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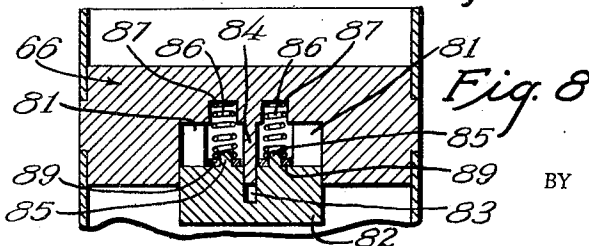
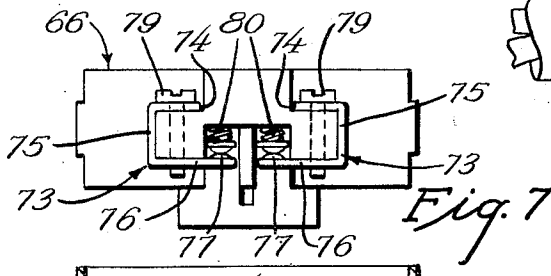
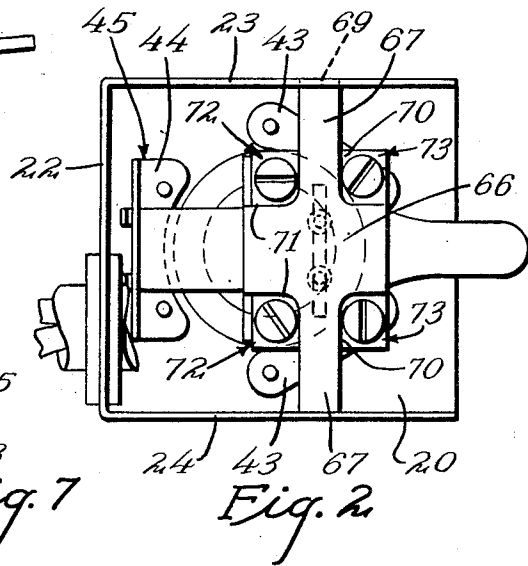
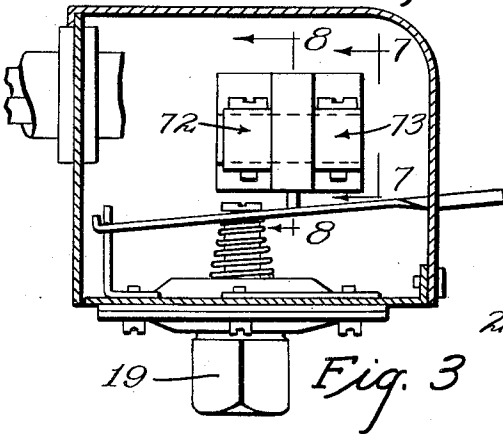
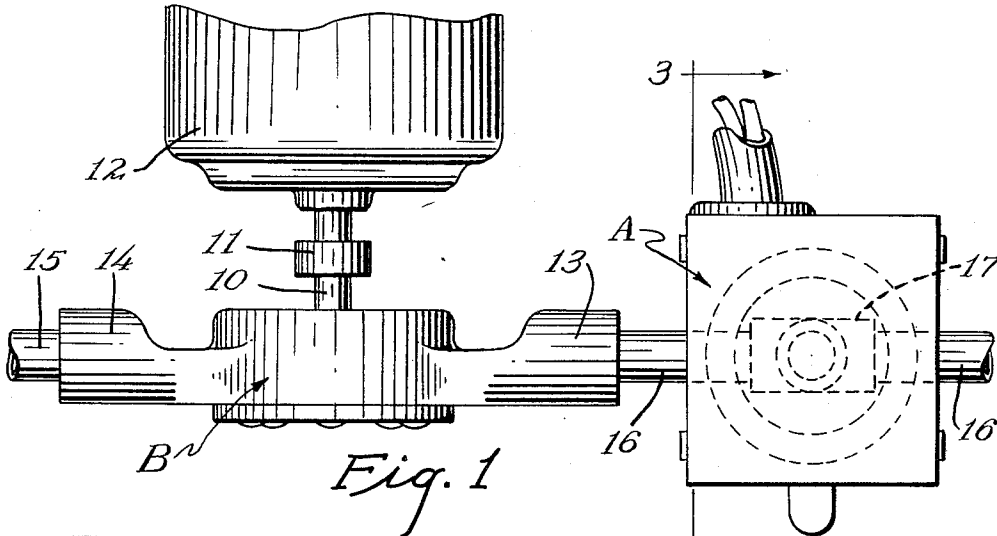
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2,765,743

