Feb. 16, 1943. R. A. BAYNE 2,311,019

COMBINATION FUSE AND CIRCUIT BREAKER

Filed April 15, 1940 2 Sheets-Sheet 1

Fig. 1.

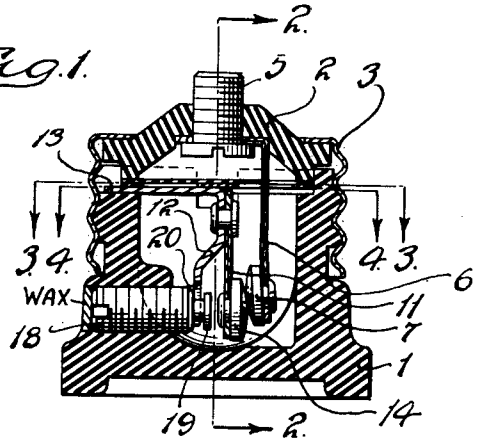


Fig. 2.

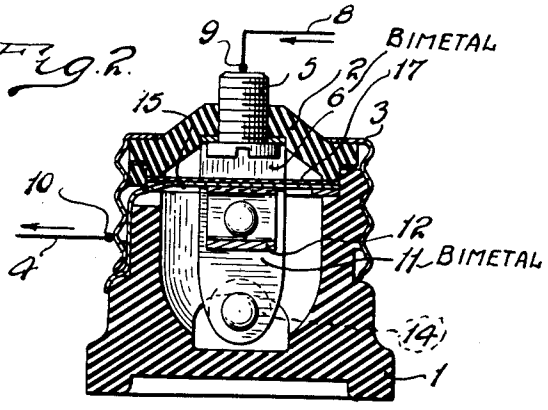


Fig. 3.

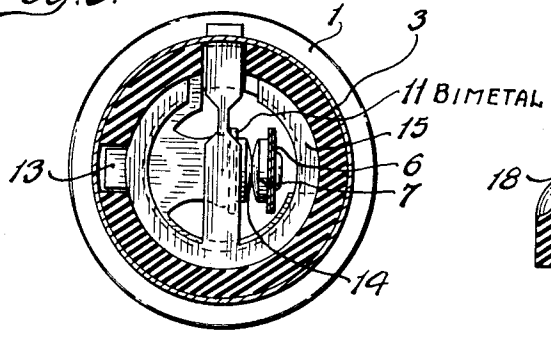
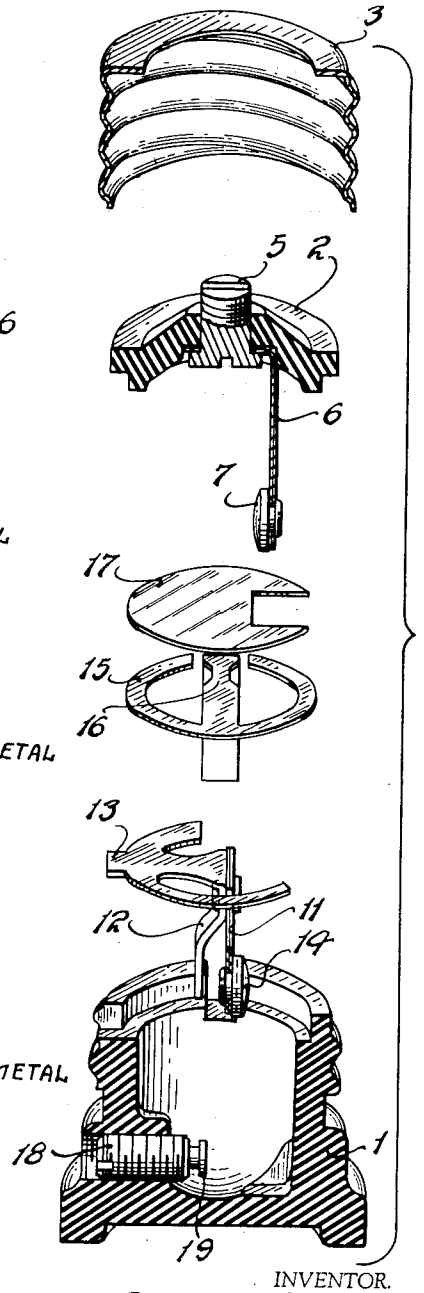


Fig. 5.



