Oct. 13, 1936. A. C. SAXE 2,057,634

CENTRIFUGAL PUMP STRUCTURE

Filed Nov. 2, 1931 3 Sheets-Sheet 1

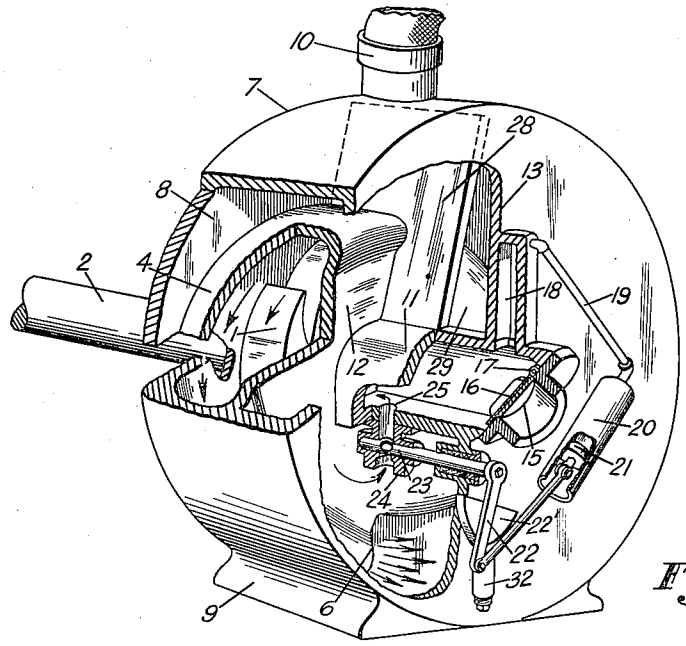


Fig. 1

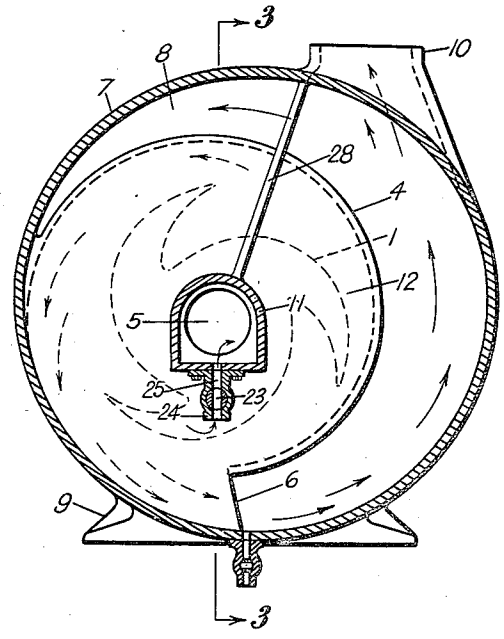


Fig. 2

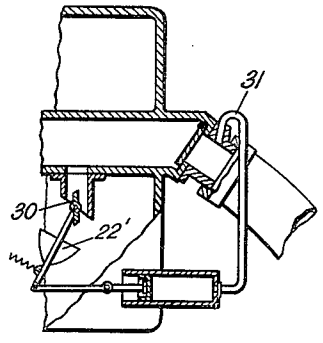


Fig. 7

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CENTRIFUGAL PUMP STRUCTURE

Filed Nov. 2, 1931 3 Sheets-Sheet 2

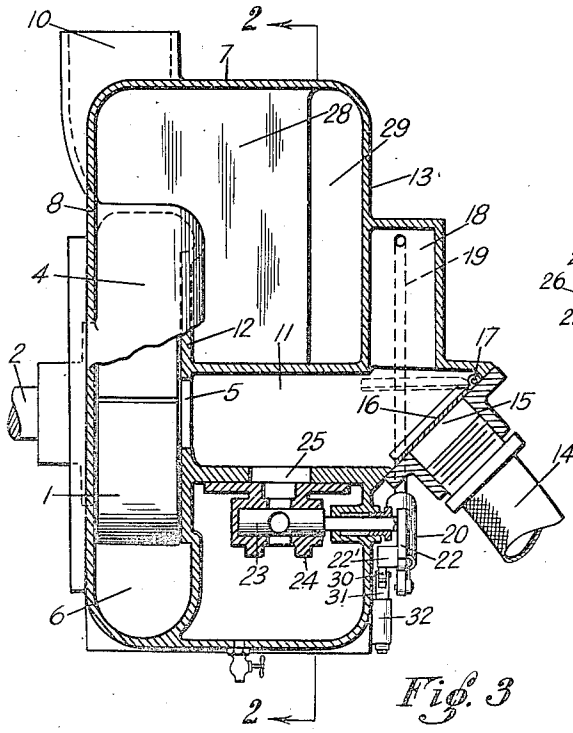


Fig. 3

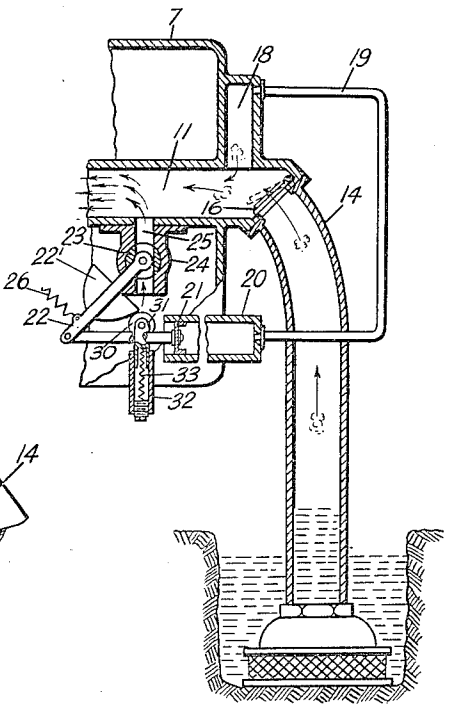


Fig. 4

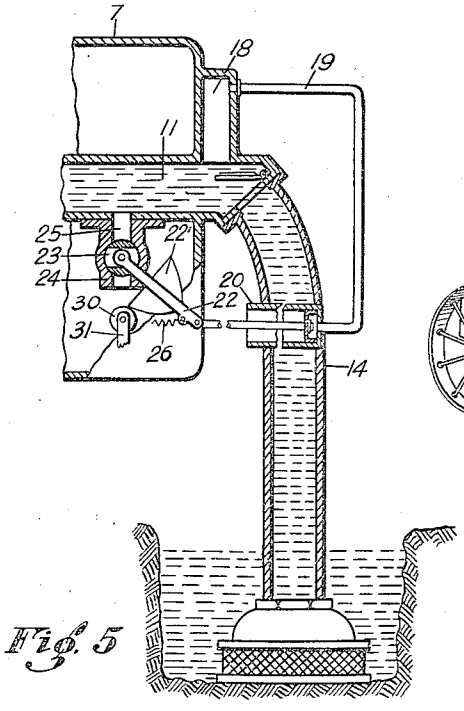


Fig. 5

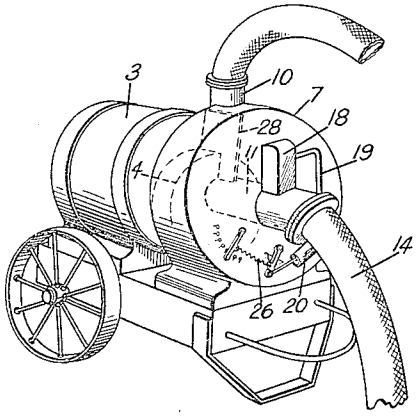


Fig. 6

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CENTRIFUGAL PUMP STRUCTURE

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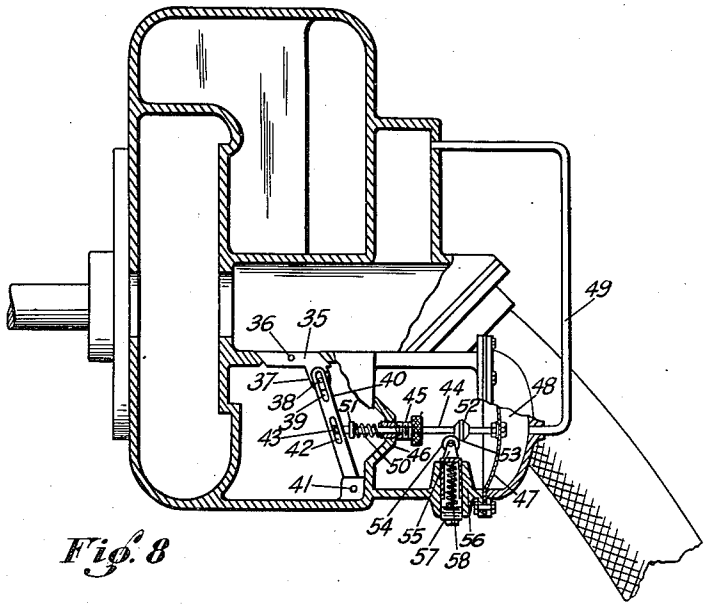


Fig. 8

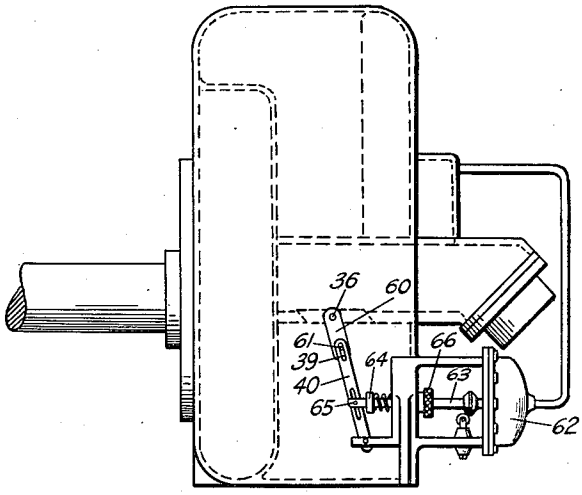


Fig. 9

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL PUMP STRUCTURE

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Application November 2, 1931, Serial No. 572,666

3 Claims. (Cl. 103—113)

My invention relates to Centrifugal pump structure. It has to do, more particularly, with centrifugal pumps which are designed to be used in the removal of water from an excavation, although it is not necessarily limited thereto.

