June 22, 1943. D. W. JOHNSON 2,322,646

MULTIPLE-CIRCUIT BREAKER

Filed Jan. 15, 1941 2 Sheets-Sheet 1

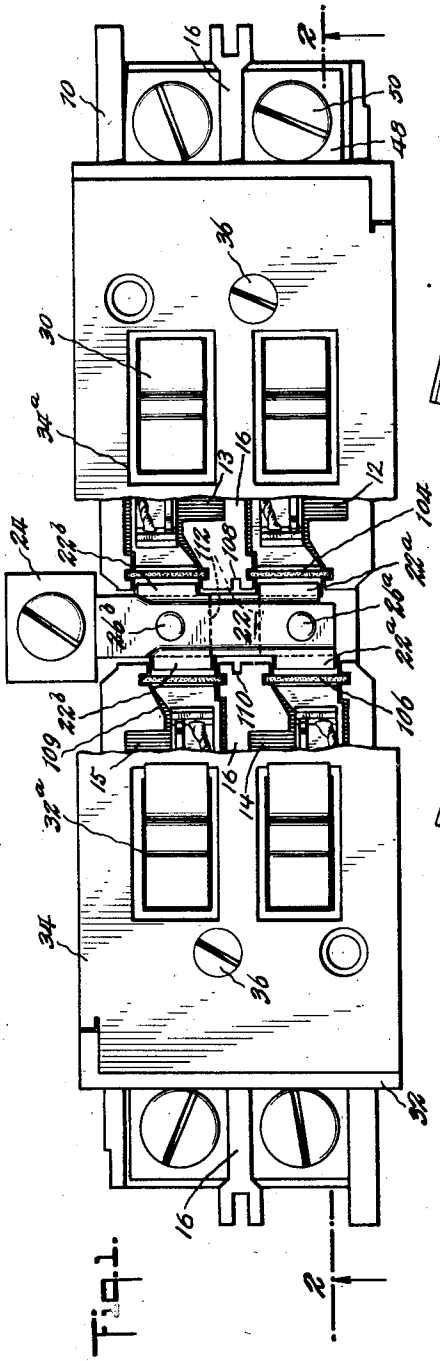


Fig. 1.

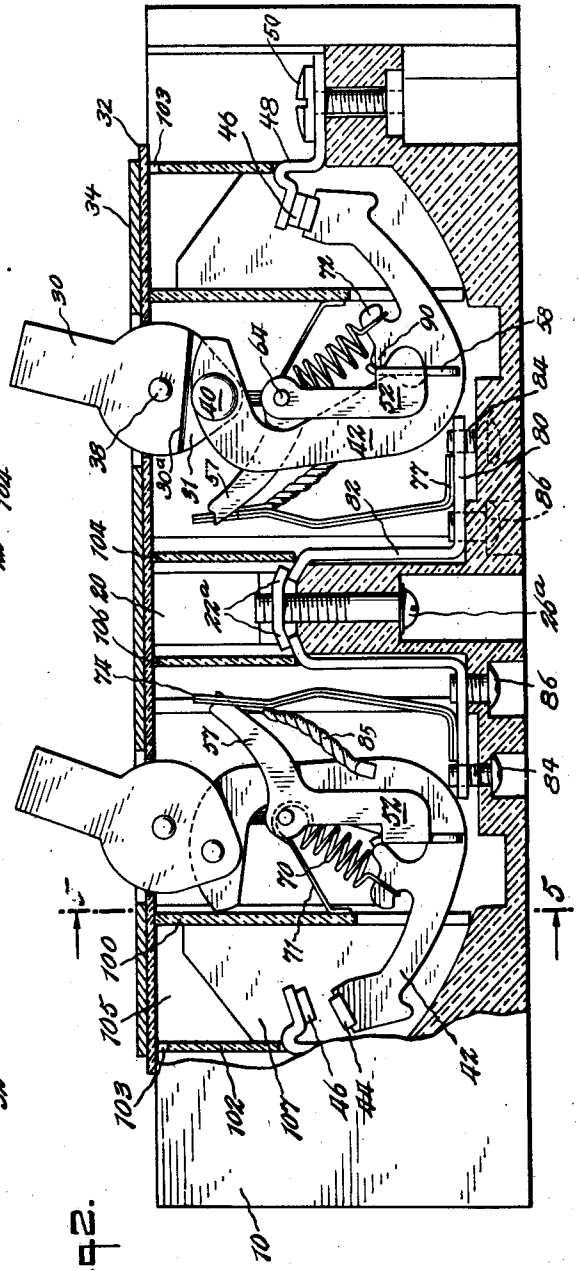


Fig. 2.

