

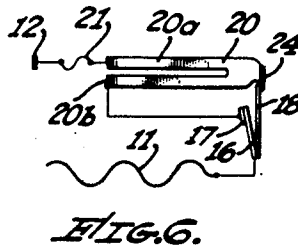
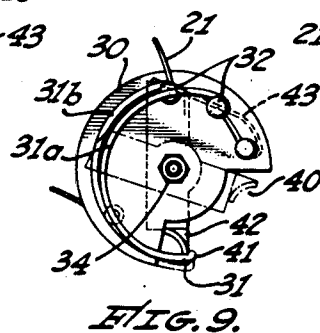
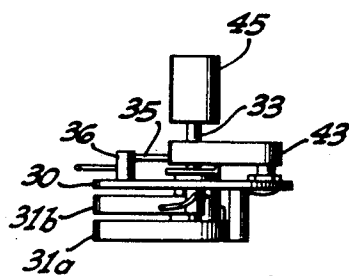
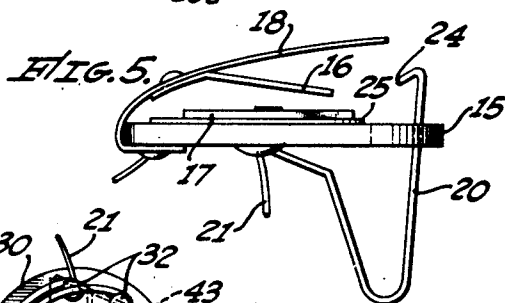
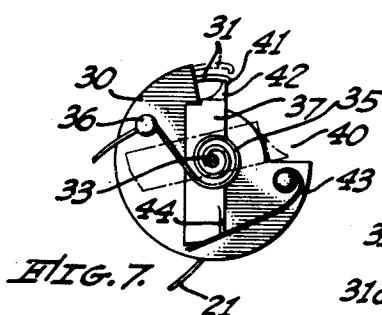
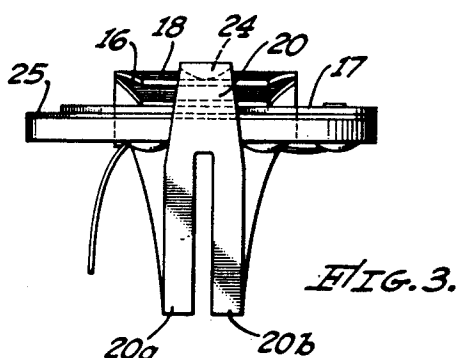
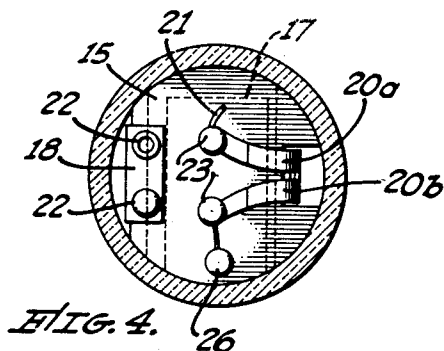
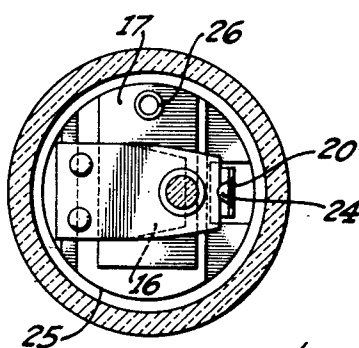
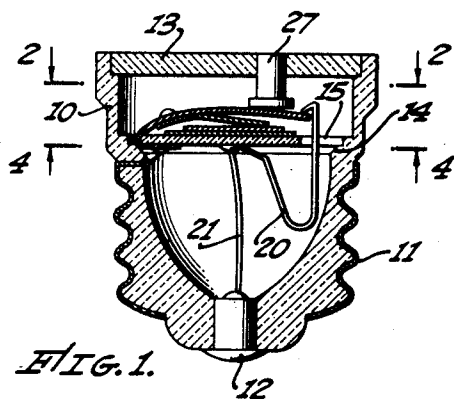
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CIRCUIT PROTECTOR

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CIRCUIT PROTECTOR

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My invention relates generally to overload protectors for electrical circuits and more particularly to such devices which are operated by the expansion and contraction of a bimetallic strip so that the device may be re-set and used again after it has been operated by an overload.

