June 3, 1952 O. I. H. EKMAN 2,599,441

THERMOCONTACT OR FUSE FOR ALARM PURPOSES

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Fig. 1.

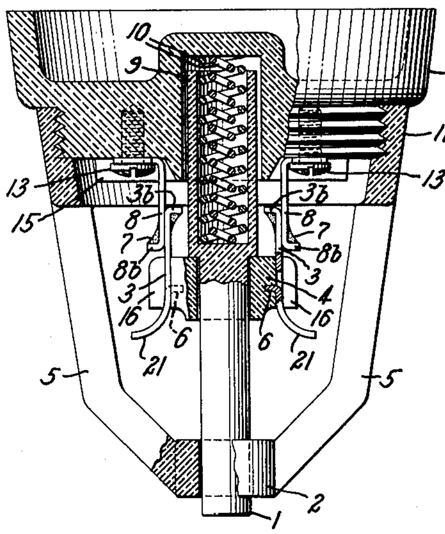


Fig. 2.

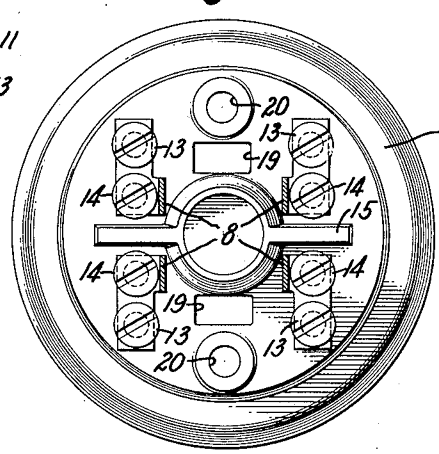


Fig. 3.

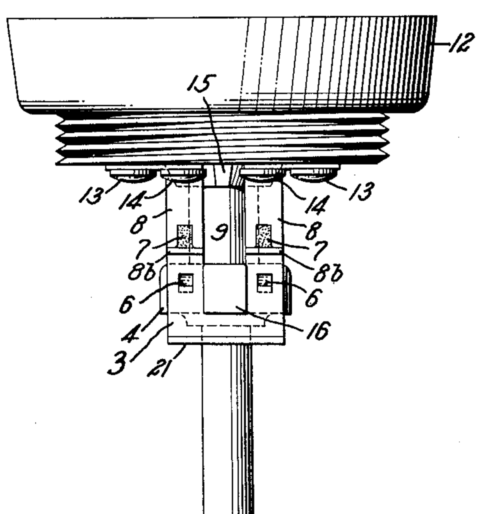


Fig. 4.

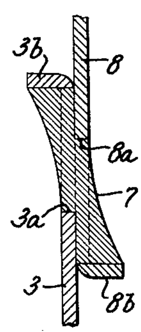
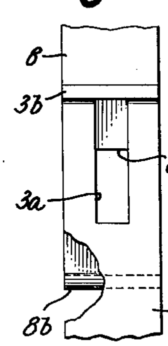


Fig. 5.



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THERMOCONTACT OR FUSE FOR ALARM PURPOSES

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In plants provided with automatic fire alarm systems, metal contacts held together with a solder material sensitive to the action of heat, so-called thermo-contacts or fuses, are nowadays commonly used, said contacts or fuses being mounted in various places, usually in the ceiling of the premises protected by the fire alarm system. A number of such thermo-contacts or fuses are thereby connected to loops leading to a central apparatus.

Each wire of the loops is in each thermo-contact provided with two metal tongues soldered together by means of an easily fusible alloy. Thus, in each thermo-contact there are four metal tongues in all, two and two joined together. When the temperature in the vicinity of the thermo-contact reaches a certain value determined by the fusion temperature of the metal alloy used for soldering, the loops will be broken in the fusible joints and the metal tongues after the soldering metal has melted, are moved apart due to their elasticity or due to the action of special springs.

