

[54] **PULL-APART SAFETY SWITCH WITH
MAGNETIC MEANS FOR MACHINES**

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335/205

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200/61.58 B, 153 F; 335/205, 206, 207;
180/82 C

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[57]

ABSTRACT

Several embodiments of pull-apart safety switches are disclosed that are for use in connection with machines from which the operator may be thrown or which he may leave with the machine remaining in motion. Each switch includes a mount to be secured to the machine and a cover so attached to the mount that it may be pulled therefrom. The mount has leads to be included in the machine circuit that is to be controlled. The cover is provided with a flexible member attachable to the operator and of sufficient length to enable him to make normal movements without pulling the cover from the mount. Each switch also has a conductor and means releasably holding it in a first relationship with the contacts when the cover is attached and a second relationship therewith when the cover is pulled free. In one of the two relationships, the control system is operative to maintain the machine in operation. Except when the control circuit is an ignition system having a magneto, said one relationship is the first relationship and in that case, said one relationship is the second relationship. In most embodiments, the cover is magnetically held in place and in second relationship circuit control, the conductor is within the mount and is held from moving into its circuit-closing position until the cover is pulled free, the conductor then being operatively positioned magnetically, resiliently, or by both such means.

6 Claims, 13 Drawing Figures

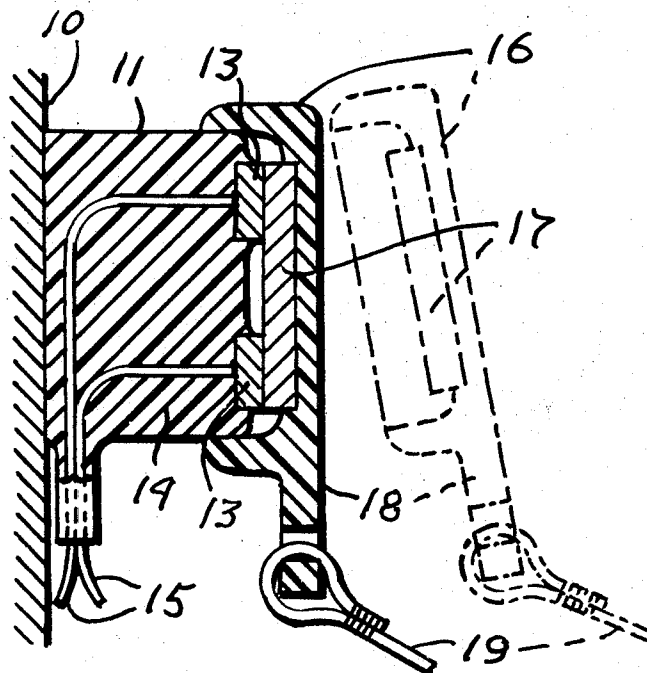


Fig. 1.

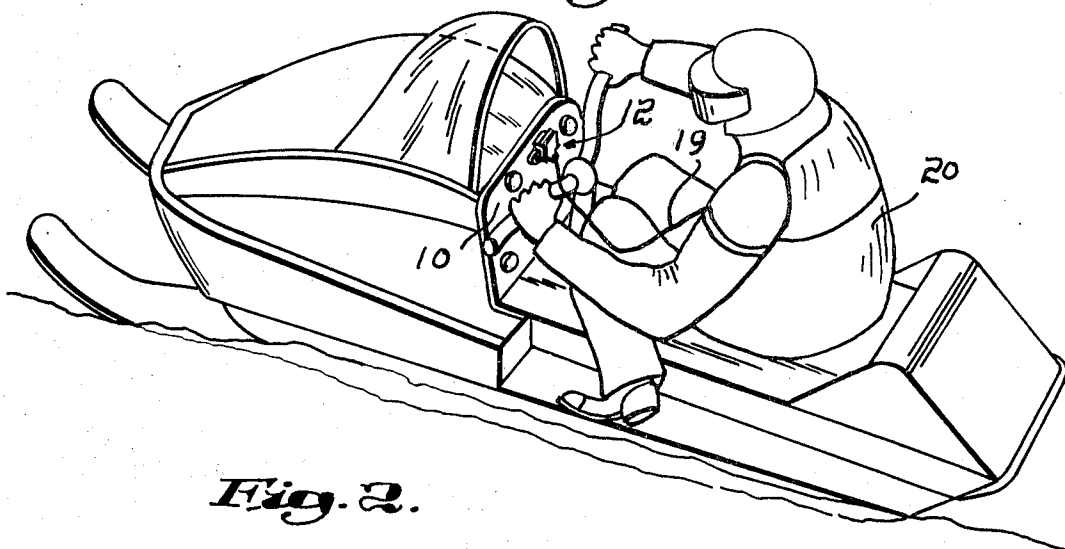


Fig. 2.