In order that the wiring of various electrical circuits, such as those in homes, factory and office buildings, and similar structures, will not be overloaded to a point where they will constitute a fire hazard, it has long been the practice to use a fusible link or fuse which will be melted and break the circuit before any damage can result to the structure. While the advent of the fusible link marked a considerable advance from the standpoint of safety, there are many disadvantages and objections to such devices including the difficulty of locating the melted or burned-out fuse when a plurality of fuses are grouped together as is customary. Furthermore, since fuses are available in different current ratings, it often happens that too large a fuse is placed in the circuit, and hence no adequate protection is furnished thereby. If fuses of several different ratings are used in one group of fuses, at least one replacement fuse of each of the different ratings must be kept handy so that any replacements will likewise have the proper value.

In more recent times, it has been proposed to make use of the properties of a so-called "bimetallic" strip composed of two dissimilar metals having different coefficients of thermal expansion so that heating or cooling of the composite structure causes it to bend or warp in a pre-determined manner. While many devices of this type have been proposed, they have generally been relatively complicated to manufacture, and consequently have been relatively expensive. Furthermore, provision must be made to prevent the mechanical holding of the circuit breaker in closed position even though an overload is present, and this has complicated the structure even more, increasing its cost still further.

Where a structure is erected or has alterations made therein which require new wiring or replacement of the circuit controlling means, some of the presently available thermal-type circuit breakers are very satisfactory, and can be installed at a cost only slightly greater than that of the well-known fusible link type. However, many home owners do not wish to make this outlay for the replacement of the circuit protectors, but would like to be able to secure the benefits of these improved devices without the large expense which has heretofore been considered necessary.

It is therefore a major object of my invention to provide a circuit protector of the bimetallic type which may be used as a replacement for the customary fusible link.

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Another object of my invention is to provide such a device which gives a positive indication when the bimetallic element has been operated, thereby greatly aiding the detection of the overloaded circuit.

It is a further object of my invention to provide a device of this type which may be manually reset when the bimetallic member has been operated, and which will open the circuit, if the overload persists, even though the resetting means is manually held closed.

Still another object of my invention is to provide a protective device in which the principal interruption of the circuit is performed by a pair of relatively heavy contacts particularly designed for this service in order that the operating mechanism will not be burned and pitted.

It is a still further object of my invention to provide an improved device of this type having all of the features mentioned above which is simply and economically manufactured so that it may be sold for a moderate price as a replacement for a fusible link type of protective device.

These and other objects and advantages of my invention will become apparent from the following description of a preferred and an optional form thereof, and from the drawings illustrating those forms in which:

Fig. 1 is a longitudinal cross-sectional view of the preferred form of my device, showing the operating elements within their housing, and in normal or circuit-closing position;

Fig. 2 is a top plan view taken at 2—2 in Fig. 1 to show one face of the supporting disc with the operating elements mounted thereon;

Fig. 3 is an end elevational view taken at 3—3 in Fig. 1 to show the construction of the bimetallic elements;

Fig. 4 is a view taken at 4—4 in Fig. 1, showing the other surface of the disc with the operating elements thereon;

Fig. 5 is a side elevational view similar to Fig. 1 but showing the operating elements in their circuit opening positions;

Fig. 6 is a schematic wiring diagram of my preferred form of device;

Fig. 7 is a view, similar to Fig. 2, of an optional form of my device;

Fig. 8 is a side elevational view of the same; and

Fig. 9 is a view, similar to Fig. 4, of the face of the supporting disc opposite to that shown in Fig. 7.