Besides being cheap in manufacture, a thermo-contact to be used in automatic fire alarm systems should be of simple and rugged construction. First of all, it should satisfy heavy demands upon ruggedness and reliability of service.

In order to increase the instantaneous character of the alarm, i. e. to reduce the period needed for heating the fusible joints to the fusion temperature, such a thermo-contact should contain as few metallic parts carrying off the heat as possible. Those metallic parts which are still necessary (such as the melting parts of the thermo-contact and the current supply lines thereto) should for this purpose have the smallest possible dimensions. Other metallic parts of the contact, especially those lying close to the melting parts, should be heat-insulated from the latter (by means of Bakelite, for example) and thus not be metallically connected with said melting parts, in order to reduce to a minimum the heat carried off from the same.

The fusible joints in earlier known thermo-contacts are actuated by separating releasing forces which, in case of fire, move the metal tongues soldered together away from each other, in order that said tongues when the soldering metal has melted, shall not make electric contact with each other. In order to insure the said movement of the metal tongues away from each other, these separating forces must be rather great. However, particularly with rough handling of the thermo-contact, this may, already when the contact is

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in cold state, result in a bursting of the fusible joints which would give rise to false alarm. From the viewpoint of ruggedness it is more advantageous in this respect that the releasing forces be pure tractive forces which have not the same tendency as breaking forces to cause breaks in the fusible joints in cold state through vibrations or the like. As such separating forces do not strain the fusible joint very much, it might also be possible to make said joint smaller, and as less heat is required for the melting said joint might fuse more easily and thus a quicker alarm will be obtained in case of fire.

In thermo-contacts the metal tongues proper or the releasing springs connected thereto may lose their elasticity after some time and consequently a release will not be effected with absolute certainty, in case of fire, especially if at the same time dust has accumulated or external damage has occurred. It is therefore desirable that the acting releasing forces should be easily controllable in some way so that it can be established whether they are still active for certain release in case of fire.

Furthermore, in order to reduce the possibilities of errors, the creeping current paths between the two wires controlled by steady state current in the thermo-contact and between said wires and earth should be as long as possible, which can be obtained by providing insulating partition walls and the like between the wires, whereby the risk of false signals in the central apparatus is reduced and the reliability of the system is increased.

Finally, the air in the vicinity of the melting metals should have essentially the same temperature as the temperature prevailing in the surroundings of the thermo-contact, and the required circulation of air to the interior of the thermo-contact should be maintained so that the changes of the temperature of the surroundings quickly manifest themselves in the thermo-contact. Thus the housing surrounding the melting parts should for this purpose be provided with sufficiently large air holes.

The present invention which satisfies all the desires and demands mentioned above, relates to a thermo-contact or fuse for automatic fire alarm systems. The fuse in question is substantially characterized by the fact that it contains a member for testing the releasing force available for actuating the fusible joints.

This test member is arranged in such a manner that it is mechanically connected with the member effecting the releasing force. An advantage of the invention is that the spring force stored for separating the alarm control contacts is free from electric current and does not form part of the circuits. Consequently, the contacts themselves need not exert any spring action but the necessary spring energy is taken from a special spring. The test member is preferably mechanically connected between the member effecting the releasing force and the fusible joints proper. The releasing force will thus actuate the fusible joints via the test member.

A particular embodiment of the invention is characterized in that the metal tongues of the thermo-contact are connected with a device (weight) which through the influence of gravity increases the tensile stresses effected by the springs in the fusible joints.

As a matter of fact, a weight for effecting the releasing force might, if there is a guarantee for it that accumulation of dust and the like does not prevent its movement at the melting of the fusible joints, satisfy all the demands from the viewpoint of safety. It is also advantageous to use a helical spring for the same purpose. In this case it is suitable to utilize a helical spring compressed almost to its end position, the said spring being preferably inserted in an insulating guide sleeve or lacquered and provided with a pin projecting under the housing of the thermo-contact, said pin being adapted to be pressed in from outside, in order to control the pressure of the helical spring.

