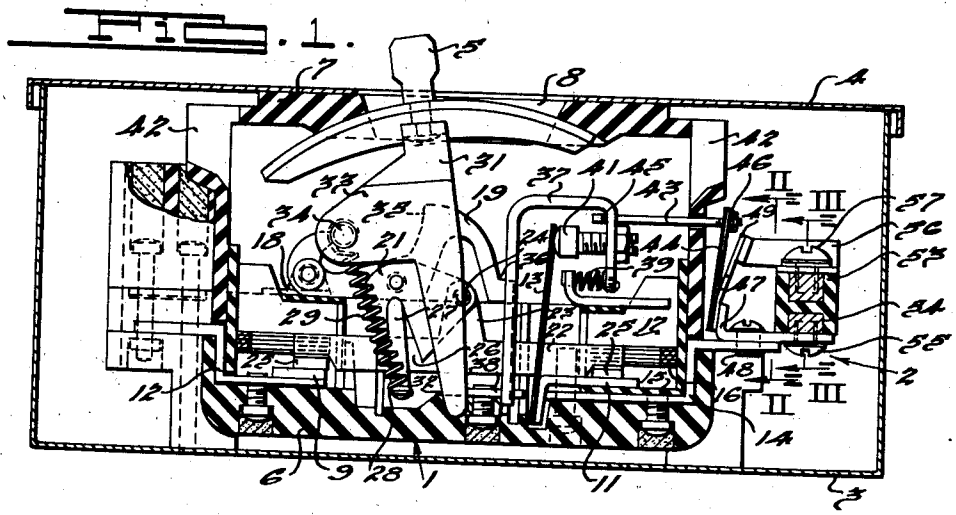
Jan. 27, 1942. J. G. JACKSON 2,271,433

MOTOR PROTECTIVE CIRCUIT BREAKER

Filed March 9, 1940

FIG. 1.



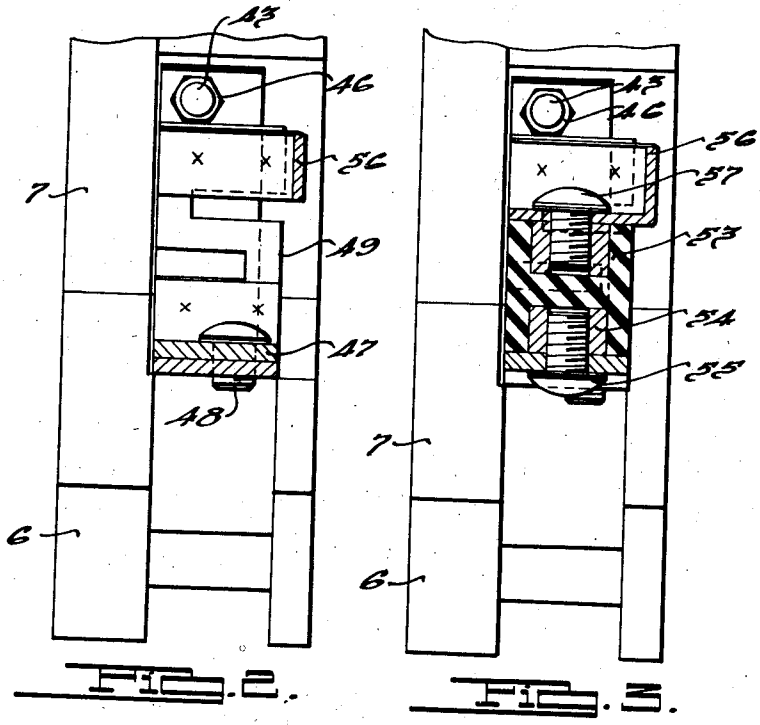


FIG. 2.

FIG. 3.

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MOTOR PROTECTIVE CIRCUIT BREAKER

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8 Claims. (Cl. 200—122)

This invention relates to electric circuit controlling instrumentalities and more particularly to automatic electric circuit breakers adapted for the protection of motors from overloads.

One object of this invention is to provide an improved form of motor protective device having economy and simplicity of form.

