

July 4, 1950

C. A. SCHAEFER

2,513,748

ELECTRIC SWITCH

Filed April 24, 1944

2 Sheets-Sheet 1

FIG. 1.

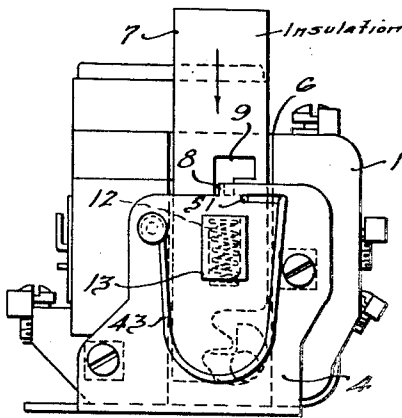
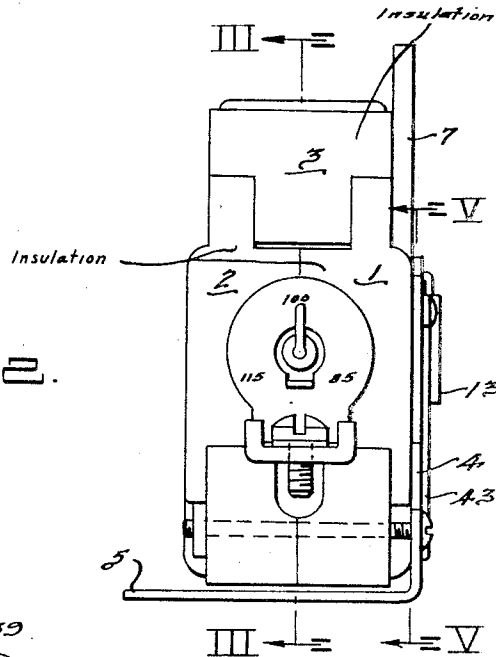
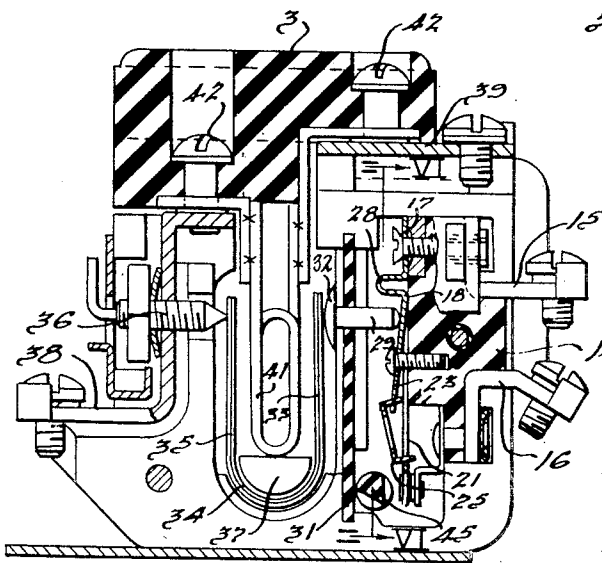


FIG. 2.



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FIG. 5.

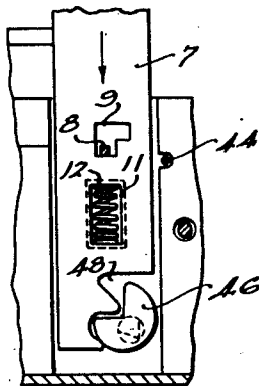


FIG. 6.

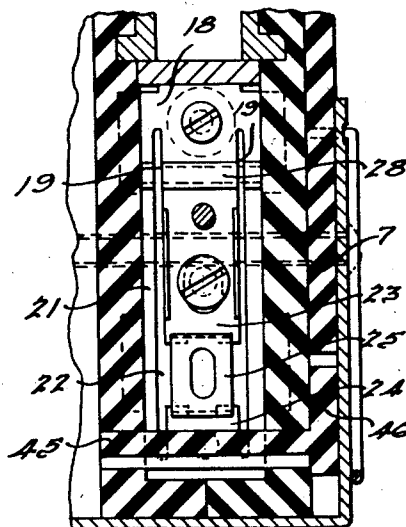


FIG. 7.