An embodiment of the invention will hereinafter be more particularly described, reference being had to the accompanying drawing, in which:

Fig. 1 is a partially sectioned side view of a thermo-contact according to the invention,

Fig. 2 shows the socket of the thermo-contact viewed from its side facing the releasing device,

Fig. 3 is a view in elevation of the thermo-contact device taken at right angles to the view in Fig. 1,

Fig. 4 is a sectional view of one of the fused joints drawn to larger scale, and

Fig. 5 is a side elevation of the joint members shown in Fig. 4 but without the solder.

As will be seen from the drawing, the thermo-contact comprises three main parts: viz. a socket intended to be applied against the support (the ceiling), a releasing device fixed to the socket, and a housing adapted to be screwed on to the socket.

The socket 12, which is made of some synthetic resin, such as Bakelite, for example, is provided with two holes 20 for fixing screws intended to be screwed into the support (the ceiling) when the thermo-contact is to be fastened to the same. Furthermore, there are two recesses 19 for inserting the electric cables (input and output wires for the electric steady current) to the thermo-contact, and four holes bored in the socket proper and threaded directly therein (thus without use of brass bushings which would introduce undesired additional metallic mass in the thermo-contact) for receiving clamping screws 13 for connecting said electric wires, and four additional holes bored and threaded in similar manner for receiving the fixing screws 14 of the metal tongues. As shown in the drawing, said two inlet holes 19 for the input and output electric wires are located between the screws 13. At the portion located next to the releasing device the socket is provided with a threaded part 18 to which the housing is to be screwed.

The housing of the thermo-contact, which like the socket is made of Bakelite or the like, is provided with a threaded ring 11 from which six arms 5 extend whose other ends are connected by means of another ring, viz. the hub 2.

The releasing device proper contains two pairs of metal tongues 8, each pair being united through a U-shaped bridge 3 which by means of fusible joints 7 at each of its respective shanks is soldered to one of the metal tongues 8. The bridge 3 is made of metal sheets and provided with additional heat absorbing surfaces 21, which are curved outwardly in order to easily absorb heat from the surrounding air currents.

At their other end the metal tongues 8 are fixed to the socket 12 by means of the screws 14, and the two bridges 3 are by means of tongues 6 formed on the same fixed to an intermediate part (weight) 4 made of electrically and thermally insulating material, such as Bakelite. In order to increase the air supply to the fusible joints, the bridges 3 are located each at its respective supporting shoulder 16 provided on each side of the intermediate part 4. Consequently, when the thermo-contact has been placed in its position of use, the intermediate part 4 will be supported pendent in the parts 3 and 8 united through the fusible parts.

The releasing force necessary for the fusible joints 7 (which also are actuated by the weight of the intermediate part 4) is effected by two helical springs 10 wound in opposite directions. These helical springs are located in a guide sleeve 9 which is closed in its end facing the intermediate part 4. One end of the helical spring member will thus bear against the bottom of the sleeve 9, and its other end will bear against the bottom of a recess provided in the socket 12. Due to the pressure action of the helical springs the guide sleeve obviously rests with its bottom against the intermediate part 4 which consequently will be held pressed away from the socket of the thermo-contact, whereby, due to the pressure of the intermediate part against the bridge 3, the fusible joints will be subjected to the necessary tensile stresses directed in the longitudinal direction of the metal tongues.

