

May 18, 1937.

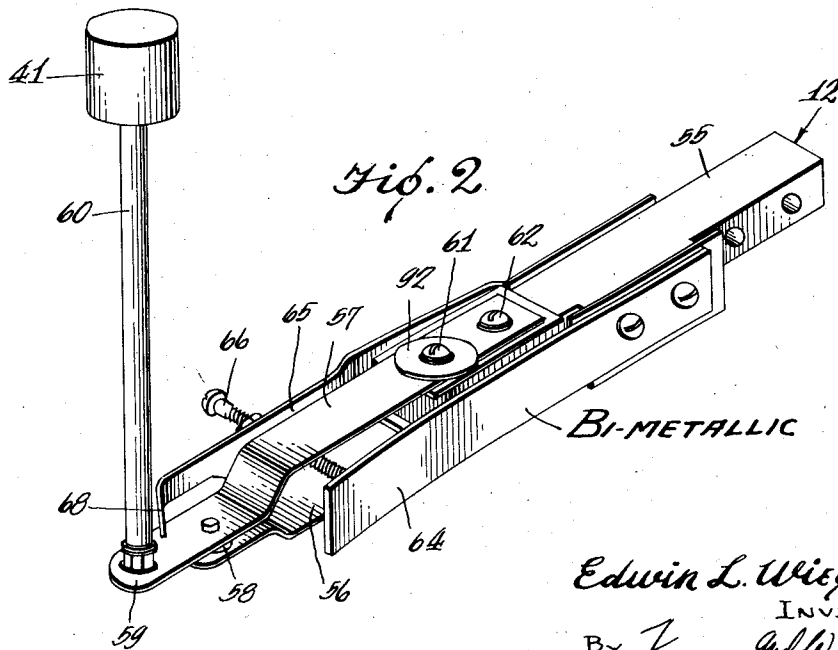
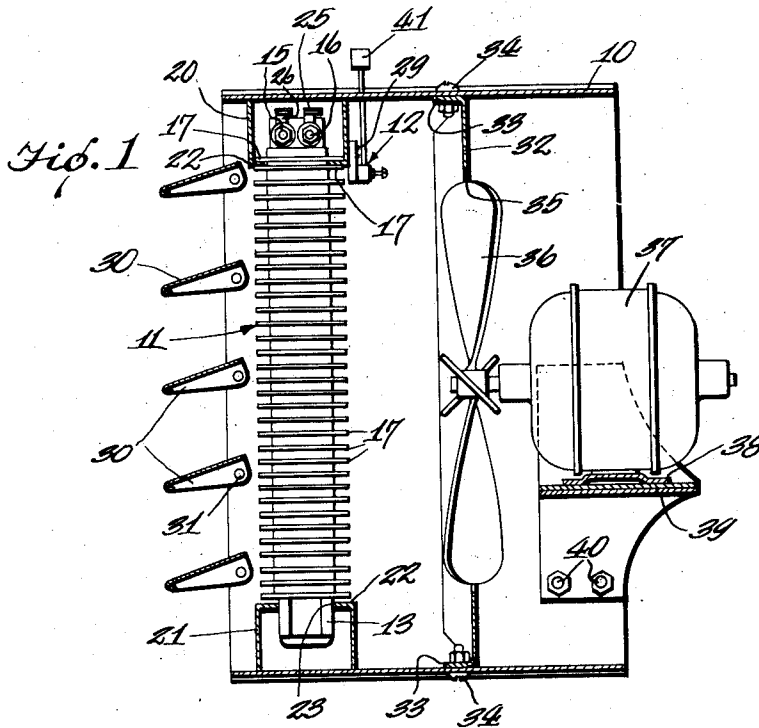
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2,080,799

