

May 31, 1955

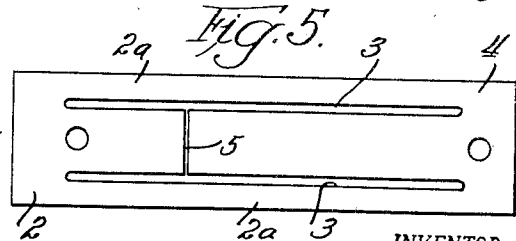
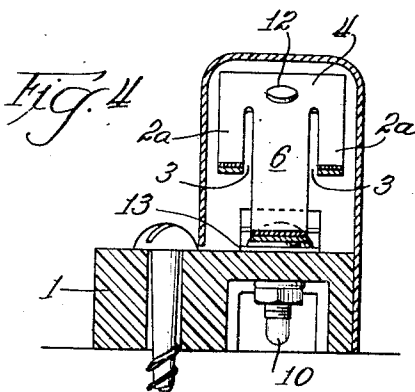
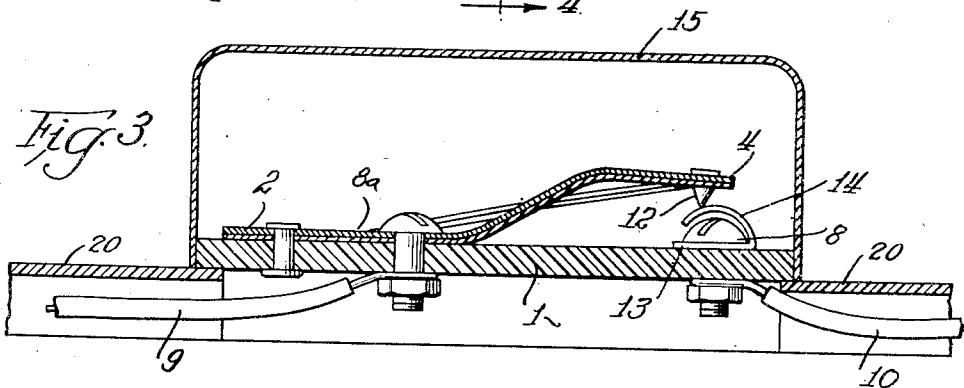
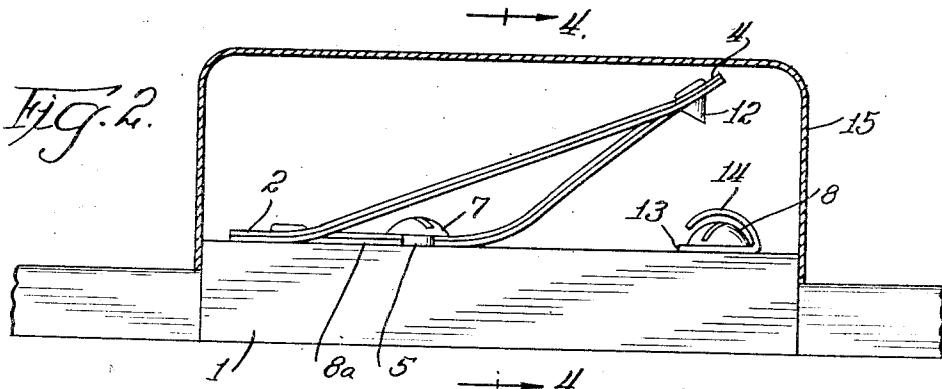
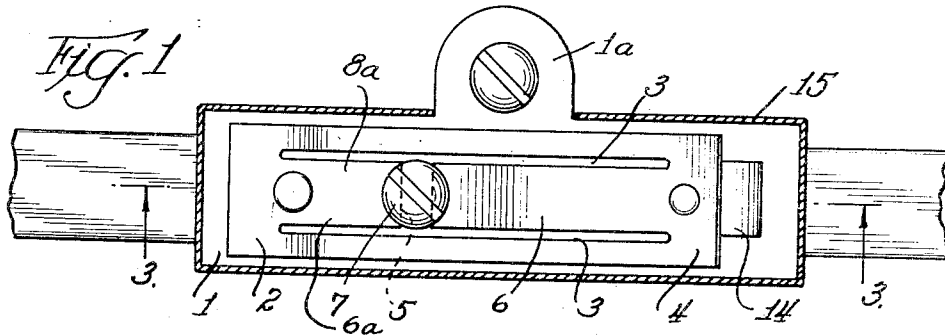
E. H. DAVIS

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THERMO-RESPONSIVE ELECTRIC SWITCH

Original Filed May 28, 1948

2 Sheets-Sheet 1



INVENTOR.  
EDWARD H. DAVIS, DECEASED  
By MARY D. DAVIS CULLER, ADMINISTRATRIX

By *Rudolph M. Loh*  
Att'y

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E. H. DAVIS

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THERMO-RESPONSIVE ELECTRIC SWITCH

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2 Sheets-Sheet 2

Fig. 6.

