Jan. 31, 1950 R. L. HENRY, JR 2,496,049

OVERLOAD INDICATING SAFETY SWITCH

Filed Sept. 6, 1946

FIG. 1.

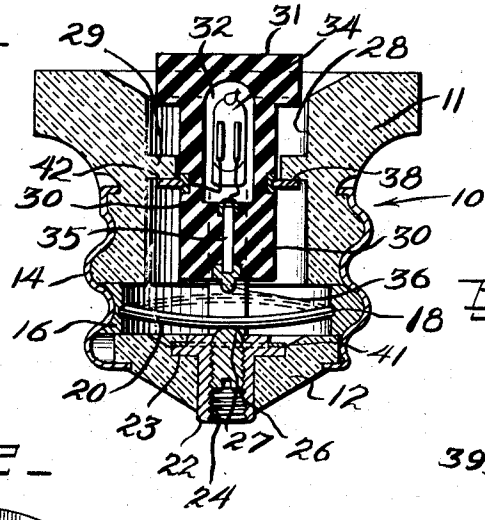


FIG. 2.

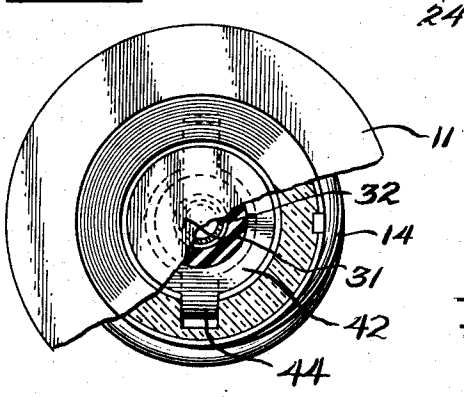


FIG. 3.

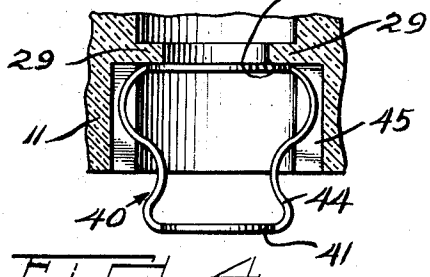


FIG. 4.

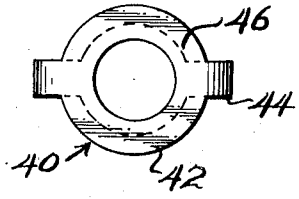


FIG. 5.

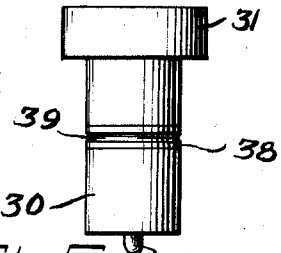


FIG. 6.

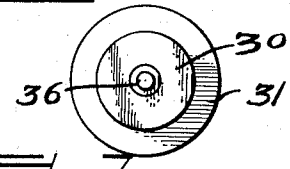


FIG. 7.

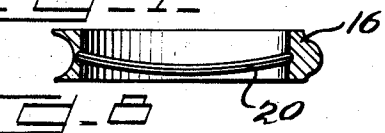
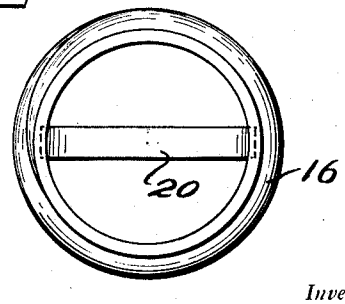


FIG. 8.



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OVERLOAD INDICATING SAFETY SWITCH

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7 Claims. (Cl. 200—121)

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This invention relates to overload safety switches of the type having a circuit breaking element capable of being used an indefinite number of times and designed to replace the ordinary fuse embodying a material fusible by the heat of an overload current.