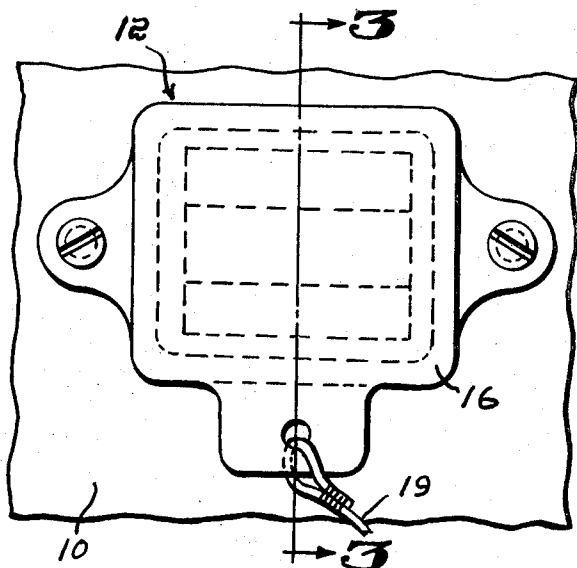


Fig. 3.

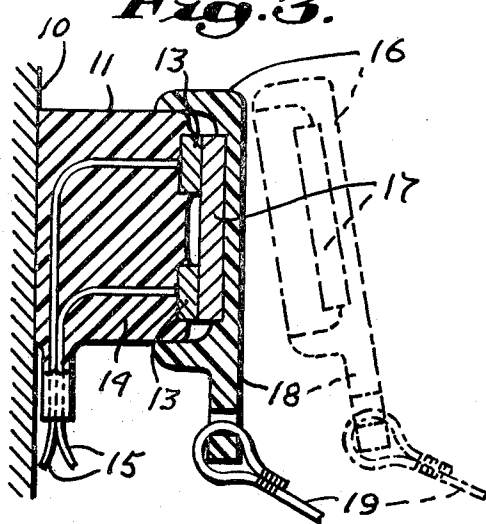


Fig. 4.

