United States Patent

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[54] **AUTOMATIC CENTRIFUGAL PUMP PRIMER**
1 Claim, 2 Drawing Figs.

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[51] **Int. Cl.** **F04b 17/00,** F04b 35/00, F04b 21/00
[50] **Field of Search** 103/113, 203, 236, 228; 415/24; 417/364, 435

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ABSTRACT: A valve assembly connected in series between a source of vacuum pressure and the intake port of a centrifugal pump. The valve assembly includes a float chamber and float therein for monitoring the passage of fluid through the pump. When the pump ceases to operate upon fluid and requires priming, the float in the float chamber causes communication between the inlet port of the pump and the source of vacuum pressure thereby effecting priming. The present invention further includes an inlet hole in the float chamber which is selectably opened to terminate vacuum in said chamber and allowing air to enter, causing any fluid buildup to be removed by centrifugal pump vacuum, restoring the chamber to ready-prime position automatically. Further, redundant check valve means are provided for insuring the prevention of fluid flow from the float chamber to the vacuum source.

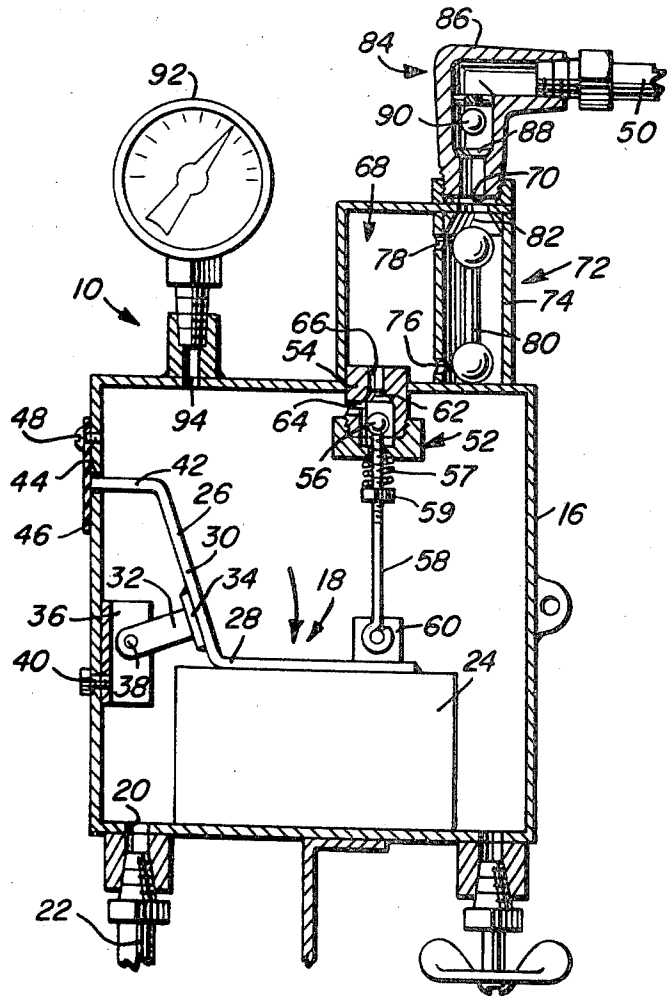


Fig. 1

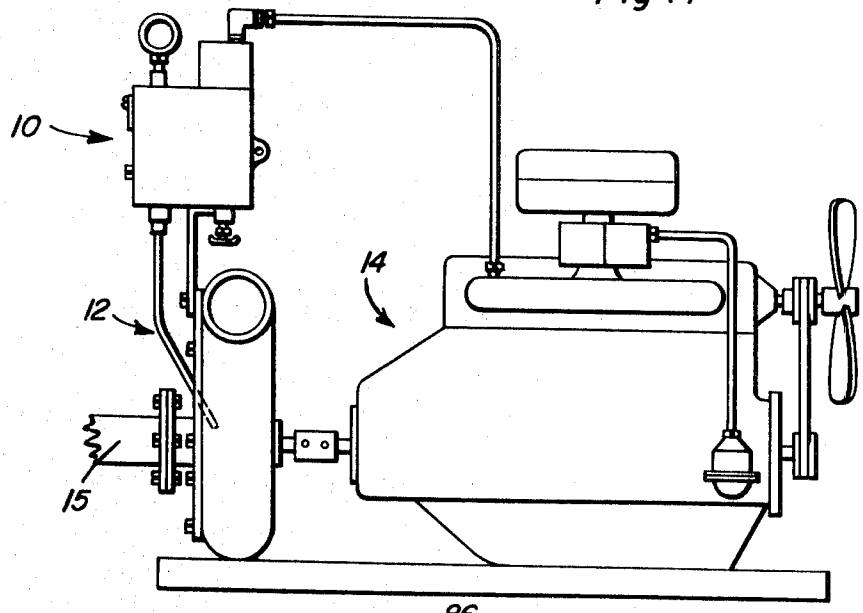
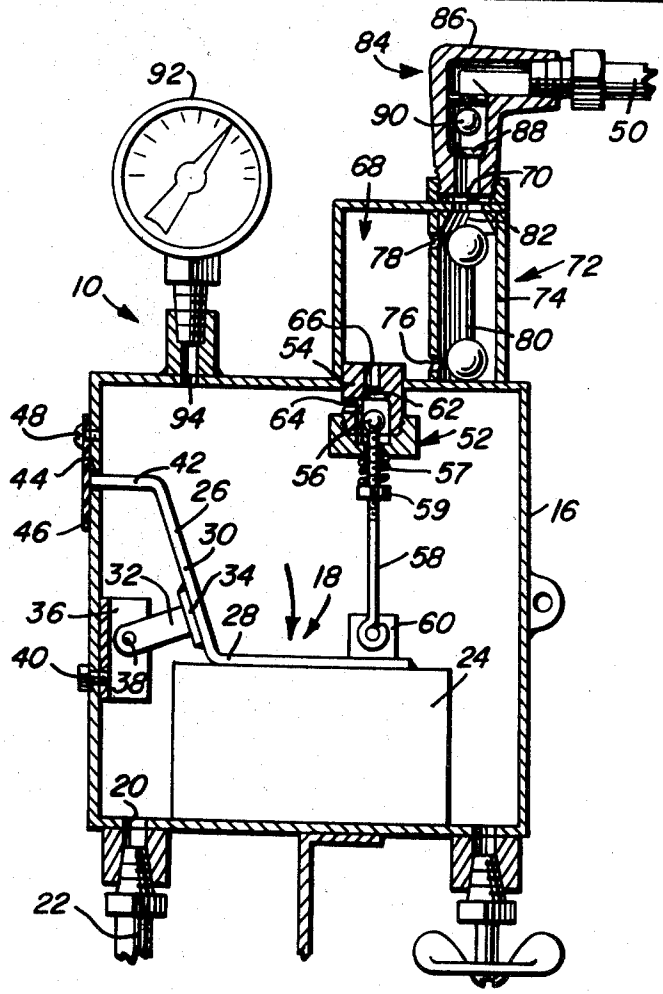


Fig. 2



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AUTOMATIC CENTRIFUGAL PUMP PRIMER

The present invention relates to pump primers and more particularly to a primer for use with a centrifugal pump.

At present, during construction operations it is often necessary to pump out a water-filled trench or excavated sump. To do this, a centrifugal pump is generally used which operates efficiently only when water entering the sump exceeds or equals the capacity of the pump. When deposited water falls below the pump's capacity, the pump will eventually operate upon all