

July 19, 1932.

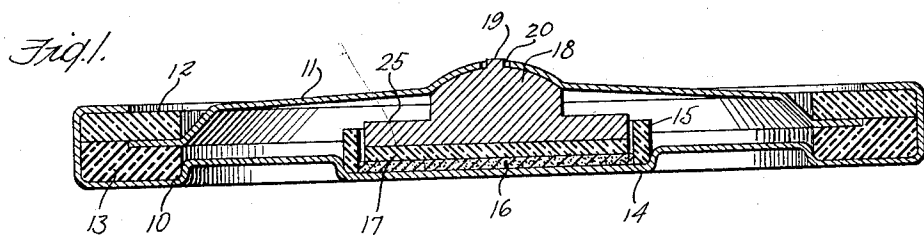
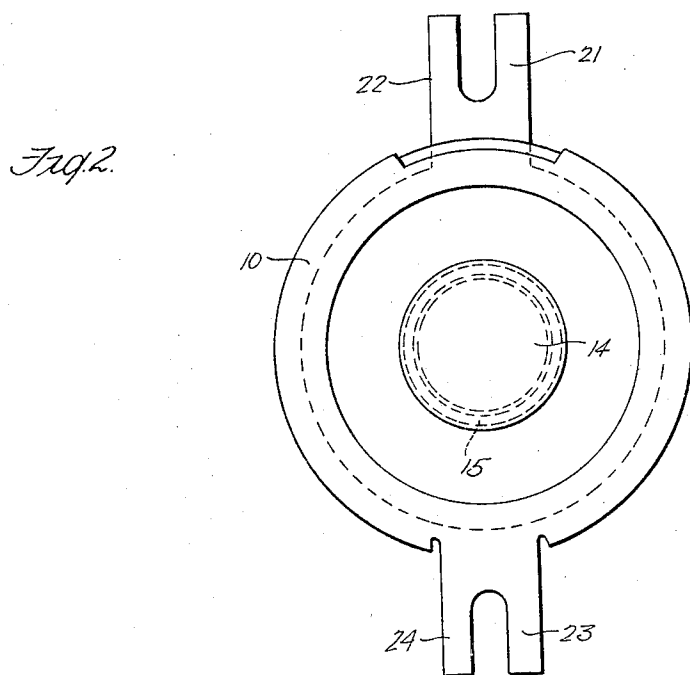
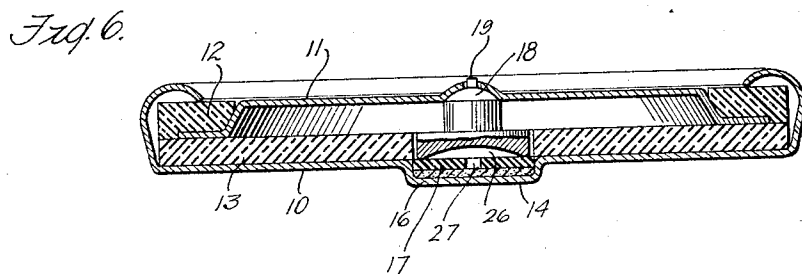
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1,868,136

TEMPERATURE RESPONSIVE DEVICE

Filed May 16, 1930

2 Sheets-Sheet 1



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Fig. 3.

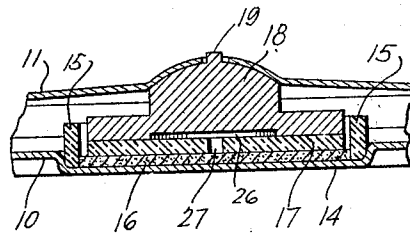


Fig. 4.

