Dec. 24, 1935. R. R. PITTMAN ET AL 2,025,525

CIRCUIT INTERRUPTER

Filed Aug. 6, 1934

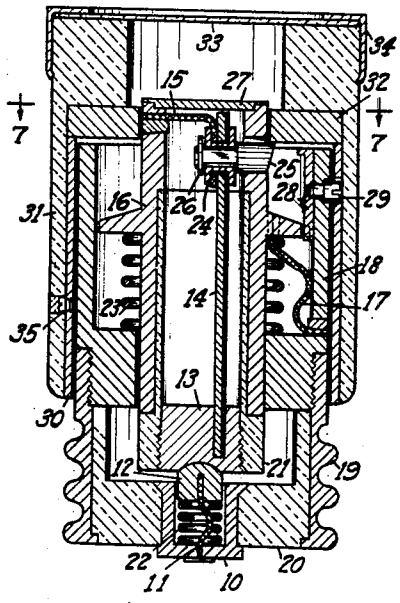


Fig. 1

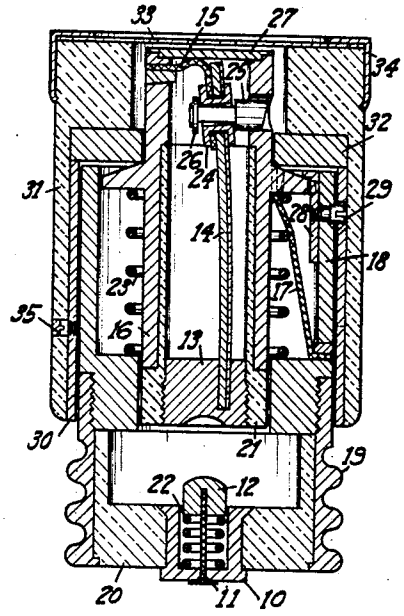


Fig. 2

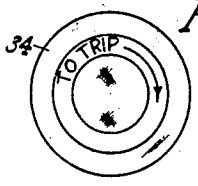


Fig. 3

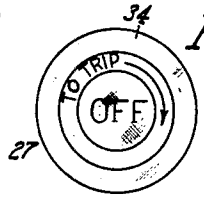


Fig. 4

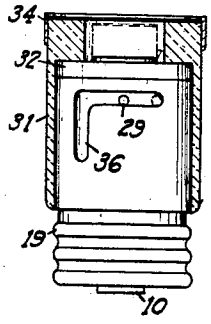


Fig. 5

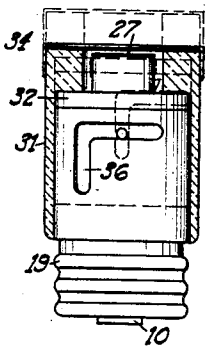


Fig. 6

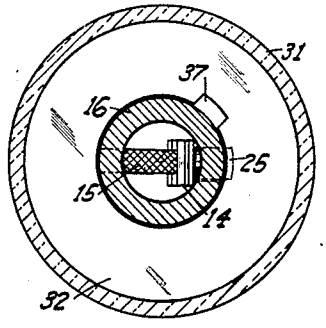


Fig 7

INVENTORS
Ralph R Pittman
BY Carroll H. Walsh

ATTORNEY

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CIRCUIT INTERRUPTER

Ralph R. Pittman and Carroll H. Walsh,
Pine Bluff, Ark.

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18 Claims. (Cl. 200—116)

This invention relates to circuit-interrupting or switching devices primarily for use with low tension circuits energized at a so-called utilization voltage, as 115–230 volt power and lighting circuits. At the present time a large number of such circuits are provided with receptacles for receiving plug fuses, and it is an object of this invention to provide a circuit-interrupting device adapted to replace such fuses.

Other objects of the invention are (*a*) the provision of a device adapted to open the connected circuit in response to a predetermined over-current in the circuit; (*b*) the provision of a device which cannot be manually held in the closed circuit position if a predetermined over-current exists in the circuit, i. e., a "trip-free" device; (*c*) the provision of means incorporated in a circuit-interrupting device for closing a circuit therethrough in response to a predetermined manual movement of a cap embodied in the device, and for actuating the device to the open circuit position in response to a predetermined movement of the cap; and (*d*) the provision of means for visibly indicating the open circuit, or "off" position of the device.

Another object is to provide a small, effective, and inexpensive device for the purpose above stated.

With these and other objects in view which will appear from the description, our invention resides in the novel combination, construction and arrangement of the parts making up the device, to the end that a minimum of space is occupied by the device, and that its small size enables it to be inexpensively constructed.

