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B. H. CLASON

2,794,879

ELECTRICAL DEVICE

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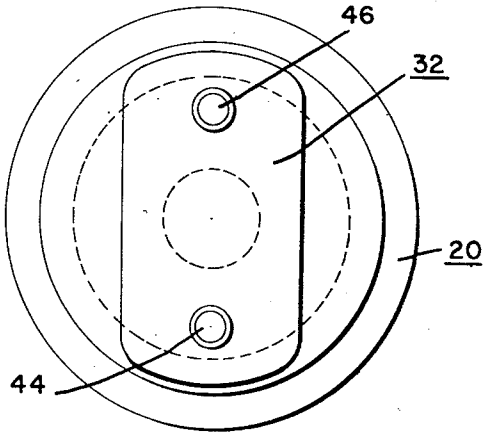

Fig. 1

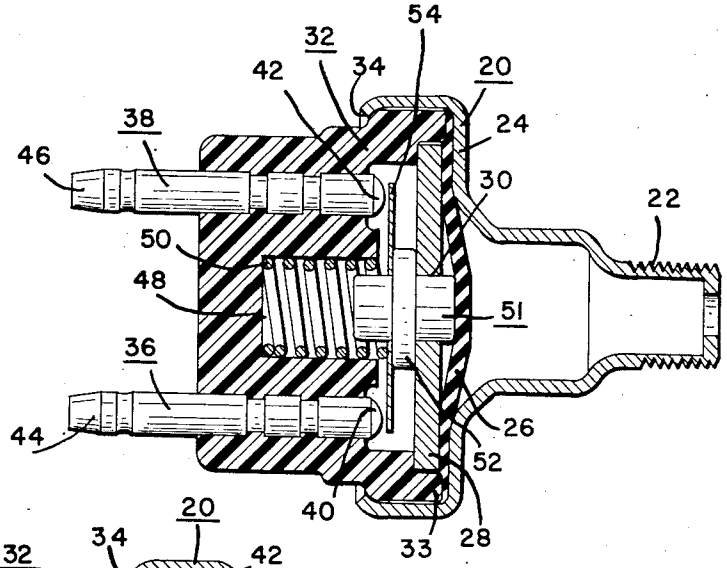

Fig. 2

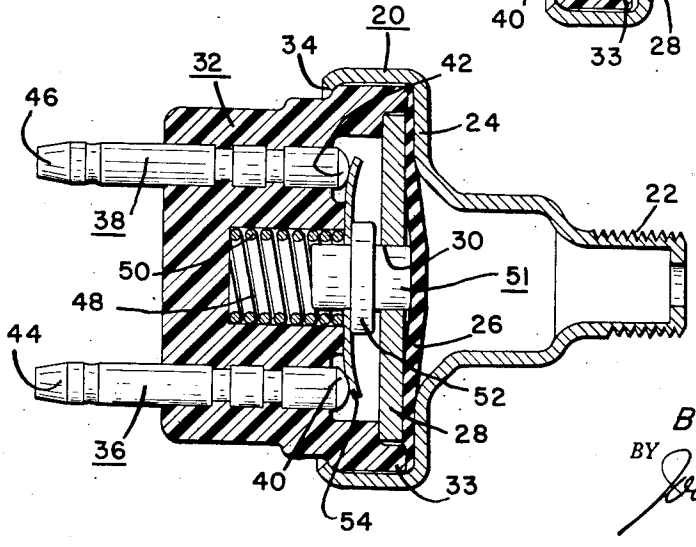

Fig. 3

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ELECTRICAL DEVICE

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3 Claims. (Cl. 200—83)

This invention relates to switches and is particularly concerned with pressure actuated switches of the diaphragm type.

An object of this invention is to provide an improved pressure operated switch of the diaphragm type wherein self-wiping contact areas are provided which maintain the operation of the switch at high efficiency throughout its use.

In carrying out the above object, it is a further object of the invention to provide a disc of flexible metal and having good electrical conductivity as the movable contact member wherein the disc is sufficiently thin to flex as it is forced into engagement with the stationary contacts whereby a wiping contact area is provided.

Another object of the invention is to provide a diaphragm type switch wherein a movable stop member is used to limit movement of the diaphragm and contact member in both directions whereby the diaphragm is never over-extended due to excessive pressure either from the fluid used to actuate the same or from the spring return utilized in connection with the contact member.

A still further object of the invention is to provide a pressure operated switch wherein the movable contact member comprises a floating disc of highly resilient, good conductivity metal which is forced into contact with stationary contacts by means of a plunger actuated by a movable diaphragm that is responsive to pressure changes within the system being controlled, the floating disc of resilient metal being self-aligning and providing wiping contact upon engagement of the stationary contacts.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

Fig. 1 is a plan view of a pressure operated switch.