the water until air enters the bottom of the section hose connected to the pump. The pump will cease to discharge water until sufficient vacuum can be built up in the hose thereby initiating the flow of water therethrough once again. Once the suction effect of the pump or suction hose is lost, the waiting period required to restore suction may cause the water to rise in the trench to a height where construction operations must cease until the water level recedes.

The present device serves as a monitor or regulator which insures that a centrifugal pump is in a primed condition when it is not discharging water, so that the pump will be ready to do so upon application of water to the pump's suction hose. The present invention includes a valve assembly including a float chamber with a float-actuated vent valve which is selectably opened to terminate vacuum in said chamber by allowing air to enter thus causing any fluid buildup in the chamber to be removed by centrifugal vacuum thereby restoring the chamber to ready-prime position automatically. Further, the present invention includes multiple or redundant check valves for insuring that water does not flow from the inlet port of the centrifugal pump (which is being monitored) to a source of vacuum pressure which comes into play when water is not being discharged by the pump. When the latter condition exists, the check valves permit communication between the source of vacuum pressure and the inlet port of the centrifugal pump thereby priming the pump. An additional check valve is included in the present invention to prevent reverse flow from the source of vacuum pressure to the float chamber, in the abnormal condition in which the vacuum pressure is higher than the pressure at the pump inlet port.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a side elevational view illustrating the mounted relation of the present invention to a centrifugal pump and an internal combustion engine prime mover.