INVENTOR.
RICHARD A. BAYNE.
BY Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS.

Feb. 16, 1943. R. A. BAYNE 2,311,019

COMBINATION FUSE AND CIRCUIT BREAKER

Filed April 15, 1940 2 Sheets-Sheet 2

Fig.4.

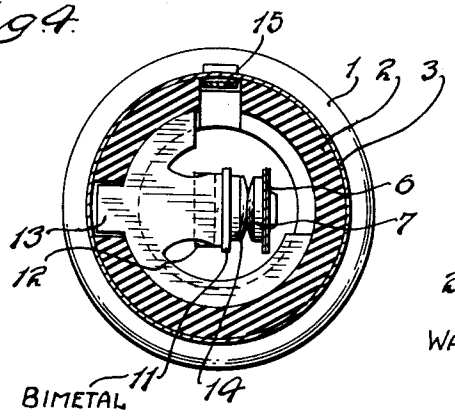


Fig.6.

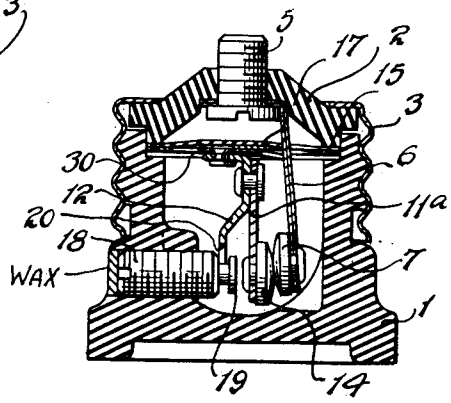


Fig.7.

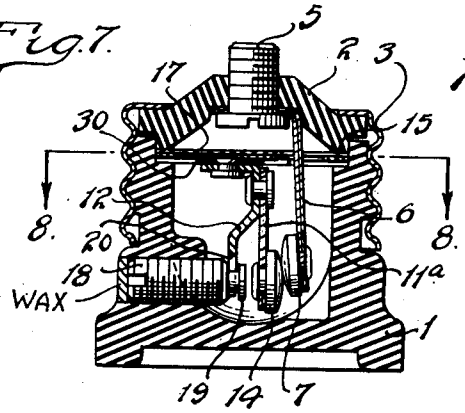


Fig.8.

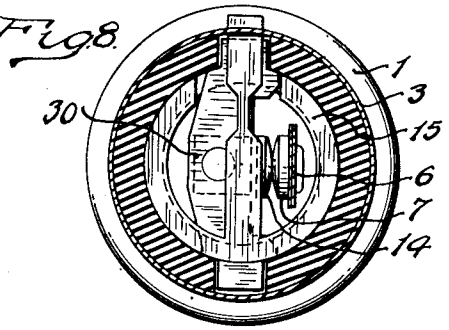


Fig.10.

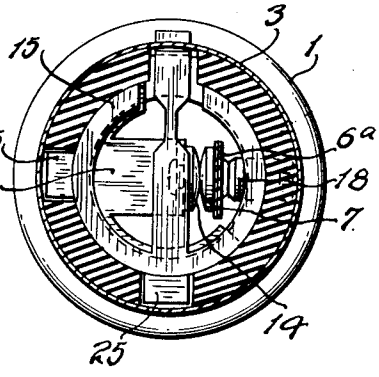
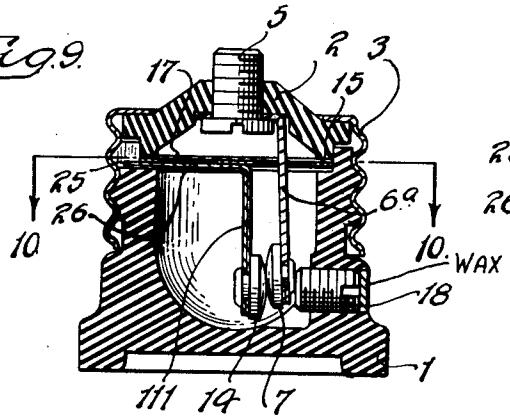


Fig.9.