Fig. 2 is a view in section of the switch in the open circuit position.

Fig. 3 is a view similar to Fig. 2 with the switch in the closed circuit position.

Pressure operated switches are used for many purposes in the control of systems utilizing fluid therein. These switches generally include a flexible diaphragm which may be distended upon application of pressure from the fluid, which diaphragm in turn actuates the switch mechanism to either open or closed circuit position, as desired.

One application of this type of switch is in hydraulic or pneumatic braking systems for vehicles wherein it is desirable to energize signal lights such as stop lights when the brakes of the vehicle are applied to warn the operators of other vehicles that a stop is being made. In order to accomplish this end, a pressure operated switch is placed in the fluid line of the braking system at any suitable point whereby when pressure is applied to the braking system, pressure is transmitted to a diaphragm which in turn causes the switch to close for energizing the signal circuit.

Pressure actuated switches for this purpose are shown in Rasmussen Patent No. 2,275,556 and in application S. N. 294,347, assigned to the assignee of the present invention. These are but two of many switch designs used for this purpose.

In all of the prior art designs of pressure actuated electrical devices problems exist in maintaining the contacting surfaces for the electrical switch portion of the device in good working condition. This is caused by oxidation of the electrical contact surfaces during use due to arcing, etc. When this condition becomes apparent, the switch does not cause the signal circuit to close in some cases and in others does not close the signal circuit until extreme pressures are applied to establish the electrical path through the contacts which often defeats the entire purpose of the signal system in which the switch is used.

The present invention is directed to a switch which includes a wiping contact therein that is of a floating character whereby alignment is established and clean contact areas are maintained through the life of the switch.

Furthermore, the present switch includes stop means which limit the movement of the diaphragm in either direction whereby possible rupture or permanent distortion of the diaphragm is eliminated.

Referring to the drawings and specifically to Fig. 2, a metal housing member **20** is shown that includes a reduced diameter threaded portion **22** which can be screwed into engagement with a portion of the pressure system with which the switch is to be used. The housing **20** includes an annular shoulder portion **24** which acts as a seat and seal for a flexible diaphragm **26**. The housing **20** is constructed so as to present rounded corners for the diaphragm **26** at all areas of contact, whereby the diaphragm is in no danger of being cut or otherwise mutilated.

A metal washer **28**, having a central aperture **30** therethrough, is placed upon the diaphragm **26** on the shoulder **24**. The washer is of less diameter than the diaphragm and is held centered and held in engagement therewith by means of a non-metallic plug member **32** formed of phenol formaldehyde condensation product or any other suitable electrical non-conductor having the desired strength, such materials being well known in the art. In order to hold the plug **32** in tight relation with the washer **28** and the diaphragm **26** and to cause it to seal the diaphragm tightly against the annular shoulder **24** of the body member **20**, the body member **20** is spun over the plug **32** as at **34** to complete the assembly. It will be noted that the plug **32** surrounds the washer **28** to center same due to an annular shoulder **33** formed integral with the plug **32**.

The plug **32** carries two terminal members **36** and **38** molded therein which have contact portions **40** and **42** at the lower ends thereof and connector portions **44** and **46** at the exposed upper or outer ends thereof. The terminals **36** and **38** are hermetically sealed in the plug during the molding operation. Also included in the plug member is a central inner recess or cavity **48** which is used to accommodate a spring **50**, the function of which will be disclosed hereinafter.

In the aperture **30** of washer **28** is guided an actuating member **51** having a centrally disposed shoulder **52** thereon. The portion of the member **51** which extends through the washer is a free fit and the washer **28** is merely used to guide the actuating member **51**. The other end of the actuating member **51** passes through an apertured spring metal plate or contact disc **54** made of Phosphor bronze or other suitable resilient, high conductivity metal. The plate **54** is sufficiently thin to permit flexing thereof and is of sufficient diameter to overlap the contacts **40** and **42**. The spring **50** heretofore mentioned bears against the

plate 54 and holds it against the shoulder 52 of the actuating member 51 which in turn centers the spring 50.

In operation, the spring 50 causes the actuating member to be bottomed on its shoulder 52 against the washer 28. In this position the actuating member 51 forces the diaphragm 26 into a position shown in Fig. 2 and maintains the contact disc 54 out of engagement with stationary contacts 40 and 42. Upon application of pressure, through the threaded inlet 22 of the device, the diaphragm 26 is moved to the left until it assumes a position noted in Fig. 3. In this position the shoulder 52 of the actuating member 51 has forced the contact disc 54 to the left and into engagement with the stationary contacts 44 and 46. It also forces the disc into engagement with the inner portion of the plug 32 so that the disc 52 cannot move any further to the left nor can the actuating member 51 move any further. In this manner, the diaphragm 26 is protected against excessive movement which might deform or injure it. Similarly, in the off position of the switch, as shown in Fig. 2, the shoulder 52 on the actuating member 51 limits the right-hand movement of the actuating member 51 by abutting the washer 28 whereby the spring 50 cannot exert further pressure on the diaphragm 26.

