REPEATING ELECTRICAL CIRCUIT INTERRUPTER

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2 Sheets-Sheet 1
This invention relates, generally, to improved construction of repeating electrical circuit interrupter, in either plug or cartridge form respectively adapted for connection in ordinary sockets and clips, to serve as a safe-guard against injurious effects of abnormal overloads and short circuits.

The invention has for its principal object to provide a compact, cheap and efficient circuit interrupter which may be set in a normal circuit closing condition, but which will automatically break the circuit upon the occurrence of an abnormal overload or short circuit in such a manner that its operative parts may be repeatedly reset in normal circuit closing condition, and in this respect differing from the usual fuse plug or fuse cartridge possessing a fusible circuit breaking element, which, when once “blown” cannot not again be used.

With the above-stated object in view, the novel repeating electrical circuit interrupter, embodying the principles of this invention, comprises a pair of separated fixed contact elements, in combination with which is provided a spring actuated vertically separable bridging contact, normally closing the gap between said fixed contact element. One of said fixed contact elements is electrically connected with one pole or exterior contact of the plug or cartridge, as the case may be, and the other fixed contact element is connected, through the medium of a thermostatically releaseable latch means, with the opposite pole or exterior contact of said plug or cartridge, said latch means normally serving to hold the spring actuated vertically separable bridging contact in operative gap closing relation to the separated fixed contact elements. This invention further consists in the novel arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same, all of which will be more fully described in the following specification, and then finally embodied in the claims appended thereto.

The invention is clearly illustrated in the accompanying drawings, in which:

Figure 1 is an exterior end view of the novel repeating electrical circuit interrupter made in plug form, and embodying the principles of this invention; Figure 2 is a vertical transverse section, taken on line 2—2 in Figure 1; Figure 3 is a vertical transverse section, taken on line 3—3 in Figure 1; and Figure 4 is a view similar to that shown in Figure 3, but illustrating the position and relation of its operative parts after release by the occurrence of an abnormal current overload or short circuit. Figure 5 is a horizontal section, taken on line 5—5 in Figure 2; and Figure 6 is a detail detached view of the separated fixed contact element and certain parts associated therewith.

Figure 7 is an exterior end view of the novel repeating electrical circuit interrupter made in cartridge form, but nevertheless embodying the principles of this invention; Figure 8 is a side elevation of the same; Figure 9 is a longitudinal vertical section through the same, taken on line 9—9 in Figure 7; Figure 10 is a transverse vertical section, taken on line 10—10 in Figure 7; and Figure 11 is a view similar to that shown in Figure 10, but illustrating the position and relation of its operative parts after release by the occurrence of an abnormal current overload or short circuit. Figure 12 is an end elevation of the cartridge form of the interrupter removed from the contact clips for holding the same in the circuit which it serves, and Figure 13 is a detail or fragmentary view of the relation of the separated fixed contact elements of the device, as disposed to provide the intermediate circuit break or interruption.

Similar characters of reference are employed in all of the hereinabove described views, to indicate corresponding parts.

Referring now to Figures 1 to 6, more especially, in which the novel repeating electrical circuit interrupter is illustrated in plug form, the reference character 14 indicates a main supporting body or core for supporting the operative parts of the device. This main body or core is made of any suitable insulating or electrically non-conductive material, but preferably of porcelain. The main body or core 14 is provided, intermediate its ends, with external screw threads 15 to receive the engagement or attachment therewith of an internally threaded cover or casing member 16, which encloses the upper end portion 17 of the same. The lower end portion of the body or core projects exteriorly beyond the cover or casing member 16, and is, preferably, of
somewhat reduced diameter so as to thus provide a plug-portion 18, upon the external cylindrical side surfaces of which is fixed a screw-threaded shell 19 to provide an exterior contact, forming one pole of the device, which is engageable in the internally threaded socket (not shown) usually provided for connecting fuse plugs and similar safety devices in an electrical circuit to be served thereby. Secured in the outer end or extremity of said plug-portion 18 is a threaded center post 20, the outwardly and longitudinally projecting end of which constitutes the exterior button contact, forming the other pole of the device.