PUMP CONTROL

Filed July 18, 1952

2 Sheets-Sheet 1



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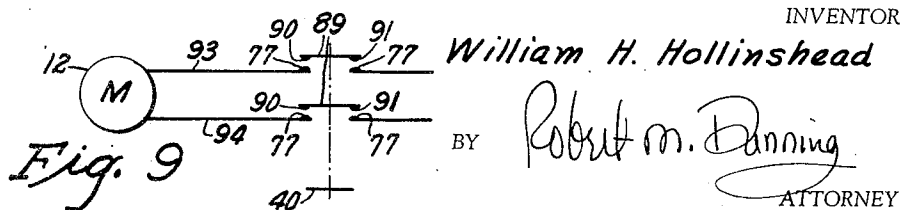
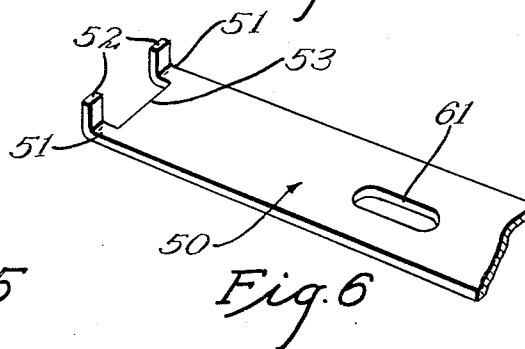
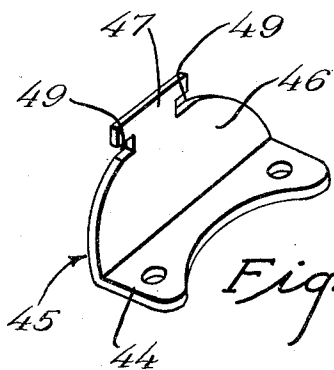
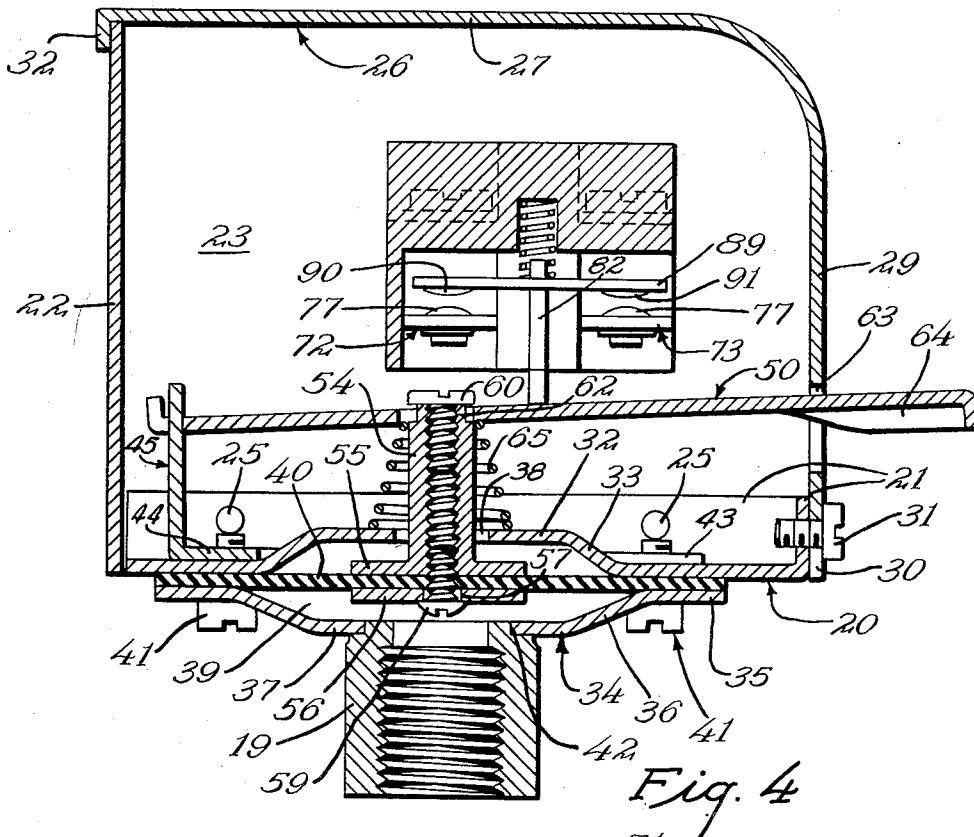
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2 Sheets-Sheet 2



