Oct. 14, 1958 J. J. ERNST 2,856,481

LOW PRESSURE PUMP CUT-OFF SWITCH

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Fig. 1

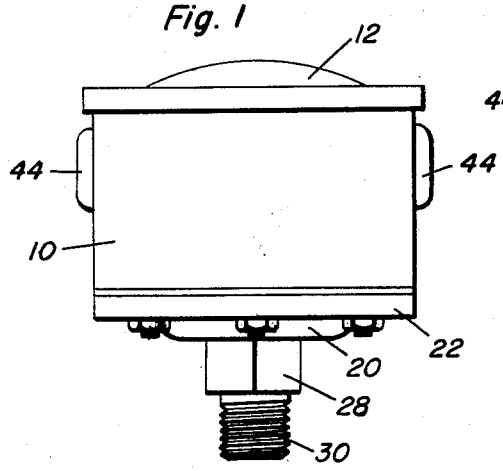


Fig. 3

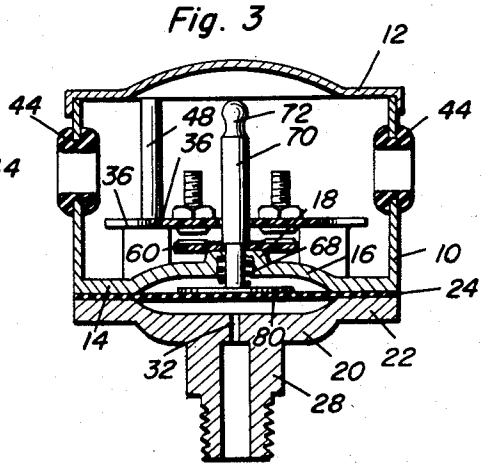


Fig. 2

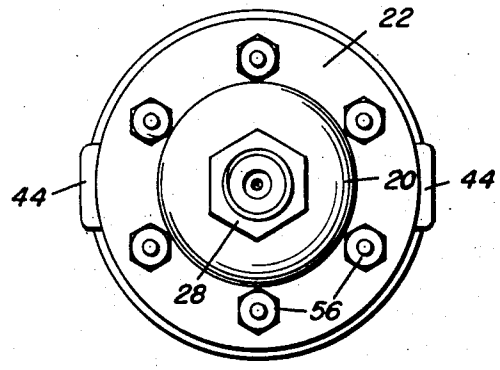
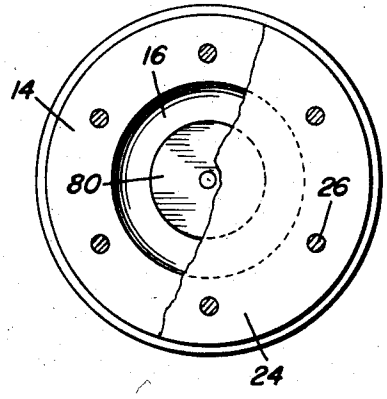