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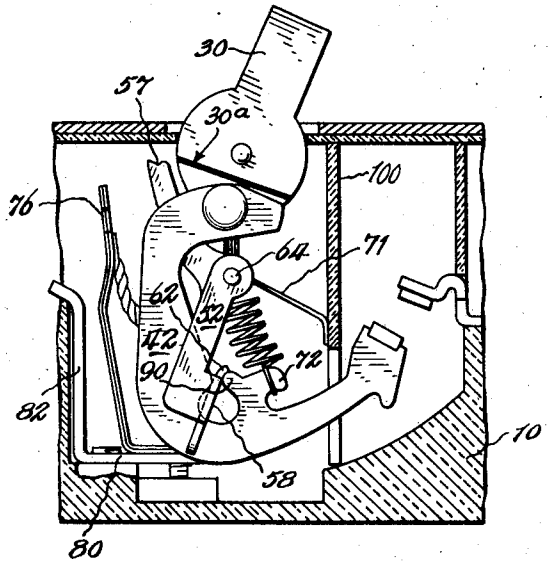


Fig. 3.

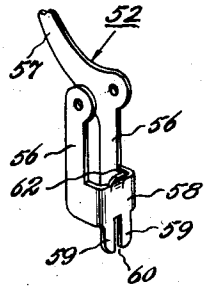


Fig. 4.

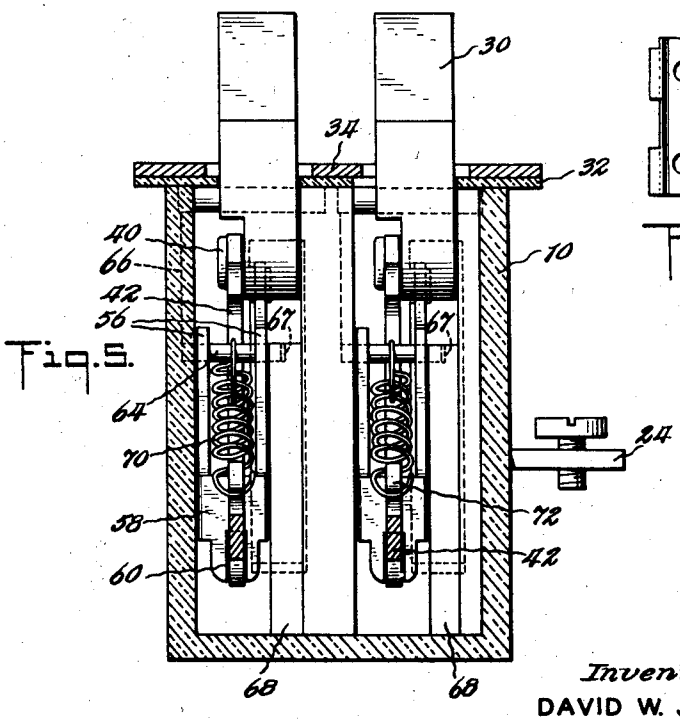


Fig. 5.

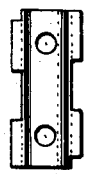


Fig. 6.

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2,322,646

UNITED STATES PATENT OFFICE

2,322,646

MULTIPLE-CIRCUIT BREAKER

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Application January 15, 1941, Serial No. 374,550

15 Claims. (Cl. 200—116)

This invention relates to automatic electric circuit breakers. More particularly, it relates to automatic circuit breakers for use in multiple circuit control work, such as the control of branch circuits and panel board work. The invention is particularly concerned with circuit breakers that have both manual and overload-operated means for operating each of the several mechanisms in the breaker.

It is an object of my invention to provide a simple form of multiple-circuit breaker of the type in which the individual units of the breaker are provided with automatic tripping means, such as a bi-metallic member, and which shall be capable of use in controlling various different circuit arrangements wherein the units may be either single-pole, multi-pole, or a combination of each.

