Sept. 7, 1954 H. TALBOT 2,688,673

RESETTABLE CIRCUIT PROTECTOR

Filed Dec. 9, 1952

Fig. 1

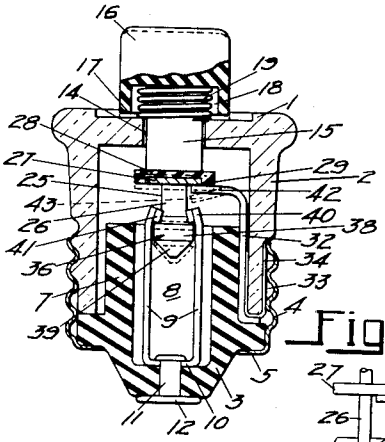


Fig. 2

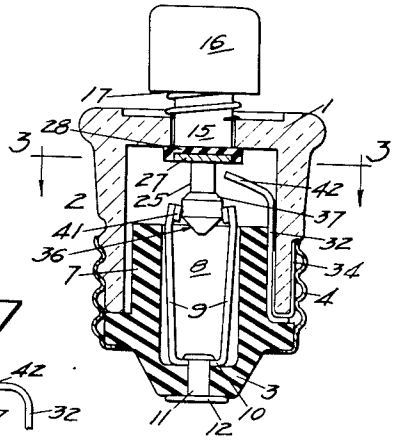


Fig. 7

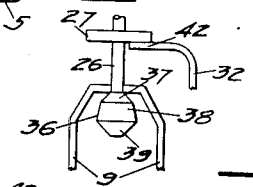


Fig. 3

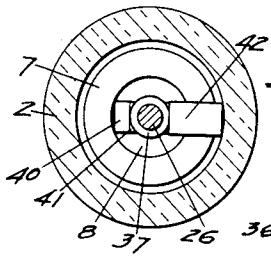


Fig. 8

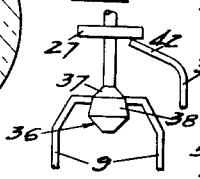


Fig. 4

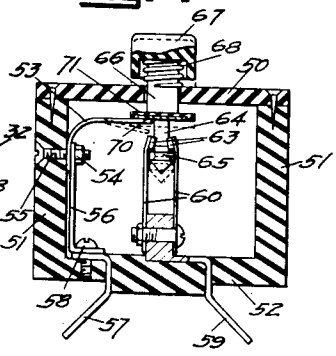


Fig. 9

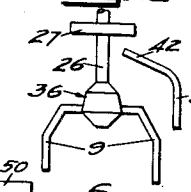


Fig. 5

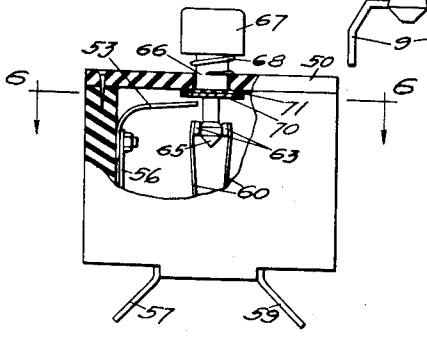
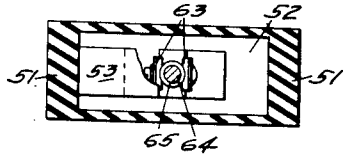


Fig. 6



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RESETTABLE CIRCUIT PROTECTOR

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Application December 9, 1952, Serial No. 324,868

13 Claims. (Cl. 200—113)

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This invention relates to a re-settable circuit interrupter, and has for one of its objects the provision of a circuit interrupter of the above type that is more economical to make than heretofore and that is reliable and safe.

Another object of the invention is the provision of a circuit interrupter in which an element responsive for movement under conditions of an overload in an electrical circuit, is in such circuit, and is so arranged as to hold a conductor in circuit closing position and to remain in electrical engagement with said conductor when the latter is urged to a position breaking said circuit, thereby precluding any chance of an arc occurring between said element and said conductor.

An added object of the invention is the provision of a circuit interrupter that is more reliable and more economical to make than systems in which bi-metallic or other thermo-responsive elements function as latch members either in association with electrical insulation members or in a closed circuit.

A still further object of the invention is the provision of a circuit interrupter that may be manually disconnected and re-set, as desired and which interrupter is provided with simple safety means for maintaining the circuit open in the event an operator should attempt to manually re-set the interrupter in the normal manner when the circuit is overloaded.

