of foreign matter contained in the liquid, so that there is no opportunity for sediment to collect in the reservoir or in the pump casing.

During the priming operation, the projecting wall 10 of the pump or impeller casing, which projects beyond the outer edge of the discharge aperture 3, has the effect of carrying the water discharged through the aperture 3, together with the layer of air carried thereby beyond the inner edge of the discharge aperture 3, so that this air is prevented from reentering the pump or impeller casing through the discharge aperture 3, and is forced to find its way upward to the discharge pipe 18 either through or exterior to the discharge passage, as previously described.

As long as the pump is in operation, the water entering through the uptake 30 will push aside the ball valve 12 and render it ineffective. When the pump stops for any reason, the ball valve 12 will instantly seat and prevent the water within the reservoir 2 and the reservoir 27 and within the pump casing from being siphoned out, thus trapping a quantity of the liquid within the reservoir 2, the pump casing and reservoir 27, and sealing the discharge opening of the pump, so that the pump can be started at any time and will prime itself in the manner previously described, withdrawing the air from the uptake 30 and resuming pumping.

In some instances I may dispense with the ball valve 12, in which case it would be desirable to provide other means for preventing the siphoning of the water of the reservoir 2 and pump housing when the pump is stopped. This can be accomplished by providing a small aperture at the top of the pump or impeller casing to admit air and break the siphoning action when the water is lowered to that point. In order to save illustration I have shown in Fig. 1, the impeller casing provided with such an opening, which is indicated at 50, and is shown closed by a plate 51 in Fig. 1, it being understood that this plate can be removed in case the ball valve or its equivalent is dispensed with.

In Fig. 5 I have shown a modified form of pumping apparatus embodying my present invention, in which the axis of the impeller is vertical instead of horizontal. In this figure in which the parts corresponding to those shown in Figs. 1 and 2 are given the same reference numerals with the addition of 100, 101 represents the body, in the lower portion of which is formed a suction reservoir 127 separated from the upper portion of the interior of the body by a sealing plate 125 engaging a gasket 126 between it and a shouldered portion of the main body to which it is secured in any usual or desired manner, as by bolts. The plate 125 is provided with the suction inlet aperture 104, registering with a corresponding aperture 104^a in the pump casing or impeller housing 105, a suitable gasket 126^a being provided to effect a tight joint between the impeller housing and the plate 125. 103 represents the discharge aperture of the pump casing 105, and 110 the outwardly extending curved lip adjacent to the outer edge of said opening. Adjacent to the upper end of the body 101, and conveniently located in the side wall thereof, is a discharge aperture 101^b, to which the discharge pipe 118 is connected in any desired way. From the discharge opening 101^b a discharge passage 109 extends to a point near the bottom of the priming reservoir 102, which is formed within the main body above the plate 125, and this passage 109 is provided near its upper end with a vent aperture 106. In this instance the body 101 is closed at its upper end by a plate 134, secured thereto in any desired manner upon a gasket or washer 134^a, and in this instance the electric motor, indicated at 136, is supported on this plate 134 and has its shaft extending through a depending cylindrical portion 137 surrounding the motor shaft, not shown, which is connected to the impeller shaft and sealed in the manner previously described with reference to the preceding figures. In this instance the suction reservoir 127 is provided with an upwardly extending pipe 130^a, provided with a T fitting 130^b at its upper end, which is closed by a cap 117 serving as a filling cap for the apparatus, and the central opening of the T is provided with the nipple 129 extending into the T and providing a seat 131 for the floatable ball valve 112. The interior of the T is provided with a deflector 130^c to guide the ball in its movements. The operation of this form of the apparatus will be exactly the same as that previously described, and the operation need not be repeated.

