Dec. 12, 1939. H. L. RAWLINS 2,183,083

DROP-OUT OPEN-CUT-OUT FUSE

Filed Nov. 13, 1935

Fig. 1.

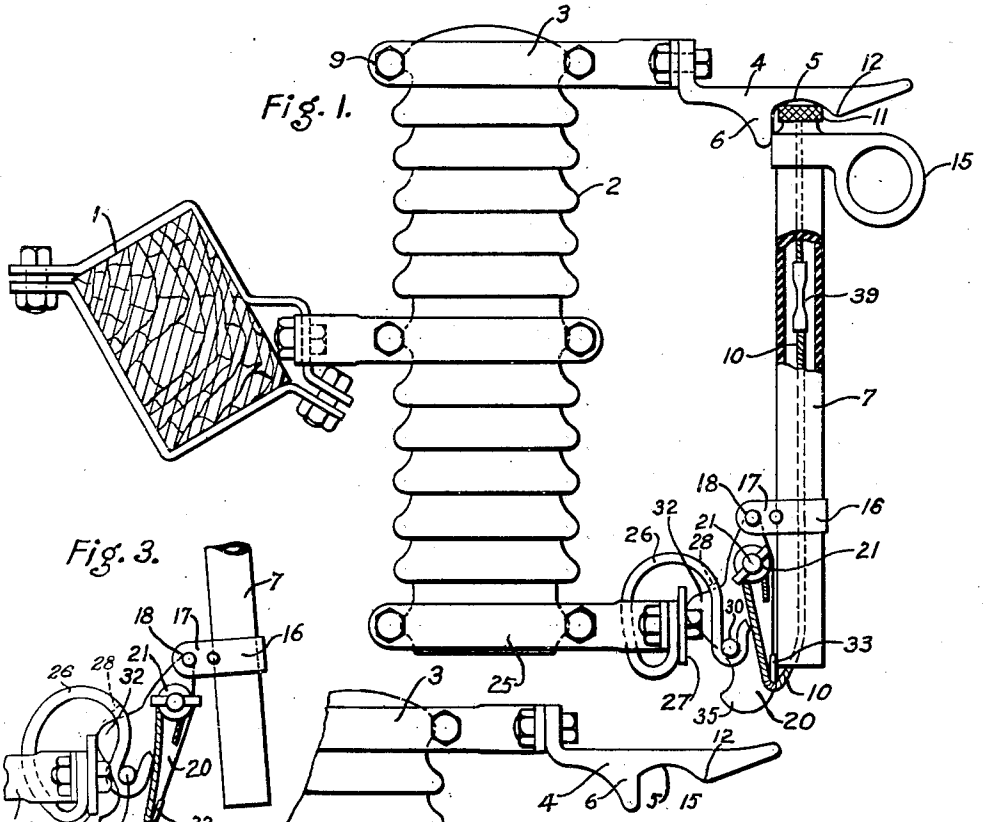


Fig. 3.

Fig. 2.

WITNESSES:

Alfred C. Hoell

W. A. Whitten

INVENTOR

Herbert L. Rawlins.

BY

F. W. Lyle.

ATTORNEY

Patented Dec. 12, 1939

2,183,083

UNITED STATES PATENT OFFICE

2,183,083

DROP-OUT OPEN CUT-OUT FUSE

Herbert L. Rawlins, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application November 13, 1935, Serial No. 49,515

18 Claims. (Cl. 200—114)

This invention relates to circuit interrupters of the type in which a fuse-carrying tube drops from a vertical position to an oblique position to open the circuit.

It is an object of this invention to produce a device of this class which is simpler, having fewer parts, than such devices heretofore.

It is a further object of this invention to provide a device of the type described in which the angle through which the tube descends is smaller than heretofore, with consequent smaller shock upon the operating spring.

It is a further object of this invention to resiliently support the tube in its open position by the same spring that effects the operation of the interrupter.