Referring now to the drawings and particularly to Fig. 1 thereof, it will be seen that my improved circuit protection device comprises a housing 10 of a size and shape similar to that of the well-known plug type fusible link widely used in homes. While various materials may be used, I prefer to form the housing 10 of some insulating

plastic, and mount a threaded shell 11 of brass or other suitable material on the outside thereof to engage the corresponding portion of the usual fuse socket. A metallic plug 12 is inserted in one end of the housing to bear against the center contact of the socket, while the opposite end of the housing is preferably closed by a disc 13 or any suitable material such as one of the plastics. As indicated, the housing 10 is hollow and is provided with an enlarged portion near the outer end, adjacent the disc 13. Consequently, a shoulder 14 is formed on the interior of the housing, and I mount an insulating disc 15 on this shoulder to support the various operating members of my device.

As shown in Figs. 1 and 5, the principal operating elements of my device include a pair of contacts 16 and 17, of which the latter is firmly held to the disc 15, while contact 16 is urged away from contact 17 by a leaf-type spring 18. One end of the spring 18 is free, and this end may be forced beneath the free end of a bimetallic latching member 20 to hold the movable contact 16 against the fixed contact 17. A fusible link 21 is connected in series with the contacts 16 and 17 to provide an additional safety factor, and to prevent the overloading of the circuit by the continued manual closure of the contacts 16 and 17.

Considering now the structure in somewhat greater detail, it will be noted that the leaf spring 18 extends substantially across the disc 15, around one edge thereof, and a short distance across the under-surface of the disc. The portion of the spring 18 beneath the disc 15 is held to the latter by any suitable means such as rivets 22, and the spring is formed so that its opposite or free end normally seeks a position considerably away from the upper or outer surface of the disc 15. The movable contact 16 is attached to the under surface of the spring 18 at a point near the edge of the disc 15, and the contact is so located that when the spring 18 is free, there is a sufficient space between the contacts 16 and 17 to interrupt any current normally likely to flow through the circuit protector.

The bimetallic element 20 is formed of any of the well-known combinations of metals whose coefficients of thermal expansion are sufficiently different to enable them to be used as temperature indicators. Since such metals are well known, and their combination in this manner is so general, it is believed that a further description thereof is unnecessary. As indicated in Figs. 3 and 4, the bimetallic element 20 is formed of a single strip of metal which is split along its length from one end to a point adjacent the other end, forming a bifurcated strip having legs 20a and 20b. The free ends of these legs are separately attached to the under surface of the disc 15 by any suitable means such as rivets 23, and the element is formed to extend downwardly and then upwardly to form a generally U-shaped element as seen in Figs. 1 and 5, with the junction of the legs 20a and 20b occurring at the free end which is turned inwardly to form a hook 24. As indicated in Figs. 2 and 4, the disc 15 is notched to receive the free end of the bimetallic element, and the latter extends above the upper surface of the disc so that it may engage the free end of the leaf spring 18.

A sheet of insulating material 25 such as mica is placed upon the upper surface of the disc 15 to cover the heads of the rivets 23, and the fixed contact 17 is held upon the insulating material by a rivet 26. As previously mentioned, the movable

contact 16 is adjusted so that it will separate from fixed contact 17 a sufficient distance to interrupt any normal current when the leaf spring 18 is disengaged from the hook 24, and the contacts are also adjusted so that they remain in contact after the free end of the spring 18 has been released from the hook 24, and are not separated until after the free end of the spring has been disengaged and traveled a considerable distance from the hook 24.

The electrical circuit is completed by connecting the fusible link 21 to the plug 12 and to the leg 20a of the bimetallic element 20, connecting the leg 20b to the rivet 26 and thus to the fixed contact 17, and connecting the movable contact 16 to the brass shell 11. The circuit thus described is shown in somewhat schematic form in Fig. 6, where it is seen that the normal flow of current is from the plug 12, through the fusible link 21 to the leg 20a and then to the hook 24, whence the circuit is completed through the leaf spring 18 to the shell 11. A series circuit consisting of the leg 20b and the contacts 16 and 17 is connected in parallel with the circuit including the hook 24 and leaf spring 18, though the relatively high resistance of the bimetallic element 20 prevents this series circuit from normally carrying a very large proportion of the load.