THERMALLY RESPONSIVE DEVICE

Original Filed May 19, 1933

2 Sheets-Sheet 1



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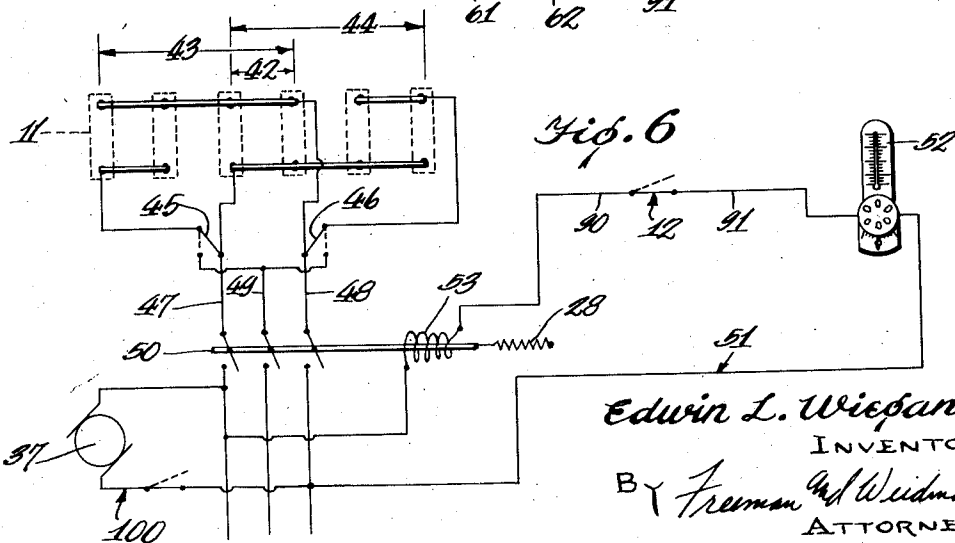
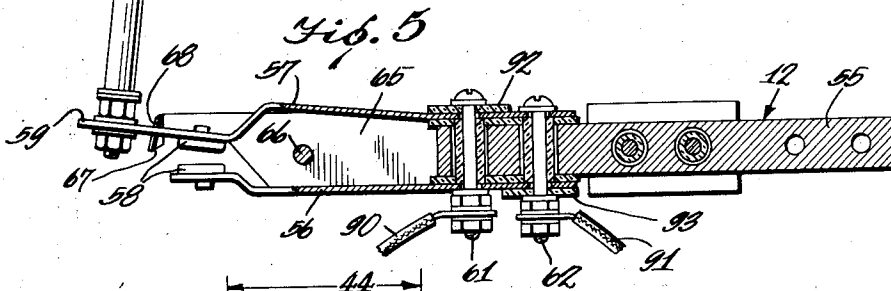
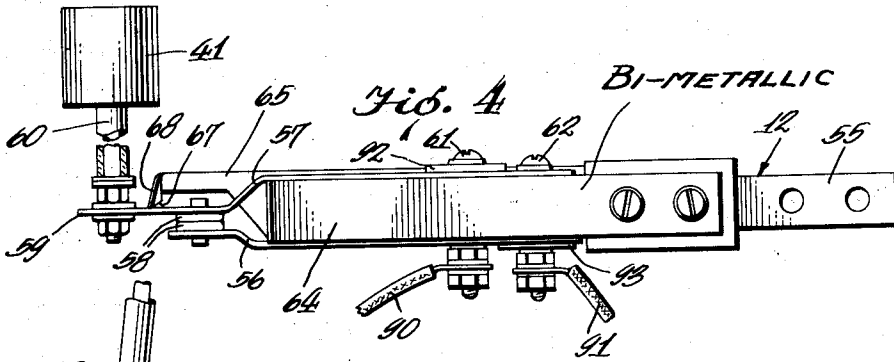
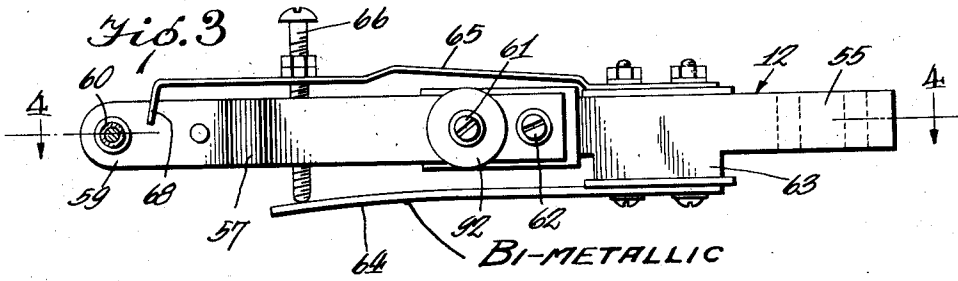
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UNITED STATES PATENT OFFICE

2,080,799

THERMALLY RESPONSIVE DEVICE

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671,878. Divided and this application March
15, 1934, Serial No. 715,672. Renewed Febru-
ary 15, 1937

14 Claims. (Cl. 200—138)

This invention relates to thermally responsive devices, and has for its principal object the provision of new and improved devices of this character.