In the drawing:

Fig. 1 is an elevational view of the device shown in the closed circuit position, and illustrated in section.

Fig. 2 is an elevational view of the device shown in the open circuit position, and illustrated in section.

Fig. 3 is a plan view of the device as seen from the top, illustrated in the closed circuit position.

Fig. 4 is a plan view of the device as seen from the top, illustrated in the open circuit position.

Fig. 5 is an elevational view of the device, shown partly in section, the solid lines illustrating the position of the elements in the closed circuit position, and the broken lines the position of the elements in the open circuit position, following manual tripping.

Fig. 6 is similar to Fig. 5, the solid lines illustrating the position of the elements in the open circuit position, and the broken lines the position of the elements following a manual movement of the cap preparatory to manual reclosing of the device.

Fig. 7 is a sectional view of the device, as seen from the plane indicated by the line 7—7 in Fig. 1.

Referring now in detail to the drawing, and particularly to Figs. 1 and 2, the numeral 20 designates a cup-shaped member of insulating material, such as hard fiber. The screw shell contact 19, of suitable conducting material, is rigidly pressed over the outer surface of the member 20, and the central cup-shaped conducting contact 10 is rigidly pressed into an opening extending through the bottom of the cup adjacent the midpoint thereof. The metal contact member 12 is arranged for reciprocatory movement within the contact 10, and connected to the latter in any suitable manner, as by the flexible conductor 11. The resilient member or spring 22 is contained by the cup 10, and interposed between the bottom of the latter and the bottom of the contact member 12.

The tubular metal member 18, having an inwardly extending flange adjacent the lower end thereof, is rigidly secured by means of cooperating threads on the respective members to the screw shell contact 19, and the former, together with the cup-shaped member 20, provides a hollow body portion adapted to contain a reciprocably movable contact member. The latter consists of a tubular member of conducting material 16, having an outwardly extending flange intermediate the ends thereof, and into which is pressed the tubular insulating member 21, together with the metal contact 13, the latter being rigidly secured within the tubular member 21 adjacent the lower end thereof by means of cooperating threads on the respective members.

The bi-metallic strip, or thermal element 14, is rigidly secured to the reciprocably movable contact member, having its lower end portion pressed into the contact 13. Adjacent the upper end of the bi-metallic strip 14 is mounted the hollow rivet 24, the latter being also employed for engaging one end of the flexible conductor 15, the other end of which is secured to the tubular metal member 16 in any suitable manner. The flexible conductor 17, having its respective ends suitably secured to the tubular members 16 and 18, completes a circuit through the device.

The path of current through the device when in the closed circuit position illustrated by Fig. 1 is from the central contact 10, through the flexible conductor 11 to the contact 12, thence to the contact 13, through the bi-metallic strip 14 and the flexible conductor 15 to the tubular metal member 16, thence through the flexible conductor 17 and the member 18 to the screw shell contact 19. It will be apparent that a separation of the contacts 12 and 13, as shown in Fig. 2, will open the circuit from the central contact 10 to the screw shell contact 19.

The cap for manually operating the device consists of the substantially cylindrical housing 31, of insulating material, such as fiber, which is pro-

vided with a stepped end portion into which is pressed the metal latch and guide collar 32. The metal sleeve 30 extends upwardly into the lower end of the housing 31, and is secured in place by means of the retaining screw 35. An opening is provided through the upper end portion of the housing 31, and the transparent disk 33, of mica or glass, is fitted over the end of the housing 31, being retained in place by the crimped metal ring 34.

From the above description it will be seen that the cap consists of an assembly of the metal sleeve 30, the insulating housing 31, the collar 32, the transparent disk 33, the metal ring 34, and the retaining screw 35.

The spring 23, having its upper end engaged on the lower surface of the outwardly extending flange of the tubular member 16, and its lower end engaged on the upper surface of the inwardly extending flange of the member 18, is obviously continuously urging the reciprocable contact member in a direction to open the circuit through the device. To prevent such a movement, the latch pin 25 is provided, extending laterally through an opening adjacent the upper end of the member 16, so that its upper surface engages the lower surface of the collar 32, and its lower surface engages the bottom surface of the lateral opening through the member 16. The other end of the pin 25 is polygonal and extends loosely, inwardly through the polygonal hollow portion of rivet 24. The pin 25 has a shoulder for engaging one side of the rivet, and a washer 26 is held on the other end of the pin for engaging the other side of the rivet. For the reason that the thermal element moves longitudinally as well as laterally when heated by an over-current, it is necessary that the pin 25 be fitted loosely in the hollow rivet 24. This is an important practical consideration to be observed in the construction of the device.

