United States Patent [19]

Hook

[11] **3,718,789**

[45] **Feb. 27, 1973**

[54] **PRESSURE SWITCH WITH OVERTRAVEL MEANS ON SWITCH ACTUATING ARM FOR MAINTAINING LOAD ON SWITCH DURING SMALL PRESSURE FLUCTUATIONS**

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[22] Filed: **April 15, 1971**

[21] Appl. No.: **134,318**

[52] **U.S. Cl.** .....**200/83 R**, 200/153 V

[51] **Int. Cl.**.....**H01h 35/32**, H01h 3/48

[58] **Field of Search**....200/83 R, 153 V, 153 T, 83 S, 200/83 W, 83 Z, 82 C, 172 A, 83 C

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[57] **ABSTRACT**

Switch operated by fluid under pressure such as the pressure of pressurized lubricating oil used in lubricating an internal combustion engine or other pressure lubricated device. The switch includes a pivoted switch arm overlying and adapted to depress a switch button, and coaxially pivoted actuator arm overlying the switch arm and operated by an extensible fluid pressure operated device. A spring biased plunger is connected between the switch arm and switch button and is loaded with sufficient strength when the switch is closed to retain the switch button in a depressed actuated condition, upon surges in pressure in the pressure line.

2 Claims, 2 Drawing Figures

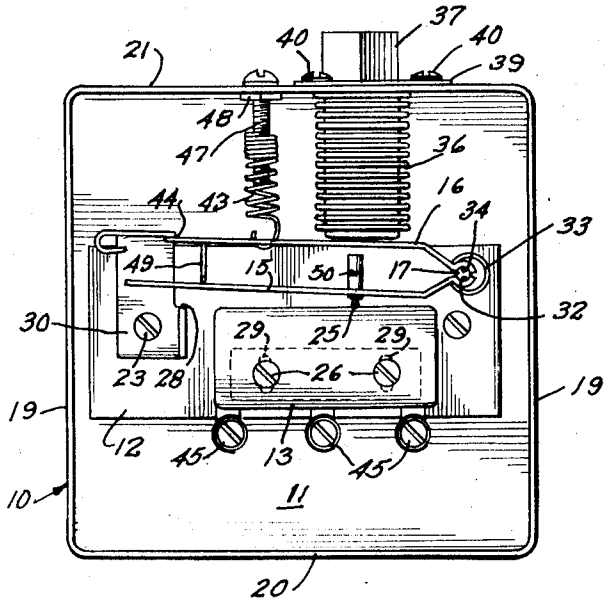


Fig. 1

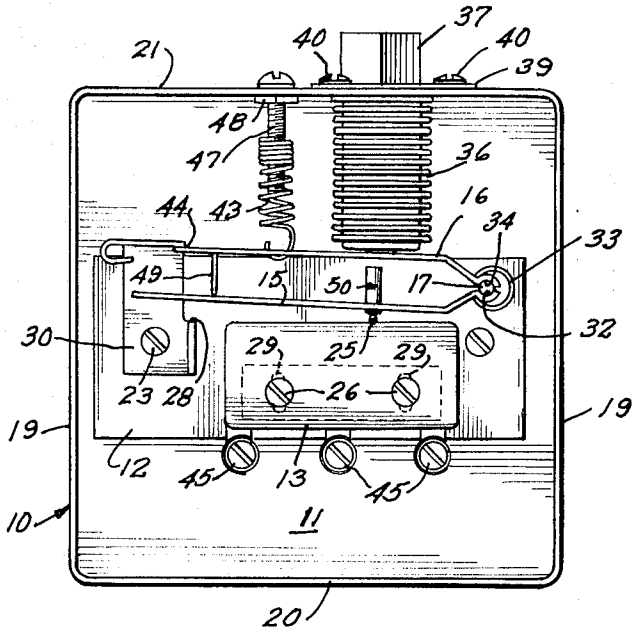
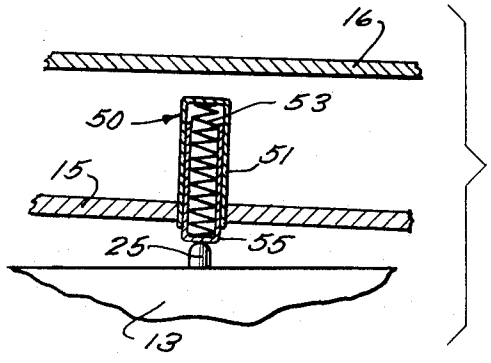


Fig. 2



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PRESSURE SWITCH WITH OVERTRAVEL MEANS ON SWITCH ACTUATING ARM FOR MAINTAINING LOAD ON SWITCH DURING SMALL PRESSURE FLUCTUATIONS

FIELD OF THE INVENTION

Pressure operated switch capable of holding the switch in its actuated mode during normal pressure conditions and preventing opening of the switch upon pressure fluctuations below normal pressure conditions.

