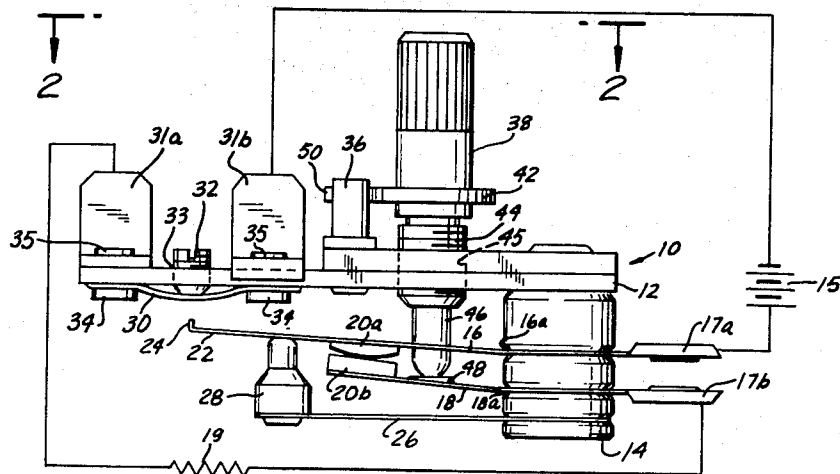


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3,158,715 11/1964 Ingwersen 337/125
2,790,046 4/1957 Richardson et al. 337/35
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[54] **THERMOSTAT WITH BUILT-IN CIRCUIT BREAKER**
17 Claims, 4 Drawing Figs.
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337/4, 337/97, 337/103, 337/125
[51] Int. Cl. **H01h 85/00**
[50] Field of Search. **337/4, 3,**
97, 142, 103, 401, 105, 125, 15, 16, 17, 35;
317/16; 219/517
[56] **References Cited**
UNITED STATES PATENTS
2,085,018 6/1937 Grady 337/103
2,598,878 6/1952 Ballou 337/103

ABSTRACT: A thermostat assembly which normally opens and closes an electrical circuit over a predetermined temperature range, and which provides a circuit breaking member to break the circuit in the event the circuit remains closed even though the upper temperature limit has been exceeded. Fixed and movable contact arms, alternately opened and closed by the action of a temperature sensitive bimetal member, are mounted on a stack which is suspended from a plate. A safety means in the form of a fusible element is mounted on the plate in the path of movement of the movable arm. In the event the contacts do not separate when the upper temperature limit is exceeded, the movable arm continues to move in the same direction and engages the fusible element, producing a short circuit and causing the fusible element to burn out, thereby to open the circuit.