One of the objects of my invention is to provide a centrifugal pump which will be self-primed under practically all conditions of operation.

Another object of my invention is to provide a centrifugal pump having a compartment for the priming water which is of such a nature and so disposed in relation to the impeller and the impeller chamber that all danger of clogging by mud and silt or other solids will be obviated.

Another object of my invention is to provide a self priming centrifugal pump which is of a simple and compact structure and which has all the parts readily accessible for inspection or repair.

In its preferred form, my invention preferably contemplates the provision of an impeller chamber of volute form which is eccentrically disposed within a larger and substantially cylindrical compartment which is adapted to contain the priming liquid. The impeller chamber empties into the larger compartment. In addition, however, the impeller is designed to be supplied with priming liquid, whenever necessary, through the medium of a passage leading from the outer compartment through the suction chamber and into the impeller. This passage is under the control of a valve which is held open by means of a spring or other mechanism, as long as there is excess air in the suction chamber or line to permit admission of the priming liquid into such line. This valve is designed to close when the pump creates sufficient suction to actuate a piston provided for closing the valve, the spring or other mechanism being capable of predetermined adjustment so that the valve may be set to operate only when water is being adequately pumped.

The preferred embodiment of my invention is shown in the accompanying drawings, wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a perspective view, partly broken away, of my self-priming pump.

Figure 2 is a section taken at right angles to the axis of my centrifugal pump and along line 2—2 of Figure 3.

Figure 3 is a section taken on line 3—3 of Figure 2.

Figure 4 is a detail, in section, diagrammatically showing the priming valve open to permit the passage of water to the impeller to effect a priming action.