In Figs. 6 and 7 I have illustrated a simple embodiment of my invention, in which the parts corresponding to those in Figs. 1 to 4 inclusive are given the same reference numerals with the addition of 200. In this modification 205 represents the pump or impeller casing having the inlet 204 adjacent to the axis of the impeller 220, and connected with the uptake 230 through a T casting 230^b constructed and operating exactly like the one illustrated in Fig. 5, in connection with the uptake and provided with the ball valve 212. The discharge opening 203 is connected to the lower end of a closed reservoir 202, said reservoir being in this instance disposed vertically

and provided with a discharge pipe 218 adjacent to its upper end, and with a discharge passage 209 extending from the discharge pipe to a point near the bottom of the reservoir, said discharge passage having an air vent aperture 206 near its upper end. The outer wall of the discharge aperture 203 may be continued beyond the inner wall, as indicated at 210, within the reservoir to conduct the discharge water and air during the priming operation along the path indicated by the arrow, *x*, in Figure 7, and out of the path of the incoming water, indicated by the arrow *y* in that figure, although the part 210 may be dispensed with if desired. The operation of this form of apparatus will be substantially as hereinbefore described. If the pump stops, water will be trapped by the closing of the valve 212 within the reservoir and pump casing, and as soon as the pump is again started, water will be drawn in along the lower or inner side of the discharge aperture 203 and discharged along the upper or outer side thereof, together with air withdrawn from the uptake, which air escapes through the vent aperture 206 and discharge pipe 218, until the air is exhausted and the pump is in full operation, when the water will be discharged from the bottom of the reservoir through the passage 209 and outlet pipe 218, carrying with it any sediment or heavy particles.

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

1. A pumping apparatus comprising a reservoir, a rotary pump having a rotor provided with a horizontal axis and a casing provided with a tangential discharge aperture communicating with said reservoir and adapted to receive priming liquid from, and to discharge it together with air, into said reservoir, said casing having a suction aperture out of communication with said reservoir, the outer wall of said discharge aperture being extended beyond the other wall and projecting to a point adjacent to the bottom of the reservoir to deliver the air carried by the discharged liquid out of contact with the entering liquid and to prevent the accumulation of sediment.

2. A pumping apparatus comprising a reservoir, a rotary pump having its casing provided with a tangential discharge aperture communicating with said reservoir and adapted to receive priming liquid from, and to discharge it together with air, into said reservoir, and having a suction aperture out of communication with said reservoir, the outer wall of said discharge aperture being extended beyond the inner wall thereof, to deliver the air carried by the discharged liquid out of contact with the entering liquid.

3. A pumping apparatus comprising a reservoir, a rotary pump having its casing provided with a tangential discharge aperture communicating with said reservoir and adapted to receive priming liquid from, and to discharge it together with air, into said reservoir, and having a suction aperture out of communication with said reservoir, the outer wall of said discharge aperture being extended beyond the other wall to deliver the air carried by the discharged liquid out of contact with the entering liquid, a suction reservoir communicating with said suction aperture, provided with an inlet aperture, a valve seat therefor, and a floatable ball valve for engaging said seat.

4. A pumping apparatus comprising a main body forming a priming reservoir, a rotary pump casing detachably mounted in said body and having a discharge and priming aperture communicating with the bottom portion of said reservoir, and forming the only communication between the pump casing and reservoir, said main body having a detachable end plate provided with a suction aperture for the pump casing, and said reservoir being provided with a discharge outlet at its upper end.

5. A pumping apparatus comprising a main body forming a priming reservoir, a rotary pump casing detachably mounted in said body and having a discharge and priming aperture communicating with the bottom portion of said reservoir, and forming the only communication between the pump casing and reservoir, said main body being provided with a detachable end plate provided with a suction reservoir out of communication with the priming reservoir and communicating with the suction aperture of the pump casing, said priming reservoir having a discharge outlet adjacent to its upper end, and a discharge passage extending therefrom to a point near the bottom of the priming reservoir.

6. In a centrifugal pumping apparatus, the combination with a centrifugal pump comprising a circular pump casing having an axial inlet adjacent to the axis of the impeller, and a single discharge and priming aperture adjacent to the periphery of said pump casing, of a rotary impeller freely revoluble on a horizontal axis in said casing, and a priming reservoir surrounding the pump casing, in communication with the said discharge and priming aperture of the pump casing and out of communication with the inlet of said casing, and a main discharge passage for the apparatus directly connected at all times with said reservoir and receiving the pumped water directly therefrom during the pumping operation, an inlet reservoir communicating with said axial inlet aperture of the pump casing and extending above the same, and provided with an inlet aperture above said axial inlet aperture, said last named aperture being provided with a horizontal valve seat, and a floatable valve in said inlet reservoir for engaging said seat.