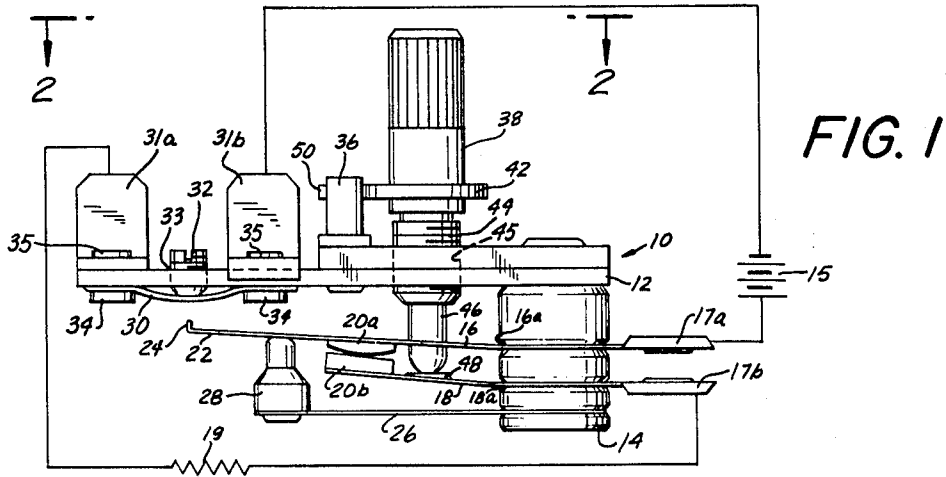


FIG. 1

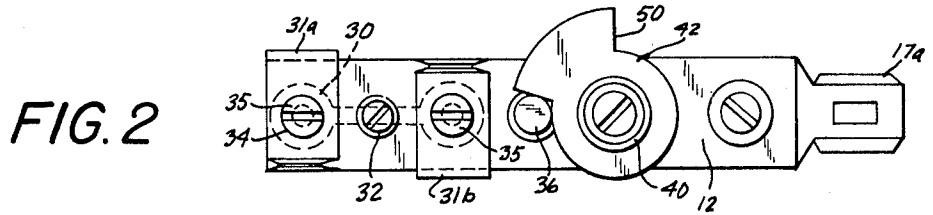


FIG. 2

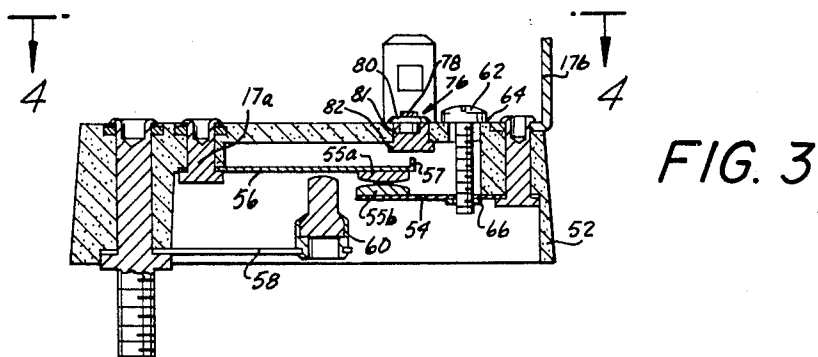


FIG. 3

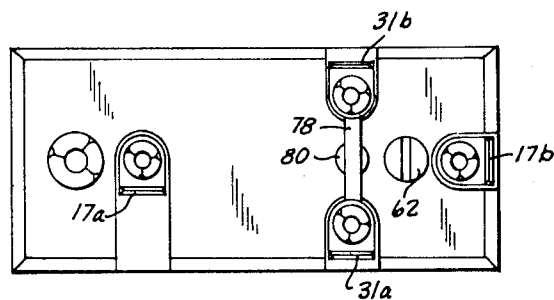


FIG. 4

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THERMOSTAT WITH BUILT-IN CIRCUIT BREAKER

It has been common practice to provide electric devices and appliances with thermostats to alternately open and close the electric circuit, thereby to regulate the appliance operating temperature. Such thermostats have generally consisted of fixed and movable contacts, with the movable contact being acted upon by a heat sensitive element. Such an element can be a bimetal member, the component metals of which have different coefficients of thermal expansion. Increases in appliance temperature normally cause this member to deflect and consequently drive the movable contact in a like direction. While this type thermostat is generally dependable through a range of temperatures, it sometimes happens that the contacts weld together. If this occurs, the thermostat will not open the electrical circuit, and as a result a dangerous overheating situation occurs which may ruin the appliance or, the more extreme situation, result in a dangerous fire.

The present invention notably supplements the prior art by providing a thermostat normally effective to open and close an electrical circuit over predetermined temperature range, in combination with a built-in circuit breaking member which functions in the event that the thermostat fails. The thermostat and circuit breaking member are arranged in a simply constructed, inexpensive but reliable unit, which provides dependable operation within a predetermined temperature range, and which ensures against dangerous overheating.

It is the prime object of the present invention to provide a thermostat to alternately open and close an electrical circuit over a predetermined operating temperature range, in combination with a circuit-breaking member which will break the circuit should the temperature upper limit be exceeded.

It is a further object of the present invention to provide a circuit-breaking member in combination with a thermostat, wherein the circuit-breaking member will break the circuit upon the onset of an adjustable present temperature.

It is an additional object of the present invention to provide a thermostat in combination with a circuit-breaking member in an inexpensive, compact and reliable assembly.