The distance between that end of the intermediate part 4 which is situated next to the sleeve, and the bottom of the recess in the socket is greater than the length of the guide sleeve 9, and therefore the guide sleeve, against the resistance of the helical springs 10, through actuation from the outside can be moved a distance in the direction towards the socket and thus out of contact with the intermediate part 4. Furthermore, the intermediate part 4 is provided with a through bore whose diameter is less than the outer diameter of the guide sleeve. Thus, the guide sleeve cannot pass through said bore. Consequently, the bore serves as a guide for a releasing and control testing pin 1 traversing the same. One end of the pin 1 is fixed to the guide sleeve, while its other end traverses the hub 2 of the housing so that, as will be seen from Fig. 1, said end will be located a small distance outside the housing surrounding the active parts of the thermo-contact. By pressing-in the pin 1 from outside the housing, the spring pressure of the helical springs, i. e. the active releasing force, can evidently be testing. As a matter of fact, the pin 1, as stated above, is displaceable in the bore of the intermediate part 4 and rigidly connected with the sleeve 9, and therefore also this sleeve is actuated at the depression of the pin and is moved towards the socket while the helical springs are being compressed.

The advantages of the invention will be hereinafter summed up.

The thermo-contact according to the present invention is most prompt in releasing the alarm because the force acting upon the fusible joints is a pure tensile stress which, when said joints are cold, does not strain the same to such a great extent as is the case in the earlier known thermo-contacts in which the fuses are subjected to breaking stresses. As the stresses are more advantageous, when the contacts are in rest, the fusible joints may, as a matter of fact, be made with less metallic mass, and thus become more easy to heat than has been the case in earlier thermo-contacts. At the same time the metal strips may be made thinner because the force of the spring exerts a pure tensile stress on said strips. Consequently, also said strips may be made with smaller dimensions. In order to increase the heat-absorbing capacity of the metal tongues, the bridge **3** uniting the same is made with additional heat-absorbing surfaces, viz. aerials, analogous to cooling flanges.

In the embodiment described the said heat-absorbing members (surfaces) represent part of the steady current path but they may also be located outside said path and be intimately connected with the fusible joints. A concentrated heat transfer to the fusible joints is obtained by making the aerial part proper i. e. bridge **3** and extension **21** of a material with high specific heat conductivity, such as copper. If the current supply conductors to the fusible joints are made of another material with low specific heat conductivity or with reduced cross sectional area in relation to the heat transfer means, heat conduction from the fusible joints via the metal tongues and the current supply conductors is minimized. Heat flow away from the fusible joints is also minimized if the tongues **8** are made from a material such as German silver having a low specific heat conductivity.

The joint itself can be made stronger, using a smaller quantity of fusible metal by providing the metal tongues **8** and bridges **3** at the joint with coinciding holes or slits **8***a* and **3***a* respectively with bent edges **8***b* and **3***b* respectively which are filled with soldering metal. Thus, the bending of the ends of the metal tongues known in earlier thermo-contacts can be avoided, which is desirable because said bent edges increase the flash-over risk between the metal tongues at release. It is also possible to so design the metal tongues **8** such that upon release by melting of the solder **7**, the tongues spring outwardly at right angles to the direction of the releasing force of the springs **10**. With this arrangement it is an advantage to solder one of the joints of each pair associated with the same current path with a metal alloy having a lower melting temperature than that used for soldering the other joint of that pair, and to so arrange the four joints of the two pairs that those joints which are soldered with the same alloy are located diagonally from each other.

The other metallic parts in the thermo-contact, which in the earlier known thermo-contacts have a tendency of carrying off heat from the meltable members, are heat-insulated from said members in the thermo-contact according to the invention. For example, the compression springs (which are doubled from the viewpoint of safety) are, due to the sleeve of insulating material surrounding them, prevented from carrying off heat from the air surrounding the melting members and thus from delaying the melting of the fusible joints by the air heated by the fire. Furthermore, the springs are protected by said sleeve against external damage, accumulation of dust and the like. Nor can they be removed from the thermo-contact without breaking the fusible joints. Finally, as already mentioned, the threads for the clamping screws **13** and the fixing screws **14** are made directly in the Bakelite mass of the socket. Furthermore, the cover of the device is made of Bakelite, whereby the metallic parts of the device are a minimum.