The replacement of fuses used for the protection of circuits, the material of which forms part of the circuit but disappears or drops out upon heating due to an overload, has been repeatedly proposed. Switches of this type, however, have not been extensively used, the main reason being that they are, as a rule, not sufficiently small and inexpensive, and can therefore not be placed in every branch of an installation in the manner of fuses and are not nearly as reliable and as accurate as regards operation at a definite overload and as safe as regards the sudden interruption of a heavy current without the forming of arcs as fuses.

In installations with many branches entailing the arrangement of a large number of protection devices, the locating of the overload and of the apparatus or device which was the cause of it, is moreover difficult.

The invention has for its principal object to provide an overload safety switch of simple and inexpensive construction and of such small size that it is comparable with the size of the plugs carrying fuses which will operate with great reliability and sensitiveness at a predetermined overload and will cause a sufficiently wide and sufficiently rapid separation of the contacts, preventing and excluding arc formation.

It is a further object of the invention to provide a reliable indicating device, indicating clearly and immediately the fact that the safety switch has been operated and permitting the immediate location of the branch in which the overload occurred.

It is a further object of the invention to provide an indicating device capable of indicating the device or apparatus in the branch protected by it which was the cause of the overload without having first to return the switch to its normal position, as is the case with the safety devices and switches hitherto known.

Further objects will be apparent from the following specification.

The invention is illustrated in the accompanying drawings showing one embodiment thereof. This embodiment is however, to be considered as illustrative and serves by way of example to show the way of carrying the invention into effect. The invention is described in such terms

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that the principle on which it is based will be clear to the expert skilled in the art, and this principle will enable him to construct other embodiments using the same principle. Such other embodiments are therefore not departures from but part of the invention.

In the drawings,

Figure 1 is an elevational sectional view of the device, the section being taken along a plane passing through the central axis of the device.

Figure 2 is a plan view partly in section of the device.

Figure 3 is a sectional and elevational part view of some of the centrally arranged members.

Figure 4 is a plan view of the members shown in Figure 3, and

Figures 5 to 8 are elevational and plan views of details.

The safety circuit breaker according to the invention essentially comprises a plug member 10 consisting of two sections 11 and 12 of insulating material, which are joined by means of the usual screw threaded sleeve or shell 14 constituting the side terminal for the plug. Between the two sections 11 and 12 a metal ring 16 is inserted, which is provided with grooves 18, pairs of pins, or other means to hold a bi-metallic strip 20. The length of the said strip is so chosen that when inserted between the two grooves 18 it is under stress and is slightly bent towards the bottom of the plug. The bottom section 12 of insulating material carries a central contact sleeve 22 provided with a stepped flange 23 which is screw threaded, as at 24. A threaded contact pin 26 is screwed into said sleeve and may be finely adjusted therein. The head 27 presses against the bi-metallic strip 20 and by adjusting its position the initial stress of the bi-metallic strip which has to be overcome when it moves away from the pin may be regulated.

It will be understood that the strip 20 is inserted in such a way that under heat the strip, on account of the unequal dilatation of its parts will have a tendency to move away from the bottom section 12 and towards the upper section 11. On account of the initial stress under which the strip is inserted, however, this tendency cannot manifest itself immediately. A certain temperature is necessary to counteract and overcome the initial stress of the bi-metallic strip. This temperature may be adjusted by adjusting the position of the contact pin 26 and of its head against which the strip 20 presses. The temperature at which the stress is finally overcome corresponds to that which is imparted to the strip 20 by the

passage of a current which is too heavy for the installation so that it may be regarded as an overload. The overload current intensity at which the safety switch starts to operate is therefore very finely adjustable.

The upper section 11 of the safety switch plug is provided with a central cylindrical bore 28 into which an inner annular flange 29 projects. The latter surrounds closely a central cylindrical body 30 of transparent or translucent plastic material which is provided with a head 31 serving as a finger-piece and with a cavity 32 containing a small glow lamp bulb 34, preferably a neon filled lamp bulb. This lamp 34 is connected with a carbon resistance 35 of high value which in its turn is connected with a central contact piece 36 on the transparent lamp holder 30, facing the contact pin 26 and the bi-metallic strip 20.

