United States Patent

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[73] Assignee **Sylvania Electric Products Inc.**

[54] **THERMAL SWITCH**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **337/407**
[51] **Int. Cl.** **H01h 37/76**
[50] **Field of Search** 337/401, 402, 407, 411, 413, 414, 416

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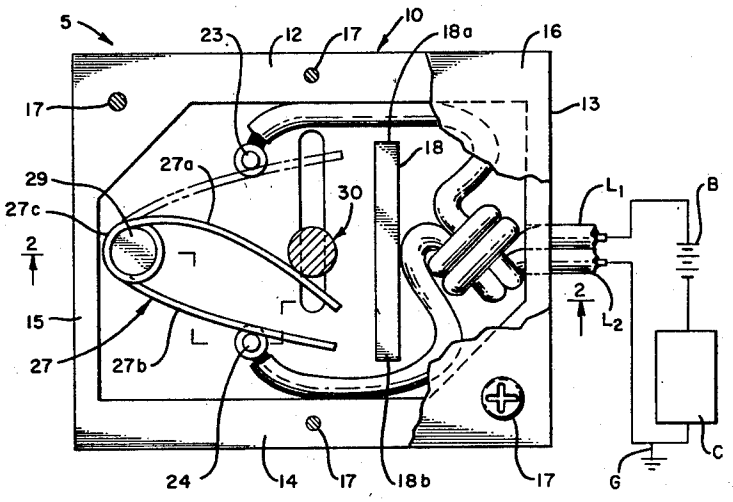
ABSTRACT: A two-piece plastic case having laterally spaced stationary contact pins extending transversely of the case interior and a movable contact comprising single strand of a spring conductor positioned within the case and tensioned transversely of its length to engage both pins. A detent having a relatively low melting temperature extends into the case through an opening in its wall and holds the moving contact out of engagement with one of the contact pins. Insulated external switch leads extend into the casing for electrical connection to the contact pins, respectively. A slot in the casing wall provides access to the movable contact from outside the casing for retracting or cocking it prior to insertion of the detent.



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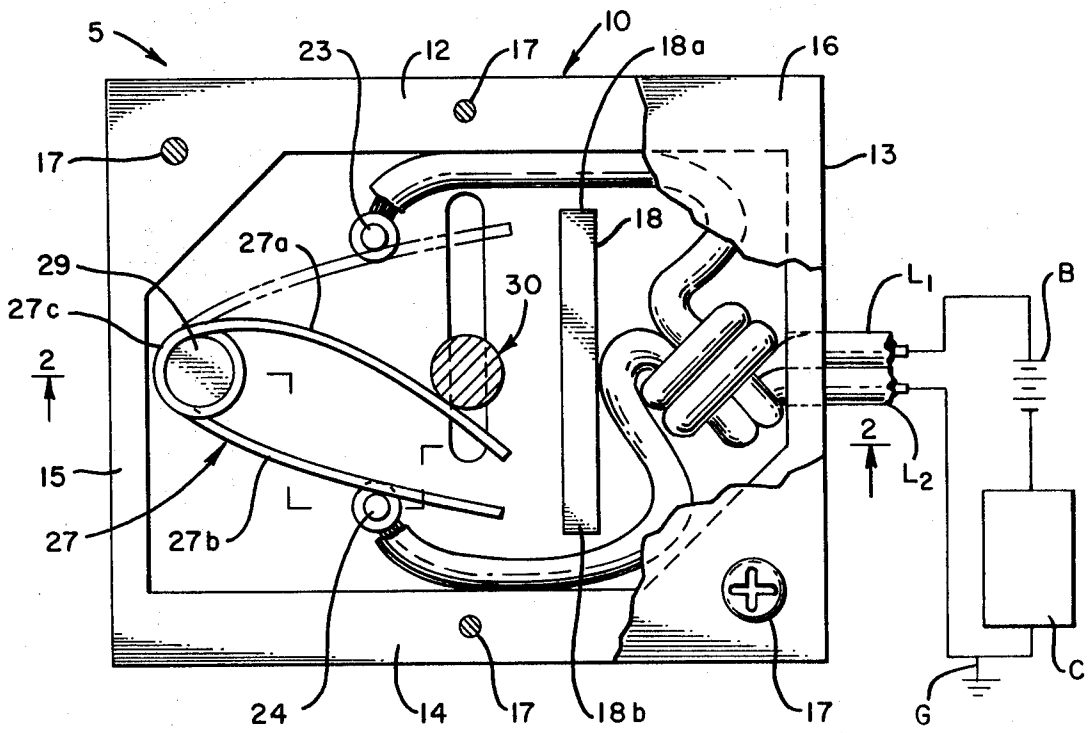

