

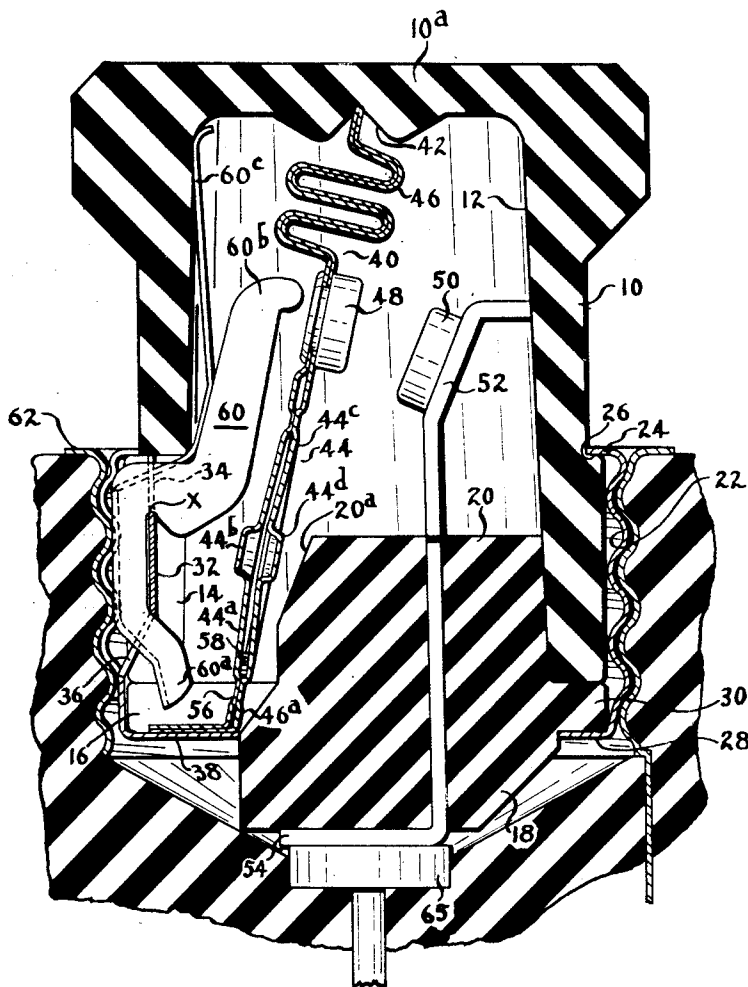
April 16, 1957

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2,789,180

ELECTRIC CIRCUIT-BREAKERS AND PARTS THEREFOR

Filed Sept. 2, 1953



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ELECTRIC CIRCUIT-BREAKERS AND PARTS THEREFOR

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Application September 2, 1953, Serial No. 378,038

7 Claims. (Cl. 200—116)

This invention relates to improvements in electric circuit-breakers and parts therefor, and it relates more particularly to improvements in resettable circuit-breakers of a character capable of being substituted for electric fuses and to parts for such circuit-breakers.

A primary object of the invention is to provide improved, dependable, and low cost resettable circuit-breakers.

Another object of the invention is to provide resettable circuit-breakers which will trip at the required current value with improved accuracy.

Another object of the invention is to provide a circuit-breaker employing a minimum number of parts, whereby the spacing between parts may be increased for improved insulating characteristics and the mass of the parts employed may be increased for greater strength and better heat dissipation characteristics.

Another object is to provide a circuit-breaker of the aforescribed character which is readily accommodated in standard fuse receptacles.

Another object is to provide a circuit-breaker which is safe to reset and is "free tripping."

Another object of my invention is to provide improved snap-acting mechanism which, while not limited thereto, is especially adapted for use in resettable circuit-breakers.

Various other objects and advantages of the invention will hereinafter appear.

The single figure of the accompanying somewhat schematic drawing illustrates, on an enlarged scale, partly in vertical section and partly in elevation, one form of circuit-breaker embodying my invention, which will now be described; it being understood that other embodiments are possible and that various modifications may be made in the structural details of the embodiment illustrated without departing from the spirit or scope of the invention as defined in the appended claims.