Heretofore where circuit interrupters have employed thermo-responsive elements in an electrical circuit in releasable holding engagement with a conductor that is part of the circuit, the interrupters have failed to operate in many instances due to the arcing and consequent welding or freezing of the parts at the point where the break has been made. Efforts to overcome this objection have resulted in circuit interrupters becoming more and more complicated. With added complications the interrupters have become expensive and with each added part their chance of failure or faulty operation has increased.

The present invention is designed to be extremely economical to make inasmuch as the body elements of present standard fuses of the plug and military types can be used with slight modifications that do not increase their size, and as there is no break between the bi-metallic or other thermo-responsive element and the conductor with which it is connected in series, there cannot be objectionable arcing at the point or points where previous difficulties have been experienced due to such arcing.

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Also, in the present invention, the structure provides for a shifting of the point where the break in the circuit is made, thus preventing objectionable pitting or burning of the parts at one point only as occurs where the break always occurs at the same point between contacts and the conductor.

In the present invention the parts are substantially balanced, insofar as tension forces in the operating mechanism are concerned, so that no objectionable unbalanced strain is placed on the parts.

Other objects and advantages will appear in the description and the drawings.

In the drawings, Fig. 1 is a vertical sectional view through a plug type circuit interrupter in which the latter is in closed position.

Fig. 2 is a vertical sectional view through the interrupter of Fig. 1 in open position.

Fig. 3 is a cross sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is a vertical sectional view taken through a military type device, showing the present invention, in closed position.

Fig. 5 is a part sectional part elevational view of the device of Fig. 4 in open position.

Fig. 6 is a sectional view taken along line 6—6 of Fig. 5.

Figs. 7, 8, 9 are semi-diagrammatic views illustrating the successive steps in the operation of the circuit interrupter from closed to open position when there is an overload in the circuit.

In detail, the plug type circuit interrupter of Figs. 1 to 3 inclusive comprises a body or housing that is made up of a head 1, cylindrical side walls 2 and a base 3 of electrical insulation material, the base and side walls being releasably secured together by a threaded external metal ferrule 4 threadedly secured to said side walls, and having a flange 5 that extends over the marginal portion of base 3.

The size and material and outline of the foregoing elements are those of a standard screw or plug type fuse, in which the head 1 and side walls 2 are usually of glass, and the base of any suitable electrical insulation material.

In the present instance the central portion 7 of base 3 projects toward head 1 a substantial distance into the space enclosed by the side walls and said portion 7 is centrally recessed from its projecting portion to provide a recess 8 in which is positioned a generally U-shaped, thermo-responsive member providing opposed legs 9 and a closed end 10. Said closed end is seated against the bottom of recess 8 and a

metal conductor button or rivet 11 extends through said base and said closed end. Said rivet has a head 12 that is exterior of the base 3 and centrally thereof to provide one of the two terminals for connecting the plug in an electrical circuit.

The legs 9 are considerably elongated, and are preferably bi-metallic members that are deflectable apart at their free ends in the event of an overload and consequent heating of said legs.

The head 1 is centrally apertured at 14 for passing the cylindrical shank 15 of a finger manipulatable button 16 therethrough, which shank is coaxial with said aperture 14, the latter being circular, and the button 16 being enlarged so as to provide a shoulder 17 that will act as a stop for limiting the movement of the button toward said head 1 when said shoulder engages said head.

This button and shank are of electrical insulation material, such as hard rubber or any suitable dielectric composition material, and the button is recessed at 18 to receive an expansion helical spring 19. This spring reacts between the head 1 and the button 16 to constantly urge the said button and shank in direction outwardly of said head.

An elongated conductor 25 coaxial with shank 15 is rigidly secured to the latter and projects between the outer ends of the legs 9 of the bi-metallic element. This conductor may be of any suitable metal, although preferably of brass, and has a cylindrical stem 26 that is adjacent to the shank 15 and that extends into the latter. An annular disc 27 also preferably of brass, is secured to the stem 26 and this disc may be countersunk into a recess in a second disc 28 that is of electrical insulation material so as to provide an annular rim 29 of said material around the disc 27, although disc 27 and the side of the rim 29 that faces toward the base 3 are substantially flush with each other.

Disposed between one side of the portion 7 of the base 3 and side wall 2 is a metal strip 32, which may also be of brass.