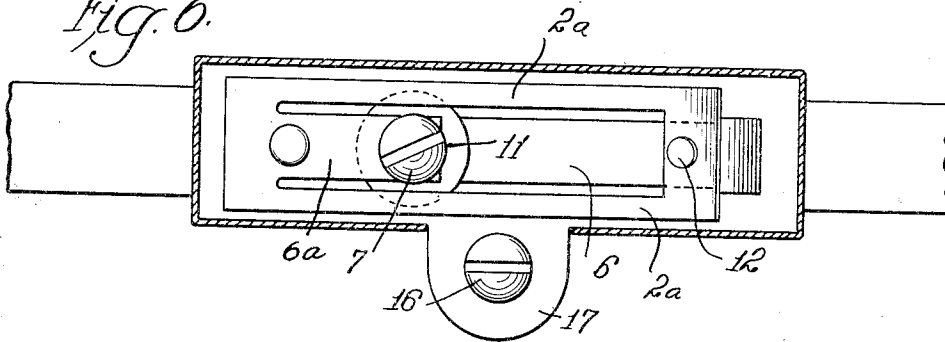


Fig. 7

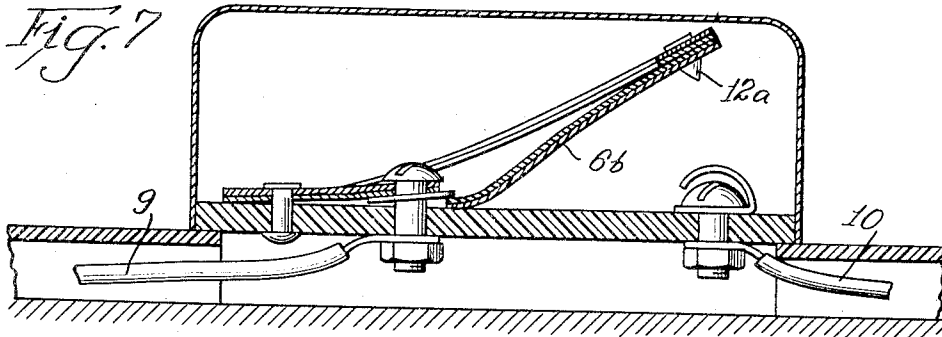


Fig. 8.

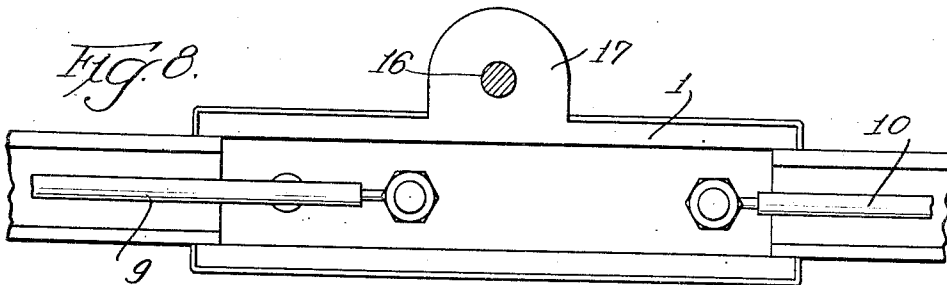


Fig. 10

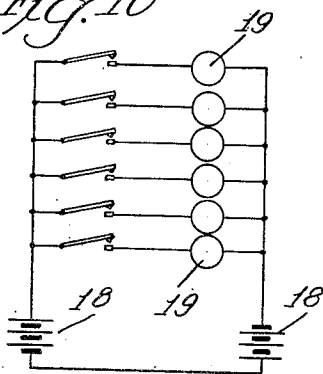
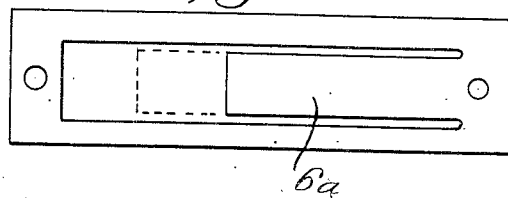


Fig. 9.