Figure 5 is a detail, in section, diagrammatically showing the priming valve closed under the influence of suction created by the column of water produced by the effectual operation of the pump.

Figure 6 is a perspective view of the complete apparatus which I preferably use in the embodiment of my invention.

Figure 7 is a detail, in section, diagrammatically showing a modified form of my apparatus.

Figures 8 and 9 are diagrammatic views illustrating a further modified form of my invention.

In the drawings, my invention is shown as comprising an impeller 1 which is carried by a rotatable shaft 2 that is designed to be driven by a motor 3 (Figure 6) or by any other type of prime mover. This impeller 1 is mounted within a volute chamber 4 having an axial inlet 5 and an outlet at 6.

The impeller chamber is eccentrically disposed within a container 7. The construction is such that the wall 8 of the container also becomes one wall of the impeller chamber. The container 7 may be provided with a supporting base 9 and preferably has a discharge port 10 upon the upper side thereof.

In coaxial alignment with the port 5 of the impeller chamber is a suction chamber 11 which may be integrally formed with the side wall 12 of the impeller chamber and which preferably extends outwardly through the side wall 13 of the container 7. This suction chamber is designed for communication with a suction hose 14.

At the point of juncture between the suction chamber 11 and the suction hose 14 there is provided a valve seat 15 having a one-way flap valve 16 which is pivoted at its upper side, as at 17. Disposed directly above this flap valve 16 is a supplemental chamber 18 which may be integrally formed upon the wall 13 of the container 7.

Leading from this chamber 18 is a pipe 19 whose opposite end is connected with the interior of a cylinder 20. Disposed within the cylinder 20 is a piston 21 having connected thereto a pitman which is in turn connected to a crank 22 of an oscillatable valve 23. The oscillatable valve 23 is mounted within a valve housing 24 and controls a passageway 25 which leads from the interior of the container 7 to the interior of the suction chamber 11.

The valve 23 is normally held in open position by means of a coil spring 26 which has one end connected to the valve crank 22 and its other end

connected to a lever 27 which is adjustable in connection with a series of calibrations to permit setting of the spring to any desired tension. The structure is such that, when the pump is not operating or when there is an excess of air in the suction chamber 11, the spring 26 will be effective to maintain the valve 23 in open position and this open position of the valve will continue until water is being adequately pumped. The adequate pumping which must occur before the valve 23 will close is predetermined by the setting of the lever 27 and the consequent degree of tension imposed upon the coil spring 26.

It is quite desirable that the valve 23 be caused to move either into open or closed position with a quick snapping action. In order to ensure this, I have provided intermediate the length of the crank 22 a cam-like formation 22' which is designed to cooperate with the roller 30 which is carried upon the side wall 13 of the container 7. This roller 30 is preferably rotatably mounted upon the upper end of the stem 31 which is carried in a socket 32 and normally maintained at its outward position by means of an adjustable coil spring 33.

When the crank 22 is moved to the left, its cam-like end 22' rides over the roller 30 until the outermost point of this cam is beyond the high point of said roller, whereupon the further movement of the crank is completed with a snapping action. The apparatus operates in a similar manner when the crank moves toward the right upon the application of sufficient vacuum to move the piston sufficiently to close the valve. In this case, as in the opening operation, the cam-like portion of the crank 22 rides over the roller 30 until the high point of this cam has passed thereover, whereupon the pressure of the spring 33 completes the movement of the crank and the valve with a snap.

My invention further embodies, within the container 7, a baffle plate 28, which extends upwardly from the suction chamber 11 and outwardly from the impeller chamber 4 in a substantially radial direction, with relation to said suction chamber. This baffle plate 28 is disposed in the upper portion of the container 7 but is of less width than the interior of this container, with the result that a passageway 29 is provided between one end of this baffle plate and the adjacent wall of the container. The baffle plate functions to intercept the swirling water being discharged from the impeller chamber and to divert the major portion thereof through the discharge outlet 10, while at the same time, permitting a sufficient amount of continuous circulation of the water within the container, to avoid settling and accumulation of dirt and silt or other extraneous material that would tend to clog the container or passageway 25.

