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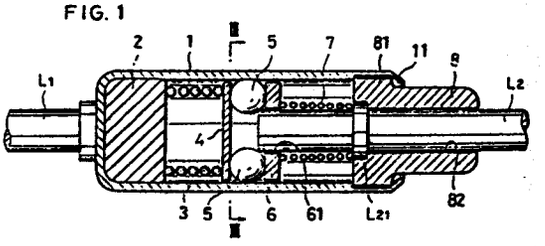
(54) **Thermal fuse.**

(57) A thermal fuse which can be constructed easily and automatically and yet works accurately. It comprises an electric conductive cylindrical case (1) with a lead wire (L1) at the bottom thereof another lead wire (L2) in the case, a fuse alloy piece (2) of fusible alloy and ball contacts (5) under spring pressed condition between the fuse alloy piece and the lead wire in case, thereby forming an electric circuit between the two lead wires. When the fuse alloy piece fuses at the preset temperature, ball contacts (5) under spring pressed condition are released from pressing by the lead wire (L2) and the circuit is opened.

FIG. 1



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Description

"THERMAL FUSE"

This invention relates to a thermal fuse which can be constructed easily and automatically and yet works accurately.

Conventionally, a thermal fuse is connected to an electric circuit in order to act as a safety means. The fuse is so designed that when a preset temperature is reached, a fusible alloy in it fuses and the electric circuit is opened, thereby protecting electric appliances and preventing a fire. In this thermal fuse, two lead wires which in their normal state are separated from each other are brought compulsorily into contact with each other and deposited with fusible alloy to close the circuit between the lead wires. Therefore, when the temperature of the protected electronic circuit itself rises to the preset temperature due to an excess current (at overload) or when the ambient temperature rises excessively, the fusible alloy fuses and thus the circuit is opened. However, in manufacturing this thermal fuse it is required to fuse the fusible alloy and to keep the two lead wires in a compressed state until the fused fusible alloy solidifies. Thus, it takes much trouble for deposition of lead wires.

In accordance with the present invention there is provided a thermal fuse characterised in that it comprises a cylindrical conductive case with a lead wire at the bottom side thereof, another lead wire in the case, a solid fuse alloy piece put in the inner bottom part of the case and ball contacts pressed by springs from both sides between the fuse alloy piece and the other lead wire, wherein an electric circuit is formed between the two lead wires through the medium of the ball contacts and the case, the arrangement being such that, when the fuse allow piece fuses at a preset temperature, the ball contacts under spring pressure are released from pressing on the other lead wire and the electric circuit is thus opened.

The thermal fuse according to the present invention is manufactured in the following way.

In a cylindrical conductive case with a lead wire at its bottom side, a fuse alloy piece which fuses at the preset temperature is inserted. Then, a compressed spring and an alloy flowing out preventive plate are fitted in. An insulating lid is fixed at the open end of the case and a further lead wire is inserted in the case through the lid. A spring is put on the end portion of the further lead wire in such a fashion that it engages with a protrusion made at the outer periphery of the further lead wire. By compressing the spring an insulating plate is fitted to the lead wire. A plurality of ball contacts an electric conductive wire which connect the case and the further lead wire are electrically interposed between the insulating plate and the alloy flowing out preventive plate. While the fuse alloy piece is in solid condition, the ball contact is pressed by the opposing two springs but when the fuse alloy piece fuses, the ball contacts and the insulating plate are separated compulsorily from the further lead wire by the action of the spring and thus the electric circuit is opened.

In order that the invention may be better understood, an embodiment thereof will now be described by way of example only and with references to the accompanying drawings in which:-

Figure 1 is a cross sectional view of an embodiment of a thermal fuse according to the present invention in its normal condition;

Figure 2 is a cross sectional view of a thermal fuse according to the present invention when it worked; and

Figure 3 is a cross sectional view of the part taken along the line III - III in figure 1.

Figure 1 shows the thermal fuse according to the present invention in its normal condition and Figure 2 shows the same thermal fuse after operation.

Reference numeral 1 designates a cylindrical case formed of nickel plated copper or iron or formed of electric conductive metal such as aluminium. A lead wire L1 is fitted to the outer surface of the bottom of the case 1 by deposition or other means. Reference numeral 2 designates a fuse alloy piece to be put in the inner bottom of the case 1. It is made of fusible alloy which fuses at a preset temperature. This fuse alloy piece 2 is put in the inner bottom by using a press or the like.

