

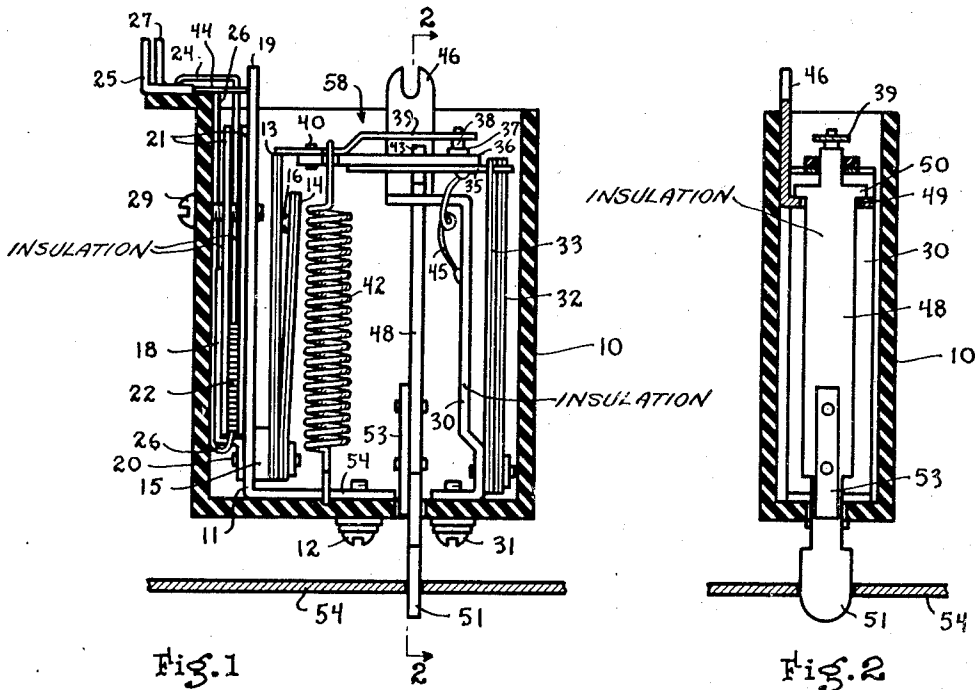
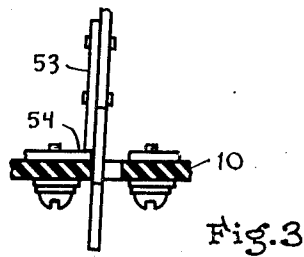
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THERMAL SAFETY SWITCH

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THERMAL SAFETY SWITCH

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The present invention is directed broadly to a thermally actuated switch, and more particularly to a switch which is biased open but normally latched closed and which is tripped open by a thermal element.

The primary object of the invention is to provide a switch of the above type which is simple in construction, inexpensive to manufacture, and yet durable and reliable in operation. A further object is to provide a switch having a minimum number of parts.

Another object is to provide a thermal safety switch in which the latch is mounted on one blade and is latched on the free end of a second blade, the two blades compensating each other for changes in ambient temperature, and the switch being carried by the latch.

Still another object is to provide the switch with a manual reset member which may be moved a certain distance to reset the switch, and a greater distance to latch itself and maintain the switch in open position. The cover for the switch may cooperate with the reset member to prevent it from being moved far enough to latch itself open so long as the cover is in place.

These and other objects will readily become apparent as the following specification is read in the light of the accompanying drawing in which

Figure 1 is a side view of the switch with part of the casing being shown in section,

Figure 2 is a section taken along the line 2—2 of Figure 1, looking in the direction of the arrows, and

Figure 3 is a detail view showing the manual reset member in its latched position.

Referring to the drawing, the reference numeral 10 indicates a casing for the switch mechanism. Actually, the casing is open only at the top but the side is shown as cut away in Figure 1 in order to provide a clear view of the switch operating mechanism. An L-shaped bracket 11 is connected to the bottom of the casing by any suitable means, such as the screw as shown at 12.