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PUMP CONTROL

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Application July 18, 1952, Serial No. 299,601

5 Claims. (Cl. 103—25)

This invention relates to an improvement in pump controls and deals particularly with a switch structure capable of controlling the circuit to a pump having a resilient impeller.

During recent years the use of rotary pumps having resilient impellers has become increasingly popular. These pumps may be produced at low cost and are capable of pumping a considerable volume of water for their size. In general the pump has but one decided disadvantage. This lies in the fact that if the pump runs while dry, the impeller is quickly ruined and must be replaced.

An object of the present invention lies in the provision of a control for use in conjunction with a pump of the type described and which is capable of controlling the circuit to the pump motor. The apparatus is so arranged that when the suction line of the pump is broken or draws air rather than water, the circuit to the motor will open and the pump will stop.

A feature of the present invention resides in the provision of a control which will function to eliminate the difficulty normally experienced with rubber impeller pumps. In the past it has been necessary to watch the pumps carefully to be sure they do not run dry. Through the use of my control switch the pump may be left in operation and will automatically turn off when the liquid being pumped is depleted. As a result the pump may be used to function automatically to empty a sump or liquid container.

A feature of the present invention lies in the provision of a switch having an operating lever which is connected to a diaphragm, one side of which is in communication with the suction line of the pump. The other side of the diaphragm is open to atmosphere. When the pump is in operation and is drawing liquid from a liquid supply the pressure in the suction line is sufficiently below atmospheric pressure to maintain the switch operating lever in circuit closing position. However, when the pump ceases to draw liquid from its supply, the pressure in the suction line increases and the operating lever moves to circuit opening position.

A feature of the present invention lies in the simplicity of construction of the apparatus. The control switch is so simple that it may be produced at a low cost. At the same time, the device is extremely reliable in operation and contains but few moving parts. As a result the switch may function over extended periods of time with no attention.

An added feature of the present invention lies in the fact that any difficulty which might be experienced with the control switch may be readily detected and the control still acts to prevent the pump from injury. In the event the switch diaphragm should leak or loosen, air would be drawn into the suction line of the pump and prevent its operation. Thus in the event the control switch fails to function it will normally function to protect the pump from injury.

These and other objects and novel features of the pres-

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ent invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

Figure 1 is a plan view of a pump showing the control switch in the circuit thereof.

Figure 2 is a top plan view of the control switch with the top cover thereof removed.

Figure 3 is a sectional view through the switch, the position of the section being indicated by the line 3—3 of Figure 1.

Figure 4 is an enlarged sectional view through the center of the switch mechanism showing the arrangement of parts therein.

Figure 5 is a perspective view of the switch lever supporting bracket.

Figure 6 is a perspective view of a portion of the switch operating lever.

Figure 7 is a sectional view through a portion of the switch mechanism, the position of the section being indicated by the line 7—7 of Figure 3.

Figure 8 is a sectional view on the line 8—8 of Figure 3.

Figure 9 is a circuit diagram of the control circuit.

The switch A is of a type particularly useful in preventing injury to the impeller of a rotary pump such as B. The pump B is of the resilient impeller type in which the rotating impeller is formed of rubber or some similar material. This impeller is normally lubricated by the liquid flowing through the pump. However, in the event the suction line should open and the pump should fail to draw liquid, continued operation of the pump will soon permanently injure the impeller.

The pump B is provided with an impeller shaft 10 connected by a coupling 11 to a motor 12. The motor 12 is preferably an electric motor designed for continuous operation or at least for operation over the normal pumping periods of the pump B.