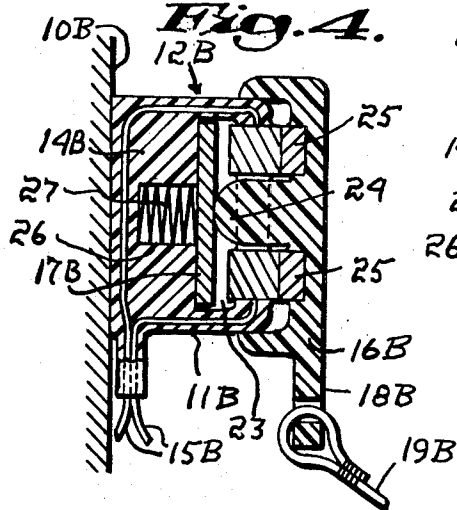
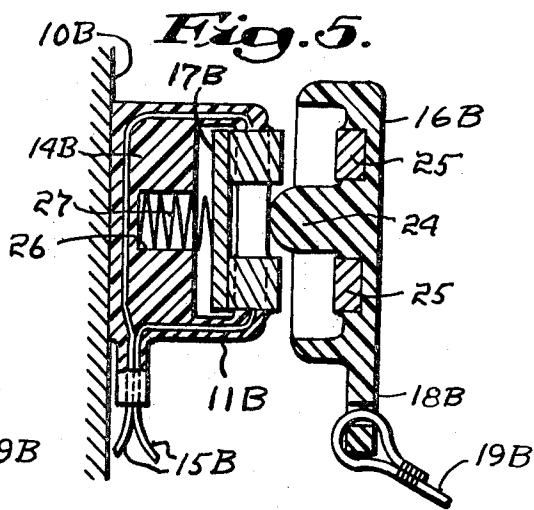
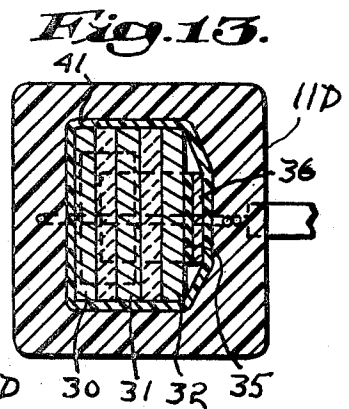
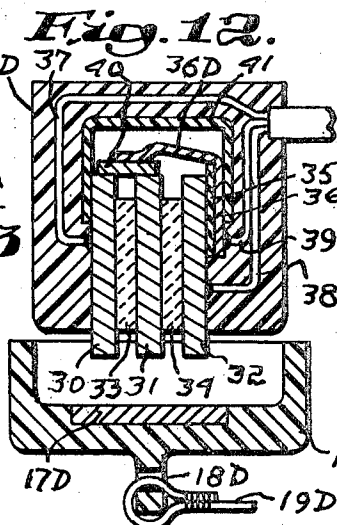
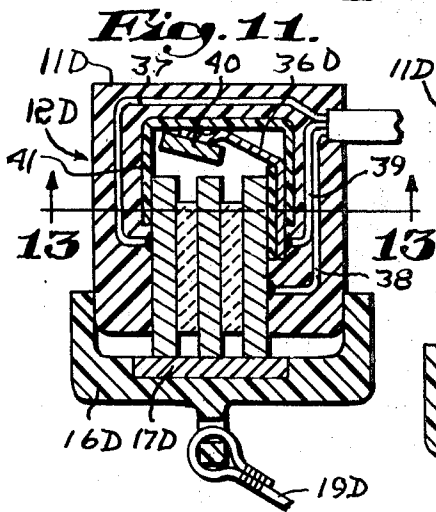
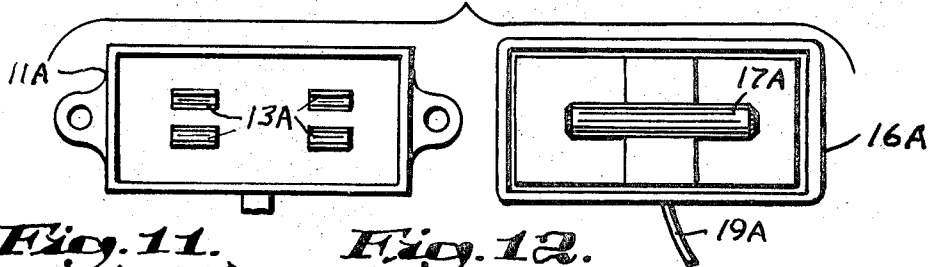
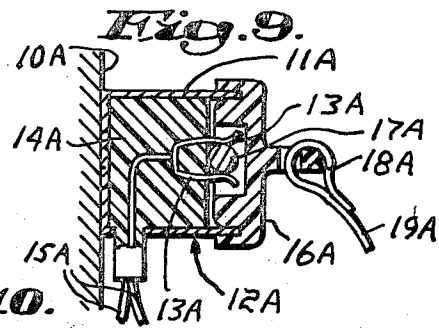
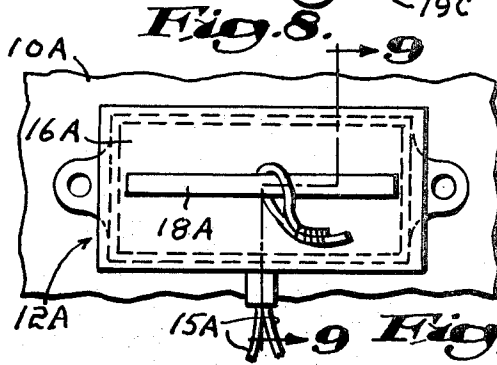
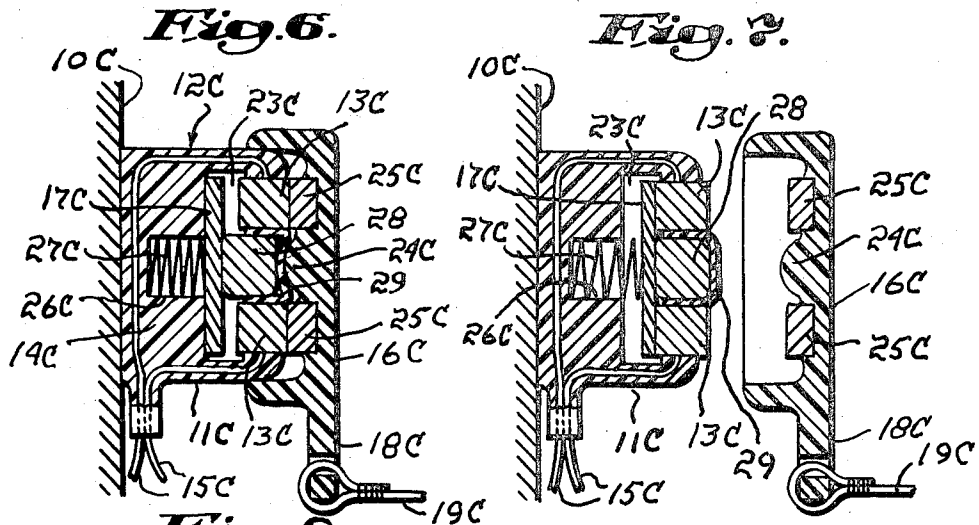