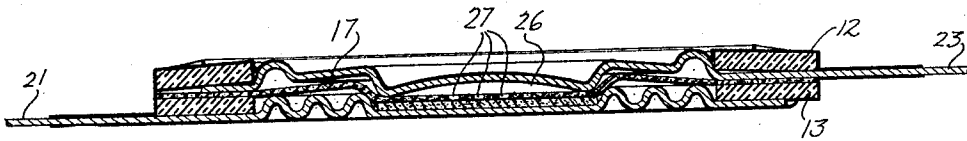
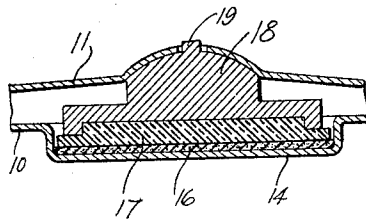


Fig. 5.



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TEMPERATURE RESPONSIVE DEVICE

Application filed May 16, 1930. Serial No. 452,895.

This invention relates to a temperature responsive device for closing a circuit when a given temperature is reached and particularly to a device having a fusible conductor between circuit terminals, but normally insulated from at least one of the terminals.

In the earlier patent granted to myself and Ernest S. Clayton, No. 1,274,248, and in my application Serial No. 269,076, filed April 11 1928, are disclosed and claimed devices intended for a similar purpose. The device as constructed according to my said patent has proved extremely efficient and satisfactory for guarding against excessive temperatures and particularly for giving alarm in case of fire or in case of excessive temperatures which might lead to fire. However, it is necessary to use great care in the manufacture of these devices in order to avoid cold flow of the fusible conductor which might eventually close the circuit although the temperature had not exceeded the given limit. Although this objection has not interfered with the usefulness of my earlier invention it is desirable to provide a more positive means for preventing the cold flow of the fusible conductor. It is accordingly an object of my invention to provide a temperature responsive device in which the cold flow of the fusible element is substantially avoided, and/or rendered unobjectionable. Other objects of my invention will be readily apparent from the accompanying description.

In the accompanying drawings

Figure 1 shows a cross section of a preferred embodiment;

Figure 2 shows a bottom elevation;

Figure 3 shows a partial cross section through a modification;

Figure 4 shows a cross section through another modification; and

Figures 5 and 6 show partial cross sections of other embodiments.

Referring particularly to Figures 1 and 2, the device is formed with a metallic casing preferably of Monel metal comprising a bottom section 10 and a top section 11 insulated from each other by the annular blocks 12 and 13 which are advantageously made of a phenol formaldehyde resin or some other insulating material which will not substantially soften at the temperature at which the device is designed to operate.

The bottom portion 10 is bent up at its edges and over the annular insulating blocks 12 and 13 so as to clamp them in place and lock the device in its assembled relation. Near the center the bottom section 10 is formed with a well 14 in which is cemented an annular ring 15 of a suitable insulating material, advantageously infusible phenol formaldehyde resin. Within the well formed by the bottom 14 of the ring 15 a disk of fusible alloy 16 is positioned and above this is a disk 17 of insulating material advantageously infusible phenol formaldehyde resin or varnished cambric. Above this and still partially within the well formed by the ring 15 is a button 18 suitably of Monel metal or other corrosion-resisting conductor. This button 18 is in electrical contact with the upper section 11 of the casing and is held in centered relation thereto by a pin 19 which projects through a hole 20 in the section 11. The thickness of the button 18, the insulating disk 17 and the fusible disk 16 and the shape of the section 11 and the section 10 are such as to cause either or both the sections 10 and 11 to be sprung slightly when in assembled relation, as shown. The amount of this springing is advantageously slightly less than the thickness of the fusible disk 16. Thus, when the conductor 16 is fused and squeezed out from between the bottom 10 and the insulator 17 by the force of the sections 10 and 11 tending to return to their normal shape, there will still remain at least a thin film of the fused conductor 16 to form a more perfect contact with the bottom 10.

As better illustrated in Figures 2 and 4, the sections 10 and 11 are extended on opposite sides to form ears 21, 22, 23 and 24 for connection to binding posts or in other suitable manner to the conductors of an electrical circuit.

In the embodiment illustrated in Figure 1, the fusible disk 16 is laterally confined by the vertical wall of the ring 15 and thus cold

flow of the material is substantially prevented.