Extending longitudinally and centrally downward through the upper end portion 17 and into the intermediate portion of the main body or core 14 is a slideway or bore 21. Imbedded in the intermediate portion of the main body or core 14, so as to extend laterally therethrough from one side thereof, is a fixed contact element 22, the inner end of which enters the side of said slideway or bore 21 adjacent to the lower inner end of the latter. The outward end of said fixed contact element 22 is electrically connected with said exterior contact shell 19 by means of an upwardly extending arm or lug 23, with which the latter is provided, and which is suitably secured to said outward end of said fixed contact element 22 by dovetailing the same thereinto, or by any other suitable manner of fastening. Imbedded in the intermediate portion of said main body or core 14, so as to extend laterally therethrough from the opposite side thereof, is a second fixed contact element 24, the inner end of which enters the opposite side of said slideway or bore 21 adjacent to the lower inner end of the latter, and so as to be opposed to but separated by a gap 25 from the inner end of said first mentioned fixed contact element 22. The main body or core 14 and its upper end portion 17 is longitudinally slotted above said second fixed contact element 24 to provide a housing space 26. The outward end of said second fixed contact element 24 is vertically bifurcated, as at 27, to receive the lower end of a metallic latch-arm 28, which is pivotally connected to said second fixed contact element 24 by a fulcrum or hinge pin 29 passed through the assembled bifurcated portions 27 and lower end of said latch arm 28. The upper free end of said pivoted latch arm 28 is shaped to provide an inwardly projecting latch-nosing 30 extending or projecting laterally toward said slideway or bore 21. The underside of said latch-nosing, in the rear of its free extremity, is hollowed out to provide a downwardly presented receiving socket 31. Connected electrically with the center post or exterior contact button 20, by means of a metallic washer 32 and fastening nut 33, is one end of a thermostatic or electrical trip wire 34, which extends upwardly through the plug-portion 18 and main body or core 14 to pass through said second fixed contact element 24 (being insulated from direct electrical contact with the latter by a sleeve 35 of suitable insulation material) and thence upwardly through said housing space 26, so that its upper free extremity 36, is operatively seated in the receiving socket 31, and thus operatively and electrically engaged with said latch-arm 28, and through said latch-arm 28 is electrically engaged between the center post or exterior contact button 20 and said second fixed contact element 24.

Slidably arranged within said slideway or bore 21, for vertical longitudinal movement, is a push-button member 37. The end wall of the cover or casing 16 is provided with a centrally disposed opening 38 through which exteriorly projects the outer end of said push-button member 37. The inner end of said push-button member 37 is provided with an upwardly extending longitudinal socket 39 in which is slidably fitted the shank 40 of a metallic bridging contact 41. The longitudinal movement of said bridging contact 41 and its shank 40 relative to the push-button member 37 is suitably limited by providing, in the wall of the latter adjacent the socket 39, a longitudinal slot 42 in which rides a stop-pin or stud 43 projecting outwardly from the side of said shank 40 through said slot 42. The bridging contact 41 is yoddably held in downwardly projected relation to the inner end of said push-button member 37 by a compression spring 44 arranged around said shank 40 intermediate the bridging contact 41 and the lower or inner extremity of said push-button member 37. Said bridging contact 41 may be suitably shaped to engage the opposed inner ends of the fixed contact elements 22 and 24 so as to bridge the gap 25 therebetween. Preferably the bridging contact 41 is of conical or wedge shape, as shown, and the opposed inner ends of the fixed contact elements 22 and 24 are respectively provided with receiving seats 29 and 27 to correspond to the shape of said bridging contact. When the push-button member 37 is thrust downwardly or inwardly, the bridging contact 41 will be carried into operative bridging engagement with the opposed ends of the fixed contact elements 22 and 24 so as to electrically bridge the gap 25 therebetween. Good electrical contact between the elements will be assured because the tension of the compression spring 44 will firmly thrust the bridging contact 41 to the desired engagement with the opposed contact elements 22 and 24, when the push-button member 37 is thrust inwardly to normal operative position.
The means for normally retaining the push-button member 37 inwardly moved to hold the bridging contact 41 in operative engagement with the opposed contact elements 22 and 24, comprises a catch-projection 45, which extends laterally from the side of said push-button member 37 into the housing space 36, so that when the said push-button member 37 is thrust inwardly, said catch-projection 45 will move past the latch-nosing 30 (which yields to such movement), so that the same is engaged beneath the latch-nosing 30, and thus normally restrained against upward or outward movement.