The second electrode of the glow lamp is connected with a metal ring 38 embedded within the transparent lamp holder body 30 and provided with a small groove 39. A metal spring holder 40 of special shape enters into said groove 39 and thereby holds the lamp holder body 30 in its proper place. This metal spring holder consists of two annular disks 41 and 42 one of which (41) is seated on the stepped portion of flange 23 while the other disk 42 is pressed against the inner side of the inner annular flange 29. The two disks 41 and 42 are joined by the elastic bands 44 which may be of undulating form as shown in Figure 3 to increase their elasticity. These bands are integral with the two disks and are narrow strips joining them. Suitable slots 45 in the plug section 11 are provided for their accommodation.

It will be clear that the spring member 40 once it has been inserted is under a small permanent tension. By virtue of this tension disk 42 is always held against flange 29. The inner edge of the disk, which may be provided with suitable cuts 46, by entering into the groove 39 holds the lamp holder body 30 in its position. This lamp holder body 30 with its enlarged head 31 acting as a finger-piece, forms a push button which may be pressed towards the bottom section of the plug.

Before the safety switch is brought into service, the bi-metallic strip 20 is adjusted so as to be under the required preliminary tension. This adjustment is merely performed once. After this adjustment the safety switch is permanently set to operate at a given overload.

This adjustment, as already described, is made by selecting a strip of greater length than the diameter of the ring 16 on groove 18 which will be bent toward the bottom section so that it is under stress. Moreover, the strip is inserted in such a way that the metal having the smaller dilatation is on the side pointing outwardly towards the bottom section. By means of the screw 26 the stress of the strip 20 is adjusted so that, after a certain amount of expansion, the strip will snap to the other side and occupy the position shown in dotted lines. This amount of dilatation required to make the switch snap is determined by the overload current which is thought to be permissible.

It will be clear that when the bi-metallic strip 20 snaps into the position indicated in dotted lines the main current which is flowing from the metal sleeve 14 (supposed to be screwed into a socket connected with the source of current supply) to the central contact 22 over the strip 20 and the contact pin 26 is interrupted and the resistance 35 and the glow lamp 34 are now in the circuit which is closed over the strip 20, the central contact 36, the resistance 35, the lamp 34, the embedded metal ring 36, the disk 42, the bands 44 and the disk 41 to the flange 23 of the central contact sleeve 22. The glow lamp will be fixed and will form an indicator announcing the presence of an overload in the circuit. The strip will remain in its position with the bulb lighted as long as the overload remains. If the condition causing the overload, for instance, the short circuit, or the electric apparatus consuming too much current, or the like is removed the glow lamp is extinguished. If it is unknown which apparatus is the cause of the overload, the apparatus in the circuit may be switched off one by one. The extinguishing of the light indicates which apparatus was the cause of the overload.

In installations with a plurality of branches, the indicator switch is connected with each of the branches and will allow to identify the branch in which the overload occurred.

After the condition causing overload is removed, the button is pressed and thereby the strip 20 is returned to its initial position as shown in full lines. It will be clear that the safety switch may be used indefinitely without requiring repair or replacement of parts.

The snap action of the bi-metallic switch due to its initial setting has the great advantage that arcs forming between contacts are effectively suppressed.

It will be self-evident that the invention is not connected with the construction of many of the details and that therefore the particulars of these details do not in any way affect the scope or nature of the invention.

I claim:

1. A safety switch for the protection of electric circuits against overloads comprising a bi-metallic strip arranged under mechanical tension in the protected circuit a current supplying contact fixedly connected with said protected circuit and said strip, two contacts at opposite sides of said bi-metallic strip, one of said contacts being in operative contact with the said strip when under mechanical tension, the other contact coming into operative contact with the said strip when the latter is heated to a predetermined amount by an overload current, a connection of the former contact with the protected circuit, and an indicator glow lamp connected on one side with one of said two last named contacts and on the other side with the other contact.