For greater clearness of illustration the parts have been shown in somewhat exaggerated proportion on the drawings. In an embodiment of my invention a Monel metal casing might be used approximately 1.593 in outside diameter and approximately .145 inch thick. In this case the ring 15 is cemented into the bottom of the well 14 and a fusible solder disk approximately .015 inch in thickness is fitted closely inside the bakelite ring, and contacts with the casing 10 at the bottom of the well 14. The disk 17 may be made of bakelite or other phenol formaldehyde resin or resin compound or may be made of a varnished cambric and it may be of a thickness between about .020 and .031 inch. These figures are not the limits of satisfactory operation but are merely the dimensions used in the preferred embodiment. The metallic button is of a thickness related to the shape of the casing so that when the casing is assembled as shown, it will be deformed about .015 inch from its normal shape and will thus exert a constant tension upon the fusible disk 16. The clearance between the peripheral edges of the insulating disk 17 and the metallic button 18 is such as to permit ready flow of the fused conductor into contact with the metallic button 18 and to avoid any binding of these elements on the sides of the ring 15. It should, however, be sufficiently narrow to assure the fused conductor rising high enough in the space to effect a good electrical contact with the metallic button 18. The disks 12 and 13 in this embodiment are approximately $\frac{3}{64}$ of an inch thick and are made of bakelite or other similar phenol formaldehyde condensation product or composition thereof.

The sections 10 and 11 may advantageously be die-pressed from sheet metal, the parts then assembled with the ring 15 cemented to the lower section 10 and the edges of the lower section 10 of the casing may then be turned over the rings 12 and 13 in order to clamp the parts in their assembled relation. The whole is then advantageously covered with a waterproof varnish such, for example, as a phenol formaldehyde or other similar resinous varnish.

In the embodiment illustrated in Figures 3, 4 and 6 the pressure element (the button 18 in Figures 3 and 6) is recessed as at 26 centrally above the insulation and the insulation used should in these cases advantageously be flexible. This recess is preferably about .005 inch in depth, its purpose being primarily to relieve the pressure on the fusible conductor about the point of perforation through the insulation. The depth of the recess should, however, be sufficiently small so that the fused conductor in passing

through the perforations will contact with the terminal at the top of the recess. The width of the recess should be at least double the width of the annular bearing surface which surrounds it. In these cases also one or more centrally positioned openings 27 through the insulation are provided. In these embodiments the pressure resulting from the deformation of the casing is applied to the fusible disk over an annular area. Such cold flow as results is accommodated by the central recess, the flexible insulation lifts if the fusible material bulges centrally due to the cold flow and the whole rises into the recess 26. Thus the flow of material into the opening through the insulating material is avoided and the device is thus protected against the giving of false alarms due to cold flow.

In the modification illustrated in Figure 5, the insulating disk 17 is molded or fitted on the face of the metallic button 18 and extends slightly beyond the edges thereof. This extending rim of the insulation serves to hold the button 18 against moving into contact with the walls of the well, which in this case are not protected by the ring 15. If any cold flow should occur the cold metal could not flow back over the projecting rim of insulation and therefore could not contact with the button 18. I have illustrated in Figure 5 an embodiment of my invention in which the well is formed entirely by the bottom 10. I find it more advantageous, however, to use the ring 15 since in this way a sharper corner and a more nearly perpendicular side may be made and thus any deflecting of the cold flow toward the vertical is more thoroughly avoided. The use of the ring 15 also permits the well to extend above the adjacent bottom of the casing and well into the interior of the casing and since it permits the use of a shallower well in section 10 simplifies the operation by which the section 10 is formed.

In Figure 6 I have illustrated another modification of the device. In this embodiment the insulating ring 13 is extended in close to the center so that its inner face defines the upper part of the well. The lower part of the well may be defined by a depression 14 formed in the bottom 10 as illustrated, or the bottom may be made perfectly flat and the insulating ring 13 be made of sufficient thickness to provide the required depth in the well. In either case it is advantageous to cement the ring 13 to the bottom 10 in order to prevent any loss of the fused conductor between the insulator 13 and the bottom 10.