In operation, the container 7 is preferably substantially filled with water. The initial rotation of the impeller 1 serves to circulate priming water through the impeller chamber, into the priming fluid compartment, through the passageway 25 and suction chamber 11 back into the impeller chamber. Since this water is insufficient to satisfy the impeller, the partial vacuum resulting draws air from the suction chamber and from the suction line. This operation continues, with the passageway 25 being maintained open and with the priming fluid continuously circulating until a preselected degree of vacuum exists in the suction line. The apparatus may be so adjusted that the priming fluid passageway 25 will be closed by its valve at the instant the column of water in the suction line enters the suction chamber 11, or immediately before this instant. If desired, however, the passageway may be held open for a substantial period after the pumping action has actually begun. The closing of the priming fluid valve is effected by the occurrence of a preselected degree of vacuum in the suction line with a consequent drawing of the piston 21 to the head of the cylinder 20 in the closing of the valve 23, as illustrated in Figure 5. Obviously, the discontinuance of the operation of the pump or the temporary occurrence of an excessive quantity of air in the suction line will reduce the vacuum applied to the piston 21 and permit the spring 26 to open the valve 23 to admit priming fluid from the container 7 into the suction chamber 11 and thence to the impeller.

It will likewise be apparent that the operation of the pump serves to discharge water from the impeller chamber in such a manner that it will travel around the interior of the container 7. Part of this water will pass outwardly through the discharge port 10 but a portion of it will travel entirely around the interior of the container. Thus, as long as the pump is in operation, the water being discharged from the impeller chamber will be maintained in constant motion to a sufficient extent to ensure that all dirt, silt or other extraneous matter will ultimately be carried through the port 10 with a consequent avoidance of settling of this material within the container and clogging of this container or the passageway 25.

A modified form of my invention is shown in Figure 7. In this figure, the valve 23 has been replaced by a butterfly valve 30. Also, the pipe 19 has been replaced by a pipe 31 which extends from the suction hose in the rear of the flap-valve, instead of from the suction chamber. The operation of this structure will be substantially identical with the operation of the preferred form.

A further modification of my invention is illustrated in Figures 8 and 9, which are substantially identical in principle. The operation of these structures is substantially identical with the operation of the structures previously described. They differ, however, in certain respects which will now be pointed out.

Instead of using a cylindrical valve, I have provided a balanced valve 35 which is carried upon trunnions 36 centrally disposed upon opposite sides thereof. In Figure 8, the valve 35 is provided with a downwardly extending lug 37 carrying a pin 38 which extends into a slot 39 of a lever 40. The lever 40 is pivotally mounted at its lower end upon a pivot pin 41 and is provided intermediate its length with a slot 42.

This slot 42 is adapted to receive a pin 43 which is carried upon a stem 44 that passes through a sleeve 45 which is threaded into a wall 46 forming a part of the container wall 13. The opposite end of the stem 44 is secured to a diaphragm 47 disposed in a supplemental chamber 48. That portion of the chamber which is to the right of the diaphragm 47, as shown in Figures 8 and 9, is connected to the vacuum pipe 49 which corresponds to the vacuum pipe 19 of the structure previously described.

In between the wall 46 and the lever 40, the stem 44 is embraced by a coil spring 50 which abuts at one end against the adjustable sleeve 45 and at the other end against the collar 51. The spring 50 is effective to assist in moving the valve 35 to open position when there is not suffi-

cient vacuum in the pipe 49 to bring about or maintain closing of the valve. The tension of this spring may be adjusted by adjustment of the sleeve 45.

The stem 44 is further provided in between the sleeve 45 and the diaphragm 47 with a cam 52 having a high central ridge 53 with inclined surfaces on both sides thereof. Mounted for cooperation with this cam 52 is a roller 54 which is rotatably supported by a hollow plunger 55. The plunger 55 is carried in a housing 56 which is integrally formed upon the wall of the chamber 48 and which is closed at its lower end by means of a nut 57. Disposed within the hollow plunger 55 is a coil spring 58 which rests at its lower end upon the nut 57 and whose tension may be adjusted by this nut.