The free edge of the side walls 2 that are remote from head 1 may be cut out or notched for passage transversely thereacross of one end of said strip, and the outer side of said side wall is grooved at 33 (Fig. 1) to receive a strip 34 of fusible conductor metal that may also extend across the edge of wall 2 in the same notch that receives the end of strip 32. Said strip 34 also may extend up the inner side of the wall 2 in engagement with strip 32, as seen in Fig. 1.

The threaded ferrule 14 is in tight engagement with the strip 34, and the said ferrule also functions to tightly hold the said strips 32, 34 together.

At a point above the portion 7 of base 3 (as seen in Fig. 1) the strip 32 extends toward the stem 26 of the conductor 25, and also slants slightly toward the disc 27. This strip is resilient so as to have the same action as a leaf spring when deflected.

The lower end of conductor 25 (as seen in Fig. 1) is enlarged as at 36, the upper surface 37 of said enlargement being tapered (Fig. 7), to form a generally axially facing shoulder, and preferably the lateral sides 38 below said shoulder may be very slightly tapered in the same direction as the surface 37, while the lower end 39 is conical or frusto-conical, and said lower end is so shaped for the purpose of facilitating the assembling of the interrupter.

The upper ends 40 of legs 9 extend slightly toward each other and each may have brass contact plates or pieces 41 on their adjacent sides and which pieces are so curved on their opposed sides as to substantially conform to the curvature of the stem 25 so as to provide a good surface contact with said stem when the conductor is in closed position.

Assuming there is a normal current, and the interrupter is secured in the socket in a conventional fuse box, the step in setting the fuse, or the circuit interrupter, is to push the finger button 16 inwardly as far as it will go. This is the normal way any person would do the operation, and in doing this the enlarged end 36 of the conductor 25 will pass below the contact pieces 41 and the latter will partially embrace the stem 26 of the conductor in slidable engagement therewith.

The other contact, which is the upper end 42 of strip 32 will initially engage the disc 27 of conductor 25 but will be quickly deflected downwardly by rim 29 of disc 28 to dotted line position 43 (Fig. 1) in which position the circuit is broken. Upon release of the pressure on the finger manipulatable button 16, the stem 26 will be urged upwardly until the contact pieces 41 engage the shoulder 37, and at this point contact 42 will engage disc 27 and the circuit will be closed.

The force of spring 19 is insufficient to overcome the frictional resistance between contact pieces 41 and the slanted shoulder 37, although no difficulty is encountered in manually pulling the conductor upwardly by the button 16.

The circuit having been established through ferrule 4, strip 32, disc 27, conductor 25, bi-metallic member 9 and pin or rivet 11, the circuit will remain closed as long as there is no overloaded condition.

In the event of an overloaded circuit the legs 9 of the bi-metallic member will be heated, causing the legs to spread and the conductor 25 will then move upwardly, contact still being maintained between contact 42 and disc 27, until the contact pieces 41 reach the juncture between shoulder 37 and sides 38 (Fig. 8). When this point is reached there is insufficient frictional resistance between the contact pieces 41 and the conductor 25 to hold the latter and the combined force of spring 19 and resilient contact 42 will result in the conductor being quickly driven upwardly. Thus the break between the contact 42 and disc 27 is very rapid, and minimizes the pitting effect that occurs where there is any arcing. It will be seen that the contact pieces 41 are still in engagement with the conductor and so no arcing can occur between the conductor and the pieces 41.

Immediately upon the breaking of the circuit due to an overload thereon, the legs 9 will commence to cool. The enlarged end of the conductor will hold them apart, but as they are resilient as soon as the button 16 is pressed inwardly, they will move into holding engagement with the shoulder 37.

In the event there is a serious overload, the legs 9 will quickly release the conductor, when the interrupter is reset, and any attempt to hold the conductor in contact with the contact members by holding the button down, will result in holding the circuit open by the action of the rim 29 of disc 28 on the contact 42. Until the button is released, the contact 42 will not come in contact with disc 27.

It is to be understood that the insulating disc 28 is not absolutely essential, but constitutes a safety feature.

In the claims the term contact has been used to include both legs of the bi-metallic member or a single leg, as the case may be, since the device will operate fairly well if only one leg is used, but in such a case the pressure is against only one side of the stem and tends to force it to one side.

Where two legs are used the forces are balanced, hence the fit of the shank 15 in aperture 14 can be fairly loose without materially affecting the operation of the device.