Fig. 4



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Fig. 5

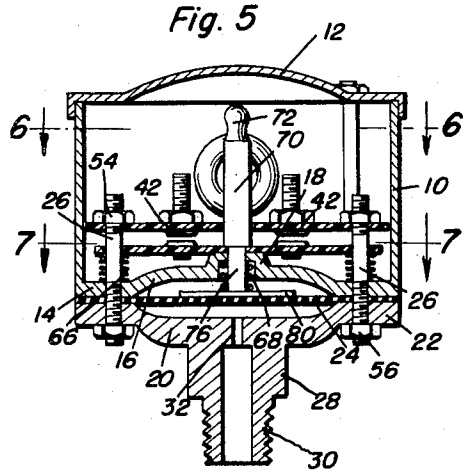


Fig. 7

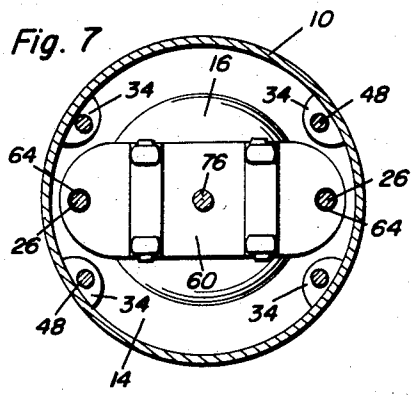


Fig. 8

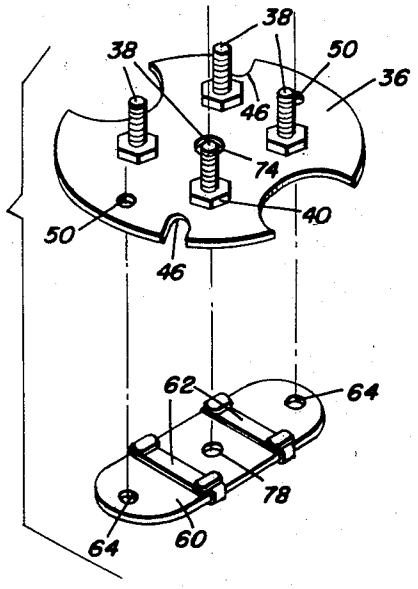
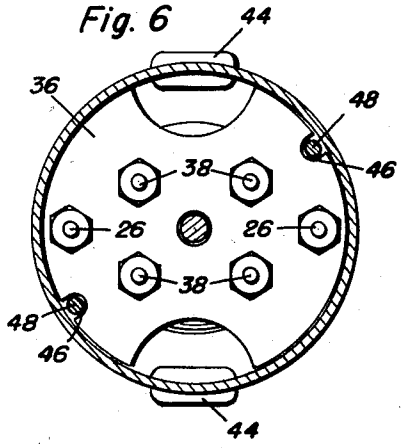


Fig. 6



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LOW PRESSURE PUMP CUT-OFF SWITCH

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11 Claims. (Cl. 200—83)

This invention comprises novel and useful improvements in a low pressure pump cut-off switch, and more particularly relates to a fluid pressure actuated switch for breaking an electric circuit when the fluid pressure applied to the switch drops below a predetermined minimum.

It is the principal object of this invention to provide a fluid pressure operated electric switch which will open an electric circuit, such as the electric circuit of a pump operating electric motor, when the fluid pressure applied to the switch drops below a predetermined value, as when the pump operated by the motor fails to build up pressure in the pump delivery line or system.

A more specific object of this invention is to provide a low pressure cut-off switch in accordance with the foregoing object in which the fluid pressure is applied in an improved manner for actuation of the switch contact elements.

Still another object of the invention is to provide a switch in conformity with the preceding objects in which there is provided manual means for overriding the switch and closing the circuit to enable operation of an electric motor for driving a pump.

A still further important object of the invention is to provide an improved low pressure cut-off switch in which a single member therein shall perform the several functions of providing a manual means for closing the switch despite a deficiency of fluid pressure in the system to which the switch is applied; constitute a guide for movement of the movable contact plate of the switch; shall constitute a guide and retainer for a switch contact opening spring which operates in opposition to the fluid pressure applied to the switch; and which transmits the thrust of the switch opening spring to the movable switch contact plate for opening the same upon decrease of the fluid pressure below a predetermined value.

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:

Figure 1 is a side elevational view of a switch assembly in accordance with this invention;

Figure 2 is a bottom plan view of the arrangement of Figure 1;

Figure 3 is a view in vertical transverse section through the switch of Figure 1 and showing the position of the parts therein when the switch contacts are open by virtue of an insufficient fluid pressure applied to the switch;

Figure 4 is a bottom plan view, with the lower closure removed and parts being broken away;

Figure 5 is a view similar to Figure 3 but taken at right angles to that figure;

Figures 6 and 7 are horizontal sectional views taken respectively upon the planes indicated by the section lines 6—6 and 7—7 of Figure 5; and

Figure 8 is a group perspective view of the fixed and movable contact plates of the switch assembly.

Although the utility of the low pressure cut-off switch in accordance with this invention is not limited thereto, it is especially adapted for and is particularly applicable for use in automatic motor operated pumping systems having an automatic fluid pressure control switch for the same. In such systems, and particularly in systems of the household type, wherein an electric motor drives a pump for maintaining a storage tank with water under pressure varying between operating limits such as 20 to 40 pounds pressure, the pressure operated switch normally closes the circuit and starts the motor to operate the pump and build up the pressure in the system when the pressure drops below the aforesaid lower limit of about 20 pounds, and opens the circuit and stops the pump and motor when the pressure reaches the desired maximum of 40 pounds. However, in some instances, as for example, when the water supply in the well falls below the level which can be reached by the pump, and sometimes for other reasons, the pump fails to build up the desired pressure. Consequently, since the pressure fails to reach that level at which the automatic fluid pressure operated switch will discontinue further operation of the motor and pump, the pump and motor are likely to be run for a considerable period of time, resulting in expensive damage to the pump, or motor, or both.