It is a further object of this invention to provide a dog securing the tube in place and means cooperating with the single operating and supporting spring to move the tube away from its circuit-closing position and to support it in its circuit-opening position.

It is a further object of this invention to provide a fused circuit interrupter which includes a pivotally mounted fuse tube and a spring disposed adjacent the pivoted end for exerting a pressure biasing the tube in the direction of its other end and so holding it against a stationary contact until it is released by the blowing of the fuse.

It is a further object of this invention to secure the dog against the tube by means controlled by the fuse.

It is a further object of this invention to provide a circuit interrupter of the type described in which the terminal at the moving end of the tube is free from movable parts.

It is a further object of this invention to provide a means whereby good contact pressure will be maintained between the movable parts associated with the tube and the circuit-terminal until after the arc is broken.

Other objects of the invention and details of the invention will be evident from the following description and the accompanying drawing, in which

Figure 1 is a view of the device in closed-circuit position,

Fig. 2 is a view of it in open-circuit position, and

Fig. 3 is a view of a portion of the device showing the position of the parts just after the beginning of the opening movement.

In the drawing the reference character 1 is a cross bar upon any line structure and reference character 2 is an insulator supported from said cross bar in the usual manner. A strap 3 disposed around the top of the insulator carries a terminal 4.

A notch 5 is provided in the terminal 4. At the side of this notch nearer the insulator, a projection 6 is provided which has a flat face on the side farthest from the insulator, affording a definite stop for the fuse-carrying tube 7. The tube has been shown broken in Fig. 1 to show the link in the fuse.

The tube 7 is of hard fiber and may have a covering of waterproof material, as is usual in this art. It contains a fusible element which is united to a cable which shows at 10 at the bottom of the tube. The upper end of the fusible member is electrically continuous with head 11 which in Fig. 1 is seated within the notch 5 and restrained from movement by the projection 6 and by a shoulder 12 which forms the other side of the notch. Around the tube 7 near to the head 11, a collar is fastened which has a ring 15 into which a hook upon a switch stick may readily be inserted for reclosing the circuit interrupter after it has operated. In the closed position the collar abuts against the flat face of the projection 6, thus saving mechanical damage to the fiber tube.

A second band 16 secured around the tube 7 near its lower end has an ear 17 which is united by a pivot 18 to the upper part of a dog 20. The dog 20 is a plate from which the pivot 18 projects upon one or both sides and the ear 17 may be adjacent one side of the plate or may contact the plate on two sides.

A clamp 21 is provided near the pivot 18 upon the dog 20 to secure the end of the cable 10. A band 25 around the lower part of the insulator 2 supports spring 26. The two ends of the band are united by a flat terminal plate 27 to which the spring is bolted.

The spring 26 is curved. It extends downward from the head of the bolt and then upward between the two members of the band 25 and curves toward the dog 20. It is bifurcated through the provision of a slot, as indicated at 28, and the two members of the bifurcation are formed into two hooks which engage the pivot 30 on the two faces of the dog 20. The spring in the position shown in Fig. 1 is under strain and, therefore, exerts force upon the pin 30.

This force has a component toward the insulator which acts to cause a cam surface 32 upon the dog 20 to engage the terminal plate 27. This component of the force of the spring is usually

several pounds in order to insure good contact at all times between the terminal plate 27 and cam surface 32. The spring also exerts a component of its force upon the pin 30 in a generally upward direction. This upward component is considerably larger than the contact pressure component, and its upward direction is important, because to assure satisfactory operation of the device the dog 20 must be normally biased for clockwise movement about its supporting pivot 18.

A bearing plate or stop 33 is provided on the dog 20 and the lower end of the tube 7 presses against it in the position shown in Figs. 1 and 2. Opposite sides of the line are connected respectively to the bands 3 and 25 and so to the terminals 4 and 27.