The bi-metallic strip 14 is arranged so that, in response to a predetermined current therethrough, its upper end portion moves in a lateral direction for a sufficient distance to pull the pin 25 away from the collar 32, at which time the spring 23 urges the contact 13, together with the other portions of the reciprocable contact member and the bi-metallic strip, in a direction away from the contact member 12. The movement of the parts just recited is initially accelerated by the spring 22, which tends to hold the contacts 12 and 13 in engagement. The travel of the contact member 12 is limited by the length of the flexible conductor 11, and upon the stopping of the movement of the contact member 12 thereby, a quick break results between the contacts 12 and 13. Following such an opening movement, the spring 23 tends to maintain the device in the open circuit position.

For guiding the movable contact member, a narrow L-shaped metal guide member 28 is supported near the upper end of the tubular member 18 by means of the stop screw 29, and a slot cooperating with the member 28 is provided near the outer edge of the flanged portion of the tubular member 16. The portion of the guide member 28 within the slot prevents a rotary displacement of the tubular member 16, and the longitudinal travel thereof is limited by the engagement of an upper portion of the flange of the member 16 with an inwardly extending end portion of the member 28.

An indicia-carrying member 27 is pressed into the upper end of the tubular member 16, and the upward travel of the movable contact member is stopped as above described at a point where the indicia-carrying member 27 is adjacent the transparent closure 33 of the cap, for the purpose of visibly indicating the position of the device with respect to the connected circuit.

As illustrated in Figs. 5 and 6, the sleeve member 30 is provided with the L-shaped slot 36, arranged to register with the head of the stop screw 29. The movement of the cap is limited in extent and direction by the slot 36, as the head of the stop screw 29 extends into the slot. Also, as shown in Fig. 7, the collar 32 is provided with a vertical slot 37, through which the outer portion of the pin 25 may be moved.

The operation of the device will now be described. Assuming that the device is in the closed circuit position under normal conditions of operation, it will appear as illustrated by Figs. 1, 3, and 7, and as shown by the solid lines in Fig. 5. It will be observed that, in this position, the contact members are held in engagement against the bias of the spring 23 by the engagement of the pin 25 with the collar 32; also that the cap is prevented from moving outwardly by the engagement of the lower surface of a horizontal portion of the slot 36 with the head of the stop screw 29.

Assume now that it is desired to manually open the circuit connected through the device. The cap is rotated in a clockwise direction facing the top thereof until the slot 37 (Fig. 7) registers with the pin 25, at which time the device is actuated to the open position by the spring 23. This position is illustrated by the solid lines of Figs. 2, 4, and 6, and by the broken lines of Fig. 5.

If the device is now to be manually closed, the cap is rotated in a counter-clockwise direction until the head of the stop screw 29 registers with the vertical portion of the L-shaped slot 36, at which time the cap may be moved outwardly to the position indicated by the broken lines in Fig. 6. As the cap is moved outwardly or upwardly, the lower surface of the downwardly and inwardly sloped end portion of the pin 25 engages the upper surface of the collar 32, and the pin is thereby urged inwardly against the inherent resilience of the bi-metallic strip 14. After the collar 32 has passed over the end of the pin 25, the latter is returned to its original position by the resilience of the bi-metalic strip. At this position the collar 32 engages the upper end portion of the pin 25, and an inward or downward movement of the cap will actuate the contact members to engagement to close the circuit. To maintain the device in the closed position the cap must be rotated in a clockwise direction until the head of the stop screw engages the horizontal lower surface of the slot 36 at an intermediate point, as shown by the solid lines in Fig. 5. Obviously a continued rotary movement of the cap will again result in the device assuming the open circuit position.

It will be observed that, should the thermal element be at such a high temperature that it is deformed so that the collar 32 will not engage the pin 25, the contacts cannot be urged to engagement by the cap. This arrangement prevents the circuit being reclosed before the thermal element has had time to cool, and thus prevents its fusing due to repeated closures on a defective circuit.

Among other advantages of the device for the purpose for which it is intended, is the fact that it cannot be screwed into the ordinary shell

receptacle by the cap while in the closed circuit position; also that it cannot be unscrewed from such a receptacle in the closed circuit position unless the contacts are manually held in engagement against the bias of the spring 23.