INVENTOR.  
EDWARD H. DAVIS, DECEASED, BY  
MARY D. DAVIS CULLER, ADMINISTRATRIX

BY

*Rudolph J. ...*  
Att. 3

1

2,709,732

## THERMO-RESPONSIVE ELECTRIC SWITCH

Edward H. Davis, deceased, late of Bristol, Ind., by Mary D. Davis Culler, administratrix, Elkhart, Ind., assignor to Mary D. Davis Culler

Substituted for abandoned application Serial No. 29,789, May 28, 1948. This application December 5, 1952, Serial No. 324,169

4 Claims. (Cl. 200—138)

This application is a substitute application for application for patent for Thermoresponsive Electric Switch, filed May 28, 1948, Serial No. 29,789, now abandoned.

This invention relates to improvements in the art of automatic electric fire alarm systems, and more particularly in improvements in thermoresponsive switches for such systems, operating to close an electric circuit of the system responsively to temperature of a predetermined degree, and to reopen said circuit as said temperature drops below said predetermined point.

The main object of the invention is to provide a fire alarm system, including the aforesaid type of switch, which is very compact, cheap, efficient, easy to install by persons unskilled in the art, and which may be embodied in a small portable device of pocket size or to be contained in hand or traveling bags of any size and hung upon a wall of a room by the occupant thereof for automatic alarm to the latter upon rise of room temperature to a given point without requiring any connection of the device with any existing electric circuit to render the same operative.

A further object of the invention is to provide a simple and efficient dry battery circuit operative fire alarm system which is adapted for use on farms, in coal mines, grain bins and cribs, in association with waste cans, or wherever spontaneous combustion may result.

Another important object of the invention is to provide a switch of the type specified which will not close a circuit responsively to a mere flash-fire, thus to avoid false fire alarms.

In the accompanying drawings illustrating a suitable or exemplary embodiment of the invention—

Fig. 1 is a plan view of a thermoresponsive switch constructed in accordance with the invention.

Fig. 2 is a side elevation of the same, the casing thereof being shown in vertical longitudinal section.

Fig. 3 is a vertical longitudinal sectional view of the same on the line 3—3 of Fig. 1 wherein the switch is shown disposed in circuit closing position.

Fig. 4 is a vertical transverse sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a plan view of the switch lever to show the separation line of the middle tongue of same from the outer marginal portions thereof.

Figs. 6 and 7 are views similar to Figs. 1 and 2 showing means whereby the switch is adjusted to respond to a lower temperature to effect closing of the circuit thereby.

Fig. 8 is a bottom plan view of the structure.

Fig. 9 is a view similar to Fig. 5.

Fig. 10 is a diagrammatic illustration of a circuit controlled by the switch.

The switch comprises a base member 1 which may be made of any suitable electrically non-conductive material, such as a suitable plastic.

In the instance illustrated, said base member 1 is of U-shape or channelled type and upon the web portion thereof there is mounted a member 2 composed, preferably, of resilient bi-metal strip stock, of any predeter-

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mined gauge, which is equipped between its parallel side edges with longitudinal slots 3 spaced equally from said side edges and extending from a point spaced from its forward end portion 4 to a point spaced farther from the other end of said strip.

A cross-cut or slot 5, at a predetermined point between the ends of said slots 3, severs the middle portion of the member 2 and thus provides middle tongues 6 (Figs. 1-5) and 6a (Fig. 9) which, when spaced apart at their opposed extremities, operate in the manner described below to flex the tongue 6 relative to the remainder of the member 2 responsively to heat to render said member 2 a unitary switch lever.

A fastening device, preferably an ordinary round head screw 7, has its shank passed through the space afforded by moving the inner end portion of said tongue 6 away from the opposed wall of the cross cut 5 by flexing the said tongue, and thus the shank of said screw, which secures the member 2 to the base member 1, constitutes one terminal of an electric circuit, clamps the inner end portion of the tongue 6, and the opposed portion of the members 2 upon the base 1.

By thus spacing the tongue 6 from the opposed wall of the slot 5, the member 2 is flexed to extend angularly upwardly so that the terminal portion 4 thereof is spaced from the switch terminal 8, which also is a screw that is passed through the web of the member 1, the respective wires 9 and 10 of the electric circuit, diagrammed in Fig. 10, being equipped with nuts and washers for securing said wires thereto.

The gauge of metal of the member 2 and the length and width of the latter, the length and width of the slots 3 and their spacing from the side edges of said member 2, determine the width of the tongue 6 relative to the width of the side edge portions of the member 2, and all of these dimensional factors, in combination with the width of the slot 5 determined by the diameter of the shank of the screw 7, or the diameter of a washer 11 interposed between the head of the screw 7 and the inner end of the tongue 6, determine the temperature to which the raised end portion of the member 2 must be heated in order to cause the end portion 4 to move downwardly to effect closure of the circuit.