In the operation of the device, when the tube 7 is in the closed-circuit position illustrated in Fig. 1, current flows from the terminal 4 through the head 11 to the fusible member within the tube and emerges over the cable 10. It passes through the clamp 21 into the body of the cam 20 and from there it is conveyed both by the spring 26 and by the cam surface 32 to the terminal plate 27.

When the current flowing over the path just described exceeds a predetermined normal value, the fusible member 39 within the tube 7 is melted. Ordinarily this occurs as a result of a short circuit somewhere in the interconnected system, and due to the magnitude of the overload current, the fuse is melted with violence, so that the cable 10 is blown out from within the tube and more or less destroyed.

Before this occurred, the cable 10 held the dog 20 from moving in a clockwise direction about its supporting pivot pin 18 under the biasing influence of the spring 26. This results from the fact that the cable 10 holds the bearing piece 33 against the tube 7 and any clockwise movement of the dog 20 about the pivot could be effected only by lengthening the cable 10 between the edge of the bearing plate 33 and the interior of the tube 7. Since this cable is secured in place by the fusible member such lengthening is impossible, and the dog 20, therefore, cannot move. When the fuse blows, the cable 10 is no longer secured and it, therefore, no longer restrains the dog 20.

The resultant force upon the pivot 30 and the resistance to this force afforded by the fact that the pin 18 is secured in place by the tube 7, which bears against the notch 5, form a couple which tends to rotate the dog 20 in a clockwise direction, as shown in the figures. As mentioned previously, the force exerted by the spring 26 against the pin 30 has a component toward the insulator 2 and this component coacts with the pressure between plate 27 and the cam 32 to form a couple which also tends to rotate the dog 20 clockwise.

When the conductor 10 is released by the fuse melting, both couples act to move the pin 18 toward the right, thereby bringing the tube 7 to an oblique position, as is shown in Fig. 3, and separating the tube 7 from the stop 33. As soon as the head 11 is out of the notch 5, the action of gravity will cause the tube 7 to rotate about the pivot 18 until the tube again contacts with the stop 33.

The tube 7 and the dog 20 will thereafter move together until the extending end portion 35 of the dog 20 contacts the lower edge of the terminal plate 27. Then, the tube 7 will move a little further, until the spring 26 brings it to rest. This is in the position shown in Fig. 2.

During most of the movement of the tube 7, the cam like contact portion 32 of the dog 20 has been held against the terminal plate 27, and so affords a connection for such current as passed through the arc after the fusible member has blown. Sparking between the bearing surface 32 and the terminal plate 27 is thereby avoided. The cam like contact portion 32 of the dog 20 also serves to prevent the pin 30 from disengaging the looped portions of the supporting spring 26 until after the fusible element has melted by virtue of the fact that the cam surface 32 engages the adjacent surface 28 at the end of the slot in the spring 26. During the final stages of the opening movement, the cam 32 separates from the plate 27.

The tube 7 and the dog 20 may be removed as a unit from the apparatus in the position of Fig. 2 for the purpose of replacing a blown fuse or supplying a new fuse. When this has been done, the tube 7 may be restored to its normal position without any danger to the operator, because the tube is at all times at a safe distance from any but one side of the line. Moreover, the manipulation of the tube 7 before returning it into place may be by means of a tool grasping the tube without requiring the operator to be near the terminals 6 and 27.

When the tube is in place, a tool comprising a hook affixed to a suitable insulating pole or the like is utilized for moving the device to the open and to the closed circuit position. This tool is used by inserting the hook portion thereof in the ring 15 and pushing the tube 7 upward into position. As the tube is moved upward, the cable 10 or the replacement thereof prevents relative motion between the tube 7 and the dog 20. They, therefore, move together. At first the spring 26 assists this movement, but as soon as the end 35 leaves the edge of the plate 27, the face of the latter plate is engaged by the cam 32 and further movement of the dog 20 is slightly resisted by the spring. When the head 11 contacts the shoulder 12, further movement of the tube 7, either under the push on the ring 15, or under its own momentum, or both, will depress the pivot 18 and also the pivot 30. The pivot 30 acts to strain the spring 26 back into its position shown in Fig. 1, the head 11 enters the notch 5, and the apparatus is then ready to repeat its action.