INVENTOR.
RICHARD A. BAYNE.

BY
Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS.

Patented Feb. 16, 1943

2,311,019

UNITED STATES PATENT OFFICE

2,311,019

COMBINATION FUSE AND CIRCUIT BREAKER

Richard A. Bayne, Detroit, Mich.

Application April 15, 1940, Serial No. 329,665

7 Claims. (Cl. 200—130)

This invention relates to a combination fuse and circuit breaker and more particularly to a combination fuse and circuit breaker of the plug type.

The conventional fuse which is almost universally used, particularly in house electrical wiring systems, is of the plug type which is screwed into a socket connected in the wiring system. The standard fuse plug comprises a hollow cylindrical body of plastic or glass provided at one end with a threaded metallic shell which serves as a contact and for screwing the plug in the socket. The plug is also provided with another contact mounted in series with the threaded metallic contact by a fusible metal member which melts whenever the wiring system is subjected to an amperage overload. To prevent damage to the wiring system the fusible link is arranged to melt at a given amperage depending upon the amperage rating of the fuse. In most instances the fuse blows out due to a momentarily slight amperage overload and only in a minority of the cases is the fuse blow-out due to a dangerously excessive overload such as occurs from a short circuit.

It is an object of this invention to produce a combination fuse and circuit interrupter wherein the fuse will blow out or melt to break the circuit whenever there is a dangerously excessive amperage overload such as occurs when the wiring system is short circuited, and which will merely interrupt the circuit temporarily in case of a slight amperage overload such as occurs, for example, when the motor of one of the domestic electrical appliances is turned on.

Since the conventional plug type fuse and fuse socket are pretty much standardized in size, it would be impractical in designing a combination fuse and circuit interrupter that would depart from the now well standardized size of the ordinary screw-in plug type fuse. Thus, it is an object of this invention to produce a combination fuse and circuit breaker of the plug type which will fit any standard fuse socket and which corresponds in size to the standard screw-in plug. This object is achieved by incorporating in the plug a thermostatic laminated metal circuit breaker and fusible link in series.

It is also an object of this invention to produce a combination fuse and circuit breaker which is efficient in operation and will under all circumstances break the circuit at the predetermined amperage rating or capacity of the combined fuse and circuit breaker. This object has been achieved by mounting the circuit breaker within the fuse plug so that the contact pressure between the circuit breaker contacts is divorced or unaffected by the contact pressure existing between the fuse contacts and the contacts in the fuse housing. In other words, the contact pressure between the circuit breaker contacts will remain the same whether the fuse is turned down tightly or lightly into the fuse socket.

In the drawings:

Fig. 1 is a sectional view showing my combination fuse and circuit breaker.

Fig. 2 is a section along the line 2—2 of Fig. 1.

Fig. 3 is a section along the line 3—3 of Fig. 1.

Fig. 4 is a section along the line 4—4 of Fig. 1.

Fig. 5 is an exploded view showing the parts of the device in their order of assembly.

Fig. 6 is a sectional view through a modified form of fuse and circuit breaker showing the relative positions of the contacts at an elevated atmospheric temperature.

Fig. 7 is a sectional view similar to Fig. 6 through the same modified form of the invention but showing the positions of the contacts at a lower atmospheric temperature.

Fig. 8 is a section along the line 8—8 of Fig. 7.

Fig. 9 is a sectional view through a second modified form of the invention.

Fig. 10 is a section along the line 10—10 of Fig. 9.

