Dec. 13, 1966 B. R. WANLASS 3,291,929

LIMIT SWITCH

Filed June 15, 1964 2 Sheets-Sheet 1

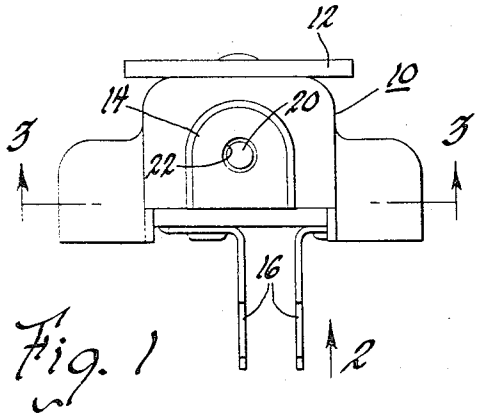


Fig. 1

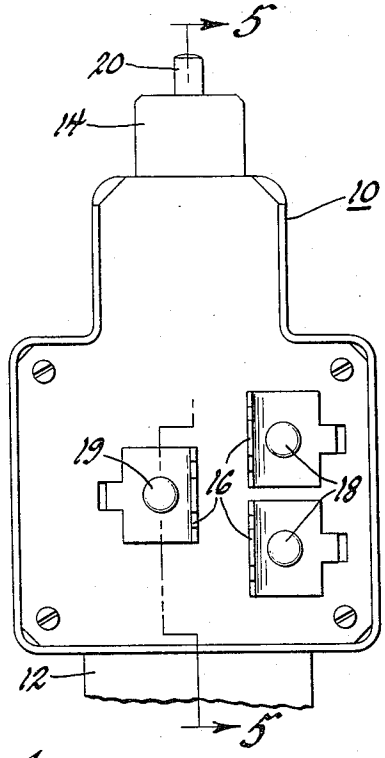


Fig. 2

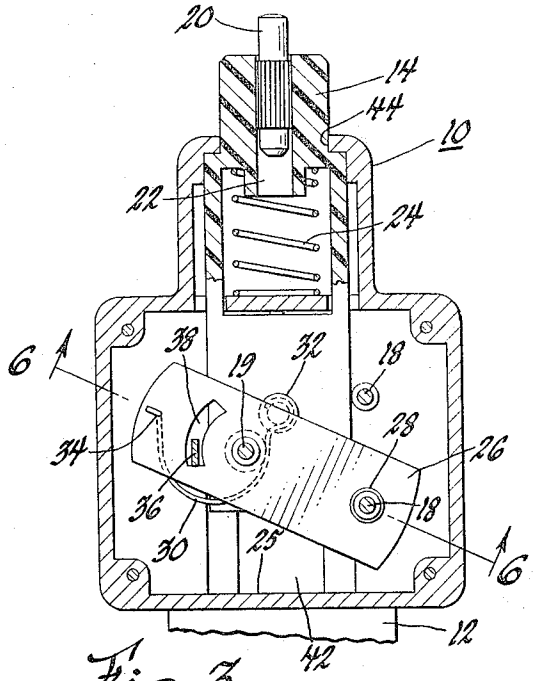


Fig. 3

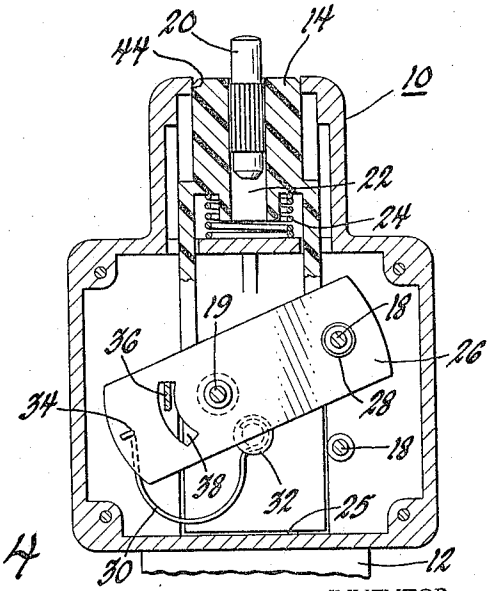


Fig. 4

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LIMIT SWITCH

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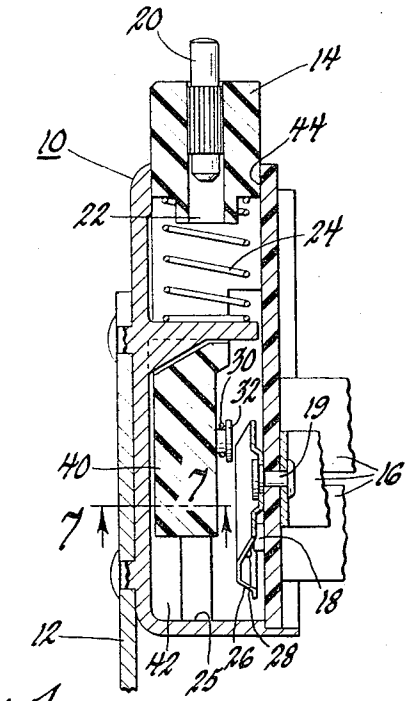


Fig. 5

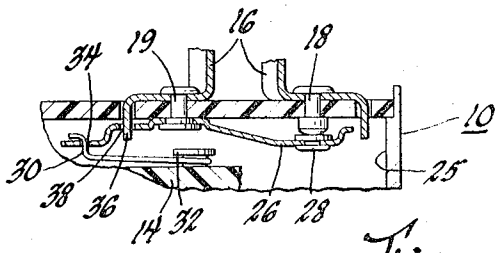


Fig. 6

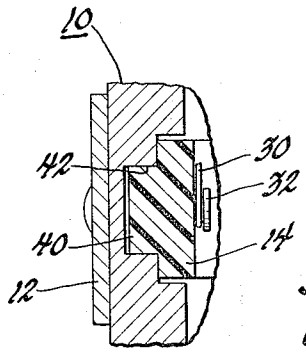


Fig. 7

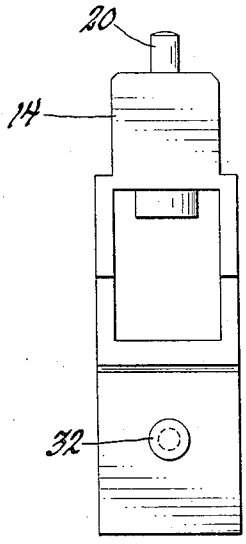


Fig. 8

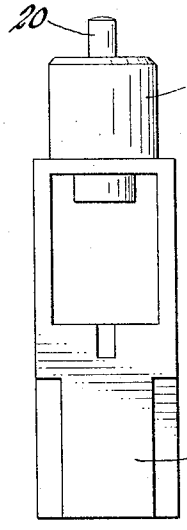


Fig. 9

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3,291,929

Patented Dec. 13, 1966

3,291,929
LIMIT SWITCH

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Filed June 15, 1964, Ser. No. 374,911
2 Claims. (Cl. 200—67)

This invention relates to electrical limit switches and more particularly to a type of electrical switch adapted to switch circuits carrying high amperage loads.

It is desirable in design of limit switches that are used in conjunction with circuits carrying high amperage to carry out the switching action in a precise manner with the actual switching taking place very quickly to minimize arcing. It is also desirable in the design of switches to have a sliding action take place between the switching contacts in order to reduce the oxidation build-up on the contacts. The speed of the switching action is important to reduce the sparking that takes place as high amperage circuits come into close proximity with one another.

