May 16, 1939. V. WEBER 2,158,711

CIRCUIT BREAKER

Filed Nov. 2, 1936

Fig. 1.

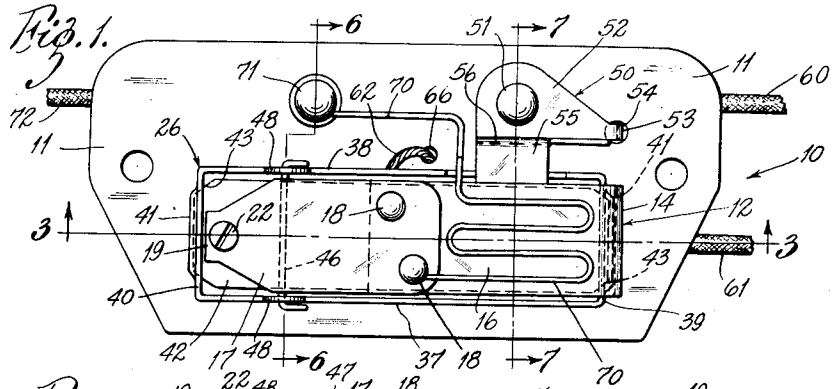


Fig. 2.

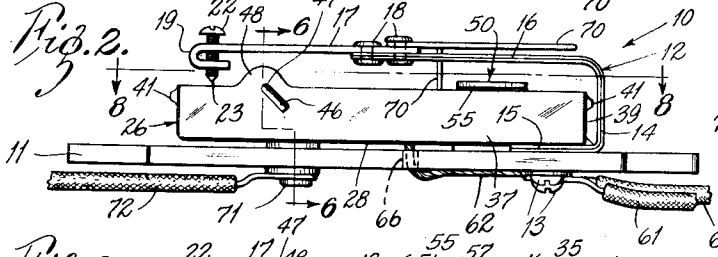


Fig. 6.

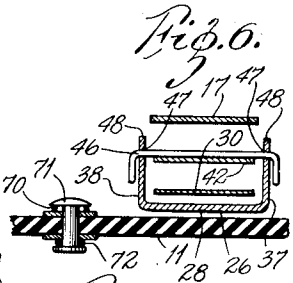


Fig. 3.

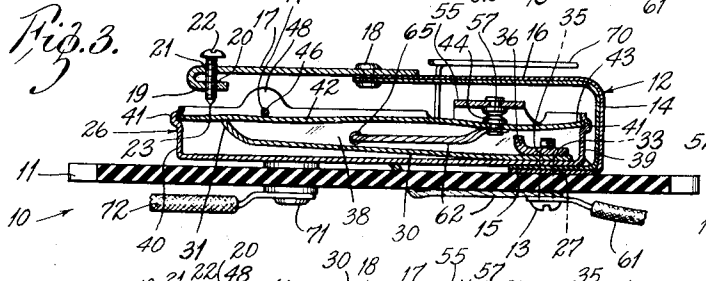


Fig. 7.

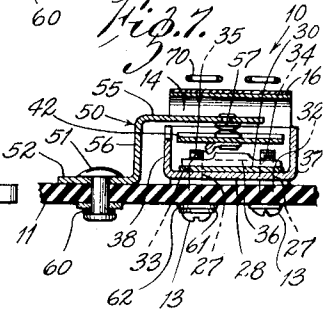


Fig. 4.

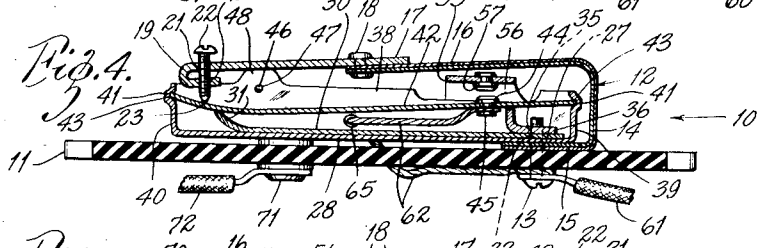


Fig. 5.