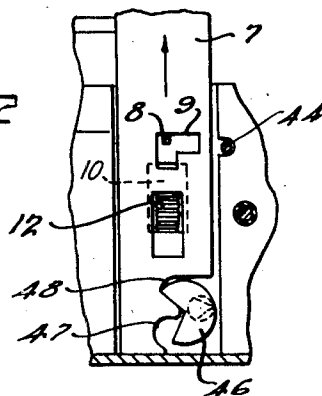
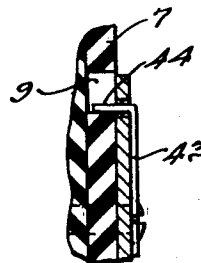


FIG. 9.

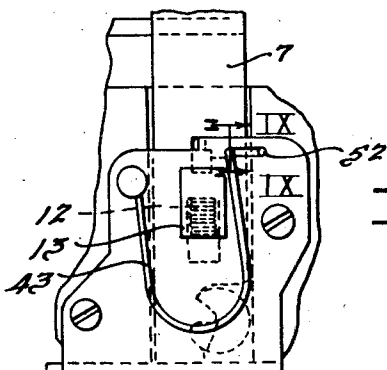


FIG. 11.

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ELECTRIC SWITCH

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Application April 24, 1944, Serial No. 532,411

5 Claims. (Cl. 200—122)

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This invention relates to electric switches, and more particularly to electrical relays automatically operable to open a circuit upon the occurrence of a current overload.

One object of the invention is to provide an electrical overload relay with an improved form of current responsive element including a floating bimetallic member.

Another object of the invention is to provide an electrical overload relay with optional means providing for the automatic or manual resetting of the relay after an automatic operation.

Another object of the invention is to provide an improved form of snap-acting electric switch.

Other objects and features of this invention will be readily apparent to those skilled in the art from the specification and appended drawings illustrating certain preferred embodiments in which:

Figure 1 is a side elevational view of an overload electrical relay according to the present invention.

Figure 2 is an end elevational view of the relay.

Figure 3 is a sectional view on the line III—III of Figure 2.

Figure 4 is a partial sectional view of the snap-acting switch in the open position.

Figure 5 is a partial sectional view on the line V—V of Figure 2.

Figure 6 is a sectional view on the line VI—VI of Figure 3.

Figure 7 is a view similar to Figure 5, but showing the parts in manually reset position.

Figure 8 is a partial elevational view similar to Figure 1, but showing the parts in automatic reset position.

Figure 9 is a detail sectional view on the line IX—IX of Figure 8.

The relay, according to the present invention, includes a main body portion made up of two mating sections 1 and 2, and a removable cover section 3. On the body section 1 there is mounted a metallic bracket 4 having a foot 5 by means of which the relay may be mechanically supported. The side wall of the body section 1 is provided with a slot at 6 within which is disposed a reset plate 7 maintained within the slot by the metal bracket 4. An ear 8 is provided integral with the bracket which cooperates with a slot 9 in the slide plate 7 to limit its upward movement. The plate 7 is provided with a slot 11 within which is disposed a spring 12 which is also received within an outwardly pressed portion 13 on the metallic bracket 4 and a depression 10 in body section 1, the spring 12 exerting a bias on the

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slide 7 tending to move it outwardly to its limiting position as shown in Figures 1 and 5. The pressed out portion 13 and depression 10 in effect form a cylindrical housing for the spring 12.