Reference numeral 4 designates an alloy flowing out preventive plate to keep fuse alloy piece 2, when fused, from flowing out toward ball contacts 5 and toward the side of the lead wire L2. It is formed of copper or other metal or ceramics and is slidably inserted in the case 1. Between the fuse alloy piece 2 and the alloy flowing out preventive plate 4, a spring 3 is inserted in compressed state. A lid 8 made of ceramic or other insulating material is fixed to an open end portion of the case 1. An opening end edge 11 of the case 1 is bent inwardly to hold a flange 81 of the lid 8 and to fix the lid 8 to the case 1. A hole 82 through which the lead wire L2 is put is made at the centre of lid 8. A protrusion L21 is made at the outer periphery of the lead wire L2 and a spring 7 is put on the outer periphery of the lead wire L2 in such a fashion that it engages with the protrusion L21. The spring 7 should be weaker in resilience than the spring 3 which presses the alloy flowing out preventive plate 4 and the other end of the spring 7 is supported by one side surface of the insulating plate 6 of washerlike shape fitted to the lead wire L2. The insulating plate 6 is forced to be pushed out toward the fuse alloy piece 2 by the resiliency of the spring 7.

The insulating plate 6 is made of ceramic, ebonite or other insulating material to withstand the specific temperature and a hole 61 through which the lead wire L2 is put in is made at the centre thereof. A plurality of ball contacts 5 are interposed between the insulating plate 6 and the alloy flowing out preventive plate 4. The ball contact 5 has a ball-like shape and is made of copper or metal of good conductivity. While the fuse alloy piece 2 is in solid state, both the spring 3 and the spring / are in

compressed state and by this spring force, the alloy flowing out preventive plate 4 and the insulating plate 6 are pressed from both directions and a forward end L22 of the lead wire L2 makes contact with the ball contacts 5, which make contact with the inner peripheral surface of the case 1. Thus, between opposing two lead wires L1 and L2, an electric circuit is formed through the medium of ball contacts 5 and the case 1.

When an excess current flows through the thermal fuse shown in Figure 1 or when the ambient temperature rises up to the preset temperature, the fuse allow piece in solid condition fuses. The fuse alloy piece 2' thus fused flows and moves from its original position at the inner bottom of the case as shown in Figure 2, whereupon the spring 3 is released from its compressed state and stretches. By the stretching of the spring 3, the spring 7 which has been in compressed state by stronger resilience of the spring 3 stretches. The stretching of the spring 7 pushes the insulating plate 6, ball contacts 5 and the alloy flowing out preventive plate 4 toward the side of the lead wire L1, whereby contact between the lead wire L2 and the ball contacts 5 is released and the electric circuit is opened. Since the fused fuse alloy 2' is kept from flowing out toward the side of the lead wire L2 by the alloy flowing out preventive plate 4, there is no fear that the electric circuit is closed again after the fuse alloy fused.

In the above-described embodiment, fuse alloy in solid state is put in the case and an electric circuit is formed between two lead wires, through the medium of ball contacts which are under spring pressure from both sides and the case. Therefore, there is no need of fusing fusible alloy for deposition as in the case of the conventional thermal fuse. Thus, the thermal fuse is easy to construct and the automation is possible for its construction.

Claims

1. A thermal fuse characterised in that it comprises a cylindrical conductive case with a lead wire at the bottom side thereof, another lead wire in the case, a solid fuse alloy piece put in the inner bottom part of the case and ball contacts pressed by springs from both sides between the fuse alloy piece and the other lead wire, wherein an electric circuit is formed between two lead wires through the medium of the ball contacts and the case, the arrangement being such that, when the fuse allow piece fuses at a preset temperature, the ball contacts under spring pressure are released from pressing on the other lead wire and the electric circuit is thus opened.