The pump B is provided with an inlet 13 and an outlet 14. The outlet 14 is connected to a pressure line 15. The inlet 13 is connected to the suction line 16 leading to a source of liquid supply. The switch A is interposed in the suction line 16 in any suitable manner. In the particular arrangement illustrated a T connection 17 is provided in the suction line 16 with the base of the T directed upwardly. This upward connection of the T is connected by a nipple to a suitable nut or coupling 19 supported at the lower extremity of the switch A.

As is best illustrated in Figure 4 of the drawings the switch includes a casing having a base plate 20 provided with upwardly extending marginal flanges 21 extending along at least three sides of the casing. The casing also includes a three sided housing member including a rear wall 22 and opposed side walls 23 and 24. Screws or other fastening means 25 connect the side walls 23 to the flanges 21 of the base plate 20 to hold the casing together.

The top of the casing and the forward wall thereof is open and is normally closed by a cover plate 26 which includes a top panel 27 and a front panel 29. The front panel 29 is notched at its lower extremity as indicated at 30 to accommodate a cover fastening screw 31 which holds the cover in place. The cover also includes marginal flanges such as 32 which overlap the rear wall 20 and the side walls 23 and 24.

The bottom panel of the base plate 20 includes a circular elevated portion 32 which is connected to the remainder of the base plate by a frustoconical wall 33. A closure disc 34 is secured beneath the base plate 20 and is provided with an anchoring flange 35 extending marginally thereabout which is connected by the frustoconical portion 36 to the circular lowered portion 37. By elevating a portion of the base plate and lowering the

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center portion of the closure disc, a diaphragm chamber 39 is provided between these parts to accommodate a diaphragm and to permit the vertical flexing thereof. The diaphragm 40 is anchored between the marginal edges of the closure plate 34 and the base plate 20. Bolts or cap screws 41 extend through the flange 35 through the diaphragm and through the base plate to secure the closure plate in position and to support the diaphragm within the chamber 39. The coupling 19 is brazed or otherwise secured at 42 to the closure plate 34, the center portion of the lowered portion 37 of the closure plate being apertured to accommodate the coupling. An axially aligned aperture 38 is provided in the elevated portion 32 of the base plate 20.

As indicated in Figure 2 of the drawings, a pair of reinforcing strips 43 may overlie the base plate 20 and be threaded to accommodate the cap screws 41. These reinforcing strips permit the cap screws 41 to be tightened more effectively than would otherwise be possible. The remaining cap screws 41 encircling the flange 35 extend into the base flange 44 of the switch lever mounting bracket 45 best illustrated in Figure 5 of the drawings.

The bracket 45 includes the anchoring flange 44 and an upright flange 46. The flange 46 includes an upward projection 47 having a pair of oppositely disposed notches 49 therein along opposite side edges thereof. The switch actuating lever 50 which is used in conjunction with the bracket 45 is provided with a bifurcated end which is formed by two projecting fingers 51 which are arranged in spaced relationship. The fingers 51 are provided with upturned extremities 52. The fingers thus provide a notch 53 therebetween which is of proper dimension to accommodate the flange area between the notches 49. The up-turned ends 52 lie rearwardly of the projection 47 and hold the switch lever from disengagement. It will be seen that the lever 50 may be attached to the bracket 45 by extending the up-turned ends of the fingers 52 through the notches 49 with the lever 50 held vertically and then swinging the lever down so that the body of the lever is substantially horizontal and the up-turned finger ends 52 hold the lever from disengagement.

An internally threaded sleeve 54 is provided with a clamping flange 55 which lies in surface contact with the upper surface of the diaphragm 40. A clamping disc 56 having a central aperture 57 lies beneath the diaphragm 40. A screw 59 extends through the aperture 57 of the disc 56 through the center of the diaphragm 40 and threads into the internally threaded sleeve 54 to connect the sleeve to the diaphragm. A screw 60 extends through a slot 61 in the switch lever 50 and is threaded into the upper end of the internally threaded sleeve 54. The screw 60 is tightened against a reduced diameter end 62 of the sleeve 54 which extends through the slot 61. The reduced diameter sleeve portion 62 is of proper length so that the lever may swing angularly in its operation.