It will be understood that this resiliently supported plunger with the roller carried thereon will cooperate with the cam 52 to complete the opening or closing of the valve with a snap action. In other words, as the stem 44 moves to open the valve, the cam 52 will ride over the roller 54 until the ridge 53 of this cam passes the center of this roller, whereupon the roller will ride down the right inclined surface of the cam to snap the valve into open position. In the closing action, the cam 52 will move to the left and ride upwardly over the roller 54 until the ridge 53 of the cam passes the center thereof, whereupon the spring-pressed roller will ride down the left inclined surface of the cam to effect closing of the valve with a snap action.

It will be apparent that the action of the diaphragm-operated structure is substantially identical with the action of the piston-operated structure previously described. In other words, the diaphragm will move to the right upon predetermined vacuum conditions to bring about closure of the valve. The degree of vacuum required to effect this closure may be regulated by adjustment of the coil spring 50 which will also assist in moving the diaphragm to the left and opening the valve when the partial vacuum produced is inadequate to prevent this movement.

The structure of the device shown in Figure 9 and the operation thereof is identical with that shown in Figure 8, with the exception that the trunnion 36 upon which the valve is mounted extends outwardly through the wall of the container and carries a crank 60 which is disposed outside of the container. The lower end of this crank is provided with a pin 61 which extends into the slot 39 of the lever 40 so that the lever may readily operate the valve through the medium of the said crank. In this case, chamber 62, stem 63, spring 65, sleeve 66 and collar 64 correspond with chamber 48, stem 44, spring 50, sleeve 45 and collar 51. However, stem 63, spring 65, and collar 64, in this case, are disposed entirely on the outside of the container.

It will be seen from this that I have provided an extremely simple form of centrifugal pump which has a self-priming mechanism of compact and efficient form. The entire structure is sightly and, yet, the various parts thereof are readily accessible for inspection or repair. The self-priming feature is simple and readily accessible and the chamber for containing the priming liquid, as well as the means for controlling the delivery of the liquid into the suction chamber, is such as to ensure continuous operation without clogging of said delivery controlling means or other parts of the apparatus. Furthermore, it will be apparent that, by delivering the water from my impeller chamber into a body of water which is already in motion, I am able to decrease the resistance to the expulsion of water from the impeller chamber.

Having thus described my invention, what I claim is:

1. A self-priming pump structure comprising a priming fluid compartment, an impeller chamber within said compartment, an impeller in said chamber, a priming fluid port, a valve controlling said port, a suction line leading into said impeller chamber, and means independent of pressure in the delivery line and responsive solely to the static vacuum head produced in said suction line by circulation of the priming fluid for substantially closing said valve when a predetermined degree of vacuum has been produced in the suction line, and means comprising a snap action device to ensure snap closing and opening of said valve.

2. A self-priming pump structure comprising a priming fluid compartment, an impeller chamber within said compartment, an impeller in said chamber, a priming fluid port, a valve controlling said port, a suction line leading into said impeller chamber, and means independent of pressure in the delivery line and responsive solely to the static vacuum head produced in said suction line by circulation of the priming fluid for substantially closing said valve when a predetermined degree of vacuum has been produced in the suction line, means comprising a snap action device to ensure snap closing and opening of said valve, and an adjustable resilient means forming a part thereof.

3. A self-priming pump structure comprising a priming fluid compartment having a discharge outlet leading therefrom, an impeller chamber disposed within said priming fluid compartment, an impeller in said impeller chamber, a suction line leading into said impeller chamber and having a portion thereof disposed within said priming fluid compartment, said portion of said suction line having a restricted priming port formed therein, said priming port being located below the horizontal center plane of said suction line, a valve controlling said port, and a means independent of the pressure in the delivery line and responsive solely to the static vacuum head produced in said suction line by circulation of the priming fluid for substantially closing said valve, said means being inoperative to initiate closing of said valve until a predetermined degree of vacuum has been produced in the suction line and priming of the pump has been completed.

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