It will also be apparent that the removal of the retaining screw 35 will permit the removal of the housing 31, thereby making the stop screw 29 accessible. Upon the removal of the latter, access to the remainder of the device may be readily gained. The retaining screw 35 is preferably sealed in place, thus preventing tampering which may obstruct the proper operation of the device upon over-currents therethrough.

While we have herein described the embodiment of the invention here presented in specific language for the purpose of facilitating an understanding of its construction and operation, it will be understood that various changes in the specific construction may be made without departing from the principles of the invention.

What we claim is new, and desire to secure by Letters Patent is:

1. A circuit interrupter comprising relatively movable first and second contact members for opening and closing a circuit, a movable cap associated with the first contact member for urging said contact members to engagement, resilient means biasing said first movable contact member to the open circuit position, a thermal element carried by said first movable contact member, said thermal element cooperating with said cap to normally maintain said interrupter in the closed circuit position, and to release said first movable contact member in response to a movement of said thermal element.

2. In a switch having relatively movable contact members for opening and closing a circuit, resilient means opposing the engagement of said contact members, a movable cap for urging said contact members to engagement in response to a longitudinal movement thereof to close a circuit, and means carried by one of said contact members cooperating with said cap for latching said contact members in engagement in response to an initial movement of said cap, and for unlatching said contact members in response to a continued rotary movement of said cap.

3. A switch comprising axially movable contact members for opening and closing a circuit, a thermal element carried by one of said contact members, resilient means opposing the engagement of said contact members, and a movable cap for urging said contact members to the closed circuit position in response to an axial movement of said cap, said thermal element cooperating with said cap for normally retaining said switch in the closed circuit position.

4. In a switch having relatively movable contact members for opening and closing a circuit, resilient means opposing the engagement of said contact members, a movable cap for urging said contact members to engagement in response to a longitudinal movement thereof to close a circuit, and latch means including a thermal element mounted on one of said contact members, the cooperation between said thermal element and said cap being such that an initial rotary movement of said cap following a longitudinal movement thereof latches said contact members in engagement, and a further rotary movement of said cap in the same direction as said first-named rotary movement permits the disengagement of said contact members.

5. A circuit interrupter comprising axially movable contact members for opening and closing a circuit, resilient means opposing the engagement of said contact members, a movable cap for urging said contact members to abutting engagement in response to a longitudinal movement thereof to close a circuit, and latch means including a thermal element carried by one of said contact members, the cooperation between said thermal element and said cap being such that a rotary movement of said cap following a longitudinal movement thereof latches said contact members in abutting engagement, and a predetermined movement of said thermal element unlatches said contact members.

6. In a switch embodying a movable cap arranged for both longitudinal and rotary movement, means responsive to a longitudinal movement of said cap followed by a rotary movement thereof for latching said switch in the closed position, and for opening said switch in response to a continued rotary movement in the same direction as said first-named rotary movement.

7. A switch comprising a movable cap arranged for axial and rotary movement, a contact member movable between open circuit and closed circuit position, a bi-metallic strip carried by said member, and means including said bi-metallic strip for urging and latching said contact member in the closed circuit position in response to an initial axial and a subsequent rotary movement of said cap.

8. A circuit interrupter comprising a movable cap arranged for axial and rotary movement, relatively movable contact members for opening and closing a circuit, one of said contact members including a bi-metallic strip carried thereby, said bi-metallic strip normally cooperating with said cap for urging said contact members to engagement in response to a longitudinal movement of said cap.

9. A circuit interrupter comprising a first contact member and a second contact member, said contact members being arranged for axial movement for opening and closing a circuit, said first contact member including a laterally movable thermal element carried thereby, a longitudinally movable cap associated with said first contact member, said thermal element cooperating with said cap so as to prevent movement of said first contact member to engagement with said second contact member in response to a predetermined lateral movement of said thermal element.

10. A circuit interrupter comprising relatively movable contact members for opening and closing the circuit, one of said contact members including a tubular member of insulating material, a bi-metalic strip contained within said tubular member, means for connecting said bi-metallic strip in series circuit relation with said contact members, and means combined with said bi-metallic strip for actuating said contact members from the closed circuit position to the open circuit position in response to a predetermined movement of said bi-metallic strip.

11. A switch comprising a hollow cylindrical body portion, central and screw shell contacts mounted in insulated relation on said body portion, two relatively movable contacts within said body portion, resilient means opposing the engagement of said movable contacts, a movable cap concentrically mounted on said body portion, means for connecting one of said movable contacts to the central contact, means for connecting the other of said movable contacts to the

screw shell contact, said last named movable contact carrying means cooperating with said cap for latching said movable contacts in engagement in response to a rotary movement of said cap.

