United States Patent

Strain et al.

[15] **3,660,792**

[45] **May 2, 1972**

[54] TIME DELAY SWITCH

[72] Inventors: **Edwin H. Strain,** Allentown; **Nalini R. Das,** Bethlehem, both of Pa.

[73] Assignee: **Caloric Corporation,** Topton, Pa.

[22] Filed: **Dec. 16, 1970**

[21] Appl. No.: **98,496**

[52] **U.S. Cl.**.....**337/102,** 337/341

[51] **Int. Cl.**.....**H01h 37/52,** H01h 37/62, H01h 61/01

[58] **Field of Search**.....337/81, 86, 87, 88, 102, 103, 337/104, 105, 106, 107, 337, 338, 339, 340, 341, 377

[56] **References Cited**

UNITED STATES PATENTS

3,017,477	1/1962	De Leonardis	337/105 X
2,639,095	5/1953	Cubberley	337/340 X
2,306,568	12/1942	Rubenstein et al.	337/102 X

FOREIGN PATENTS OR APPLICATIONS

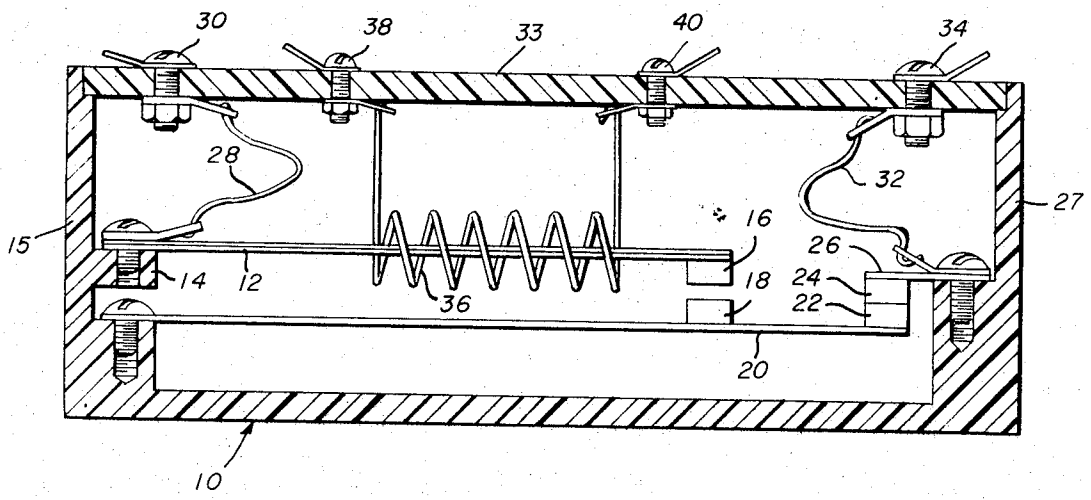
632,450	1/1962	Italy	337/102

Primary Examiner—George Harris
Assistant Examiner—Dewitt M. Morgan
Attorney—Harold A. Murphy and Joseph D. Pannone

[57] **ABSTRACT**

A switch which embodies a fail safe feature achieved by means for interrupting the switch circuit when the switch contacts remain closed for longer than a predetermined time period, said switch comprising a support having first and second terminals to one of which a bimetallic element is conductively connected, and third and fourth terminals to which respective ends of a heater element are connected, a conductive strip disposed in normally nonconductive relation to any of the terminals, and a contact member attached to the second terminal, with the bimetallic element and conductive strip being normally spaced out of electrical contact with one another, and with the conductive strip and contact member being normally in electrical contact with one another.