It is the primary purpose, therefore, of this invention to provide a safety switch which, when the pressure drops below a predetermined limit which is less than the lower limit of the range of automatic operation of the system, as for example, 10 pounds or less, the circuit will be broken, thereby discontinuing useless and dangerous operation of the electric motor and the pump.

The switch illustrated herein is adapted to be applied as an adjunct to any conventional electric motor operated pumping system of the automatic type and having a fluid pressure control switch therein. The present switch is disposed in series with the automatic control switch whereby the contacts of the automatic switch and of the safety switch of this invention must be both closed in order for the motor to operate and the pump to be driven thereby, while the opening of either of the contacts of either switch will serve to break the circuit and cause stopping of the electric motor and pump. Thus, if the safety switch contacts are open, as by dropping of the fluid pressure considerably below the minimum of the range of the automatic operating switch, or after the desired pressure has been attained, the electric motor will be stopped.

It is an important feature of this invention that the low pressure pump cut-off switch disclosed in this application may be applied without any alteration of the automatic pumping system and the electric circuit of the pumping motor including the fluid pressure operated switch therein.

In the form of the switch assembly illustrated in the accompanying drawings as constituting a satisfactory manner for practicing the principles of this invention, there is disclosed a cylindrical casing **10** having an open upper end which is adapted to be closed as by the removable cover plate **12** and having an integral bottom wall **14** with an upwardly dished central portion **16** having an axially disposed upwardly raised hollow boss **18** therein. The lower surface of the dished portion **16** in the bottom wall provides a chamber or cavity which is complementary to that of the dished portion **20** of a plate-like closure member **22**. The cavities of the two portions **16** and **20** constitute a chamber which is divided by a flexible diaphragm **24**. A plurality of bolts **26** extend through the members **14** and **22** and through the diaphragm **24** interposed therebetween for securing these

parts together in a detachable manner, as shown in Figure 5.

From the central portion of the dished section **20** there depends a tubular boss **28** which is externally threaded at **30** for attachment to any member to which fluid under pressure is supplied by a motor driven pump, not shown.

The upper end of the tubular boss **28** communicates with the lower chamber formed in the dish portion **20** as by a bore or passage **32**, whereby the fluid pressure generated by the motor driven pump is applied to the lower side of the diaphragm **24** in a manner tending to yieldingly urge the diaphragm upwardly.

Referring now particularly to Figure 7, it will be seen that the interior of the casing **10** has a plurality of lugs or projections **34** extending from the sides of the same and rising from the bottom wall **14**. These projections serve to support a detachable but fixedly positioned stationary or fixed contact plate **36**. Extending through this plate, which is of an insulating or dielectric material, are two sets of binding posts **38** which are secured to the fixed contact plate, as by nuts **40**. The lower portions of the binding posts, extending through the plate **36**, are provided with headed portions **42** which constitute stationary switch contacts. Extending through apertures in the sides of the casing **10** are rubber grommets **44** through which may pass the electric conductors, not shown, which connect the stationary binding posts **38** to the electric motor circuit and in series with the automatic fluid pressure operated control switch, not shown.

As will be best apparent from a comparison of Figures 5, 6, 7 and 8, the fixed contact plate **36** is provided with a pair of diametrically disposed peripheral notches **46** which are adapted to be slidably engaged upon a pair of bolts **48** which extend through two of the projections or bosses **34**, and which serve to secure the cover **12** to the casing **10**. The plate **36** is also provided with a pair of apertures **50** through which extend the previously mentioned bolts **26** provided with nuts **54** by which the stationary contact plate is clamped upon the supporting bosses or lugs **34**. As above mentioned, these bolts extend through the bottom wall **14** of the casing, and the closure plate **22**, being provided with securing nuts **56**.