As shown in Fig. 2, the portion 4 of the member 2 is equipped with conical contact member 12, and the screw 8 secures to the member 1 a metal strip 13 which includes a portion 14 which overhangs the head of said screw 8 and is adapted for engagement with the contact member 14 to close the circuit aforesaid.

The bent over portion 14 of the strip 13 opposes a convex surface to the member 12, and, responsively to temperature increase, said bent or loop portion 14 of the strip 13 will expand and thus a sliding contact between said member 12 and the opposed convex surface portion 14 of the strip 13 will effect assured circuit closing contact between said members 12 and 13 through any coating that may have collected upon said convex surface 14 or the member 12, or both.

The members 12 and 13 are composed, preferably, of silver or a silver alloy or of any other metal best suited to the purpose.

The width of the tongues 6 is greater preferably, than the combined width of the side edge portions of the member 2 which, for convenience, may be referred to as the tension elements of the same, and the tongue 6 referred to as the compression member thereof which maintains the side edge portions, or legs 2a, under tension.

The washer 11 is shown in Fig. 7 wherein the tongue 6b, substituted for the integral tongue 6, is shown also as being a separate element riveted at one end to the portion 4 of the member 2, thus permitting said tongue 6b to be made of a different gauge of metal than the

member 2, and also of different dimensions than the tongue 6 of Figs. 1-5.

Bi-metal strips will bend in only one direction responsively to heating thereof and, in the instance illustrated, this bend is such as to cause the outer end portion 4 of the member 2 to move toward the head of the screw 8.

The heat also causes the tongue 6 to bend likewise and, due to the fact that its inner extremity is spaced from the opposed end of the shorter tongue 8a, it is caused to buckle, gradually, to attain the ultimate shape shown in Fig. 3.

Obviously the legs 2a and the tongue 6 swing about fulcrums while absorbing heat.

As soon as this buckling has attained a given degree, at which it may be regarded in the light of having attained a dead center position, wherein the tension stress on the legs 2a is maximum, and passes this position, the tongue 6 effects a more rapid downward movement of the portion 4 of the member 2 which finally terminates in the equivalent of a snap motion, so that the electric circuit is closed as with a blow.

The member 13 may be omitted and the member 12, equipped with a relatively sharp point, caused to contact a convex surface portion of the head of the screw 8 spaced sufficiently from its axis to effect a sliding movement thereof along said surface and thus assure that it will cut through any deposit of dust or grease upon the screw head and the point of the member 12.

The action last described is substantially identical with what occurs in the conventional type of snap switch, wherein a spring held plunger snaps from one position to another when it passes a dead-center position, but the present switch presents the advantage that, upon cooling, it operates to reopen the circuit.

Obviously the member 12a of Fig. 7 may be in the form of a rivet for securing the tongue 6b to the member 2.

The switch may be made to close the circuit responsively to any desired temperature, as, for example, from 120° F. up but below a degree that may be destructive thereof.

The said switch lever is disposed, preferably, within a sheet metal casing 15 which may be of sealed type or perforated to connect its interior with atmosphere.

The base member 1 is equipped with a side projection 1a equipped with an opening for passage of the shank of a fastening screw 16 which passes also through an opening in the flange 17 of the casing 15.

The sealed type of casing 15 is particularly adapted and designed for mounting or loose disposition in grain bins or other receptacles for products which are subject to spontaneous combustion, the circuit wires 9 and 10, shown in Fig. 8, being adapted to project from the receptacle and be connected with any suitable alarm means, such, for example, as an electric bell.

Either type of casing 15 may also be incorporated into small, pocket size assemblies (including batteries 18 (adapted to be secured to or hung upon walls of bedrooms or any type of room, as in factories, warehouses, etc., to alarm the occupant of fire, or danger thereof. Such assemblies may include circuit wires of sufficient length to permit the alarm element to be disposed outside the room by passing said wires through a transom or any other opening. Thus, in instances wherein laws compel installation of fire alarm systems which involve electric wiring, such assemblies may be installed temporarily and later incorporated into permanent wiring of the building which is not always accomplished speedily.

In Fig. 10 there is shown a diagram of an electric circuit through a series of alarm devices 19, such as electric lamps or bells.

In Fig. 10, two batteries 18 supply the current required, the wire 9 being connected with all of the devices 19, which may be disposed in different rooms, and the wire 10 being connected with the switch terminals 3,

so that, upon closure of any one of the circuits by a switch lever 2, the alarm via a light or bell will be effective.