Referring to the drawing, the numeral 10 generally designates a substantially cylindrical shell of molded insulating material. Shell 10 has a recess 12 formed therein and preferably opening to one end thereof. A notch 14 is formed in the shell wall at the open end thereof. A similar notch 16 is formed at a corresponding point in the periphery of a base member 18 which member is positioned against the bottom of the shell 10 and has a portion 20 extending within the recess 12. The shell 10 and base member 18 are held in properly assembled relationship to each other by a metal screw-shell member 22 of suitable form as illustrated. The end portion 28 of screw-shell 22 is preferably preformed to engage and support the flange portion 30 of base member 18. The end portion 24 of member 22 is turned down over a peripheral shoulder 26 formed on the outer wall of the shell 10.

Screw-shell 22 is provided, between its opposite ends 24 and 28, with corrugations which define a screw thread adapted for accommodation in and cooperation with an electrical fuse receptacle 62 of suitable form. A por-

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tion 32 of screw-shell 22 extends laterally into the notch 14 and is perforated at its ends 34 and 36, respectively, for a purpose hereinafter described.

The portion of base member 18 below the flange portion 30 is cut away at the side thereof toward notch 16 to accommodate an extension 38 of the lower end portion 28 of member 22. To the upper side of this extension 38 is connected, as, for example, by welding or brazing, the lower end of a snap-acting mechanism 40 which extends through the notch 16 and through the recess 12 into pivotal engagement with an open pivotal bearing 42 formed on the inner surface of the end wall 10^a of shell 10.

The snap-acting mechanism 40 consists of a vapor-pressure type electro-thermal power element 44 and a reflexed spring portion 46, which is shown as having a plurality of reflexes formed therein. It may be formed, as shown, from a single sheet of metal, such as stainless steel, which is folded upon itself.

A movable contact 48 is welded or otherwise suitably attached to mechanism 40 intermediate power element 44 and spring 46. Contact 48 is engageable with a fixed contact 50 which is attached to a conductor bar 52. The latter extends through base member 18 and its bent upper end abuts against the inner surface of the wall of shell 10. The lower end 54 of the bar 52 is bent as shown to overlie the bottom surface of base member 18 and serves as one electric terminal of the circuit-breaker unit.

The left-hand section 44^a of power element 44, as shown in the drawing, is of generally conical form and extends to the left. A boss 44^b is formed at its apex and extends toward the left. The right-hand section 44^c is also of generally conical form. This section normally extends toward the left, as shown. A central boss 44^d, formed at the apex of section 44^c, extends toward the right. Sections 44^a and 44^c are welded or otherwise joined together along a continuous seam 56, so that the power element is sealed. A suitable quantity of thermometric fill 58 is disposed within the power element 44. When heated the fill vaporizes and causes expansion of the power element. Section 44^a is polarized so that its shape is substantially unaffected by vaporization of the fill. Section 44^c, however, acts in the manner of a Spencer disk, and when the fill vaporizes this section "pops" or snaps outwardly toward the right with respect to the other portions of the power element, and carries the boss 44^d toward the right.

The circuit-breaker is shown in its open or tripped condition. The snap-acting mechanism 40 is disposed between extension 38 of the screw-shell member 22 and the bearing 42 in insulating shell 10, and is held in the over-center position illustrated by spring portion 46. The power element 44 is shown in the normal condition with its fill 58 cooled and in liquid state and with its section 44^c in its re-entrant or inner position. The device is then in condition to be reset to closed position.

The reset mechanism comprises a lever 60 which is pivotally engaged at edge X of the inwardly offset portion 32 of screw-shell member 22. The lower arm 60^a of lever 60 extends along the outer side of portion 32 of member 22 and its extreme lower end extends through opening 36 into the space afforded by notches 14 and 16. When the circuit-breaker unit is threadedly inserted into a suitable receptacle, indicated generally by the numeral 62, portions of the receptacle will engage the outer edge of the upper portion of arm 60^a and hold said arm adjacent portion 32 of member 22. The upper arm 60^b of lever 60 is then held retracted toward the left, as shown. When the circuit-breaker unit is unscrewed from the receptacle 62 sufficiently to free its lower arm 60^a, the lever 60 will be moved pivotally in a clockwise direction

about point X, due to the action of a biasing spring 60^c formed integrally with lever 60. Arm 60^b will be forced against the snap-acting member 40 intermediate the power element 44 and reflexed spring portion 46. The snap-acting mechanism 40 will be forced over-center, whereupon movable contact 48 will engage fixed contact 50, and boss 44^d will abut against a sloping surface 20^a of that part 20 of base member 18 which extends within shell 10.