In the drawings accompanying this specification and forming a part of this application, I have shown, for the purpose of illustration, one form which my invention may assume, and in these drawings:

Figure 1 is an elevational view of the invention, as employed in connection with an air conditioning apparatus, showing the later partly in vertical section and partly in elevation,

Figure 2 is an enlarged perspective view of an embodiment of the invention,

Figure 3 is a top plan view, partly in section, of the embodiment shown in Figure 2,

Figure 4 is a broken, side elevational view, corresponding substantially to the line 4—4 of Figure 3, and showing the parts in one position.

Figure 5 is a broken, vertical sectional view, partly in elevation, disclosing the parts in a different position, while

Figure 6 is a diagrammatic layout of the electrical appliances employed in connection with the invention.

This application constitutes a division of my copending application Serial Number 671,878, filed May 19, 1933.

As shown in Figures 1 through 5, there is disclosed a metallic casing 10, oblong rectangular in cross-section and open at both ends, and adjacent one end of the casing 10 is disposed a plurality of electrical heating elements 11, and adjacent the latter is positioned a thermally responsive safety cut-out device 12. The electrical heating units 11 extend transversely across the passage defined by the inner casing wall, and each is oblong rectangular in cross-section, disposed edgewise to the direction of air flow through the casing 10, comprising a metallic outer casing 13 enclosing a heating coil, not shown, connected to terminal posts 15 and 16. Arranged along the body portion of each heating element 11, is a plurality of laterally extending fin members 17, providing large radiating surfaces and operating also to provide air passages therebetween which direct passing air in well defined directions.

Supporting the heating elements 11 in proper position in the casing 10 are similar substantially U-shaped supports 20 and 21, one for each end of the heating units 11, and each support 20 and 21 has a horizontal flange 22 provided with openings 23 for the reception of the opposite ends

of the rectangular body portions of each heating element 11, the projecting ends of which extend into a hollow formation defined by each of the supports 20, 21 and the inner surface of the casing 10. In the case of the support 20, the horizontal flange 22 extends between the adjacent end pair of fins 17 of each heating unit 11, the later pair of fins preferably being placed closer together than the remainder of the fins to insure snug reception of the flange 22 therebetween, and in the case of the support 21 the end fin of each heating unit 11, is spaced from the flange 22 to allow for expansion of the heating element 11.

The terminal posts 15 and 16 are connected to bus bars 25 by means of angular connecting members 26, and the bus bars 25 in turn are electrically connected in a circuit hereinafter more particularly pointed out in connection with the description of the diagrammatic layout shown in Figure 6.

At the outlet of the casing 10 there are provided a plurality of louvers or deflectors 30 pivotally mounted as at 31, and manually adjustable for intercepting and directing the air issuing from the outlet of the casing 10 as desired.

At the inner side of the bank of heating elements 11, and within the casing 10, there is mounted a partition 32 having angular flanges 33 secured to the casing wall by bolts 34, and the partition 32 is provided with a central aperture 35 within which is disposed a fan 36, carried by the armature shaft of a motor 37.

The motor 37 is supported in position with respect to the casing 10, by a plate 38, bearing upon the central portions of a pair of resilient metallic supporting strips 39, the opposite end portions of which diverge with respect to each other, and end flanges thereof are secured to the casing wall, as by bolts 40.

As best shown in Figure 6, the heating elements 11 are connected in parallel circuits 42, 43, and 44, the circuits 43 and 44 connecting through jumper straps 45 and 46 with the conductors 47 and 48, the jumper straps in the positions shown in full lines in Figure 6, rendering the system suitable for single phase operation. The jumper straps 45 and 46 however, may be rearranged, as indicated in dotted lines in Figure 6, to connect with a conductor 49, and thus render the system suitable for three phase operation. The conductors 47, 48, and 49 are adapted to be connected with feed wires through a switch 50. Control mechanism is included in a parallel circuit 51, comprising the thermally responsive device

12, and a thermostatically controlled switch 52 of any commercial type, both operable to make and break the circuit 51 dependent upon the temperature, and operating through any well known type of switch operating mechanism, one of which may include a spring 28 normally urging the blades of the switch 50 to disengaged position, while a solenoid 53, when energized, operates to close and hold closed the switch 50, so that when the thermostatically controlled switch 52, or the thermal responsive device 12, breaks the circuit 51, the solenoid is deenergized, permitting the spring 28 to disengage the switch 50 and cut off the supply of current to the heating elements 11. The motor and fan unit may be included in another circuit 100 not affected by the making and breaking of the circuit 51.