FIG-1

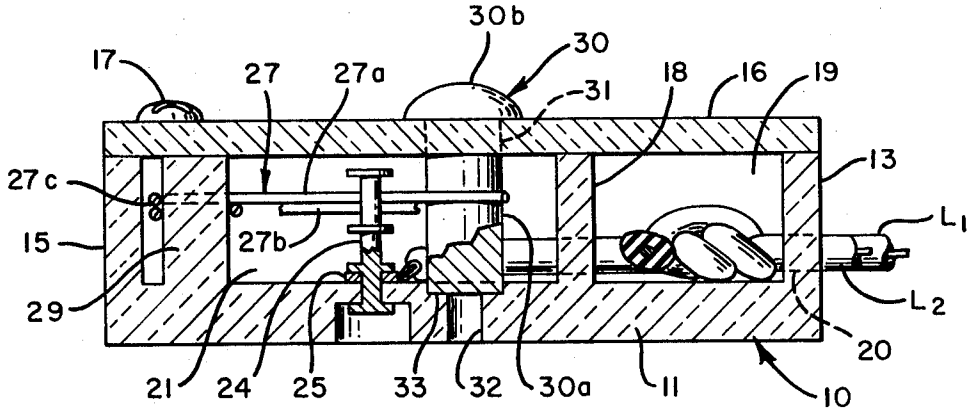

FIG-2

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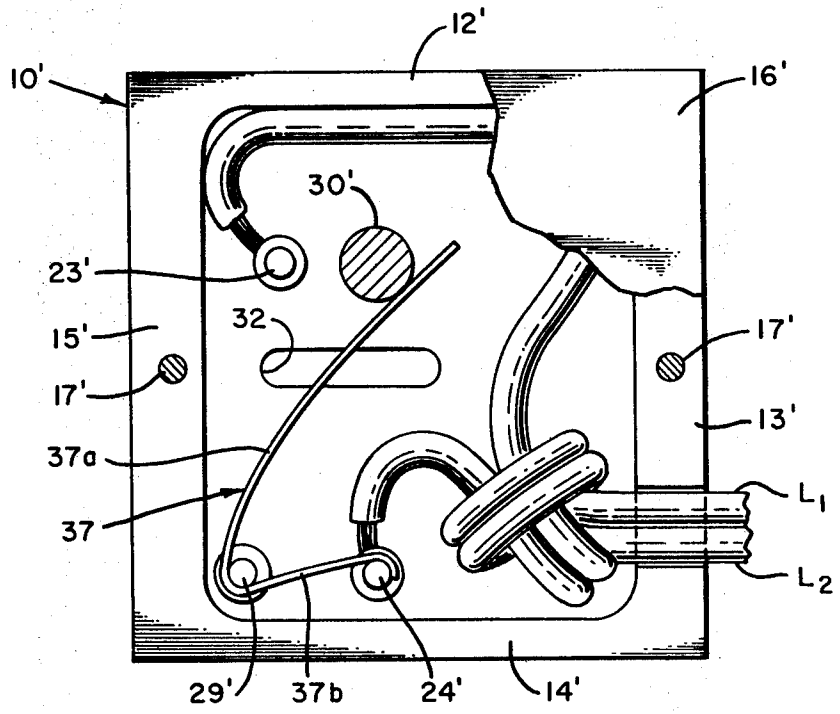