Means are further provided for causing an outward releasing movement of said push-button member 37, whereby when the latch-nosing 30 is released from the catch-projection 45 the push-button member will be automatically moved outwardly, to thus remove the bridging contact 41 from circuit closing engagement with the fixed contact elements 22 and 24. This means preferably consists in the provision of longitudinal sockets 46 in the upper end portion 17 of the body or core 14, one at each side of the slide-way or bore 21 and communicating with the latter through intermediate slots 47. Disposed in each socket 46 is a push-spring 48.

Projecting from the sides of said push-button member 37, respectively in opposite directions, so as to be disposed in said respective sockets 46 and intermediate slots 47, are lateral thrust lugs 49, against the underside of which said push-springs 48 thrust. Inward movement of said push-button member 37 compresses said push-springs 48, so that, upon release of the push-button member 37, the tension of the springs will automatically outwardly move the push-button member. The outward or releasing movement of the push-button member 37 is limited by the engagement of said lugs 49 with the underside of the end wall of said core or casing 18, or by any other convenient means.

In order to prevent accidental displacement of said cover or casing 16 from assembled relation to the main body or core 14, and a consequent disarrangement of the internal operative parts of the device, a setscrew 50 may be provided to be threaded through the side wall of said cover or casing 16 so as to bind on the main body or core 14, to thus prevent loosening of the cover casing.

In operation, when the plug, constructed as above described, is connected in an electrical circuit to be served thereby, and the push-button member 37 is thrust inwardly to position the bridging contact 41 across the fixed contact elements 22 and 24, and normally-retained in such position by the engagement with its catch-projection 45 of said latch-nosing 30, the current will enter through the post or exterior contact button 20, to pass through the trip wire 34, into the latch-arm 28, thence to fixed contact element 24 through the bridging contact 41 to the fixed contact element 22, and thence through the conductive arm or lug 23 to the exterior contact shell 19, thus completing the normal circuit through the device. The normal operative relation of the parts, as above described, will maintain the path of the current complete under normal circuit conditions. Upon the occurrence of an abnormal overload or short circuit however, the excessive amperage of the current passing through the trip wire 34 suddenly increases the temperature of the same, whereby it is suddenly expanded, to thereby cause an outward thrust to be quickly exerted upon the latch-arm 28. Such thrust swings outwardly said latch-arm 28 and thereby withdraws the latch-nosing 30 from normal engagement with the catch-projection 45, thus freeing the latter from the restraint of the former and thereby releasing the push-button member 37. The push-springs 48 immediately thrust outward the push-button member 37, which thus retracts the bridging contact 41 from the fixed contact elements 22 and 24, so that the gap 26 intermediate the latter being no longer bridged, the path of the current through the device is immediately interrupted and the circuit is broken. The breaking of the circuit stops the flow of current through the trip-wire 34, which consequently quickly regains its normal temperature and thereupon contracts so as to resume its normal tension upon the latch-arm 28, thus causing the latter to resume position in the path of said catch-projection 45. The circuit, when broken or interrupted in the manner above-described, will remain interrupted until, by normal manipulation, the push-button member 37 is again thrust inwardly to restore the parts to normal circuit closing relation again. The operations above described by which the automatic interruption and normal resumption of closed circuit conditions are attained, may be repeatedly effected, so that the device may be used over, and over again, until mechanical wear becomes excessive.