The relay is provided with a snap-acting switch more particularly shown in Figures 3, 4 and 6. This includes an insulating base portion 14 upon which are mounted the terminals 15 and 16. The terminal 15 is connected through the stud 17 to the resilient switching arm 18. This arm, as shown in plan in Figure 6, includes a strip having spaced elongated slits 19 therein adjacent its edges, thus forming a pair of side arms 21. The portion of the strip 18 between the slots 19 is cut away at 22 to form a pair of separated portions 23 and 24 which are joined together by a rigid link 25. The end of the strip 18 remote from its mounting at stud 17 carries a movable contact 26 which cooperates with a stationary contact 27 mounted on the base 14 and connected to the terminal 16. The strip 18, to increase its resiliency, is provided with a transverse fold 28 as shown. The tapered head of stud 17 and the depression in the surface of terminal 15 provides an adjustment for the bias in arm 23 and determines the point at which switch reset occurs. An operating pin 29 is provided for the switch and presses upon the arm 23 thereof to effect snap-opening movement of the contact 26. The pin 29 is slidably mounted within an opening in a transverse insulating plate 31 and has an enlarged head 32 adapted to be engaged by the leg 33 of a U-shaped bimetallic element 34 having its second leg 35 engaged with an adjustable stationary abutment 36. The two halves 1 and 2 of the base are provided with projections 37 which, with the walls of the base sections provide an arcuate slot within which the U-shaped bimetal 34 is loosely and floatingly mounted.

Supported on the base sections 1 and 2, by being held therebetween, are a pair of conducting terminals 38 and 39. The cover 3 carries a heating coil 41 disposed between the legs 33 and 35 of bimetal 34 and electrically interconnecting the terminals 38 and 39. The cover 3 is maintained in position and the heating coil is connected to the terminals by means of the studs 42.

Pivotaly mounted in the sections of the base is a shaft 45 disposed, as shown more particularly in Figures 3 and 4, in a position to be engaged by the contact end of the resilient plate 18. Upon one end of the shaft 45 there is mounted an arcuate plate 46 having its end portions cooperating with a pair of spaced slots 47 and 48 at the interior end of the plate 7. The action of the

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parts is such that movement of the plate inwardly from the position of Figure 5 into the position of Figure 7 will effect a rotation of the plate 46 and the shaft 45 in a counterclockwise direction while movement of the plate 7 upwardly will effect movement of the plate 46 and shaft 7 in a clockwise direction. With the shaft 45 in the position shown in Figures 3 and 4 the contact carrying end of the resilient switch will move outwardly a sufficient distance, as the actuating pin 29 is moved to the right, so that the snap switch will not recover; or, in other words, the position shown in Figure 4 is a stable one in which release of pin 29 will not be accompanied by a return of the contact 26. However, rotation of the shaft 45 will move the point 49 thereof into engagement with the resilient switch arm, thus moving it in a counterclockwise direction a sufficient distance for the resilient force thereof to pass overcenter and effect snap operation of the contact to engaged position. This occurs upon a manual depression of the sliding plate 7 after an automatic operation has opened the contacts 6, moving the plate 7 from the position of Figure 5 to the position of Figure 7 and rotating the shaft 45 to move the contact carrying arm over center.

In the operation of the device, the circuit in response to overload of which the switch is designed to open is connected through the terminals 38 and 39 so that the current will pass through the resistor coil 41. On the occurrence of a predetermined overload current as determined by the value of the resistance and the setting of the adjustable abutment 36, the bimetal 34 will become heated and will tend to straighten out due to the difference in coefficients of expansion of the material from which it is formed. The arm 35 of the bimetal is engaged with the stationary abutment 36 which is threaded into the terminal 38 and by its position effects the calibration of the device. Since the arm 35 will have its position determined by the position of the abutment 36, all of the force and movement generated within both legs of the bimetal will be reflected by movement of the leg 33 which will have not only movement due to its own flexure but that movement which would otherwise have been afforded to the leg 35, this, since the bimetal is loosely and floatingly mounted within the base. As the arm 33 moves toward the right, as viewed in Figure 3, it will engage the head 32 upon the actuated pin 39 to move the pin to the right to the position shown in Figure 4. This will move the arm 23 and the link 25 until they pass through center at which time the contact 26 will, through the automatic movement of the arms 21, be snapped into the open position shown in Figure 4. As the bimetallic member 34 cools, the force exerted by the arm 33 will be removed, but the switch will remain in the position of Figure 4 since, as previously explained, the contact 26 is moved outwardly sufficiently so that a stable open position is reached. To effect a reengagement of the contacts 26 and 27, the slide plate 7 is moved inwardly, rotating shaft 45 to move contact 46 toward the right until the bias produced in arm 23 is sufficient to overcome the toggle action at which point there is a further snap movement of the contact to its engaged position.