Another object of my invention is to provide a simple and inexpensive construction for the individual circuit-interrupting units of a multiple-circuit breaker of the above-mentioned type.

Another object of the invention is to provide a multiple-circuit-breaking device which is adapted for use in control of many types of circuits when used alone, and is further adapted for use with other like circuit breakers where a multiplicity of circuits requires the use of additional units.

Another object of the invention is to provide a circuit breaker for multiple circuit control work which may be used alone, or with other similar units in panel board work.

Other objects and advantages of my invention will become apparent as it is described in connection with the accompanying drawings.

In the drawings—

Fig. 1 is a plan view, partly broken away, of a multiple-circuit breaker embodying the principles of my invention.

Fig. 2 is a side elevation view partly in section, the section being along line 2—2 of Fig. 1, to show the individual circuit breaker mechanisms at one side of the breaker in open and in closed positions.

Fig. 3 is a fragmentary detail vertical section view of one of the individual circuit breaker mechanisms in the tripped position.

Fig. 4 is a perspective view of the latching member used in the individual circuit breaker mechanisms.

Fig. 5 is a vertical cross-section view taken along line 5—5 of Fig. 2.

Fig. 6 is a plan view of a connecting member for connecting adjacent mechanisms of adjoining identical breakers of the type shown in Figs. 1 and 2.

Referring to the drawings, the multiple circuit breaker is shown as housed in a rectangular base 10 of molded insulating material. The base is preferably formed with flat side faces and a flat bottom face and is hollowed out from the top to provide four inter-connecting cavities 12, 13, 14, 15, in each of which is housed an individual circuit breaker mechanism. The cavities on opposite sides of the base are separated by a longitudinal barrier or wall 16, as are the terminals at the ends of the base. All of the circuit breaker mechanisms are alike and are interchangeable in position. The base is provided with a medial transverse passageway 20 into which fits a bus bar 22 having a terminal portion 24 extending beyond one side of the base 10 for the purpose of making outside connections to the device. The bus bar 22 has shoulders 22*a* and 22*b* extending oppositely from its side edges at spaced positions along the bus bar so as to overlie the supporting members for the bi-metals of the individual circuit breakers and to form an electrical connection therewith, as will hereinafter more fully appear. The bus bar is secured in the transverse channel 20 by means of bolts 26*a* and 26*b* passing upwardly through the bottom of the base and threading into apertures in the bus bar.

Since all of the individual circuit breaking mechanisms are alike, a description of one will suffice and like numerals will be applied to like parts of the several mechanisms that are shown in the different positions in Fig. 3 and in the right and left halves of Fig. 2.

Each mechanism is operated by an insulating pivotally-mounted lever or handle 30 whose upper end extends through an aperture 32*a* in a fiber lining 32 which fits closely about the handle to prevent flames or hot gases of an arc from coming out of the casing around the handle and endangering the operator. A metallic cover plate 34 lies upon the insulating lining and has similar, but larger, apertures 34*a* for the handles of the several circuit breaker mechanisms. The cover 34 may be secured by screws 36 to the insulating base 10. The pivots for the handles 30 are pins 38, whose ends are seated in suitable bearing channels (not visible) in the base at the top edge thereof. The lining 32 forms a top to these channels and holds the pivots 38 in their seats. Connected to the inner end of the handle 30 by a pivot pin 40 is one end of a C-shaped contact carrier 42. This contact carrier is preferably stamped from sheet metal into the form as may

be best observed in the right-hand portion of Fig. 2 and has mounted on its free end a contact block 44 of highly conductive material such as silver. Preferably the pivot pin 40 which connects the handle and the contact carrier has an enlarged head and holds the end of the contact carrier for movement in a plane substantially coincident to the flat face 31 on the inner end of the handle 30 against which the pivot end of the contact carrier lies. In closed circuit position of the circuit breaker mechanism, the contact block 44 is in engagement with a similar contact block 46 on a stationary support or terminal 48, whose end extends toward the end of the base 10 and is secured fixedly in position in any suitable fashion, such as by a terminal screw 50. The support 48 may be stamped in strip form from sheet metal into the shape illustrated in Fig. 2.