The present invention provides a thermostat in combination with a circuit breaking member. The thermostat comprises fixed and movable contact arms mounted on a stack, with a temperature responsive bimetal strip acting on the movable arm. Upon increase in temperature, the bimetal strip deflects, consequently moving the contact on the movable arm out of engagement with the contact on the fixed arm. Under certain operating conditions the arm may fail to separate. To take care of this condition a circuit-breaking safety means here shown as a fusible element, is mounted on a plate from which the stack is suspended. The fusible element is mounted in the path of travel of the movable arm, and is operatively connected in the electrical circuit. Should the contacts fail to separate at the predetermined temperature any further temperature rise causes the bimetal strip to continue to deflect, thereby moving the arms and their engaged contacts toward the fusible element. Increasing temperature results in continued movement of the arms until the movable arm engages the fusible element. This engagement shorts the circuit, causing the fusible element to burn away, thereby breaking the circuit.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to a thermostat assembly as defined in the appended claims, and as described in the specification taken together with the accompanying drawings in which:

FIG. 1 is an elevational view of a preferred embodiment of the present invention showing the contacts disengaged;

FIG. 2 is a top plan view of the assembly shown in FIG. 1;

FIG. 3 is an elevational view of an alternative embodiment of the present invention showing the contacts engaged; and

FIG. 4 is a top plan view of the embodiment shown in FIG. 3.

Referring to FIG. 1, there is illustrated a preferred embodiment of the present invention generally designated by the nu-

meral 10. The plate 12, shown in FIG. 2 as being generally rectangular in shape, has a stack 14 suspended from one end thereof, that stack being preferably fabricated from an electrically nonconductive and refractory material.

Mounted in any suitable manner on the central portion of the stack 14 is the fixed arm 18, and the movable arm 16, the movable arm 16 being interposed between the fixed arm 18 and the plate 12. Both the fixed arm 18, and the movable arm 16, are resilient (that fixed arm being biased toward that movable arm) and electrically conductive, and have at outer ends thereof terminals 17a (on the movable arm) and 17b (on the fixed arm). The terminal 17a is integral with the movable arm 16 and is adapted to be connected to one side of the line of an electrical circuit such as the plus side of battery 15. The terminal 17b integral with the fixed arm 18, may be connected to one side of the resistance 19 of an electrical appliance. The arm 16 may be resiliently biased downwardly, while the arm 18 is resiliently biased upwardly.

As best illustrated in FIG. 1, a protruding contact 20b is mounted on the free end of fixed arm 18. Directly above that contact, and spaced therefrom, is a contact 20a on the movable arm 16. The movable arm 16 extends beyond the contact 20a in the form of an integral extension 22, finally terminating in the lip 24, the function of which will be apparent as the description progresses.

Suitable mounted on the stack 14 is a bimetal strip 26 which is longer than the fixed arm 18, but shorter than the movable arm 16, and has an insulator 28 attached to and extending up from its free end. Under normal operation within a selected temperature range (the predetermination of which will be discussed at a later point), when the contacts 20a and 20b are engaged, an electrical circuit is completed from the line terminal 17a, through the movable arm 16 to the contact 20a, and then via contact 20b through fixed arm 18 to terminal 17b, and finally through the appliance resistance 19. As the current flows, the appliance temperature rises accordingly. Rising temperature causes the bimetal strip 26 to deflect upward toward the plate 12. The insulator 28 accordingly acts on the movable arm 16 deflecting it about the fulcrum 16a. When the upper limit of the temperature range is reached, the movable arm 16 will have normally deflected sufficiently for the contact 20a to have fully separated from the contact 20b, thus opening the circuit through the appliance resistance 19. While the circuit remains open, the appliance temperature decreases. This decrease in temperature permits the bimetal strip 26 to relax some of its deflection causing the insulator 28 to move downward. The deflection of the movable arm 16 is thereby likewise relaxed, and as it pivots downward about its fulcrum 16a, contact 20a engages contact 20b, thereby closing the circuit through the resistance 19. As the current flows through the circuit again, there is a resulting temperature increase, and the cycle repeats itself through the normal operation of the appliance. In this manner, the appliance temperature is carefully regulated under normal operating conditions.