Fig. 5.





PULL-APART SAFETY SWITCH WITH MAGNETIC MEANS FOR MACHINES

BACKGROUND OF THE INVENTION

The invention is adapted for use wherever it is desired to prevent the operation of a machine if its operator is not in a position in which the machine can be controlled to meet certain standards such as performance and safety. While the invention can be used in so controlling a wide range of machines, it is herein discussed with particular reference to vehicles, especially such vehicles as motorcycles, motor boats, particularly those equipped with outboard motors, and snowmobiles.

The invention is herein discussed primarily in connection with its use in vehicles such as those specifically referred to and as stopping their engines.

Even in vehicles where the throttles are self-closing, they may become stuck for various reasons and remain open. This is particularly true in the case of snowmobiles whose throttle-operating cables often become frozen. If this happens when the operator has been thrown from his snowmobile, the snowmobile continues in motion at a speed depending, of course, on the position in which the throttle is caught. Even when the speed of the vehicle is moderate, the snowmobile may be destroyed or badly damaged. There have been occasions where injuries and even deaths were caused by runaway snowmobiles, for one example, at a race track when a runaway snowmobile killed a spectator.

The problem has been recognized and one solution utilizes a switch to short out the spark when a sensor detects excessive accelerator cable tensions indicating that it has become frozen.

THE PRESENT INVENTION

In accordance with the invention, the problems of preventing the continued operation of a machine when its operator is not in a predetermined location is met by means of a pull-apart switch having a fixed mount, usually secured to the machine and a cover attached to the mount in a manner enabling it to be pulled therefrom. The cover has a flexible member whose free end is to be pulled if the operator moves or is moved from his position. At least in the case of vehicles, the free end is attachable to the operator and of such length that his normal movements do not result in the cover being pulled free of the mount.

The mount is provided with two contacts connectable to the ends of the lead that controls the operation of the machine, a motor circuit or an ignition circuit. The switch also includes a conductor and means releasably holding it in a first relationship with the contacts when the cover is attached to the mount and providing a second relationship with the contacts when the cover is pulled free. In one relationship, the conductor is seated against the contacts to interconnect the lead ends and in the other relationship, the conductor is spaced from the contacts. In one of the two named relationships the control lead is operative to maintain the machine in operation, the first or normally closed relationship if the machine is powered by an electric motor or an engine whose ignition system includes a generator and the second or normally open relationship if the ignition system of an engine includes a magneto.

In one embodiment, the cover is held magnetically to the mount and in another, it is held in place by spring clips.

Another objective of the invention is to provide that the conductor is part of the cover and is magnetically held in its first relationship and another objective is to enable the second relationship of the conductor where the safety switches are of the normally open type, to be effected by resilient means, magnetically, or by combinations thereof, the conductor being movably positioned within the mount.