Referring more particularly to the drawings the combination fuse and circuit breaker comprises a hollow housing 1 of electrically non-conducting material, such as Bakelite or other suitable plastic or glass, provided with a removable cap 2 retained in position by the threaded metal shell 3 screwed on to the housing 1. The threaded cylindrical shell 3 serves as a contact member which makes an electrical contact with one of the electrical leads or lines 4. A second contact 5 in the form of a screw is screwed into the cap 2. One leg or resistor 6 consisting of thermostatic laminated metal is secured to the cap 2 by the screw 5.

The leg 6 is provided with a contact point 7 of silver or other suitable metal. When the fuse is screwed into the fuse plug, contact 5 contacts with lead or wire 8, as diagrammatically shown at 9, and contact 3 makes contact with lead or wire 4, as diagrammatically shown at 10 (Fig. 2). Another leg 11 of thermostatic laminated metal having the same thermal coefficient of flexivity and the same electrical resistivity is riveted or otherwise fixed adjacent one end to leg 12 of metallic support member 13. Leg 11 is provided

with a contact point of silver or other suitable metal.

Support member 13 is mounted between the top of housing 1 and the cover 2. Positioned on top of the support 13 is the metallic ring 15 provided with a fusible link 16 which has a given current carrying capacity so that it will fuse or melt at some predetermined amperage, e. g., five amperes more than required to open the circuit breaker. Ring 15 and fuse link 16 are connected in series with leg 11 and contact shell 3. An insulating disk 17 is positioned upon ring 15 and insulates leg 6 and screw 5 from fuse link 16 and metallic support member 13.

It will be noted that leg 11 is shorter than leg 6. Thus per degree rise in temperature, leg 6 flexes a greater distance than leg 11. The legs 6 and 11 are preferably made of thermostatic bimetal with the high expanding side on the left, as viewed in Fig. 1, so that upon a rise in temperature the legs will flex toward the right as viewed in Fig. 1. The atmospheric temperatures under which the circuit breaker operates will vary from summer to winter, in some instances roughly through about 100° F. Since leg 6 is longer than leg 11, it will flex a further distance per degree rise in temperature than leg 11. Inasmuch as legs 6 and 11 are each mounted to flex in the same direction upon change in temperature, this ambient atmospheric temperature will be partially compensated for so that the contact pressure between contacts 7 and 14 will remain approximately constant.

The contact pressure is regulated by means of screw 18 threaded in the housing 1, the inner end 19 of which interengages the bifurcated lower end 20 of arm 12. Thus as screw 18 is screwed inwardly or toward the right, Fig. 1, metallic arm 12 flexes to the right thereby increasing the contact pressure between the contacts 7 and 14. When the screw 18 is screwed to the left, Fig. 1, the contact pressure is decreased. Thus by regulating the contact pressure by means of screw 18, the circuit breaker can be set to open at any given amperage. Once the contact pressure is set, the hole for set screw 18 is sealed with wax or other suitable sealer.

Bearing in mind that the space in which the circuit breaker legs can be mounted is exceedingly limited, the rather difficult problem has presented itself of arranging the thermostatic metal circuit breaker so that sufficient movement of the contacts could be obtained to properly break the circuit. Numerous attempts to arrange the thermostatic metal circuit breaker within the fuse plug have proved failures. It will be noted that the circuit breaker legs 6 and 11 are positioned parallel to the longitudinal axis of the approximately cylindrical housing 1. By thus arranging the legs, sufficient flexing or movement of the contacts have been achieved so that the circuit breaker will open at the amperage for which it is set under all operating conditions regardless of ambient atmospheric temperatures.