As shown in Figures 1 through 5, the thermally responsive safety cut-out device 12 comprises an elongated metallic block, or support 55 secured by bolts 29 to the supporting formation 20 for the heating elements 11, and to the opposite sides of the block 55 are clamped resilient contact members 56 and 57, having angular end portions provided with contact points 58, and the member 57 is extended to provide an extension 59, and to the latter is clamped an operating rod 60, suitably insulated, extending to the outside of the casing 10 and terminating in an operating knob 41. Each of the contact members 56 and 57 is insulated from the block 55 and from each other by suitable insulating members, as best shown in Figure 5, and the contact members 56 and 57 are clamped in position by bolts 61 and 62, the bolt 61 being electrically connected with the contact member 56 and insulated, as indicated at 92, from the contact member 57; and the bolt 62 being electrically connected with the contact member 57 and insulated, as shown at 93, from the contact member 56; the bolts 61 and 62 also serving as terminal members for connection with wires 90 and 91 forming part of the control circuit 51. The block 55 is also provided with an offset portion 63 to which is secured a bimetallic thermally responsive element 64, and to the opposite side of the block 55 is secured a resilient latch member 65 having a screw extending laterally therethrough providing an adjustable post 66 which extends between the contact members 56 and 57 and into abutment with the thermally responsive element 64, and beyond the post 66 the latch member 65 is provided with a laterally extending portion having a flat engaging face 67 adapted in one position to bear against the extension 59 to hold the contacts 58 in engagement, and also having a beveled surface 68 to facilitate movement of the extension 59 into latching position when the extension 59 is moved by manipulation of the rod 60 to reset the latch 60 after the same has been detached.

Assuming the jumper straps 45 and 46 to be in the position illustrated in full lines in Figure 6 for single phase operation, and the circuit 51 closed, the fan will operate to direct air through the casing 10, and through and into contact with the heating elements 11, such air emerging between the louvers or deflectors 30. Due to the manner in which the heating elements 11 are arranged in the casing, that is, edgewise with respect to the air stream, and because of the presence of the fins 17 upon the heating elements 11, passage of the air through the heating elements not only is not unduly obstructed, but the air is directed in well defined paths forwardly from the mouth of the casing and the air so issu-

ing may be more effectively directed where desired through manipulation of the louvers 30; in addition the fins 17 provide extensive radiating surfaces and great efficiency as will be understood. The heating elements 11 may be operated in concert, as just described, but, if desired, the heating units in the circuits 43 and/or 44 may be cut out temporarily by disconnecting the jumper straps 45 and/or 46.

Automatic control of the heating elements 11 is effected through operation of the thermostatically controlled switch 52 which interrupts the circuit 51 when the temperature rises beyond a predetermined level, resulting in disconnection of the switch 50, and deenergization of the heating elements 11. When the temperature falls sufficiently to again operate the thermostatically controlled switch 52, the circuit 51 is again closed, resulting in closing of the switch 50, and energization of whatever heating elements are included in the circuit.

The safety thermal cut-out 12 is located adjacent to the heating coils 11, and when the temperature rises too high for safety, the safety cut-out operates to interrupt the circuit 51, and deenergizes the heating elements. This operation takes place through deformation of the bimetallic strip 64, which forces the latch member 65 outwardly, and causes the contact member 57 to spring away and separate the contact points 58. The safety cut-out 12 deenergizes the circuit 51 until the device is reset by manipulation of the rod 60, which may be pressed inwardly, causing the extension 59 of the contact member 57 to ride along the beveled surface 68 of the latch member 65 until the latch springs into position to again hold the contact points 58 in engagement. The safety cut-out 12 may be regulated to operate at different temperatures by adjusting the post 66 with respect to the thermally responsive element 64.

It will be noted that the safety thermal cut-out device 12 is located adjacent the heating coils 11 and in the path of the outgoing air stream generated by the fan 36, so that the generated air stream cools the thermally responsive element 64 and removes therefrom such heat as may be absorbed from the heating coils 11 by radiation. Accordingly if the fan 36 is not rotating, the temperature of the thermal element 64 rises rapidly and operates to open the circuit 51 until the device is reset by manipulation of the rod 60. And if the device be reset to close the circuit 51 before the air flow has been restored or increased, the bimetallic strip 64 will respond quickly to radiant heat from the heating elements 11 to open the circuit 51, provided the rise in temperature is above the predetermined safety point.