Another object of this invention is to provide a simplified motor protective device comprising a sealably enclosed automatic electric circuit breaker mechanism and a readily accessible overload protective unit in combination therewith and adapted to effect automatic operation of the circuit breaker mechanism in response to current overloads of different characteristics than those to which the circuit breaker itself is responsive.

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

Figure 1 is a side elevation sectional view of the circuit breaker according to the present invention.

Figure 2 is a sectional view taken on the line II—II of Figure 1.

Figure 3 is a sectional view taken on the line III—III of Figure 1.

The circuit breaker mechanism illustrated in the drawing follows that shown and described in Patent No. 2,132,623 issued October 11, 1938 to John G. Jackson and Wallace T. Allen. The particular mechanism used is not material to the invention which lies rather in the combination of the protective features.

The motor protective device, according to the present invention, comprises a circuit breaker unit 1 and an overload protective unit 2 and is disposed within an enclosing box 3 having a cover 4 mounted thereover, with the cover having an opening therethrough for the passage of the circuit breaker operating handle 5 to the exterior thereof.

The circuit breaker unit 1, as specifically shown, comprises an enclosing structure consisting of a base 6 and a cover 7. The cover 7 is provided with a slot 8 through which extends the operating handle 5. The base 6 is in the form of a shallow cup in which, at opposite ends, are disposed stationary contacts 9, 11. Contact 9 is secured to a conducting connector leading to the exterior of the enclosure. Contact 11 is rigidly connected to one leg of a U-shaped bimetallic member 13 while to the other leg there is secured a conducting connector 14 leading to the exterior of the breaker. An insulating sheet 15 separates contact 11 from the connector 14. An arc suppressor 16 and shield 17 are disposed over each of the contacts 9 and 11.

On a bracket 18 rigidly secured to the base 6 adjacent the top thereof is pivotally mounted a carrier 19. Upon this carrier, intermediate its ends, are pivotally mounted a pair of plates 21 disposed on opposite sides of the carrier. A conducting bar 22 has an integral finger 23 extending from the mid portion thereof which is pivotally supported on the plates 21 by the pivot 24 which also serves to join the plates 21 together for common movement as a unit. The conducting bar 22 has contacts 25 mounted thereon adjacent the ends thereof in position to engage the stationary contacts 9 and 11.

The plates 21 are equipped with parallel notches 26 in which is located a flipper 27 having parallel legs which are disposed in the notches on opposite sides of the conducting bar 22. The ends of the flipper legs are joined by a cross bar 28 to which a pair of operating springs 29 are connected.

A U-shaped operating member 31 is fulcrumed in grooves 32 in the bottom of the cup-shaped base 6. The legs of the U are extended at 33 and are joined together by a pin 34 to which the ends of the operating springs 29 are secured.

The carrier 19 is provided with a surface 35 which is engaged by the pin 34 for resetting the breaker after automatic operations. The carrier is provided at its free end with a latching surface 36 normally engaged by a latch 37 which is pivotally carried by the supporting plate 38 and is biased toward latching position by spring 39. The latch 37 has a portion thereof provided with an adjustable insulating abutment 41 which is disposed on the low expansion side of the bimetal in a position to be engaged thereby when the bimetal bends due to excess current. Openings 42 in the opposite ends of the breaker enclosure are provided for the venting of arc gases. For a more detailed description of the circuit breaker mechanism, reference is made to the aforementioned Patent No. 2,132,623.

The latch 37 is provided with an opening therein through which extends one end of an elongated connecting member 43. The opposite, or right hand, extremity of said connecting member 43 is threaded and extends through an opening in an end wall of the circuit breaker enclosure to the exterior thereof and is then passed through an opening provided in a bimetallic member 44.

A pin 45 disposed crosswise through the left hand extremity of the connecting member 43 and an adjusting nut 46 carried by the threaded extremity of this member maintains the connecting member 43 in connecting relation with the latch 37 and the bimetallic member 44. With this connective arrangement movement of the bimetallic element 44 to the right will bring about movement of the latch 37 in the same direction to carry it out of engagement with the surface 36 and thereby permit the carrier 19 to swing upwardly under the bias of the operating springs 29 to move the contacts to "off" position as will hereinafter be described.