7. In a centrifugal pumping apparatus, the combination with a centrifugal pump comprising a circular pump casing having an axial inlet adjacent to the axis of the impeller, and a single discharge and priming aperture adjacent to the periphery of said pump casing, of a rotary impeller freely revoluble on a horizontal axis in said casing, and a priming reservoir surrounding the pump casing, in communication with the said discharge and priming aperture of the pump casing and out of communication with the inlet of said casing, and a main discharge passage for the apparatus directly connected at all times with said reservoir and receiving the pumped water directly therefrom during the pumping operation, said discharge passage having a portion extending to a point near the bottom of said reservoir for insuring the discharge of solid matter therefrom during pumping, an inlet reservoir communicating with said axial inlet aperture of the pump casing and extending above the same, and provided with an inlet aperture above said axial inlet aperture, said last named aperture being provided with a horizontal valve seat, and a floatable valve in said inlet reservoir for engaging said seat.

8. In a centrifugal pumping apparatus, the combination with a centrifugal pump comprising a circular pump casing having an axial inlet adjacent to the axis of the impeller, and a single aperture adjacent to the periphery of said pump

casing, of a rotary impeller freely revoluble in said casing, and a priming reservoir surrounding the pump casing, in communication with the said discharge aperture of the pump casing and out of communication with the inlet of said casing, and a main discharge passage for the apparatus directly connected at all times with said reservoir and receiving the pumped water directly therefrom during the pumping operation, said discharge passage having a portion extending to a point near the bottom of said reservoir for insuring the discharge of solid matter therefrom during pumping, and being provided with an air outlet adjacent to the upper end of the said reservoir and communicating therewith, an inlet reservoir communicating with said axial inlet aperture of the pump casing and extending above the same, and provided with an inlet aperture above said axial inlet aperture, said last named aperture being provided with a horizontal valve seat, and a floatable valve in said inlet reservoir for engaging said seat.

9. In a centrifugal pumping apparatus, the combination with a centrifugal pump comprising a circular pump casing having an axial inlet adjacent to the axis of the impeller, and a single tangential discharge and priming aperture adjacent to the periphery of said pump casing, of a rotary impeller freely revoluble in said casing, and a priming reservoir surrounding the pump casing, in communication with the said discharge and priming aperture of the pump casing adjacent to the bottom of said reservoir, said reservoir being out of communication with the inlet of said casing, and a main discharge passage for the apparatus directly connected and in open communication at all times with said reservoir and receiving the pumped water directly therefrom during the pumping operation, said discharge passage having a portion extending to a point near the bottom of said reservoir for insuring the discharge of solid matter therefrom during pumping, the tangential discharge aperture of the pump casing discharging in a direction toward the lower end of said discharge passage, to assist in delivering solid matter from said reservoir.

10. In a centrifugal pumping apparatus, the combination with a centrifugal pump comprising a circular pump casing having an axial inlet adjacent to the axis of the impeller, and a single tangential discharge aperture adjacent to the periphery of said pump casing, of a rotary impeller freely revoluble in said casing, and a priming reservoir surrounding the pump casing, in communication with the said discharge aperture of the pump casing and out of communication with the inlet of said casing, and a main discharge passage for the apparatus directly connected at all times with said reservoir and receiving the pumped water directly therefrom during the pumping operation, said discharge passage having a portion extending to a point near the bottom of said reservoir for insuring the discharge of solid matter therefrom during pumping, the tangential discharge aperture being located adjacent to the lower part of the pump casing and discharging in a direction toward the lower end of said discharge passage, and being provided with a deflector extending from the outer edge portions only of said discharge aperture and projecting toward said discharge passage, to permit the admission of water from said reservoir to the pump casing adjacent to the inner edge of said aperture and to facilitate the discharge of entrained air from the pump casing during priming.