A movable contact plate **60** of a dielectric or insulating material is provided which is mounted within the casing **10** and is movable beneath the fixed contact plate **36**. The movable contact plate has secured thereto a pair of terminal contact strips **62** whose ends are adapted to coact with the contacts **42** of the binding posts **38** when the movable plate is moved upwardly from the position shown in Figure 5. As will be apparent, the engagement of the member **62** with the contacts **42** serve to close the circuit through this switch. However, when the movable plate is in its lower position, as shown in Figures 3 and 5, the contacts **42** and **62** will be opened, thereby breaking the circuit and stopping the flow of current to electric motor, regardless of the operation of the automatic fluid pressure actuated control switch.

Referring now to Figures 3 and 5, it will be seen that the previously mentioned upwardly extending hollow boss **18** is provided with a flat top surface upon which is adapted to rest and by which is supported the lower surface of a movable contact plate **60**. This top surface thus constitutes a stop which limits downward movement of the movable contact plate, and it will thus be seen that the movable plate is limited in movement between its lowermost position shown in Figure 5 and in which the circuit through the contacts **42** and **62** is broken, and its upper position when these contacts are closed.

It will be observed that the two previously mentioned bolts **26** by means of which the fixed contact plate is clamped in position, constitute guides which are slidably received in the apertures **64** of the movable contact plate **60**. In addition, they receive and guide coil springs **66** whose ends engage respectively the bottom wall **14** of the casing **10** and the undersurface of the movable contact switch to thereby yieldingly urge the latter into an upward or switch closing position. As so far described, it will be apparent that the spring **66**, if allowed to act, would close the contacts **62** and **42** and thus maintain the circuit through this switch closed.

A very essential feature of this invention comprises the means by which the contacts are opened against the action of the spring **66** in response to a sufficient decrease in the pressure applied to the underside of the diaphragm **24**.

It will be observed that the hollow tubular boss **18** constitutes a chamber which receives a compression spring **68**. This spring is of considerably greater strength than that of the spring **66** and is so disposed as to overcome the force of those springs and urge the movable contact plate into its lowered or circuit opening position. For that purpose, there is provided a control pin **70**. At its upper end, this pin has a finger grip portion **72** disposed in the upper portion of the casing **10** and which may be gripped when the cover **12** is removed to forcibly lift the pin and compress the spring **68**, thereby permitting the spring **66** to cause the movable contact member to close the circuit through the contacts **42** and **62**. The pin **70** extends through an axial opening **74** formed in the fixed contact plate **36** by means of which the pin is guided in its vertical movement. At its lower end, the pin is provided with a reduced stem **76** which extends through the axial opening **78** in the movable contact plate **60** for free sliding movement therethrough, extends through the compression spring **68** to constitute a guide for the same, and is screw threadedly engaged into a flat plate or foot piece **80** which rests upon the diaphragm **24**. At the junction of the reduced portion **76** with the main portion of the pin **70**, there is provided an annular shoulder which rests upon the movable contact plate upon the edges of the aperture **78**. The function of this shoulder is to enable the pressure of the spring **68** as applied to the plate **80** to draw the pin and consequently the movable contact plate into their lowermost position to thus break the circuit through the contacts **42** and **62**.

As will now be understood, the springs **66** and **68** are of such force and the diaphragm **24** is of such area that when the pressure supplied to the tubular boss **28** from the motor operated pump is in excess of a predetermined low value, as, for example, 10 pounds, such pressure applied to the diaphragm will be sufficient to lift the pin **70** against the differential effect of the springs **66** and **68**, whereby the shoulder on the pin will be raised sufficiently to permit the spring **66** to close the contacts by lifting the movable contact plate. However, when the pressure drops below the predetermined value, as 10 pounds, the force of the spring **68** will be sufficient to overcome the pressure applied to the underside of the diaphragm **24** and also the pressure applied by the spring **66**, and will thereby force the movable contact plate to its lowered position and upon the stop or support surface of the tubular boss **18**.

It will be apparent, therefore, that this device provides a greatly improved pressure actuated switch assembly. The fixed and movable contact plates can be readily removed; the switch control pin can be manually manipulated to close the switch for starting the electric motor and pump; the movable contact plate has a guided action upon the fasteners **26** as well as by the control pin **70**, **76**; the springs **66** and **68** are guided by the fasteners **26** and the reduced portion **76** of the control pin, respectively; and the pressure plate **80** serves to contact and transmit the thrust of the diaphragm **24**, to form a retainer for the spring **68**, and to transmit the force of the spring **68** to the lower end of the control pin **70**.