A pair of bimetallic elements 13 and 14 are mounted at the lower ends to the bracket 11 and are separated therefrom by means of the metallic block 15. The element 14 is provided with a projection 16 which bears against the element 13. These elements are adapted to warp in the same direction on heating and two elements are used instead of one in order that more power be available for operating the switch.

A second smaller bracket 18 is connected to the vertical leg 19 of the bracket 11 as shown

at 20 and is located between the leg 19 and the lefthand side of casing 10, as shown in Figure 1 of the drawing. The bracket 18 supports a pair of spaced insulating sheets 21 between which is mounted the coils of an electric resistance heater 22. One end of this heater is connected by means of wire 24 to a terminal 25. The other end of the heater is connected by wire 26 to the terminal 27.

The threaded stem of a screw 29 is inserted through an oversize hole in the side of the casing 10 and screw-threadedly engages an opening in the leg 19 of the bracket 11. The leg 19 is tensioned for movement toward the right as seen in Figure 1, and, therefore, holds the head of the screw 29 against the outer face of the casing 10. Rotation of the screw 29 will therefore adjust the position of the leg 19 and hence shift the position of the free ends of the two bimetallic elements 13 and 14. The purpose of this adjustment will be described later.

A third bracket 30 is connected to the base of the casing 10 by some suitable means such as the screw 31. A second pair of bimetallic elements 32 and 33 are connected at their lower ends to the bracket 30 by any suitable connecting means. The upper ends of the elements 32 and 33 are pivotally connected with a metallic plate 35 which in turn carries an insulating member 36. The insulating member 36 supports the stationary electrical contact 37 which cooperates with a movable contact 38. The movable contact 38 is carried on the free end of a flexible blade 39 which is connected to the insulating member 36 as shown at 40. The lefthand end of the member 39 extends out beyond the insulating member 36 and normally engages over the free end of the bimetallic element 13. A tension spring 42 is looped at its upper end over the members 39 and 36, and at its lower end is looped under the horizontal leg of the bracket 11, a portion of the base of the casing 10 being cut away to accommodate this looped portion of the spring 42. The effect of this spring is to hold the lefthand end of the member 39 in engagement with the free end of the bimetallic member 13. The members 35, 36 and 39 together form in effect a pivoted latch member 58 and will be referred to as such in the remainder of the specification.

The terminal 25 may be connected by means of a wire 44 to the upper end of leg 19 of the bracket 11 as shown in Figure 1, or the leg 19 may be made a separate terminal to provide a separate circuit through the switch. The circuit to the

switch formed by the contacts 37 and 38 may therefore be traced from the terminal 25, through wire 44, bracket 11, metallic block 15, bimetallic element 13 and flexible switch blade 39 to the movable contact 38. A parallel circuit extends directly from the bracket 11 through the tension spring 42 and to the switch blade 39. The stationary contact 37 is connected by a conductor 45 directly to the bracket 30 which carries at its upper end the terminal 46. The switch therefore controls the circuit connections between terminals 25 and 46.

A manual reset device in the form of an insulating member 48 extends through an opening 49 in the horizontal portion of bracket 30. The reset member is provided with a pair of shoulders 50 which prevents its upper end from passing downwardly through the opening 49. The upper end of the reset member 48 is relatively narrow and is inserted through an opening in the members 35 and 36 and terminates slightly below the switch blade 39 as seen in Figure 1.

As stated above, the two bimetallic elements 13 and 14 warp in the same direction on heating and therefore provide a greater force than a single element for a given temperature change, although the deflection is about the same. The bimetallic elements 32 and 33 also warp in the same direction and here again two elements are used instead of one in order to increase the available force. Moreover, the elements 32 and 33 warp in the same direction as the elements 13 and 14, and as the upper ends of the elements 32 and 33 carry the latch 58, it can be seen that on variations in ambient temperature the relative position of the upper end of the bimetallic element 13 and the lefthand end of the latch 58 will remain unchanged.