Provision for operating the circuit breaker mechanisms automatically upon the occurrence of an overload is made through the agency of a latching or holding member 52 which is of irregular shape, as may be clearly seen in Fig. 4. This locking or latching member may be stamped from sheet metal and provided with parallel side arms 56 which near their lower ends are connected across their side edges by a transverse portion 58 that has downwardly-extending parallel fingers 59 forming a guide slot 60 between them for the mid-portion of the contact carrier 42, whereby the contact carrier and the holding member 52 mutually cooperate to guide one another. Extending upwardly from the transverse portion 58 of the latching member is a tongue 62 which is bent slightly out of the plane of the transverse portion 58 to afford a bearing for the contact carrier, as will hereinafter more fully appear. The upper ends of the parallel arms 56 are provided with registering apertures through which passes a fixed pivot pin 64 which is seated in the bottom of open channel bearings 66 and 67 which are formed in the casing. The channel of the bearing 66 extends to the top of the casing, while the bearing 67 is formed in the top of a post 68 formed integral with the opposite wall of the chamber in which the particular mechanism is located. Anchored to the pivot pin 64 is one end of a coil tension spring 70, whose other end is connected to a hook 72 extending inwardly from the central portion of the contact carrier. The hook 72 is so located that the line of action of the spring 70 will urge the movable contact in engagement with the fixed contact in closed position of the switch.

In the normal open and closed positions of the switch (as distinguished from the tripped position) an arm 57, in extension of one of the side arms 56 of the latching member, has its end in engagement with a bi-metallic latch 74 which is formed by stamping from a strip of sheet metal and cutting a notch 76 near the upper end thereof to form a shoulder against which the end of the latching arm 57 may engage.

The contact carrier is provided with a bearing extension or finger 90 which abuts against the transverse part 58 and the curved finger 62 of the latching member and pivots about its point of abutment as the upper end of the contact carrier is moved by the oscillation of the handle 30. Combined with this pivotal movement is a slight downward sliding of the finger 90 on the transverse web 58 due to the fact that the pivot pin 40 moves the contact carrier 42 downwardly as well as pivotally. In closed circuit position, as illustrated in the right-hand portion of Fig. 2, the line of action of the spring is to the right of this point of abutment, causing the movable contact to remain in engagement with the fixed contact. In this connection, it will be noted that the latching member 52 is held against any movement that the pressure of the contact carrier would tend to have it make in a clockwise direction by reason of engagement of the extending arm 57 of this latching member with the bi-metal 74.

If the handle 30 is moved in the opposite direction for the purpose of opening the breaker mechanism, the pivot pin 40 and the upper end of the contact carrier will be moved to the right (referring to the mechanism in the right hand portion of Fig. 2), causing the contact carrier to pivot about the point of abutment of the bearing finger 90 with the transverse portion 58 of the latch 52 in a clockwise direction. This carries the pivot pin 40 through the plane defined by the pivots 38 and 64 of the handle and latching member 52 respectively, and tends to hold the contacts in open circuit position (as illustrated in Fig. 2), due to the upward force of the spring 70, exerted through the contact carrier 42, tending to maintain the pivot 40 on one side or the other of the plane through the pivots 38 and 64.

If the contacts are in closed position and an overload occurs, the bi-metal 72 will bend toward the center of the casing, releasing the arm 57 which thereupon will move in a clockwise direction due to the pressure of the spring exerted through the bearing finger 90 against the latching member 52. This position is illustrated in Fig. 3. As soon as the latching member 52 starts its clockwise movement, the contact carrier will also move clockwise about the pivot 40, causing separation of the fixed and movable contacts. To re-engage the contacts, the handle is moved to the left from the position of Fig. 3, until the finger 57 engages in the notch in the ends of the bi-metal 74. This is accomplished by the ledge 30a engaging the back side of the top of contact carrier 42 as the handle is moved counterclockwise, after which engagement the handle and carrier 42 move as a unit about pivot 38. This movement of the carrier 42 causes a corresponding counterclockwise movement of the latching member 52 until the end 57 thereof engages the bi-metal. The device will then be in open-circuit position. In order to close it, the handle is moved back to the right into the position shown in the right-hand portion of Fig. 2.