It will be noted that the fuse 16 is mounted in series with the circuit breaker. Thus in operation upon an excessive overload, such as occurs when the electrical system is short circuited, the fuse 16 will melt and break the circuit. In the absence of an excessive overload whenever the electrical system is carrying an amperage equal to, or slightly above the amperage rating of the circuit breaker, the legs 6 and 11 will be heated by internal electrical resistance. Since leg 6 flexes a greater distance per degree rise in temperature within a short period of time, say, for one-half to three minutes, the legs 6 and 11 will separate and break the circuit. It should be noted that when the fuse plug is turned into the socket the pressure exerted on contacts 5 and 3 is taken up entirely by the housing 1 and cover 2 and is not at all transmitted to the circuit breaker legs 6 and 11.

The circuit breaker shown in the modified form, Figs. 6, 7 and 8, differs from the principal form of the invention in two particulars, namely, circuit breaker leg 11*a* is made from a single strip or ply of metal such as brass rather than from laminated thermostatic metal such as leg 11 and is supported by a strip of laminated thermostatic metal 30 having its high expanding lamina positioned on the top side, as viewed in Figs. 6 to 8, and the low expanding lamina on the bottom side. In this form of the invention the leg 6 is supported by contact 5 and is inclined at an angle downwardly and toward the right, as viewed in Figs. 6 and 7.

It is common to place the fuse box out of doors where the temperatures range from 0° F. in the winter to around 100° F. or more in the summer. This modified form of the invention maintains a constant contact pressure regardless of ambient temperature. In the winter, for example, the relative position of the contacts 7 and 14 is demonstrated in Fig. 7. At this time bimetal support 30 is approximately straight. Upon a rise in temperature, say, to a summer temperature of 90° F. or thereabouts, the thermostatic metal leg 6 will flex or swing to the right about contact 5 as a pivot. This position of leg 6 at an elevated summer temperature is shown in Fig. 6. The amount of movement, of course, will be very small so the drawings are illustrative only. As this rise of atmospheric temperature occurs, support 30 will flex or bow upwardly to the position shown in Fig. 6, which automatically raises the contact 14 vertically. Bearing in mind that leg 6 and contact 7 are inclined downwardly towards the right, Figs. 6 and 7, as contact 14 is raised by support 30 upon a rise in temperature, the contact pressure between contacts 14 and 7 will increase provided leg 6 did not simultaneously flex toward the right. However, as a rise in temperature raises contact 14, contact 7 is moved by the flexing of leg 6 to the right with the net result that the contact pressure remains the same. The reverse of this operation occurs upon a fall of atmospheric temperature. Thus the modified form shown in Figs. 6 to 8 fully compensates for ambient atmospheric temperatures and maintains a constant contact pressure.

In the second modified form of the invention, shown in Figs. 9 and 10, the leg 6*a* is not made of thermostatic metal but consists of brass or some other suitable metal. The leg 111 is made from thermostatic laminated metal such as bimetal and is formed integrally with the semi-circular ring portion 25 and support 26 which supports leg 111. The semi-circular ring portion 25 is clamped between the cover 2 and housing 1. In this form of the invention the high expanding lamina of leg 111 is mounted on the right and on the top of support 26, as viewed in Fig. 9, so that upon a rise in temperature the leg 111 will flex to the left. The support 26 will flex downwardly thus increasing the leftward movement of leg 111. A reverse action occurs upon a fall in temperature. Contact pressure is reg-

ulated by screw 18 which bears directly against the lower end of leg 6a.

I claim:

1. A plug type fuse comprising a hollow housing of electrically non-conducting material, a metallic contact in a wall of said housing having portions located interiorly and exteriorly thereof, a second metallic contact mounted on the outside of the housing spaced from the first mentioned contact, two metallic strips mounted adjacent their ends within and adjacent one end of the housing in spaced relation and extending toward the opposite end of the housing with their free ends normally touching each other and spaced from the interior wall of said housing, one of said strips consisting of thermostatic laminated metal and constituting an electrical resistor, electrical connections between one of said contacts and one of said strips and between the other of said contacts and the other of said strips whereby the said contacts and strips are normally connected electrically in series, the said fuse being adapted for connection in an electrical circuit whereby when a predetermined amperage flows through the laminated metallic resistor it will flex away from the other strip to break the electrical circuit.