Also the word "conductor," as used, includes the disc 27 and enlarged head 36 as well as stem 26, as these are all parts of the conductor.

It is not absolutely essential that contact pieces 41 be used. The material of the bi-metallic elements themselves may make the contact with stem 26 and the enlarged end 36 if desired, but the pieces 41 make a better bearing surface with the conductor, and the curved surfaces of said pieces establish a better and larger contact with the stem.

The form of the invention as seen in Figs 4, 5, and 6 mainly differs from the type described and shown in Figs. 2 to 3 in the type of housing. The housing of Fig. 4 has a head 50, side walls 51 and a base 52.

Contact 53 is substantially the same as contact 42, being a resilient strip. Contact 53 is secured to side wall 51 by nut 54 on a screw 55 and this same screw and nut connect the said contact with one end of a fusible link 56 that in turn is connected with a terminal prong 57 by means of a screw 58.

The other terminal prong 59 connects with the lower ends of bi-metallic strips 60, which strips are identical with the legs 9 of the bi-metallic element of Fig. 1, and together constitute a contact for engagement of the contact pieces 63 at their upper ends with the stem 64 and enlarged lower end 65 of a conductor that is in every respect the same as conductor 25 of Fig. 1.

The said conductor is secured in a shank 66 of a finger manipulatable button 67 that is urged outwardly by a spring 68. Also secured to stem 64 is a metal disc 70 that is countersunk in the lower side of a disc 71 of insulation material, all as described relative to discs 27, 28 of Fig. 1.

The operation of the device of Figs. 4, 5 is the same as for the device of Figs. 1 to 3.

In the normal structure, the shank 15 (Fig. 1) or 66 (Fig. 4) need not be closely fitted in the aperture through which they extend because of the fact that the legs 9 or 60 will press with substantially the same force on opposite sides of the conductor centering the latter.

The conductor in either of the two forms described, including the conductor disc (27 or 70) is easily rotatable in the opening through which it extends and it has been found that the yieldable pressure of contact 42 or 53 against the contact disc 27 (or 70) results in the conductor (and disc) being given a slight rotary movement each time the conductor is re-set after a break. Thus means is provided for causing rotary movement of said conductor which not only prevents objectionable localized pitting of the disc, as would occur were the break to always come in the same place, but the wear on the shoulder 37 by the contact pieces is equalized and thus the release of the conductor will always be uniform.

The fact that the contact 42 (or 53) forceably urges disc 27 (or 70) away when there is an overload, also greatly reduces objectionable pitting of the disc.

I claim:

1. A re-settable circuit interrupter comprising a stationary contact, a fixed contact and a conductor in slidable engagement with said fixed contact and in series with the latter and with said stationary contact, said conductor being movable from a closed position electrically connecting said fixed contact and said stationary contact to an open position spaced from said stationary contact, a spring operably connected with said conductor for moving the latter to said open position, means on said conductor in frictional engagement with said fixed contact for holding said conductor in closed position under normal circuit conditions, said fixed contact being a bi-metallic element deflectable under overload for reducing the frictional resistance between said fixed contact and said conductor to permit said movement of said conductor to said open position, and said conductor having a part thereof in slidable engagement with said fixed contact during said movement to said open position and when the connection between said conductor and said stationary contact is broken.

2. A re-settable circuit interrupter comprising a stationary contact, a fixed contact and a conductor in slidable engagement with said fixed contact and in series with the latter and with said stationary contact, said conductor being movable from a closed position electrically connecting said fixed contact and said stationary contact to an open position spaced from said stationary contact, a spring operably connected with said conductor for moving the latter to said open position, means on said conductor in frictional engagement with said fixed contact for holding said conductor in closed position under normal circuit conditions, said fixed contact being a bi-metallic element deflectable under overload for reducing the frictional resistance between said fixed contact and said conductor to permit said movement of said conductor to said open position, and said conductor having a part thereof in slidable engagement with said fixed contact during said movement to said open position and when the connection between said conductor and said stationary contact is broken, a body enclosing said contacts and said conductor, means movable with said conductor extending through a side of said body to the outside for manually moving said conductor to closed position.