To convert the heater circuit for three phase operation it is only necessary to disconnect the jumper straps 45 and 46 from communication with the conductors 47 and 48, and connect the ends thereof to the third conductor 49, in which case the circuits 43 and 44 are completed through the conductor 49, and the remainder of the apparatus operates in the manner already described.

While I have herein disclosed the preferred embodiment of my invention it will be understood that various changes may be made and details modified, all without departing from the spirit of my invention, or sacrificing the advantages thereof, either those advantages hereinabove specifically pointed out or any other advantages not specifically pointed out but which nevertheless will be apparent to those skilled in the art.

Therefore it will be understood that the disclosure herein is illustrative only, and that my invention is not limited thereto.

I claim:

1. A device of the character described, comprising: a support; a plurality of spaced contact members carried by said support, and relatively movable toward and from each other, and having contact means engageable to close a circuit, said contact members being normally urged apart to maintain said circuit open; latch means, extending adjacent to said contact members, movable at an angle to the direction of relative movement between said contact members, and having a latching element engageable to hold said contact members in position to maintain said contact means in engagement; actuating means relatively movable with respect to said latch means and operable to release said latch means and effect separation of said contact members and interruption of said circuit; and means extending between said actuating means and said latch means, adjustable to vary the relative movement necessary to release said latch means.
2. A device of the character described, comprising: a support; a plurality of spaced contact members carried by said support, and relatively movable toward and from each other, and having contact means engageable to close a circuit, said contact members being normally urged apart to maintain said circuit open; latch means, including an inherently resilient strip of material secured to said support, extending adjacent to said contact members, movable at an angle to the direction of relative movement between said contact members, and having a latching element engageable to hold said contact members in position to maintain said contact means in engagement; actuating means relatively movable with respect to said latch means and operable to release said latch means and effect separation of said contact members and interruption of said circuit; and means extending between said actuating means and said latch means, adjustable to vary the relative movement necessary to release said latch means.
3. A device of the character described, comprising: a support; a plurality of spaced inherently resilient contact members secured at one set of ends to said support, projecting from said support, and relatively movable toward and from each other, and at their free ends having contact means engageable to close a circuit, said contact members being normally biased apart to maintain said circuit open; latch means, including an inherently resilient strip of material secured to said support, extending adjacent to said contact members, movable at an angle to the direction of relative movement between said contact members, and having a latching element engageable to hold said contact members in position to maintain said contact means in engagement; actuating means relatively movable with respect to said latch means and operable to release said latch means and effect separation of said contact members and interruption of said circuit; and means extending between said actuating means and said latch means, adjustable to vary the relative movement necessary to release said latch means.
4. A device of the character described, comprising: a support; a plurality of spaced inherently resilient flat contact carrying strips of material, secured adjacent one set of ends to said support, projecting from said support, relatively movable toward and from each other, and adja-

cent their free ends having contact means engageable to close a circuit, said contact members being biased apart to maintain said circuit open; latch means, including a flat strip secured to said support, disposed substantially at right angles to said contact carrying strips, movable at an angle to the direction of relative movement between said contact members, and having a latch element engageable to hold said contact members in position to maintain said contact means in engagement; and a flat thermostatic strip secured to said support in spaced substantially parallel relation with respect to said latch strip, and movable in a path coinciding with the path of movement of said latch strip, and operable to trip said latch strip to release said contact carrying members and effect separation of said contact means and interruption of said circuit.

5. A device of the character described, comprising: a support; a plurality of spaced inherently resilient flat contact carrying strips of material, secured adjacent one set of ends to said support, projecting from said support, relatively movable toward and from each other, and adjacent their free ends having contact means engageable to close a circuit, said contact members being biased apart to maintain said circuit open; latch means, including a flat latch strip secured to said support, disposed substantially at right angles to said contact carrying strips, movable at an angle to the direction of relative movement between said contact members, and having a latch element engageable to hold said contact members in position to maintain said contact means in engagement; a flat thermostatic strip secured to said support in spaced substantially parallel relation with respect to said latch strip, and movable in a path coinciding with the path of movement of said latch strip, and operable to trip said latch strip to release said contact carrying members and effect separation of said contact means and interruption of said circuit; and a set screw carried by said latch strip and extending toward said thermostatic strip to variably adjust the relative movement necessary for actuation.