2. A plug type fuse comprising a hollow housing of electrically non-conducting material, a metallic contact in an end wall of said housing having portions located interiorly and exteriorly thereof, a resistor of thermostatic laminated metal supported longitudinally wtihin the housing adjacent one end by said metallic contact and having its free end spaced from the interior wall of said housing, a second metallic contact mounted on the outside of said housing spaced from the first mentioned contact, a metallic strip mounted longitudinally within the housing approximately parallel to the resistor having its free end normally in electrically conducting contact with the free end of the resistor, said resistor and said metallic strip each being supported adjacent one and the same end of said housing and extending toward the opposite end of said housing with their free ends contacting, electrical connections between the said strip and the said second contact, the said contacts, metal strip and resistor normally being connected electrically in series, and means passing through the housing for flexing the said strip to regulate the contact pressure between said metallic strip and resistor whereby when a predetermined amperage flows through the resistor the said resistor will flex away from said strip to break the electrical circuit.

3. A plug type fuse comprising a hollow housing of electrically non-conducting material, spaced metallic contacts mounted on the said housing, a pair of thermostatic laminated metal strips mounted in approximately parallel relation adjacent their ends within the housing and having their free ends spaced from the interior wall of said housing, electrical connections between the thermostatic metal strips and the said contacts whereby the contacts and strips are normally connected electrically in series, said thermostatic strips flexing in the same direction upon a change in temperature, one of said strips having a greater length than the other whereby per degree rise in temperature it will deflect a greater distance, the said fuse being adapted for connection in an electrical cricuit whereby when a predetermined amperage flows through the laminated metallic strips the said strips will flex at different rates to separate the free ends and break the circuit.

4. An ambient temperature compensated electrical circuit breaker comprising two thermostatic laminated metallic members one of which is an electrical resistor, said members being arranged to flex upon a change in temperature in intersecting directions, and contact points normally in contact supported by said members, said contact points moving one along the other during temperature changes to maintain a constant contact pressure and separating whenever a predetermined amperage flows through said resistor.

5. An ambient temperature compensated electrical circuit breaker comprising two thermostatic laminated metallic members one of which is an electrical resistor, said members being positioned in approximately perpendicular planes, and contact points normally in contact supported in converging relation upon said members, said thermostatic members arranged to flex upon a change in temperature in intersecting directions whereby upon a rise in temperature the one contact point tends to move away from the other and the other tends to move towards the first mentioned contact point to compensate for temperature change and maintain approximately constant contact pressure, said contact points separating whenever a predetermined amperage flows through said resistor.

6. A plug type fuse comprising a hollow housing of electrically non-conducting material, two thermostatic laminated metallic members one of which is an electrical resistor mounted within said housing, one of said members being positioned lengthwise and the other crosswise of the housing, the one thermostatic member flexing upon a change in temperature in a direction approximately parallel to the longitudinal axis of the housing and the other flexing in a direction transversely of the longitudinal axis of the housing, contact points normally in contact supported by said thermostatic members with the faces of the contact points in converging relation, said contact points riding one along the other during a temperature change to maintain a constant contact pressure and separating whenever a predetermined amperage flows through said resistor.

7. A plug type fuse comprising a hollow housing of electrically non-conducting material, two thermostatic laminated metallic members one of which is a resistor mounted within the housing, one of said members being supported adjacent an end and extending lengthwise of the housing and arranged to flex toward and away from the side wall of the housing as the temperature varies, the other thermostatic member being mounted across the housing and arranged to flex toward and away from the top and bottom walls of the housing as the temperature varies, contact points carried by each of the said thermostatic members, said contact points being mounted in converging relation whereby as the thermostatic metal members respond to a rise in temperature the one contact point tends to move away from the other and said other contact point tends to move toward the first mentioned contact point to maintain a constant contact pressure, the said contact separating whenever a predetermined amperage flows through said resistor.

RICHARD A. BAYNE.