In operation of the unit, member 22 and portion 54 of bar 52 serve as external terminals. An electric current flowing between these terminals is conducted by power element 44, movable contact 48, fixed contact 50, and conductor bar 52. The current heats the power element. If more than a preselected value of current flows through the power element, the heat produced thereby will cause the fill material 58 to vaporize whereupon section 44^c will snap outwardly. However, its boss 44^d then rests against face 20^a so that upon expansion of the diaphragm the latter is driven to carry the intermediate portion of the snap mechanism 40 over-center with respect to bearing 42. Thereafter spring 46 holds the mechanism 40 over-center to a degree dependent upon the length of spring 46 and the resilience of the mechanism 40, especially in the portion 46^a near its lower end. The contact 48 is thus disengaged from the fixed contact 50 and the circuit is opened until reset as aforescribed. If preferred, boss 44^d may be omitted and, if desired, a corresponding projection may be formed on face 20^a of member 18.

It is considered preferable that section 44^c of the power element 44 be so polarized, as shown, that it will exert a force which aids the reflexed spring portion 46 in opposing the resetting action of arm 60^b and spring 60^c until the unit is partially or entirely unscrewed manually. The unit is free-tripping because the contacts are not automatically re-engaged or closed when the power element cools. Also, the reset mechanism cannot be made to hold the circuit closed because only after the unit is screwed into receptacle 62 sufficiently far to result in the retraction of arm 60^b away from mechanism 40, will terminal 54 engage the corresponding central contact 65 of receptacle 62 to complete the electrical circuit.

It will be apparent that the snap-acting mechanism 40 need not be of the type illustrated. Other types of power elements and springs may be employed and these need not be integrally formed as is mechanism 40. Also the reset mechanism may have other forms. The spring 60^c is intended to be representative only. Other forms of springs attached to shell 10, or to member 22, or simply trapped in place, or formed integrally with lever 60 as shown, may be used.

It will also be apparent that the device may be readily modified for use in other types of receptacles or may be made in tubular form for insertion into receptacles of the type with which cartridge fuses are usually associated.

I claim:

1. In a circuit-breaker unit, in combination, actuating mechanism comprising an electrically conductive, vapor pressure type electro-thermal power element expandable with a snap movement in response to excessive current flow therethrough and over-center spring means, a movable electric contact carried by said mechanism, a fixed electric contact engageable by said movable contact to complete a circuit through said power element, and a member disposed within said unit in position to be engaged by said power element when said contacts are engaged and said power element expands with a snap action, said power element upon expansion against said member being forced away therefrom to carry said spring means over-center and effect snap disengagement of said contacts.

2. In a circuit-breaker unit, in combination, over-center actuating mechanism comprising an electrically

conductive vapor pressure type electro-thermal power element expandable with a snap movement in response to excess current flow therethrough, a movable electric contact carried by the mechanism, a fixed electric contact engageable by said movable contact, and a member disposed within said unit in position to be engaged by said power element when said contacts are engaged and said power element expands with snap movement, said power element upon expansion against said member being forced away therefrom to move said mechanism over-center and disengage said contacts.

3. A circuit breaker unit of the type wherein the breaker is to be disposed in a receptacle having terminals to connect with corresponding terminals of the breaker and wherein resetting of the breaker is to be accomplished by removal thereof from the receptacle sufficiently to interrupt connection between a terminal of the breaker and the corresponding terminal of the receptacle, comprising, a receptacle having terminals, and a circuit breaker comprising, terminals for connection with the terminals of the receptacle, a pair of breaker contacts, actuating mechanism comprising an electrically conductive, vapor pressure type electro-thermal power element and over-center type spring means for opening and closing said contacts and responsive to excessive current flow therethrough to open said contacts, and reset mechanism engageable with and normally biased for engagement with said actuating mechanism to effect closure of said contacts, said reset mechanism having a portion engageable with said receptacle when the terminals of the receptacle and breaker are connected to hold said reset mechanism out of engagement with said actuating mechanism.