2. A combined overload indicator and safety switch for the protection of circuits against overloads comprising a contact sleeve adapted to be connected with the protected circuit a pair of contacts facing each other at a distance, one of said contacts being a normal load contact and the other an overload contact, a bi-metallic strip arranged between said contacts and connected with said contact sleeve, means for holding said bi-metallic strip in contact with one of the said contacts under normal load, said strip being arranged to come into contact with the overload contact upon dilatation of the strip due to overload, and a connection between said normal load and said overload contact, including an indicating glow lamp, for indicating the condition of the bimetallic strip.

3. A combined overload indicator and circuit interrupter switch comprising a pair of contacts facing each other, one of said contacts being an

overload and the other a normal load contact, a bi-metallic strip connected with a further current supplying contact, arranged transversely with respect to the line joining said pair of contacts, means for holding said strip under initial tension in contact with the normal load contact, and in a position to come into contact with the overload contact upon dilatation to an extent overcoming said initial tension and corresponding to a predetermined overload, and an indicating glow lamp connected across the two contacts facing each other.

4. A combined overload indicating and circuit interrupting safety switch comprising a hollow plug provided with a contact sleeve adapted to be connected with the circuit to be protected, a fixed central normal load contact, insulated from said sleeve, an overload contact facing said normal load contact, a bi-metallic strip and means for carrying the same within the contact sleeve and in electrical contact with the same under initial tension between said two contacts, said tension holding the strip in electric contact with the normal load contact in a position and at a distance bringing said strip into contact with the overload contact upon dilatation, overcoming said initial tension, an indicating glow lamp, a transparent carrier for the same and for the overload contact held within said plug, an electric connection of said lamp with the overload contact and means for connecting said lamp with the normal load contact, including a contact on the carrier connected with the lamp, and a conductive means for holding said carrier, electrically connecting said carrier contact with said normal load contact.

5. A combined overload indicating and circuit interrupting safety switch comprising a hollow plug provided with a contact sleeve adapted to be connected with the circuit to be protected, a fixed central normal load contact, insulated from said sleeve, an overload contact facing said normal load contact, a bi-metallic strip and means for carrying the same within the contact sleeve and in electrical contact with the same under initial tension between said two contacts, said tension holding the strip in electric contact with the normal load contact in a position and at a distance bringing said strip into contact with the overload contact upon dilatation overcoming

said initial tension, an indicating glow lamp, a movable transparent insulating carrier provided with a conductive gripping ring and a push head, held within said hollow plug, an electrical connection between said glow lamp and said overload contact, a further connection between said glow lamp and said conductive gripping ring, and a compressible elastic spring, seated on the central normal load contact, gripping and holding said insulating carrier, for an axial movement within said plug, transversely to the bi-metallic strip for returning the same into its initial position after operation due to dilatation.

6. A safety switch for the protection of circuits against overloads, comprising a current supplying contact adapted to be connected with the protected circuit, a bimetallic strip in fixed connection with the same, a pair of contacts located on both sides of said bimetallic strip, adapted to come into operative contact with said strip in positions occupied by the latter upon dilation and contraction respectively, one contact of said pair being a current supplying contact connected with the protected circuit, and a connection including an indicator lamp between the two contacts of the contact pair for indicating the position occupied by the bimetallic strip.

7. A combined overload safety switch and indicator comprising a bi-metallic strip, adapted to adopt two positions, one of them being a position for normal current loads and the other being a position corresponding to overloads, a current supplying contact connected with said strip, a fixed contact on one side of said bi-metallic strip, in contact with the same during normal load, a movable contact on the other side of the strip for contact with the same after the occurrence of an overload, an indicator glow lamp connected with the movable contact, a carrier for said movable contact and said glow lamp, compressible holding means for the movable contact carrier, and an electrical connection between the fixed and the movable contact including the said carrier and the said indicator lamp, the latter thus indicating the position of the bi-metallic strip.

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No references cited.