12. A circuit interrupter comprising a body portion, central and screw shell contacts mounted in insulated relation on said body portion, relatively movable first and second contact members within said body portion, means for connecting said second contact member to said central contact, means including a bi-metallic element carried by said first contact member for connecting the latter to said screw shell contact, a movable cap mounted on said body portion, and resilient means opposing the engagement of said first and second contact members, the cooperation between said cap, said body portion, and said bi-metallic element being such that said first and second contact members are normally latched in abutting engagement in response to a predetermined movement of said cap.

13. A circuit interrupter comprising a hollow substantially cylindrical body portion, central and screw shell contacts mounted in insulated relation on said body portion, a resiliently mounted contact member within said hollow body portion adjacent one end thereof, means for connecting said resiliently mounted contact member to the central contact, a reciprocable contact member arranged for movement within said hollow body portion to engage said resiliently mounted contact member, resilient means within said hollow body portion for opposing said movement, means including a bi-metallic element within said reciprocable contact member for connecting the latter to said screw shell contact, and a movable cap mounted on said hollow body portion, said cap cooperating with said bi-metallic element for latching the contact members in engagement in response to an initial movement of said cap in a definite direction, and for disengaging said contact members in response to a continued movement of said cap in the same direction.

14. A circuit interrupter comprising a hollow substantially cylindrical body portion, central and screw shell contacts mounted in insulated relation on said body portion, a resiliently mounted contact member within said hollow body portion adjacent one end thereof, means for connecting said resiliently mounted contact member to the central contact, a reciprocable contact member arranged for movement within said hollow body portion to engage said resiliently mounted contact member, resilient means within said body portion for opposing said movement, means including a bi-metallic strip having a movable portion within said reciprocable contact member for connecting the latter to the screw shell contact, and means depending upon the position of said movable portion for latching the contact members in engagement against the bias of said resilient means.

15. A circuit interrupter comprising a hollow substantially cylindrical body portion, central and screw shell contacts mounted in insulated relation on said body portion, a centrally positioned contact member within said hollow body portion adjacent one end thereof, means for connecting said centrally positioned contact member to the central contact, a reciprocable contact member arranged for movement within said hollow body portion to engage said centrally positioned contact member, means including a bi-metallic element within said reciprocable contact member for connecting the latter to the screw shell contact, means cooperating with said element for normally latching the contact members in engagement, resilient means associated with said reciprocable contact member for urging said contact members to disengagement, and resilient means associated with said centrally positioned contact member for maintaining said contact members in engagement.

16. In a circuit interrupter, a substantially cylindrical body portion, a movable cap mounted thereon, an opening in the top of said cap, a transparent closure for said opening, relatively movable contact members within said hollow body portion arranged for reciprocatory movement for engaging and disengaging to respectively close and open the circuit, means including a thermal element carried by one of said contact members for normally latching said contact members in the closed circuit position, means responsive to a movement of said thermal element for actuating one of said contact members so that an end portion thereof enters said opening to a point adjacent said transparent closure, and indicia carried on said end portion for visibly indicating the position of said contact members.

17. In a circuit interrupter, a hollow body portion, a movable cap mounted thereon, an opening through the top of said cap, a transparent closure for the opening, relatively movable contact members within said hollow body portion arranged for reciprocatory movement for engaging and disengaging to respectively close and open the circuit, means responsive to a rotary movement of said cap for actuating one of said movable contact members so that an end portion thereof enters said opening, and indicia carried on said end portion for visibly indicating the position of said interrupter with respect to the circuit.

18. A circuit interrupter comprising a hollow substantially cylindrical body portion, central and screw shell contacts mounted in insulated relation adjacent one end of said body portion, a movable cap insulatingly mounted adjacent the other end of said body portion, a resiliently mounted contact member within said hollow body portion adjacent one end and near the midpoint of said end, means for connecting said resiliently mounted contact member to the central contact, a reciprocable contact member arranged for movement within said hollow body portion to engage said resiliently mounted contact member, resilient means surrounding said contact member in coaxial spaced relation, said resilient means opposing said movement, means including a bi-metallic strip within said reciprocable contact member for connecting the latter to said screw shell contact, and a latch pin loosely carried by said bi-metallic strip adjacent one end thereof, said latch pin cooperating with said cap for normally maintaining said contact members in engagement.

RALPH R. PITTMAN.
CARROLL H. WALSH.