BACKGROUND AND SUMMARY OF THE INVENTION

Pressure operated switch particularly adapted to control operation of internal combustion engines by pressure in the lubricating system for the engine. The switch is so arranged that upon starting the engine, the lubricating oil pressure rises to the actuating pressure of the switch and the switch holds the engine in operation during normal engine operating speeds including "idle speed," under which conditions the lubricating oil pressure may drop below the actuating pressure required to move the switch to its actuated mode.

The switch is in the form of a micro-switch operated by coaxially pivoted overlying switch and actuating arms, as in my application Ser. No. 97,783, filed Dec. 14, 1970, now U.S. Pat. No. 3,676,619, and entitled "-Manual Override Pressure Operated Switch." As in the aforementioned application, the switch arm extends over the button of the switch and is engaged by the actuating arm, which moves the switch arm in a switch actuating direction, and holds the switch arm in its actuated mode. A bellows extended by oil under pressure from the lubricating system for the engine, operates the actuating arm to actuate the switch arm and close the switch.

A spring biased plunger is mounted on the switch arm and engages the button of the micro-switch to close the switch arm upon movement of the actuating arm in a switch closing direction. The plunger is loaded to hold the micro-switch closed upon fluctuations in pressure below normal engine operating speeds, such as idling speeds of the engine, under which conditions the lubricating oil pressure may drop below the rising actuating pressure. This prevents nuisance shut-downs over the normal range of pressure fluctuation between idler and top engine speeds and also due to the normal drop in pressure due to viscosity changes at elevated temperatures of the lubricating oil.

As soon, however, as the decreasing oil pressure of the engine drops below the low pressure set point of the switch as determined by the loading of the spring biased plunger, the switch will move to an open position and thereby protect the engine against damage caused by loss of oil pressure.

An advantage of the present invention, therefore, is that the switch provides a simple and inexpensive shut-off device providing protection against loss of oil pressure as soon as the decreasing pressure drops below a preselected low pressure set point of the switch.

A further advantage and object of the invention is to improve upon the pressure switches heretofore utilized in shutting off internal combustion engines and the like upon loss of lubricating oil pressure, and the decrease of the pressure below the low pressure set point of the switch, in which a mechanical spring loaded connection is provided to hold the switch in its actuated mode upon normal operating pressures and reduction in pressure during idling of the engine or change in viscosity of the lubricating oil by temperature rises, which shuts off the engine only upon the reduction in lubricating pressure below the set point of the switch.

A still further object of the invention is to provide a pressure operated switch particularly adapted to shut off internal combustion engines upon low pressure conditions of the lubricating oil, arranged with a view toward utmost simplicity and efficiency in construction and operation.

Other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in side elevation of a pressure switch constructed in accordance with the principles of the present invention; and

FIG. 2 is an enlarged partial fragmentary detail sectional view of the switch arm and switch showing the plunger for holding the switch in operation in section.

DESCRIPTION OF PREFERRED EMBODIMENT OF INVENTION

In FIG. 1 of the drawings, I have shown a switch box or housing **10** having a flat back **11** forming a mounting for a base plate **12** for a switch **13**, herein shown as being a micro-switch. I have also shown coaxially pivoted switch and actuator arms **15** and **16**, respectively, mounted for movement about a common pivot pin **17**, mounted on and extending perpendicular of the base plate **12**. The switch box also includes parallel end walls **19**, a bottom wall **20** and a parallel top wall **21** connecting said end walls together. While the box is shown as being a rectangular box, it need not necessarily be rectangular, but may be of any suitable form. The switch box may be closed by a cover (not shown) which may be suitably sealed thereto.

The base plate **12** may be spaced from the back wall **11** by suitable spacers (not shown), interposed between said back wall and the back of said base plate and encircling machine screws **23**, securing said base plate to said back wall.