Previously known thermo-contacts do not admit of a simple testing of the releasing force. For several reasons, said force may be incapable of acting, e. g., due to fatigue or break of the springs, accumulation of dust, and so on. However, the present invention admits of an easy testing of the spring members effecting the releasing force and due to the suspension of the part **4** in the metal tongues **8** also insures, that said force is made more effective with the aid of gravity. However, the releasing force is effected substantially by the compression springs **10**, the pressure action of which, through the contact of the sleeve with the intermediate part **4** and through the pressure of the said part on the U-shaped bridge **3**, is converted into a tractive force acting on the fusible joints, as earlier described. For this purpose it is possible to utilize draw springs, but during operation said springs run a certain risk of getting fatigued and thus permanently deformed (by being overstrained by the control device, for example). As the intermediate part **4** is provided with a bore, whose diameter is less than the outer diameter of the sleeve, a shoulder will be formed for effecting pressure contact between the sleeve and the intermediate part, the pin **1** arranged as extension piece of the sleeve being at the same time freely displaceable in said bore. When in case of fire the thermo-contact is released, the pin will, due to the intermediate part **4** getting loose and under the pressure of the helical spring device **10**, be thrown out some distance through the hub **2** arranged in the housing. The testing pin **1**, which preferably, just as the sleeve, is made of insulating material, should have a colour preferably contrasting to that of the housing. Thus, when a thermo-contact within a group of contacts has been released, it is easy to determine which of them has been released. When the fusible joints are unbroken, the pin **1** may be used for testing the efficiency of the spring device **10**. According to what has been stated above, the intermediate part **4** is free from said pin, and it is thus possible, without actuating the fusible joints, to press the pin a small distance against the socket **12** in accordance with what has been earlier described. The intermediate part **4** then remains in its original position, while the sleeve secured to the pin is moved a few millimeters in the direction of the socket, the helical springs located in said sleeve being compressed. The acting releasing force may evidently also be measured by means of a spring balance which is applied to the outer end of the test pin. This may be used not only for testing the fuse while in service but also for testing during manufacture.

Another advantage of the subject matter of the present invention is that the acting spring members may be made common to the two paths of current, for the same releasing member (the device **10**, **9**, **4**) actuates the fusible joints for both of these paths of current which thus are released almost simultaneously, while there is only one direction of motion for the release in contradistinction to the earlier known thermo-contacts in which separate springs are used to release each of the paths of the current and in which there is a possible risk that but one of the springs may be functioning. Thus, in the thermo-contact according to the invention the spring members may be made stronger, which still more increases the reliability of service of the device.

The risk of creeping currents between the two paths of current in the thermo-contact and to earth is considerably reduced through the relatively great creeping current distances between the parts of these two paths of current and the insulated metallic parts. For example, flanges **15** are arranged between the terminals of the two paths of current in the socket. Furthermore, the spring members **10** are inserted in a sleeve, and so on.

The heat circulation between the surrounding air and the chamber in the housing of the thermo-contact is considerably facilitated by providing said housing with arms **5** and large spaces between said arms. Yet the risk of dust accumulation and external damage is small because the vital releasing members (the springs **10**) lie well protected in the sleeve **9** and can be made stronger than in the earlier known constructions.

A great many constructive changes may of course be made in the thermo-contact according to the invention without going beyond the scope of the principle forming the basis of the invention.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A thermo-contact of the normally closed supervisory circuit type for automatic fire alarm plants, comprising, a pair of contacts, said contacts being joined together with a solder meltable at a temperature at which the alarm is desired to be given, a spring member loading at least one of said contacts in such manner as to effect separation thereof from the other contact upon melting of said solder to open said supervisory circuit, and means for testing said spring comprising means engageable with the spring and actuatable by an operator to displace the spring in a direction counter to the contact loading direction.