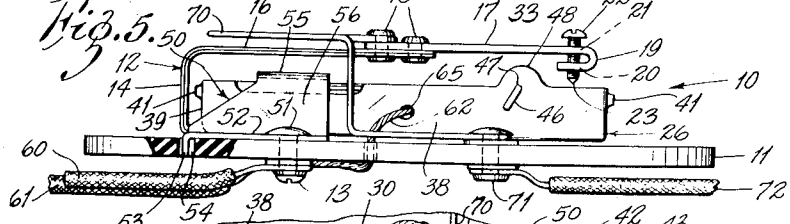
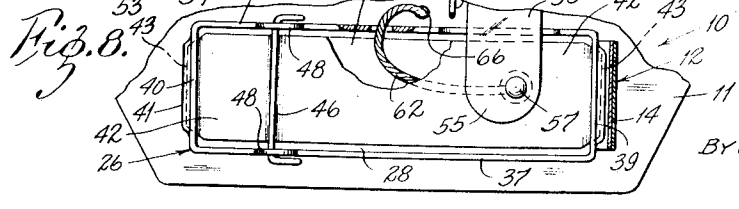


Fig. 8.



INVENTOR
VICTOR WEBER,
BY Lawrence LaTingsland,
ATTORNEY.

Patented May 16, 1939

2,158,711

UNITED STATES PATENT OFFICE

2,158,711

CIRCUIT BREAKER

Victor Weber, St. Louis, Mo., assignor to The Emerson Electric Mfg. Co., St. Louis, Mo., a corporation of Missouri

Application November 2, 1936, Serial No. 108,737

10 Claims. (Cl. 200—122)

The present invention relates generally to circuit breakers, and more particularly to a thermally-actuatable circuit breaker which includes automatic reset mechanism and snap make-and-break action.

An object of the present invention is to provide a thermally-actuatable circuit breaker which is adapted to interrupt the electrical circuit of an energy-translating device upon an excessive current therethrough or upon a dangerous internal overheating of the device.

Another object is to provide a thermally-actuatable circuit breaker which includes means for automatically resetting the device subsequent to a current interruption action thereof.

Another object is to provide a thermally-actuatable circuit breaker which includes a heating element adapted to actuate the circuit breaker by current passing therethrough.

Another object is to provide a thermally-actuatable circuit breaker which includes ripple snap mechanism for closing and opening the contacts thereof to prevent arcing.

Another object is to provide a thermally-actuatable circuit breaker which is adapted to efficiently and effectively protect an energy-translating device, as a motor, under a variety of conditions.

Another object is to provide a thermally-actuatable circuit breaker which is compact in structure, cheap to manufacture and adapted to fulfill all of the purposes and advantages sought therefor.

Other objects and advantages will be apparent from the following description, taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a plan view of a circuit breaker constructed in line with the present invention.

Fig. 2 is a side elevation of the circuit breaker shown in Fig. 1.

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

Fig. 4 is a section on the line 3—3 of Fig. 1 showing the contacts in break relation.

Fig. 5 is a side elevation of the circuit breaker shown in Fig. 1 opposite to the side elevation of Fig. 2.

Fig. 6 is a section on the line 6—6 of Fig. 2.

Fig. 7 is a section on the line 7—7 of Fig. 1.

Fig. 8 is a section on the line 8—8 of Fig. 2.

Referring to the drawing more particularly by reference numerals, 10 designates generally a circuit breaker constructed in line with the present invention. A base 11 of non-conducting material has fixed to one face thereof a J-shaped member generally indicated 12 by bolts 13, or the like. The member 12 includes a J-shaped bimetallic portion 14, the parallel sides 15 and 16 of which parallel the base 11, the shorter side 15 being in supporting engaging relation with the said base 11. An extension 17 is connected to the longer side 16 by rivets 18, or the like. The extension 17 terminates in a reduced hook portion 19 through which is threadably engaged by means of the threaded apertures 20 and 21 therein a screw 22 having a point 23.

A boat-shaped support generally indicated 26 has apertures 27 in a bottom 28, which are spaced to surround the bolts 13 to sustain the support 26 in spaced relation relative to the base 11 throughout its major extent. A flat spring 30 having a deflected end 31 has apertures 32 and 33 therethrough which surround the bolts 13 in the manner of the apertures of the support 26. The J-shaped member 12, the boat-shaped support 26, and the flat spring 30 are maintained in assembled relation by the engagement of the bolts 13 with threaded apertures 34 and 35 in a securing element 36.

The boat-shaped member 26 includes sides 37 and 38 and ends 39 and 40. Each of the ends 39 and 40 has a groove 41 therein adjacent the top thereof. A flat, elongated, flexible blade 42 has its ends 43 positioned within the grooves 41. The blade 42 is of a length greater than the straight line distance between the grooves 41 so that it is maintained in a state of bowed compression. A contact 44 is fixed to the blade 42 towards one end thereof by a rivet 45, or the like. The end of the blade 42 remote from the contact 44, in one position of repose, abuts a wire stop 46 which extends through similarly located apertures 47 in extensions 48 of the sides 37 and 38.