An L-shaped conducting element 47 is secured to the connector 14 by a stud 48. A resistor member 49 and the bimetallic element 44 are conductingly secured at their lower extremities to the upwardly directed leg of the L-shaped conducting element 47. Upon the outer extremity of the conducting element 47 is disposed an insulating block 53 by means of the metallic insert 54 into which is threaded the mounting stud 55. A conducting member 56 is secured to the top of the block 53 by a terminal stud 57 threaded into a metallic insert and is provided with a flanged portion to which is secured the upper extremity of the resistor member 49. Movement of the bimetallic member 44 will be dependent upon the amount of heat generated in the resistor member 49 which is a function of the current passing therethrough.

The circuit breaker mechanism as shown is in the closed circuit position. To open the contacts manually, the handle 5 is moved clockwise, thus carrying the springs 29 in the same direction until the flipper 27 moves to the opposite side of the slot quickly carrying the springs past the dead center position of the bell crank formed by the plates 21 whereupon the conducting bar 22 is quickly snapped to open position. To manually close the breaker, the handle 5 is then moved in the opposite direction and a reverse action of the parts occurs.

In the automatic operation of the circuit breaker unit itself, upon the occurrence of an overload current the bimetal 13, which is in series with the breaker, becomes heated and bends clockwise moving the latch 37 out of engagement with the surface 36, whereupon the carrier 19 swings upwardly under the bias of the operating springs 29 and the contacts will thus be automatically moved to "off" position. To reset the breaker the handle 5 is moved to the right whereupon the pin 34 engages surface 35 and moves the latching surface 36 into position to be engaged by the latch 37. The parts will then be in normal "off" position and the operation to "on" position will be as previously described.

The bimetallic element 13 of the circuit breaker unit 1 is factory calibrated and sealed against access and functions to protect the motor and the wiring against short circuits or extremely heavy overloads. However, a motor overload may occur in which the current is not sufficiently excessive to cause the bimetallic element 13 to flex sufficiently to trip the breaker and which will not injure the wiring but which may be sufficient, if continued long enough, to cause injury to the motor. It is for a case such as this that the protective unit comprising the resistor member 49 and the bimetallic member 44 is provided. The resistor and the bimetallic member are so calibrated that the heat generated in the resistor by the current will reach an amount sufficient to flex the bimetal 44 to trip the latch 37 when the temperature of the motor windings is still below the danger point. The flexing of the bimetallic member 44 to the right carries the connecting member 43 in the same direction and causes it to move the latching member 47 out of engagement with the surface 36 to thereby bring about a breaking of the circuit.

Inasmuch as the device may be used to protect motors of varied ratings, the motor protective unit 2 is made accessible for adjustment of the nut 46 to vary the amount of flexing of bimetal 44 necessary to open the breaker contacts. For large variations in ratings, the units may be entirely replaced with others having different bimetal or heater values and in some instances the heater alone may be made replaceable to vary the heat generated by a given current. One of the basic inventive concepts herein lies in the sealing of the circuit breaker mechanism and current responsive means from access to prevent tampering or adjustment therewith while the motor protective unit is made readily accessible for adjustment or replacement. Thus nothing can be done to vary the calibration of the circuit protective responsive means while the motor protective responsive means may be readily adjusted to different values. It is to be further noted that the construction prevents any hinderance on the operation of the breaker since neither the handle 5 nor the rod 43 can be manipulated to prevent the operation of the breaker in its circuit protective function.

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 interpretation within the terms of the following claims.

What is claimed is:

1. An electric circuit breaker apparatus comprising a sealably enclosed electric circuit breaker mechanism having means including current responsive means for automatic operation, a second current responsive means at the exterior thereof in unsealed relation having operative connection with said circuit breaker mechanism to effect its operation to break the circuit independently of said first mentioned current responsive means when the current exceeds a predetermined value for a predetermined period of time.