The features of the present switch reside in the floating contact member 54 which merely rests upon the actuating member 51 and is held thereto by the action of spring 50. Upon pressure applied to the switch diaphragm, the contact member 54 is forced into engagement with the stationary contacts and the dimensions of the device are so calculated that the actuating member must move a predetermined distance past that point where actual engagement exists between the disc 54 and stationary contacts. This causes the disc to be dished or flexed inwardly as noted in Fig. 3, which causes a wiping action at the contacts, thereby permitting self-cleaning thereof. Further, since disc 54 floats on the actuator 51, it is possible for the disc to self-align itself with the contacts due to its inherent resiliency and if through vibration the actuator and disc tend to turn slightly, the operation of the switch is in no way impaired since the disc, being circular in design, presents contacting areas throughout 360°.

The use of the floating actuating member 51 is another feature of the invention wherein the actuating member 51 by means of a single shoulder thereon cooperates with other parts of the switch to limit the action of both the diaphragm and the spring whereby the diaphragm cannot be injured and wherein excessive movement thereof is prevented which might affect the action of the switch per se.

It is understood that the present switch is hermetically sealed by the spinning operation at 34 on the housing member 20 and that all adjustments for pressure, etc. are made prior to the assembly thereof which adjustments merely consist in the use of a proper spring. It is further apparent that if external adjustments are desired that external adjusting means may be provided for varying the action of the spring from the outside of the plug member, such modifications coming fully within the scope of this invention.

The diaphragm as used in this switch may be any resilient material not affected by the fluid being sealed. Thus, if the fluid is air or water, rubber, rubberized cloth, etc. may be used; if the fluid is oily in character, butadiene acrylonitrile copolymer rubber, polychloroprene, butyl or other of oil resistant materials well known in the art may be used.

While the forms of embodiment of the invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A pressure actuated switch comprising; a metallic body member and an insulating plug member fixedly attached thereto, a diaphragm interposed between the plug and body and hermetrically sealed thereby, a pair of stationary contacts carried by the plug member and opening into a cavity therein, a movable contact member consisting of a disc of relatively thin flexible metal of good electrical characteristics within said cavity and movable into and out of engagement with said stationary contacts, an actuator loosely carrying said disc at one end thereof and contacting the diaphragm at the other end thereof, means for guiding the actuator and for limiting its movement in two directions and a spring disposed between the plug and the disc urging the disc into contact with said actuator and for yieldably urging the actuator towards one limit of its movement, said diaphragm being movable to yieldably compress said spring upon application of pressure to cause said movable contact member to move relative to said stationary contacts.

2. A pressure actuated switch, comprising in combination; a two-piece body including a shouldered shell and a plug adapted to be assembled thereto, a diaphragm adapted to be seated on said shoulder portion of the shell and to be held in sealing engagement thereto by said plug when the plug is in assembled relation to the shell, an actuator movable to two extreme positions and having one end thereof in yieldable contact with said diaphragm, stationary contacts carried by said plug, a disc of relatively thin flexible metal loosely associated with said actuator and adapted to yieldably bridge said contacts when the actuator is moved to one of said extreme positions by said diaphragm and a spring acting between a portion of the plug and the disc for urging the disc into engagement with the actuator and for opposing movement of said diaphragm.

3. A pressure actuated switch, comprising in combination; a body having an internal cavity therein including an opening at one end thereof, a flexible diaphragm sealed to said body for hermetrically closing said opening, at least two spaced stationary contacts within the body in spaced relation from said diaphragm, a relatively thin flexible metal disc adapted to be used as a movable contact, said disc having a diameter greater than the distance between said stationary contacts, a shouldered actuator interposed between the diaphragm and the disc for actuating the disc in response to movement of the diaphragm by pressure applied thereto by said shoulder for causing the disc to bridge said contacts in one position, stop means within said cavity positioned in spaced relation to the diaphragm for limiting movement of said disc, in said bridging position, said stop means being positioned so as to permit a limited movement of said disc after initial contact thereof with said stationary contacts whereby a wiping action is obtained at the contacting surfaces and a spring acting between a portion of the body and the disc for urging the disc away from said contacts and into engagement with said shoulder.

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