FIG. 1

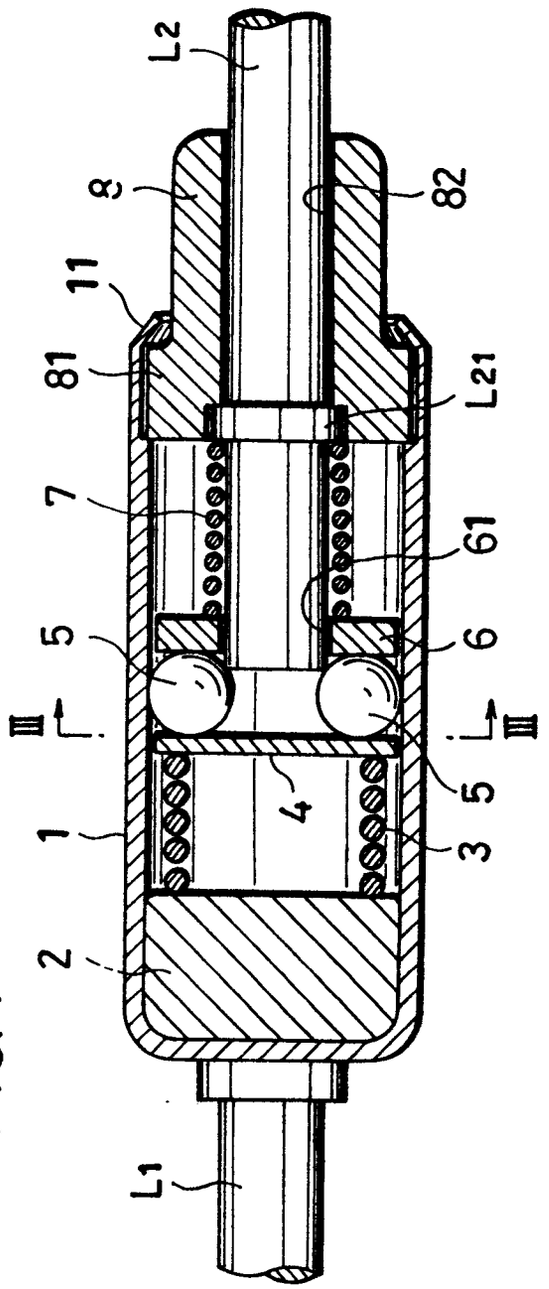

FIG. 2

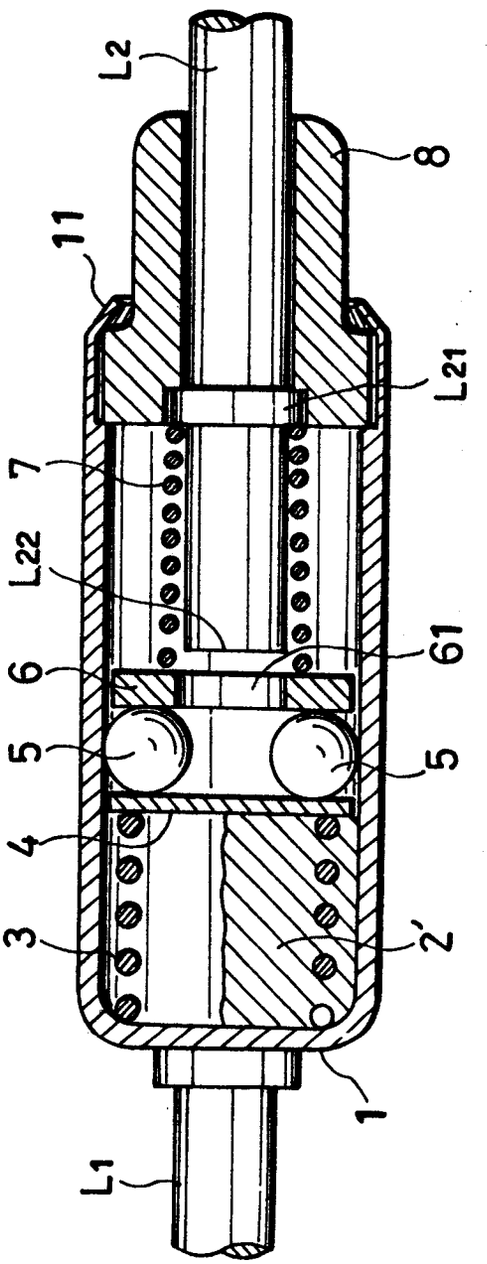

FIG. 3