It is an object of the present invention to provide an improved limit switch that is push button actuated and in which the switching action takes place after a certain amount of movement has taken place by the actuator.

It is another object of the present invention to provide an improved limit switch in which the switching action takes place very rapidly and a wiping action is generated between the switch contacts during switch actuation.

It is still another object of the present invention to provide an improved push button actuated limit switch whose actuator is normally biased in one direction toward one contact and rapidly moves into engagement with another contact after the actuator has traveled a predetermined amount.

It is yet another object of the present invention to provide an improved limit switch that will carry out the aforementioned objects and has a minimum number of moving parts and, hence, is economical to manufacture.

It is a further object of the present invention to provide an improved limit switch that is substantially impervious to the deleterious effects of humidity and moisture.

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

In the drawings:

FIGURE 1 is a plan view of the subject invention;

FIGURE 2 is a side elevation of the subject invention;

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a sectional view taken along line 3—3 of FIGURE 1 with the actuator shown in a depressed position;

FIGURE 5 is a sectional view taken along line 5—5 of FIGURE 2;

FIGURE 6 is a sectional view, with parts broken away, taken along line 6—6 of FIGURE 3;

FIGURE 7 is a sectional view taken along line 7—7 of FIGURE 5;

FIGURE 8 is a side elevation of the subject invention;

FIGURE 9 is a side elevation of the subject invention viewed from the opposite side of the switch seen in FIGURE 8.