3. A re-settable circuit interrupter comprising a stationary contact, a fixed contact and a conductor in slidable engagement with said fixed contact and in series with the latter and with said stationary contact, said conductor being movable from a closed position electrically connecting said fixed contact and said stationary contact to an open position spaced from said stationary contact, a spring operably connected with said conductor for moving the latter to said open position, means on said conductor in frictional engagement with said fixed contact for holding said conductor in closed position under normal circuit conditions, said fixed contact being a bi-metallic element deflectable under overload for reducing the frictional resistance between said fixed contact and said conductor to permit said movement of said conductor to said open position, and said conductor having a part

thereof in slidable engagement with said fixed contact during said movement to said open position and when the connection between said conductor and said stationary contact is broken, a body enclosing said contacts and said conductor, means movable with said conductor extending through a side of said body to the outside for manually moving said conductor to closed position, said conductor having a flat surface in slidable and yieldable engagement with said stationary contact when said conductor is in said closed position and a slanted shoulder on said conductor in frictional holding relation to said fixed contact when the conductor is in said closed position, said part of said conductor including a surface offset to one side thereof in the direction in which said bi-metallic element is deflectable.

4. A resettable circuit interrupter comprising: a hollow body of electrical insulation material having a head, a base opposed thereto and side walls extending between said head and said base, a first fixed contact secured to said base and projecting toward said head, a second stationary contact spaced from said first contact, a conductor movably supported on said body for movement from a closed position in engagement with said second stationary contact to an open position out of engagement with the latter and vice versa, a spring operably connected with said conductor yieldably urging the latter at all times from said closed position to said open position, means on said conductor frictionally engaged by said first contact when said conductor is in said closed position for holding said conductor in said closed position against the force of said spring, said first contact being deflectable in direction away from said means upon overload for releasing said conductor for movement to said open position, means for connecting said contacts and conductor in series in a circuit when said conductor is in said closed position.

5. A resettable circuit interrupter comprising: a hollow body of electrical insulation material having a head, a base opposed thereto and side walls extending between said head and said base, a first fixed contact secured to said base and projecting toward said head, a second stationary contact spaced from said first contact, a conductor movably supported on said body for movement from a closed position in engagement with said second stationary contact to an open position out of engagement with the latter and vice versa, a spring operably connected with said conductor yieldably urging the latter at all times from said closed position to said open position, means on said conductor frictionally engaged by said first contact when said conductor is in said closed position for holding said conductor in said closed position against the force of said spring, said first contact being deflectable in direction away from said means upon overload for releasing said conductor for movement to said open position, means for connecting said contacts and conductor in series in a circuit when said conductor is in said closed position, said means on said conductor including a shoulder slanted relative to the direction of movement of said conductor for maintaining a connection between said conductor and said first contact during said movement of said conductor.

6. A resettable circuit interrupter comprising: a hollow body of electrical insulation material having a head, a base opposed thereto and side walls extending between said head and said base, a first fixed contact secured to said base and projecting toward said head, a second stationary contact spaced from said first contact, a conductor movably supported on said body for movement from a closed position in engagement with said second stationary contact to an open position out of engagement with the latter and vice versa, a spring operably connected with said conductor yieldably urging the latter at all times from said closed position to said open position, means on said conductor frictionally engaged by said first contact when said conductor is in said closed position for holding said conductor in said closed position against the force of said spring, said first contact being deflectable in direction away from said means upon overload for releasing said conductor for movement to said open position, means for connecting said contacts and conductor in series in a circuit when said conductor is in said closed position, said second contact being of resilient material and held in yieldable engagement with said conductor when said conductor is in said closed position.

7. A resettable circuit interrupter comprising: a hollow body of electrical insulation material having a head, a base opposed thereto and side walls extending between said head and said base, a first fixed contact secured to said base and projecting toward said head, a second stationary contact spaced from said first contact, a conductor movably supported on said body for movement from a closed position in engagement with said second stationary contact to an open position out of engagement with the latter and vice versa, a spring operably connected with said conductor yieldably urging the latter at all times from said closed position to said open position, means on said conductor frictionally engaged by said first contact when said conductor is in said closed position for holding said conductor in said closed position against the force of said spring, said first contact being deflectable in direction away from said means upon overload for releasing said conductor for movement to said open position, means for connecting said contacts and conductor in series in a circuit when said conductor is in said closed position, manually actuatable means connected with said conductor projecting outwardly of said head and housing for moving said conductor to said closed position, and means connected with said conductor for movement therewith engageable with said second contact for disconnecting said second contact from said conductor upon manual actuation of said manually actuatable means a predetermined distance in direction for moving said conductor to said closed position.