The free end of the lever 50 extends through an aperture 63 in the front panel 29 of the cover 26 and is provided with flanged reinforcing edges 64. This lever 50 thus projects from the switch housing for manual operation in starting or stopping the pump. A conical spring 65 is interposed between the undersurface of the switch lever 50 and the upper surface of the raised central portion 32 of the base plate 20. This spring 65 thus normally biases the switch lever 50 upwardly and downward movement of the free end of the lever is against spring tension.

A block of insulation 66 is provided with integral laterally extending bars 67 which include short projections 69 extending through apertures in the casing side walls 23 and 24. The apertures and the projections are rectangular or multi-sided so as to hold the insulation block from pivoting movement. Notches are provided in the upper surface of the block 66, two such notches 70 being provided in the forward side of the block and the remain-

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ing two notches 71 being formed in the rear or inner side of the block communicating with the top thereof. As indicated in Figure 3 of the drawings, a U-shaped bracket 72 is provided in each of the rear notches 71 and similar U-shaped clips 73 are provided in the forward notches 70.

The clips 72 and 73 are identical in form and the clips 73 are shown in detail in Figure 7 of the drawings. In this figure it will be noted that the clips include a top anchoring portion 74, a vertically extending portion 75 and a horizontally extending bottom portion 76. The bottom portion of each clip extends somewhat beyond the top portion thereof and supports a fixed contact point 77. An anchoring screw 79 extends through the upper portion 74 of each clip, through a portion of the insulation block 66, and threads into the bottom portion 76 of the corresponding clip.

A pair of parallel notches 80 are provided in spaced relation extending from front to rear of the insulation block 66, the notches terminating short of the rear edge of the block. A transverse recess is provided in the insulation block on either side of the center thereof and mid-way between the front and rear surfaces. These recesses, which are generally rectangular in section, are indicated at 81 in Figure 8 of the drawings, and are designed to slidably support a contact actuated plate 82. The plate 82 is provided with a notch 83 in its upper surface designed to accommodate the center wall 84 between the notches 80. The contact supporting plate is also provided with a pair of upwardly extending ears 85 which are designed to accommodate springs 86 which extend up into recesses 87 above the notches 80.

The ears 85 also extend through apertures in the contact blades 89 which are supported for vertical movement in the parallel notches 80. The springs 87 thus serve the double purpose of holding the contact arms against the upper surface of the arm supporting plate 82 and also of biasing the plate 82 downwardly.

As indicated in Figure 4 of the drawings the contact blades 89 support a pair of contact points 90 and 91 which are designed to contact the fixed contact points 77 of the U-shaped clips 72 and 73. As indicated in the drawings each contact blade 89 when in lowered position acts to span the space between a fixed contact 77 of a rear clip 72 with the fixed contact 77 of a forward clip 73.

In the circuit diagram, the motor 12 is actuated by line wires, 93 and 94. Each line wire 93 and 94 extends through a corresponding contact blade 89 and its associated contact points 90 and 91, and through the fixed contacts 77 of the clips 72 and 73. When the arm 50 is manually lowered, the circuit through the line wires is completed to the pump motor, and this circuit is maintained during the time the pump is pumping liquid.

The operation of the apparatus is extremely simple. The switch contacts are connected in the line leading to the pump motor 12. For example the line wires may be connected to the clips 73 and the pump motor terminals may be connected to the clips 72. The spring 65 urges the switch operating lever 50 upwardly, the upper surface of this lever bearing against the undersurface of the switch blade supporting plate 82. As the spring 65 is stronger than the small springs 87, the spring normally holds the contacts of the contact blades in spaced relation to the fixed contacts 77.

When it is desired to start the pump B in operation the switch actuating lever 50 is manually pressed downwardly by applying downward pressure on the end 64 of the lever. This closes the circuit to the motor by lowering the contact blade supporting plate 82, the springs 87 urging the contact blades 89 against the fixed contacts. The operating lever 64 is held depressed until the pump draws liquid from a supply through the intake pipe 16 and into the pump. As soon as liquid enters the inlet pipe the suction effect reduces the pressure within the diaphragm chamber 39 beneath the diaphragm 40 and the air pres-

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sure forces the diaphragm downwardly and holds the switch actuating valve in lowered position. Obviously the circuit remains closed to the pump motor during such action.