In order to prevent the bi-metal setting from being affected no matter what amount of distortion there may be on the terminal 24 or bus bar 22 of the device, I have provided a novel form of bi-metal mounting. The lower end of the bi-metal is bent at right angles to the body thereof to form a foot 77 which may be welded or otherwise suitably secured to a flat horizontal portion 80 of a mounting and connector member which has a portion 82 extending vertically with its end bent in position to lie under one or another of the shoulders 22a or 22b of the bus bar 22. The portion 80 is secured upon a low step up from the floor of the base by means of a screw 86 passing through the portion 80 adjacent vertical arm 82. An adjustment bolt 84 passing through the casing floor screws into the overhanging end of portion 80 and causes it to bend and tilt the bi-metal toward the switch mechanism to vary the amount of deflection necessary for overload tripping of the breaker. It may

now be seen that the support for the bi-metal is secured in position at three points: namely, the point of engagement of the bus bar shoulder 22b, and the points of engagement of the bolts 84, 86. By this means, the accuracy of the bi-metal setting of the individual circuit breaker mechanisms is made very positive and reliable. A cable 85 is provided to carry current between the bi-metal and the movable contact carrier 42.

In order to confine the arc incident to separation of the stationary and movable contacts within a chamber, fibrous sheet inserts 100, 102, are slid downwardly from the top of the base in slots provided in the opposed walls of the cavities of the individual circuit breaker mechanisms, the slots being provided at spaced positions from the end of the casing on either side of the stationary contact 46 forming a chamber 105. The fibrous sheets 100, 102, are suitably provided with recesses or slots so that these shields will fit closely about the stationary contact carrier 48 and the movable contact carrier 42. To aid in arc quenching, fibrous side wall liners 107 may be provided for the arc chambers 105.

In the event that arc gases might blow back into the switch mechanism and tend to blow from one mechanism to another, fibrous insulating shields 104, 106, are provided and are adapted to be slid downwardly from the top of the base in slots provided in the side walls of the passages 109 that connect the transverse bus bar passage with the cavities in which the individual switch mechanisms are located. In this manner, a substantially closed chamber is provided for each of the circuit breaker mechanisms and a substantially closed arcing chamber is provided for each set of stationary and movable contacts. The arcing chambers may have a small vent opening 103 formed in the top edge of the end inserts 102.

In order to adapt the circuit breaker to several fields of use, I contemplate the removal or omission of the central portion of the bus bar 22 so that only the mechanisms at opposite ends of the same side of the device will have their movable contacts electrically-connected. In that event, short forms of bus bar and terminal members, that is, with the center omitted, as for example, by severing along dotted lines 112 in Fig. 1, would be provided. This short form of terminal bar might be provided on either side of the device for outside connections. Alternatively, a bus bar (as illustrated in Fig. 6) without a terminal portion but extended to engage and connect with another circuit breaker device alongside the one shown may be provided. This bus bar may conveniently have a form (see Fig. 6) like the bus bar portion 22 of the bus bar and terminal member 22, 24, hereinbefore described.

As another alternative, when the device is used for panel board work, a bridge plate (such as the short end remaining from the bar terminal 22, 24, when the center is removed) connecting only the aligned bi-metal supports (82) on one side of the base may be secured in place by a bolt passing through the base, into a bus bar beneath it. In such a case, the bolt would be both a securing means for the bridge plate and an electrical connector between it and the underneath bus.

When the device is connected for multiple circuit work, that is, when the bus bar 22 is not common to all four of the individual mechanisms of the breaker but only the mechanisms opposite each other at opposite ends are connected, a fibrous barrier (not shown) will be slid downwardly from the top of the casing in slots 108, 110, formed in the middle of the side walls of the transverse or bus bar passage. Thereby, a continuous central longitudinal barrier is formed in connection with the central longitudinal walls 16 that separate the cavities on one side of the base from those on the other, so that the mechanisms on one side are isolated from those on the other side of the device.

With the foregoing alternative constructions possible, I am able to use my circuit breaker unit in many different circuit arrangements. Four of such circuit arrangements are as follows:

(1) With the device as illustrated and with one power line connected to the bus bar 22, the breaker will comprise four single pole breakers, of the same polarity.