4. A circuit breaker of the type to be disposed in a receptacle having terminals to connect with corresponding terminals of the breaker, and wherein resetting of the breaker is to be accomplished by removal of the breaker from the receptacle sufficiently to interrupt the connection between a terminal of the breaker and the corresponding terminal of the receptacle, comprising, external terminals, a pair of breaker contacts, conductive over-center actuating mechanism to open and close the contacts and being, when said contacts are closed, connected in series circuit with said contacts between said terminals, said actuating mechanism being responsive to excess current flow therethrough to open said contacts, reset mechanism movable to and normally biased to a position of engagement with said actuating mechanism to effect closing of said contacts and being movable against said bias to second position in readiness to be moved to said position first mentioned by its bias, said reset mechanism having a portion engageable with a receptacle in which said breaker may be disposed to hold said reset mechanism in said second position against the action of the bias unless the breaker is removed from the receptacle to interrupt the connection therebetween.

5. A circuit breaker of the type to be disposed in a receptacle having terminals to connect with corresponding terminals of the breaker, and wherein resetting of the breaker is to be accomplished by removal of the breaker from the receptacle sufficiently to interrupt the connection between a terminal of the breaker and the corresponding terminal of the receptacle, comprising, external terminals, a pair of breaker contacts, mechanism for opening said contacts comprising mechanism electrically and mechanically connected to one of said contacts and responsive to excessive current flow through said contacts to carry said one of said contacts out of engagement with the other, mechanism for closing said contacts comprising said mechanism first mentioned and a reset mechanism biased to engage said mechanism first mentioned and cause it to move to carry said contacts into engagement, said reset mechanism having a portion engageable with the receptacle in which said breaker may be disposed when both terminals of the breaker and receptacle are connected, and said portion being adapted to be held by said receptacle

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to hold said reset mechanism against its bias to prevent resetting action of said reset mechanism.

6. A circuit breaker of the type to be disposed in a receptacle having terminals to connect with corresponding terminals of the breaker, comprising: a fixed breaker contact; over-center actuating mechanism comprising an electrically conductive, expansible vapor pressure type electrothermal power element and over-center spring means; a contact connected to and carried by said mechanism and engageable with said fixed contact; a structure disposed to be engaged by said power element to drive said mechanism over-center to open said contacts upon expansion of said power element; external contacting surfaces electrically connected to the power element and fixed contact respectively and engageable with contacts of a receptacle in which the breaker may be disposed; and reset mechanism having a portion engageable with and biased toward engagement with said actuating mechanism to effect resetting movement of the latter over-center to close said contacts; said reset mechanism further having a portion connected with said portion first mentioned and being engageable with the receptacle in which said breaker may be disposed when both terminals of the breaker are engaged with both terminals of the receptacle to hold said portion first mentioned of said reset mechanism against its bias to prevent resetting engagement thereof with said actuating mechanism.

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7. In a circuit breaker unit, in combination, over-center switch actuating mechanism comprising a stationary contact and an expansible vapor pressure type electrothermal power element normally disposed in a first position, said power element carrying a contact and forming a part of the controlled circuit, a member disposed to be engaged by said power element when the latter is in said first position wherein said second contact is engaged with said first contact, and said power element when expanded against said member being forced away therefrom to carry said switch actuating mechanism over-center to a second position wherein said contacts are disengaged.

References Cited in the file of this patent

UNITED STATES PATENTS

1,639,888	Hawkins	Aug. 23, 1927
1,781,288	Levy	Nov. 11, 1930
1,935,906	Hicks	Nov. 21, 1933
2,073,286	Raney	Mar. 9, 1937
2,171,866	Rowe	Sept. 5, 1939
2,191,501	Schmidt	Feb. 27, 1940
2,288,517	Dubilier	June 30, 1942
2,338,563	Andersson	Jan. 4, 1944
2,484,932	Cox	Oct. 18, 1949
2,496,332	Carle	Feb. 7, 1950