FIG. 2 is a sectional view illustrating the interior components of the present invention.

Referring to FIG. 1, the present invention is generally referred to by reference numeral 10 which serves as a monitor or regulator and is serially connected to serve as a controlled valve between the inlet port of a centrifugal valve 12 and the intake manifold of an internal combustion engine generally indicated by 14. During normal water discharge by the pump, the invention serves to seal any connection between the intake manifold and the pump inlet port so that normal pumping operations are effected. However, when air enters the suction hose 15 of the pump 12, it is necessary to restore a primed condition. This is accomplished by the present invention when the valve assembly selectively connects the intake manifold, which is a source of vacuum pressure, to the inlet portion of the pump.

The particular structure of the present invention is clearly seen in FIG. 2 wherein the main body of the device is an enclosure 16 serving as a float chamber. Enclosed with the chamber is a float mechanism generally indicated by 18 serving to monitor the flow of liquid to the pump and the discharge therefrom. The monitoring operation is effected by connecting a pipe 22 between the inlet port of the centrifugal pump 12 and an inlet fitting 20 of the float chamber 16. Float means 18 particularly includes a conventional float member 24 which may be a hollowed or buoyant body. A mounting arm 26 is connected at a first end 28 thereof to the upper surface of the float member 24. An intermediate section 30 of the mounting arm is connected to a linkage 32 by means of welding 34 or the like. The opposite end of the linkage 32 is pivotally connected to an interiorly disposed L-shaped bracket 36 by a pivot mount 38. The bracket itself is mounted to the interior surface of the float chamber 16 by suitable fasteners 40. A third and opposite end portion of the mounting arm 26 is indicated by 42 and extends horizontally toward a wall of the float chamber 16. More particularly, the end of the latter-mentioned mounting-arm section is received within an aperture 44 formed in the floating chamber 16. The aperture serves as an inlet hole for admitting air into the interior of the float chamber. A flap valve 46 made of rubber, neoprene or similar material is normally disposed in sealing engagement with the aperture 44. The flap valve is secured to the external surface of the float chamber 16 by means of fasteners 48. In the normal disposition of the mounting arm, the flap valve is not engaged and therefore performs a sealing function. However, when the pump 12 is being automatically primed, the existence of connecting pipe 22 will cause a certain amount of water to be deposited within the float chamber 16 which elevates float member 24, in turn causing the displacement of the mounting arm 26 to force the flap valve 46 outwardly. In this respect, the mounting arm 26 may be considered an actuator for the flap valve. The dual purpose for venting the float chamber is to reduce the vacuum pressure therein which might otherwise induce water to be drawn into the intake manifold which also is prevented by a check valve arrangement and also restore the chamber to the ready-prime position automatically as hereinafter explained.

At this point, reference is made to manifold pipe 50 which is connected at one outward end thereof to the intake manifold of an internal combustion engine as seen in FIG. 1. The opposite end of the pipe is indirectly connected to pipe 22 through the present device which selectively prevents communication between the intake manifold pipe 50 and the connecting pipe 22 during periods of normal water discharge by the centrifugal pump. However, when such a discharge ceases, it is desirable to maintain the centrifugal pump in a primed condition. This is accomplished by selectively connecting the manifold pipe 50 with the connecting pipe 22 thereby causing the transfer of vacuum pressure to the connecting pipe 22 which will in turn be transferred to the inlet port of the centrifugal pump 12.

In order to effect sealing action between the manifold pipe 50 and the connecting pipe 22 during pump priming, a first check valve assembly is provided and is indicated by reference numeral 52. The check valve assembly includes a casing 54 extending into the float chamber 16. A valve seat 62 is formed in the casing and receives a ball valve 56 therein. An opening is formed in the casing to permit the passage of the upper end of actuator rod 58 therein. The ball valve 56 is attached to the received end. The opposite end of the actuator rod is pivotally mounted to the first section of mounting arm 26 through a pivotal connection indicated by 60. As indicated in the figure, the valve seat includes a downwardly stepped passageway 62 for effecting sealing action by the ball valve 56 upon upward displacement of the actuator rod 58. The latter occurs when water fills the fluid chamber 16 thereby causing the float means 18 to become elevated.