Yet another objective of the invention is to provide a pull-apart switch that has first, second, and third contacts. When the first and third contacts are included in a control circuit, first relationship circuit control is provided. When the first and second leads are included in a control circuit, second relationship circuit control is provided.

A further objective of the invention is to provide pull-apart switches of the last named type in which there are three conducting contacts in the mount each having an appropriate one of the leads secured thereto and with the contacts separated by magnets which are of the ceramic type and hence non-conductors. The third contact has an arm within the mount engageable with the second contact but spring-biased out of contact therewith. The cover includes a conductor interconnecting all three contacts when it is secured to the mount so that in first relationship control, the controlled circuit is opened when the cover is pulled from the mount. In second relationship circuit control, the magnetic field as applied to the switch arm is insufficiently strong to overcome the spring bias until the cover is pulled from the mount.

SHORT DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, several embodiments of safety switches in accordance with the invention are shown and

FIG. 1 is a perspective view of a snowmobile to the instrument panel of which the mount of a safety switch of the normally closed type is secured and the flexible member of its cover attached to the clothing of the operator;

FIG. 2 is a plan view of the safety switch with its cover attached;

FIG. 3 is a section taken approximately along the indicated lines 3—3 of FIG. 2;

FIG. 4 is a section similar to FIG. 3 taken transversely of a normally open safety switch in accordance with the invention;

FIG. 5 is a like view but with the cover pulled free of the mount and the switch closed;

FIG. 6 is a section, similar to FIG. 4, of a normally open safety switch in accordance with another embodiment of the invention;

FIG. 7 is a like view but with the cover pulled free and the switch closed;

FIG. 8 is an elevational view of another normally closed switch in accordance with the invention;

FIG. 9 is a section taken approximately along the indicated lines 9—9 of FIG. 8;

FIG. 10 is a view showing the inside surfaces of the cover and the mount;

FIG. 11 is a section, taken lengthwise of another embodiment of the invention that may function as either

a normally open or a normally closed switch depending on which of its leads are employed;

FIG. 12 is a like view but with the cover removed; and

FIG. 13 is a section taken approximately along the indicated lines 13—13 of FIG. 11.

THE PREFERRED EMBODIMENTS OF THE INVENTION

While pull-apart switches, as previously stated, are adapted for use in a wide variety of machines, they are herein discussed with particular reference to snowmobiles.

In FIG. 1, the panel of a snowmobile is indicated at 10. The snowmobile, with the embodiments of the invention illustrated by FIGS. 1—5, will be assumed to have its ignition system including a generator. As such systems are well known, no details thereof are shown.

The mount 11 of a pull-apart safety switch, generally indicated at 12 and shown in FIGS. 2 and 3, is secured to the panel 10 and it includes a pair of contacts 13 protruding from a molded body 14 of insulating material in which they are embedded with their leads 15 exposed to interconnect the ends of a lead of the ignition system that will permit the operation of the snowmobile engine only when that control lead is closed. The contacts 13 are permanent magnets.

The safety switch 12 includes a molded cover 16 of insulating material shaped and dimensioned to receive within and have a short overlap with the end of the mount 11 in which the contacts 13 are exposed, the cover 16 protecting the interior from dirt, snow, etc. and covering the contacts when the snowmobile is operable.

The cover 16 has a conductor 17 embedded therein but exposed on its inner surface and of such length that when the cover 16 is fitted on the mount 11, the conductor 17 seats against both contacts 13 and is magnetically held thereby thus releasably but securely attaching the cover 16 to the mount 11 and establishes a normally closed switch.

The cover 16 has a tab 18, usually but not always a depending tab, to which one end of a flexible member 19 is connected with its other end attachable to the clothing of the operator 20 in any desired manner, by means of a safety pin or clip (not shown) by way of examples. The flexible member 19 is of sufficient length to permit, when attached to the operator, his normal movements without pulling the cover 16 from the mount 11 but, should he be thrown from the snowmobile, the cover is pulled free thus opening the control lead of the ignition system and thereby immediately stopping the snowmobile's engine.

The pull-apart safety switch illustrated by FIGS. 8—10 is another embodiment of a normally closed switch and as it is generally similar in construction and use to the switch 12, it will not be detailed and parts that correspond thereto are distinguished by the suffix addition "A" to the appropriate reference numerals.