A bracket generally designated 50 is fixed to the base 11 by a rivet 51, or the like, extending through a horizontally disposed portion 52. A down-turned flange segment 53 of the portion 52 extends into an opening 54 in the base 11 to assist in anchoring the bracket 50. The bracket 50 also includes a horizontal portion 55 spaced from the horizontal portion 52 by a vertical portion 56. A contact 57 is fixed to the horizontal portion 55 in a position to directly overlie the contact 44.

A lead 60 is connected to the rivet 51 and a lead 61 is connected to one of the bolts 13. A current-carrying wire 62 is connected to the rivet 45 at one end and to the bolt 13 supporting the lead 61 at the other end, said wire passing through apertures 65 and 66 in the wall 38 of the support 26 and in the base 11, respectively.

A heater element 70 is connected at one end to one of the rivets 18 and at the other end to a terminal rivet 71 to which a lead 72 is connected. The heater element 70 is sinuously disposed above the longer side 16 of the bimetallic portion 14 of the member 12.

Operation

The above described circuit breaker is particularly adapted to be used within the casing of a motor for protection against damage either from excessive heat within the casing or from a line block or overload stoppage, though it is evident that it may be otherwise employed. When disposed within the casing of a motor, the circuit breaker functions to interrupt the actuating current when heat supplied to the bimetallic portion 14 of the member 12 reaches a predetermined point. As has been indicated above, this heat may come from a gradual rise in temperature within the motor windings caused by a continuous small overload, or it may be supplied by a sufficient amount of current passing through the heater element 70, which will occur when the armature is blocked or when the electrical wiring is short-circuited.

When heat from whatever source reaches the bimetallic portion 14, stresses are set up therein caused by the different coefficients of expansion of the two metals, causing the side 16 to move towards the base 11. Movement of the side 16, of course, carries with it the extension 17 and the screw 22. As the temperature rises, the screw 22 is moved downwardly until its point 23 contacts the resilient or ripple blade 42. Further movement of the screw downwardly depresses that end of the blade 42 beneath the point 23. As the blade 42 is under bowed compression, the downward deflection effected by the point 23 of the screw 22 is carried in a ripple along the length of the blade until the downward movement effects an over-center movement of the blade. In passing over-center, the ripple or wave built up by the continuous downward deflection of the blade suddenly flattens in the general downward expansion of the whole length of the blade. This sudden flattening movement carries with it the contact 44, effecting a snap-break of the contact 44 with the contact 57, which prevents arcing. The breaking of the contacts, of course, interrupts the supply of current to the motor.

The circuit breaker is automatically reset upon the cooling of the bimetallic portion 14, for, as the bimetallic portion cools, it returns to its normal position shown in Fig. 3, carrying with it the extension 17 and the screw 22. As the screw point is elevated, the deflected end 31 of the flat spring 30 becomes effective to move the blade upwardly until it is halted by the wire stop 46. Obviously, this return movement of the blade 42 through the medium of the spring 30 effects an over-center action thereof which is just the reverse to that caused by the downward movement of the screw 22. In the return over-center action, the contact 44 is snapped into engagement with the contact 57. The spring 30 and the stop 46 cooperate to maintain the blade 42 in a position to normally hold the contacts in engaging relation. The spring 30 is manifestly upwardly sprung to bias at all times the blade 42. The heater and the motor circuits are clear from an inspection of the drawing.

From the foregoing description, taken in conjunction with the accompanying drawing, it is obvious that there has been provided a circuit breaker which obtains all of the advantages and objects sought. It is to be understood that the said description and accompanying drawing have been given by way of illustration and example and not for purposes of limitation, the invention being limited only by the following claims.

What is claimed is:

1. A circuit breaker comprising a support including spaced apart abutments, a ripple blade having its ends disposed against said abutments, said blade being of a length greater than the straight line distance between said abutments, so that it is bowed by longitudinal compression, a member disposed adjacent said support including a bimetallic portion having an extension fixed thereto, said extension having a projection, said bimetallic portion upon the application of heat being adapted to move said extension into contact with said blade to throw said blade across dead center, and spring means mounted on said support adapted to return said blade across dead center upon the return of said member towards normal position.

2. A circuit breaker comprising a base, a support mounted on said base of boat-like configuration including two ends adapted to serve as abutments, a flexible blade of a length greater than the straight line distance between the abutments disposed with its ends engaging said abutments, a contact carried by said blade, a second contact supported by the base and disposed in cooperating relation to said first contact, and means to break said contacts comprising a member including a J-shaped bimetallic portion and an extension, an element extending through the end of said extension, said bimetallic portion being adapted to flex upon rise in heat around it to move said element into contact with said blade to move said blade across dead center to break the contacts with a snap action.