Although I have shown the recess in Figures 3, 4 and 6 in the pressure button 18, the insulation 17 or the fusible metal 16 may be recessed instead. The important thing is to relieve the pressure on the fusible metal adjacent the openings 27. Instead of the above

the part 14 of the bottom 10 which forms the bottom of the well may be dished slightly so as to provide a recess near the openings 27 into which the fusible conductor will cold-flow more readily than through the openings 27.

In the operation of the device illustrated and described above the cold flow of the fusible element is confined by the ring 15 and/or is accommodated in the recess 26. However, as soon as the fusion point is reached the fusible element 16 becomes fluid and readily flows into the narrow space between the disk 17 and the ring 15 or through the opening 27 and over the top of the disk 17 into contact with the button 18. The result of this is the closing of the circuit through the sections 10 and 11 and the automatic operation thereby of a suitable alarm or of any other desired electrical device.

Although I have illustrated in the accompanying drawings and described above a preferred embodiment and a number of modifications thereof, it will be understood that my invention is not limited to these but that many other changes and modifications may be made within the scope of my invention.

Although I have referred above and in the accompanying claims to a button 18, it is to be understood that I do not intend by this term to be limited to a button separate from the top 11, or other forms of circuit terminal with which it may be associated, but, on the contrary, the button thus referred to may be an integral part of the top 11 and/or the circuit terminal as, for example, in the embodiment illustrated in Figure 4.

I have used the term "floating disc" in the accompanying claims to define a disc which is free to move within the well without flexing,—for example, a disc such as that shown at 17 in Figs. 1, 3, 5 and 6, as distinguished from the insulating disc 17 of Fig. 4.

What is claimed as new is:

1. A temperature responsive device for closing an electrical circuit when a given temperature is reached which comprises a circuit terminal having a well thereon, a conductor adapted to fuse at the given temperature mounted in said well so that in its fused condition it will contact with said circuit terminal, a layer of insulating material substantially covering said fusible conductor but leaving a small space through which the conductor may, when fused, flow past said insulating layer, a second circuit terminal resiliently pressed against the insulating layer and toward the fusible conductor whereby to force the latter, when fused, through said space and into contact with said second circuit terminal, the second circuit terminal being recessed about said space whereby to avoid contact between the fusible conductor and the second circuit terminal in case of cold flow of the fusible conductor.

2. A temperature responsive device for closing an electrical circuit when a given temperature is reached which comprises a circuit terminal, an insulating band secured to said circuit terminal and define a well, a fusible conductor mounted in said well so that when fused it will be in contact with said circuit terminal, a disk of insulating material fitted in said well but adapted to permit a substantial stream of the fusible conductor when fused to escape past it, means for maintaining a resilient pressure on said disk against said fusible conductor, and a second circuit terminal mounted so as to contact with the fused conductor when it escapes past the insulating disk.

3. A temperature responsive device for closing an electrical circuit when a given temperature is reached, which comprises a circuit terminal having a well thereon so that a contact portion is within said well, a conductor adapted to fuse at the given temperature mounted in said well so that when fused, it will be in electrical contact with the circuit terminal, and a floating disc in said well of a diameter to leave sufficient clearance between its edge and the sides of the well to permit free movement of said disc in the well when the fusible conductor is fused, means for pressing the disc against said fused conductor so as to cause the latter, when it is fused, to flow past the disc, and a second circuit terminal contact portion electrically insulated from the first circuit terminal, but positioned near the fusible conductor in said well so as to make electrical contact with the fused conductor which escapes past said disc.

4. A temperature responsive device as defined in claim 3, in which the well is designed to limit cold flow of the fusible conductor.

5. A temperature responsive device as defined in claim 1, in which the resilient pressure of the second circuit terminal is such that it will not move the insulating layer toward the first circuit terminal farther than will leave a substantial layer of the fused conductor therebetween.