The contacts 13A are spring clips and the conductor 17A is a bar held by supports 22 embedded in the cover 16A. The contacts 13A and the conductor 17A are so positioned that when the cover 16A is in place, the conductor 17A is releasably caught by the contacts 13A establishing a normally closed switch, with the contacts covered, that opens if the cover 16A is pulled free.

The embodiments of the invention illustrated by FIGS. 4 and 5 are for use where the ignition system includes a magneto and a normally open ground lead that enables the engine to be stopped by closing that control lead.

The pull-apart safety switch of FIGS. 4 and 5 is to be incorporated in such a lead and is, accordingly, of the normally open type but as it is otherwise generally similar to the normally closed pull-apart safety switches that have been previously described, corresponding parts are not again detailed but are distinguished by the suffix addition "B" to the appropriate reference numerals.

In this embodiment of the invention, the mount 11B of the safety switch 12B has a channel 23 in its body 14B underlying the contacts 13B and dimensioned to loosely receive the conductor 17B and of such depth that when the conductor is bottomed therein, it is spaced from the contacts 13B which are permanent magnets.

The inside of the cover 16B is provided with a post 24 of a material that is a non-conductor of electricity and shaped and dimensioned to fit between the contacts 13B to engage and bottom the conductor 17B when the cover is fitted on the mount. The cover 16B also has a pair of magnetically responsive holders 25 exposed on its inner surface, each positioned to engage the appropriate one of the permanent magnet contacts 13B thus to releasably hold the cover 16B attached to the mount 11B.

To ensure the engagement of the conductor 17B with the contacts 13B of the cover 16B pulled free, the channel 23 has a central pocket 26 for a spring 27 operable to force the conductor into engagement with the contacts 13B when it is not held bottomed by the post 24.

As the embodiment of the invention illustrated by FIGS. 6 and 7 is generally similar, its parts that correspond to previously described embodiments are distinguished by the suffix addition "C" to the appropriate reference numerals. In this embodiment of the invention, a post 28 is attached to the center of the conductor 17C and the cover 16C has a central projection 24C. A resilient diaphragm 29 of the material that is a non-conductor of electricity seals the space between the permanent magnet contacts 13C but yields when engaged by the projection 24C to enable the conductor 17C to be bottomed to provide the normally open switch position when the cover 16C is in position.

In the embodiment of the invention illustrated by FIGS. 11—13, parts that correspond to those of previously described embodiments are distinguished by the suffix addition "D" to the appropriate reference numerals.

In this embodiment the mount 11D has three conductors serving as contacts 30, 31, and 32 separated from each other by a pair of magnets 33 and 34, each a non-conductor as it is of the ceramic type having magnetized particles embedded therein. Such magnets have their sides functioning as their poles. In practice the contacts and magnets are cemented together. An insulating sheet 35 is also cemented to the contact 32 and the end of a brass conductor 36 is cemented to the sheet 35. Leads 37, 38, and 39 are attached, respectively, to the contacts 30 and 32 and to the conductor 36 which includes a resilient arm 36D spaced from the inner ends of the contacts 30, 31, and 32 and provided

with a magnetically responsive conductor 40 dimensioned to seat against the inner ends of the contacts 30 and 31 but normally held therefrom by the resiliency of the conductor arm 36D. It will be noted that the outer and inner ends of the contacts 30, 31, and 32 extend slightly beyond the corresponding ends of the magnets 33 and 34. In practice the inner ends of the assembled contacts, magnets, the sheet 35 and the conductor 36 are fitted into a shell 41 housing and providing space for the movement of the switch arm 36D and its conductor 40 and the assembly is molded into the material from which the mount 11D is formed with the leads outside the shell.

The cover 16D has its conductor 17D dimensioned not only to be in engagement with the outer ends of all three of the contacts 30, 31, and 32 but also to provide a conductor mass that is substantially larger than that of the conductor 40.

When the leads 37 and 38 are connected to be included in the control circuit, first relationship control is provided since the conductor 17D is in engagement with all three of the contacts 30, 31, and 32. When the leads 37 and 39 are connected to be included in a control circuit, second relationship control is provided. Because of the substantial difference between the mass of the conductor 17D and that of the conductor 40, the conductor 40 is not magnetically pulled into engagement with the contacts 30 and 32 while the cover 16D is attached to the mount 11D.