3. A circuit breaker comprising a base, a support mounted on said base of boat-like configuration including two ends adapted to serve as abutments, a flexible blade of a length greater than the straight line distance between the abutments disposed with its ends engaging said abutments, a contact carried by said blade, a second contact supported by the base and disposed in cooperating relation to said first contact, means to break said contacts comprising a member including a J-shaped bimetallic portion and an extension, an element extending through the end of said extension, said bimetallic portion being adapted to flex upon rise in heat around it to move said element into contact with said blade to move said blade across dead center to break the contacts with a snap action, and a heater element disposed adjacent said bimetallic portion.

4. A circuit breaker comprising a base, spaced apart abutments supported by said base, a flexible blade disposed with its ends against said abutments, said blade being of a length greater than the straight line distance between the abutments, so that the blade is bowed under compression, contact means carried by said blade, contact means supported by the base and disposed in cooperating relation with the first contact means, heat-actuatable means disposed in cooperating relation with said blade including an element adapted to effect a substantially perpendicular contact with said blade to move the same across dead center to effect a snap-break of the contacts, and spring means exerting a force upon said blade opposed to the force exerted through said element to return said blade

across center upon the removal of said element to snap-make contact.

5. A circuit breaker comprising a base, a boat-shaped support and a J-shaped member mounted upon said base by means of a common securing means, said J-shaped member having its longer side extending above and parallel to said support, a flexible blade held by said support under compression and spring-biased towards one extreme position, contact means on said blade, and relatively stationary contact means supported by said base in cooperating relation to said first contact means, said member including means adapted under certain conditions to move said blade against the spring-bias over dead center to snap-break the contact means, said spring-bias being adapted to move said blade back across dead center to snap-make the contacts upon the dissipation of the said conditions.

6. A circuit breaker comprising a base, a boat-shaped support and a J-shaped member mounted upon said base by means of a common securing means, said J-shaped member having its longer side extending above and parallel to said support, a flexible blade held by said support under compression and spring-biased towards one extreme position, contact means on said blade, stationary contact means supported by said base in cooperating relation to said first contact means, said member including means adapted under certain conditions to move said blade against the spring-bias over dead center to snap-break the contact means, said spring-bias being adapted to move said blade back across dead center to snap-make the contacts upon the dissipation of the said conditions, and a heater element disposed adjacent said member to materialize said conditions adapted to effect breaking of the contacts.

7. A circuit breaker comprising spaced apart abutments, a resilient blade disposed with its ends engaging said abutments, said blade being of a length greater than the straight line distance between said abutments, so that said blade is bowed under longitudinal compression, contact means carried by the blade adjacent one end, a stationary contact disposed to cooperate with said contact means, and means to break said contact means and contact when in engaging relation including a thermally-actuatable member having an element adapted to engage the blade adjacent its end remote from the contact means, increasing contact of said element with said blade deforming said blade in a ripple which moves along said blade to move the said blade across center in a manner to snap open the contact and contact means.

8. A compact circuit breaker comprising a base, a thermally-responsive member, a support, and a spring, all mounted on said base in superposed relation, said support including spaced abutments, a ripple contact-carrying blade disposed between said abutments under bowed compression, a stationary contact cooperatively disposed relative to the first contact, said spring at all times biasing said blade towards one extreme position in which said contacts are in make relation, said thermally-responsive member being adapted under certain changes in heat conditions to move said blade across center against the force of the spring to effect a snap-break of the contacts.

9. A compact circuit breaker comprising a base, a support, a thermally-responsive member, a flat spring, and a contact-carrying blade, all disposed in superposed relation, a stationary contact disposed to cooperate with said contact on the blade, said blade being disposed under bowed compression between two abutments forming part of the support, said member being adapted under certain changes in heat conditions to move said blade across center to break the contacts with a snap, and said spring being adapted to return said blade across center to make the contacts with a snap upon a return to normal of the heat conditions.

10. A compact circuit breaker comprising a base, a thermally-responsive member of J-configuration mounted on the base with the short side of the J disposed against the base and the long side spaced therefrom, a support and a spring mounted between the sides of the J, said member, support, and spring all being secured to the base by a common retaining means, a movable blade carrying a contact disposed under bowed compression between two abutments forming part of the support, said blade lying between the long side of the member and the spring, and a stationary contact supported by the base and disposed to cooperate in make- and break-action with the first contact.

VICTOR WEBER.