Referring now to FIGURE 1, a switch body **10** is shown as mounted on a panel **12** is any well-known manner. An actuator **14** is seen in its operative position relative to the panel **12**.

Referring now to FIGURE 2, a series of terminals **16** are illustrated in conductive relationship with a plurality of contacts **18** that attach the terminals **16** to a wall of the switch body **10**. One of the terminals **16**, for example, connected to a power source, not shown, is attached to a wall of the switch body **10** by means of a contact rivet **19**.

Referring now to FIGURE 3, the actuator **14** is illustrated as carrying a serrated pin **20** disposed in a pocket **22** formed in one end of the actuator **14**. The serrated pin **20** frictionally engages the walls of the pocket **22** and is adapted to be permanently pressed into frictional engagement with a portion of the pocket **22** when the switch is initially mounted in its operative environment. A moving member, not shown, will make contact with the pin **20** and will serve to move the actuator **14** into the switch body. A spring **24** is biased against a portion of the switch body and the underside of the actuator **14** to provide a return means for the actuator as it is moved into the switch body by pressure being exerted on the serrated pin **20**.

A conductive member **26** is pivotally mounted on a wall of the switch body **10** and is arranged to pivot around the contact rivet **19**. The pivotable member **26** carries a contact **28** which is hereinafter referred to as a movable contact. The contact rivets **18**, previously described, have an end disposed in opposition to the movable contact **28** and will hereinafter be referred to as the fixed contacts.

A resilient means or spring **30** is pivotally carried on a pivot post **32** formed on a surface of the actuator **14**. An opposite end of the spring **30** cooperates with an aperture **34** formed on an opposite end of the conductive member **26** from the end in which the movable contact **28** is disposed.

An upstanding flange **36**, formed as an extension of the terminal **16** engaging the contact rivet, extends into the switch body and cooperates with a slot **38** of arcuate shape formed in the conductive member **26**. The relationship of the conductive member **26** and the contact rivet **19** and terminal **16** is more clearly illustrated in FIGURE 6.

Referring now to FIGURE 7, the actuator **14** is seen to have a T-shaped portion **40** arranged to slide in a keyway **42** formed in one wall of the switch body **10**. In this manner, the actuator is laterally located for sliding movement of a translational nature as pressure is put on the serrated pin **20**.

Referring now to FIGURE 5, the actuator **14** is seen to have an overall dimension in cross section substantially equal to the dimension of an aperture **44** formed in one end of the switch body **10**.

In operation, the subject invention is mounted on a panel or member **12** in an operative location where it can be struck by a moving member whose travel is to be limited. This could be, for example, a moving portion of a convertible top on an automobile. As the moving member, whose travel is to be limited, strikes the serrated pin **20** during the initial installation of the switch, the frictional resistance between the serrations and the pocket **24** is greater than the force needed to compress the spring **24**. Therefore, the actuator **14** will be driven into

the switch body until the actuator bottoms out on a wall **25** of the switch body. If further travel of the moving member, whose travel is to be limited, is necessary, this extra movement will move the serrated pin **20** to some point within the pocket **22** and, thereafter, in that particular installation, will maintain that adjusted position. This adjustment of the pin **20** relative to the actuator **14** could be accomplished by manual movement of the member whose travel is to be limited or might be accomplished by measuring devices which would establish the exact relationship of parts. In this manner, the switch is enabled to be mounted in an operative environment where slight dimensional inaccuracies in the mounting structure are automatically compensated for.

Referring now to FIGURE 3, the subject invention is illustrated in a position it will assume when no pressure is exerted on the pin **20** and the movable contact **28** is conductively engaging one of the fixed contacts **18**. Power is supplied through the contact rivet **19** into the conductive member **26** and it becomes therefore apparent that a path for current flow is established between the power source in conductive relationship with the rivet **19** and a power operable means in conductive relationship with one of the contacts **18**.