2. A thermo-contact of the normally closed supervisory circuit type for automatic fire alarm plants comprising, a housing having wall openings ventilating the same to the surrounding air, a pair of contacts within said housing one of which is movable, said contacts being joined together with a solder meltable at a temperature at which the alarm is desired to be given, a spring member loading the movable one of said contacts in such manner as to effect separation thereof from the other contact upon melting of said solder to open said supervisory circuit, and means for testing said spring comprising a movable test member mounted by said housing and cooperative with said spring, said test member projecting exteriorly of said housing for actuation by an operator to displace said spring in a direction counter to the contact loading direction to unload the spring from said movable contact.

3. A thermo-contact of the normally closed supervisory circuit type for automatic fire alarm plants comprising a housing, fixed and movable contact means within said housing joined together with a solder meltable at a temperature

at which the alarm is desired to be given, a support for said movable contact means, a spring member under compression and a test member loaded by said spring and transmitting the restoring force of the spring attributable to its compression to the said support for said movable contact means in such direction as to effect separation of said movable from said fixed contact means upon melting of said solder, said test member being accessible from the exterior of said housing and actuatable in a direction opposite to that effected by said spring to further compress said spring for testing of the latter.

4. A thermo-contact as defined in claim 3 wherein said test member projects beyond the exterior of said housing for visual indication of a separation of said fixed and movable contact means.

5. A thermo-contact as defined in claim 3 wherein said fixed contact means is comprised of a pair of spaced metallic tongues secured to said housing and said movable contact means is comprised of a metallic contact bridge carried by said support spanning said tongues and soldered to each of the latter.

6. A thermo-contact as defined in claim 5 wherein said contact bridge is provided with a metallic extension directing air streams towards the soldered joints between said bridge and said tongues.

7. A thermo-contact as defined in claim 3 wherein said fixed contact means is comprised of a pair of spaced metallic tongues secured to said housing and having a low specific heat conductivity, and said movable contact means is comprised of a metallic contact bridge carried by said support having a high specific heat conductivity, said contact bridge spanning said tongues and being soldered to each of the latter.

8. A thermo-contact as defined in claim 7 wherein said metallic tongues are provided with slits at the soldered junction with said contact bridge.

9. A thermo-contact as defined in claim 3 wherein said fixed contact means is constituted by two paralleled sets of spaced metallic tongues located on opposite sides of said test member, and said movable contact means is constituted by metallic contact bridges individual to and spanning and soldered to each set of spaced tongues.

10. A thermo-contact as defined in claim 9 wherein one of the two soldered joints between each contact bridge and the spaced tongues associated therewith is made with a solder having a melting temperature lower than that of the solder with which the other joint is made, and wherein the joints which are made with solder of like melting temperatures are located diagonally from each other, the tongues forming the two joints made with the lower melting point solder having an initial inherent spring force directed at right angles to the restoring force exerted by said compressed spring member.

11. A thermo-contact of the normally closed supervisory circuit type for automatic fire alarm plants comprising a housing of electrically nonconducting and thermally insulating material having wall openings ventilating the same to the surrounding air, fixed and movable contact means in said housing, said fixed contact means being secured to said housing and said fixed and movable contact means being joined together with a solder meltable at a temperature

at which the alarm is desired to be given, a bushing having an axial bore, means securing said movable contact means to said bushing, a test member of electrically non-conducting and thermally insulating material having a pin portion at one end, an axially recessed portion at the other end and a shouldered portion therebetween, the pin end portion of said test member passing through the bore in said bushing to a point exteriorly of said housing, the axially recessed end portion of said test member being slidable in a recess provided in said housing and the shouldered portion of said test member being larger in transverse dimension than the bore in said bushing to thereby establish a seat for the shouldered portion upon the adjoining end face of said bushing, and a helical coil spring under compression within the axial recess of said test member, opposite ends of said spring bearing respectively against the bottoms of the recesses respectively in said housing and test member, the restoring force in said spring at-

tributable to compression thereof being transmitted through the shouldered portion of said test member to said bushing and from the latter to the said movable contact means in such direction as to effect separation thereof from said fixed contact means upon melting of said solder.

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