As shown in Figs. 2, 3 and 4, the base member 1 is an inverted channel bar which is adapted to receive, telescopically, the extension channel bar members 20 through which circuit wires 9 and 10 may pass and which may be secured to walls along which said wires extend from one switch base member to another.

Obviously the middle or tongue portion of the strip 2 may be severed at any one of a number of predetermined points, as, for example, at the junction of the tongue 6 with the end portion of said strip to be secured to the base member if said tongue 6 is desired to be of maximum length, or at any point spaced therefrom which will serve to render said tongue 6 as short as may be required to effect closure of the electric circuit responsively to heat of less degree than is required in instances wherein the said tongue 6 is of greater length.

Also, the inner extremity of a shorter tongue 6 may be secured to the base member at any desired point spaced from the secured end portion of the strip 2 by means other than said screw 7 alone or by means of elements such as the washer 11.

Having thus set forth and disclosed the nature of the invention, what is claimed is:

1. An electric switch comprising a base member composed of suitable non-conductive material, a switch lever composed of a strip of resilient bi-metal having parallel side edges and equipped with parallel longitudinal slots parallel with and spaced equidistantly from said side edges and spaced apart a distance no more than twice the spacing of same from said side edges, the portion of said strip lying between said slots being severed between its ends at a predetermined point to provide a pair of tongues of respectively different lengths and meeting substantially along said line of severance, a metallic screw passed between the opposed ends of said tongues through said base and constituting a terminal of an electric circuit and operating also to maintain said tongues spaced apart, and a second metallic screw passing through said base and disposed in the path of the free end portion of said strip and constituting the other terminal of said circuit, the spacing apart of said tongues operating to cause the free end portion of said strip to be spaced normally from said second-named screw.

2. A thermoresponsive electric switch comprising a non-conductive base member, a normally substantially straight resilient bi-metal switch lever, an electric circuit terminal member securing one end of said lever to said base member, a second terminal member mounted in said base in spaced relation thereto and in opposed relation to the other end portion of said lever, the latter comprising parallel spaced apart side leg portions, a pair of tongue members of respectively different lengths disposed between and spaced equally from said side leg portions and having their opposed extremities disposed normally in substantially meeting relation to each other, the shorter tongue projecting from the portion of said lever secured to said base member and the inner extremity of the longer tongue being secured to said base member at a point spaced a predetermined distance from the extremity of the shorter tongue and thereby maintained normally bowed to present concave face between its ends and operating to maintain the free end portion of said lever spaced from said base member and the side leg portions thereof under tension, said lever and longer tongue arranged to become concave along its face opposed to the base member when heated and thus cause the outermost free end portion thereof to move into engagement with said second circuit terminal member with the outer end portion of said longer tongue bowed oppositely from its first-named shape and projecting above the side legs of said lever and exerting pressure upon said outermost free end portion of the latter.

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3. A structure, according to claim 2, wherein the last-named portion is equipped with a sharp projection and the second-named circuit terminal member presents a surface portion arranged to be engaged by said projection of shape adapted to cause the latter to slide along the same responsively to the pressure exerted by the last-named end portion of said longer tongue.

4. A temperature responsive electric switch comprising a base member composed of non-conductive material and equipped with a pair of spaced apart electric circuit terminal members projecting from a continuous surface thereof, a normally substantially straight switch lever composed of resilient bi-metal, rigidly secured at one end portion to said base surface and in engagement with one terminal member with the face thereof which becomes concave as said lever is heated, opposed to said base surface and bridging the space between said terminals, said lever equipped between its ends with parallel longitudinal slots spaced from its side edges and bordering a middle portion of predetermined width and severed between its ends to provide tongues of different lengths, the shorter tongue being integral with the end portion of said lever secured to said base, the longer tongue being secured at its inner end portion to said base

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in greater than its normal spaced apart relation to the shorter tongue and operating to space the free end portion of said lever, spaced laterally therefrom, disposed out of engaging relation to the other of said terminal members with said longer tongue bowed to present an outer concave surface, the heating of said lever causing its free end portion to move toward said second terminal member and said longer tongue to become ogee curved with its outermost end portion rendered convex and projecting, in part above the remainder of said lever and to operate to cause the outermost end portion of the latter to contact said second terminal member to close the circuit, the lowering of the temperature of said lever operating to cause the same to return to the position normally determined by the degree to which the longer tongue is spaced from the said shorter tongue, said spacing determining the temperature at which said lever effects closing of the said circuit.

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