FIG-3

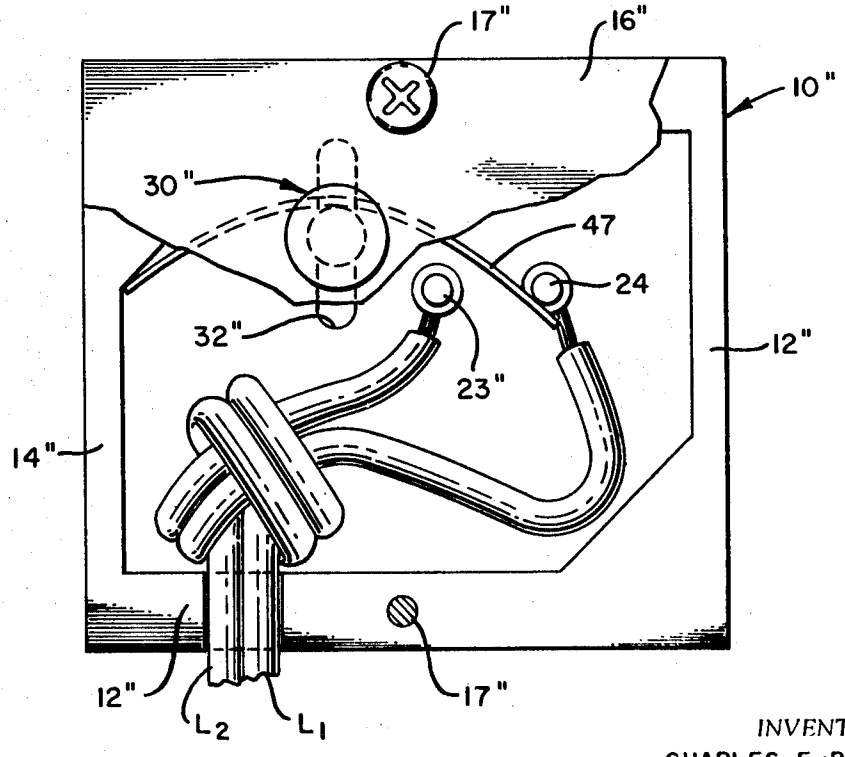

FIG-4

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THERMAL SWITCH

BACKGROUND OF THE INVENTION

The invention relates to electric switches and more particularly to an extremely low-cost temperature-sensitive electric switch.

Electric switches which close automatically in response to heat generally are constructed to be resettable to the initial or normal position. This enables the switch to be used again once it has been tripped and permits testing of circuits associated with the switch. Examples of such resettable switches are a circuit breaker with a manual reset mechanism and the bimetallic switch which resets automatically. Such types of switches, however, are inherently relatively costly to produce and are therefore not economically suitable as heat sensors for home fire detection apparatus because of price sensitivity of the homeowner for such safety systems.

An object of this invention is the provision of a reliable heat responsive switch of extremely simple low-cost construction.

SUMMARY OF THE INVENTION

This switch assembly features a pair of spaced stationary contact pins, a tensioned conductive strand as a movable contact, and a detent with a relatively low melting temperature in the path of the movable contact to hold it out of engagement with one of the pins. When the detent melts in response to ambient heat, the movable contact swings against the stationary contact and thus closes the switch.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a switch assembly embodying the invention, the cover of the switch casing being broken away to show details of construction;

FIG. 2 is a section taken on line 2—2 of FIG. 1; and

FIGS. 3 and 4 are views similar to FIG. 1 showing modified forms of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings, a switch **5** embodying the invention is shown in FIGS. **1** and **2** connected to lines L_1 and L_2 for controlling energization of an external circuit coupled to these lines and consisting of a source B of electrical energy, such as a battery, and utilization apparatus C such as a bell. Switch **5** comprises a casing **10** composed of electrically nonconductive material such as plastic and having a base wall **11** and integral sidewalls **12**, **13**, **14** and **15**, and a preferably metallic cover **16** removably secured by screws **17** to the casing sidewalls. Casing **10** also has an integral intermediate wall **18** which abuts the underside of cover **16** and together with the adjacent sidewalls defines a compartment **19** for retaining a knotted portion of lines L_1 and L_2 adjacent to casing wall opening **20** through which the lines extend. Ends **18***a* and **18***b* of wall **18** are spaced from sidewalls **12** and **14**, respectively, to permit lines L_1 and L_2 to extend into switch compartment **21** on the opposite side of the intermediate wall.

The stationary switch contacts are substantially identical laterally spaced parallel pins **23** and **24** which are secured to and extend through base wall **11** into compartment **21** for a distance slightly less than the depth of the latter so as to be spaced from cover **16**. Pins **23** and **24** preferably are configured with spaced shoulders as shown and each is permanently electrically connected adjacent to base wall **11** to a terminal **25** on the end of the associated line L_1 or L_2.