4 Claims, 2 Drawing Figures



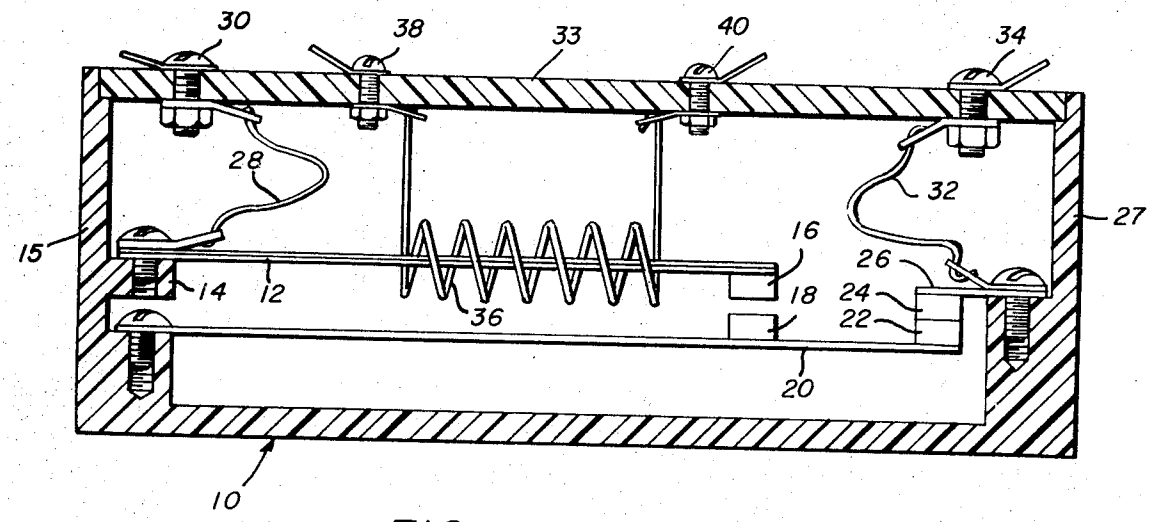

30
38
33
40
34
28
32
27
15
16
26
14
12
18
24
36
22
20
10

FIG. 1

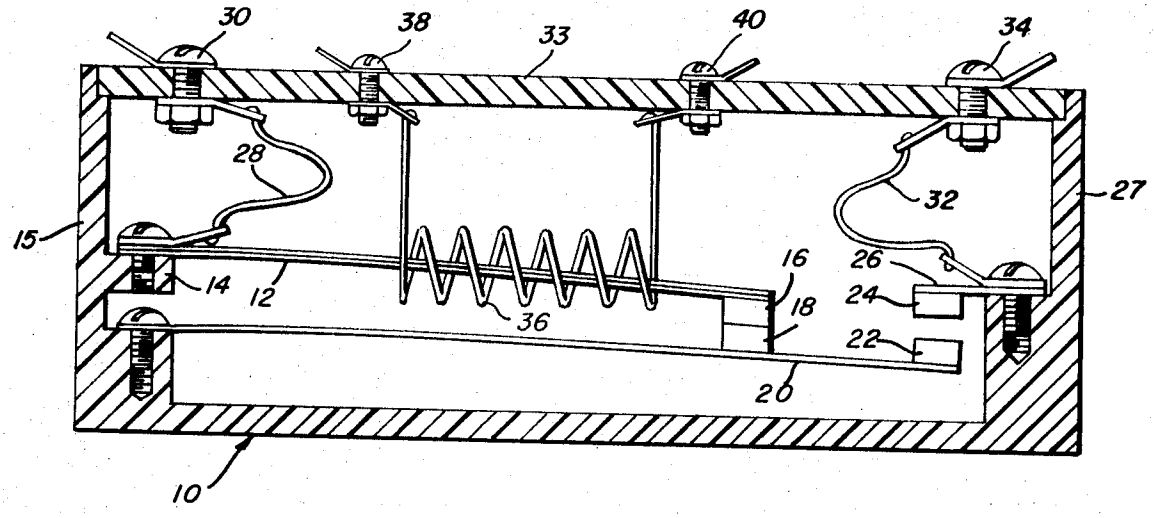

30
38
33
40
34
28
32
27
15
16
26
14
12
18
24
36
22
20
10

FIG. 2

TIME DELAY SWITCH

BACKGROUND OF THE INVENTION

Switches have generally been utilized to complete or disrupt electrical circuits, and when necessary have been employed with a time delay relay to close an electrical circuit for only a selected time period. In some installations, for example, a switch in a time delay relay is closed to an electrical circuit which operates a mechanism for performing a specified function and after a selected time interval controlled by the time delay factor of the relay the switch is opened so that the mechanism will cease its function.