11. In a centrifugal pumping apparatus, the combination with a centrifugal pump comprising a circular pump casing having an axial inlet adjacent to the axis of the impeller, and a single tangential discharge aperture adjacent to the periphery of said pump casing, of a rotary impeller freely revoluble in said casing, and a priming reservoir surrounding the pump casing, in communication with the said discharge aperture of the pump casing and out of communication with the inlet of said casing, and a main discharge passage for the apparatus directly connected at all times with said reservoir and receiving the pumped water directly therefrom during the pumping operation, said discharge passage having a portion extending to a point near the bottom of said reservoir for insuring the discharge of solid matter therefrom during pumping and being provided with an air inlet adjacent to the upper end of the said reservoir, the tangential discharge aperture being located adjacent to the lower part of the pump casing and discharging in a direction toward the lower end of said discharge passage, and being provided with a deflector extending from the outer edge portions only of said discharge aperture and projecting toward said discharge passage, to permit the admission of water from said reservoir to the pump casing adjacent to the inner edge of said aperture and to facilitate the discharge of entrained air from the pump casing during priming, said air outlet adjacent the upper end of the said reservoir during priming.

12. In a pumping apparatus, the combination with a reservoir provided with a discharge adjacent to its upper end and a discharge passage leading therefrom to a point near the bottom of the reservoir, of a rotary pump having its casing provided with a tangential discharge aperture communicating with said reservoir and discharging in a direction toward the lower end of said discharge passage to facilitate the delivery of entrained solid material during pumping, and adapted to receive priming liquid from and to discharge it together with air into said reservoir during priming, said pump casing having a suction aperture out of communication with said reservoir, the outer wall of said discharge aperture being extended beyond the other, in a direction toward said discharge passage, to deliver the air carried by the discharged water during priming clear of the entering liquid.

13. In a pumping apparatus, the combination with a reservoir provided with a discharge adjacent to its upper end and a discharge passage leading therefrom to a point near the bottom of the reservoir, of a rotary pump having its casing provided with a tangential discharge aperture communicating with said reservoir and discharging in a direction toward the lower end of said discharge passage to facilitate the delivery of entrained solid material during pumping, and adapted to receive priming liquid from and to discharge it together with air into said reservoir during priming, said pump casing having a suction aperture out of communication with said reservoir, the outer wall of said discharge aperture being extended beyond the other, in a direction toward said discharge passage, to deliver the air carried by the discharged water during priming clear of the entering liquid, and to facilitate the delivery of solid matter during pumping, said discharge passage being provided with an aperture

adjacent to the upper part of said reservoir communicating therewith to facilitate the discharge of air from said reservoir during priming.

14. A pumping apparatus comprising a liquid reservoir provided with a discharge adjacent to its upper end and having a discharge passage extending therefrom to a point adjacent to the bottom of the reservoir, said discharge passage being separated from the reservoir throughout its entire length and having an inlet communicating with said reservoir at a point adjacent to the bottom of the same to insure the discharge of entrained solid matter, a pump casing located in said reservoir provided with an axial inlet aperture out of communication with the reservoir, and a tangential discharge aperture communicating with the reservoir adjacent to the lower end thereof and adjacent to the inlet of said discharge passage, and a rotary impeller in said pump casing, said reservoir being provided with an air vent aperture communicating with said discharge passage adjacent to the upper end of said passage.

15. A pumping apparatus comprising a liquid reservoir provided with a discharge adjacent to its upper end and having a discharge passage extending therefrom to a point adjacent to the bottom of the reservoir, said discharge passage being separated from the reservoir throughout its entire length and having an inlet communicating with said reservoir at a point adjacent to the bottom of the same to insure the discharge of entrained solid matter, a pump casing located in said reservoir provided with an axial inlet aperture out of communication with the reservoir, and a tangential discharge aperture communicating with the reservoir adjacent to the lower end thereof and a deflector at the lower edge of said aperture forming a continuation of the wall of the pump casing and directed toward the inlet of said discharge passage, and a rotary impeller in said pump casing, said reservoir being provided with an air vent aperture communicating with said discharge passage adjacent to the upper end of said passage.

CHARLES HIRAM FERGUSON.