From the above it will be understood that my novel device is of simple construction involving but few parts, which may be easily and quickly assembled; furthermore, the provision of the separated fixed contact elements with the bridging contact determines the position or place of break of the electric circuit, so that the trip wire and latch-arm may remain constantly in electrical contact and freed from injurious effects of arcing when the circuit breaks. The device is easy to reset requiring only the simple and easily understood application of inward pressure upon the exterior end of the push-button member; and, furthermore, the positive break assured by the vertical movement of
the bridging contact eliminates likelihood of short circuits within the device itself. Referring now to Figures 7 to 10 inclusive, I have shown my novel repeating electrical circuit interrupter in the form of a cartridge device suitable for connection in the usual cartridge receiving clips, which are provided in the electrical circuit to be served thereby. Since, so far as the operative parts are concerned, the mechanism of this form of interrupter is substantially the same as already above described in connection with the plug form of interrupter, I will not repeat the detailed description thereof, since the application of corresponding reference characters in the illustrations will readily identify said parts with the above description. I will, therefore, merely describe such changes in main body construction and exterior contacts which are involved in such cartridge form of my novel repeating interrupter. In said Figures 7 to 13, the reference character 51 indicates a block-like or rectangular main body of a suitable insulating material cutaway at one side so as to receive a cover plate 52, which may be detachably secured thereto by fastening screws 53. Said body 51 is provided with the slidebar or bore 21 and parallel sockets 46 to respectively receive the push-button member 37 and its thrust lugs 49, said sockets 46 being further provided with the springs 48 for moving outward to released position the push-button member 37.

The push-button member 37 is equipped at its inner end with the yieldable bridging contact 41. Said body 51 and cover plate 52 are also cutaway in proper locations to provide the housing space 26 along a side of and parallel to said push-button member 37. Said body 51 is provided adjacent to its lower end with outwardly projecting cylindrical bosses 54 respectively projecting from each lateral end of said body. Mounted upon one boss 54 is one exterior metallic contact ferrule 55, and mounted upon the other boss 54 is the other or opposite exterior metallic contact ferrule 56. Supported in said body 51, with its inner end disposed within the lower end of said slidebar or bore 21, is one fixed contact element 22, the outer end of which is electrically engaged with and secured to the exterior contact ferrule 55. Also supported in said body 51, with its inner end disposed within the lower end of said slidebar or bore 21 so as to be opposed to the fixed contact element 22, but separated therefrom by the gap 25, is a second fixed contact element 24. Said fixed contact elements 22 and 24 are suitably shaped to suit the environment provided by the altered shape of the body 51 as compared with the above-described plug type of body, but are otherwise, in function and arrangement, the same. The chief difference in the arrangement of said contact elements is that their opposed but separated inner ends are disposed at a right angle (as shown in Figure 10) instead of the longitudinally aligned arrangement shown in connection with the plug type of the device. Pivotedly connected with the contact element 24 is the latch-arm 28, which extends upwardly through the housing space 26, and which is provided with the latch-nosing 30. The latch-nosing 30 possesses on its under-side the socket portion 31. Electrically connected with an extension arm 57 extending from the ferrule 56 is the trip-wire 24, which passes upwardly through the fixed contact element 24 (being insulated therefrom by the insulator sleeve 35), so that its free end is operatively engaged in the socket 31 of the latch-nosing 30. The push-button member 37 is provided with the catch-projection 45 engageable with the latch-nosing 30, when the push-button member 37 is moved inwardly to engage said bridging contact 41 in circuit closing contact with and across the gap 25 between said fixed contact elements 22 and 24. The reference character 58 indicates the clips which are usually provided in the circuit to be served by a cartridge fuse. Using my novel repeating circuit interrupter in cartridge form, the same is engaged so that its respective contact ferrules 55 and 56 are respectively embraced by the clips 58 to thus bridge across said clips, and provide a path for the served circuit. When thus connected in the circuit to be served, and the push-button member 37 is inwardly moved and so retained to hold the bridging contact 41 in operative contact with the contact elements 22 and 24, the current enters the ferrule 56 and its extension arm 57 to pass through the trip wire 24 to the latch-arm 28 and thence into the fixed contact element 24, whence it passes through the bridging contact 41 into the opposite fixed contact element 22, and thence into the opposite contact ferrule 55, thus completing the normal circuit through the device. Upon the occurrence of an abnormal overload or short circuit, the trip-wire 34 will expand under the increased or abnormal temperature induced, and the latch-arm 28, will be swung away from the catch-projection 45, thus releasing the push-button member 37 for outward movement induced by the tension of the springs 48, so that the bridging contact 41 is removed from engagement with the fixed contact elements 22 and 24, thus interrupting the served circuit. The served circuit being thus interrupted, the trip wire 34 will contract so as to regain normal condition whereby the latch-arm 28 is in turn swung back to normal position, so that when the push-button member 37 is again thrust inwardly and its catch-projection 45 again re-engaged with the latch-nosing 30 of the
latch-arm 28, the bridging contact will be returned to and retained in operative circuit closing contact with the fixed contact elements 22 and 24 until abnormal conditions again induce the release thereof. It will be obvious from the above, that the construction, arrangement and functioning of the operative elements of my novel interrupter are substantially the same in the above-described cartridge form thereof, as in the heretofore described plug form thereof, and that the only structural differences are those which modify the supporting body shape to adapt the same to receive and support the ferrule type of exterior contacts.