In the normal operation of my device, the leaf spring 18 is engaged by the hook 24, thereby closing the contacts 16 and 17, and completing the circuit from the plug 12 to the shell 11. Until an overload occurs, this condition will remain. However, when the circuit in which this protective device is connected starts to consume current in excess of the rating of the device, the heat generated by the resistance of leg 20a of the bimetallic element 20 will cause the latter to flex and move the latch 24 thereof away from the end of the leaf spring 18, thereby releasing the latter. Since the contacts 16 and 17 are connected in parallel with the hook 24 and the end of the leaf spring 18, very little arcing will occur between the hook and the spring as these members separate, since the current may still flow through the contacts 16 and 17. With the spring 18 released, the movable contact 16 is thereafter quickly separated from the fixed contact 17 and the final interruption of the circuit occurs between these two. Since they may be relatively heavy, however, and are preferably formed of a material having a high melting point, the contacts 16 and 17 are able to withstand repeated separations under load without having their efficiency impaired. The circuit between the plug 12 and the shell 11 is thus interrupted, and the device has performed the function for which it was intended.

When the equipment which caused the overload has been disconnected from the circuit, the latter may again be energized by closing the contacts 16 and 17 and latching the free end of the leaf spring 18 beneath the hook 24. As indicated in Fig. 1, the closure disc 13 is provided with a re-set button 27 which bears against the upper surface of the leaf spring 18, with the outer or upper end of the button being flush with the surface of the closure disc 13 when the spring is held beneath the hook 24. When an overload has occurred and the device has functioned, the spring 18 has moved toward the closure disc 13, and forced the button 27 outwardly so that its free end projects from the surface of the closure disc. This furnishes a positive indication that the bimetallic element 20 has operated be-

cause of an overload, and it is only necessary to press the button 27 inwardly to reset the device for further operation.

If, as is sometimes done by persons not knowing the function and purpose of circuit protectors, the button 27 is manually forced inwardly to hold the contacts 16 and 17 closed, even though a considerable overload still exists, the heat generated by the resistance of the fusible link 21 will heat the latter to its melting point so that the circuit will be broken and the wiring protected in spite of the well meaning but harmful effort of the user. In order that the bimetallic element 20 instead of the fusible link 21 will normally operate to interrupt the circuit when an overload occurs, the current rating of the fusible link is selected to be somewhat greater, e. g., 10% higher, than that for which the bimetallic element is adjusted, and the fusible link may thus be considered as a so-called "second line defense."

Description of Optional Form

In Figs. 7, 8 and 9, I have shown an optional form of my device whose principles of operation are substantially the same as those of my preferred form, but whose mechanical construction is slightly different. In these views, the housing 10, the plug 12, the shell 11, and the closure disc 13 have been omitted for the sake of clarity, but it is to be understood that these elements or their equivalents are recommended for a complete and operative device, and all of these elements, with the possible exception of the closure disc 13, may be identical with those previously described.

As in the preferred form, the operating elements are mounted upon an insulating disc 30 adapted to fit against the shoulder 14 of the housing 10, and a bimetallic element 31 is split lengthwise to provide a pair of legs 31a and 31b. The free ends of the legs 31a and 31b are separately attached to the disc 30 by means such as rivets 32 so that the plane of the legs and of the bimetallic element is substantially perpendicular to the plane of the disc 30. The entire bimetallic element 31 is then given a generally arcuate form in a plane parallel to the plane of the disc 30 so that the legs 31a and 31b are attached to the disc at one side thereof, while the element extends around the disc near the edge thereof to a point substantially opposite the rivets 32.

Centrally located with respect to the disc 30 is a shaft 33 which extends perpendicularly outward from the disc and is rotatably held thereto by any suitable means such as a nut 34. A spiral spring 35 has one of its ends attached to the disc 30 by any convenient means such as a rivet 36, and the other end of the spring is attached to the shaft 33 to urge the latter in a clockwise direction as seen in Fig. 7. A contact arm 37 is rigidly attached to the shaft 33 for rotation therewith, and I prefer to mount the contact arm on the outer or upper surface of the disc 30 while the bimetallic element 31 is mounted on the inner or lower surface thereof.