When pressure is exerted on the pin **20** by a member whose travel is to be limited, the actuator **14** is driven downwardly until it assumes a position as viewed in FIGURE 4. On its way to this position, as the pivot post **32** moves past a line passing through the aperture **34** and the contact rivet **19**, the spring **30** will very quickly pivot the conductive member **26** in a snap-acting manner into a position as viewed in FIGURE 4. A preset alignment is established between the bottomed actuator **14**, the movable contact **28** and one of the fixed contacts **18**, and the relationship of the flange **36** and the slot **38**. This is accomplished in order to positively locate the conductive member **26** and the movable contact **28** with the fixed contacts **18**. It should be noted that the aforementioned line, established between the aperture **34** and the pivot point **19**, will not be crossed by the pivot post **32** until the actuator **14** has practically completed its movement. This is important in that it allows a moving member, whose movement is to be limited, to be very positively and precisely stopped at a predetermined point.

When the moving member is moved away from the switch body **10**, the serrated pin **20** will follow that movement through a force provided by the return spring **24**. When this return motion is practically completed and the pivot post **32** moves past the newly established line defined by the aperture **34** and the rivet **19**, a snap action will again take place and the conductive member **26** will assume a position as illustrated in FIGURE 3.

The subject invention finds utility in an environment where the movement of some member is sought to be controlled. Such an environment might be the linkage mechanism controlling the positioning of a convertible top on an automobile. In this environment, a moving member would be in contact with the serrated pin **20** and would be moved to either extreme of movement by an auxiliary motor. This auxiliary motor could, for example, be an electric motor having a reversible drive. The switch could be positioned in a circuit to this motor with the terminal **16** held by the rivet **19** connected to a source of power and the contacts **18** through the terminal **16** connected thereto being disposed in a circuit controlling the direction of rotation of the motor. It is thus seen that, as an object moved by the motor approached a predetermined point during which time the pin **20** was being driven into the switch body, a snap-action switching action could be generated which would very quickly cut off power to either direction of drive of the motor. The foregoing is offered to illustrate a specific operative environment for the subject invention and is not meant to limit the operation or utility of the switch to that environment.

It is also an important feature of the subject device that the switch body can be substantially enclosed and any parts, exposed to an area outside the switch body, could be easily sealed. This sealing would serve the dual purpose of preventing foreign material from entering the switch body and would also serve to keep the switching area of the subject invention substantially free of moisture. This is a desirable feature in view of the propensity of high amperage circuits, as herein described, to arc as contacts switching such circuits approach contact with one another.

It is also to be noted, as a particularly advantageous feature of the subject device, that the switching action is generated with a sliding motion of a movable contact across one or more fixed contacts. This is generally referred to as a wiping action and serves to destroy the oxidation build-up on electrical contacts before the conductive path established between such contacts can be adversely affected. It becomes therefore apparent that the subject invention combines switching features in one switch that are normally found only in separate switches. These features are, more specifically, a snap-action switching of contacts for high amperage installations and a contact-wiping action normally associated with low amperage circuits.

While the embodiment of the present invention, as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An electric switch comprising: a switch body; actuator means slidably disposed for translational movement in said switch body; fixed contacts spaced apart and carried by the switch body, said fixed contacts being adapted to be connected respectively to an electrical load, conductive means pivotally mounted on a portion of the switch body at a point equidistant from said fixed contacts, said conductive means carrying a contact movable in an arcuate path between the fixed contacts; locating means including a slot formed in said conductive means for positioning said conductive means positively with respect to any one of the fixed contacts; and resilient means including means comprising a substantially U-shaped portion having one end pivotally engaging said actuator means and having another end pivotally engaging said conductive means, said resilient means being responsive to sliding movement of the actuator means near either extreme of translational movement to rapidly drive the movable contact into sliding engagement with any of the spaced fixed contacts.

2. An electric switch comprising: a switch body having an opening in one end thereof; actuator means slidably disposed for translational movement between two extremes on said switch body, said actuator means having a portion extending through the opening in the switch body and including an end adapted to be pressed by an actuating impulse from outside the switch body; at least two fixed contacts spatially disposed on an inside surface of the switch body and adapted to be electrically connected to external electrical circuits; conductive means pivotally mounted on a portion of the switch body and including a contact on one end thereof adapted to be moved in an arcuate path between the fixed contacts in response to movement of the actuator means, said conductive means having a slot arranged to cooperate with a stationary portion of the switch body during pivotal movement of the conductive means to positively locate the movable contact in engagement with any selected fixed contact; and a resilient overcentering U-shaped spring pivotally engaging the actuator means and the conductive means at points on opposite sides of the pivotal mounting of said conductive means to snap the movable contact into sliding engagement with the fixed contacts as the conductive means pivots in response to

translational movement of the actuator means as it approaches either extreme of movement.

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