Having thus described my invention, I claim:

1. A repeating circuit interrupter in the form of a screw plug, comprising a main body of insulating material having exterior contacts mounted thereon respectively comprising a screw-threaded metallic shell and a central exterior contact button; said main body having a central slideway, a pair of internal fixed contacts supported in said main body with their respective inner ends entered in the inner end of said slideway so as to be opposed one to another but separated by an intermediate gap, a longitudinally movable push-button member slidable in said slideway, a bridging contact yieldably supported by the inner end of said push-button member, spring means for moving outwardly said push-button member, one of said internal fixed contacts being electrically connected with one external contact, a latch-arm connected with the other internal fixed contact, said main body having a housing space communicating with said slideway and parallel to said push-button member in which said latch-arm is disposed, said latch-arm having a latch-nosing at its free end, said latch-nosing having in its underside a socket, said push-button member having a stop-projection engageable by said latch-nosing to hold said push-button member in normal inwardly moved position, an electrical trip-wire interconnected between the other exterior contact and said latch-arm for actuating the latter.

2. A repeating circuit interrupter, comprising a main body of insulating material having exterior contacts mounted thereon, said main body having a central slideway, a pair of internal fixed contacts supported in said main body with their respective inner ends entered in the inner end of said slideway so as to be opposed one to another but separated by an intermediate gap, a longitudinally movable push-button member slidable in said slideway, a bridging contact yieldably supported by the inner end of said push-button member, spring means for moving outwardly said push-button member, one of said internal fixed contacts being electrically connected with one external contact, a latch-arm connected with the other internal fixed contact, said main body having a housing space communicating with said slideway and parallel to said push-button member in which said latch-arm is disposed, said latch-arm having a latch-nosing at its free end, said latch-nosing having in its underside a socket, said push-button member having a stop-projection engageable by said latch-nosing to hold said push-button member in normal inwardly moved position, an electrical trip-wire having its lower end electrically connected with the other exterior contact, and the upper end of said trip-wire being engaged in said latch-nosing socket to mechanically and electrically connect the same with said latch-arm.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 2nd day of September, 1924.

ERNEST AICHELE.