Moving contact **27** of this switch consists of a single conductive strand of spring wire configured in a U-shape similar to a safety pin with two legs **27***a* and **27***b* projecting from a coil portion **27***c*. A fixed post **29** preferably integral with base wall **11** projects therefrom across compartment **21** generally parallel with and offset from pins **23** and **24** and anchors the coiled strand portion **27***c* which is wound thereabout. Legs **27***a* and **27***b* extend between and overlie pins **23** and **24** and are tensioned by coil **27***c* to normally move apart toward and into engagement with the pins; leg **27***b* operatively engages contact pin **24** continuously.

In accordance with the invention, a detent **30** is disposed between stationary contact **23** and movable contact leg **27***a* to hold the switch open. Detent **30** has a cylindrical stem **30***a* which extends snugly through opening **31** in cover **16** into the path of movement of leg **27***a* and an enlarged head **30***b* which abuts the exterior or the cover when the detent is fully inserted. The material of which detent **30** is composed is sufficiently rigid when cool, i.e., at room temperatures, to hold leg **27***a* in its tensioned or "cocked" position as shown in solid lines in FIG. **1** and yet is responsive to heat to soften or melt at a temperature well below the melting temperature of the other parts of the assembly so as to unblock leg **27***a* and permit it to snap into engagement with pin **23** as shown in broken lines to close the switch when such a heat condition prevails. By way of example, detent **30** may be made of an alloy of Wood's metal and lead having a melting temperature of 147° F. and marketed under the trademark Cerrolow by United Refining and Smelting Company of Chicago, Illinois. Cover **16** has high thermal conductivity to facilitate transmission of ambient heat to the detent and for this purpose may be aluminum or an aluminum alloy. Line L_2 may be grounded as indicated at G so that contact pin **24** to which it is connected along with detent **30** and cover **16** are not electrically "hot."

In order to check the operation of the switch when making a system test, detent **30** simply is physically removed from the casing, thus disengaging contact arm **27***a* which snaps into engagement with pin **23** to close the switch. In order to permit resetting of the switch, a slot **32** is formed in base wall **11** aligned with and extending on opposite sides of detent stem **30***a*. A small tool such as a screwdriver may be inserted through slot **32** to retract arm **27***a* prior to reinsertion of detent **30** in the operative position. As shown, the width of slot **32** is less than the diameter of detent **30***a* and recess **33** on the inside of base wall **11** in alignment with cover opening **31** provides a seat for the detent.

It will be noted that casing **10** and cover **16** provide an effective protective enclosure which may readily be mounted in strategic locations to detect conditions which generate excessive heat. Casing **10** is a one-piece structure capable of being reproduced in large quantities at low cost by injection molding or similar mass production techniques. Cover **16** not only constitutes part of the enclosure but also greatly increases the sensitivity of the detent to ambient heat due to the high coefficient of heat transfer of the cover material. The detent itself is physically part of the switch mechanism and also is the heat sensor. The moving contact **27** is both a spring and the conductive bridge between stationary contacts, thus further simplifying construction and minimizing the number of parts required for the assembly. The action of detent **30** in positively blocking movement of contact arms **27***a* in the absence of excessive heat insures against inadvertent tripping of the switch even when accidentally jolted or struck.

An alternate embodiment of the invention is shown in FIG. **3** in which the spring wire movable contact **37** is L-shaped and has a tensioned long leg **37***a* held out of engagement with one stationary contact **23'** by a similar detent **30'** and a similarly tensioned short leg **37***b* hooked over and anchored on the other stationary contact **24'**. Thus strand **37** is not coiled around post **29'** but is simply bent substantially at a right angle about this post so as to cause leg **37***a* to exert a torque against the detent.

Another embodiment of the invention is shown in FIG. **4** wherein the spring wire contact **47** in the cocked position is concavo-convexly bowed around detent **30''** in the manner of a toggle with the concave side engaging the detent and opposite ends of the convex side engaging casing sidewall **14''** and stationary contact pin **24''**, respectively. When detent **30''** melts or is otherwise removed from the switch casing, contact **47** tends to straighten and snaps into engagement with stationary contact **23''** to close the switch. In other respects,

the switch assemblies shown in FIGS. 3 and 4 are substantially the same as that shown in FIG. 1 and like parts are indicated by the primes of like reference characters.