Many variations of this invention will occur to those skilled in the art, and I do not desire to be limited by the exact details shown.

I claim as my invention:

1. In a circuit interrupter, a fusible element, a member carrying said element, retaining means having a recess cooperating with said member to retain it in circuit-closing position, a spring biasing said member to circuit-opening position at least following the disengagement of said member from said retaining means, and means whereby said spring acts in conjunction with said element to cause said member to cooperate with said recess.

2. In a circuit interrupter, a dog, a movable member pivoted to said dog, a stationary member having a notch, a spring pivotally supporting said dog to exert pressure upon the pivot of said movable member and seat it in the notch, a retaining means restraining the dog from rotation about said pivot and current responsive means for rendering said retaining means ineffective

upon the occurrence of predetermined conditions, said spring normally biasing said movable member to the open circuit position.

3. In a circuit interrupter, a dog, a movable member pivoted to said dog, a stationary member having a notch, a spring pivotally supporting said dog, the line of action of said spring being approximately lengthwise of said movable member and in a direction to seat it in said notch, a bearing upon said dog contacting said movable member, restraining means holding said dog and movable member from relative movement and fusible release means for rendering said restraining means ineffective upon overload, said spring acting upon said release to rotate said dog and to normally rotate said movable member when said restraining means are effective.

4. In a circuit interrupter, a dog, a tubular carrier, a fusible link therein, a conductor connecting said link to the dog, a pivot uniting said carrier and dog, a bearing limiting the motion about said pivot of said carrier relative to the dog, a circuit terminal having a notch, a conductive head on the carrier conductively connected to the link opposite said conductor, a spring resiliently supporting said dog to seat said head in said notch, and also tending to rotate said dog about said pivot in the direction not stopped by said bearing and to bias said tubular carrier to the open circuit position when said link is connected to said dog.

5. In a circuit interrupter, two spaced terminals one of which has a notch, a fuse carrier therebetween, one end of which has a head seated in said notch, a fuse supported by said carrier, and means at the other end of said fuse carrier including a spring controlled by the fuse and acting upon fusion thereof to remove said head from said notch, said fuse carrier being biased to open circuit position by said spring when said fuse is in operative condition.

6. In a circuit interrupter, two spaced terminals, one of which has a notch, a spring mounted adjacent the other terminal, a dog supported and actuated by said spring and a fuse carrier biased by said spring to open circuit position and held seated in said notch by said dog.

7. In a circuit interrupter, a dog having two pivots, a fuse carrier mounted on one of said pivots and a spring resiliently supporting said dog at the other pivot, said spring acting upon said dog to cause relative movement between said dog and said carrier and to assist rotative movement of said fuse carrier when relative movement between said dog and said fuse carrier has been restrained.

8. In a circuit interrupter, spaced terminals, a dog having two pivots and two thrust receiving surfaces, a fuse tube mounted on one of said pivots and bearing against one of said surfaces and a spring acting on the other pivot and forcing the other of said surfaces against a terminal.

9. In a circuit interrupter, spaced terminals, a dog having two pivots and two thrust receiving surfaces, a fuse tube mounted on one of said pivots and bearing against one of said surfaces and a spring acting on the other pivot and forcing the other of said surfaces against a circuit terminal the other circuit terminal having a notch into which the end of said fuse tube is received.

10. In a circuit interrupter, spaced terminals, a fuse tube extending therebetween, pivot means for said tube adjacent one of said terminals, and a spring supporting said pivot means which biases said tube toward the other of said terminals and also to the open circuit position.

11. In a circuit interrupter, spaced terminals, a fuse tube extending therebetween and pivoted adjacent one of said terminals, a spring adjacent the pivoted end of the tube which normally biases said tube toward the other of said terminals and also to the open circuit position, and means released by the blowing of the fuse and actuated by said spring when released for moving said tube away from the terminal against which it is normally biased by said spring.