6. A temperature responsive device as defined in claim 3 in which the surface of the second circuit terminal is set back from the corresponding surface of the disk adjacent the space through which the fusible metal is to flow so as to avoid electrical contact between said circuit terminal and the fusible conductor by cold flow of the latter.

7. A temperature responsive device for closing an electrical circuit when a given temperature is reached which comprises a pair of circuit terminals, a conductor adapted to fuse at the given temperature mounted on one circuit terminal so as to be in electrical contact therewith when fused and confined so that, when fused, it is free to flow only so as to contact with the other circuit terminal, insulating means separating the fusi-

ble conductor from the second terminal but having centrally disposed openings there-through to permit escape of said conductor, when fused, into contact with the second terminal, said second terminal being resiliently pressed against said insulating means toward said fusible conductor over an annular area surrounding said centrally disposed opening and having a depression adjacent said opening whereby cold flow of the fusible conductor may swell the central part of the fusible conductor without causing it to flow into contact with the second circuit terminal.

8. In a thermostatic circuit closer, a circuit terminal, a disk of conducting material fusible at the desired temperature of operation of the thermostat and having one face bearing against said terminal, insulation peripherally confining said disk, other insulation bearing against the remote face of said disk but peripherally spaced from said aforementioned insulation, and a second circuit terminal bearing against said second mentioned insulation and being surrounded by said first mentioned insulation, but having sufficient clearance therefrom to be freely movable therein.

9. In a thermostatic circuit closer, insulating means forming a well, a circuit terminal at the bottom of said well, a disk of conducting material fusible at the desired temperature of operation of the thermostat resting upon said circuit terminal and confined by the sides of said well, a second circuit terminal comprising a button extending into said well and having sufficient clearance therefrom to be freely movable therein and insulation pressed by said button against said fusible disk and peripherally spaced from the sides of said well.

10. A thermostatic circuit closer comprising a circuit terminal having one face exposed for receiving the operating heat, a disk of conducting material fusible at the desired operating temperature bearing against the other face of said terminal, insulation closely confining said disk above the circuit terminal and forming a well thereabove, a second circuit terminal comprising a button extending into said well and having sufficient clearance therefrom to be freely movable therein and insulation pressed by said button against said fusible disk and peripherally spaced from the sides of said well.

11. A thermostatic circuit closer comprising a disk of conducting material fusible at the desired operating temperature, a circuit terminal having one face exposed to the operating heat and the other face in engagement with said disk, rigid insulation peripherally confining said disk and forming a guide extending beyond the other face of said disk, a second circuit terminal movable within said guide and having its face insulated from the face of said disk, said circuit

terminals being so pressed toward and insulated from each other that said disk is maintained under compression, space being provided in the insulation between the last mentioned terminal and the fusible disk for flow of conducting material into circuit closing contact with said terminal when said disk is fused.

12. A temperature responsive device comprising a pair of circuit terminals resiliently pressed toward each other, one of said terminals having thereover means for laterally confining a fusible conductor when fused, a fusible conductor between said terminals and within said confining means, means for insulating one of said terminals from the other and from the fusible conductor adapted to permit said conductor, when fused, to flow into circuit-closing contact between said terminals, said parts being adapted and related so as to prevent cold flow of the fusible conductor into circuit closing contact.

13. A device as defined in claim 12 in which the insulating means has a central opening therethrough adapted to permit flow of the fused conductor into contact with second conductor, and one of the enumerated members is recessed over an area surrounding said opening so as substantially to relieve the fusible conductor adjacent the opening from pressure exerted upon the fusible conductor.

14. A device as defined in claim 12 in which the means for preventing cold flow comprises an annular ring surrounding the fusible conductor and having its inner wall substantially perpendicular to the plane of the normal cold flow of said conductor.

Signed at New York, N. Y., this 12th day of May, 1930.

JOHN H. DERBY.