(2) If the bus bar 22 be separated in the middle and separate terminals be provided for the mechanisms on opposite sides of the device, then the two mechanisms on one side of the device may comprise two single pole breakers of one polarity, while the mechanisms on the other side of the device will comprise two single pole breakers of the opposite polarity.

(3) When the bus bar 22 is separated in the middle, the breakers at one end of the device may comprise a double pole breaker and the breakers at the other end of the device may comprise another double pole breaker.

(4) When the bus bar 22 is separated in the middle, the mechanisms at one end of the device may comprise a double pole breaker and the mechanisms at the other end of the device may comprise two single pole breakers of opposite polarity in a load balancing arrangement.

One of the important features of my invention is the ability to put a number of circuit breaker devices, like that illustrated, side by side with their side walls flat against one another, when it is necessary by reason of a multiplicity of circuits to be controlled, such as when it is desired to use the devices in panel board work. In multiple circuit devices of the type to which this invention relates, as heretofore made, it has not been possible to place breakers containing four units directly against a similar four-breaker unit, and to connect them in line by bus bars running through their centers. Thus, my invention possesses many additional valuable features over the related devices of the prior art.

In order to give a quicker action to the separation of the contacts and the opening of the circuit, I loop the upper end of the spring 70 about the pivot pin 64 and extend the end 71 to press against the arc shield 100. The end 71 is maintained under considerable stress and gives to the axis of the coil 70 a slight curvature. By actual comparative test, this type of spring has been found superior in action to a simple coiled tension spring.

Many modifications within the scope of my invention will occur to those skilled in the art. Therefore, I do not limit the invention to the specific embodiments herein shown or described.

I claim:

1. A multi-pole circuit breaker comprising a rectangular casing having cavities for individual circuit breakers in the four quarters thereof, an individual automatic circuit breaker mechanism in each of the four quarters thereof, a transverse passage between the mechanisms at one end and the mechanisms at the other end of the breaker, conductive members having portions extending from each mechanism into said passage, connecting means having a part overlying the

inwardly-extending portions of the conductive members on the same side of the breaker and having another part extending out of said passages, said casing having a flat face against which the casing of another similar circuit breaker may lie with the transverse passages aligned, and means to secure said connecting means in firm engagement with said conductive members whereby adjacent mechanisms on the neighboring sides of the two circuit breakers may be connected in uni-polar arrangement by said connecting means within said aligned passageways, and a cover enclosing said mechanisms and covering said passageway.

2. A multi-pole circuit breaker comprising a rectangular casing having cavities for individual circuit breakers in the four quarters thereof, an individual automatic circuit breaker mechanism in each of the four quarters thereof, a transverse passage between the mechanisms at one end and the mechanisms at the other end of the breaker, a bi-metal member in each of said cavities operable on overload to trip the mechanisms individually, a mounting member in each cavity for each bi-metal member and having a portion extending toward said passage, means for engaging each of said mounting members at two points at least, and holding the mounting members upon the floor of their cavities, and connecting means in said passage connecting, at least, mechanisms on the same side of the breaker at opposite ends thereof and engaging said mounting members at a third point on said mounting members and affording, with said other two points of mounting, a three point mounting for said bi-metal supporting member.

3. An automatic circuit breaker mechanism comprising an oscillatory handle, a contact-carrying member pivoted thereto, a fixed contact engageable by said movable contact-carrying member, a bi-metallic latch, a holding member engaging said latch and having a portion affording a pivotal mounting for said movable contact carrier, pivotal mounting means for said holding member, spring means acting on said movable contact carrier and holding it in either open or closed circuit positions normally, and moving it to open circuit position when said bi-metal disengages said holding member.

4. In a circuit breaker, an oscillatory operating handle, a movable contactor pivoted to said handle and engageable with and disengageable from a fixed contact, a movable support affording a fulcrum for pivoting of said contactor in normal operation, a bi-metal holding said support normally against movement and operable on overload to release said support, spring means for moving said fulcrum on overload operation and for holding said contactor in either open or closed circuit position in normal operation.

5. In a circuit breaker, oscillatory operating means, movable contact means pivotally connected to said operating means, movable supporting means affording a fulcrum for pivoting of said movable contact means in normal operation, over-load operative holding means maintaining said supporting means stationary in normal operation and operable on overload to move said fulcrum, spring means to move said supporting means and contact means on overload and holding said contact means in either open or closed circuit position in normal operation.