12. In an expulsion circuit interrupter, a pair of spaced contacts, means for normally bridging said contacts including a tubular means for defining the walls of an arc chamber, terminal means disposed at either end of said tubular means, and conducting means including a current-responsive element disposed within said arc chamber for completing the electrical circuit between said terminals and for establishing the arc incident to the opening operation of said interrupter within said arc chamber, and means for pivotally supporting said bridging means upon one of said contacts for swingable movement to an open and to a closed circuit position in which latter position one of said terminals engages the other of said contacts, said supporting means on said one contact including means for resiliently biasing said bridging means into engagement with said last mentioned contact and also for biasing said bridging means to open circuit position and means automatically actuable in response to the operation of said current responsive means to cause said biasing means to swing said bridging means from the closed circuit to the open circuit position.

13. In an expulsion circuit interrupter, a pair of spaced contacts, means for normally bridging said contacts including a tube of insulating material for defining the walls of an arc chamber, terminal means disposed at either end of said tube, and conducting means including a current-responsive element disposed within said arc chamber for completing the electrical circuit between said terminals and for establishing the arc incident to the opening operation of said interrupter within said arc chamber, said bridging means being supported upon one of said contacts for swingable movement to an open and to a closed circuit position in which latter position one of said terminals engages the other of said contacts, means carried by said one contact for resiliently biasing said bridging means into engagement with said other contact and means automatically actuable in response to the operation of said current responsive means to cause said biasing means to swing said bridging means from the closed circuit to the open circuit position, said last mentioned means including a dog which is pivotally supported upon said tube, adjacent the supported end thereof, for movement from a normal inoperative to an operative position, said dog including means for engaging said biasing means and being normally restrained in said inoperative position by said current-responsive element, said biasing means normally acting to maintain said dog in engagement with the said one of said contacts.

14. In a circuit interrupter, a pair of spaced terminals, a fuse tube extending therebetween, pivot means for said tube adjacent one of said terminals and resilient means carried by said one terminal for supporting said pivot means which biases said tube toward the other of said termi-

nals, said resilient means also biasing said pivot means into contacting engagement with the said one of said terminals.

15. In a circuit interrupter, a pair of spaced terminals, a fuse tube extending therebetween, a coupling member pivoted to said tube adjacent one end thereof and a spring mounted adjacent one of said terminals and pivotally connected to said coupling member for normally biasing the latter into contacting engagement with said terminal, said spring also normally biasing the other end of said fuse tube into contacting engagement with said other terminal.

16. In a circuit interrupter, a pair of spaced terminals one of which has a notch, movable means for making and breaking the circuit between said terminals comprising a tubular member, a contact terminal on one end of said tubular member adapted to be seated in said notch, a coupling member pivoted to said tubular member, a spring mounted at one end to the other of said terminals and pivoted at its other end to said coupling member, conducting means including a fusible element connected between said contact terminal and said coupling member, said conducting means normally holding said tubular member and said coupling member against relative movement, said spring being operative to normally maintain contacting engagement between said tubular member and said notched terminal and between said coupling member and the other of said terminals, said spring being effective in response to the fusion of said fusible element to rotate said coupling member relative to said tubular member whereby the latter is caused to be disengaged from said notched terminal.

17. In a circuit interrupter, a pair of spaced terminals, a fuse tube extending therebetween, pivot means for said tube adjacent one of said terminals and resilient means carried by said one terminal for supporting said pivot means and for biasing said pivot means into contacting engagement with the said one of said terminals.

18. In a circuit interrupter, a pair of spaced terminals, a fuse tube extending therebetween, pivot means for said tube adjacent one of said terminals and resilient means carried by said one terminal for supporting said pivot means, said resilient means biasing said pivot means into engagement with the said one of said terminals and said fuse tube to circuit opening position.

HERBERT L. RAWLINS.