The switch **13** may be a conventional form of single pole double throw micro-switch although it need not necessarily be a micro-switch, and has a switch button **25** depressible to move the switch into its actuated mode and extending from the top of the switch casing. Said switch is mounted on the base plate **12** by machine screws **26**, threaded in a nut **27**, which may be a tinnerman nut, which is shown as abutting the back of said base plate. The machine screws **26** pass through vertically extending slots **29**, formed in the base plate **12** to accommodate adjustment of the position of the switch **13** and switch button **25** toward and from the switch arm **15**, to set the trip point of the switch in proper relation relative to movement of the switch arm **15**.

The switch arm **15** has an elongated plane arm surface extending over the switch and switch button **25** beyond the end of said switch arm. Downward movement of said switch arm is limited by a stop **28** extending at right angles to a plate **30** mounted on the base plate **12**, as by a machine screw **23**, and extending upwardly along said base plate above the top thereof.

The opposite end of the switch arm **15** from the bracket **30** is shown as being upwardly inclined and terminating into an upwardly opening socket **32** engaged with the pivot pin **17** by a C spring **33**.

The actuator arm **16** also has a plane surface overlying the plane surface of the switch arm **15** and extending generally parallel thereto and having a downwardly inclined end portion terminating into a downwardly opening socket **34** like the socket **32** and pivotally retained to the pivot pin **17** by the C spring **33**.

The C spring **33** cooperating with a snap washer (not shown) thus holds the switch arm **15** and actuating arm **16** to the pivot pin **17**, to pivot thereabout and biases the switch arm in a direction away from the switch button **25**. Said C spring also biases a stop **49** extending from the switch arm **16** toward the switch arm **15**, into engagement with said switch arm.

A bellows **36** extends downwardly from a fitting **37** which extends outwardly of the top wall **21** of the switch housing. The fitting **37** has a flange **39** abutting the top wall **21** and secured to said top wall as by machine screws **40**.

The bellows **36** may be a conventional form of pressure extensible bellows, and need not necessarily be a bellows but may be of various other forms of extensible mechanisms extended by pressure. The bellows **36** is shown as having a closed lower end seated on the actuating arm **16**, to pivot said arm in a switch actuating direction and pivot the switch arm in the same direction by engagement of the stop **49** projecting from said actuator arm with said switch arm upon increases in pressure in said bellows.

The fitting **37** may be connected to a suitable source of fluid under pressure, such as an oil line (not shown) leading from the pressure side of a lubricating system of a Diesel or other form of internal combustion engine (not shown), to effect expansion of the bellows and actuation of the switch **13** upon predetermined engine oil pressures, and to accommodate reverse operation of the switch out of its actuated mode, as the pressure is reduced below a predetermined preset value, to thereby prevent damage to the engine.

The switch **13** has three terminals **45** which may be connected in the electrical circuit for the engine, such as the ignition switch, spark coil or relay or other control (not shown) for stopping the engine when the oil pressure drops below a predetermined safe value. A time delay relay and bridging circuit may be incorporated in the starting or ignition circuit for the engine, to enable the engine to be started when the oil pressure is not sufficient to move the switch into its actuated mode, but opening after a predetermined time delay, as the engine is started. The engine may thus be started and run until the switch **13** is moved into its actuated mode by the normal range of lubricating oil pressure.

A tension spring **43** serves as a return spring for the actuator arm **16** and bellows **36** and biases said arm into engagement with a stop surface **44** extending from the upper end of the base plate **30** at right angles with respect thereto. As shown in FIG. **1**, the tension spring **43** is hooked to the actuator arm **16** intermediate the ends of said arm. An internally threaded sleeve (not shown) may extend within the upper part of said spring, and may be welded or otherwise secured thereto. An adjustment screw **47** extending through the top wall **21** of the switch box **10**, and depending therefrom is threaded within said sleeve. A lock nut **48**, threaded on the screw **47** and abutting the underside of the top wall **21** of the box **10**, is provided to lock said screw from turning movement, and to thereby hold the spring **43** under the desired tension.