6. In a circuit breaker, pivotally mounted operating means, movable contact means pivotally connected to said operating means and having its pivotal portion sliding over and guided by a flat portion of said operating means, movable supporting means affording a fulcrum for pivoting of said movable contact means in normal operation, over-load operative holding means maintaining said supporting means stationary in normal operation and operable on overload to move said fulcrum, spring means to move said supporting means and contact means on overload and holding said contact means in either open or closed circuit position in normal operation.

7. In a circuit breaker, pivotally mounted operating means, movable contact means pivotally connected to said operating means, pivoted supporting means affording a fulcrum for pivoting of said movable contact means in normal operation, over-load operative holding means maintaining said supporting means stationary in normal operation and operable on overload to move said fulcrum, spring means to move said supporting means and contact means on overload and holding said contact means in either open or closed circuit position in normal operation.

8. In a circuit breaker, pivotally mounted operating means, movable contact means pivotally connected to said operating means, pivoted supporting means affording a fulcrum for pivoting of said movable contact means in normal operation, spring means for biasing said movable contact means either in open or closed circuit positions upon movement of the pivotal connection of said operating and contact means through the plane of the pivots of said supporting and said operating means, overload operative holding means maintaining said supporting means stationary in normal operation and operable on overload to move said fulcrum, said spring means being operative on overload to move said movable contact means to open circuit position.

9. A circuit breaker as set forth in claim 2, wherein one of said means-engaging-said-mounting-member-at-two-points is an adjustment screw whose head is accessible from the bottom of the casing whereby adjustment of the setting of the bi-metal member may be made from the outside of the casing.

10. In a circuit breaker, a casing having at least one cavity for an automatic circuit breaker mechanism, separable contacts at one end thereof, a bi-metallic member at the other end thereof for automatic operation of the breaker, manually and automatically operable mechanism between said ends, a supporting member for said bi-metallic member having a portion overlying a ledge of said casing and extending outwardly of said cavity, a connector member securable in engagement with said portion, another portion of said supporting member lying parallel to the floor of the casing below said outwardly-extending portion, and means extending through the floor of said cavity engaging said supporting member at two other points to afford a three point mounting for said support.

11. A circuit breaker as claimed in claim 10, wherein one of said two other points comprises an adjustment screw for adjusting from outside the casing the position of the bi-metallic member relative to said mechanism.

12. In a circuit breaker, an oscillatory operating member, a contact carrying member having a pivotal engagement with said operating member, a movable support engaged by said contact-carrying member, said contact-carrying member having a combined sliding and pivoting move-

ment about its point of engagement with said movable support when moved by said operating member, and overload responsive means holding said support under normal conditions and releasing said support on occurrence of an overload, and spring means for holding said contact-carrying member in either open or closed circuit positions under normal conditions and moving it to open circuit condition on overload.

13. In a circuit breaker, pivotal operating means, movable contact means pivotally engaged with said operating means, pivoted supporting means for said contact means, spring means biasing said contact means in either open or closed circuit position in normal operation, and overload responsive means holding said supporting means normally and releasing it on overload, whereupon said spring means moves said contact means to open circuit position, said contact means having a pivotal and sliding movement upon said supporting means when moved by said operating means.

14. A circuit breaker as claimed in claim 5, wherein said spring means is provided with an extended end maintained under tension and pressing against a stationary switch part whereby to increase the speed of contact separation.

15. A multi-pole circuit breaker comprising a rectangular casing having cavities for individual circuit breakers in the four quarters thereof, an individual automatic circuit breaker mechanism in each of the four quarters thereof, a transverse passage between the mechanisms at one end and the mechanisms at the other end of the breaker, a bi-metallic member in each of said chambers operable on overload to trip the mechanisms individually, a mounting member in each cavity for each bi-metal member, and means engaging each of said mounting members at three points to establish the position of said bi-metal members accurately and firmly with relation to said casing and mechanisms, one of said means-engaging-said-mounting-members being an adjustment screw whose head is accessible from the bottom of the casing whereby adjustment of the setting of the bi-metal member may be made from the outside of the casing.

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