As long as the pump remains in operation and the suction line 16 is drawing liquid the reduced pressure in the diaphragm chamber 39 holds the switch contacts closed. However, if the suction line should run dry for any reason or when all of the liquid has been pumped, air may enter the inlet pipe and substantially equalize the pressure on both sides of the diaphragm 40. When this occurs the spring 65 urges the operating lever 50 upwardly, raising the contact blade supporting plate 82 and thereby raising the contact blades 89 from the fixed contacts and opening the circuit to the pump.

It will be seen that my switch functions automatically to stop the pump when liquid is no longer drawn into the pump from the supply source. As a result the impeller stops motion before it runs sufficiently dry or for a sufficient time to injure the impeller permanently.

In accordance with the patent statutes, I have described the principles of construction and operation of my pump control, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that obvious changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. For the control and protection of a pump system including in combination an arrangement consisting of a pump, said pump having an inlet and an outlet, a switch housing chamber mounted on said inlet, a diaphragm within said chamber sensitive to differential pressures on opposite sides of said diaphragm, electrical means for actuating said pump, a circuit to said pump actuating means, a switch lever, means connecting said diaphragm and said switch lever for actuating said lever upon changes in pressure acting upon opposite sides of said diaphragm, resilient means normally urging said switch lever away from said diaphragm, a switch supported adjacent to said switch lever, said switch including contact blade means and fixed contacts engageable therewith, in said circuit, means normally urging said contact blades toward said fixed contacts, means interposed between said contact blade means and said lever for transmitting movement of said switch lever to said contact blades, said switch lever biasing said switch blades away from said fixed contacts, whereby sufficient suction at said inlet will overcome the biasing action of said lever to engage said switch blades with said fixed contacts and loss of suction will permit said blades to separate from said contacts.

2. A pump system in combination with a control therefor, the system including a pump, a pump housing for said pump having an inlet and an outlet, a diaphragm chamber connected to said inlet, a diaphragm within said chamber, a switch connectable with said diaphragm for operation thereby, a spring connectable with said dia-

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phragm for normally biasing said diaphragm in one direction and urging said switch toward open position said diaphragm operating upon a reduction in pressure in said inlet, to oppose the force of said spring, an electrically operable pump operating member connected to said pump, a circuit to said pump operating member including a source of power supply and said switch, the flow of fluid through said pump inlet causing a reduction in pressure in said diaphragm chamber on one side of said diaphragm and overcoming the biasing action of said spring.

3. A pumping system including in combination with an operative and protective switch therefor, a pump having an impeller, electrical means for actuating said pump, a circuit to said pump actuating means, a switch interposed in said circuit, diaphragm means sensitive to inlet water pressure connected to the inlet of said pump, means connecting said diaphragm means and said switch, and resilient means connectable with said switch for biasing said switch toward circuit opening position, a manually operable arm forming a part of said connecting means engageable with said switch by means of which said switch may be moved to circuit closing position to start said pump, a predetermined reduction in pressure in said pump inlet holding said switch closed.

4. A pumping system including in combination with an operative and protective switch therefor, a pump, a motor for operating said pump, electrical circuit means for actuating said motor, said pump having an inlet and an outlet, a diaphragm chamber connected to said inlet, a diaphragm in said chamber, an "on" and "off" control switch in said circuit for starting and stopping said motor, a control switch lever connected to said diaphragm by which said circuit may be manually closed, spring means engaging said switch lever and urging said switch lever in a direction to open the circuit, said diaphragm being operable when subjected to a predetermined sub-atmospheric pressure in said pump inlet when said pump is in operation to hold said switch closed.

5. The structure described in claim 4 and in which said switch is normally urged toward open position by said switch lever, said diaphragm and said spring under conditions of normal atmospheric pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

1,201,660	Weatherhead et al. -----	Oct. 17, 1916
1,253,687	Hicks -----	Jan. 15, 1918
1,513,705	Haentjens -----	Oct. 28, 1924
1,562,561	Horter -----	Nov. 24, 1925
1,682,331	Goyne et al. -----	Aug. 28, 1928
1,784,205	Seeger -----	Dec. 9, 1930
1,837,505	Tice -----	Dec. 22, 1931
1,842,295	Schurle -----	Jan. 19, 1932
1,929,382	Arthur -----	Oct. 3, 1933
2,499,040	Steinback -----	Feb. 28, 1950
2,623,963	Wolfe et al. -----	Dec. 30, 1952