When the circuit is closed through the electrical heater 22, it will become heated and will gradually raise the temperature of the brackets 18 and 11 on which it is mounted, as well as the metallic block 15 and will, after a predetermined interval of time, raise the temperature of the bimetallic elements 13 and 14 sufficiently to cause the upper end of the element 13 to move out from under the lefthand end of the latch 58. The time necessary for the element 13 to trip the latch 58 depends upon the distance the free end of element 13 must travel. This in turn depends upon the position of the free end of element 13 with respect to the lefthand end of the latch 58 when the parts are cold. This relative position, and hence the timing of the switch, are adjustable by rotating the screw 29. After it is tripped, the latch will be pulled downwardly by the spring 42 at which time the latch will pivot freely about the upper ends of the bimetallic elements 32 and 33. Movement of the latch will be stopped by the engagement of member 35 with the shoulders 50 on the reset member 48, and at this time the upper end 43 will engage the flexible contact blade 39 and cause the movable contact 38 to separate from the stationary contact 37, thereby opening the circuit through the switch. At this time it will be seen that the switch is effectively locked in open position and can be reclosed only by a manual operation.

The resetting operation is effected by manually moving the reset member 48 in an upwardly direction by pushing on the lower end 51. This causes the shoulders 50 to again pivot the latch 58 about the upper ends of the members 32 and 33, and if the members 13 and 14 have cooled, the latch may be relatched on the upper end of the member 13. It will be noted that during this

operation and as long as the shoulders 50 on reset member 48 are in engagement with the latch 58 that the upper end 43 of the reset member is maintaining the movable contact out of engagement with the stationary contact. In other words, these contacts cannot be closed by the reset member 48 other than by relatching the latch 58 on the bimetallic element 13 and then releasing the member 48 at which time the flexible blade 39 is free to cause engagement of the contacts 37 and 38. In other words, this switch is provided with what is known as a trip-free reset.

The manual reset member 48 is provided with a latch which is shown at 53. After the manual reset member is raised sufficiently far and then moved to the left, the bottom of the latch 53 may be made to engage with the foot 54 of the bracket 11, thereby maintaining the reset member 48 in its raised position, at which time it will be holding the contacts 37 and 38 separated. This feature provides for a positive manual "off" position for the switch. In order to release the switch for movement to closed position again, it is necessary only to move the handle 51 of the reset member 48 to the right, at which time the spring 42 will return the parts to the position shown in Figure 1.

One of the principal uses of a switch of this type is as a safety switch in connection with automatic oil burner control equipment. In such a case, the switch will be mounted on a panel along with other devices, such as relays and transformer. This panel is usually provided with a cover enclosing all of the parts, such as is indicated in part in Figure 1 by the reference numeral 54. It is intended that the cover 54 bear such a relation to the reset member 48 that with the cover in position, the member 48 may be pushed upwardly far enough to relatch the latch 58 on the free end of the bimetallic element 13 after it has been tripped, but not far enough to cause the latch 53 to seat on the foot of the bracket 11. The purpose of this is so that when the safety switch is opened for some reason, the house owner may reset the switch by pushing the member 48 upwardly without danger of latching the switch in open position. However, when the service man comes to repair the oil burner, he may remove the cover and then latch the switch in open position to facilitate repairs. Thus, there is no danger under the normal use of this switch of ever latching it in open position and thus preventing operation of the oil burner, but yet a simple manual "off" position is provided for the service man when he comes to make repairs.

Various changes and modifications of the above device will undoubtedly occur to those who are skilled in the art, and it is therefore to be understood that I am to be limited only by the scope of the appended claims and not by the specific embodiment of the invention which I have chosen to disclose.