Under certain operating conditions, however, the contacts 20a and 20b may fail to disengage upon the onset of the temperature upper limit. Should the contacts 20a and 20b weld together, the circuit through the appliance will remain closed and additional heating will result. Under such conditions, the bimetal strip 26 will continue to deflect upwardly such that the insulator 28 will rotate the movable and fixed arms 16, 18 about their respective fulcrums 16a, 18a in a clockwise direction as viewed in FIG. 1. The excessive temperature rise may result in permanent damage to the appliance, or may produce a dangerous electrical fire.

To prevent such a situation, there is provided on the underside of plate 12 a circuit-breaking member in the form of a resilient fusible element 30 mounted on the electrically conductive bosses 34. That fusible element is mounted in the path of movement of the extension 22, and is operatively connected in the electrical circuit by means of the line terminal 31b and resistance terminal 31a which are connected to the bosses 34 by means of the screws 35 which are received in the

holes (not shown) in the bosses 34. The path of the current is from the line terminal 17a through the appliance resistance 19 to resistance terminal 31a, through the fusible element 30, and finally to line terminal 31b, that in turn being adapted to be connected to the negative side of battery 15. As the current continues to flow, the arms 16, 18 continue to rotate clockwise until the lip 24 contacts the fusible element 30. This produces a short circuit, which causes the fusible element 30 to burn out, thus terminating the flow of current in the appliance.

The operating temperature range of the arms 16, 18 and bimetal strip 26 combination, and the temperature at which the lip 24 engages the fusible element 30, are both adjustable. The former adjustment is accomplished in a conventional fashion by providing a shaft 38 having a threaded section 44 which is received in a hole 45 in the plate 12. The threaded section 44 terminates in an insulating finger 46 which depends toward and engages the substantially horizontal platform 48 on the fixed arm 18. The shaft 38 can be rotated such that it travels downward, causing the finger 48 to bear against the platform 48, thereby rotating the fixed arm 18 counterclockwise about its fulcrum 18a. Thus, the normal position of the contact 20b can be varied, producing engagement and disengagement of the contacts 20a and 20b at temperatures as desired. For example, if the normal location of contact 20b is raised by moving the shaft 38 upward, the contacts 20a and 20b will engage and disengage at a higher temperature. Similarly, if the shaft 38 is lowered, thereby moving the contact 20b to a lower position, the contacts 20a and 20b cannot engage until the temperature has reached a lower value.

To prevent the fixed arm 18 from being adjusted to either an abnormally low or high position, the shaft 38 is provided with a rotation stop 42 which engages the post 36 which extends from the top of plate 12. That rotation stop is fixed to the shaft 38 just above the threaded section, and is of a disc shape with a projecting extension 50. The sides of that extension (seen best in FIG. 2) engage the post 36, and thereby limit the permissible downward and upward travel of shaft 38.

The adjustment of the short circuit temperature is effected by providing a screw 32 in a hole 33 in the plate 12. The hole 33 is directly above the fusible element 30, and the screw 32 bears against the fusible element 30 along its central portion. The screw 32 forces the fusible element 30 to bend downward toward the lip 24. Since the amount of deflection the strip 26 must undergo is a function of the distance between the lip 24 and the fusible element 30, the greater the bend of the fusible element 30, the lesser the distance between that fusible element and the lip 24, and consequently the lower the circuit breaking temperature. Conversely the greater the distance between that fusible element and the lip 24, the higher must be the temperature before the circuit is broken.

An alternative embodiment of the invention is illustrated in FIGS. 3 and 4. The fixed arm 54 and movable arm 56 are connected at opposite sides of the housing 52, and extend toward each other. The contacts 55a and 55b on the movable and fixed arms 56 and 54 respectively, engage and disengage in the same manner as in the previous embodiment, due to the deflection of the bimetal strip 58. The safety means 76 again in the form of a fusible element 78 (FIG. 4) is connected on the top of the housing 52 by means of the line terminal 31a and resistance terminal 31b. Contiguous the fusible element 78, and directly therebeneath, is the contact 80 which is inserted in a hole 81 in the housing 52. Press fit into hole 81 and on to contact 80, is a mating "female" contact 82. In the event the contacts 55a, 55b weld together, the bimetal strip 58 will drive the arms 54, 56 upwardly, such that the lip 57 will engage contact 82 producing a short circuit, and as in the previous embodiment the fusible element 78 will burn away so as to break the circuit.