One end 42 of the contact arm 37 is bent to extend through a notch 40, formed in the disc 30, to a point adjacent the free end of the bimetallic element 31, and the latter is provided with a hook or latch portion 41 adapted to engage the end 42 of the contact arm 37. It will be noted that, as seen in Fig. 7, the contact arm 37 is urged to rotate in a clockwise direction,

and the bimetallic element 31 extends in a clockwise direction from the rivets 32. Consequently, when the end 42 of the contact arm 37 is engaged by the latch 41 of the bimetallic element 31, rotation of the contact arm will be restrained so long as the latch holds the end 42. However, if the latch 41 is moved radially outwardly to release the end 42, the latter will be moved with the contact arm 37 in a clockwise direction, away from the latch.

Adjacent the other end of the contact arm 37 I mount a resilient member 43 which is firmly attached to the disc 30 and which is adapted to cooperate with a movable contact 44 mounted on the adjacent end of the contact arm. As indicated, the resilient member 43 and the movable contact 44 are adapted to cooperate so that the movable contact bears against the resilient member when the end 42 is engaged by the latching member 41, but the member 43 and the contact 44 are separated when the latch 41 has been released and the contact arm 37 moved in a clockwise direction to its limiting position. Consequently, the movable contact 44 and the resilient member 43 cooperate in a manner similar to the movable contact 16 and the fixed contact 17 of my preferred form, making contact when the end 42 is held by the latch 41, and separating after the latch has been moved to release the arm 37.

To complete the optional form of my device, a fusible link 21 is connected between the rivet 32 holding the leg 31b and the plug 12, the other rivet 32 holding the leg 31a is connected to the resilient member 43, and the rivet 36 anchoring the spiral spring 35 is connected to the threaded shell 11. In this way, a circuit very similar to that shown in Fig. 6 is provided, with the fusible link 21, the leg 31b, the latch 41 and 42, and the spring 35 being connected in series. In addition, a series circuit including the leg 31a, the resilient member 43, and the movable contact 44 is connected in parallel with the latch 41 and contact arm 37.

In the operation of this form of my device, assuming that the end 42 is engaged by the latch 41, the circuit will normally be completed through the latch and end in the manner previously described. However, when an overload occurs, the bimetallic element 31 will be heated and will expand to an arc of greater radius so that the latch 41 no longer holds the end 42. As these two elements separate, there may be a very slight amount of arcing, but the principal flow of current will be through the parallel circuit including the resilient member 43 and the movable contact 44. However, once the latch 41 is released from the end 42, the spring 35 will rotate the contact arm 37 in a clockwise direction and the movable contact 44 will thereafter be separated from the resilient member 43, thereby interrupting the circuit so that the overload can cause no further damage. It will be noted that the contact 44 and the resilient member 43 are the members which break the principal current flow of the circuit, and these members are made of relatively heavy material to withstand repeated interruptions under load. Consequently, as in my preferred form, the bimetallic element 31 acts as a current carrying member of the circuit, and the latch 41 normally carries the entire current in the circuit, but when the circuit is to be broken because of an overload, the final interruption is performed by heavy duty contacts especially adapted for this purpose.

To re-set my optional form of circuit protector after the latch 41 has been disengaged from the arm 42, a knob 45 is mounted on the outer end of the shaft 33, extending beyond the closure disc 13 so that the knob may be grasped and rotated in a counter-clockwise direction to re-engage the end 42 by the latch 41. Since the knob 45 rotates with the shaft 33, an arrow may be formed in the knob to indicate whether the end 42 is held by the latch 41, or whether it has been released. To prevent an overload circuit from being maintained in closed condition by the continual manual urging of the knob 45 in a counter-clockwise direction, the fusible link 21 is provided as in my preferred form, with the link having a current rating somewhat greater than that of the bimetallic element 31 so that it is the latter which is normally operated to break the circuit.

It will thus be seen that I have provided a new and improved circuit protector which is readily adapted for use as a replacement for the presently used fusible links. Furthermore, this circuit protector has the advantage that it may be re-set and thus reused as many times as may be necessary, if an attempt is not made to hold the contacts in closed position by the application of manual force when an overload exists. In addition, the use of the fusible link in series with the thermally operated contacts provides an additional safety factor so that the convenience of the thermal contacts is provided, while the positive safety features of the fusible link is maintained.