I claim as my invention:

1. A thermostatic switch comprising in combination, first and second bimetallic blades fixed at one end and free at the other, a latch pivotally carried by the free end of said first blade and normally latching on the free end of said second blade, means for causing movement of one of said blades away from the other whereby said latch is released, a normally closed switch moved to open position by said latch upon its release, and manual reset means for said latch, said last named means including means for maintaining

said switch open until after said latch has been relatched on the free end of said second blade.

2. A thermostatic switch comprising in combination, first and second bimetallic blades fixed at one end and free at the other, a latch pivotally carried by the free end of said first blade and normally latching on the free end of said second blade, means for causing movement of one of said blades away from the other whereby said latch is released, a normally closed switch carried by said latch, and means for causing opening of said switch upon release of said latch, said means acting also as a reset means for said latch and maintaining said switch open during the resetting operation.

3. A thermostatic switch comprising in combination, first and second bimetallic blades fixed at one end and free at the other, a latch pivotally carried by the free end of said first blade and normally latching on the free end of said second blade, means for causing movement of one of said blades away from the other whereby said latch is released, a stationary contact mounted on said latch, a movable contact mounted on said latch and biased into engagement with said stationary contact, a manual reset member having a first portion engageable with said movable contact for separating said contacts upon release of said latch, and a second portion on said reset member for resetting said latch, said first portion maintaining said contacts separated during the resetting operation.

4. A thermostatic switch comprising in combination, first and second bimetallic blades fixed at one end and free at the other, a latch pivotally carried by the free end of said first blade and normally latching on the free end of said second blade, means for causing movement of one of said blades away from the other whereby said latch is released, a stationary contact mounted on said latch, a movable contact mounted on said latch and biased into engagement with said stationary contact, means engaging said movable contact for moving it out of engagement with said stationary contact upon release of said latch, and means for manually resetting said latch.

5. A thermostatic time switch comprising in combination, a first bimetallic blade fixed at one end to a first support and free at the other end, a second bimetallic blade fixed at one end to a second support and free at the other end, said blades being so arranged that their free ends move in the same direction on temperature variations, a latch pivotally carried by said first blade and normally latched on the free end of said second blade, an electric heater for one of said blades causing it to warp in a direction to release said latch, a normally closed switch moved to open position by said latch upon its release, and manual reset means including means for maintaining said switch open during the resetting operation.

6. A thermostatic time switch comprising in combination, a first bimetallic blade fixed at one end to a first support and free at the other end, a second bimetallic blade fixed at one end to a second support and free at the other end, said blades being so arranged that their free ends move in the same direction on temperature variations, a latch pivotally carried by said first blade and normally latched on the free end of said second blade, an electric heater for one of said blades causing it to warp in a direction to release said latch, a normally closed switch moved to open position by said latch upon its release, and

manual reset means including means for maintaining said switch open during the resetting operation, and means for adjusting one of said supports for varying the time necessary for said one blade to release said latch.

7. A thermostatic switch comprising in combination, a bimetallic blade fixed at one end and free at the other, a movably mounted latch biased for movement in one direction, said latch including an insulating member, a fixed contact mounted on said member, a resilient blade fixed to said insulating member and carrying a movable contact at a free end, said resilient blade biasing said movable contact into engagement with said stationary contact, said resilient blade having a portion which extends slightly beyond said insulating member and which is normally latched on the free end of said bimetallic blade, means for heating said blade to cause it to warp in a direction to release said latch, and means acting in conjunction with said latch for separating said contacts upon release of said latch.

8. A thermostatic switch comprising in combination, a bimetallic blade fixed at one end and free at the other, a movably mounted latch biased for movement in one direction, said latch including an insulating member, a fixed contact mounted on said member, a resilient blade fixed to said insulating member and carrying a movable contact at a free end, said resilient blade biasing said movable contact into engagement with said stationary contact, said resilient blade having a portion which extends slightly beyond said insulating member and which is normally latched on the free end of said bimetallic blade, means for heating said blade to cause it to warp in a direction to release said latch, means for conducting electric current through said thermostatic switch, said last named means including said bimetallic blade and extending portion of said resilient blade, and means acting in conjunction with said latch for separating said contacts upon release of said latch.