Adjustment of the normal operating temperature range of the appliance in this embodiment, is accomplished by providing registering holes 64, 66 in the housing 52 and the fixed arm 54 respectively. The fixed arm 54 is downwardly biased, and a

screw 62 is inserted into those registering holes. The head of that screw bears against the top of housing 52 and prevents the arm 54 from rotating counterclockwise due to its bias. As the screw 62 is rotated so as to move downwardly through the arm 54, that arm is raised, thus lifting the normal position of the contact 55b, and the temperature at which those contacts engage is thereby raised.

The present invention, therefore, provides an inexpensive and reliable thermostat assembly of simple construction, for regulating the flow of current through an appliance over a predetermined temperature range, and ensures against dangerous overheating or possible fire. The characteristics of adjustable operating temperatures provide this assembly with a high degree of utility.

While but two embodiments of the present invention are herein disclosed, it will be appreciated that many variations may be made in the details thereof, without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A thermostat assembly comprising a support, circuit means on said support adapted to be connected to an external circuit and effective to open and close said circuit, temperature sensitive means on said support movable in a given direction upon increase in temperature and active on said circuit means to move it in said given direction and to open said circuit when said means has been moved to a given position, and safety means on said support located beyond said given position in the path of movement in said given direction of said circuit, said safety means being adapted to be operatively connected to said electrical circuit and effective when engaged by said circuit means to open said circuit.

2. The thermostat assembly of claim 1, said circuit means comprising a fixed contact and a movable conductive arm adapted to be electrically connected in said electrical circuit, said temperature sensitive means being active on said arm to move the latter.

3. The thermostat assembly of claim 2, in which said safety means comprises an electrically conductive fusible element.

4. The thermostat assembly of claim 3, said support comprising a plate and a stack assembly attached thereto.

5. The thermostat assembly of claim 4, in which said fixed contact and movable arm are mounted on said stack assembly.

6. The thermostat assembly of claim 4, in which said fixed contact is resilient and biased toward said movable arm.

7. The thermostat assembly of claim 4, in which said movable arm is interposed between said fixed contact and said plate.

8. The thermostat assembly of claim 4, in which said fusible element is attached to said plate and is exposed to said movable arm as the latter moves in said given direction.

9. The thermostat assembly of claim 4, said temperature sensitive means comprising a bimetal member.

10. The thermostat assembly of claim 9, in which said bimetal member is mounted on said stack assembly.

11. In the thermostat assembly of claim 1, adjustment means operatively connected to said safety means and active to adjustably position it toward and away from said circuit means.

12. The thermostat assembly of claim 11, in which said safety means comprises a fusible element and said circuit means makes electrical connection thereto when it engages therewith.

13. The thermostat assembly of claim 12, in which said fusible element comprises a bendable part exposed to said circuit means, said adjustment means comprising means movably mounted on said support, engageable with said bendable part, and effective when moved relative to said support to cause said part to bend toward or away from said circuit means.

14. The thermostat assembly of claim 1, said support comprising a plate on the undersurface of which said safety means is mounted, said circuit means comprising fixed and movable contacts mounted on a stack assembly depending from said

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plate, and means resiliently urging said movable contact against said fixed contact, said temperature sensitive means comprising a bimetal strip mounted on said stack assembly and engageable with said movable contact as said strip moves in said given direction, said given direction being toward said plate, said movable contact having a part which, as said movable contact is moved in said given direction, engages said safety means.

15. The thermostat of claim 14, in which said safety means comprises a strip of conductive fusible material, said movable contact making electrical connection thereto when making

physical engagement therewith.

16. In the thermostat of claim 15, means carried by said plate, operatively connected to said strip, and effective to adjust the position of said strip toward and away from said movable contact.

17. In the thermostat of claim 14, means carried by said plate, operatively connected to said safety means, and effective to adjust the position of said safety means toward and away from said movable member.

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