While the mounts of the safety switches may be otherwise attached, they are shown as having wings apertured to permit them to be secured to the panel 10 by screws and preferably they also may have on their back surfaces a length of a tape (not shown) having both surfaces adhesive coated and with the exposed adhesive coated face protected by a removable paper sheet.

I claim:

1. A pull-apart safety switch for the control circuit of a machine and operable to prevent its operation if its operator is not at a predetermined station, said switch comprising a mount attachable to the machine and including first and second contacts, each a permanent magnet, to which leads of the control circuit are to be connected that enable the operation of the machine to be controlled, a cover attachable to the mount in a manner enabling it to be pulled therefrom, a conductor on the inside of the cover and secured thereto, means releasably holding said conductor in a first relationship with said contacts when said cover is attached to said mount and providing a second relationship with said contacts when said cover is detached from the mount, in one of said relationships, said conductor being seated against said contacts and in the other of said relationships said conductor being disengaged therefrom, and in one of said relationships said control circuit being operative to maintain the machine in operation and in the other of which its operation is prevented, and a flexible conductor secured to said cover with its free end attachable to the operator, said connector being of such length that normal movements of the operator are permitted without pulling the cover from the mount.

2. A pull-apart safety switch for the control circuit of a machine and operable to prevent its operation if its operator is not at a predetermined station, said switch comprising a mount attachable to the machine and including first and second permanent magnet contacts to

which leads of the control circuit are to be connected that enable the operation of the machine to be controlled, a cover attachable to the mount in a manner enabling it to be pulled therefrom, said mount having a pocket underlying said contacts, a conductor within said pocket, said pocket of a depth enabling said conductor to have two positions therein defining first and second relationships with said contacts, in one of said positions, the conductor being bottomed in the pocket, means releasably holding said conductor in a first relationship with said contacts when said cover is attached to said mount and providing a second relationship with said contacts when said cover is detached from the mount, in one of said relationships, said conductor being seated against and held by said contacts and in the other of said relationships said conductor being disengaged therefrom, and in one of said relationships said control circuit being operative to maintain the machine in operation and in the other of which its operation is prevented, and a flexible conductor secured to said cover with its free end attachable to the operator, said connector being of such length that normal movements of the operator are permitted without pulling the cover from the mount.

3. The pull-apart safety switch of claim 2 in which the means operable to hold the conductor in its bottomed position is a member disposed and dimensioned to extend between the contacts and connected to the conductor and the means operable to effect the engagement of the conductor with said contact portions when the cover is pulled from the mount is a resilient diaphragm of a material that is a non-conductor of electricity connected to said member and biasing it in a direction in which the conductor engages said contact portions but held by the cover when attached to said mount to prevent such engagement.

4. The pull-apart safety switch of claim 2 in which the means operable to effect the engagement of the conductor with the contact portions are magnetic.

5. A pull-apart safety switch for a device having an electrical operating source and first and second control circuits, said switch operable to connect said circuits in the alternative to said source, said switch comprising a mount attachable to the device and including first and second contacts one for each circuit and connectable therein, a third contact between said first named contacts, permanent magnets that are non-conductors of electricity, one magnet between the third contact and each of said first named contacts and having opposed forces magnetically connected thereto, a cover attachable to the mount in a manner enabling it to be pulled therefrom, a magnetically responsive conductor within said cover and secured thereto and for engagement with said three contacts when said cover is attached to said mount and a second conductor connectable to said source and including a portion of a magnetically responsive material and engageable with said third and one of said other contacts but resilient and normally spaced therefrom when the cover is attached to said mount, the first conductor being of a mass so much greater than that of the second conductor that said portion of the second member is not magnetically attracted to said magnet until the cover is separated from the mount, and a flexible connector secured to said cover with its free end attachable to the operator, said connector being of such length that normal move-

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ments of the operator are permitted without pulling the cover from the mount.

6. The pull-apart safety switch of claim 5 in which the mounting means for the second conductor is a resilient

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arm of a material that is not magnetically responsive and yieldably holds the second conductor spaced from said first and third contacts.

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