While I have shown and described a preferred and an optional form of my device, it will be apparent that modifications may be made therein without departing from the spirit of the invention, and I do not wish to be restricted to the particular form or arrangement of parts herein described and shown, except as limited by my claims.

I claim:

1. A circuit protector of the class described which includes: a bimetallic member having a pair of legs joined at one end and separated at the other; cooperating means normally adapted to bear against the junction end of said bimetallic member to establish a connection therewith; and electrical means connecting said member and said cooperating means in a circuit having one branch including one of said legs and said cooperating means, and another branch including both of said legs in series and a portion of said cooperating means, whereby current is adapted to flow through said one of said legs and said means until they are separated, and thereafter through both said legs connected in series.

2. A circuit protector of the class described which includes: a housing; a pair of contacts within said housing; spring means normally urging said contacts apart; and bimetallic latching means normally adapted to overcome said spring means to hold said contacts together, said latching means comprising a bifurcated member connected for current flow through one of its legs and a portion of said spring means when said contacts are held together, and for current flow through both of its legs and said contacts when said spring means is released.

3. A circuit protector of the class described which includes: a pair of terminals; a bimetallic member having a pair of substantially parallel legs joined at one end thereof, the opposite end of one of said legs being connected to one of said

terminals; a latch attached to said member near the junction of said legs for operation thereby; a latch cooperating member adapted to be engaged and held by said latch to establish a circuit therebetween; spring means urging said latch cooperating means away from said latch; a pair of contacts, one of which is connected to said spring means for movement therewith and resiliently pressed thereby against the other of said contacts for separation from the latter after the release of said latch cooperating means from said latch; means connecting said latch cooperating means to the other of said terminals; and means connecting said contacts between the opposite end of the remaining leg of said bimetallic member, and said latch cooperating member.

4. A circuit protector of the class described which includes: a housing; a terminal mounted in one end of said housing; a shell mounted on said housing to form another terminal; an insulating disc held within said housing; a leaf spring having one end attached to said disc and the other end extending away therefrom; a bifurcated bimetallic member having the free ends of its legs separately attached to said disc, said legs extending away from said disc and then returning toward the latter, passing through an opening therein to a point on the other side thereof; a latch member connected to the free end of said bimetallic member adapted to engage the free end of said spring; a fixed contact mounted on the surface of said disc adjacent said spring; a movable contact mounted on said spring and adapted to cooperate with said fixed contact to complete a circuit when said spring is engaged by said latch member, said contacts being adapted to separate after said spring is released by said latch member; means connecting one of said legs of said bimetallic member to one of said terminals; means connecting the other of said legs to one of said contacts; means connecting said spring and the other of said contacts to the other of said terminals; a fusible link connected in the circuit thus adapted to be completed between said terminals, said link being in series with said circuit; and manually operable means adapted to move the free end of said spring toward said disc whereby the free end of said spring is engaged and held by said latch member.

5. A circuit protector of the class described which includes: a housing; a terminal mounted in one end of said housing; a shell mounted on said housing to form another terminal; an insulating disc held within said housing; a shaft rotatably mounted on said disc; spring means urging said shaft to rotate in one direction; a contact arm mounted on said shaft for rotation therewith, said arm having a contact on one end thereof; a fixed contact mounted on said disc and adapted to engage said first mentioned contact to complete a circuit when said shaft is rotated against the urging of said spring to a first limiting position, and to disengage and be separated from said first mentioned contact to interrupt said circuit when said shaft is rotated with the urging of said spring to a second limiting position; a bifurcated bimetallic member having the free ends of its legs separately attached to said disc, said legs arcuately extending from said points of attachment to a point substantially diametrically opposite therefrom; a latch member connected to the free end of said bifurcated member; a projection attached to the free end of said contact arm and adapted to be engaged by said latch member and held in said first limit-

ing position thereby; means connecting one of said legs of said bifurcated member to one of said terminals; means connecting the other of said bifurcated legs to said fixed contact; means connecting said contact carried by said contact arm 5 and said projection thereof to said other terminal; and a fusible link connected in the circuit adapted to be completed between said terminals, said link being in series therewith.

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