I claim:

1. A switch for a pair of electrical lines comprising
an electrically nonconductive casing having a base wall and integral sidewalls and an integral post
a cover secured to said sidewalls spaced oppositely from said base wall and defining with said casing an enclosure for the two end portions of said lines, said cover having an opening therein,
a pair of laterally spaced parallel electrically conductive pins secured to said base wall and extending transversely of the interior of said enclosure,
said pins being electrically connected to said lines, respectively,
said integral post being between and offset from said pins,
an electrically conductive U-shaped spring element having a coiled part wound about said post and having one portion thereof extending from said coiled part electrically connected to one of said pins and another portion thereof extending from said coiled part movable between a first position spaced from the other pin and a second position in engagement with said other pin,
said element being self-tensioned for producing movement of said another portion in a direction from said first position to said second position,
a detent projecting from outside the enclosure through said opening in said cover into the path of movement of said another portion of said element for holding the latter in said first position,
said detent being sufficiently rigid at room temperatures to hold said another portion of said element in said first position and being responsive to heat at elevated temperatures less than the melting temperature of said casing to soften and unblock movement of said another portion of the element to said second position.

2. A switch for a pair of electrical lines comprising
an electrically nonconductive casing having a base wall and integral sidewalls and an integral post,
a cover secured to said sidewalls spaced oppositely from said base wall and defining with said casing an enclosure for the two end portions of said lines, said cover having an opening therein,
a pair of laterally spaced parallel electrically conductive pins secured to said base wall and extending transversely of the interior of said enclosure,
said pins being electrically connected to said lines, respectively,
said integral post being between and offset from said pins,
an electrically conductive L-shaped spring element bent partially around said post and having one portion thereof electrically connected to one of said pins and another portion thereof movable between a first position spaced from the other pin and a second position in engagement with said other pin,
said element being self-tensioned for producing movement of said another portion in a direction from said first position to said second position,
a detent projecting from outside the enclosure through said opening in said cover into the path of movement of said another portion of said element for holding the latter in said first position,
said detent being sufficiently rigid at room temperatures to hold said another portion of said element in said first position and being responsive to heat at elevated temperatures less than the melting temperature of said casing to soften and unblock movement of said another portion of the element to said second position.

3. A switch for a pair of electrical lines comprising
an electrically nonconductive casing having a base wall and integral sidewalls,
a cover secured to said sidewalls spaced oppositely from said base wall and defining with said casing an enclosure for the two end portions of said lines, said cover having an opening therein,
a pair of laterally spaced parallel electrically conductive pins secured to said base wall and extending transversely of the interior of said enclosure,
said pins being electrically connected to said lines, respectively,
an electrically conductive spring element having one portion thereof electrically connected to one of said pins and another portion thereof movable between a first position spaced from the other pin and a second position in engagement with said other pin,
said element being self-tensioned in a concavo-convex shape and being disposed with opposite ends of the convex side engaging a sidewall of the casing and said one of said pins, respectively, for producing movement of said another portion in a direction from said first position to said second position,
a detent projecting from outside the enclosure through said opening in said cover into the path of movement of said another portion of said element for holding the latter in said first position,
said detent being sufficiently rigid at room temperatures to hold said another portion of said element in said first position and being responsive to heat at elevated temperatures less than the melting temperature of said casing to soften and unblock movement of said another portion of the element to said second position.

4. A switch for a pair of electrical lines comprising
an electrically nonconductive casing having a base wall and integral sidewalls, said base wall having a slot therein,
a cover secured to said sidewalls spaced oppositely from said base wall and defining with said casing an enclosure for the two end portions of said lines, said cover having an opening therein,
a pair of laterally spaced parallel electrically conductive pins secured to said base wall and extending transversely of the interior of said enclosure,
said pins being electrically connected to said lines, respectively,
an electrically conductive spring element having one portion thereof electrically connected to one of said pins and another portion thereof movable between a first position spaced from the other pin and a second position in engagement with said other pin,
said element being self-tensioned for producing movement of said another portion in a direction from said first position to said second position,
said base wall slot being aligned with the direction of movement of said one portion of the element between said first and second positions whereby to permit access to the interior of the casing from the exterior for resetting said element,
a detent projecting from outside the enclosure through said opening in said cover into the path of movement of said another portion of said element for holding the latter in said first position,
said detent being sufficiently rigid at room temperatures to hold said another portion of said element in said first position and being responsive to heat at elevated temperatures less than the melting temperature of said casing to soften and unblock movement of said another portion of the element to said second position.