The operation previously described is for manual reset of the device. Provision is also made for automatic reset wherein, as the bimetal 34 cools after an automatic operation, the contacts

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26 and 27 will automatically close without the necessity of a manual manipulation. To effect this, the slide plate 7 is maintained in its inward position so that the point 49 on shaft 45 is always in a position to prevent the movement of the contact 26 to its stable open position. Upon the metallic bracket 4 there is provided a spring wire 43 having an inward projection 44 upon its free end. In the position of Figures 1, 5 and 7 the projecting end portion 44 is disposed out of the path of the plate 7, which is then free to move outwardly under the bias of spring 12 to the position determined by the projection 8 on the bracket 4. To maintain the plate 7 in its inward or automatic reset position, the projection 44 on the spring wire 43 is moved to the alternate opening 51 in the bracket 4, whereupon it will be inserted within the slot 9 of the plate 7 and will maintain it in its depressed position as shown in Figures 8 and 9. Hence, the disposition of the movable end of the spring wire in either the opening 51 where it projects within slot 9 or in the opening 52 where it is out of the path of the plate 6 will determine whether the operation of the relay is such as to effect automatic resetting or whether a manual operation of the sliding plate 7 is necessary to reclose the contacts after they have been opened.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims:

What is claimed is:

1. In an automatic electric switch, separable contacts, current responsive means for automatically effecting the separation of said contacts and including a bimetallic strip bent about a transverse axis into substantially U-shape, means floatingly mounting said bimetal strip so that no portion of said bimetallic member is fixedly mounted to any other member, means providing a stationary abutment engageable by one leg of the U whereby relative movement between the legs is reflected by movement of the other leg, and means for varying the position of said abutment to vary the calibration of the switch.

2. In an automatic electric switch, separable contacts, current responsive means for effecting separation of said contacts and comprising a bimetallic strip bent about a transverse axis into substantially U-shape, means floatingly mounting said bimetallic member so that no portion of said bimetallic member is fixedly mounted to any other member, means for restraining one of the legs of said U-shaped bimetallic strip against movement in one direction whereby flexure of the strip is reflected in movement of the second leg, and a resistance heating element disposed within the loop between said legs.

3. In an electric relay, a snap-acting electric switch, operating means for effecting snap action of said switch in response to movement of said operating means, and current responsive means for effecting movement of said switching means and including a bimetallic member of substantially U-shape with the direction of flexure of the member being substantially parallel to the plane of the U, means floatingly mounting said bimetallic member so that no portion of said bimetallic member is fixedly mounted to any other member, and means limiting the movement of one leg of said U, the other leg of said U engaging

said operating means to effect movement thereof upon flexure of the bimetallic member.

4. In an automatic electric switch, separate contacts, current responsive means for automatically effecting the separation of said contacts and including a bimetallic element of substantially U shape, the high and low expansion sides of said bimetallic elements being arranged to effect opening of the U upon a rise in the temperature of the element, means floatingly mounting said bimetallic element so that no portion of said bimetallic member is fixedly mounted to any other member, and means providing a stationary abutment engageable by one leg of the U whereby an increase in temperature of the bimetallic element is reflected in a movement of the other leg thereof, in accordance with the flexing of substantially the entire length of the element.

5. In an automatic electric switch, separable contacts, current responsive means for effecting separation of said contacts and comprising a bimetallic strip bent about a transverse axis into substantially U shape with the high expansion side of the strip constituting the inside surface of the U so that an increase in temperature of the strip causes an opening of the U, means floatingly mounting said bimetallic strip so that no

portion of said bimetallic member is fixedly mounted to any other member, and means for restraining the end of one of the legs of said strip against movement in one direction whereby an increase in temperature of the strip is primarily reflected in the movement of the second leg thereof.

CARL A. SCHAEFER.

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Certificate of Correction

Patent No. 2,513,748

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CARL A. SCHAEFER

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 17, for the word "demote" read *remote*; column 4, line 24, for the numeral "6" read 7; column 5, line 3, for "separate" read *separable*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of September, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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