In the event that the actuator rod 58 or ball valve 56 stick or become otherwise inoperative, the check valve assembly 52 is bypassed and a second check valve becomes operative. This is accomplished by a port 64 formed in the casing 54 of the check valve assembly. The outer end of the port 64 communicates with the float chamber while the inner end of the port 64 communicates with the valve seat 62. Thus, when the ball valve 56 is inoperative and the level of water reaches port 64, water will bypass ball valve 56 and flow through an outlet port 66 of the check valve assembly 52. A second float chamber 68

is positioned over the check valve outlet 66. Thus when water passes through the outlet 66 it fills the float chamber 68. The second float chamber 68 has an outlet port 70 which is serially connected to the manifold pipe 50. A second float assembly generally indicated by 72 is associated with the second float chamber 68. In detail, a hollow cylinder 72 is disposed within the second float chamber 68 and includes two vertically spaced apertures 76 and 78 formed therein. A dumbbell-shaped float member 80 is located within the cylinder 74 and as will be appreciated by viewing the figure, as water enters the second float chamber 68 it causes upward vertical movement of the dumbbell-shaped float member 80. The inclusion of the two vertically spaced ports 76 and 78 insure that the presence of water in the second float chamber will be detected by the float member 80. As will be noted by referring to FIG. 2, the upper portion of the cylinder 74 includes an inwardly and upwardly tapered tapered valve seat 82 so that upon upward displacement of the vertically oriented dumbbell-shaped valve member 80, sealing action is effected and no fluid flows through the outlet port 70.

In order to prevent vacuum flow in the opposite direction, that is, in the case where pump vacuum pressure is greater than manifold vacuum pressure, a third check valve assembly of conventional and commercially available construction is provided at 84. This assembly includes an elbow casing 86 having right-angled passageway formed therein. A ball valve 90 is located within the passageway and during water discharge by the pump, the ball valve 90 is seated against a valve seat 88 in the right-angled passageway. As will be readily appreciated by viewing FIG. 2, this passageway is in serial alignment with the outlet port 70 of the second check valve assembly 72. When the ball valve 90 is seated on valve seat 88, it seals the manifold pipe 50 from the float chamber 16 so that a pressure condition which induces a reverse flow through the float chamber 16 would force the tight seating of ball valve 90 within its associated valve seat 88. Thus, the possibility of reverse flow is obviated.

To equalize or balance the valve 52, rod 58 is threaded and provided with a light coil spring 57 and an adjustable nut 59. The spring 57 is compressed when the valve member 56 is seated on seat 62 thus exerting downward pressure on the rod 58 to prevent vacuum pressure holding the valve member 56 and float 24 in elevated position.

In order to monitor pressure conditions within the first float chamber 16, a conventional pressure gauge 92 is mounted to the exterior of the float chamber 16 and communicates with the interior thereof through an outlet port 94 formed in the float chamber wall.

In summary, the present invention provides means for selectively connecting a source of vacuum pressure to the inlet port of a centrifugal pump when the pump is in a nondischarging condition. This permits the pump to maintain primed readiness. However, when the pump is normally discharging water, the present invention permits the sealing of the intake manifold pipe by preventing the flow of water thereto. Also, check valve means is provided for preventing reversed vacuum flow between the intake manifold pipe and the float chamber.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What I claim as new is as follows:

1. In an automatic primer for a centrifugal pump, the primer having a float chamber serially inserted between the pump and a source of vacuum pressure, the float chamber having an outlet port, the improved primer structure comprising, a float member, a valve actuated by the float member for preventing outward flow through the outlet port, an actuator rod connected at one end thereof to the valve, the opposite end of the rod being connected to the float member for moving the valve to a closed position in response to predetermined float displacement, a second float chamber communicating with the outlet port, a float valve means disposed in the second chamber, a second outlet port associated with the second chamber, the float valve means closing the second outlet port in response to the presence of liquid in the second chamber, the float valve means serving to prevent fluid flow to the source of vacuum pressure should the float-member-actuated valve fail, a check valve communicating with the second outlet port for preventing vacuum flow from the vacuum source in the event that the vacuum pressure of the source is exceeded by the vacuum pressure in the first mentioned float chamber, a vent hole formed in the first-mentioned float chamber, a flap valve normally sealing the hole, and actuator means connected to the float member for opening the flap valve when liquid enters the first-mentioned float chamber and elevates the float member, opening of the flap valve permitting inlet of air into the chamber thereby eliminating the vacuum therein and allowing any liquid buildup to return to the centrifugal pump and automatically restoring the float chambers to ready-prime condition, said actuator rod including spring means associated therewith to bias the valve connected thereto away from closed position thereby preventing the vacuum source from holding the float-member-actuated valve in closed position when liquid in the first float chamber is removed.