6. A device of the character described, comprising: a rectangular support; a plurality of spaced inherently resilient flat contact carrying strips of material, secured adjacent one set of ends to opposed sides of said support, projecting from said support, relatively movable toward and from each other, and adjacent their free ends having contact means engageable to close a circuit, said contact members being biased apart to maintain said circuit open; latch means, including a flat strip secured to a third side of said support, disposed substantially at right angles to said contact carrying strips, movable at an angle to the direction of relative movement between said contact members, and having a latch element engageable to hold said contact members in position to maintain said contact means in engagement; and a flat thermostatic strip secured to the fourth side of said support and extending in substantially parallel relation with respect to said latch strip, and movable in a path coinciding with the path of movement of said latch strip, and operable to trip said latch strip to release said contact carrying members and effect separation of said contact means and interruption of said circuit.

7. In combination: cooperating abutable contact members relatively movable in a plane at an angle to the general plane of abutment of

said contact members, and biased out of abutment with each other; latch means constructed and arranged for releasably holding said contact members in abutment, said latch means being constructed and arranged for movement in said general plane; and thermally responsive means constructed and arranged for moving said latch means to release said contact members.

8. In combination: cooperating abutable contact members relatively movable in a plane at an angle to the general plane of abutment of said contact members, and biased out of abutment with each other; latch means constructed and arranged for releasably holding said contact members in abutment, and for movement in said general plane; thermally responsive means constructed and arranged for moving said latch means to release said contact members; and means, cooperable with said latch means, so constructed and arranged that movement of said contact members into latched position first positively moves said latch means, in said general plane, in a direction away from latching position.

9. In combination: cooperating abutable contact members relatively movable in a plane at an angle to the general plane of abutment of said contact members, and biased out of abutment with each other; latch means constructed and arranged for releasably holding said contact members in abutment, said latch means being constructed and arranged for movement in said general plane; and thermally responsive means, constructed and arranged for movement in said general plane and for moving said latch means in said general plane to release said contact members.

10. In combination: a first contact member; a second contact member mounted for movement with respect to and biased away from said first contact member; latch means constructed and arranged for releasably holding said contact members in engagement, and for swinging movement, and further constructed and arranged so that it is biased into latching position; thermally responsive means constructed and arranged for moving said latch means to release said contact members; and resetting means, cooperable with said latch means including a cam disposed in a plane generally parallel to the general axis of swing of said latch means, said resetting means being so constructed and arranged that movement of said second contact member toward engagement with said first contact member moves, in cooperation with said cam, said latch means in a direction away from latching position.

11. In combination: cooperating abutable contact members relatively movable in a plane at an angle to the general plane of abutment of said contact members, and biased out of abutment with each other; latch means constructed and arranged for releasably holding said contact members in abutment; and thermally responsive means, constructed and arranged for movement in said general plane and for moving said latch means to release said contact members.

12. In combination: cooperating contact members relatively movable in a general plane, and biased out of engagement with each other; latch means constructed and arranged for releasably holding said contact members in engagement; thermally responsive means; said latch means and said thermally responsive means being mounted laterally of said cooperating contact members on opposite sides of said general plane; and means so constructed and arranged that predetermined movement of said thermally responsive means causes movement of said latch means to release said contact members.

13. In combination: cooperating contact members relatively movable in a general plane, and biased out of engagement with each other; latch means constructed and arranged for releasably holding said contact members in engagement; thermally responsive means; said latch means and said thermally responsive means being mounted laterally of said cooperating contact members on opposite sides of said general plane, said latch means being constructed and arranged for movement in a plane at an angle to said general plane; and means so constructed and arranged that predetermined movement of said thermally responsive means causes movement of said latch means to release said contact members.

14. In combination: cooperating contact members relatively movable in a general plane, and biased out of engagement with each other; latch means constructed and arranged for releasably holding said contact members in engagement; thermally responsive means; said latch means and said thermally responsive means being mounted laterally of said cooperating contact members on opposite sides of said general plane, said thermally responsive means being constructed and arranged for movement in a plane at an angle to said general plane; and means so constructed and arranged that predetermined movement of said thermally responsive means causes movement of said latch means to release said contact members.

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