2. An electric circuit breaker apparatus comprising a sealably enclosed electric circuit breaker mechanism having manual and automatic means including current responsive means for effecting the operation thereof to make and break a circuit, a second current responsive means at the exterior thereof in unsealed relation having an operative connection with said circuit breaker mechanism to break the circuit independently of said first mentioned current responsive means when the current passing therethrough exceeds a predetermined value for a predetermined period of time, said connection being such as to preclude interference with the operation of said automatic means by said first mentioned current responsive means.

3. An electric circuit breaker apparatus comprising a sealably enclosed electric circuit breaker mechanism having current responsive means for effecting automatic operation thereof upon the occurrence of a current overload of prede-

termined magnitude and duration, a second current responsive means disposed at the exterior of the enclosed circuit breaker mechanism so as to be readily accessible and comprising a bimetallic element and heater therefor connected in series circuit with the circuit breaker contacts, and means connecting said bimetallic element to said circuit breaker mechanism to effect operation of said circuit breaker mechansm to break the circuit when the current through said heater constitutes an overload of a different predetermined magnitude or duration.

4. An electric circuit breaker apparatus comprising a sealably enclosed electric circuit breaker mechanism having current responsive means for effecting automatic operation thereof upon the occurrence of a current overload of predetermined magnitude and duration, a second current responsive means disposed at the exterior of the enclosed circuit breaker mechanism so as to be readily accessible and comprising a bimetallic element and heater therefor connected in series circuit with the circuit breaker contacts, and means connecting said bimetallic element to said circuit breaker mechanism to effect operation of said circuit breaker mechanism to break the circuit when the current through said heater constitutes an overload of a different predetermined magnitude or duration, said connecting means precluding interference with the operation of said circuit breaker mechanism in response to the action of said first current responsive means.

5. An electric circuit breaker apparatus comprising an electric circuit breaker mechanism having manual means for manual operation and current responsive means for automatic operation and being sealed within an enclosure against access from the exterior, a second current responsive means disposed at the exterior of the enclosure in unsealed relation and comprising a bimetallic element and a resistance heater with the heater in series circuit with the first current responsive means, and means connecting said bimetallic element and said circuit breaker mechanism to effect operation of said circuit breaker mechanism to break the circuit when the current through said heater exceeds a predetermined current time value relation.

6. An electric circuit breaker apparatus comprising a sealably enclosed electric circuit breaker mechanism having a current responsive means for effecting automatic operation thereof when the current reaches a predetermined value, said current responsive means comprising bimetallic elements connected in series circuit, a second current responsive means disposed at the exterior of the enclosed circuit breaker mechanism in unsealed relation and comprising a bimetallic element and a resistance heater with the heater also connected in series circuit, and means connecting said bimetallic element and said circuit breaker mechanism to effect operation of said circuit breaker mechanism to break the circuit when the current through said resistor means exceeds a predetermined value for a predetermined period of time.

7. A motor protective device comprising an enclosure, a self-contained sealably enclosed electric circuit breaker mechanism therein having means responsive to predetermined overload currents of predetermined duration to effect automatic operation of the breaker mechanism to break the circuit therethrough, a second overload means disposed within the enclosure and exteriorly of said sealably enclosed electric circuit breaker mechanism in unsealed relation, said second overload means having an operative connection with said circuit breaker mechanism to actuate the mechanism independently of said first overload current responsive means and break the circuit when the current exceeds a predetermined value for a predetermined period of time.

8. A motor protective device comprising an enclosure, a self-contained sealably enclosed electric circuit breaker mechanism therein having overload current responsive means to effect automatic operation of the breaker mechanism to break the circuit therethrough, a conducting connector extending from within said sealably enclosed electric circuit breaker mechanism to the exterior thereof, thermal means disposed adjacent said enclosed circuit breaker mechanism and connected to said conducting connector, said thermal means having an operative connection with the circuit breaker mechanism to actuate said circuit breaker mechanism independently of said overload current responsive means and break the circuit upon the occurrence of a second predetermined current and time value relation.

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