8. A re-settable circuit interrupter comprising: a generally U-shaped contact providing spaced legs, each of said legs being thermo-responsive for movement away from each other upon overload when in a circuit, a second contact spaced from said U-shaped contact, a conductor supported for reciprocable movement from a closed position in engagement with said second contact to an open position spaced therefrom and vice versa, a spring operably connected with said conductor for urging the latter toward said open position at all times, said U-shaped contact being in slidable engagement with said conductor when the latter is in said open position and in said closed position and during movement of said conductor between said positions, a portion of said conductor being disposed between said legs and being in frictional holding relation with the

latter when the circuit conditions are normal and when said conductor is in said closed position, and means for connecting said U-shaped contact, said second contact and said conductor in series in an electrical circuit.

9. A re-settable circuit interrupter comprising: a generally U-shaped contact providing spaced legs, each of said legs being thermo-responsive for movement away from each other upon overload when in a circuit, a second contact spaced from said U-shaped contact, a conductor supported for reciprocable movement from a closed position in engagement with said second contact to an open position spaced therefrom and vice versa, a spring operably connected with said conductor for urging the latter toward said open position at all times, said U-shaped contact being in slidable engagement with said conductor when the latter is in said open position and in said closed position and during movement of said conductor between said positions, a portion of said conductor being disposed between said legs and being in frictional holding relation with the latter when the circuit conditions are normal and when said conductor is in said closed position, and means for connecting said U-shaped contact, said second contact and said conductor in series in an electrical circuit, said portion of said conductor being an enlargement having a shoulder engaged by the said legs at their free ends for so holding said conductor in said closed position in the absence of an overload in said circuit.

10. A re-settable circuit interrupter comprising: a generally U-shaped contact providing spaced legs, each of said legs being thermo-responsive for movement away from each other upon overload when in a circuit, a second contact spaced from said U-shaped contact, a conductor supported for reciprocable movement from a closed position in engagement with said second contact to an open position spaced therefrom and vice versa, a spring operably connected with said conductor for urging the latter toward said open position at all times, said U-shaped contact being in slidable engagement with said conductor when the latter is in said open position and in said closed position and during movement of said conductor between said position, a portion of said conductor being disposed between said legs and being in frictional holding relation with the latter when the circuit conditions are normal and when said conductor is in said closed position, and means for connecting said U-shaped contact, said second contact and said conductor in series in an electrical circuit, means movable with said conductor mechanically disconnecting said second contact and conductor upon movement of said conductor a predetermined degree past said closed position, and manually actuatable means connected with said conductor for causing movement of said conductor from said open position to said closed position and past said closed position to said predetermined degree.

11. A re-settable circuit interrupter comprising a stationary contact, a fixed contact and a conductor movable to and from a position connecting said contacts in series, said conductor being elongated with its outer surfaces concentric with its longitudinal axis, means supporting said conductor for movement longitudinally of said axis and for rotation thereon, means supporting said conductor in slidable engagement with said fixed contact during longitudinal movement thereof between predetermined points, and means supporting said stationary contact in a position for engagement with said conductor at one end of the longitudinal movement of said conductor between said points and out of engagement with said conductor at the opposite end of its said movement.

12. A re-settable circuit interrupter comprising a stationary contact, a fixed contact and a conductor movable to and from a position connecting said contacts in series, said conductor being elongated with its outer surfaces concentric with its longitudinal axis, means supporting said conductor for movement longitudinally of said axis and for rotation thereon, means supporting said conductor in slidable engagement with said fixed contact during longitudinal movement thereof between predetermined points, and means supporting said stationary contact in a position for engagement with said conductor at one end of the longitudinal movement of said conductor between said points and out of engagement with said conductor at the opposite end of its said movement, means for rotating said conductor and means for yieldably urging said conductor to its position out of engagement with said stationary contact.

13. A re-settable circuit interrupter comprising a stationary contact, a fixed contact and a conductor movable to and from a position connecting said contacts in series, said conductor being elongated with its outer surfaces concentric with its longitudinal axis, means supporting said conductor for movement longitudinally of said axis and for rotation thereon, means supporting said conductor in slidable engagement with said fixed contact during longitudinal movement thereof between predetermined points, and means supporting said stationary contact in a position for engagement with said conductor at one end of the longitudinal movement of said conductor between said points and out of engagement with said conductor at the opposite end of its said movement, means for rotating said conductor and means for yieldably urging said conductor to its position out of engagement with said stationary contact, said last mentioned means including said stationary contact.

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