Referring now in particular to the means preventing nuisance shutdowns of the engine over the normal range of pressure fluctuation encountered between idle and top speed, together with the normal drop in pressure due to viscosity changes in the oil at elevated temperatures of the oil, a preloaded plunger **50** is mounted on the switch arm **15** in alignment with the switch button **25**, to engage said switch button and move the switch into its actuated mode, upon movement of the switch arm **15** toward the switch, and to hold the switch in its actuated mode upon movement of the switch arm **15** away from the switch, which may be occasioned by fluctuations in oil pressure, but to accommodate movement of the switch out of its actuated mode to protect the engine against loss of oil pressure, as the oil pressure drops below the low pressure set point of the switch and plunger **50**.

The plunger **50** is shown as including a downwardly opening cylinder **51** extending through and suitably secured to the switch arm **15** and extending upwardly of said switch arm toward the actuator arm **16**, but maintained free from said actuator arm by a stop **49**.

The cylinder **51** has a closed top forming a seat for a compression spring **53**. The compression spring **53** extends within a cylindrical plunger **55** slidably mounted in the cylinder **51** and having a closed bottom forming a seat at the opposite end of said spring from the cylinder **51**, and engaging the switch button **25**. The spring **53** may be loaded to maintain the switch button **25** in its inwardly retracted position relative to the casing for the switch, and to retain said switch button in its depressed position upon movement of the switch arm **15** away from the switch casing, caused by pressure fluctuations of the oil between idle and top speed operating conditions, or changes in viscosity of the oil at elevated temperatures of the oil.

As the oil pressure drops below the low pressure setting of the switch, the switch arm **15** will be moved away from the switch button **25** by its C spring **33**, and reduce the loading of the spring **53** to the extent that the biasing force of the switch button will be greater than the loading rate of the spring **53** and cause the switch to move out of its actuating mode by its bias.

It may be seen from the foregoing that a simple pressure switch and control for a Diesel or conventional internal combustion engine has been provided, which operates solely by the lubricating oil pressure of the engine, and holds the switch in its actuated mode during normal engine operating speeds, including idle speeds of the engine where the lubricating oil pressure may drop below the normal actuating pressure required to hold the switch in its actuated mode, but shuts down

the engine upon low pressure conditions below the low pressure set point of the switch. Nuisance shut-downs over the normal range of pressure fluctuating of the lubricating oil between idle and top speed are thus prevented by the use of a simple spring loaded plunger on a pivoted switch arm loaded to a greater load than that of the switch under normal pressure conditions of the lubricating oil, and relieving the load on the switch, to effect opening of the switch upon low pressure conditions of the lubricating oil below the low pressure range of setting of the switch.

I claim as my invention:

1. In a pressure switch particularly adapted to control the operation of internal combustion engines in accordance with the pressure of the lubricating oil of the engine,

a switch housing,

a switch mounted in said housing and including a casing,

a depressible axially movable switch button extending from said casing and biased in extended relation relative to said casing,

a pivot pin mounted within said housing and extending perpendicular to said switch button and spaced over and to one side of said switch button,

a switch arm pivotal about the axis of said pivot pin and extending over said switch button,

an actuator arm pivoted for movement about the axis of said pivot pin for movement independently of said switch arm and extending along said switch arm,

a C spring extending about said pivot pin and engaging said actuating arm and said switch arm at its free ends and biasing said switch and actuating arms toward each other,

a stop extending from said actuator arm toward said switch arm and limiting movement of said actuator arm and switch arm toward each other,

a pressure actuator for said actuator arm and said switch arm mounted in said housing and adapted to be connected with the oil line leading from the pressure side of the lubricating system of an internal combustion engine, including a member extensible by pressure and having engagement with said actuator arm,

a spring connected with said actuator arm and said housing and biasing said actuator arm toward said pressure actuator,

means for varying the tension of said tension spring and the pressure of operation of said actuator arm,

a stop limiting movement of said switch and actuator arms toward said switch casing, and

a spring loaded plunger mounted on said switch arm for movement therewith and having operative engagement with said switch button for depressing said switch button upon predetermined movement of said switch arm toward said casing and loaded to maintain the switch in its actuated mode upon normal fluctuations in pressure of the lubricating oil.

2. The pressure switch of claim 1,

wherein the spring loaded plunger comprises a cylinder mounted on said switch arm and having an open end opening toward said switch button and an opposite closed end spaced from said actuator arm,

a plunger slidably mounted in said cylinder in position to engage said switch button upon movement of said switch arm toward said switch button, and

a spring in said cylinder biasing said plunger into engagement with said switch button and loaded to maintain the switch closed upon reductions in oil pressure to a predetermined low pressure set point of the switch.

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