9. A thermostatic switch comprising in combination, a bimetallic blade fixed at one end to a metallic support and free at the other, a movably mounted latch, said latch including an insulating member, a fixed contact mounted on said member, a resilient blade fixed to said insulating member and carrying a movable contact at a free end, said resilient blade biasing said movable contact into engagement with said stationary contact, said resilient blade having a portion which extends slightly beyond said insulating member and which is normally latched on the free end of said bimetallic blade, means for heating said blade to cause it to warp in a direction to release said latch, a spring connected between said resilient blade and said metallic support for biasing said latch into engagement with the free end of said bimetallic blade, means for conducting electric current through said thermostatic switch, said last named means including said metallic support, bimetallic blade, and resilient blade forming one path, and said metallic support, spring, and resilient blade forming a parallel path, and means acting in conjunction with said latch for separating said contacts upon release of said latch.

10. A thermal safety switch comprising in combination, a bimetallic blade fixed at one end and free at the other, a biased latch having a metallic portion normally latched on the free end of said blade, an electric heater for said bimetallic blade for causing it to warp in a direc-

tion to release said latch, a normally closed switch carried by said latch and electrically connected to said metallic portion, means acting in conjunction with said latch for opening said switch upon release of said latch, and means for passing current, through said switch including the latched portions of the bimetallic blade and latch.

11. A thermal safety switch comprising in combination, a bimetallic blade fixed at one end and free at the other, a movably mounted latch having a metallic portion, a spring biasing said metallic portion into engagement with the free end of said bimetallic blade, an electric heater for said bimetallic blade for causing it to warp in a direction to release said latch, a normally closed switch carried by said latch and electrically connected to said metallic portion, means acting in conjunction with said latch for opening said switch upon release of said latch, and means for passing current through said switch including the latched portions of the bimetallic blade and latch forming a first path, said spring forming a parallel path.

12. In a thermal safety device comprising a biased open switch, a thermal element normally latching said switch in closed position, and an electric heater for heating said element to cause it to warp and release said switch, the combination of a manual reset member which is biased to a first position, said member being movable to a second position in which it operates to relatch said switch on said element following a release, said member being movable to a third position beyond said second position in which it maintains said switch in open position, and means for retaining said member in said position.

13. In a thermal safety device comprising a biased open switch, a thermal element normally latching said switch in closed position, and an electric heater for heating said element to cause

it to warp and release said switch, the combination of a manual reset member which is biased to a first position, said member being movable to a second position in which it operates to relatch said switch on said element following a release, said member being movable to a third position beyond said second position in which it maintains said switch in open position, means for retaining said member in said position, and cover means preventing said manual reset member from being moved to its third position, but permitting movement to its second position.

14. In a thermal safety switch comprising first and second bimetallic blades fixed at one end and free at the other, and a releasable bridging member pivotally secured upon the free end of one of said blades and releasably latched upon the free end of the other of said blades, the combination of, a fixed contact carried by said bridging member, a movable contact also mounted thereon, and reset means for resetting said bridging member after it has been released by the action of said bimetallic blades, said reset means including means for holding said movable contact out of engagement with said fixed contact when said bridging member is released and during the resetting operation.

15. In a thermal safety switch comprising first and second bimetallic blades fixed at one end and free at the other, and a releasable bridging member pivotally secured upon the free end of one of said blades and releasably latched upon the free end of the other of said blades, the combination of, switch means carried by said bridging member, and reset means for resetting said bridging member after it has been released by the action of said bimetallic blades, said reset means including means for disabling said switch means when said bridging member is released and during the resetting operation.

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