In certain installations it may be desirable to utilize a first circuit for closing a switch to complete a second circuit to a mechanism for a specified time interval, after which the first circuit is disrupted and the switch is opened so that the second circuit is broken to stop operation of the mechanism. However, it has been found that such devices sometimes malfunction. For example, the first circuit may fail to be disrupted at the end of the preset time cycle, whereupon the mechanism may continue to operate with what may be undesirable or even disastrous effects.

SUMMARY OF THE INVENTION

The present invention is directed to a novel switch having a built-in safety feature which avoids the referred-to disadvantages of and objections to conventional devices of this character. The invention is achieved by a switch which embodies a bimetallic member which carries one of a pair of normally open contacts the other of which is mounted on a conductive strip or blade. A heater located adjacent the bimetallic element is connected to an external circuit and when heated causes movement of the bimetallic element in a manner whereby the normally open contacts become closed. A second normally closed pair of contacts, one of which is fixed and the other of which is mounted on the conductive strip, are maintained in close condition to complete an external circuit when the first pair of contacts are closed.

After a predetermined time interval, controlled by the bimetallic element structure, continued heating of the element will cause such continued movement of the element as will move the conductive blade in a manner such as will open the normally closed contacts. Thus, the external circuit will be disrupted.

BRIEF DESCRIPTION OF THE DRAWING

Other objects and advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a side elevational view of a switch embodying the invention shown in inoperative condition; and

FIG. 2 is a side elevational side view of the switch of FIG. 1 showing the parts thereof in operative positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings wherein like characters of reference designate like parts in the respective views, there is provided an elongated housing or casing **10** preferably of nonconductive material, although it is to be understood that the casing may be made of conductive material if desired, in which case the conductive parts which are mounted within the casing or which extend through the casing must be insulated therefrom.

Inside the casing **10** is a flat bimetallic strip element **12** which is made of two laminated materials having different coefficients of expansion so that when the element is heated it will curve in response to the different expansion characteristics. One end of the element is fixedly located such as by anchoring it with screws to a projection or shelf **14** formed on an inner end wall **15** of the casing as shown.

The lower surface of the element **12** carries near its free end one of a pair of contacts **16–18**, the second of the contacts being mounted on a conductive metal strip or blade **20** one end of which is fixed to the end wall **15** of the casing **10** as by a screw or the like.

The other end of conductive blade **20** carries on its upper surface one contact of a second pair of contacts **22–24**, the other of which is mounted upon a short metal plate or bracket **26** fixedly attached to the adjacent end wall **27** of the casing **10** as by a screw or the like.

Contacts **16–18** are normally maintained in spaced or open relationship while contacts **24–26** are normally maintained in closed or engaging relation as shown. The bimetallic element **12** is electrically conductive and is connected by a lead **28** to a terminal **30** which extends through the top wall **33** of the casing **10**. The fixed plate **26** is similarly connected by a second lead **32** to a terminal **34** which also extends through the top **33** of the casing. Thus, when terminals **30** and **34** are connected into an external circuit, the circuit will be completed when contacts **16–18** are closed through terminal **30**, lead **28**, element **12**, contacts **16–18**, blade **20**, contacts **22–24**, bracket **26**, lead **32** and terminal **34**. When this occurs, the circuit may be utilized to perform any selected function such as to activate mechanism.

Means for closing contacts **16–18** is in the form of a heater **36** which is a resistive wire coiled around or beside the bimetallic element in spaced relation with it, the ends of the wires being connected to respective spaced terminals **38** and **40** extending through the casing top wall **33**. Terminals **38** and **40** are adapted to be connected to an external circuit which supplies electrical current to the heater coil **36** for the purpose of generating heat therein. Such heat will cause the bimetallic element **12** to bend or flex as shown in FIG. **2**.

It is well known that a bimetallic strip such as element **12** will bend or flex in the direction of the side having the smaller coefficient of expansion. Therefore, such flexure of element **12** will cause movement of contact **16** on element **12** into engagement with contact **18** on blade **20**, thus completing an operating circuit through normally closed contacts **22–24** as described.