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 as claimed.

What is claimed as new is as follows:

1. A low pressure, fluid pressure actuated cut-off switch for the electric circuits of pump operating motors comprising; a casing having a bottom wall with an upwardly recessed portion, a plate secured to said bottom wall and having a downwardly recessed portion, said portions defining therebetween a fluid pressure switch actuating chamber, means in said chamber movable in response to fluid pressure variations, passage means operatively connecting the preceding means to a source of fluid pressure, stationary switch contacts in said casing supported in fixed positions above said bottom wall, a movable contact plate in said casing between said bottom wall and said stationary contacts and movable towards and from the latter and having a set of movable contacts thereon cooperating with said stationary contacts for controlling an electric circuit, resilient means in said casing abutting said bottom wall and said movable contact plate and yieldingly urging the latter to cause engagement of said movable and stationary contacts, a control pin in said casing extending through said bottom wall and operatively engaging said movable means and said movable contact plate, a spring in said actuating chamber engaging said control pin and said bottom wall and opposing the movement of said first mentioned means to close said contacts and of a strength to override said resilient means and normally urge the movable contacts away from said stationary contacts.

2. The combination of claim 1 including a stationary contact plate in said casing carrying said stationary contacts and mounted in fixed spaced relation to said bottom wall, said control pin being slidably and guidably extended through said stationary plate and having a manual finger grip portion above the latter.

3. The combination of claim 1 wherein said upwardly recessed portion has a top surface providing an abutment limiting downward movement of said movable contact plate and supporting the latter in spaced position above said bottom wall.

4. The combination of claim 1 wherein said upwardly recessed portion has an upwardly extending bore opening from said chamber, said spring being received in said bore and surrounding said control pin.

5. The combination of claim 1 including a stationary contact plate in said casing carrying said stationary contacts and mounted in fixed spaced relation to said bottom wall, said control pin being slidably and guidably extended through said stationary plate and having a manual finger grip portion above the latter, pins in said casing projecting upwardly from said bottom wall and secured to said stationary plate, said movable plate being guidably and slidably mounted on said pins.

6. The combination of claim 1 including pins mounted upon said bottom wall of said casing and extending upwardly therein, a stationary contact plate in said casing fixedly supported upon said pins in fixed spaced relation to said bottom wall and carrying thereon said stationary contacts.

7. The combination of claim 1 including pins mounted upon said bottom wall of said casing and extending upwardly therein, a stationary contact plate in said casing fixedly supported upon said pins in fixed spaced relation to said bottom wall and carrying thereon said stationary contacts, said movable plate having openings therein receiving said pins therethrough for guidably and slidably mounting said movable plate upon said pins.

8. The combination of claim 1 including pins mounted upon said bottom wall of said casing and extending upwardly therein, a stationary contact plate in said casing fixedly supported upon said pins in fixed spaced relation to said bottom wall and carrying thereon said stationary contacts, said pins having portions extending through and below said bottom wall, said first mentioned plate being secured to said extending portion of said pins.

9. The combination of claim 1 including pins mounted upon said bottom wall of said casing and extending upwardly therein, a stationary contact plate in said casing fixedly supported upon said pins in fixed spaced relation to said bottom wall and carrying thereon said stationary contacts, said resilient means comprising coil springs each embracing one of said pins.

10. The combination of claim 1 including pins mounted upon said bottom wall of said casing and extending upwardly therein, a stationary contact plate in said casing fixedly supported upon said pins in fixed spaced relation to said bottom wall and carrying thereon said stationary contacts, said resilient means comprising coil springs each embracing one of said pins, said pins having portions extending through and below said bottom wall, said first mentioned plate being secured to said extending portions of said pins.

11. The combination of claim 1 including pins mounted upon said bottom wall of said casing and extending upwardly therein, a stationary contact plate in said casing fixedly supported upon said pins in fixed spaced relation to said bottom wall and carrying thereon said stationary contacts, said movable plate having openings therein receiving said pins therethrough for guidably and slidably mounting said movable plate upon said pins, said pins having portions extending through and below said bottom wall, said first mentioned plate being secured to said extending portions of said pins.

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