The heater coil may continue to be heated for a predetermined time after which it is intended that the circuit be broken to the mechanism which is being operated.

It will be apparent that subsequent interruption of the external circuit to heater coil **36** will cause the coil to cool and will result in the return of the bimetallic element **12** to its initial shape. This will, of course, cause contacts **16–18** to open. The operating circuit to the external mechanism will thus be disrupted and the mechanism will cease functioning in the absence of other means for continuing its operation. However, it has been found that the heater circuit may not be interrupted at the desired time for any one of many reasons, and therefore the circuit to the mechanism will remain closed and the mechanism will continue to operate with what may be disastrous results.

The present invention, therefore, includes a safety feature which provides for the required disruption of the circuit to the mechanism at the end of a predetermined time interval. This is achieved by the structures of the bimetallic element **12** and the blade **20**. The rate at which a bimetallic element of specified shape moves is well known and easily computed. The tension of a metal strip such as blade **20** is also easily determined. Therefore, in accordance with this invention the heater coil **36** will remain energized and the bimetallic element will continue to be heated. Such additional heating of the element **12** will cause it to bend or flex still more against the inherent tension exerted by the blade **20** until, at the end of a predetermined time period, the blade **20** will be forcibly bent of flexed by the pressure of element **12**, and the normally closed contacts **22–24** will open. This will interrupt the circuit and the mechanism will cease functioning.

When the heater coil **36** is thereafter deenergized by any suitable means, the parts will return to their normal positions

as shown in FIG. 1 and the device is ready for a repetitive operation.

It will be apparent that the time delay which is built into the switch of this invention may be precisely controlled by the characteristics of the heater coil **36**, the structures and compositions of the bimetallic element **12**, and the metal blade **20**. Since this represents conventional well-known engineering, no examples of specific sizes, shapes or compositions are believed to be necessary here.

The switch embodying this invention can be utilized where precise control of equipment or mechanism is desired for only selected time intervals and the safety feature built into the switch provides a novel and highly desirable fail safe element.

It will also be apparent that various changes and modifications in the structure shown and described may be made by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims. Therefore, all matter shown and described is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. A fail safe switch comprising a support having first and second spaced terminals, a heater element for connection to an external source of heater current, third and fourth terminals on the support and connected to respective ends of the heater element, a bimetallic element adjacent said heater element and connected to said first terminal, a conductive strip adjacent said bimetallic element and mounted on said support in normally nonconductive relation to any of said terminals, and a contact member adjacent said strip and connected to said second terminal, said bimetallic element and conductive strip being normally spaced out of electrical contact with one another, and said conductive strip and contact member being normally in electrical contact with one another.

2. A fail safe switch comprising a casing having first, second, third and fourth spaced electrical terminals, a contact member anchored to said casing and connected to said first terminal, an elongated bimetallic element having one end anchored to the casing and connnected to said second terminal, the opposite end of the bimetallic element extending within the casing toward said contact member and movable along a predetermined path when heated, an elongated flexible conductive strip anchored at one end to the casing in normally nonconductive relation to any of said terminals and with its opposite end disposed normally in electrical contact with said contact member, a midportion of said strip being disposed in the path of movement of the bimetallic element and normally spaced out of electrical contact therewith, and heating means adjacent said bimetallic element and connected at its respective ends to said third and fourth terminals for initially heating the element to cause its movement into electrical contact with the conductive strip and for continued subsequent heating of the element to cause it to forcibly flex the conductive strip in a manner to disrupt the electrical contact between the strip and contact member.

3. A switch as set forth in claim 2 wherein said bimetallic member carries a fixed contact on its movable end, and the conductive strip carries two spaced fixed contacts one of which is positioned for engagement by the fixed contact on the bimetallic element and the other being positioned for engagement with said contact member.

4. A switch as set forth in claim 2 wherein said bimetallic element is structured so that it will bend sufficiently to move the conductive strip out of engagement with the contact member at the end of a predetermined time period.

* * * * *